The Role of Wetland Pond Permanence in the Assembly of Biological Communities in the Prairie Potholes of Alberta

by

Jody Daniel-Simon

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EXAMINING COMMITTEE MEMBERSHIP

The following served on the Examining Committee for this thesis. The decision of the Examining Committee is by majority vote.

External Examiner	Dr. Michael Anteau Chief - Wildlife and Ecosystems Branch Northern Prairie Wildlife Research Center United States Geological Survey
Supervisor	Dr. Rebecca Rooney Associate Professor Department of Biology
Internal Member	Dr. Roland Hall Professor Department of Biology
	Dr. Marcel Pinheiro Continuing Lecturer, Undergrad Advisor (Biomedical Science) Department of Biology
Internal-External Member	Dr. Derek Robinson Associate Professor Department of Geography and Environmental Management

AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

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ABSTRACT

Wetlands in the Prairie Pothole Region (PPR) support numerous biological communities, and the composition of these communities depends on the length of time ponded water is present (i.e., hydroperiod or permanence class). There is consensus in the literature that land cover/land use and climate dictate ponded water amounts in prairie pothole wetlands. While terrain is understood to be an important factor in determining a wetland's hydroperiod, this metric is seldom included in models forecasting the impact of climate and land cover/land use on hydroperiod. To understand how the habitat of these wetland biota will change under a warmer climate, we must study the relative importance of each hydroperiod driver (i.e., climate, land cover/land use and terrain). Also, to best predict how the structure of these wetland biota will be affected by habitat changes, we must study the role hydroperiod plays in their community assembly. My thesis is centered on two major themes: 1) what is the relative importance of climate, land cover/land use and terrain on wetland permanence class and 2) what is the role of hydroperiod in the assembly of three wetland biota: birds, aquatic macroinvertebrates and plants? First, I investigate the relative importance of the major factors influencing wetland permanence – climate, land cover/land use and terrain. Using 19 metrics representing climate, land use/land cover and terrain, each of which literature suggests could explain permanence, I predicted wetland permanence class in the Boreal, Parkland and Grassland Natural Regions. Climate was most important in predicting wetland permanence class in all three Natural Regions. However, in the Boreal and Parkland, terrain was the second most important driver of permanence class. Based on my findings, I believe that while it is important to consider climate and land cover/land use in forecasting the impact of climate change in PPR models, terrain

metrics can provide additional insight into how PPR wetlands will be affected by climate change. Second, I determined whether short- and long-hydroperiod wetlands differed in the relative influence of biological and environmental filtering on community abundances. My findings suggest that: 1) biological interactions had an equivalent role in shaping community abundances across the hydroperiod gradient and 2) hydroperiod alone could not explain community abundances because cross-taxon relationships were stronger (77% ±SE 12%) than taxon-hydroperiod relationships. Third, I determined whether hydroperiod had a more important role in the functional dispersion (i.e., how species abundances vary in trait space) of wetland biota. I conclude that: 1) there is a direct influence of hydroperiod on functional dispersion of all taxa; 2) both bird and aquatic macroinvertebrate functional dispersion is causally related to the functional dispersion of plants; and 3) hydroperiod had a more important role in structuring functional dispersion than cross-taxon interactions. Fourth, I sought to understand how sensitive wetland biota would be to an inter-year change in hydroperiod that was driven by a change in precipitation timing, which occurred between the two years my wetlands were surveyed. I found that for birds and aquatic macroinvertebrates, there was a change in community composition between years, which I could attribute to a change in hydroperiod. For birds and aquatic macroinvertebrates, I found that this change in hydroperiod resulted in wetlands supporting taxa that were weakly associated with wetland permanence or those being able to reproduce/survive these drier conditions. I posit that if the delay in precipitation became a sustained climatic pattern, we would eventually see changes in the community structure of plants similar to the changes we observed among birds and aquatic macroinvertebrates after a single year of delayed precipitation.

DEDICATION

To those gone, but pivotal in steering me towards this academic path.

… Lyril Miller, my grandmother.

…. Larry Daniel, my father.

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List of Acronyms

AIC	Akaike Information Criterion
DEM	Digital Elevation Model
ISA	Indicator Species Analysis
PPR	Prairie Pothole Region
PERMANOVA	Permutational Multivariate Analysis of Variance
NMDS	Non-metric Multidimensional Scaling
SEM	Structural Equation Model

1. BACKGROUND & LITERATURE REVIEW

1.1. Background

Wetlands in the Prairie Pothole Region (PPR) support numerous biological communities (Gibbs 1993; Loesch et al. 2012; Sundberg et al. 2016), and the composition of these communities depends on the length of time ponded water is present (i.e., hydroperiod or permanence class) (e.g., Gleason and Rooney 2017a; Daniel et al. 2019). These prairie pothole wetlands may differ in their hydroperiods because of land use activities (White and Fennessy 2005), the topography of their surrounding landscape (Shaw et al. 2013), climate (Schneider 2013) or geographical history (Wright 1972; Wolfe et al. 2019). Of these hydroperiod drivers, climate and land use activities explain much of the change in ponded water duration in the last decade(Werner et al. 2013; McCauley et al. 2015). To understand how habitat for biological communities may change, we must understand the relative influence of each driver on ponded water duration. Additionally, to understand how changes in hydroperiod will influence these communities, we must also understand the role of hydroperiod in the assembly of wetland biota.

1.1.1. Thesis Overview

My thesis is centered on understanding 1) the relative importance of the drivers of wetland hydroperiod on permanence class in Albertan PPR marshes and 2) the relationship between hydroperiod and community structure of wetland biota. I investigate these central objectives over six chapters, focusing on three key wetland indicator taxa: wetland dependent birds, aquatic macroinvertebrates and wetland macrophytes (i.e. plants). First, I review the literature on the drivers of wetland hydroperiod in the northern PPR. Second, I use predictive modeling to evaluate the relative importance of climatic, land cover/land use and terrain-based drivers of wetland permanence class. I conclude with a summary of the preceding chapters and identify areas in need of future research to better elucidate the relationship between wetland biota and hydroperiod. Third, I evaluate how congruence in the relative abundance of my three wetland indicator taxa are sensitive to wetland hydroperiod. Fourth, I test the alternate hypotheses about the relative importance of hydroperiod in determining the functional dispersion of the wetland taxa. Fifth, I take advantage of a change in the temporal pattern of annual precipitation between 2014 and 2015 to test how consequent reductions in hydroperiod might shift the diversity and composition of my indicator taxa in prairie potholes. In this final chapter, I also discuss the way in which prairie pothole wetland permanence is likely to change as a result of cumulative human impacts in the northern PPR.

1.1.1.1. Manuscripts & Author Contributions

From this thesis, I will co-author four manuscripts. Chapter 2 will be submitted to Nature and Climate Change with two additional authors – Dr. Derek Robinson (internal-external committee member) and Dr. Rebecca Rooney (supervisor). Dr Robinson provided early feedback on Chapter 2, post-processed the digital elevation model and advised on estimating terrain metrics. Dr. Rooney, as for all data chapters, designed the study, oversaw data collection (biological and environmental), advised on research questions and provided feedback on the manuscripts. Chapter 3 is under review in Scientific Reports and is co-authored with Dr. Rebecca Rooney. Similar to Chapter 3, Chapter 4 is under review (Ecosphere) and is co-authored with Dr. Rebecca Rooney. Chapter 5 is co-authored with Dr. Rebecca Rooney and will be submitted to Wetlands.

1.2. Review of Literature

1.2.1. History of PPR Wetlands

1.2.1.1. Geological History

Prairie potholes were formed in the last glacial period. During the Pleistocene era, ending ~ 10,000 years ago, northern North America was dominated by large ice sheets; and at the ends of these sheets, there were ice lobes that protruded into periglacial bedrock in lowland areas (Wright 1972). These protrusions formed glacial depressions or sloughs, and the type of bedrock determined their shape and depth (Wright 1972). Also during the Pleistocene period, the climate was cold and dry, which fostered a tundra-like-vegetated landscape, dominated by ice sheets for ~100,000 years (Schneider 2013). Then, with a shift to a warmer, wetter climate, upland vegetation communities altered to shrub, tree, and grasslands, as sloughs and depressions filled with ponded water (Schneider 2013). Initially, sediment run-off as glaciers melted modified the shape and depth of these glacial depressions (Wright 1972). While some recent agricultural activities have accelerated sedimentation rates (Gleason and Euliss 1998; Luo ’ et al. 1999; DeKeyser et al. 2009; Skagen et al. 2016), consequently shortening hydroperiods (Stewart and Kantrud 1971; van der Kamp et al. 2016), others have led to a lengthening in hydroperiods (McCauley et al. 2015; Anteau et al. 2016; Haque et al. 2018).

1.2.1.2. History of Land Use Practices

Agriculture is a main driver of wetland loss and degradation in the PPR. Between 2006 – 2011, in the US PPR, nearly 530, 000 hectares of grassland was converted to cropland, often in proximity to wetlands (Wright and Wimberly 2013). In Manitoba, the loss of PPR wetlands was accelerated by a ~40 % discount on lands intended for cropping between 1990 and 2009 (Lawley

2014). Within the Beaverhill subwatershed of Alberta, an area that is likely representative of activities within the entire Province as argued by the authors, agriculture contributed to the highest proportional losses of wetland area (39 %) between 1999 and 2009 (Clare and Creed 2014). Interestingly, 48% of the Beaverhill subwatershed was used by the agriculture sector in 2009 (Clare and Creed 2014). Also within the Beaverhill subwatershed, Serran and Creed (2016) estimated historical wetlands losses up to 2009. The authors reported that agriculture activities resulted in losses of 16.7% in wetland numbers and 2.7% of wetland area; they also report that smaller wetlands were removed disproportionately for agriculture. Interestingly, Bethke et al. (1995) hypothesized that within the eastern Canadian PPR, up to 90% of wetland habitat was lost to agriculture prior to the 1950s because losses post-1951 were negligible. The authors similarly hypothesized that losses of wetland habitat in the western Canadian PPR were likely extensive in that same time period. Thus, estimates within the past half-century may vastly underestimate historical wetland losses due to reliance on a contemporary baseline that misses that majority of historic wetland loss (but see Serran and Creed 2016).

Prairie pothole wetlands are disproportionately affected by agriculture. Prairie potholes have a high organic content in the upper layers of soil because inundation slows decomposition rates (Bedard-Haughn 2011). Because of the rich, fertile soils that result, and because wetland presence and flooding decreases crop profits (Verhoeven and Setter 2010), many PPR wetlands are drained illegally in Canada (Clare and Creed 2014). There have been declines in the loss of prairie pothole wetlands in the past few decades (Oslund et al. 2010; Withey and Van Kooten 2013). However, because of increases in the demand for corn and soybean (Johnston 2014), many of the remaining prairie pothole wetlands are at risk to be converted to cropland (Higgins et al. 2002; Rashford et al. 2010).

1.2.2. Hydrology of PPR Wetlands

Based on extensive work by Stewart and Kantrud (1971), PPR wetlands have been grouped by their hydroperiod, soils and vegetation zones into seven permanence classes. Typically, smaller, shallower wetlands will have shorter hydroperiods and fewer vegetation zones (Table 1.1). Larger, deeper wetlands, however, will typically have longer hydroperiods and more vegetation zones (Table 1.1).

Table 1.1. Descriptions of the seven permanence classes as described by Stewart and Kantrud (1971). [1]

#	Class Name	Subclass	Hydroperiod	Vegetation Zones & Notes
I	Ephemeral	None	Ponded water during snowmelt	Low-prairie (prairie-affiliated plants), highest seepage
II	Temporary	Fresh	Ponded water until early spring	Wet-meadow (wet-meadow emergent), low-prairie, high seepage
III	Seasonal	Fresh – Slightly Brackish	Ponded water past three weeks	Shallow-marsh, (from shallow to deep – emergent plants, submerged aquatic plants), wet-meadow, low prairie
IV	Semi-permanent	Slightly Brackish	Ponded water retained, except in drought years	Deep-marsh (emergent vegetation, open-water with bare-soil), shallow-marsh, wet-meadow, low- prairie
V	Permanent	Slightly Brackish	Ponded water always	No vegetation, deep marsh, shallow-marsh, wet-meadow, low-prairie

[1] I describe the typical length of time that these prairie pothole wetlands contain ponded water, their subclass and associated vegetation zones.

#	Class Name	Subclass	Hydroperiod	Vegetation Zones & Notes
VI	Alkali	None	Ponded water for a few weeks to months	No plants in the intermittent alkaline zone (high conductivity/salinity), shallow-marsh, wet-meadow, low-prairie, no deep-water phase, preferred by shore birds
VII	Fen	None	Ponded water always	Fen (fen-associated plants, with sparse, peripheral to central high-dominance), wet-meadow, low-prairie, no deep-water phase

1.2.2.1. Hydroperiod

Permanence class, though often diagnosed by patterns of vegetation, is ultimately the product of a wetland's hydroperiod, which is influenced by all water sources – precipitation, surface run-off and degree of groundwater connection (van der Kamp and Hayashi 2009; Shaw et al. 2012). Typically, snowmelt contributes the largest quantity of water to prairie pothole wetland water budgets (Hayashi et al. 1998b; Tangen and Finocchiaro 2017) because frozen soil does not permit infiltration, allowing all the melted snowpack from the wetland's catchment to run-off into the wetland (van der Kamp et al. 2003). However, due to more recent changes in weather patterns, precipitation from early spring and summer thunderstorms may make larger contributions to wetland water budgets than snowmelt (McKenna et al. 2017). Regardless, in summer, when the soil is no longer frozen, much of the precipitation infiltrates into the catchment soils or is evapotranspired by upland vegetation; the amount that reaches the wetland will depend on the degree to which the water-holding capacity of the soil is surpassed during rainfall events (LaBaugh et al. 2018). Usually, precipitation run-off that does reach the wetland may contribute to subsurface/lateral groundwater flow (Heagle et al. 2007). Contributions to ponded water amounts from groundwater is minimal, with the exception of low-lying sites

(Eisenlohr 1972; Euliss et al. 2014). Also influencing ponded-water amounts from precipitation, run-off, and groundwater is the size of the wetland catchment (Novikmec et al. 2016), permeability of the wetland soil (van der Kamp et al. 2003), and the extent of vegetation interception within the catchment (Miller et al. 2009). Mechanisms of ponded-water loss, however, include evaporation, transpiration and groundwater recharge from the wetland (Eisenlohr 1972). Ponded-water from summer precipitation is completely lost through evapotranspiration (Heagle et al. 2007), even when heightened summer precipitation contributes to extensive flooding (Poiani et al. 1995; Brooks et al. 2018). Thus, the ratio of rainfall run-off, snowmelt run-off, and groundwater discharge into a wetland will vary from site to site, depending on climate, landscape position, basin morphology and soil type (Anteau et al. 2016).

1.2.2.1.1. Groundwater

Groundwater is the main contributor of solutes in ponded water (Goldhaber et al. 2014), and it may connect otherwise geographically-isolated prairie pothole wetlands (Tiner 2003). However, it is generally agreed that groundwater does not significantly influence water levels in pothole wetlands (Hayashi et al. 1998b; Hayashi et al. 1998a). Generally, higher-elevation wetlands contribute to groundwater (recharge), mid-elevation wetlands neither contribute or remove ground water (flow-through), and lower-elevation wetlands remove groundwater (discharge) (Toth 1963; LaBaugh et al. 1998; Euliss et al. 2004b; Euliss et al. 2014). Groundwater flow can be deep (downward), contributing to regional groundwater that feeds local wetlands, or lateral/subsurface, used by neighboring plants (Hayashi et al. 1998b; van der Kamp and Hayashi 2009). Deep groundwater flow, however, is slow, occurring over hundreds of years, as minerals are transported from upland to lowland areas (Krasnostein and Oldham 2004;

Goldhaber et al. 2014). Thus, the volume of water contributed to prairie pothole wetlands via discharge of deep groundwater flow is never a large component of the wetland’s water budget. Lateral/Subsurface groundwater flow peaks when soil saturation is high, or when ponded water levels are near to the maximum storage capacity of the wetland (Krasnostein and Oldham 2004). The groundwater flows effectively balance surrounding shallow groundwater with ponded water in the wetland (Krasnostein and Oldham 2004). Because shallow groundwater flows more rapidly, it can be a more significant contribution to a wetland’s water budget than deep flowing groundwater.

1.2.2.1.2. Wetland Topographic Variation and Landscape Position

The magnitude of difference in elevation around a wetland can influence its pond permanence. This topographic variation can influence the wetland’s water budget by dictating the rate and volume of surface and subsurface water flows (Frei et al. 2012); this variation can influence wetlands at two scales – local (inclusive of areas immediately around the wetland) or regional (inclusive of an entire watershed). Most landscapes in the PPR have low local and regional topographic relief, resulting in gentle slopes (Neff and Rosenberry 2017; Wolfe et al. 2019). In landscapes with gentle slopes, surface water flow toward a wetland is limited, and the acceleration of this surface water flow is low, except during intense precipitation events (Neff and Rosenberry 2017; Wolfe et al. 2019). In landscapes with more local topographic variation, precipitation may be funneled from the catchment into the wetland (Neff and Rosenberry 2017; Wolfe et al. 2019). This surface water run-off contribution will be greater in wetlands situated in regional topographic depressions.

1.2.3. Past and Forecast Effects of Climate Change & Land Use

1.2.3.1. Effects of Climate Change on Hydroperiod

Wetlands in the PPR are sensitive to changes in climate, even when these changes are irregular (Johnson et al. 2004). In South Dakota, drought conditions changed water-table elevations in temporary wetlands by as much as 4 m (Johnson et al. 2004), highlighting the importance of climate on wetland hydroperiod. As described above, precipitation is an important source of water to PPR potholes, but temperature and humidity also play a role. Both temperature and humidity determine evaporation and transpiration rates, which are a major pathway of water out of PPR potholes. Unfortunately, as the climate is changing, a historical normal may no longer yield accurate predictions of future water budgets in PPR wetlands (Zhang et al. 2011; Werner et al. 2013; Fay et al. 2016).

With respect to climate change, there is a consensus that summer temperatures will increase, shortening hydroperiods, but the magnitude of change in summer precipitation is uncertain (Schneider 2013). Flood-causing rainfall events could, hypothetically, increase wetland water budgets, just as with flash-snow melts (Garris et al. 2015). However, a general increase in summer precipitation would not likely offset increased evaporative losses, as rainfall run-off is more likely to infiltrate the soils of wetland catchments (Poiani et al. 1995; Johnson et al. 2010b; van der Valk et al. 2015; van der Kamp et al. 2016). Fay et al. (2016) reported that the magnitude of change in hydroperiod increases with permanence class, regardless of how wet or dry the climate. This is because less permanently-ponded wetlands dry out before peak evapotranspiration rates in mid-summer. Consequently, more permanently-ponded wetlands are expected to experience a greater change in hydroperiod than more ephemeral wetlands, likely shifting the frequency distribution of wetland permanence classes in the PPR (Fay et al.2016). Further, since the southern and western portions of the PPR have drier climates, warmer summer temperatures could be particularly influential on wetlands in these areas (Fay et al.2016). Interestingly, a trend of shortened hydroperiod, overall, has been observed in the PPR in last few decades (Werner et al. 2013).

1.2.3.2. Effects of Land Use on Hydroperiod

Land use may cause both increases and decreases in wetland hydroperiods. For example, roads may block snow melt and rainfall run-off (Shaw et al. 2012), producing greater ponding on one side and drier conditions on the other. Consolidation drainage can also increase a wetland's hydroperiod; this involves directing water to wetlands positioned lower in the landscapes from those full/partially draining at higher positions in the landscape (McCauley et al. 2015). Consequently, wetlands receiving this redirected water have longer hydroperiods (McCauley et al. 2015; Krapu et al. 2018; Haque et al. 2018). The way a particular land use may influence the hydroperiod of wetlands in a catchment is not always straight forward. Cattle grazing can reduce snow accumulation, as short vegetation is less effective in trapping snow (Willms and Chanasyk 2013), which will reduce snowmelt inputs and may therefore reduce wetland permanence. Conversely, grazing and tillage may compact soils and reduce evapotranspiration, thereby increasing rainfall run-off inputs and increasing wetland permanence (Voldseth et al. 2007; Collins et al. 2014). Similarly, van der Kamp et al. (2003) reported shortened hydroperiods when croplands were revegetated with natural plants in southern Saskatchewan. The reduction in hydroperiod was attributed to the stronger snow-trapping abilities of native vegetation and the larger infiltration of snowmelt in frozen, vegetated soil (van der Kamp et al. 2003). Though the ways in which croplands and grazing affect surface run-off and snow accumulation can differ, changes in snow accumulation will have larger impacts on hydroperiod than changes in summertime precipitation.

1.2.3.3. Wetland Biota in the PPR

We can study birds, aquatic macroinvertebrates and plants in the PPR to better understand how sensitive wetland biota are to hydroperiod and determine the ecological significance of hydroperiod in the assembly processes of these communities. Though studying fish communities can be equally valuable in understanding the sensitivity of wetland biota to hydroperiod (e.g., Maurer et al. 2014), this taxon has not been observed in the Albertan PPR; consequently, they will not be discussed. One reason that these taxa are useful in studying assembly processes is that they are sensitive to wetland characteristics, and this is inclusive of wetland hydroperiod (Daniel et al. 2019). Second, they are widely used bioindicators in studying wetlands (Adamas 1996) .Third, they are likely to interact in a diversity of ways including competition, predation, parasitism, and facilitation (Klaassen and Nolet 2007; Reynolds and Cumming 2016; Gleason et al. 2018). Finally, these taxa represent a range of motility, with birds being highly mobile – travelling between hemispheres, Natural Regions and landscapes (Naugle et al. 2001; Oslund et al. 2010), inverts being intermediate – travelling to neighboring wetlands (Panov and Caceres 2007; Mabidi et al. 2017), and plants being fairly sessile.

1.2.3.3.1. Effects of Climate Change and Agriculture on Wetland Birds

1.2.3.3.1.1. Bird Assembly in the PPR

Birds in the PPR may differ in their reliance on wetland habitat for feeding and reproduction (Vanausdall and Dinsmore 2019). As much as half of the birds that use PPR wetlands are typically categorized as terrestrial/facultative (Anderson and Rooney 2019), using wetlands for foraging and pairing, but nesting in upland habitat (Johnson et al. 2010a). While wetland-dependent birds, such as shorebirds, waterbirds and waterfowl, also forage in wetlands, some of these wetland species may nest in upland habitat adjacent to wetlands (Greenwood et al. 1995; Reynolds et al. 2001), and others may nest in the wetland proper (Kantrud and Stewart 1984). Of these wetland-dependent birds, Murkin et al. (1997) reports that waterbirds, in addition to selecting wetlands with longer hydroperiods for nesting, require wetland complexes throughout their breeding season. In support of this requirement for wetland complexes, Naugle et al. (1999) found that though Black Terns (*Chlidonias niger*) nest in permanent-classified wetlands, they forage in wetlands of lower permanence up to 4 km from their nesting site.

Wetland hydroperiod can influence the abundance, richness and diversity of birds, where wetlands with longer hydroperiods do support more species (Ruwaldt Jr et al. 1979; Kantrud and Stewart 1984; Bartzen et al. 2017). Daniel et al. (2019) observed more diverse bird communities in wetlands with longer hydroperiods, and they attribute this higher diversity to the greater habitat heterogeneity in permanently-ponded wetlands. Though alpha diversity may be lower in wetlands with shorter hydroperiods, Niemuth et al. (2006) reported that temporarily-ponded wetlands are integral foraging grounds, and that they do provide critical habitat for migrant shorebirds.

1.2.3.3.1.2. Climate Change Influences Birds

Wetland-dependent birds in the PPR are sensitive to climate change-driven changes in wetland hydroperiod. Because shortened hydroperiods are forecasted with a warmer climate, shifts in distribution of birds are expected in the PPR, especially in areas where the climate is more arid (Johnson et al. 2005; Polan 2016; Reese and Skagen 2017). Observations in these more-arid regions, which are in the south and west PPR, confirm that a larger proportion of birds now breed in the northern and eastern PPR (Janke et al. 2017; Steen et al. 2018).

A warmer climate can also influence PPR birds nesting initiation dates. Raquel et al. (2019) reported that when spring and winter temperatures were warmer, the first day that birds initiated nesting was earlier. When winters were cooler with warmer springs, birds nested later (Raquel et al. 2019). While there was no direct influence of temperature on nest survival, delays in first nest date have been associated with lower reproductive successes because birds may have fewer opportunities for re-nesting (Devries et al. 2008), and the probability of nesting failure increases with additional attempts (Harriman et al. 2017). Because we expect warmer winters and earlier spring start dates due to climate change, birds in the PPR could undergo increases in reproductive success as there are more re-nesting opportunities.

1.2.3.3.1.3. Land Use Influences on Birds

Increasing cropland cover and grazing will further lower abundances and species diversity of birds in the PPR (Austin et al. 2001). One explanation for this influence of agriculture is that increases in cropland activity result in increased predator activity, preying on eggs, chicks and nesting females (Greenwood et al. 1995; Sherfy et al. 2018). Alternatively, increases in agricultural activities may eliminate the habitat required by birds that forage or nest in upland habitat. This loss of upland habitat could explain why disturbance-insensitive bird species are more abundant within wetlands in agricultural landscapes (Anderson and Rooney 2019). More, Popotnik and Giuliano (2000), in investigating trends in waterbird abundances within riparian zones of pastures in southwest Pennsylvania, found lower abundances in areas with high-grazing intensity. For some species, like the Lesser Scaup (*Aythya affinis*), it appears that reductions in abundance with agricultural disturbance are due to the effects of farming on macroinvertebrate prey abundance (Lindeman and Clark 1999; Anteau and Afton 2011).

1.2.3.3.2. Effects of Climate Change and Agriculture on Aquatic Macroinvertebrates

1.2.3.3.2.1. Aquatic Macroinvertebrate Assembly in the PPR

Several authors have reported lower abundance, diversity, and richness of macroinvertebrates in wetlands with lower pond permanence (Brooks 2000; Hall et al. 2004; Whiles and Goldowitz 2005). Fritz and Dodds (2004) suggested that draw downs in wetlands can lead to large declines in macroinvertebrate abundance and richness because taxa lacking desiccation strategies are eliminated. Further, Daniel et al. (2019), Gleason and Rooney (2017a) and McLean et al. (2019) reported that shorter-hydroperiod wetlands contain only a subset of the macroinvertebrate taxa pool that occupy permanently-ponded wetlands. In these short-hydroperiod wetlands, macroinvertebrates typically possess desiccation avoidance or tolerance strategies. Consequently, they hypothesize that the community structure of macroinvertebrates in shorter-hydroperiod wetlands are less subject to interspecific interactions and more strongly structured by the environmental filter of periodic drying compared with more permanent wetlands. Further, in these short-hydroperiod wetlands, colonization from neighboring, longer-hydroperiod wetlands sustains macroinvertebrate communities (Whiles and Goldowitz 2005). Whiles and Goldowitz (2005) hypothesize that colonization is critical to sustaining populations in short-hydroperiod wetlands because draw-down events eliminate most species. Thus, if wetlands are disconnected from their complexes, macroinvertebrate communities in short-hydroperiod wetlands are particularly vulnerable (Sim et al. 2013).

1.2.3.3.2.2. Climate Change Influences on Aquatic Macroinvertebrates

Though changes in the diversity and composition of aquatic macroinvertebrates are likely with climate change, studies assessing the impacts of climate change on wetland biota have focused more on other taxa (but see McLean et al. 2016). Because aquatic macroinvertebrates require ponded water and aquatic vegetation to feed and reproduce (Gleason et al. 2018), we could expect shorter-hydroperiod wetlands to support only taxa able to reproduce or develop under drier conditions (e.g., Huang et al. 2006; Rowbottom et al. 2017). Taxa unable to tolerate these drier conditions, either because they have larval stages that require continuous standing water or consume smaller aquatic macroinvertebrates by diving (e.g., Applegate and Kieckhefer 1977), will survive only if they are able to disperse to neighboring wetlands (Whiles and Goldowitz 2005; Gleason and Rooney 2017a). Because plants play and integral role in the feeding and reproduction of some functional groups of aquatic macroinvertebrates (Davis et al. 1999), a change in plant community composition (discussed below in 1.2.3.3.3.2) due to changes in wetland hydroperiod (Euliss et al. 2004) could amplify the impacts of climate change on aquatic macroinvertebrate communities.

1.2.3.3.2.3. Land Use Influences on Aquatic Macroinvertebrates

The effects of agricultural activities on the abundance and diversity of wetland macroinvertebrates appear variable. While some studies indicate that there is a positive effect of grazing on macroinvertebrate diversity and abundance (Marty 2005; O'Neill et al. 2016), others find lower abundances and richness in wetlands with cropping or tilling in the surrounding landscape (Euliss and Mushet 1999; Euliss et al. 2002). Still other studies find little to no measured effect of agriculture in the catchment on the abundance, richness and diversity of macroinvertebrates in a wetland (Tangen et al. 2003; Davis et al. 2006; Meyer et al. 2015; Sundberg et al. 2016; Gleason and Rooney 2017b). Authors of a study in South African wetlands with similar hydroperiods and surface connectivity as those in the PPR reported that cropland cover may have little influence on aquatic macroinvertebrate diversity or abundance (Bird et al. 2013). The authors hypothesized that environmental conditions that typically influence aquatic macroinvertebrate abundance or diversity (e.g., turbidity and nutrient concentrations) (Meyer et al. 2015) are unaffected by surrounding land use. I hypothesize that these geographically-isolated wetlands may be unaffected by cropland activities because there is a delay in when surface water affected by agricultural activities reaches the wetland. This mechanism may explain why studies in the PPR found no effect of agriculture on aquatic macroinvertebrate diversity in PPR wetlands (Meyer et al. 2015; Sundberg et al. 2016; Gleason and Rooney 2017b). Regardless, changes in water and sediment quality do affect aquatic macroinvertebrate diversity and composition (Johns et al. 2012) and changes in wetland sediment and water chemistry can be related to land cover within about 500 m of PPR wetlands (e.g., Silver et al. 2012; Kraft et al. 2019).

1.2.3.3.3. Effect of Climate Change and Agriculture on Vegetation

1.2.3.3.3.1. Plant Assembly in the PPR

Wetland plant assemblages are influenced by hydroperiod (Hargiss et al. 2008; Tsai et al. 2012a), which drives natural cycles in vegetation (Stewart and Kantrud 1971). As summarized in Euliss et al. (2004b), during draw-down periods, litter from macrophytes is quickly decomposed aerobically, which provides nutrients for aquatic plants when the wetlands are re-flooded. When the mudflats are exposed during draw-down periods, however, seeds from both upland and aquatic plants germinate (Euliss et al. 2004b). The sustained presence of ponded water allows submerged and emergent plants to outcompete upland vegetation and the characteristic wetland vegetation zones to develop (Euliss et al. 2004b). In shallower areas, wet meadow plants establish, while submerged and floating aquatic vegetation establish in areas of deeper water (Casanova and Brock 2000). Euliss et al. (2004b) also explain that groundwater contributions also influence plant assemblages, both directly – by lengthening hydroperiod in discharge wetlands, and indirectly – by ecologically filtering which plants can persist because of their salinity tolerances.

1.2.3.3.3.2. Climate Change Influences on Plants

Because climate change forecasts predict a warmer climate, and subsequently higher rates of evaporative loss in pothole wetlands, plant communities are possibly vulnerable. Aquatic plant cover will likely decline in wetlands as hydroperiods shorten and wetlands shrink (Johnson et al. 2010). Besides shifts in flowering dates (Munson and Long 2017), less-dynamic vegetation cycles have been observed within the last century (Werner et al. 2013). With less-dynamic vegetation cycles, there are smaller differences in water depths between draw-down and re-flooding, eliminating some vegetation assemblages, particularly in semipermanently-ponded wetlands. (Werner et al. 2013; Fay et al. 2016).

1.2.3.3.3.3. Land Use Influences on Plants

Plant communities, within and around wetlands, can mitigate the impacts of surrounding land use on water quality, but agriculture can directly influence plant assemblages. Main et al. (2017)

reported lower ponded-water contamination from pesticides, herbicides, and fungicides, which plants incorporated into their tissue, in wetlands exhibiting vegetation patterns of natural, undisturbed sites. Similarly, Rickerl et al. (2000) found the natural vegetation around wetlands can lower sedimentation rates and nutrient runoff into wetlands. Conversely, when wetlands are drained, the seedbank community composition is changed (Wetzel et al. 2001), as the congruence between the living biomass and seedbank is lost (Craft and Casey 2000). Thus, disturbed wetlands have lower species richness, higher cover of exotic species, and fewer perennial species than undisturbed wetlands (Bolding et al. 2020 ; Smith and Haukos 2002; Vodseth et al. 2009; Tsai et al. 2012b).

1.2.4. Summary: Climate & Land Use Impacts on Wetland Biota

Both climate change and land use will shape PPR wetland communities, with shorter hydroperiods, lower water quality and higher sedimentation rates affecting plant, birds and macroinvertebrate communities. With increasing cropland cover in the PPR and a warmer, drier climate, the prevalence of short-hydroperiod wetlands will increase (Fay et al.2016). Such short-hydroperiod wetlands in the Grassland ecoregion may have weaker cross-taxon congruence because there is a negative effect of increasing non-natural cover (Rooney and Azeria 2014). Similarly, if within- (Gleason 2017) or between-taxon congruence is stronger with longer-hydroperiod wetlands (Chapter 2), we may observe weakened congruence among birds, plants, and macroinvertebrates communities with climate change. Thus, to adequately prepare for climate change, we must understand the mechanisms and processes driving cross-taxon congruence and community structure.

2. CLIMATE AND TOPOGRAPHY: THE TWO ESSENTIAL INGREDIENTS IN PREDICTING WETLAND PERMANENCE.

2.1. Introduction

Wetlands provide habitat for diverse communities of flora and fauna (Gibbs 1993; Loesch et al. 2012; Sundberg et al. 2016) as well as a disproportionate amount of ecosystem services relative to the area they occupy compared to other ecosystems (Mitsch et al. 2015). The diversity and abundance of flora and fauna in wetland ecosystems is dictated by the availability of ponded water (Gleason and Rooney 2017a; Daniel et al. 2019), which is forecast to decline in amount and duration of presence (i.e., hydroperiod) across the prairie pothole region of North America due to climate change (Euliss et al. 2004; Steen et al. 2014; Fay et al. 2016; Steen et al. 2016). In this region, the majority of wetlands are ponded non-permanently and they support resident biological communities (Stewart and Kantrud 1971; Daniel et al. 2019) that are sensitive to climate change (Johnson et al. 2010b; Fay et al. 2016). Therefore, understanding the relative influence of climate on wetland water levels is critical to improving our understanding of how biological communities in the PPR will respond to climate change.

Given the PPRs' semi-arid climate, a decline in wetland hydroperiod is expected because of increases in wetland water deficits (Schneider 2013; Werner et al. 2013). Most sensitive to climate change are wetlands that contain ponded water year-round; we expect up to a 20% decline in the hydroperiods of such wetlands (Fay et al. 2016). Some forecasts suggest that many of the wetlands in the southern and western PPR may be lost completely, driven by drier climate conditions in these areas (Johnson et al. 2005; Johnson et al. 2010b; Reese and Skagen 2017). Conversely, observational studies in the southern and western PPR suggest there have been increases in pond permanence, which are attributed to changes in land use practices (McCauley et al. 2015; Anteau et al. 2016; McKenna et al. 2017; McKenna et al. 2019). Regardless, simulations for the PPR suggest that the magnitude of change in climatic conditions between 1946 and 2005 were vast enough to drive declines in pond permanence (Werner et al. 2013).

In addition to climate, land use activities can also affect hydroperiods in PPR wetlands (Johnson et al. 2010b; Tsai et al. 2012a; McCauley et al. 2015). Landscapes with a higher proportion of agricultural activities have longer hydroperiods due to the combination of increased surface run-off and decreased soil infiltration (van der Kamp et al. 2003; Voldseth et al. 2007). Agricultural activities can also influence ponded water levels through consolidation drainage – fully or partially draining wetlands in the upper watershed and directing this water to wetlands lower in the watershed (McCauley et al. 2015). This is typically done to lower the probability that neighboring croplands are flooded (Schindler and Donahue 2006; Verhoeven and Setter 2010), which increases farming efficiency (Wiltermuth and Anteau 2016). To date, many studies modelling the impacts of climate change on PPR wetlands have incorporated land use (Vodseth et al. 2009; Anteau et al. 2016), and there is resounding evidence that wetlands exposed to the same climate regime, but situated among different land use activities, differ in their sensitivity to climate change (McCauley et al. 2015; Wiltermuth and Anteau 2016).

Though we understand that terrain is important in predicting pond permanence (Shaw et al. 2013; Wiltermuth and Anteau 2016; Hayashi et al. 2016; Neff and Rosenberry 2017), few studies have included this metric (but see Wolfe et al. 2019). Models for the PPR that predict pond permanence in response to climate often omit terrain, but typically include land use/cover (e.g., WETSIM (Poiani and Johnson 1993a), WETLANDSCAPE(Johnson et al. 2010b). Quantifying the individual and combined contribution of climate, land use/cover and terrain to wetland permanence is necessary to improve wetland and waterfowl population management across the PPR (Fay et al. 2016). For example, differences in terrain may cause wetlands belonging to the same permanence class to differ in their sensitivity to climate change. To ameliorate this scientific gap, I analyzed data collected across multiple field projects. I used these spatial data, comprising thousands of wetlands across the PPR in Alberta (Canada), to predict wetland permanence class.

2.2. Methods

2.2.1. Study Area

The wetlands in my study are in the south-Albertan extent of the Prairie Pothole Region (PPR) (Figure 2.1). Wetlands in this region are called potholes because they are depressions filled with ponded water, each formed in the last glacial period (Wright 1972). Potholes can differ in the length of time they contain ponded water, which can range from just a few weeks after snowmelt to the entire year (Stewart and Kantrud 1971).

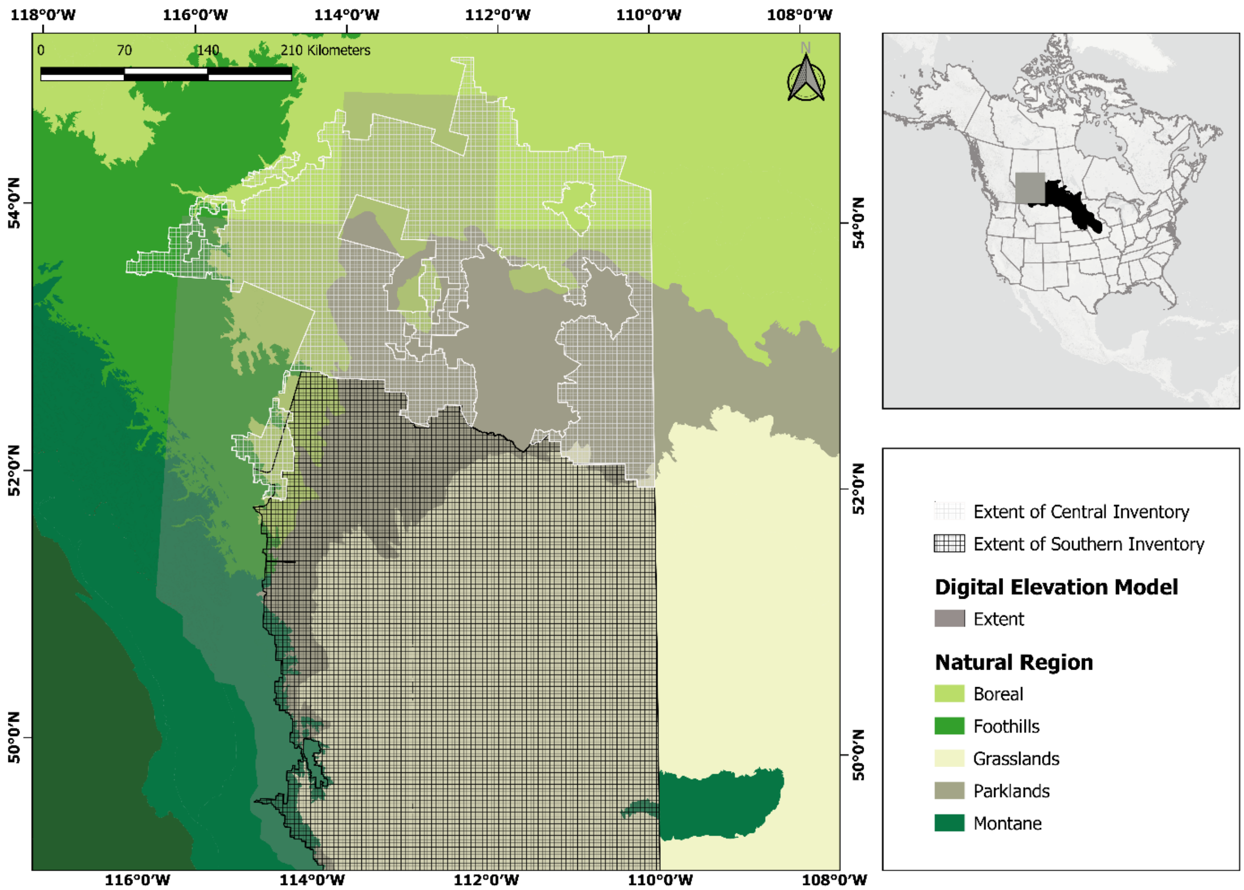

Figure 2.1. Extents of the Central and Southern Wetland Inventories used to delineate wetlands in the study, which are in the prairie pothole region (inset map). ¶selected wetlands from three Natural Regions – Boreal (12,0000), Parkland (12,0000) and Grassland (16,0000). These wetlands are within the southern-Albertan Prairie Pothole Region. There are 356,246 wetlands delineated in the Southern Inventory and 253,873 in the Central Inventory.

I acquired data on two wetland inventories (Government of Alberta 2014) that delineated the location, boundary and permanence class based on Stewart and Kantrud's classification of PPR wetlands (Table 2.1; Stewart and Kantrud 1971).

Table 2.1. Descriptions of the four permanence classes included in this study.¶ describe the typical length of time that these prairie pothole wetlands will contain ponded water, their associated vegetation zones, as described by Stewart and Kantrud (Stewart and Kantrud 1971), and the number of wetlands belonging to each class in the Alberta Merged Wetland Inventory (Government of Alberta 2014) that were within the extent of our 25-m digital elevation model.

Permanence class	Typical hydroperiod	Vegetation zones	Natural Region		
			Boreal	**Parkland**	**Grassland**
Temporary	Until mid-spring, typically for four weeks	Wet-meadow (includes wet-meadow emergent), low-prairie, high seepage	40461	51062	153872
Seasonal	Late spring to early summer for approximately two months	Shallow-marsh (vegetation zones from shallow to deep: emergent plants, submerged aquatic plants), wet-meadow, low prairie	30890	43836	108924
Semi-permanent	Dries fully in drought years only	Deep-marsh (vegetation zones from shallow to deep: emergent vegetation, open-water with bare-soil), shallow-marsh, wet-meadow, low-prairie	39375	47075	12240
Permanent	Open water year-round	Open water, deep marsh, shallow-marsh, wet-meadow, low-prairie	5704	10785	4952

The two wetland inventories differ in their accuracy, but they collectively span three Natural Regions (Grassland, Parkland and Boreal). The Grassland, comprising mixed-grass prairie, and the Parkland, comprising deciduous trees and grasses, are semi-arid regions with potential evapotranspiration rates that are greater than annual precipitation (Downing and Pettapiece 2006). The Parkland, however, experiences more precipitation than the Grassland (Downing and Pettapiece 2006). While the Boreal Natural Region is dominated by decided and coniferous trees, and annual precipitation amounts typically exceed evapotranspiration rates (Downing and Pettapiece 2006), PPR wetland in the Boreal experience semi-arid to humid climate conditions (Devito et al. 2005; Brown et al. 2010).

2.2.2. Wetland Locations & Extents

For my analyses, I selected a subset of wetlands from the Merged Albertan Wetland Inventories within each Natural Region. After excluding wetlands with buffered (500m) boundaries that overlapped with more than one Natural Region, I randomly selected 12,000 wetlands in the Boreal and Parkland Natural Regions (3,000 per permanence class) and 16,000 in the Grassland (4,000 per permanence class).

2.2.3. Selecting Metrics

To select metrics representative of climate, land cover/land use and terrain that would be useful in testing the relative contribution of these three factors in predicting prairie pothole wetland permanence class, I conducted a literature review. I used Web of Science to conduct this review, limiting the search to papers published between 1950 to 2018, and key words for: 1) the PPR: Prairie Pothole Region, Northern Great Plains, Alberta, Saskatchewan, Manitoba and Dakota; 2) weather: climate, temperature and precipitation; 3) disturbance: land use, agriculture, disturbance, oil and gas, grazing and roads and 4) pond permanence: watershed, hydroperiod, permanence class, catchment and wetland. I used "OR" operators between key words under the same class and "AND" operators between each key word class. For the terrain metrics, I used selected metrics that are commonly used to describe topographic variations, based on a previous review (Branton and Robinson 2019). Details and results from this review are reported in a Table 2.2.

Table 2.2. List of climate, land cover and land use and terrain metrics used to predict wetland permanence class.¶n this table, I include a description of the significance of each metric for wetland hydroperiod and the proxy metrics I selected. For the purpose of my analysis, winter months range from November to February, spring April to May and summer June to August

Category	Variable	Significance for Wetland Hydroperiod/Formula	Proxy/Class[2]
Climate	Snowpack/Winter precipitation	Snowpack accounts for 30-60% of ponded water amounts(Hayashi et al. 1998a; Tangen and Finocchiaro 2017b) Longer hydroperiods with higher winter precipitation (Collins et al. 2014)	Total Spring Precipitation Total Winter Precipitation Total Precipitation in Winter & Spring Total Spring Snowpack Total Winter Snowpack Total Snowpack in Winter & Spring
	Sumer Precipitation	Longer hydroperiods from increased summer precipitation (Eisenlohr 1972; Leibowitz and Vining 2003; Euliss et al. 2014; Clare and Creed 2014)	Total Summer Precipitation
	Summer Temperature	Evapotranspiration rates/water losses higher in summer (from June) (Heagle et al. 2007)	Average Maximum Temperature in June Average Maximum Temperature in July Average Maximum Temperature in Summer
	Winter/Spring/Summer Temperature	Snowpack may melt too fast with warmer conditions (Crosbie et al. 2013),13]	Average Maximum Temperature in Spring Average Maximum Temperature in Winter Average Maximum Temperature in Spring & Winter
	Precipitation Timing	Fewer wetlands dry up when summer precipitation is earlier in the summer (Polan 2016; Meyers 2018)	Proportion of Summer Precipitation in June
Land Use & Land Cover	Natural Vegetation	Loss of natural cover increases surface runoff (Clare and Creed 2014)	% Natural Cover
	Cropland Cover	Because soil is less porous (more compacted), much of the accumulated water, either from the snowpack or spring/summer precipitation, flows into the wetland – this increases water levels (van der Kamp et al. 2003; Voldseth et al. 2007)	% Cropland Cover

[2] This differentiates terrain metrics by global (estimated using a 100 × 100-m moving window and mean value within 500-m buffer recorded) and local (estimated within a 500-m buffer of the wetland.

Category	Variable	Significance for Wetland Hydroperiod/Formula	Proxy/Class[2]
	Urban Cover	Longer hydroperiods in urban landscapes, mostly because of higher runoff (when compared to those in croplands (Fossey and Rousseau 2016)	% Urban Cover & Bare Ground
	Grazing	Grazing lowers snow accumulation (Willms and Chanasyk 2013), which can increase runoff and hydroperiod (Niemuth et al. 2010; Collins et al. 2014)	% Pastureland
	Culverts/Roads	Lowers hydroperiods by blocking surface runoff (Shaw et al. 2012)	Distance to Road
	Tilling	Can lower pond area/depth, and by extent hydroperiod, as increases in sedimentation can in fill ponds (Skagen et al. 2016)	% Cropland Cover
Terrain Metrics	Mean Elevation (DEM) - Deviation	$\lvert \text{Elevation} - \text{Elevation}_{mean} \rvert^2$ (Lindsay et al. 2015)	Local
	Elevation (DEM) - Standard Deviation	$\sqrt{\frac{\sum (\text{Elevation}-\text{Elevation}_{mean})}{n}}$ (Grohmann et al. 2011)	Local
	Profile Curvature (PC) - Standard Deviation	$\sqrt{\frac{\sum (\text{Profile Curvature}-\text{Profile Curvature}_{mean})}{n}}$ (Olaya 2009)	Local
	Slope - Standard Deviation	$\sqrt{\frac{\sum (\text{Slope}-\text{Slope}_{mean})}{n}}$ (Olaya 2009)	Local
	Terrain Surface Convexity	Percentage of upwardly-convex cells within the moving window (Iwahashi and Pike 2007)	Global
	Terrain Surface Texture	Relative frequency of pits and peaks in a 100 × 100-m moving window (Iwahashi and Pike 2007)	Global
	Topographic Position Index	$\frac{\text{Elevation}_{mean} - \text{Elevation}_{min}}{\text{Elevation}_{max} - \text{Elevation}_{min}}$ (De Reu et al. 2013)	Local
	Slope Variability	$\text{Slope}_{max} - \text{Slope}_{min}$ (Grohmann et al. 2011)	Local

2.2.3.1. Climate

I acquired 2013-2014 daily weather data from the AgroClimatic Information Service of Alberta to calculate climate metrics. These data comprised of precipitation and temperature measurements from 7,914 weather stations across the province, observed from October 2013 to August 2014. I calculated seasonal precipitation totals and temperature averages from a compilation of proxy variables (Table 2.2) at each station. Then, using a simple inverse distance weighting (Tarroso et al. 2019), I interpolated climate metrics at the center of each wetland in R (R Core Team 2019).

2.2.3.2. Land Cover & Land Use

Prior worked identified strong concordance between landcover within 500-m of wetlands and wetland psychochemical conditions (Kraft et al. 2019), indicating this was an appropriate buffer width for prairie pothole wetlands in Alberta. Within this distance, I used landcover data from Agriculture and Agri-Food Canada's (AAFC) Annual Crop Inventory for 2014 (Agriculture and Agri-Food Canada 2014) and road network data from the Government of Canada (Statistics Canada 2010) to estimate land cover and land use metrics. I used the proportion of area within the 500 m buffer for each land cover class to measure percentage cover. Next, I measured the percentage cover of each land cover class reported under Table 2.2. I used the road layer for Alberta to measure the distance of each wetland center to the nearest road. I estimate these land cover/land use metrics in ArcMap 10.4.1 (ESRI 2012).

2.2.3.3. Terrain

I quantified topographic characteristics using a 25-m digital elevation model (DEM) for southern and central Alberta (Figure 5.1; Yang et al. 2014). I estimated eight terrain metrics (Table 2.2) using ArcMap 10.4.1 (ESRI 2012) and SAGA 2.3.2 (Conrad et al. 2015). These metrics may be grouped as those with local (e.g., standard deviation of slope) versus global (e.g., terrain surface convexity) application. For local metrics, I applied the formula to areas only within 500 m of the wetland boundary. With global metrics, I applied a 100 × 100-m moving window and computed the mean value within the 500 m buffers.

2.2.4. Data Analysis

I aimed to quantify the relative contribution of climate, land cover/land use and terrain for different wetland permanence classes and determine the ability of these drivers for predicting wetland permanence class. Achieving these two outcomes involved four steps: reducing the number of metrics to an orthogonal and parsimonious set for application; visualizing if wetlands could be partitioned based on their permanence class (Figure 2.2); parametrizing and calibrating a predictive model; and then predicting permanence class and assessing model fit. These analyses were performed in R (R Core Team 2019).

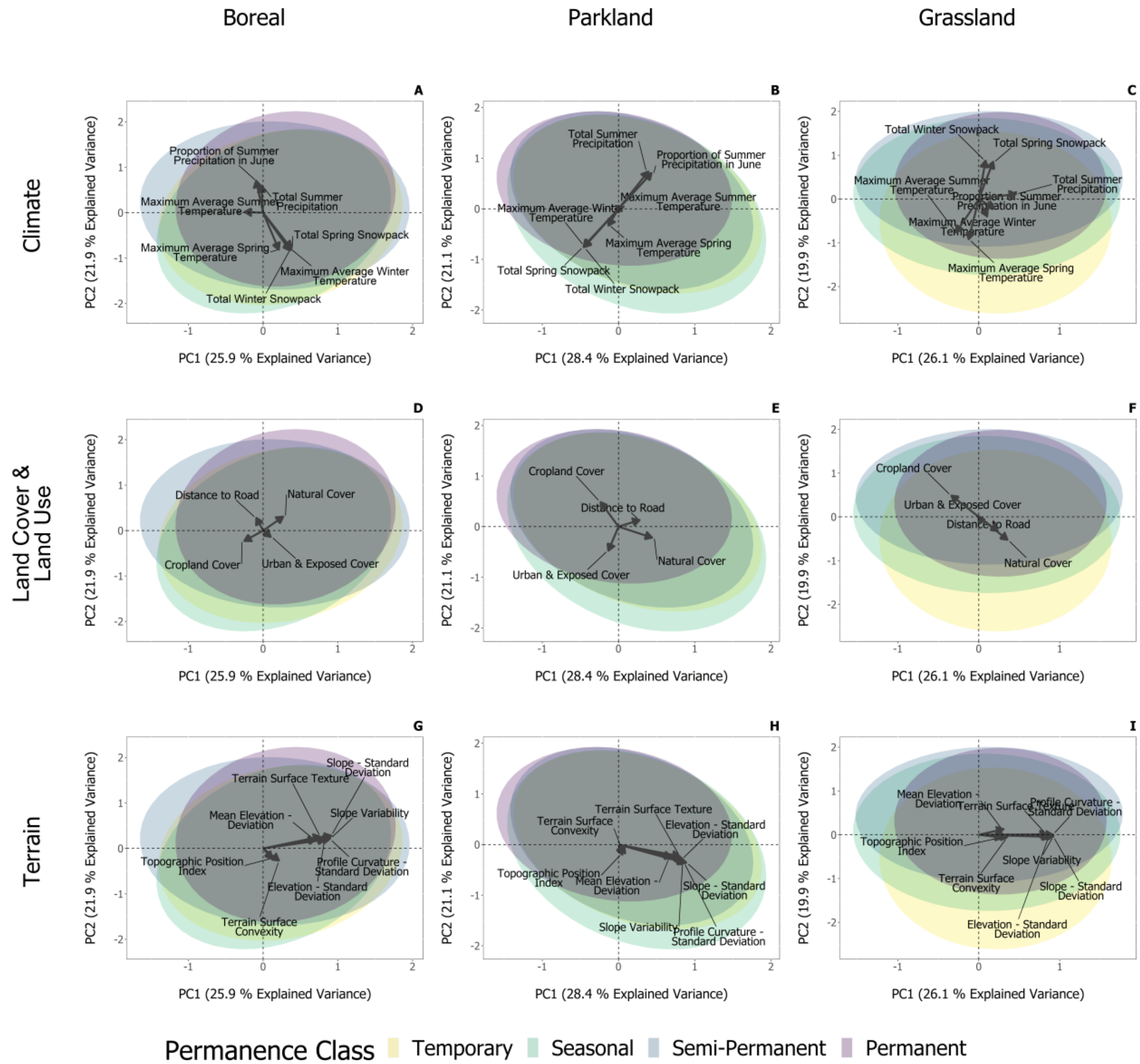

Figure 2.2. Principle Components Analysis for wetlands delineated in the 1) Boreal (totaling 12,000 wetlands), 2) Parkland (totaling 12,000 wetlands) and 3) Grassland (totaling 16,000 wetlands) Natural Regions.¶PCAs apply an orthogonal transformation to summarize the data into axes that explain the variance between two correlation matrices. Our data were scaled before implementing the PCA. Vectors on climate (A-C), land use and land cover (D-F) and terrain roughness (G-I) show correlations with both axes. Axis two, for all datasets, represents a hydroperiod gradient and terrain roughness is represented on axis 1. The ellipses are 90 % confidence intervals, assuming a multivariate t-distribution.

2.2.4.1. Predicting Wetland Permanence Class

I used an extreme gradient boosting model to predict wetland permanence class. Extreme gradient boosting is considered a more robust predictive tool than random forest (Sheridan et al. 2016). Like random forest, extreme gradient boosting creates an ensemble of decision trees that partition data based on a specified grouping (McCune et al. 2002; Hastie et al. 2009); in my case, this is wetland permanence class. In the first decision tree, all observations are equally weighted (Cutler et al. 2007). The second decision tree attempts to correct the misclassifications of the first tree, assigning a higher weight to observations that were difficult to classify. Each subsequent tree are attempts to minimize the model error by classifying these error-prone observations (Cutler et al. 2007). The use of the minimum error to build a model ensemble makes extreme gradient boosting models prone to overfitting (Cutler et al. 2007). To correct for overfitting, extreme gradient boosting models include a regularized object that penalizes more complex trees (Chen and Guestrin 2016).

2.2.4.2. Fitting Model

After parametrizing the three models, I predicted wetland permanence class in the 1) Boreal, 2) Parkland and 3) Grassland Natural Regions using a combination of climate, land cover/land use and terrain metrics (see Table 2.3 for information on these parameters). For each model, I also assessed its performance using the test data (70:30 training to test ratio) to determine the misclassification error rate, comparing results between the training and test data. I also evaluated the relative importance of each metric in predicting permeance class by comparing gain values and assessed under which ranges of each metric a permanence class was more likely to occur with waterfall plots.

Table 2.3. List of parameters tuned for the extreme gradient boosting model, a description of these parameters, their ranges and the ranges evaluated in the cross-validation.

Parameter	Description	Range
Learning rate	Used to control the contribution of each tree to model. Lower values result in the model being more robust to overfitting.	Typical: 0-1 Model: 0-0.3 Boreal (0.01), Parkland (0.1); Grassland (0.05)
Gamma	This controls the complexity of the model. It determines how much loss (difference between prediction and observation) allowable for the formation of a new node.	Typical: 0-20 Model: 0-10 Boreal (8), Parkland (4); Grassland (10)
Maximum depth of a tree	This sets the maximum number of nodes that can exists between the tree root and leaves. The larger the value, the more likely a tree is to overfit.	Typical: 1-7 Model: 1-7 Boreal (5), Parkland (7); Grassland (7)
Minimum sum of instance weight needed in a child	This sets a minimum weight/purity of data (e.g., number belonging to a given group) for splitting to create a new node in a tree. The higher this number is, the more conservative the algorithm will be.	Typical: 1-7 Model: 1-7 Boreal (5), Parkland (3); Grassland (7)
Subsample ratio of the training instance	This sets the number of rows (fractional) that should be included in building a tree.	Typical: 0-1 Model: 0.6-1 Boreal (0.8), Parkland (0.65); Grassland (0.7)
Subsample ratio of columns when constructing each tree	This sets the number of predictors (fractional) that should be considered in each tree.	Typical: 0-1 Model: 0.6-1 Boreal (0.8), Parkland (1); Grassland (0.9)

2.3. Results

2.3.1. Metric Reduction & Exploration

Before using a combination of metrics representing 1) climate, 2) land cover/land use and 3) terrain to predict wetland permanence class in the Boreal, Parkland and Grassland of the Albertan Prairie Pothole Region (PPR), I eliminated correlated metrics within each of these three conceptual categories. The process started with 30 metrics (Table 5.1, 15 climate, 6 land use, and 8 terrain metrics), which were reduced through correlation analysis to 19 (7 climate, 4 land use, and 8 terrain).

2.3.2. Model Performance

I built an extreme gradient boosting model for each Natural Region – Boreal, Parkland and Grassland. I selected 19 metrics that reflected climate, land cover/land use and terrain. The parameters and misclassification error rates among Natural regions differed slightly (Table 2.4).

Table 2.4. Value of parameters used in extreme gradient boosting models for the three datasets, the misclassification error rates and number of trees for our models.

Parameter	**Natural Region**		
	Boreal	**Parkland**	**Grassland**
Learning rate	0.01	0.1	0.05
Gamma	4	6	8
Maximum depth of a tree	5	5	7
Minimum sum of instance weight needed in a child	5	5	7
Subsample ratio of the training instance	0.8	0.90	0.70
Subsample ratio of columns when constructing each tree	0.8	1.0	0.90
Misclassification error rate	49.6 (training) 56.3 (test)	52.6 (training) 59.7 (test)	45.3 (training) 50.1 (test)
Number of decision trees	37	52	46

2.3.1. Predicting Permanence Class Within Observed Range of Each Metric

Though I also visualized the range in which each permanence class is more likely to be predicted across all three regions, there were few consistencies among the models for the three Natural Regions. Regardless, figures demonstrating the relationships between each metric and predicted probability of each permanence class (waterfall plots) are reported in Appendix 1.

2.3.2. Relative Importance of Metrics in Predicting Wetland Permanence Class Among Natural Regions

In each Natural Region, climate explained the greatest amount of variance in wetland permanence class based on relative gain values (Figure 2.3).

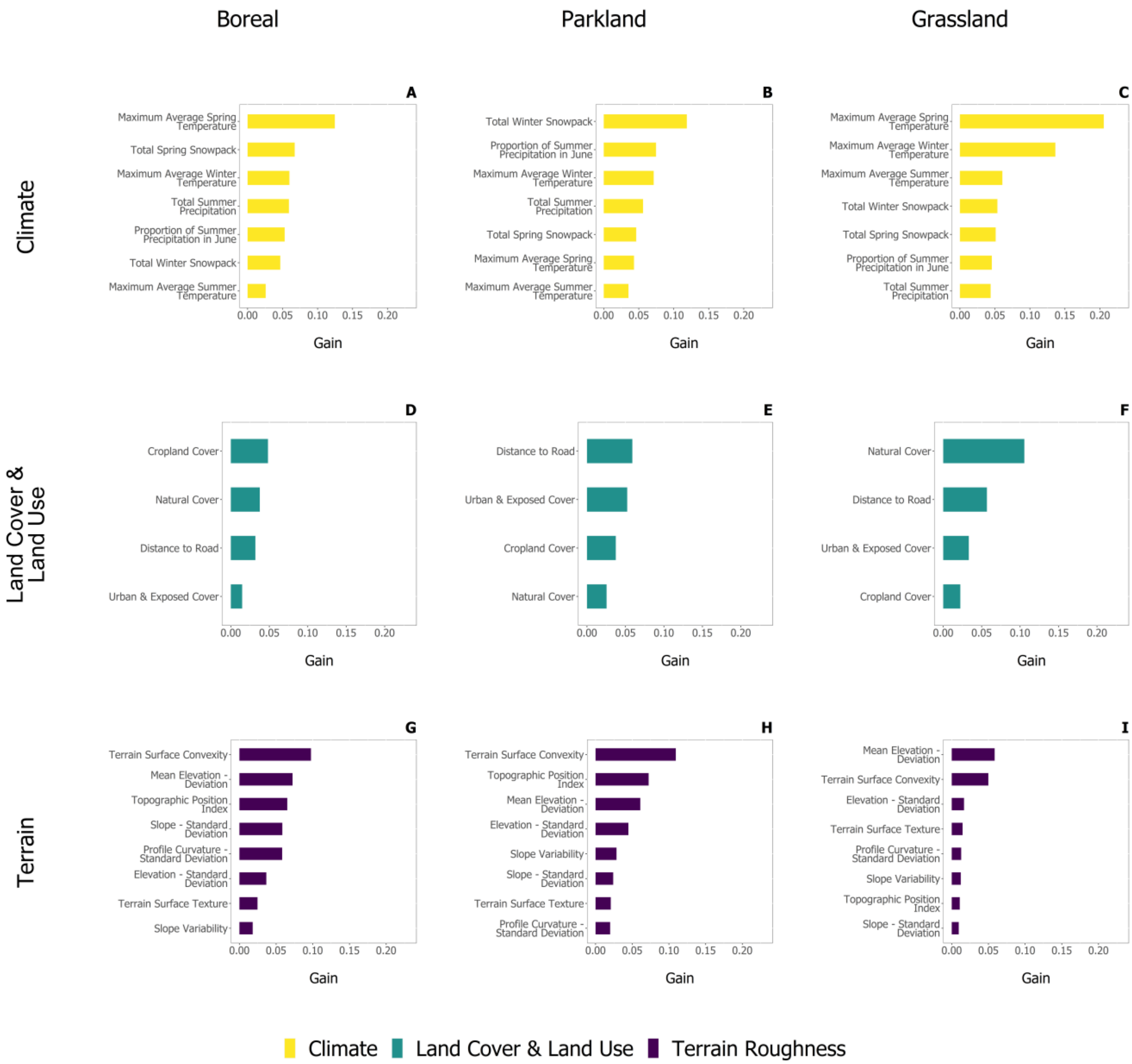

Figure 2.3. Metrics ranked by their importance in the extreme gradient boosting models for wetlands delineated in the 1) Boreal (totaling 12,000 wetlands), 2) Parkland (totaling 12,000 wetlands) and 3) Grassland (totaling 16,000 wetlands) Natural Regions. ¶hese metrics were proxies for climate (A-C), land cover and land use (D-F) and terrain (G-I).

Among the climate variables included in my analyses, spring temperature explained the highest magnitude of variance in predicting permanence class in the Boreal and Grassland (Figure 2.4A;1C).

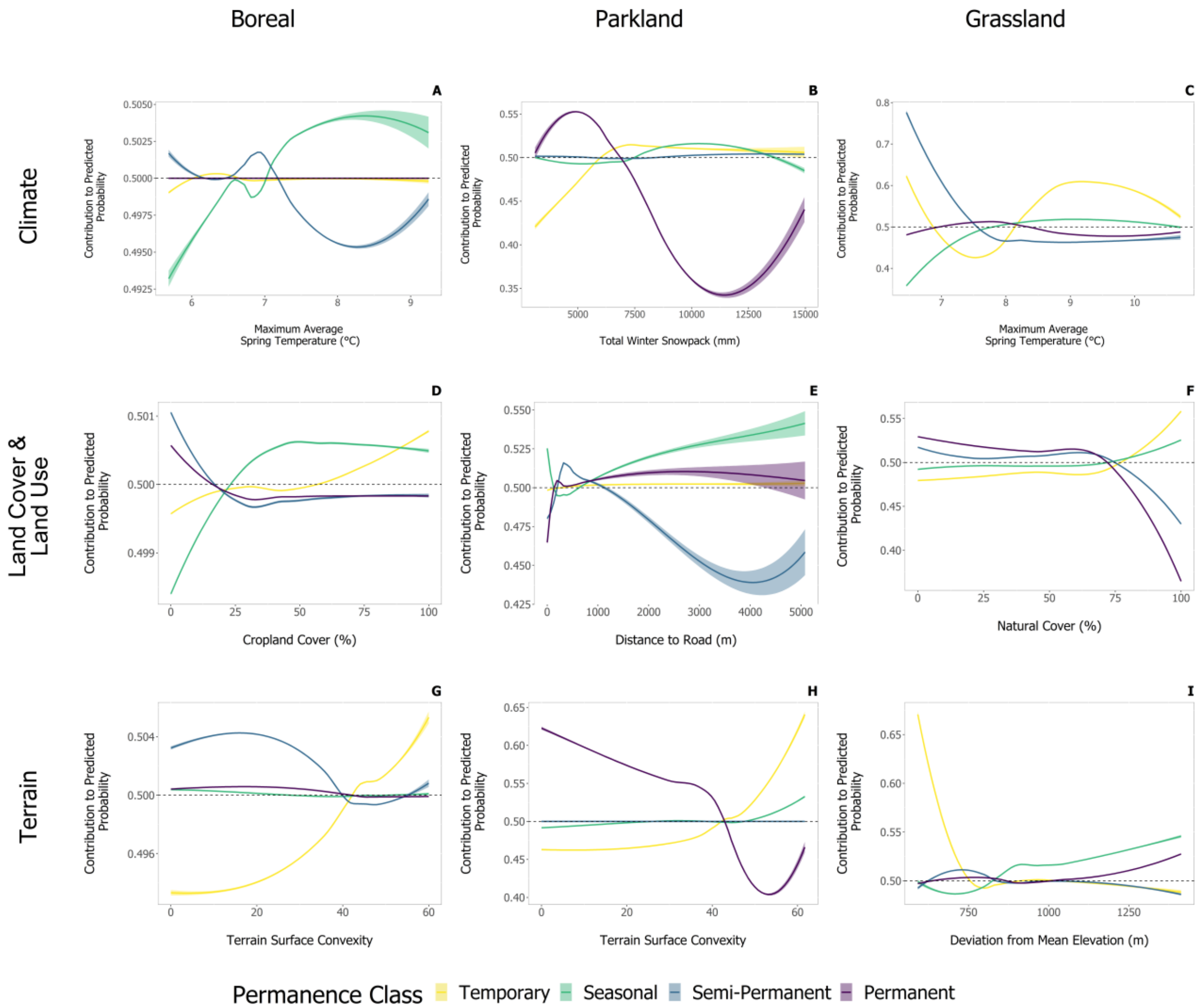

Figure 2.4. Metrics ranked by their importance in the extreme gradient boosting models for wetlands delineated in the 1) Boreal (totaling 12,000 wetlands), 2) Parkland (totaling 12,000 wetlands) and 3) Grassland (totaling 16,000 wetlands) Natural Regions. ¶hese metrics were proxies for climate (A-C), land cover and land use (D-F) and terrain roughness (G-I).

In the Parkland, however, winter snowpack depth was most important climate metric (Figure 2.4B); I hypothesize that this may be because precipitation metrics delineated permanently-ponded wetlands. Among the climate metrics, permanently-ponded wetlands were most sensitive precipitation metrics – winter snowpack pack depth, proportion of summer precipitation in June and total summer precipitation (Appendix 1AAppendix 1B). These precipitation metrics that permanently-ponded wetlands showed the strongest sensitivity to (Appendix 1B) were the same metrics that were most important in predicting wetlands in the Parkland (Figure 2.4). The Grassland model showed this sensitivity to semi-permanently-ponded wetlands (Appendix 1AAppendix 1B; Figure 2.4); in the Boreal model, this trend was observed with both seasonal and semi-permanently-ponded wetlands (Appendix 1AAppendix 1B; Figure 2.4 A;C;F). Regardless, climate conditions did differ among Natural Regions (Figure 2.5A-D).

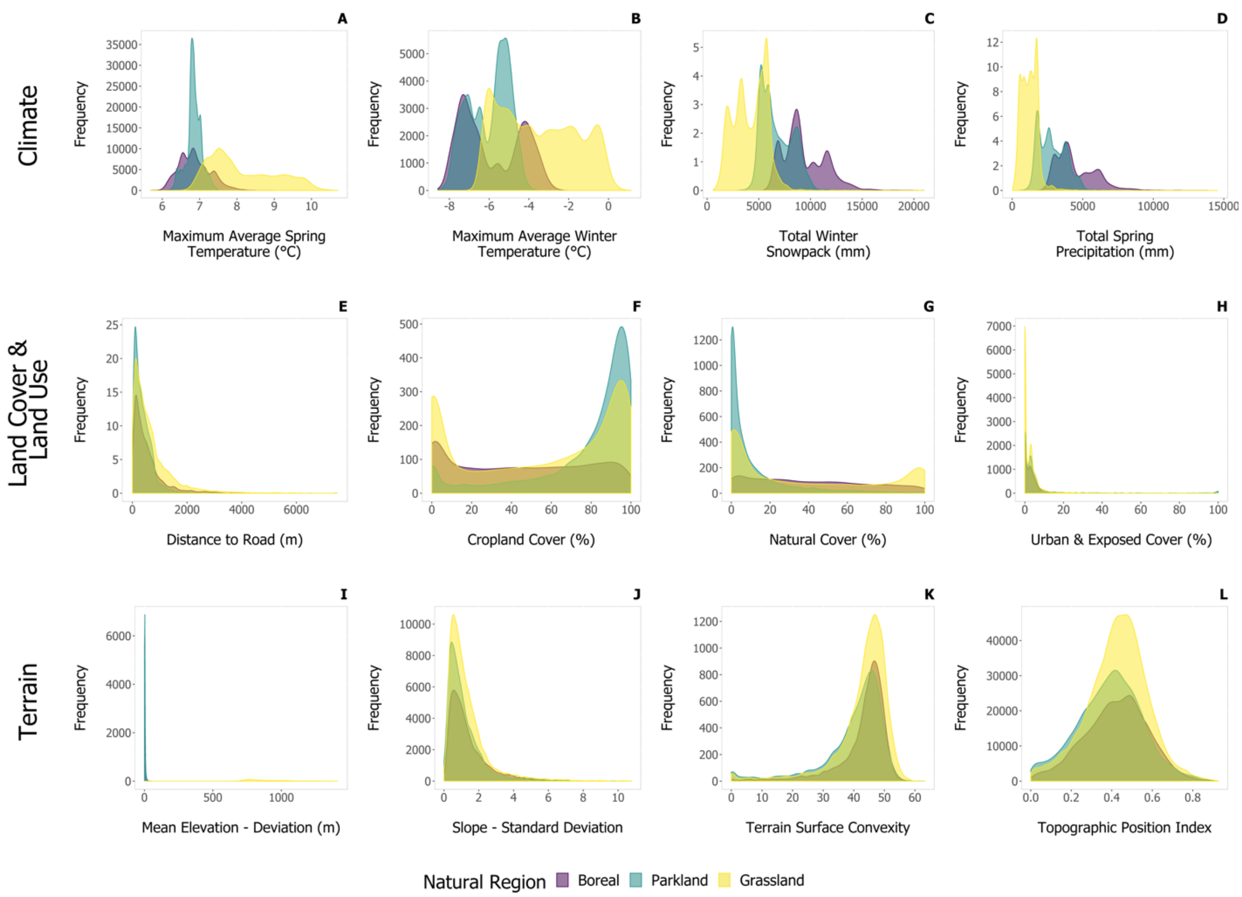

Figure 2.5. Frequency distribution of the top four climate, land cover and land use and terrain metrics by Natural Region.

Landcover/land use was the second most important variable affecting Grassland wetlands (Figure 2.3F). Notwithstanding, land cover did influence Boreal and Parkland wetlands (Figure 2.4) – shorter-hydroperiod wetlands were predicted in Boreal landscapes with higher agricultural activities (Figure 2.3D) and closer to roads in the Parkland (Figure 2.4E). However, these land use activities were less important than terrain in determining permanence class. Also, wetlands in all regions had similar in extents of land cover (Figure 2.5E-H).

Terrain was the second most important variable in predicting Boreal and Parkland wetlands (Figure 2.3G; H). In the Boreal and Parkland, the order of importance for the terrain metrics were nearly the same (Figure 2.3). Shorter-hydroperiod wetlands were predicted in landscapes with higher abundances of pits and peaks; the opposite was true for wetlands with longer hydroperiods (Figure 2.4G; H). In the Grassland, terrain was the least important variable (Figure 2.3I). However, only seasonally-ponded wetlands showed sensitivity to the most important terrain metric, occurring in landscapes with lower deviations from mean elevation (Figure 2.4I). Interestingly, terrain metrics overlapped in all three regions (Figure 2.5I-L).

2.3.3. Predicting Wetland Permanence Class in the Boreal Natural Region

Boreal wetlands, ranging in pond permeance classes from temporary to semi-permanent, are most strongly predicted by climate and terrain (Figure 2.6). Permanently-ponded wetlands, however, are most strongly predicted by land cover/land use (Figure 2.6F), with lower sensitivity to climate (Figure 2.6C) and terrain (Figure 2.6I). Generally, seasonal and temporarily-ponded wetlands were situated in landscapes with similar climate conditions (Appendix 1A-Appendix 1B) and land cover/land use (Appendix 1C). However, temporarily-ponded wetlands were positioned much higher in the landscape than seasonally-ponded wetlands (Appendix 1E I; V; VII). Similarly, semi-permanently- and permanently-ponded wetlands were similarly situated in the landscape; they were predicted in landscapes with similar land cover/land use (Figure 2.4; Appendix 1C). However, the model was unable to identity which terrain conditions one is likely to observe a permanently-ponded wetland. Regardless, semi-permanently-ponded wetlands were situated near topographic lows (Appendix 1E I; V; VII).

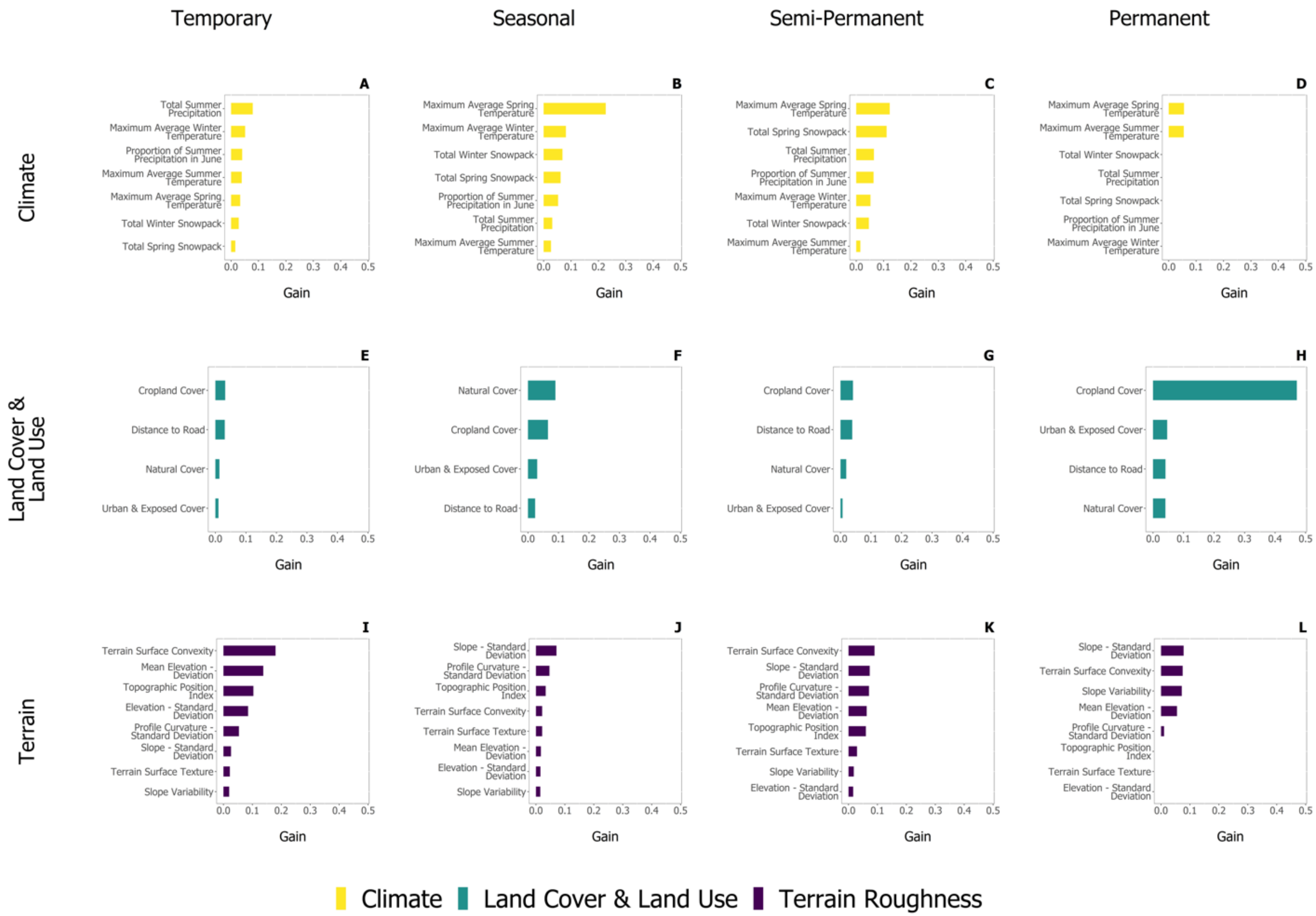

Figure 2.6. Metrics ranked by their importance in the extreme gradient boosting models for wetlands delineated in the 1) Boreal (totaling 12,000 wetlands) by permanence class. ¶hese metrics were proxies for climate (A-D), land cover and land use (E-H) and terrain roughness (I-L).

2.3.4. Predicting Wetland Permanence Class in the Parkland Natural Region

Land cover/land use was important in delineating between wetlands that are temporarily/seasonally ponded versus those that are semi-permanently/ permanently ponded in the in the Parkland. The extent of urban cover in the landscape was important in delineating temporarily-ponded from seasonally-ponded wetlands; for the longer-hydroperiod wetlands, distance to road delineated wetlands. Of all the permanence classes, seasonally- and semi-permanently-ponded wetlands were most sensitive to terrain and climate (Figure 2.7). Generally, temporarily/seasonally-ponded wetlands were situated similarly in the landscape, sharing climate, land cover/land use and terrain context (Appendix 1A-Appendix 1E). Semi-permanently-ponded wetlands, however, were situated closer to peaks, while permanently-ponded wetlands were position in and around topographic lows (Appendix 1E II;VIII).

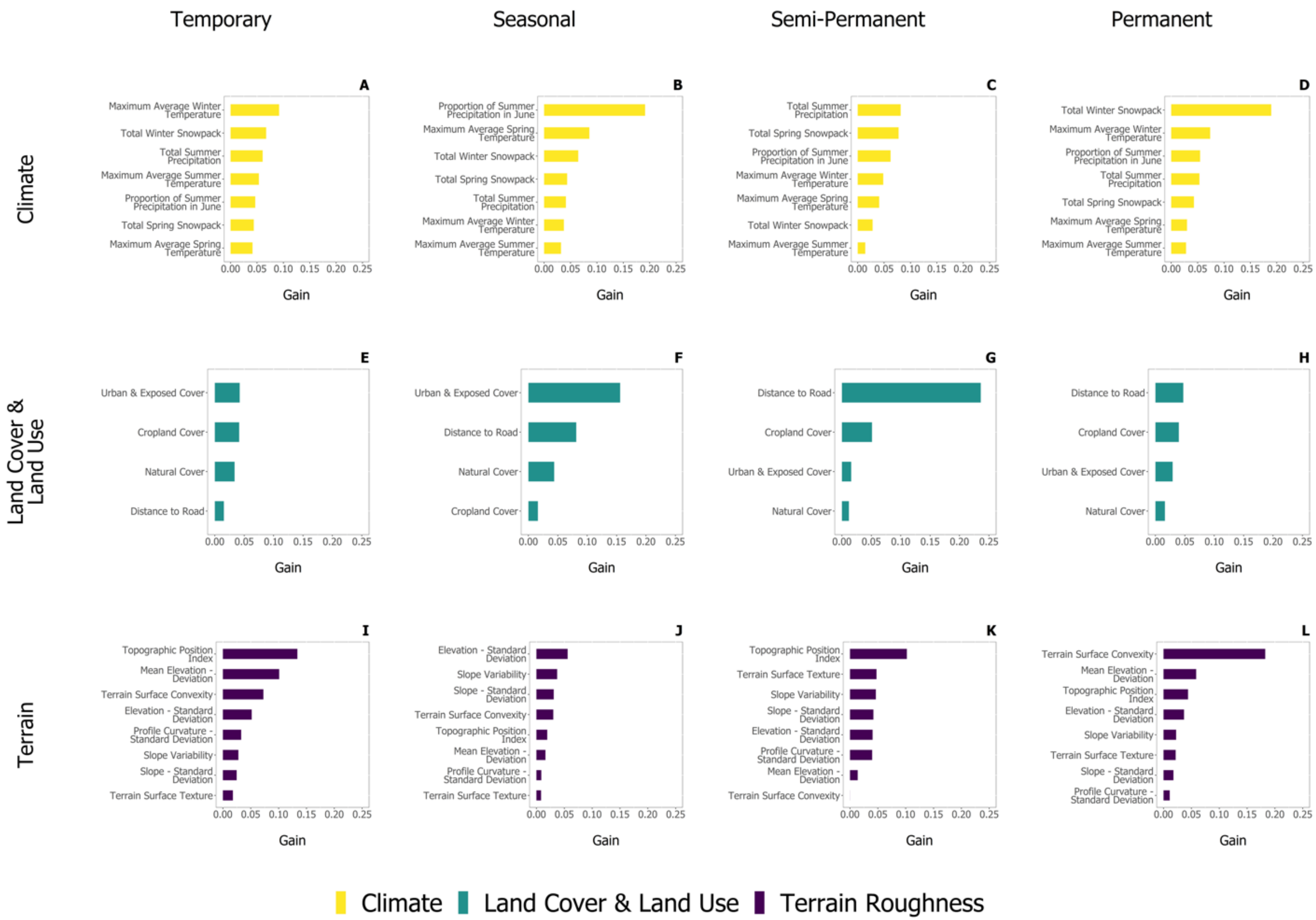

Figure 2.7. Metrics ranked by their importance in the extreme gradient boosting models for wetlands delineated in the Parkland (totaling 12,000 wetlands). ¶hese metrics were proxies for climate (A-C), land cover and land use (D-F) and terrain (G-I).

2.3.5. Predicting Wetland Permanence Class in the Grassland Natural Region

Temporarily- and seasonally-ponded wetlands in the Grassland occurred in similar situations in the landscape. In support of this hypothesis, temporary and seasonally-ponded wetlands were predicted by the same climate, land cover/land use metrics, in nearly same relative order of importance (Figure 2.8). Also is support of this hypothesis is the fact that these wetlands were predicted in landscapes with nearly identical climate conditions (Appendix 1AAppendix 1B) and surrounding land cover/land use (Appendix 1C). These wetlands were also situated in landscapes closer to peaks (Appendix 1D-Appendix 1E) but temporarily-ponded wetlands were situated higher in the landscape than seasonally-ponded wetlands (Appendix 1E IX).

Semi-permanently-ponded wetlands were situated similarly in landscape to permanently-ponded wetlands. In support of this hypothesis, both wetland classes were congruent in the relative importance of each metric associated with the climate, land cover/land use and terrain (Figure 2.8; Appendix 1DAppendix 1E). Additionally, semi-permanently-ponded and permanently-ponded wetlands were predicted in landscapes with similar land cover/land uses (Appendix 1C). Though both wetland classes were situated in the landscape where variance in surrounding elevation and slope was low (Appendix 1D XI;XII), permanently-ponded wetlands were situated in and around topographic lows (Appendix 1E III; VI; IX) and were exposed to warmer temperatures (Appendix 1A).

Figure 2.8. Metrics ranked by their importance in the extreme gradient boosting models for wetlands delineated in the Grassland (totaling 16,000 wetlands). ¶hese metrics were proxies for climate (A-C), land cover and land use (D-F) and terrain roughness (G-I).

2.4. Discussion

As with other studies, I do find support for the assertion that a warmer climate could affect wetland hydroperiods in the PPR (Johnson et al. 2005; Johnson et al. 2010b; Werner et al. 2013; Fay et al. 2016; Johnson and Poiani 2016; Reese and Skagen 2017); however, failure to consider terrain context could limit our understanding on how wetland permanence classes may change. Even with the use of a relatively poor-resolution DEM, my models detect a strong importance of terrain in even undulating landscapes. While I would recommend the use of finer-scale elevation models in forecasting climate impacts, future studies forecasting the impacts of climate change on wetland water levels and or biological communities in the PPR should include terrain metrics.

As with other studies, I do find support for the assertion that topography is a useful proxy in wetland mapping (Los Huertos and Smith 2013; Branton and Robinson 2019). One major influence of terrain on wetland hydrology is that topographic variation influences surface runoff generating processes, including spring melt water volumes, which dictates ponded water amounts (Hayashi et al. 2016; Mushet et al. 2018). Notably, simulations predicting the influence of climate change on the area size and isolation of PPR wetland have focuses on climate and land cover/land use (Conly et al. 2001; Voldseth et al. 2007; Chasmer et al. 2012; McCauley et al. 2015; Anteau et al. 2016; Johnson and Poiani 2016; Steen et al. 2016). Consequently, there is a lack of research quantifying terrain characteristics of wetland and the landscapes within which they reside. Links between terrain, vegetation and wetland condition have not been rigorously studied and regulations on the creation or restoration of wetlands prescribe width-to-length ratios and slopes that are uniform (Environmental Partnerships and Education Branch Alberta 2007). Consequently, permanently-ponded, open-water wetlands that are not representative of the diversity and frequency distribution of wetland permanence classes across Alberta's PPR have come to dominate the Canadian PPR (Serran et al. 2017). If we had a better understanding of how terrain structure determines wetland hydrology/function, we revise regulations governing wetland restoration and creation to ensure we better match natural landscapes in their frequency and distribution of wetland permanence classes.

Existing literature identified land cover/land use as the second greatest driver of wetland conditions following climate (Anteau et al. 2016). I hypothesize that differences in topography and land use-driven surface runoff could explain why land cover/land use was least important in delineating permanence class in the Boreal and Parkland. In the Grassland, the terrain is relatively flat compared to the Boreal and Parkland (Alberta Tourism Parks and Recreation 2015), which suggests that there may be overlaps in the terrain context that each permanence class occurs; this was generally the case for land cover/land use metrics. Consequently, climate, evidenced by shorter-hydroperiod wetlands being more prevalent in the more arid south (Government et al. 2014), and land cover/land use, which is largely pastureland and cropland (Alberta Tourism Parks and Recreation 2015), would be stronger delineators of permanence class than terrain. Secondly, the percentage cover of natural vegetation can influence wetland permanence class(van der Kamp et al. 2003), and this is more pronounced in the Grassland. Wetlands surrounded by natural vegetation may have shorter hydroperiods, and this is because upland vegetation lowers surface runoff to wetlands (van der Kamp et al. 2003; Voldseth et al. 2007; Anteau 2012). Thus, wetlands within landscapes with extensive natural vegetation may come to have shorter hydroperiods because snow-sourced surface runoff, which can account for up 27% of ponded water amounts(van der Kamp et al. 2003), are captured by upland plants.

Because some landscapes in the PPR are flatter than others (Schneider 2013), and land use activities can modify the terrain (Anteau 2012; Wiltermuth and Anteau 2016; Anteau et al. 2016), my findings do highlight the importance of considering land use in forecasting the impacts of climate change on PPR wetlands. Boreal and Parkland wetlands have stronger overlaps in terrain metrics and climate; and, as a result, differences in land use within these regions may be integral in determining future shifts in the frequency distribution of permanence classes. Forecasts for the province of Alberta suggest there will be expansions in the agricultural industry within the next decade (Government of Alberta 2015), and this suggests that climate impacts on Albertan PPR wetlands will be compounded by land use activities.

My models had moderate to high error rates, which suggests that climate, land use/cover and terrain are not sufficient variables in predicting permanence class. I hypothesize that my inability to account for soil characteristics (Schneider 2013) could explain these high error rates. Schneider (2013) stated that within Natural Regions, both elevation (which I did account for) and soil characteristics can vary across a landscape. As such, wetlands situated similarly in the landscape may not have the same soil characteristics, and soil characteristics are understood to influence wetland hydrology by dictating the proportion of surface run of that is infiltrated (Hayashi et al. 2016). Though Schneider (2013) also mentioned an influence of disturbance history on ecosystems, prior work in my study region reported no temporal lag in wetland environmental conditions and surrounding land cover (Kraft et al. 2019).

Though my findings suggest differences in the topographic position of wetlands by permanence class, I am unable to ascertain whether this is driven by geological history or land cover/land use. Across the three Natural Regions, wetlands with shorter hydroperiods (i.e., temporary and seasonal) were situated in landscapes with higher cropping activity. One explanation for this trend could be consolidation drainage, where wetlands situated higher in the landscapes are drained and the water is redirected to wetlands positioned lower in the landscape (McCauley et al. 2015; Wiltermuth and Anteau 2016). Thus, we may come to observe wetlands with higher pond permanence in these areas because they have received ponded water from drained temporary/seasonal wetlands situated higher in the landscape. Alternately, we may observe semi-permanent/permanently-ponded wetlands situated lower in the landscape because they 1) can hold larger volumes of ponded water (i.e., larger pond size/volume – Novikmec et al. 2016) and 2) receive higher volumes of water inputs from the surrounding landscape (e.g., surface run-off, groundwater – Toth 1963; LaBaugh et al. 1998; Euliss et al. 2004b; Euliss et al. 2014). Because I did not aim to predict permanence class in a vacuum, my analyses could not account for influence of terrain on permanence class in the absence of agricultural activities. Therefore, I am unable to ascertain which factor largely explains this finding. Future work should seek to investigate the role of topographic position on permanence class, in the absence of human disturbance.

2.5. Conclusion

My results demonstrated that for Parkland and Boreal Natural Regions, terrain characteristics explained more of the variance in permanence class than land cover and land use. This revealed the importance of terrain in determining wetland hydroperiods. My results also emphasize the importance of terrain in wetland hydrology and the interrelationship between climate, land cover/land use and terrain factors in determining a wetland's permanence class in the prairie pothole region of Alberta.

3. WETLAND HYDROPERIOD INFLUENCES COMMUNITY ABUNDANCES, BUT NOT THE MAGNITUDE OF CROSS-TAXON CONGRUENCE.

3.1. Introduction

Understanding the mechanisms that explain the composition of biological communities is a major focus of community ecologists. Both environmental conditions and interactions among biological communities are known to dictate which species will establish in a given habitat (Kraft et al. 2015; Cadotte and Tucker 2017; Pearson et al. 2018), and thus numerous studies have attempted to partition those relative influences on community composition (Duan et al. 2016; Robertson and Avilés 2019; Uboni et al. 2019; Vleminckx et al. 2019). However, apart from examination of the stress gradient hypothesis among plants (Maestre et al. 2010; He et al. 2013; Scherrer et al. 2019) and predation-permanence gradient model with aquatic macroinvertebrates and their predators (Wellborn et al. 1996), only a few studies have explored whether the strength of biological interactions among multiple taxa is influenced by environmental conditions along a gradient (Chamberlain et al. 2004; Pennings and Silliman 2005; Chamberlain et al. 2014) beyond simply gradients in space or time (Kissling et al. 2012; Rudolf 2019). Questions arising from this gap include: 1) do relationships among taxa change along environmental gradients, and 2) does the strength of cross-taxon relationships vary with environmental conditions? By investigating whether the strength of cross-taxon relationships change across environmental gradients, we could better understand how communities assemble.

Because species differ in which environmental conditions are optimal for their growth and development, we may observe changes in the strength of interspecific cross-taxon interactions (herein referred to as non-stationarity) across environmental gradients (Thompson

1988; Hengeveld 1994; Bar-Massada and Belmaker 2017). Non-stationarity in cross-taxon relationships are widely reported in geographic space and across time (Osborne et al. 2007; Clark et al. 2018), and we would expect non-stationarity in cross-taxon relationships along environmental gradients to be explained by similar mechanisms. Indeed, such studies often attribute the spatial or temporal pattern to a correlated pattern in environmental conditions, though without explicitly quantifying those conditions. Across geographic space, we can attribute non- stationarity in plant-plant relationships to differences in environmental conditions under which species were able to establish (Bar-Massada and Belmaker 2017); the rate at which established species increased their abundances determined whether there was space for later-arriving species to also establish. The influence of differential tolerances and requirements among species on population structures has also been observed in predator-prey interactions. For instance, authors of one study argued that predation rates are lower in wetlands with shorter hydroperiods because fewer predators are able to sustain populations under these stressful conditions when the diversity and abundance of prey is lower (Wellborn et al. 1996). Non-stationarity across environmental gradients could also be explained by species requiring additional defenses to combat new predators or competitors. For example, Alaska paper birch species in nutrient-poor environments used carbon-vs nitrogen-based defenses to herbivory, which resulted in them differing in their palatability to Snowshoe hare species across a gradient in soil chemistry (Bryant et al. 1981). More recent examinations of cross-taxon relationships across environmental gradients demonstrate non-stationarity between zooplankton and fish(Post et al. 2008), plants and insect herbivores (Agrawal et al. 2006) and numerous other pairwise interactions (Chamberlain et al. 2014). Given these observations of non-stationarity of interspecific interaction outcomes along environmental gradients, we wanted to determine whether congruence between horizontal communities would be consistent across an environmental gradient. Or alternatively, whether one end of an environmental gradient might exhibit weaker relationships between taxon than is evident at the other end of that gradient.

Congruence/concordance is a measure of the correlation between two multivariate matrices (Lisboa et al. 2014). Typically, these comparisons are often made between the relative abundance patterns evident in species belonging to different horizontal communities [(i.e., “a set of species sharing common needs in terms of resources or space” – Vellend (2016)] to estimate the strength of inter/cross-taxon interactions (Kraft et al. 2019). In other cases, comparisons are made between the pattern of relative abundances in one horizontal community and environmental conditions (Toranza and Arim 2010; Rooney and Bayley 2012) to estimate the strength of the dependency of a particular horizontal community on a given set of physicochemical factors.

While strong congruence between a taxon and some measure of environmental conditions in its habitat indicates a structuring role of abiotic factors on community composition, strong cross-taxon congruence could be explained by either biological interactions (Larsen et al. 2012), horizontal communities responding similarly to a gradient in environmental conditions (Heino et al. 2005; Corte et al. 2017), or a common biogeographic history among taxa (Cracraft and Prum 1988; Moritz et al. 2001). If there was support for the hypothesis that cross-taxon agreement among matrices of species’ relative abundances was explained by horizontal communities responding similarly to a gradient or sharing a common biogeographic history, we would expect that the strength of cross-taxon congruence would be near equivalent to that between each horizontal community and a matrix describing the environmental condition (Figure 3.1A-B). In contrast, if there was support for the hypothesis that biological interactions are largely responsible for cross-taxon agreement among matrices of species' relative abundance, we would expect that the strength of cross-taxon congruence would be much higher than that between each taxon and a matrix describing the environmental condition (Figure 3.1C-D).

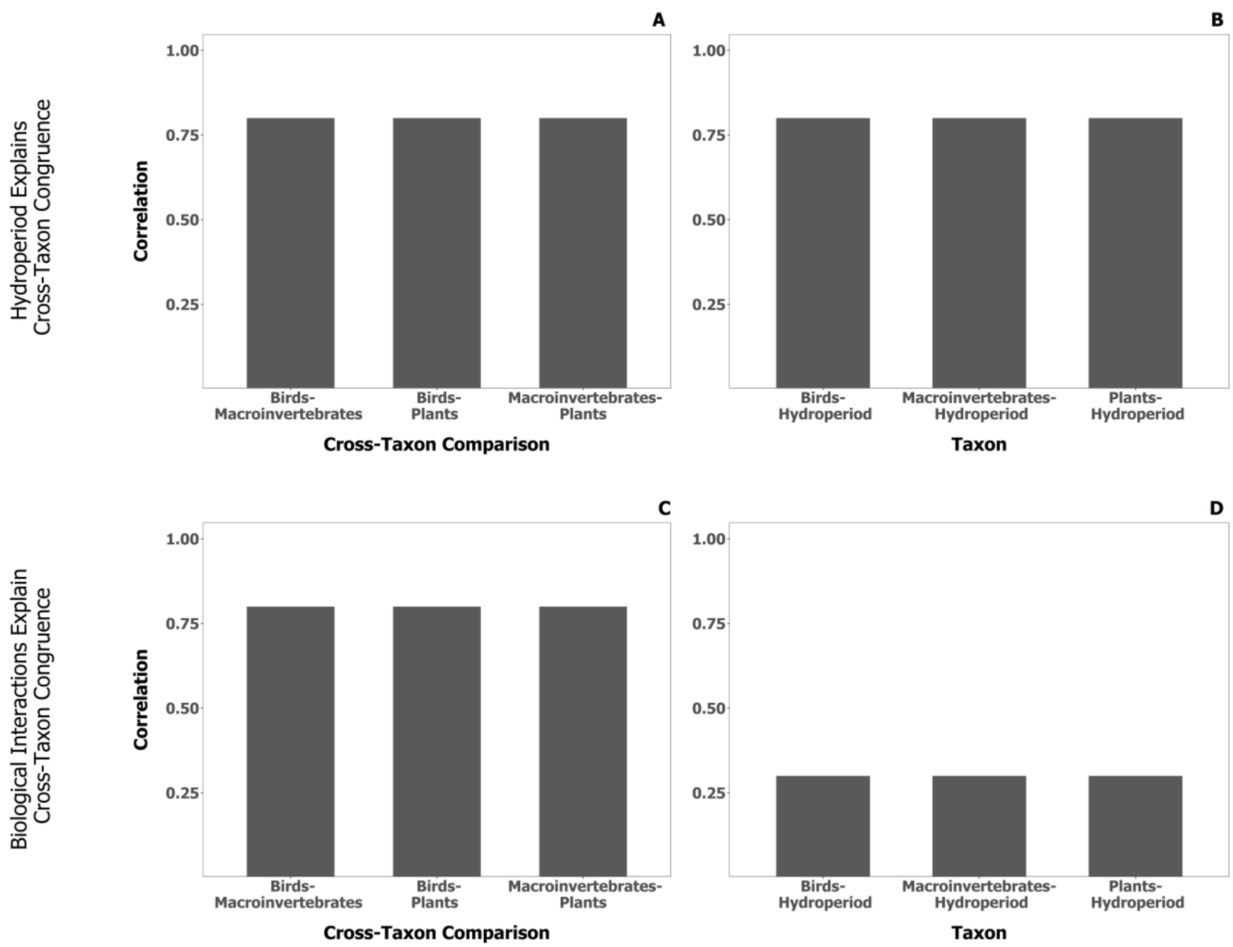

Figure 3.1 Hypothesized measures of congruence if cross-taxon congruence (A) was best explained by the influence of wetland hydroperiod (B), or if cross-taxon congruence was best explained by biological interactions (C) and not solely the influence of wetland hydroperiod (D). When the strength of cross-taxon relationships is similar in magnitude to that between each horizontal community and hydroperiod, we would expect that high cross-taxon congruence is explained by each horizontal community responding similarly to wetland hydroperiod (A-B). However, when cross-taxon relationships are much stronger than that between each horizontal community and hydroperiod, we would expect that high cross-taxon congruence is mostly explained by biological interactions (C-D).

This approach to evaluating the relative importance of cross-taxon interactions and environmental filtering on community abundances is best implemented in a system that is largely structured by a single environmental gradient, e.g., a moisture-aridity gradient such as that created by variation in inundation time in wetlands or precipitation in desert ecosystems. Along such a gradient, the availability of water can act as a clear environmental filter, excluding taxa that lack adaptations to persist under either dry or inundated conditions (Gleason and Rooney 2017a). This results in the emergence of distinct communities, dependent on moisture availability (Brock et al. 2003; Clark et al. 2009). Prairie pothole wetlands, for example, differ in the diversity and community composition of birds, aquatic macroinvertebrates and plants along a gradient in hydroperiod from ephemeral to permanently-ponded(Daniel et al. 2019). Hydroperiod in these wetlands influence whether a wetland supports only wet meadow species or includes more water-loving robust emergent species like cattails and bulrushes or even submersed aquatic and floating vegetation (Stewart and Kantrud 1971). Hydroperiod also dictates if a wetland will support aquatic macroinvertebrates that cannot survive dry-down events or if such taxa will be excluded (Gleason and Rooney 2017a). Since the foraging and nesting opportunities of migratory birds are determined by wetland vegetation characteristics and the availability of aquatic macroinvertebrate prey, hydroperiod also indirectly dictates bird community composition (Euliss et al. 2004). Given these three taxa exhibit distinct communities at different positions along the hydroperiod gradient, we can test whether the strength of cross-taxon congruence differs between short and long-hydroperiod prairie potholes.

In an earlier study, beta diversity was inversely correlated with wetland hydroperiod for wetland birds, aquatic macroinvertebrates and plants (Daniel et al. 2019). The authors speculated that species in wetlands with longer hydroperiods had more time to progress toward community equilibrium through interspecific interactions, whereas community composition in wetlands with brief hydroperiods was more a product of ecological drift. If this hypothesis were correct, I expect to see weaker cross-taxon congruence in short-hydroperiod than long-hydroperiod prairie pothole wetlands (i.e., non-stationarity). I consequently asked three questions, using relative abundances of three horizontal communities (birds, aquatic macroinvertebrates and plants): examining species from prairie potholes ranging from short- to long-hydroperiods 1) is there significant congruence among these three horizontal communities; and 2) if so, does a common response to the dominant environmental gradient (hydroperiod) alone explain the observed cross-taxon congruence; then, after partitioning the dataset into long- and short-hydroperiod prairie potholes, 3) is there evidence of non-stationarity in cross-taxon congruence between prairie potholes of long vs. short-hydroperiod wetlands?

3.2. Materials and Methods

3.2.1. Study Area

This study took place in the Grassland and Parkland Natural Regions of Alberta, Canada (Figure 3.2). Wetlands in the region are called prairie potholes and comprise water-filled depressions that were formed in the last glacial period (Wright 1972). The climatic conditions are semi-arid since annual precipitation exceeds evapotranspiration rates (Sauchyn et al. 2004).

While mixed-grass prairie dominates the Grassland Natural Region, both deciduous trees and grasses are widespread in the Parkland Natural Region(Downing and Pettapiece 2006).

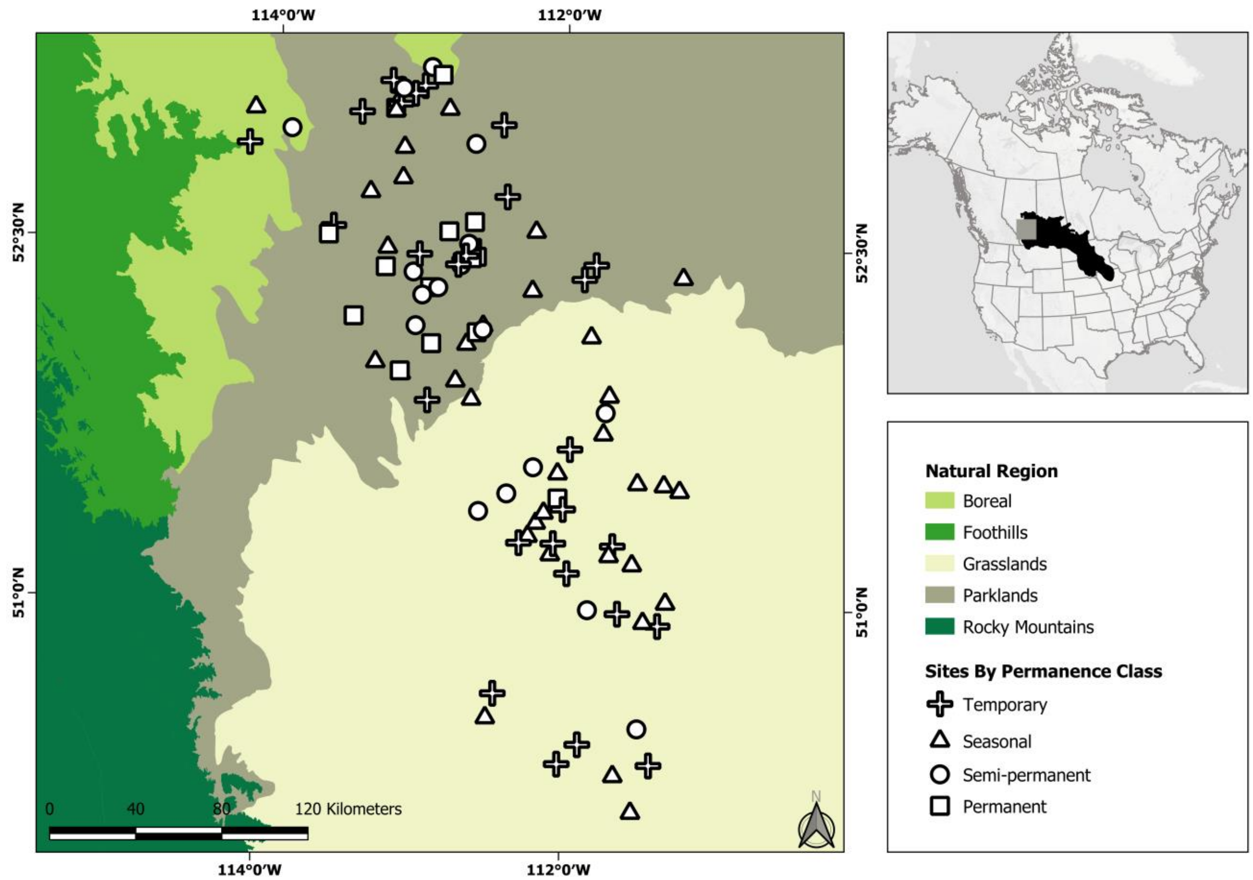

Figure 3.2 Map of the study region, situated in the northern prairie pothole region (inset map). The 96 wetland sites covered the Grassland and Parkland Natural Regions, and represented temporary (n = 28), seasonal (n = 35), semi-permanent (n = 17) and permanent (n = 14) ponded-water permanence classes.

3.2.2. Study Design

The 96 study sites spanned a gradient in hydroperiod, i.e., they ranged in pond permanence from temporary to permanent (Stewart and Kantrud 1971). Further, they were selected to represent the size-frequency distribution of wetlands within their respective sub-watersheds, based on the Alberta Merged Wetland Inventory (Government of Alberta 2014). As such, most were small (mean size 0.81 ± SE 0.12 ha).

3.3. Biological Surveys

3.3.1. Birds

Birds were surveyed using both visual and auditory surveys, twice during the peak breeding season (May-June in either 2014 or 2015). Importantly, the abundances of each species were summed between both visits, rather than averaged, to account for the staggered breeding seasons among species. More details on these bird surveys are provided in another study (Anderson and Rooney 2019). In brief, surveys commenced half an hour before sunrise and went no later than six hours thereafter. Surveys were rescheduled if weather conditions were unfavorable to bird activity (e.g., rain, traffic sounds, or wind enough to rustle field notes). First, 10-minute long visual surveys from a vantage point that covered the entire open water zone were undertaken to record any foraging or nesting birds before the site was entered, as observers entering the site can flush waterfowl. Next, observers conducted auditory surveys that were 8-minute long, 100 m fixed-radius point counts, typically carried out at the center of the wetland. In larger wetlands (> 3 ha), multiple auditory surveys were carried out, spaced >100 m from any wetland edge and >200 m from any other point count location to ensure independence. Counts across multiple auditory point counts within a wetland were summed to reflect differences in wetland size. The identity and abundance of species detected by visual and auditory survey techniques was recorded (species list in Appendix 2A). The same technician conducted both the visual and audio point counts, which reduced the chance that individuals were double counted.

3.3.2. Aquatic Macroinvertebrates

Aquatic macroinvertebrates were sampled using the quadrat-column-core method (Meyer et al. 2013), which was revised (Gleason and Rooney 2017b) for use in this study region(

May-June in either 2014 or 2015). Sampling was stratified between the open-water zone (submersed and floating vegetation) and the emergent zone (cattail, bulrush, or other robust perennial sedges), presuming both zones were present. Two replicates of each sample type were collected in each wetland zone: 1) a 0.25 m^2 vegetation sample, clipped from the emergent or submersed vegetation and then washed vigorously to remove clinging invertebrates; 2) two, 10 cm diameter water column samples and 3) a 10 cm deep, 4.8 cm diameter sediment core, collected using a steel corer obtained using a tube-sampler inserted to just above the sediment. Ultimately, sediment core sample fractions were excluded from analysis because: 1) densities were low and 2) there were no taxa in the sediment cores that were novel to the combined water column and vegetation samples. The replicates of each sample type were composited, yielding a single water column and vegetation sample per wetland vegetation zone (open water and emergent). These were then sorted to remove aquatic macroinvertebrates so they could be identified to the lowest practical taxonomic level (typically Family) (Clifford 1991; Merrit et al. 2008). For vegetation samples, technicians used a Marchant box to sub-sample based on the protocol of the Canadian Aquatic Biomonitoring Network (Environment Canada 2014), where the taxon abundances were area-weighted to estimate density per meter-squared. Similarly, counts from water samples were scaled to the meter squared and then the densities were summed within each wetland zone. Next, samples were averaged across zones to obtain wetland-level data on invertebrate relative abundances. A comprehensive taxonomic list of taxa observed is provided in Appendix 2B.

3.3.3. Plants

Plant surveys occurred in late July to August in 2014 and 2015, which coincided with peak aboveground biomass and when most herbaceous species could be confidently identified. First, the extent of each plant assemblage was mapped, and this was based on their vegetation structure (e.g., deciduous tree, coniferous tree, dead deciduous, dead coniferous, deciduous shrub, coniferous shrub, robust emergent, narrow-leaved emergent, forb, broad-leaved emergent, floating-leaved vegetation) and then by co-dominant or dominant species. These extents were determined in the field by mapping the assemblage boundaries with a GPS/GNSS unit with sub-meter real-time accuracy (SX Blue II receiver, by Geneq Inc., Montreal, Canada). For each 100-5000 m^2 sized community, the identity and percentage cover (modified Braun-Blanquette approach) of each vascular plant species within five, 1 m^2 quadrats were recorded. For communities larger than 5000 m^2, an additional quadrat was surveyed per 1000 m^2 of community area over the 5000 m^2 threshold. In addition to vascular plants, the identity and percentage cover of the following classes were also included: algae, bare ground, litter, moss, rock, seedling/unidentified forb, standing dead litter, and open water (species list in Appendix 2C). Note, only the percent cover of vascular plants was included in subsequent analyses. More details on these plant surveys are provided in another study (Bolding et al. 2020).

3.3.4. Hydroperiod

I consider hydroperiod a latent variable that is indicated by several measurable variables. At each wetland, technicians installed a staff gauge in May at the deepest point of the open water zone. Technicians then collected water depth measurements from these staff gauges every 3-5 weeks between May and September. If the wetland dried out entirely, technicians recorded the date that this was first observed. If the wetland remained flooded until September, then I considered it to possess ponded water for 365 days. The difference between the deepest and shallowest water depth measurement was the wetland's amplitude. Lastly, technicians collected 30 mL water samples from each wetland in May, which was later used to estimate evaporative loss. For details on the stable isotopes analysis, see (Meyers 2018). From these data, I used four variables to describe hydroperiod - the approximate number of days the wetland contained ponded water, the maximum water depth, the ratio of water amplitude to the maximum water depth, or an index of evaporative loss based on stable isotope analysis.

3.4. Statistical Analysis

The analyses were centered on three main objectives. First, I investigated whether it was possible to detect cross-taxon congruence and if this cross-taxon congruence could be attributed to an environmental gradient (hydroperiod). Second, I determined whether there was a difference in the strength of biological interactions when there was a stronger influence of the environmental driver. Third, I tested for non-stationarity in cross-taxon congruence between prairie potholes with short vs long hydroperiods. I describe these analyses below, which were all conducted in in R (R Core Team 2017).

3.4.1. Congruence

To determine if I could 1) detect cross-taxon congruence, 2) attribute cross-taxon congruence to a dominant environmental gradient (hydroperiod) and 3) detect a difference in the strength of congruence in short vs long-hydroperiod wetlands, I used a Procrustes analysis. In terms of my general approach, I first measured the strength of congruence between each pair of horizontal communities (i.e., relative abundance matrices): 1) birds and plants, 2) birds and aquatic macroinvertebrates, and 3) plants and aquatic macroinvertebrates. Next, I measured congruence between each horizontal community individually and the four measures of wetland hydroperiod (i.e., matrix on approximate number of days the wetland contained ponded water, the maximum water depth, the ratio of water amplitude to the maximum water depth, or an index of evaporative loss based on stable isotope analysis). Then, I compared cross-taxon congruence and congruence between each horizontal community and measures of wetland hydroperiod to determine whether a common response to variation in hydroperiod could explain any observed cross-taxon congruence (Figure 1C-D). Next, to test for non-stationarity in any observed cross-taxon congruence in short vs. long-hydroperiod wetlands, I sub-divided the dataset into wetlands of low (temporary and seasonal) permanence class and wetlands of high (semi-permanent and permanent) permanence class and then recalculated both cross-taxon congruence and congruence between each horizontal community and the matrix of hydroperiod indicators. I then compared the strength of these congruence measures between the low and high permanence class wetland subgroups.

Though the Mantel test is popularly used to measure congruence in ecology (Lisboa et al. 2014), Peres-Neto and Jackson (2001) showed that Procrustes analysis is better at detecting significant relationships (lower risk of type II errors). Additionally, in a majority of studies testing for multivariate correlations, Procrustes analysis can be substituted for a Mantel test (Lisboa et al. 2014), apart from when the aim is to test for a relationship between community dissimilarity and geographic distance (Nekola and White 1999). Given my aim to assess how congruence changes with pond permanence, I was confident that Procrustes analysis was most appropriate for this study, which was implemented using the protest function in the vegan package (Oksanen et al. 2017). For each horizontal community, I applied a Hellinger transformation to our relative abundance matrices to make the data suited for projection in Euclidean space (Lisboa et al. 2014), as required by the Procrustes analysis.

3.4.2. Rarefication

Sample size can influence estimates of congruence (Broadbooks and Elmore 1987). To ensure sites were representative of the frequency distribution of permanence classes in the wetland inventory, surveys were done at an unequal number of wetlands across permanence classes (Figure 2). Unequal treatments and small sample sizes can cause: 1) higher than expected estimates of congruence for classes with spatially-aggregated wetlands (e.g. permanently-ponded wetlands), or 2) an inability to detect congruence in classes with fewer wetlands. To determine if sample size influenced my ability to detect congruence, or the magnitude of congruence, I rarefied my data to identify the sample size threshold at which the sensitivity to sample size plateaued. First, I subsampled the Hellinger-transformed relative abundance matrices, increasing *n* from 3 to 40 and selecting the same sites from each horizontal community in the cross-taxon comparison (birds versus macroinvertebrates, birds versus plants, macroinvertebrates versus plants). Then, for each subsample and cross-taxon comparison, I measured congruence. Since congruence can be influenced by this random subsampling, I repeated the rarefication 100 times. I repeated these sensitivity tests in analyzing congruence between each horizontal community and the matrix describing hydroperiod. I found the mean and standard error across iterations for the 3 to 40 subsampled sites (Appendix 3). On average, congruence was stable with >23 sites. Thus, I combined the temporary and seasonally-classified wetlands (short hydroperiod: *n* = 65) and the semi-permeant and permanently-classified wetlands (long hydroperiod: *n* = 31) into separate groups, such that this threshold was exceeded.

The long-hydroperiod group still constituted fewer sites (*n* = 31) than the short-hydroperiod group (*n* = 65), which could bias comparisons of congruence between wetland permanence class groups. To counter this bias, I stratified the horizontal community relative abundance matrices and the matrix describing hydroperiod by permanence class. Using the package a biostatisticians toolbox for various activities, including plotting, data cleanup and data analysis: fifer (Fife 2017) in R, I then subsampled and randomly selected 31 sites (without replacement) from the 1) entire dataset and 2) short-hydroperiod wetlands (including both seasonally-ponded and temporarily-ponded wetlands). I compared this to all 31 long-hydroperiod wetlands (including both semi-permanently-ponded and permanently-ponded wetlands). I repeated this random sampling 1000 times, measuring congruence for each iteration.

3.5. Results

3.5.1. Congruence

The strength of cross-taxon congruence (Figure 3.3A) was much larger than that between each horizontal community and measures of hydroperiod (Figure 3.3B), when I consider all wetlands surveyed. Using the Procrustes pseudo-R value, the strength of bird cross-taxon relationships (i.e., bird-aquatic macroinvertebrate, bird-plant) were 84% higher in magnitude than that between birds and hydroperiod. With aquatic macroinvertebrates, relationships with both birds and plants were 52% larger in magnitude than aquatic macroinvertebrate-hydroperiod relationships. Similarly, for plants, cross-taxon relationships were 95% larger in magnitude than that between plants and hydroperiod. For a full list of Procrustes pseudo-R values and the associated *p*-value, see Appendix 4

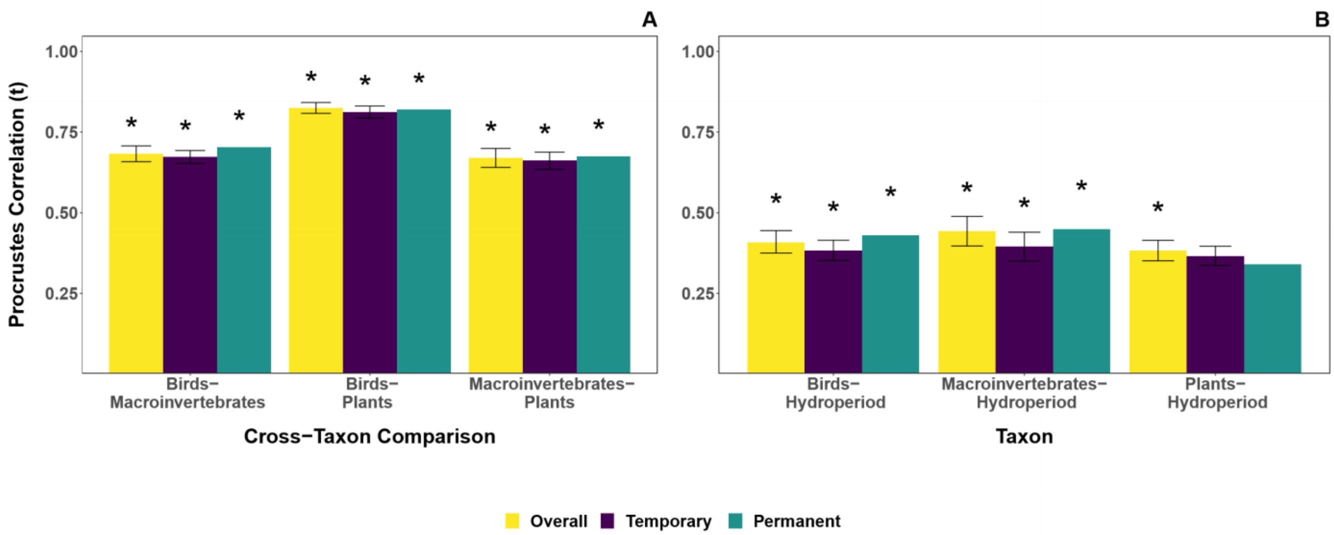

Figure 3.3 Congruence among horizontal communities(A) and between each horizontal community and hydroperiod (B) using a Procrustes Analysis. ¶measured congruence for our balanced rarefied datasets at 31 sites. Over 1000 iterations, we sampled without replacement: 1) all sites, regardless of permanence class (*n* = 96) and 2) short-hydroperiod wetlands (including both seasonally-ponded and temporarily-ponded wetlands; *n* = 65); thus, error bars are 90 % confidence intervals from bootstrapping. Long-hydroperiod wetlands were inclusive of those that were semi-permanently and permanently ponded; "*" indicates that congruence was significantly greater than zero (*p*-value < 0.1).

Differences in congruence based on permanence class (short hydroperiod: temporary and seasonal; long hydroperiod: semi- permanent and permanent) were marginal, contrary to my prediction. While birds and macroinvertebrates had marginally-stronger congruence with hydroperiod in long-hydroperiod wetlands (Figure3.3B), difference in cross-taxon congruence between the long and short hydroperiod wetlands were negligible.

3.6. Discussion

Biological interactions are important drivers of community composition and some argue that biological interactions are equally as important in shaping community composition as are environmental filters (Kraft et al. 2015; Janke 2016; Zimmer et al. 2016; Pearson et al. 2018). Without understanding the influence of one horizontal community on another, we have an incomplete understanding of how communities assemble. It is difficult to disentangle the relative influence of biological interactions and environmental filters on community composition in the absence of manipulative experiments (Levine 1999; Maestre et al. 2005), especially with the use of natural experiments as opposed to causal-based models (Duan et al. 2016; Lewis et al. 2017). However, my results confirm that hydroperiod alone cannot explain patterns in species relative abundances, despite sampling across a strong hydroperiod gradient, since there were stronger relationships among the horizontal communities I surveyed than between each horizontal community and my measures of hydroperiod. Similar to my findings, another study reported a strong influence of biological interactions on plant biomass in alpine grasslands in Norway along a precipitation gradient (Klanderud et al. 2015).

Interestingly, though cross-taxon congruence was high compared with the congruence between each horizontal community and the matrix of hydroperiod indicators, I did not detect a difference in the strength of cross-taxon congruence between wetlands of short and long hydroperiods. I attribute my failure to detect this non-stationarity in the strength of cross-taxon relationships to two factors. First, out of the three horizontal communities that I studied, hydroperiod had the largest influence on aquatic macroinvertebrates, filtering out those invertebrates missing the capacity to survive drawdown and desiccation. Therefore, it is likely that the influence of vegetation on the abundance of macroinvertebrates is masked by the stronger influence of hydroperiod (Gleason and Rooney 2017a). Work by within Australian ephemeral wetlands suggests that the influence of hydroperiod on aquatic macroinvertebrates may be similar to that on plants, and this is because they reported that duration of inundation and water depth will dictate which plants will establish (Casanova and Brock 2000). Consequently, from short to long-hydroperiod wetlands, I should observe plant and aquatic macroinvertebrates that are adapted to the same conditions, and this would mean that plants will have the same magnitude of influence on aquatic macroinvertebrates across the hydroperiod gradient. Second, birds select wetlands based on whether their foraging and nesting needs can be met (Murkin et al. 1997), which is typically dependent on vegetation in both short and long-hydroperiod wetlands. As an example, my long-hydroperiod wetlands were occupied by waterbirds, and short-hydroperiod wetlands were more associated with upland birds (Appendix 5A and D). Thus, while I may observe birds that feed on aquatic plants/insects or nest in reeds in long-hydroperiod wetlands, birds in short-hydroperiod wetlands likely had foraging and nesting behaviors suitable for the prey and nesting habitat available. In other words, the birds are cueing to vegetation in their selection of wetland habitat across the measured hydroperiod gradient.

For wetland biota that are active dispersers, cross-taxon biological interactions may be more important in shaping their community composition than for sessile species. I demonstrate that bird abundances were most strongly tied to plant and aquatic macroinvertebrate abundances, and birds were the strongest dispersers of the horizontal communities I studied. Birds in the NPPR are migratory, and they are known to choose wetlands for pairing and brood rearing based on the vegetation structure within the landscape and wetland-scale vegetation characteristics (Naugle et al. 2001). Thus, birds occupying the wetlands in my study actively selected these areas because their foraging and nesting needs could be met. For aquatic macroinvertebrates, however, some families are able to colonize neighboring wetlands with better-suited hydroperiod regimes; for those invertebrates incapable of moving between wetlands, drawdown may extirpate them from a wetland, if they do not have desiccation-adapted traits (Panov and Caceres 2007; Mabidi et al. 2017). Consequently, because aquatic macroinvertebrates are not generally able to select wetlands based on their preferred hydroperiods, plants may have a smaller role in structuring their communities than for birds. For plants, which are passive dispersers, the water depth gradient may determine which subset of the seedbank will germinate at a given location (Casanova and Brock 2000; Faist et al. 2013). Because plants in these short-hydroperiod wetlands had seeds that are typically animal dispersed (Appendix 5C and F), I can conclude their abundances may be also influenced by birds. Seed dispersal by birds is widely reported to influence wetland plant abundances (DeVlaming and Proctor 2006; Klaassen and Nolet 2007a; Reynolds and Cumming 2016; Kleyheeg et al. 2017); cyclic drying increases seedbank diversity as the sediment is frequently exposed (Poiani and Johnson 1989; Ma et al. 2014). However, the authors also argue that seedbank composition and richness are congruent along the water depth gradient; when comparing seedbanks between wetlands, they are often indistinguishable. This would suggest that while seed dispersal by birds can influence seedbank diversity, it is hydroperiod that determines which plants within the seedbank establish (Casanova and Brock 2000). Though plant abundances are influenced by seed dispersal by birds, the strong filtering of hydroperiod on their abundances results in birds being more sensitive to cross-taxon interactions as they can select which wetland meets their foraging and nesting needs.

There are two gaps in my study design that could explain the weaker congruence between each horizontal community and hydroperiod than among the horizontal communities. First, submerged plants were not surveyed in either year, and this plant assemblage is typical of wetlands with longer hydroperiods (i.e., semi-permanently-ponded and permanently-ponded wetlands – Stewart and Kantrud 1971). Thus, plants abundance may, in fact, be more strongly related to hydroperiod than I detected. Because congruence between hydroperiod and the other horizontal communities (i.e., birds and aquatic macroinvertebrates) were similar in magnitude to that of plants, I believe that exclusion of submerged plants did not largely affect my results. Another factor that could have influenced my measures of congruence between each horizontal community and hydroperiod is that the variables I used to measure hydroperiod did not accurately represent wetland water levels. I believe that this is unlikely because, generally, wetlands with longer hydroperiods were typically classified as semi-permanent and permanent. In the few cases where there was poor agreement between hydroperiod and permanence class, I believe that this may be explained by annual changes in weather and land use/land cover, which are known to affect wetland hydroperiods (Johnson et al. 2005; Voldseth et al. 2007).

3.7. Conclusion

Contrary to my predictions, I did not detect non-stationarity in cross-taxon relationships across an environmental gradient. This was surprising because I hypothesised that longer hydroperiods would facilitate more time for cross-taxon interactions, and my failure to detect any differences suggests that horizontal communities in short to long-hydroperiod wetlands are equally influenced by each others' abundances. Secondly, I detected stronger correlations between each horizontal community than between each horizontal community and measures of hydroperiod, and this was strongest for birds and plants. I hypothesize that these stronger correlations suggest that plant and aquatic macroinvertebrate abundances are important in determining whether a bird will occupy a wetland, and birds may influence plant abundances wetlands when they disperse their seeds.

4. FUNCTIONAL DISPERSION OF WETLAND BIRDS, INVERTEBRATES AND PLANTS MORE STRONGLY INFLUENCED BY HYDROPERIOD THAN EACH OTHER.

4.1. Introduction

Though there is consensus among community ecologists that abiotic and biotic filters structure communities (Azeria et al. 2009; Qian and Kissling 2010; Chase and Myers 2011; Cabra-García et al. 2012; Devercelli et al. 2016), the relative role of each filter is widely debated (Kraft et al. 2015; Duan et al. 2016). Poff (1997) presented a nested filter conceptual model of community assembly. The author argued that species within the regional species pool must first pass through the coarse filter of abiotic conditions; species with functional traits adapted to the range of conditions set by the abiotic filter would survive. Next, these surviving species can then influence each other's abundances through biological interactions – a more fine-scaled filter. There are several other authors that find support for this nested filter model (e.g., Ackerly and Cornwell 2007; Williams et al. 2009; Aronson et al. 2016). Though manipulative experiments should prove useful in understanding the relative role of abiotic and biotic filters (Tiunov and Scheu 2005; Wardle 2006; Maynard et al. 2018), I posit that studying taxonomic groups exposed, largely, to a single environmental filter could help in partitioning their relative role in the assembly of communities.

We can study the dispersion of functional groups (i.e., organisms that share characteristics/behaviors in a community) in wetlands of the northwestern Prairie Pothole Region (PPR), which differ in their exposure to an environmental filter, to evaluate Poff's (1997) model of community assembly. Wetlands in the PPR differ in the length of time ponded water is present (i.e., hydroperiod), some containing ponded water year-round and others drying up a few weeks after spring snowmelt (Stewart and Kantrud 1971; Leibowitz and Vining 2003). While the diversity and community structure of birds, aquatic macroinvertebrates and plants in PPR wetlands are directly impacted by hydroperiod (Ruhí et al. 2014; Daniel et al. 2019), interactions are evident among these taxa: 1) birds forage on plants and disperse their seeds (e.g., Soons et al. 2016); 2) birds consume aquatic macroinvertebrates and can influence their egg bank (e.g., van Leeuwen et al. 2017); and 3) plants provide habitat for aquatic macroinvertebrates (e.g., Gleason et al. 2018). Evaluating the relative role of these filters can be pursued using a causal framework, which require univariate proxies of community composition; functional dispersion – a measure of how species abundances vary based on their traits (Schleuter et al. 2010) – is argued as a reliably proxy for community structure in studying community assembly processes (Gerhold et al. 2015). Dispersion is preferred when studying these assembly processes because it captures how abiotic and biotic filtering can influence community structure; species with similar functional traits will "passes through" an abiotic filter, while biotic filtering will encourage species with different functional traits to establish to minimize competition for resources (Gerhold et al. 2015). I would expect, therefore, that if there is support for Poff's nested filter model, then the influence of hydroperiod on a taxon's functional dispersion would be stronger than the correlation in functional dispersion between taxa.

Though unlikely, functional dispersion of taxanomic groups in the PPR may be unrelated the functional dispersion of co-occurring taxa; this would mean that Poff's hypothesis that biotic filters are of lesser importance would be unsupported. Instead, hydroperiod may limit common resources that each taxon requires, and their functional dispersion may simply be dictated by hydroperiod (Figure 4.1A). For example, hydroperiod may determine which plants in the seedbank will germinate (Casanova and Brock 2000; Tsai et al. 2012b). Hydroperiod may also filter out macroinvertebrates lacking desiccation adaptations (Gleason and Rooney 2017a). Birds also show sensitivity to hydroperiod; it can dictate which terrestrial birds, shorebirds and waterfowl can establish (Niemuth et al. 2006; Morissette et al. 2013). Thus, any apparent relationship between taxon's functional dispersion could be the result of a common response to hydroperiod.

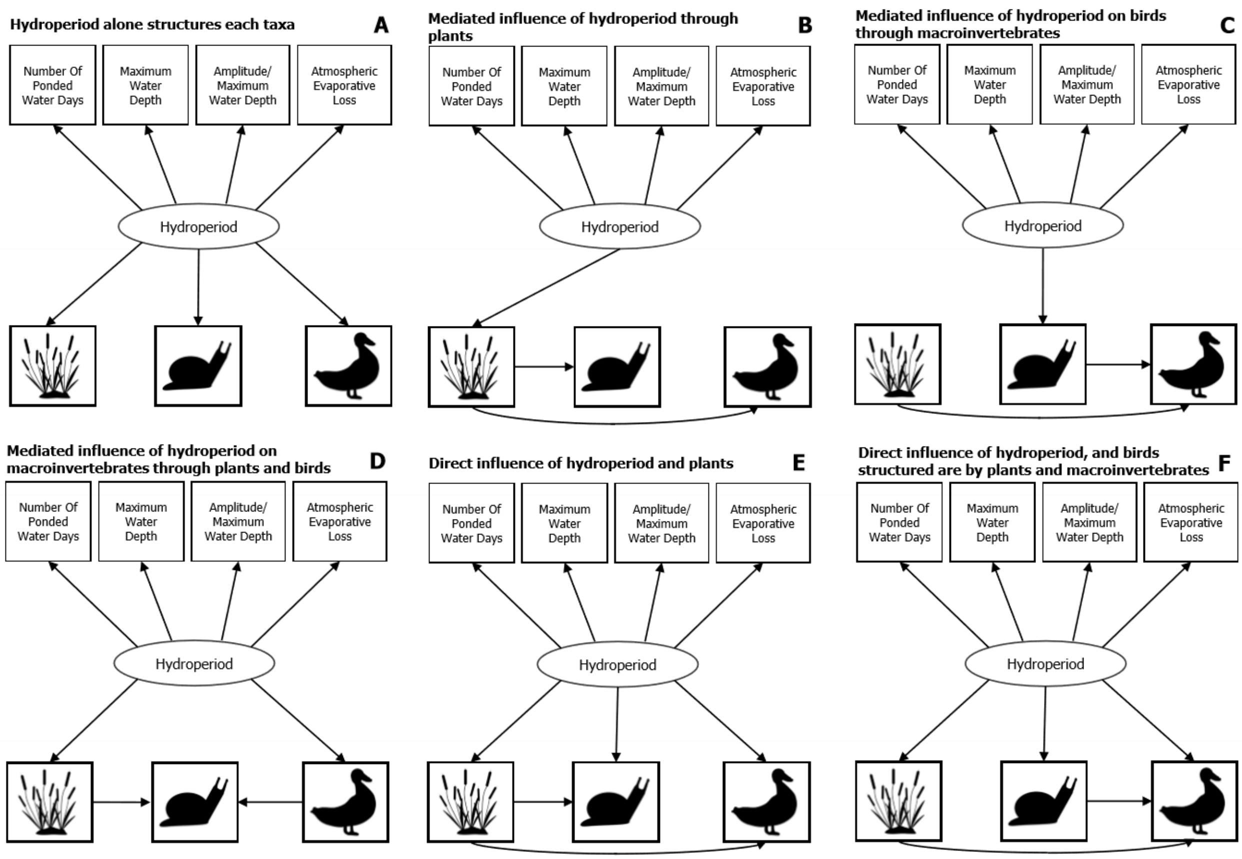

Figure 4.1 Six candidate structural equation model to evaluate the relative influence of biological interactions and hydroperiod on community functional dispersion.

An alternative mechanism that could explain poor support for Poff's hypothesis of a finer-scale biotic filter could be that community functional dispersion may be mediated rather than a direct response of biota's functional dispersion to hydroperiod. Consequently, any correlations in community functional dispersion could be simply attributed to a joint, indirect influence of hydroperiod. I have three possible pathways that could explain this mediated effect. My first mediated-effect model posits that hydroperiod structures the functional dispersion of communities through its effect on the functional dispersion of plants (Figure 4.1B). Here, I hypothesized that because plants determine whether birds can nest or forage (Klaassen and Nolet 2007b; Austin and Buhl 2011; Fox et al. 2011; Ayers et al. 2015) and act as substrate for numerous aquatic macroinvertebrate families (Campeau et al. 1993), they shape resource availability for the other taxa and hydroperiod directly dictates their resource availability. For my second mediated-effect model, I posit that hydroperiod structures macroinvertebrate functional dispersion directly, while plants are structured by stochastic factors (i.e., seed dispersal) and both taxa structure bird functional dispersion (Figure 4.1C). Aquatic macroinvertebrates are the most sensitive to wetland hydroperiod, while plants are the least sensitive (see Chapter 3). Additionally, because wetland plants are largely wind dispersed (Guarino et al. 2005), the abundance of plants may be not be strongly predicted by hydroperiod and may be random with respect to ecological selection pressures like hydroperiod. Since plants and aquatic macroinvertebrates structure the availability of nesting habitat and foraging opportunities for birds (e.g., Gurney et al. 2017; Vanausdall and Dinsmore 2019) functional dispersion for birds may only be related to plants and aquatic macroinvertebrates with no direct influence of hydroperiod. My final mediated model posits that hydroperiod structures both birds and plants functional dispersion, which in turn structures aquatic macroinvertebrates functional dispersion (Figure 4.1D). In support of this direct influence of birds on aquatic macroinvertebrates functional dispersion, a Hungarian study reported that wetlands supporting waterbirds typically support smaller species of aquatic macroinvertebrates, which are not easily consumed by birds (Horváth et al. 2012). Similarly, vegetation, whether upland or within the wetland, are reported to influence the diversity and abundance and diversity aquatic macroinvertebrates (Davis et al. 1999; Meyer et al. 2015).

Full support for Poff's nested filter model could be evidenced by both hydroperiod and cross-taxon interactions influencing community functional dispersion directly, and I would expect a stronger influence of hydroperiod. I have two competing hypotheses on these direct effects. My first direct-influence model posits that the functional dispersion of all communities is structured by wetland hydroperiod and that plants structure the functional dispersion of birds and aquatic macroinvertebrates (Figure 4.1E). While numerous studies demonstrate that plants and aquatic macroinvertebrate communities are structured by hydroperiod (e.g., Gleason and Rooney 2017a), I believe that birds may be sensitive to wetland hydroperiod because the percentage of open water has a direct influence on the number of waterbirds that can establish (O'Neal et al. 2008). Also, bird and aquatic macroinvertebrate abundances are strongly related to plants (Gallardo et al. 2011; García 2016). My final direct-influence model posits that the functional dispersion of all communities is structured by hydroperiod, but it is bird functional dispersion that is structured by aquatic macroinvertebrates and plants (Figure 4.1F). I believe that this model may explain community functional dispersion because birds are the most transient of these taxa, and they can select wetlands for foraging and nesting based on whether their preferred habitat is present.

In Chapter 3, I showed that biological interactions played an important role in shaping community abundances, but unclear from this finding is whether biological interactions are of lesser or greater importance in structuring the abundances of different functional groups. I tested hypotheses on how the functional dispersion values of birds, plants, and aquatic macroinvertebrates relate to hydroperiod and the functional dispersion of co-occurring taxa. I asked 1) whether functional dispersion is driven by hydroperiod alone or by both hydroperiod and the functional dispersion of co-occurring taxonomic groups, 2) whether the influence of hydroperiod on each taxonomic group was primarily direct or indirect; and 3) whether hydroperiod had a stronger influence on the functional diversity of taxonomic groups than the functional dispersion of co-occurring taxonomic groups (i.e., support for Poff's nested filter model). I used structural equation modelling and AIC to evaluate the support for my six alternative hypotheses (Figure 4.1). I predicted that there would be support for Poff's nested filter model, which would be evidenced by 1) the influence of wetland hydroperiod exceeding that of the functional dispersion of co-occurring taxonomic groups, as this theory dictates that abiotic filters like hydroperiod should take precedence over biological filters like the functional dispersion of co-occurring taxa and 2) a direct influence of both hydroperiod and cross-taxon interactions on community functional dispersion.

4.2. Methods

4.2.1. Study Area

My wetlands are prairie potholes in the Grassland and Parkland Natural Regions of Alberta, Canada (Figure 4.2). They are called prairie potholes because they are depressions filled with ponded water, which were formed in the last glacial period (Wright 1972). Also in this region, the climate is semi-arid, as the rate of potential evapotranspiration exceeds that of annual precipitation (Hayashi et al. 2016). In the Grassland Natural Region, the dominant vegetation is mixed-grass prairie. Conversely, in the Parkland Natural Region, deciduous trees and grasses dominate (Downing and Pettapiece 2006).

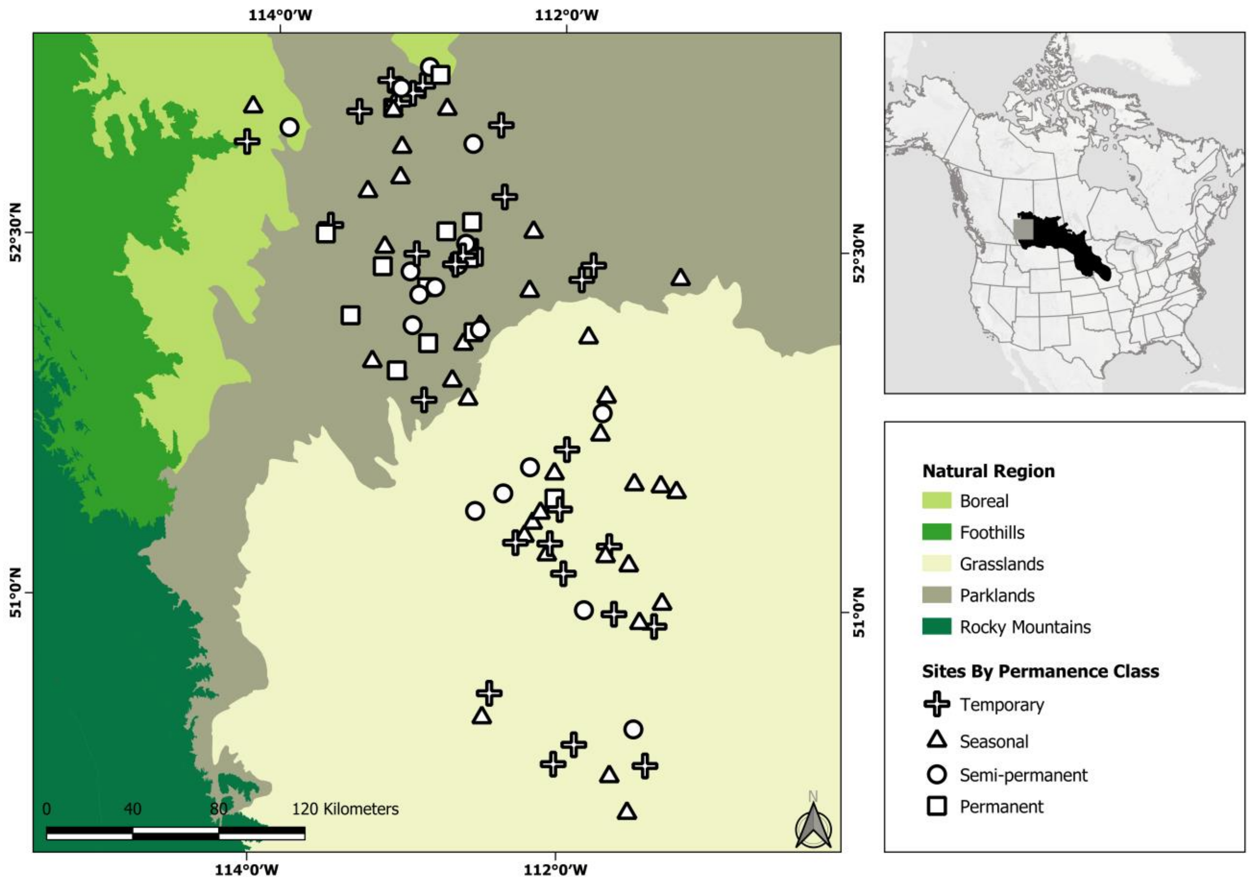

Figure 4.2 Map of the study region, situated in the northern prairie pothole region (inset map). ¶he 96 wetland sites covered the Grassland and Parkland Natural Regions, and represented temporary (n = 28), seasonal (n = 35), semi-permanent (n = 17), and permanent (n = 14) ponded-water permanence classes.

4.2.2. Study Design

96 wetlands were surveyed in my study, and they ranged in pond permanence class (sensu Stewart and Kantrud 1971) from temporary with a hydroperiod on the order of weeks to permanent with ponded water year-round, even in dry years. Sites selected in my study mirror the frequency distribution of permanence classes in Alberta Merged Wetland Inventory (Government of Alberta 2014), and so included an unequal number of wetlands per permeance

class category. Generally, most of the wetlands were small (mean size 0.81 ± SE 0.12 ha), reflecting the dominance of small prairie pothole wetlands in the region, independent of their permanence class.

4.2.3. Biological Surveys

4.2.3.1. Birds

Both visual and auditory point counts were used to survey birds twice during the peak breeding season (May-June in either 2014 or 2015). In summary, visual surveys commenced first; they lasted for 10 minutes and were carried out from a vantage that allowed a clear view of the open water zone. We next conducted an 8-minute auditory survey. These surveys were 100-m, fixed-radius point counts, occurring at the center of the wetland (>3 ha). When a wetland was larger than 3 ha, technicians conducted multiple auditory surveys; each point-count location was at least 100 m from the wetland end and 200 m from any other point-count location. I summed abundances across the multiple auditory point counts to account for differences in wetland size. For both visual and auditory counts, technicians recorded the identity and abundance of species (species list in Appendix 2A). Importantly, species abundances were summed across visits, rather than averaged, to account for the staggered breeding seasons among species. Additional details on the bird surveys are reported in Anderson and Rooney (2019).

4.2.3.2. Aquatic Macroinvertebrates

A revised version (Gleason and Rooney 2017a) of the quadrat-column-core method (Meyer et al. 2013) was used to survey aquatic macroinvertebrates. Technicians sampled aquatic macroinvertebrates in both the open water (submersed and floating vegetation) and the emergent (cattail, bulrush, or other robust perennial sedges) zones, when both were present. In each zone, technicians collected three replicates of a: 1) vigorously washed and clipped 0.25 m^2 vegetation sample, from the emergent or submersed aquatic vegetation; 2) two, 10-cm diameter water column sample; and 3) a 10 cm deep, 4.8 cm diameter sediment core, which was collected using a steel corer that was inserted to just above the sediment. The sediment core sample fractions were excluded for two reasons. First, densities were low. Second, there were no taxa in the sediment cores that were novel to the combined water column and vegetation samples. Technicians composited the replicates of each sample type; this yielded one water column, sediment core, and vegetation sample in each wetland vegetation zone (open water and emergent). Following, for water column samples, technicians sorted aquatic macroinvertebrates to identify them to the lowest practical taxonomic level (typically Family), following Clifford (1991) and Merrit et al. (2008). Technicians used a Marchant box to sub-sample the vegetation sample, which was based on the protocol of the Canadian Aquatic Biomonitoring Network (Environment Canada 2014). Here, taxon abundances are area-weighted to estimate density per meter-squared. For both vegetation and water column samples, aquatic invertebrates were scaled to the meter squared. Next, technicians summed densities to represent each wetland zone, and subsequently averaged across zones for wetland-level invertebrate relative abundances. Additional information on the aquatic macroinvertebrates sampling are reported in Gleason and Rooney (2017a), and a comprehensive taxonomic list is provided in Appendix 2B.

4.2.3.3. Plants

Technicians conducted plant surveys during peak aboveground biomass (late July to August). During peak biomass, the presence of inflorescences allows for herbaceous plants to be confidently identified and cover values are at their maximum. After mapping the extent of each plant assemblage based on their vegetative structure (e.g., deciduous tree, forb, floating-leaved vegetation), technicians then mapped them by which species were co-dominant or dominant. We used a GPS/GNSS unit (SX Blue II receiver, by Geneq Inc., Montreal, Canada) to map these assemblages. For communities sized between 100-5000 m^2, technicians identified the percentage cover (modified Braun-Blanquette approach) of each vascular plant species within five, 1 m^2 quadrats. When communities were larger than 5000 m^2, technicians surveyed an additional quadrat per 1000 m^2 of plant community area. Technicians also recorded the percentage cover of algae, bryophytes, bare ground, litter, rock, seedling/unidentified forb, standing dead litter, and open water (species list in Appendix 2C), but these cover classes were not included in subsequent analyses of vascular plant cover. For more details on plant survey methods, see Bolding et al. (2020).

4.2.4. Characterizing Prairie Pothole Permanence

Wetland permanence is a latent variable that cannot be directly measured but can be quantified nonetheless by a set of correlated indicators within a structural equation modelling framework (Grace et al. 2010). I used four proxies for wetland permanence, all related to the concept of hydroperiod. I used a matrix including the approximate number of days a wetland contained ponded water, the maximum water depth observed, the ratio of water amplitude to maximum water depth and an index of evaporative losses to the atmosphere relative to water inputs based on stable isotopes analysis. For details on the stable isotope analysis, see Meyers (2018)

4.2.5. Statistical Analysis

4.2.5.1. Calculating Functional Dispersion

I used functional dispersion as a proxy for community structure in studying community assembly process. Generally, when functional dispersion is high, some functional traits are more abundant than others; if functional abundances are equal, I would expect low functional dispersion (Finke and Snyder 2008; Comte et al. 2016). To measure the functional dispersion of each taxon, I used Rao's quadratic entropy with the dBF function in the functional diversity (FD) package (Laliberte et al. 2014) in R (R Core Team 2019). This functional dispersion index uses the weighted mean distance of each species to the group centroid, where weights are based on species relative abundances. Thus, functional dispersion is the variance in a species' traits and where they are located in trait space (Schleuter et al. 2010), and it uses both species relative abundances and the pairwise functional differences to summarize functional diversity. Importantly, this index is not influenced by richness (Rao 1982).

The traits one selects for functional diversity indices can have profound effects on our understanding of a communities' ecology (Zhu et al. 2017); this suggests that our trait selection can affect our interpretation of the relative influence of permanence and cross-taxon interactions on functional dispersions. Because I aimed to capture as many assembly processes as possible, and not bias our analyses to traits related to abiotic filtering (Spasojevic and Suding 2012), I selected a wide range of traits and not simply those likely to be sensitive to wetland hydroperiod. For birds, I selected functional traits indicative of feeding behavior (e.g., ground gleaner, dabbler) nesting ecology (e.g., bank, reed), primary habitat (e.g., shoreline, grassland), wetland status (e.g., obligates versus facultative) and migratory status (e.g., neo-tropical migrant). With macroinvertebrates, I used traits on feeding (e.g. filter feeder), behavior class (e.g., climbers) and desiccation strategy (e.g., disperser). For plants, however, I used wetland indicator status (e.g., emergent), dispersal (e.g. wind), reproduction (e.g. vegetative), and nativity (e.g., native vs exotic). A comprehensive functional traits list is provided in Table within Appendix 6.

4.2.5.2. Partitioning the Influences of Community Composition into Environmental and Biological Components

I used structural equation models to evaluate the pathways that could explain the relative influence of abiotic and biotic filters on functional dispersion. I compared the fit of six candidate models. My first model examined whether functional dispersion was explained by permanence alone, my second to forth models assessed whether there was a direct or indirect influence of permanence and my fifth to sixth models were assessments of the relative influence of permanence and biological interactions.

I implemented the structural equation models in the latent variable analysis (lavaan) package (Rosseel 2012) of R (R Core Team 2019). Before implementing each model, I relativized each variable by their respective maximum values because they differed in range and scale. I was confident that my relativized data did not violate the assumption of multivariate normality, which is required for structural equation models, based on results of a Mardia's multivariate kurtosis of multiple variables test ($z = -0.325$, p-value = 0.774), implemented using the mardiaKurtosis function in the useful tools for structural equation modeling (semTools) package (Jorgensen et al. 2018) in R (R Core Team 2019). For each model, I set the endogenous covariances to zero, fixed the factor loading of the approximate number of days that a wetland contained ponded water to 1.0 and used an unbiased estimator (wishart) for maximum likelihood estimation. To rank the candidate models, I used AIC_c and model fit statistics. Finally, I standardized all parameter estimates, to ensure that I could compare the relative influence of hydroperiod and biological interactions on each taxonomic group's functional dispersion.

4.3. Results

4.3.1. Partitioning the Influences of Community Composition into Environmental and Biological Components

I compared the fit of six structural equation models (Figure 4.1), each representing a different hypothesis about the relative influence of co-occurring taxonomic groups and ponded-water permanence on the functional dispersion of birds, aquatic macroinvertebrates and vascular plants in my study wetlands.

My best model hypothesized a direct influence of permanence and plant functional dispersion on the functional dispersion of birds and aquatic macroinvertebrates (Table 4.1).

Table 4.1. Performance of six candidate structural equation models predicting the relative influence of biological interactions and hydroperiod on community congruence. Direct influence of permanence and plants was the best model with the ΔAIC of all other models being > 9 units.

Model	Chi-square	*p*-value	AIC	ΔAIC	AIC weight
A: Hydroperiod alone structures taxon	30.983	0.006	-231.165	14.291	0.077
B: Mediated influence of hydroperiod through plants	42.022	0.000	-219.990	25.465	0.000
C: Mediated influence of hydroperiod through inverts on birds	24.093	0.020	-234.134	11.321	0.341
D: Mediated influence of hydroperiod on birds through plants and inverts	24.745	0.025	-235.475	9.980	0.667
E: Direct influence of hydroperiod and plants	12.902	0.376	-245.455	0.000	98.034
F: Direct influence of hydroperiod, and birds are structured by plants and inverts	22.220	0.035	-236.030	9.426	0.880

Because no models were within two ΔAIC units of this top-performing model (Arnold 2010), I conclude that there is strong support for this model. More, the AIC weights indicate that a direct influence of permanence and plant functional dispersion on the functional dispersion of birds and aquatic macroinvertebrates was substantially more likely (AIC weight = 98), given the data, than the other five models (Table 4.1; Wagenmakers and Farrell 2004). Based on the *p*-value and chi-square statistic for this model (Table 4.1), I am confident there is strong support for this model, and it fit my data well. The standardized regression coefficients for this model are presented in Figure 4.3.

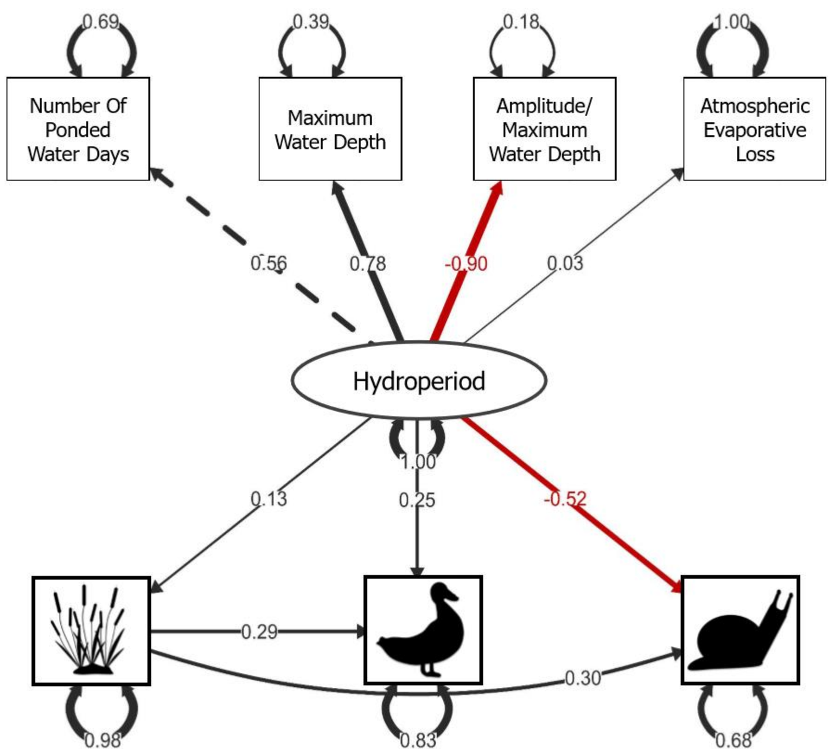

Figure 4.3 Measurement model for the best fitting of the six candidate structural models (there is a direct influence of permanence on the functional dispersion of birds, aquatic macroinvertebrates and plants, and plants directly structure birds and aquatic macroinvertebrates functional dispersion)¶Unidirectional lines are standardized regression slopes while bi-directional lines are standardized variances. The dashed, unidirectional line indicates which exogenous variable was fixed to a factor loading of one. Lines in black indicate that there was a positive relationship, while red lines indicate that the relationship was negative. Line thickness reflects the magnitude of the standardized regression slopes.

While permanence alone did not explain functional dispersion of our three wetland taxa (research question one), there was a direct influence of permanence on the functional dispersion of each taxon (research question two). Interestingly, the relative influence of permanence and the functional dispersion of plants on the functional dispersion of birds and invertebrates differed (research question three). Ponded-water permanence had the strongest influence on aquatic macroinvertebrate functional dispersion, with plant functional dispersion being less influential. However, bird and plant functional dispersion were less strongly sensitive to permanence (Figure 4.3), and plants were the only taxon that was not influenced by the functional dispersion of another taxon.

4.4. Discussion

Using the functional dispersion of co-occurring taxonomic groups in PPR wetlands, I evaluated whether there was support for Poff's nested filter model in describing community assembly processes. I assumed that support for Poff's model would be evidenced by a stronger direct influence of hydroperiod on functional dispersion than cross-taxon interactions. I find support for Poff's nested filter model – abiotic filtering primarily influences functional dispersion and biotic filters are of lesser importance. Importantly, in evaluating the pathways that could explain the assembly of birds, aquatic macroinvertebrates and plants, and simultaneously evaluate if there was support for Poff's model, I asked three questions: 1) does the abiotic filter of ponded-water permanence alone structure prairie pothole wetland communities, 2) is the influence of this abiotic filter primarily direct or indirect and mediated through biological interactions, 3) what is the relative influence of this abiotic filter and the biological filtering of co-occurring communities?

To address my first question, if hydroperiod alone explained functional dispersion, I report that the structural equation model with the strongest support incorporated both hydroperiod-taxon and cross-taxon pathways influencing functional dispersion. Hence, my model confirms that both the functional dispersion of co-occurring taxa and hydroperiod are important determinants of functional dispersion in these wetlands. This conclusion is supported by both observational studies and manipulative experiments, which report that biological interactions and environmental conditions structure resource availability for establishing taxa (Tiunov and Scheu 2005; Wardle 2006; Maynard et al. 2018). Environmental conditions can influence resource availability for primary producers by limiting whether nutrients necessary for growth are present (Fourqurean and Zieman 1992; Bowman et al. 1993; Guignard et al. 2017); and for consumers, environmental conditions determine whether energy gained (i.e., from feeding) (e.g., Schoo et al. 2012) is lower than the energetic costs to establish (e.g., from maintaining optimal body temperature, or time and effort placed into foraging) (Magnuson et al. 1979; Reid and Sprules 2018). Biological interactions, however, can influence resource availability through prey availability (for consumers) (Spivak et al. 2009; Groendahl and Fink 2017) or habitat provisioning (Thompson et al. 1996; Jackson et al. 2008). Thus, in predicting environmental change (Urban et al. 2016) or even species ranges (Dormann et al. 2018; Palacio and Girini 2018), we must also consider biological interactions.

To address my second question, whether the influence of hydroperiod was mainly direct or was mediated through the functional dispersion of co-occurring taxa, I find that the influence of hydroperiod was primarily direct. The functional dispersion of plants was driven exclusively by hydroperiod (standardized regression coefficient = 0.13). The functional dispersion of birds and aquatic macroinvertebrates included both a direct influence of hydroperiod (standardized regression coefficient = 0.25 and -0.52, respectively) and a much smaller indirect component. This mediated effect was through the influence of plant functional dispersion on birds (indirect standardized regression coefficient = 0.0377) and on aquatic macroinvertebrates (indirect standardized regression coefficient = 0.0390). Consequently, I conclude that taxon community structure in prairie pothole wetlands is mainly influenced by hydroperiod directly, even where indirect pathways of influence are supported by the data.

In terms of my third question, if there was support for Poff's nested filter model of community assembly, wherein abiotic filters take primacy over secondary biological filters, I find moderate support for Poff's model. Hydroperiod had a much stronger influence on aquatic macroinvertebrate functional dispersion than plant functional dispersion; for birds, the influence of hydroperiod was moderately weaker than that of plants. This suggests that the abiotic filter of hydroperiod is more influential of functional dispersion in each of our wetland taxa than the functional dispersion of co-occurring taxa. Indeed, the magnitude of influence of hydroperiod on both birds and aquatic macroinvertebrate functional dispersion was 31% greater than the influence of plants on either taxon's functional dispersion. This supports Poff's model wherein abiotic resources and environmental conditions first filter out species from the regional species pool, which lack the necessary adaptations or tolerances to persist, and only subsequently do biological interactions constrain community assembly. I can conclude that biotic filters may be less influential than abiotic filters in community assembly processes.

Though my model fit our data well, I could not account for some community assembly processes. Unknown is whether my hypothesized direct effects are not, in fact, mediated effects that I have categorized as direct effects. For instance, wetlands with longer hydroperiods may come to have higher bird functional dispersion because they are larger and some microhabitats are more abundant (Kantrud and Stewart 1984). If microhabitat availability is the direct pathway influence bird functional dispersion, the influence of hydroperiod would be best described as indirect, contrary to my findings. An additional missing link in my model is intra-taxon interactions. Widely debated before Poff's (1997) nested filter model was introduced is Diamond's (1975) assertion that the “checkered” distribution of species could be explained by competition-driven assembly. Though Diamond's (1975) hypothesis sparked debates lasting several decades (e.g., Connor and Simberloff 1979, Gotelli 2000), some authors have found support for this model (e.g., Gotelli and McCabe 2002, Gotelli and Rohde 2002, Maestre et al. 2008). Because my models focused on cross-taxon interactions, I was unable to incorporate the influence of competition as community assembly process, which should be included in future studies.

4.5. Conclusion

Using structural equation modelling, I demonstrate that the functional dispersion of birds, aquatic macroinvertebrates and plants are explained by both hydroperiod and the functional dispersion of co-occurring taxa. Because hydroperiod generally had a stronger influence, even if indirect effects are considered, I find support for Poff’s nested filter model in the community assembly of co-occurring birds, vegetation and invertebrates in PPR wetlands.

Because hydroperiod plays an important role in the functional dispersion of birds and aquatic macroinvertebrates, I anticipate that these taxa will be more sensitive to the impacts of climate change. Based on forecasts for the Canadian Prairie Pothole Region, we expect that wetlands in the Grasslands and Parklands will undergo declines in their hydroperiods (Schneider 2013). Due to this shortening in wetland hydroperiod, I would expect that wetlands will shift from supporting nearly equal abundances of various functional groups to being dominated by only a few functional groups. I would expect that for birds and plants, however, that functional groups with traits adapted to these drier conditions will become equally abundant.

5. CONSISTENT BUT DELAYED TIMING OF PRECIPITATION AFFECTS COMMUNITY COMPOSITION OF PRAIRIE POTHOLE BIRDS AND AQUATIC MACROINVERTEBRATES, BUT NOT WETLAND PLANTS.

5.1. Introduction

A warmer climate is forecast to increase losses of ephemeral wetlands in the Prairie Pothole Region (PPR) (Johnson et al. 2010b; Fay et al. 2016), but uncertainty in precipitation forecasts make it difficult to estimate the true magnitude of wetland losses (Zhang et al. 2011) or the impacts on wetland biota. Precipitation forecasts for the NPPR differ among climate scenarios, some forecasting increases and others declines in cumulative annual and seasonal amounts (Zhang et al. 2011; Paimazumder et al. 2013; Schneider 2013). Because winter precipitation is the largest contributor to ponded water amounts in PPR wetlands (van der Kamp et al. 2003), a simple change in precipitation timing could also impact wetland hydroperiods (Zhang et al. 2011), even if the cumulative amount of precipitation were to remain consistent. Since the composition of biological communities in these PPR wetlands depend on hydroperiod (e.g., Daniel et al. 2019), understanding how sensitive taxa are to changes in hydroperiod can help us predict the impacts of climate change on ephemeral wetlands.

There is high uncertainty in how precipitation-driven changes in hydroperiod will affect PPR wetlands. Forecasts from numerous studies suggest that PPR precipitation will either: 1) increase (Zhang et al. 2011; Paimazumder et al. 2013) or reduce (Johnson et al. 2010b; Schneider 2013; McIntyre et al. 2019; Mushet and McKenna 2019) in the winter and spring; or 2) increase (Zhang et al. 2011) or reduce (Paimazumder et al. 2013) in the summer. Depending on which scenario occurs, we could observe either an increase or decrease in wetland water budgets, and this could leave wetlands in higher aridity regions of the PPR (i.e., prairies) with a smaller magnitude of changes in hydroperiods than we anticipate (Withey and Van Kooten 2013; Fay et al. 2016). Regardless, a warmer climate will increase evapotranspiration rates (Viglizzo et al. 2015), which means that for hydroperiods to remain unchanged or increase, winter and summer precipitation must be high enough to combat this additional loss of water (Fay et al. 2016). Based on past climate and hydroperiod trends in the PPR, however, regions where there have been increases in precipitation amounts do show evidence of increases in wetland water deficits (Werner et al. 2013). This decline in wetland water budgets is driven by net increases in evapotranspiration rates because of a much warmer climate (Schneider 2013). Thus, regardless of the precipitation scenario, we are likely to observe declines in hydroperiod (Schneider 2013).

The community composition of wetlands forecast to change with a shortening in wetland hydroperiod. For birds, aquatic macroinvertebrates and plants in Alberta's PPR, diversity increases with a lengthening hydroperiod (Daniel et al. 2019). Thus, because wetlands with longer hydroperiods are expected to have the largest magnitude of decline in hydroperiod with climate warming (Johnson et al. 2010b), birds, aquatic macroinvertebrates and plants are likely to undergo changes in their abundances and distribution in the PPR. For birds, northern and eastern shifts in breeding waterbird distributions are expected with the losses in wetland complexes in the south and west PPR, and species reliant on ponded water for reproduction/feeding may undergo large declines in their abundances within the PPR (Johnson et al. 2005; Polan 2016; Reese and Skagen 2017). The diversity in life history traits of aquatic macroinvertebrates, which is likely sustained in shorter-hydroperiod wetlands by individuals colonizing from longer hydroperiod wetlands (Fritz and Dodds 2002; Whiles and Goldowitz 2005; Sim et al. 2013), could be reduced as wetland hydroperiods decline. Similarly, for plants, species that require consistent inundation (e.g., submerged and floating plants) may have much lower abundances as wetlands that previously contained ponded water year-round begin to draw-down annually (Johnson et al. 2010b; Werner et al. 2013).

I observed a inter-year change in precipitation timing between 2014 and 2015 in the Alberta PPR, which I anticipated influenced wetland hydroperiods and the community structure of bird, aquatic macroinvertebrates and plant communities. Though cumulative precipitation amounts were near equivalent in 2014 and 2015, the timing of precipitation differed between the two years. In 2014, precipitation followed the climate normal, apart from the slightly lower precipitation amounts in spring. Similarly, in 2015, spring precipitation was slightly lower than the climate normal, but this precipitation deficit was even lower than that of the previous year. Thus, the precipitation offset in the late summer of 2015 was proportionally higher than that in 2014, both occurring when there was peak aboveground biomass (Figure 5.1).

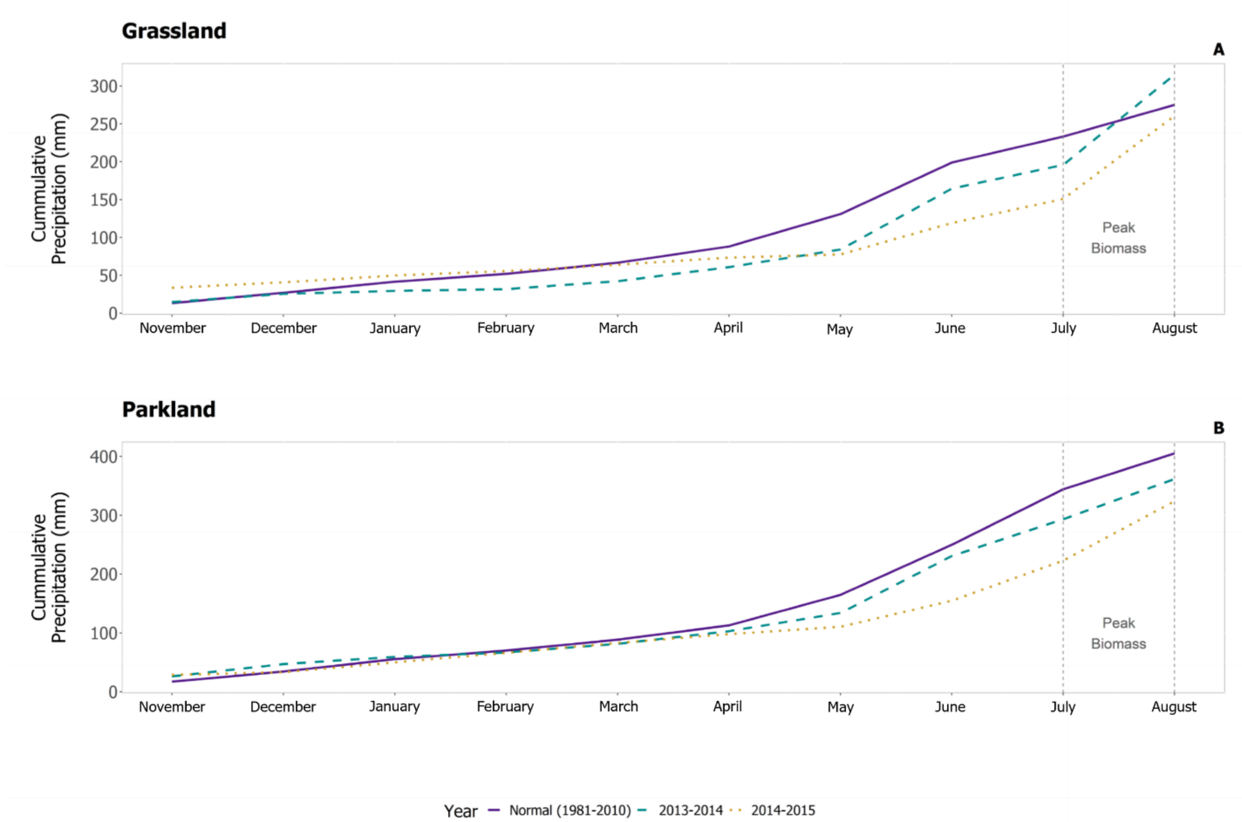

Figure 5.1. Cumulative precipitation in the Grassland (A) and Parkland (B) under the climate normal (1981-2010), in the year with typical summer precipitation (2013-2014) and the year with delayed summer precipitation (2014-2015).¶The solid, purple line represents mean cumulative precipitation between 1981 to 2010. The dashed, aqua-blue line shows 2013-2014 cumulative precipitation. The orange, dotted line shows cumulative precipitation between 2014 and 2015.

Because prairie pothole wetlands primarily obtain their water from snowmelt runoff (Hayashi et al. 1998b; Tangen and Finocchiaro 2017a), I hypothesized that 1) this change in precipitation timing would have a meaningful effect on wetland hydroperiods even though cumulative precipitation was near equal. Secondly, since the magnitude of influence of hydroperiod on wetland biota differs among taxa (Daniel et al. 2019; Chapter 3 & 4), I anticipated that the community composition of taxa more sensitive to hydroperiod (i.e., birds and aquatic macroinvertebrates) would be more responsive to a change in wetland hydroperiod than less-sensitive taxa (i.e., plants) (see Chapter 3 & 4). I test these hypotheses using a natural experiment;

24 wetlands were surveyed in 2014 and again in 2015. I 1) compared community composition between years, 2) examined the extent to which a change in community composition could be attributed to change in wetland hydroperiod and 3) explored how the identity of indicator species/families were influenced by this change in wetland hydroperiod.

5.2. Methods

5.2.1. Study Region

The wetlands in this natural experiment are in the Grassland and Parkland Natural Regions of Alberta, Canada (Figure 5.2). Wetlands in this southern Alberta region are called prairie potholes, mainly because they were formed in the last glacial period and are now depressions filled with ponded water (Wright 1972). Wetlands in this region experience a semi-arid climate – the rate of evapotranspiration is higher than that of annual precipitation. Wetlands in the Grasslands are surrounded by mixed-grass prairie, while Parkland wetlands are surrounded by a mix of deciduous trees and grasses.

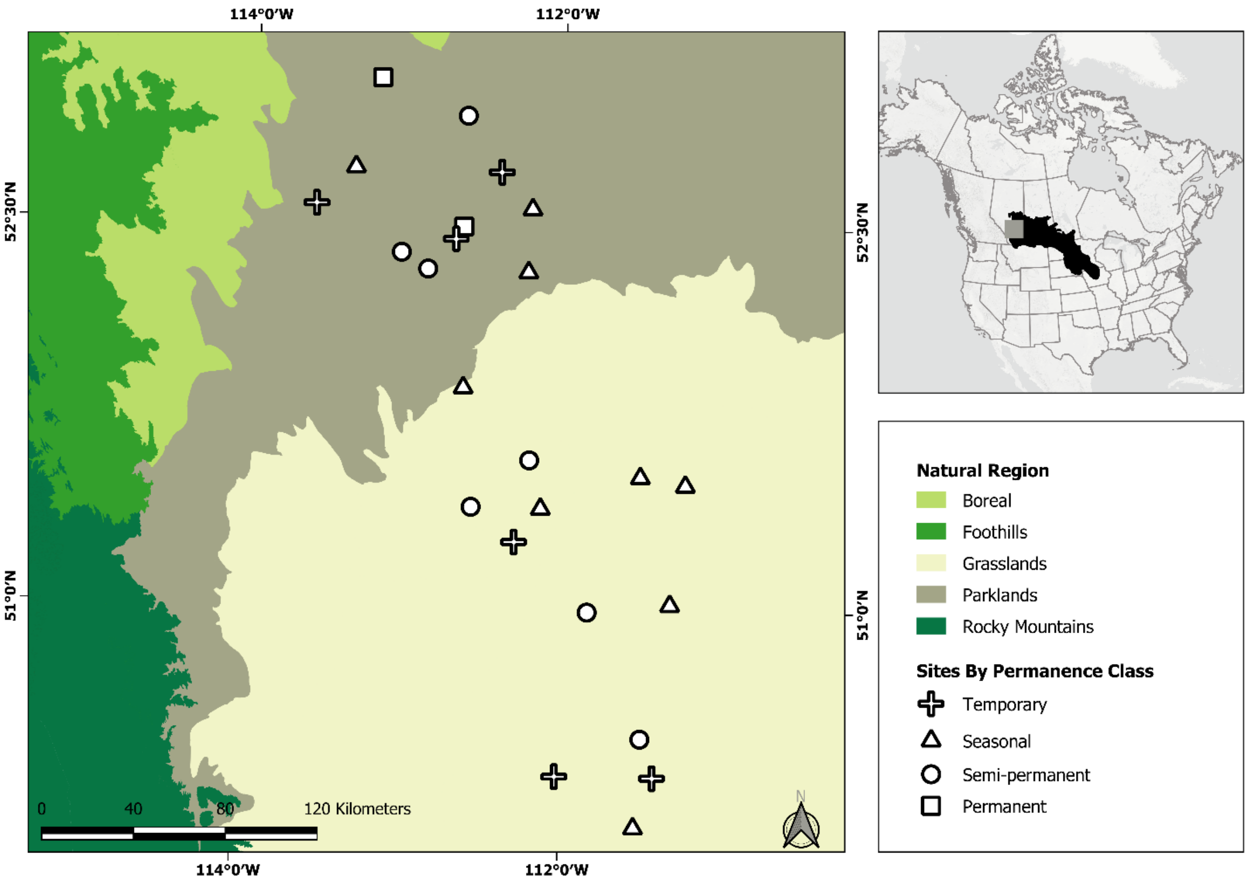

Figure 5.2. A map of the study region in the northern prairie pothole region (inset map).¶The 24 wetland sites occupied both the Grassland and Parkland Natural Region, and they differed in permanence class – temporary (*n*=6), seasonal (*n*=9), semi-permanent (*n*=7), and permanent (*n*=2).

5.2.2. Interannual Variation in Precipitation Timing

I compared mean total precipitation amounts among weather stations from the Alberta Climate Information Service (see Meyers 2018) in the study region (Figure 4.2). I made this comparison to ensure I could attribute a change in hydroperiod to inter-year variation in precipitation timing, and not differences in annual precipitation amounts.

I also compared hydroperiod measured among wetlands (Figure 5.2) surveyed in 2014 and 2015. I used this comparison to determine whether changes precipitation timing led to change in wetland hydroperiod. I compared the following values between years – the approximate number of days the wetland contained ponded water, the maximum water depth, the ratio of water amplitude to the maximum water depth, or an index of evaporative loss based on stable isotope analysis. See Hydroperiod in Chapter 3, for additional descriptions on these variables.

5.2.3. Study Design

In 2014, 24 study wetlands were surveyed, and they were revisited in 2015. The 24 study wetlands replicated the frequency distribution of permanence classes in the Alberta Merged Wetland Inventory (Government of Alberta 2014), ranging from temporarily-ponded to permanently-ponded (sensu Stewart and Kantrud 1971) and resulting in an unequal number of wetlands per permeance class category. The 24 wetlands also captured a range in land cover types, ranging in the percentage cover of non-natural cover within 500-m of the wetland. Non-natural cover included maily crop or pasture, but also built-up and bare ground covers. In addition to grassland, wetland, and open water, natural covers included aspen forest in the Parkland Natural Region.

5.3. Surveys of Biological Communities & Sampling of Wetland Soil and Water Chemistry

5.3.1. Birds

Birds were surveyed twice during peak breeding season (May-June in 2014 and 2015) using visual and audio surveys. The identity and abundance of species (species list in Table within Appendix 1) were recorded in both audio and visual surveys. Visual surveys were conducted for 10 minutes, each time at a location that allowed a clear view of the open water zone. Thereafter, the 8-minute auditory surveys commenced, within 100 m at the wetland center (>3 ha). If a wetland was larger than 3 ha, multiple auditory surveys were conducted. These point counts were a minimum of 1) 100 m from the wetland-upland boundary and 2) 200 m from any other point-count location. Abundances were summed across the auditory point counts within each wetland to account for the differences in the size of wetlands. Species abundances were also summed across visits to account for the staggered breeding seasons among species. For, additional information on the birds surveys, see Anderson and Rooney (2019). A comprehensive taxonomic list is provided in Table within Appendix 2A.

5.3.2. Aquatic Macroinvertebrates

Aquatic macroinvertebrates were surveyed using a revised version (Gleason & Rooney 2017) of the quadrat-column-core method (Meyer et al. 2013). These aquatic macroinvertebrates were surveyed in the open water and the emergent zones, if both zones were present. Two replicates were collected in each zone: one 0.25 m^2 vegetation sample, two 10-cm diameter water column samples and a sediment core sample. The sediment core sample was excluded because densities were low and no novel taxa were recorded to this sample, when compared to the vegetation and water samples. Later, composites were made of the two replicates, which yielded one sample from the vegetation and water column in each vegetation zone. To identify individuals in the water column sample, the aquatic macroinvertebrates were sorted to the lowest practical taxonomic level (typically Family), following Clifford (1991) and Merrit et al. (2008). For the vegetation sample, individuals were placed in a Marchant box for sub-sampling. For both water and vegetation samples, the abundances of each taxon were area-weighted; this was based on the Canadian Aquatic Biomonitoring Network protocol (Environment Canada 2014). Next, the abundances were scaled to the meter squared, densities summed to represent each wetland zone. If both an emergent and an open water zone were present, abundances were averaged across zones to summarize the invertebrate community at the wetland level. For additional information on the sampling of aquatic macroinvertebrates, see Gleason and Rooney (2018). A comprehensive taxonomic list is provided in Table within Appendix 2B.

5.3.3. Plants

Plant surveys were conducted between during July and August, when the presence of inflorescence allows for herbaceous plants to be confidently identified. First, the extent of each plant assemblage is mapped, and this was based on their vegetative structure (e.g., deciduous tree, floating-leaved vegetation). Next, assemblages were further mapped based on which species were co-dominant or dominant. A GPS/GNSS unit (SX Blue II receiver, by Geneq Inc., Montreal, Canada) was used for this mapping. If an assemblage was between 100-5000 m^2, measures of the percentage cover (modified Braun-Blanquette approach) included each vascular plant species within five, 1 m^2 quadrats. If an assemblage was larger than 5000 m^2, surveys included an additional quadrat per 1000 m^2 of plant community area. The following cover classes were identified but not included in analyses: algae, bare ground, litter, moss, rock, seedling/unidentified forb, standing dead litter, and open water (species list in Table within Appendix 2C). See Bolding et al. (2020) for more information on these plant surveys.

5.3.4. Environmental Conditions

Environmental conditions were measured during the biological surveys. *In-situ* measurements on water depth, turbidity and soil and water conductivity were taken on each visit. From this *in-situ* sampling, I included the following in the later-described analysis: ratio of amplitude to maximum depth, maximum depth, mean turbidity and mean soil and water conductivity. In addition to the *in-situ* measurements, soil cores were taken on the first visit to each site – three per vegetation assemblage, and a bulk water sample. Both the soil cores and bulk water samples were sent to the University of Alberta Biogeochemical Analytical Services Laboratory for analysis. I incorporated measurements of total carbon (water), total nitrogen (water), total phosphorus (water), sodium (water), potassium (water and soil), calcium (water and soil), magnesium (water and soil), total suspended solids (water), bulk density (soil), gravimetric and volumetric soil water content (soil) and loss on ignition (soil) in the analyses described below. See Kraft et al. (2019) for further information on how water and soil chemistry was measured. Also collected on the first visit to each site was a water sample for isotopic characterization of the water to determine the atmospheric losses of water to evaporation. This atmospheric losses of water to evaporation was also included in the analyses described below; see (Meyers 2018) for more information on this stable isotopes analysis.

5.4. Statistical Analysis

I implemented all data analyses in R (R Core Team 2019). Before commencing the analyses, I first removed rare species (birds and aquatic macroinvertebrates: species with fewer than 2 occurrences; plants: species with less than 1% total percentage cover among all sites), as recommended by McCune et al. (2002) for analyses of community data. Unless stated otherwise, I used raw abundance matrices for my analyses.

5.4.1. Visualizing Community Composition Between Years

I used a nonmetric multidimensional scaling (NMDS) to both ascertain and visualize how community composition changed between 2014 and 2015. Before implementing the NMDS, I transformed species abundances (counts of birds and aquatic macroinvertebrates: square root;

plant percent covers: arcsine square root) and relativized the data by their column maximums to improve multivariate normality. I converted the transformed, relativized community abundances to a Bray-Curtis dissimilarity matrix. I used the metaMDS function in the vegan package (Oksanen et al. 2017) to implement the NMDS. To determine the optional number of axes for the NMDS, I ran the NMDS 50 times, increasing the number of axis from two to ten and allowing a maximum of 100 iterations for convergence. The final NMDS was allowed 100 attempts before convergence.

I used vectors estimated from species abundances and environmental conditions, as well as sites symbolized by permanence class, disturbance class and natural region to help interpret the resulting NMDSs. Species vectors were estimated from the transformed, relativized abundances, while environmental vectors were from relativized water chemistry, soil chemistry and wetland hydroperiod data. I included vectors with correlations greater than 0.2 with one or more axes. I plotted a final NMDS with vectors connecting each sites' position in ordination space in 2014 with its position in ordination space in 2015 to visualize the year-to-year change in composition and related this to correlations between wetland hydroperiod, climate, and chemistry with each ordination axis.

5.4.2. Quantifying Change in Community Composition

I determined the magnitude of change in community composition between 2014 and 2015, using a Permutational multivariate analysis of variance (PERMANOVA) on plant cover, bird and aquatic macroinvertebrate count matrices with the adnois function in the vegan package (Oksanen et al. 2017). Next, I investigated whether observed differences in community composition were due to a subset of species (nestedness in beta diversity) or to a unique assemblage (turnover in beta diversity) of taxa occupying these wetlands in 2015. I used the braypart function in the partitioning beta diversity (betapart) package to partition beta diversity (Baselga et al. 2017). Next, I compared nestedness, turnover and overall beta diversity between 2014 and 2015; I used a PERMANOVA to ascertain whether differences were significantly different from zero.

When significant differences in community composition were detected between years, I assessed which species were strong indicators of normal (2014) versus delayed precipitation (2015) conditions. I used indicator species analysis (ISA) to determine which families/species were both faithfully and exclusively associated with one year vs the other year (Dufrêne and Legendre 1997). I implemented the ISA using on transformed, relativized counts (birds and invertebrates) or percent covers (plants). The ISA was implemented using indval function in the ordination and multivariate analysis for ecology (labdsv) package (Roberts 2016). Species with *p*-values lower than 0.1 were assumed to reliable indicators.

I examined whether I could attribute any changes in community composition between 2014 and 2015 to a change in hydroperiod. I determined whether the magnitude of change in community composition along the hydroperiod gradient (identified in the NMDS) differed from that along the other gradients/axes. To do so, I found the difference in site scores (from the NMDS) for each site between 2014 and 2015 and compared mean change in site scores with a repeated measures ANOVA. When a significant difference was detected, I used an estimated marginal means to determine whether these differences lie with the emmeans function in the estimated marginal means (emmeans) package of R (Lenth 2019) in R studio.

5.5. Results

5.5.1. Changes in Hydroperiod from 2014 to 2015

Winter precipitation was near equivalent in 2014 and 2015 (Figure 1). Based on a comparisons between climate normal (1981-2010) and each sampling year, any difference in mean annual precipitation in the Grassland (2013-2014 – paired t-test: t = 1.833, *p*-value = 0.652, df = 9; 2014-2015 – paired t-test: t = 1.833, *p*-value = 0.878 , df = 9) or Parkland (2013-2014 – t-test: t = 1.833, *p*-value = 0.344, df = 9; 2014-2015 – t-test: t = 1.833, *p*-value = 0.315 , df = 9) is negligible. Summer precipitation in 2015 was delayed to July through August (Figure 1), which I hypothesized led to a decline in wetland hydroperiod.

To test the hypothesis that a change in precipitation timing led to a decline in wetland hydroperiod, I compared hydroperiod between years. Though wetland amplitude did not differ between years (paired t-test: t = - 0.0753, *p*-value = 0.9406, df = 23), hydroperiods were generally shorter in 2015 (maximum water depth – paired t-test: t = 2.17, *p*-value = 0.04059, df = 23; the ratio of water amplitude to the maximum water depth – paired t-test: t = -2.777, *p*-value = 0.0107, df = 9; index of evaporative loss based on stable isotope analysis – paired t-test: t = -4.068, *p*-value < 0.001, df = 23). Thus, I conclude that a higher number of wetlands drying in 2015 (2014: *n* = 12, 2015; *n* = 18) could be attributed to the change in precipitation timing rather than an overall reduction in precipitation in 2015.

5.5.2. Visualizing Community Composition Between Years

I used a NMDS to visualize how community composition differed between years and varied across the hydroperiod gradient. For all taxa, stress was low (birds: 16.350, aquatic macroinvertebrates:15.364, plants: 16.195) and the NMDSs converged in fewer than 75 attempts (birds: 20, aquatic macroinvertebrates: 73, plants: 28). For birds, axis 1 differentiated sites by Natural Region, axis two reflected a hydroperiod gradient and axis 3 partitioned sites by the percentage cover of cropland within 500-m of the wetland (Figure 5.3A-B). The hydroperiod gradient for both aquatic macroinvertebrates and plants was aligned with axis 1 (Figure 5.3C-F). Axis 2 for aquatic macroinvertebrates, however, reflected an increasing preference for benthic habitat, while axis 3 reflected a decreasing reliance on ponded water for reproduction (Figure 5.3C-D). Axis 1 for plants, in addition to the hydroperiod gradient, also partitioned sites by Natural Region, and axis 2 reflected a nutrient availability gradient (Figure 5.3E-F). As for with birds, axis 3 for plants also reflected a disturbance gradient (higher proportion of agricultural activities upland the wetland) (Figure 5.3F). Generally, along the hydroperiod gradient for birds and aquatic macroinvertebrates, sites changed in community composition between years such that they reflected communities with shorter hydroperiods. However, for plants, the magnitude of change was marginal.

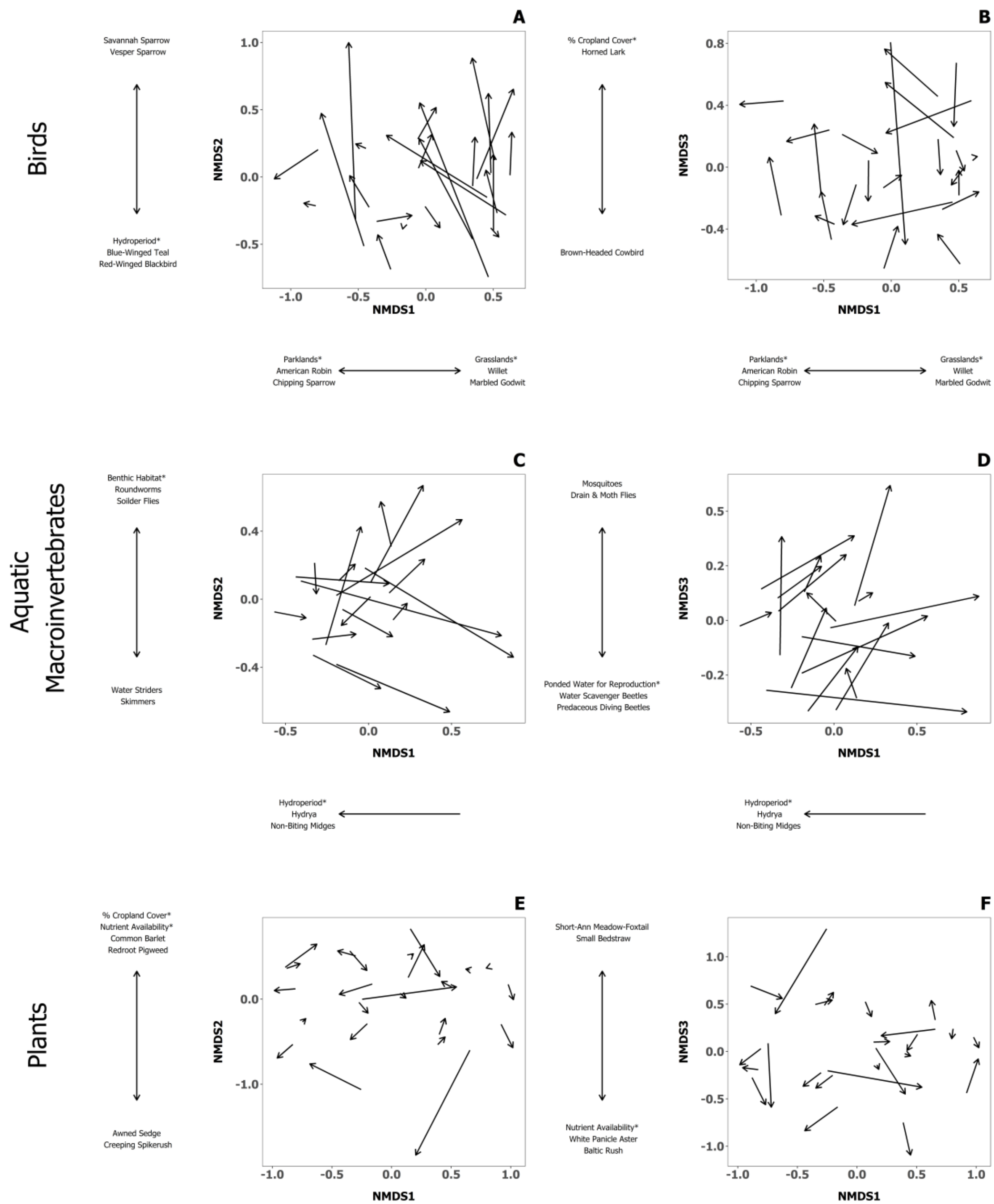

Figure 5.3. Non-metric multidimensional scaling showing the change in community composition from 2014 to 2015. Vectors indicate the magnitude and direction of change in community composition from 2014 to 2015.¶Along each axis, I show which gradients (indicated by *) and taxa were negatively and positively associated with the axis – these correlations were greater than 0.1.

5.5.3. Quantifying Change in Community Composition

I determined whether there was a difference in community composition between years. There was no significant difference in plant community composition between 2014 and 2015 (PERMANOVA: $F_{1,47}$ = 1.080, *p*-value = 0.341), but there was a statistically significant difference for birds and aquatic macroinvertebrates (PERMANOVA: birds – $F_{1,47}$ = 2.644, *p*-value = 0.001; aquatic macroinvertebrates – $F_{1,33}$ = 2.983, *p*-value = 0.003).

I also partitioned beta diversity in counts of birds and aquatic macroinvertebrates to identify whether the community dissimilarities between sites in 2014 and in 2015 that I detected with the PERMANOVAs were due more to nestedness or to turnover in community composition. For birds, community composition differed because of higher turnover in 2015 (PERMANOVA: $F_{1,47}$ = 3.600, *p*-value = 0.002) and not nestedness (PERMANOVA: $F_{1,47}$ = -3.554, *p*-value = 0.994). For aquatic macroinvertebrates, I found that the differences in community composition could be attributed to higher nestedness in 2015 (PERMANOVA: $F_{1,47}$ = 9.900, *p*-value = 0.002) and not turnvover (PERMANOVA: $F_{1,47}$ = -1.55, *p*-value = 0.993).

To identify bird and aquatic macroinvertebrate taxa or traits that were indicative of normal (2014) or delayed precipitation timing (2015) I used indicator species analysis (Dufrêne and Legendre 1997). For birds, I found that ground nesting species were associated with 2014, while upland species were indicative of 2015 (Table 5.1). Aquatic macroinvertebrates in 2014 were of diverse feeding behaviors, desiccation strategies and life histories, though most were reliant on ponded water for reproduction; 2015 aquatic macroinvertebrates belonged to families that are able to reproduce in non-wetland areas [e.g., Mosquitos can also reproduce in moist soil; Minakawa et al. (2009)] or could suspend metabolic activities until conditions are favorable [e.g., Fairy shrimp can become dormant until the wetland rewets; Bohonak and Whiteman (1999)] (Table 5.1).

Table 5.1. Indicator values for indicator species of both years for birds and aquatic macroinvertebrates; 2014, where precipitation timing was normal and 2015, where summer precipitation was delayed.¶The associated *p*-value indicates the probability that an indicator value that large could be obtained from the data by chance alone.

Taxon	**Common Name**	**Species Name[1] Lowest Practical Taxonomic Level[2]**	**Indicator Value** 2014	2015	***p*-value**
Birds	Blue-winged Teal	*Anas discors*	52.925	11.049	0.009
	Horned Lark	*Eremophila alpestris*	32.413	1.130	0.011
	Savannah Sparrow	*Passerculus sandwichensis*	11.165	61.002	0.001
	Song Sparrow	*Melospiza melodia*	1.398	27.741	0.046
	Vesper Sparrow	*Pooecetes gramineus*	0.000	33.333	0.003
Aquatic Macroinvertebrates	Worms	Oligochaeta	65.841	32.150	0.024
	Biting Midges	Ceratopogonidae	65.234	28.631	0.015
	Roundworms	Nematoda	64.777	22.791	0.010
	Leeches	Hirudinea	64.198	29.484	0.025
	Seed Shrimp	Ostracoda	62.683	37.317	0.007
	Water Boatmen	Corixidae	62.467	17.804	0.003
	Water Scavenger Beetles	Hydrophilidae	60.738	36.953	0.018
	Phantom Midges	Chaoboridae	59.511	8.158	0.002
	Non-Biting Midges	Chironomidae	59.501	40.499	0.024
	Predaceous Diving Beetles	Dytiscidae	59.497	40.503	0.034
	Crawling Water Beetles	Haliplidae	59.281	16.480	0.014
	Springtails	Collembola	54.527	19.876	0.046
	Hydra	Hydrachnidia	53.514	18.539	0.067
	Crane Flies	Tipulidae	47.796	15.195	0.085
	Shore Flies	Ephydridae	46.705	9.819	0.055
	Horse & Deer Flies	Tabanidae	29.412	0.000	0.036
	Mosquitos	Culicidae	5.664	62.529	0.003
	Fairy Shrimp	Anostraca	0.323	33.359	0.019

[1] Species name is shown for birds; 2 Lowest practical taxonomic level is shown for aquatic macroinvertebrates.

I determined whether changes in community structure and composition could be attributed to change in hydroperiod. First, I quantified the change in NMDS axis scores for sites between 2014 and 2015 along the axis most associated with hydroperiod and compared this to change in scores on other axes. For both birds and aquatic macroinvertebrates, the mean change in site scores between 2014 and 2015 differed among the three NMDS axes (Repeated measures ANOVA: birds – $F_{2,32}$ = 7.316, *p*-value = <0.001aquatic macroinvertebrates – $F_{2,69}$ = 10.34, *p*-value <0.001). Interestingly, changes in community composition of both birds and aquatic macroinvertebrates could be explained by a change in hydroperiod between 2014 and 2015 (Estimated marginal means: birds – Region $_{NMDS\ 1}$- Hydroperiod $_{NMDS\ 2}$ *p*-value <0.001, Disturbance$_{NMDS\ 3}$- Hydroperiod$_{NMDS\ 2}$ *p*-value = 0.0732; aquatic macroinvertebrates – Hydroperiod$_{NMDS\ 1}$- Benthic Habitat$_{NMDS\ 2}$ *p*-value <0.001, Hydroperiod $_{NMDS\ 1}$- Ponded Water for Reproduction$_{NMDS\ 3}$ *p*-value = 0.01203). For plants, the change in site scores between 2014 and 2015 did not occur along one axis more or less than the others, indicating that no systematic change in plant community composition associated with the change in hydroperiod between years was evident (Repeated measures ANOVA: $F_{2,69}$ = 0.241, *p*-value = 0.787).

5.6. Discussion

As a natural experiment, I sought to understand whether a change in precipitation timing could lead to 1) a decline in wetland hydroperiod and 2) changes in the community composition of wetland birds, aquatic macroinvertebrates and plants in 24 NPPR wetlands between 2014 and 2015. Because precipitation amounts were equivalent in both years, I conclude that the reduction in hydroperiod I observed in 2015 was due to a delay in precipitation to late July-August in 2015, which is when evapotranspiration rates are highest in the summer. Further, I observed a change in the community composition of birds and aquatic macroinvertebrates associated with this reduction in hydroperiod between 2014 and 2015. With shortened hydroperiods, I observed and increase in the abundance of 1) upland birds and 2) aquatic macroinvertebrates that can either survive periodic drying or that are able to reproduce in non-aquatic habitat. Since the emergent plants surveyed are able to utilize below ground resources to subsidize growth and persistence during periods of poor growing conditions, I postulate that priority effects (Van der Valk and Davis 1980; Wetzel and Howe 1999) explain why they were less sensitive to an inter-annual change in wetland hydroperiod.

A shortening of wetland hydroperiod, either due to a change in precipitation timing or a decline in wetland water budgets, could change which bird functional groups a PPR wetland supports. Because plants showed little sensitivity to this one-year change in precipitation timing, I suspect that the change in bird community composition was driven a decline in food availability and nesting habitat for waterbirds. Prior work suggests that both upland and wetland-dependent birds use PPR wetlands (e.g., Anderson and Rooney 2019). However, in longer-hydroperiod wetlands (Puchniak Begley et al. 2012; Tsai et al. 2012a; Morissette et al. 2013), and the longer-hydroperiod year, we are more like to observe waterbirds, likely because aquatic macroinvertebrates are more abundant (Appendix 5). Conversely, in both shorter-hydroperiod wetlands (Appendix 5), and the shorter-hydroperiod year, we are more likely to observe upland birds. Because aquatic macroinvertebrates that are adapted to draw-down events are more abundant when hydroperiods are shorter, and this functional group represents a only a fraction of the taxon included in these analyses (Appendix 5), we can presume that food availability for waterbirds is lower under drier conditions. Similarly, birds with nesting behaviors tied to the availability of wetland habitat (e.g., pond/reed nesters) are more abundant in longer-hydroperiod wetlands (Appendix 5) and the longer-hydroperiod year (e.g., Blue Winged Teals).

We can conclude that these waterbirds are more abundant in the longer-hydroperiod year because the expanse of ponded water preferred for foraging and nesting is readily available. Thus, unsurprisingly, numerous studies have forecasted that with climate change, we will observe a decline in habitat for waterbirds in the PPR (Forcey et al. 2007; Loesch et al. 2012; Steen and Powell 2012; Steen et al. 2014). For example, Steen et al. (2016) demonstrated that of the 29 species of wetland-dependent birds they forecasted future ranges for, 28 would experience restricted ranges with declines in wetland hydroperiod due to climate change. Consequently, as recommended by Steen and Powell (2012), restoration of wetlands in the northeastern PPR could benefit waterbirds, since the high aridity in landscapes with more-abundant, less-disturbed wetlands (Schneider 2013; Withey and Van Kooten 2013) may become more favorable for upland birds.

Because aquatic macroinvertebrates functional diversity depends on ponded water amounts (Gleason et al. 2018b), a shortening in wetland hydroperiod can exclude taxa reliant on ponded water for reproduction and or foraging. Daniel et al. (2019) hypothesized that each spring, the communities in these temporarily-ponded wetlands “reset”, and which taxa establishes depends on the egg bank and the tolerance of colonizing taxa to cyclic drying. Thus, with an inter-year change in precipitation timing, wetlands that previously had hydroperiods that were favorable to taxa that require deeper water depths are subsequently inhospitable to these taxa because they lack the functional traits that allow them to persist in shallower wetlands; taxa that are able to disperse (e.g., water boatman) can migrate to neighboring wetlands with longer hydroperiods (Gleason and Rooney 2017a). For instance, in the longer-hydroperiod year, wetlands were associated with taxa that deposit eggs on submerged rocks, plants and sticks, may forage by diving for smaller aquatic macroinvertebrates (i.e., water boatman) (Applegate and Kieckhefer 1977) or have larval stages that require aquatic habitat (i.e., crane flies) (Freeman 1968). Following a decline in hydroperiod in the next year, these wetlands were associated with taxa that were either able to survive cyclic drying by producing eggs that have suspended growth and development (i.e., Anostraca: fairy shrimp) (Alekseev and Starobogatov 1996; Fryer 1996) or can reproduce in the absence of ponded water by ovipositing on damp soil (i.e., Culicidae: mosquitos) (Huang et al. 2006; Rowbottom et al. 2017). Thus, delayed precipitation, resulting in shortened hydroperiods, changes the composition of aquatic macroinvertebrates by excluding ponded-water reliant taxa.

Of all taxa I surveyed, plants may be the most resilient to changes in wetland hydroperiod. Biennial and perennial wetland plants, particularly rhizomatous species capable of clonal subsidy, are likely resilient to delayed precipitation in a single growing season. However, prolonged changes to precipitation timing leading to a sustained change in hydroperiod regime should result in altered community composition. For submerged plants, which were not surveyed, a one-year decline in hydroperiod can eliminate intolerant species if standing water, needed for them to acquire nutrients, is lost (Harris and Marshall 1963). Emergent plants, however, can persist following draw-down events, but they often experience declines in growth and reproduction with a decreases in soil moisture content (Van der Valk and Davis 1980). These emergent plants are forced to use up their carbon stores to persist until water levels return to normal levels (Van der Valk and Davis 1980; Wetzel and Howe 1999). If these draw-down conditions continue in subsequent years, these plants are eliminated (Harris and Marshall 1963). Thus, the higher aridity forecasted for the much of the southern Albertan PPR (Schneider 2013) could result in a shift from submerged/emergent vegetation to wet meadow and terrestrial plants as hydroperiod declines year-to-year (Euliss et al. 2014).

5.7. Conclusion

I observed that a delay in annual precipitation from spring to later summer resulted in a significant reduction in wetland hydroperiod between 2014 and 2015, even though the cumulative annual precipitation was similar between years. I also observed that this change in precipitation timing and consequent reduction in hydroperiod led to immediate changes in the community composition of wetland birds and aquatic macroinvertebrates. Because a shortening in hydroperiod is forecasted for the Canadian PPR (Schneider 2013), I expect that wetlands that previously supported communities of birds and aquatic macroinvertebrates with diverse functional traits would be restricted to upland birds and aquatic macroinvertebrates that are able to survive cyclic drying. In contrast, plant community composition was more resistant to inter-year changes in precipitation in Alberta's Prairie Pothole Region. Though plants are less sensitive to an inter-year change in hydroperiod, consecutive declines in hydroperiod year-to-year could shift vegetation communities to being wet meadow or terrestrial-plant dominated.

6. SUMMARY, RESEARCH IMPLICATIONS & FUTURE WORK

6.1. Summary

6.1.1. How important are climate, land cover/land use and terrain in predicting wetland permanence class?

Understanding that wetland hydroperiod is an important driver of community structure, I aimed to investigate the relative importance of the major factors influencing wetland permanence – climate, land use/land cover and terrain. Using WETLANDSCAPE models for the PPR, numerous authors have shown that PPR wetlands are likely to undergo declines in hydroperiod due to climate change (Johnson et al. 2010b; Werner et al. 2013; Rashford et al. 2016). Authors have also shown that increases in cropland activity have led to changes in wetland hydroperiod, though these impacts can be either positive or negative (Voldseth et al. 2007; Anteau et al. 2016). Though work in the PPR has shown that the topographical position of wetlands in the landscape can also influence their permanence class (Wolfe et al. 2019), few studies have accounted for this metric in predicting impacts of climate and land use/land cover. Using 19 metrics representing climate, land use/land cover and terrain, each of which literature suggests could explain permanence, I predicted wetland permanence class using extreme gradient boosting. I used relative gain values and waterfall plots to assess how important climate, land use/land cover and terrain were in predicting wetland permanence class in the Boreal, Parkland and Grassland. Climate was most important in predicting wetland permanence class in all three models. However, in the Boreal and Parkland, terrain was the second most important driver of permanence class. Based on my findings, I believe that while it is important to consider climate and land use/land cover in forecasting the impact of climate change on PPR models, terrain metrics can provide additional insight into how PPR wetlands will be affected by climate change.

6.1.2. Does congruence differ between short- and long-hydroperiod wetlands?

Since wetland permanence, and by extension wetland hydroperiod, is influenced by climate, land use/land cover and terrain, I next aimed to understand the role of wetland hydroperiod in the assembly of wetland biota. I believe that it was important to understand the role of hydroperiod in the assembly of these horizontal communities because: 1) diversity and community composition of wetland biota are sensitive to hydroperiod (Daniel et al. 2019), and 2) hydroperiod is forecast to shorten with climate change (Johnson et al. 2010b; Fay et al. 2016). My first objective was to understand whether hydroperiod alone influenced abundances of birds, aquatic macroinvertebrates and plants. I assumed that stronger correlations in the abundances of these horizontal communities than between each horizontal community and hydroperiod would be indicative of strong biological interactions. I also sought to determine whether the strength of relationships among these horizontal communities differed between wetlands that dried up versus those the typically contain ponded water year-round. For this, I assumed that changes in the strength of relationships among horizontal communities would be evidenced by short- and long-hydroperiod wetlands differing in cross-taxon congruence. I conclude that cross-taxon relationships were stronger (77% ±SE 12%) than taxon-hydroperiod relationships, and this I took to mean that hydroperiod alone could not explain community abundances. I also conclude that there is no significant difference in congruence between short- and long-hydroperiod wetlands, and I extrapolate this to mean that biological interactions had an equivalent role in shaping community abundances across the hydroperiod gradient.

6.1.3. Is hydroperiod more important in explaining community structure than cross-taxon relationships?

Since I understood that the abundances of birds, aquatic macroinvertebrates and plants were explained by both hydroperiod and biological interactions, I next aimed to understand their relative influence in the abundance of functional groups that a wetland could support. I believe that by studying abundances at the species and functional group level, we gain a better understanding on how these communities assemble. While we can use species abundances to infer the capacity of an environment (i.e., number of individuals that can coexist based on available resource in a wetland), studying the abundance of functional groups can tell us how a community functions (i.e., what functional traits are favored and in what quantity). Thus, in Chapter 4, I evaluated the fit of six models hypothesizing mechanisms that could explain the functional dispersion of birds, aquatic macroinvertebrates and plants, to ascertain whether the abundances of functional groups that a wetland supports is more strongly related to biological interactions versus environmental filtering. Past work in ecosystems structured by a dominant environmental filter have pointed to a nestedness of filters (i.e., Poff (1997) – environmental conditions act as the first filter eliminating taxa based on their tolerances. If there was support for the nested filter model, I would expect support for a model hypothesizing a direct influence of both cross-taxon relationships and hydroperiod on communities. I would also expect that the relative influence of hydroperiod would be stronger than that of cross-taxon relationships. If there was poor support for the nested filter model, I would expect the best model to hypothesize either a: 1) direct influence of hydroperiod with no cross-taxon interactions or 2) direct effect of hydroperiod on one or two taxa, which in turn strongly structure the others. The best fitting model posited that there is a direct influence of hydroperiod on functional dispersion of all taxa and that both bird and aquatic macroinvertebrate functional dispersion is causally related to the functional dispersion of plants. Because hydroperiod had as much as a 31% higher magnitude of influence on both birds and aquatic macroinvertebrates than the influence of plants on their functional dispersion, I conclude that environmental filtering may have had a stronger influence on community structure in these PPR wetlands, which supports the nested filter model of community assembly.

In Chapter 3, I found that hydroperiod alone could not explain community abundances; and support for the nested filter model in Chapter 4 suggests that biological interactions are of lesser importance in shaping functional dispersion. I believe that these findings are not contradictory. The findings from Chapter 3 suggest that communities influence each other's abundances at a stronger degree than hydroperiod. For Chapter 4, however, I can ascertain that hydroperiod also influences communities by determining the proportion of taxa with a given functional trait that a wetland can accommodate. Thus, while hydroperiod is more important than biological interactions in dictating the number and abundance of functional traits, it is less important in determining the abundances of species within each taxonomic group.

6.1.4. Are wetland biota sensitive to an inter-year change in wetland hydroperiod?

Based on my understanding that hydroperiod is important in shaping community structure in Chapter 3 ad 4, I sought to understand how sensitive wetland biota would be to an inter-year change in hydroperiod that was driven by a change in precipitation timing. Between 2014 and 2015, I observed 1) an increase in the number of wetlands that dried up before October, and this was despite precipitation totals being near equivalent in both years and 2) a significant decline in wetland hydroperiods. What differed between both years, however, was that summer precipitation was delayed to July and August in 2015. To evaluate if this one-year change in precipitation timing could influence community structure, I compared the mean change in community composition across three NMDS axis (birds – hydroperiod, Natural Region, disturbance; aquatic macroinvertebrates – hydroperiod, benthic habitat availability, pond area; plants – hydroperiod/Natural Region, disturbance, nutrient availability). I found that for birds and aquatic macroinvertebrates, the magnitude of change in community composition across the hydroperiod axis differed from that along the other axes; this confirmed my hypothesis that there would be a change in community composition because of shortened hydroperiod. Unsurprisingly, I found that this change in community structure for birds and aquatic macroinvertebrates resulted in wetlands supporting taxa that were weakly associated with wetland permanence or those being able to reproduce/survive these drier conditions. I posited that a sustained climatic pattern that leads to a shortening of wetland hydroperiod could lead to changes in the community structure of plants similar, to the changes we observed among birds and aquatic macroinvertebrates after a single year of delayed precipitation. This is because plants would eventually exhaust their below ground resources and be extirpated from sites exhibiting unfavorable conditions. These findings led me to conclude that regardless of the mechanisms driving a decline in hydroperiod, we are likely to see vast turnover in wetland biota if a shortening in hydroperiod were sustained for several years in response to changes in precipitation timing.

6.2. Research Implications

6.2.1. Terrain context is the missing element in PPR climate forecasts.

Terrain is an important driver of permanence class, and by extension hydroperiod, in PPR wetlands. With the increasing availability of high-resolution LiDAR-derived digital elevation models, accurately mapping terrain features is feasible even in the relatively flat Grasslands Natural Region. The Albertan PPR extends northward beyond the Grassland into the Boreal and Parkland Natural Regions, which possess atypically high topographic variation for a Prairie Pothole landscape. Unsurprisingly, I found that wetland permanence class in these regions was strongly associated with terrain metrics. Due to the low topographic variation in the Grassland Natural Region, I might have assumed that terrain would be unimportant, but Grassland wetland permanence class was also sensitive to terrain metrics. Thus, including terrain metrics in modes for climate forecasting in flatter regions could help in improving the accuracy of WETLANDSCAP or other PPR models across the PPR.

6.2.2. Predictions on the influence of climate change on permanence class may be error prone in nature.

The influence of climate change on wetlands within a permanence class category can differ within and among Natural Regions. Generally, wetlands with higher pond permanence (i.e., semi-permanent and permanent) were situated lower in the landscape than those with lower pond permanence (i.e., temporary and seasonal). While this finding would suggest that wetlands within the same permanence class will be similarly influenced by climate change, I postulate that this may be unsupported. First, wetlands with higher pond permanence differed in their relationships with land cover/land use among the Natural Regions. Consequently, two wetlands, situated similarly in the landscape and experiencing the same climatic pattern, could diverge on their sensitivity to climate change because their land cover/land use context. Second, within a permanence class, there were differences in landscape position. For example, permanently-ponded wetlands in the Boreal showed sensitivity to land cover/land use. However, the model did not predict the terrain context for which we are most likely to observe a permanently-ponded, suggesting that they occurred under a wide range of terrain positions. As such, while these permanently-ponded wetlands may generally be situated lower in the landscape, the exceptions to this trend means that we may not be able to confidently predict how their water budgets may change with a warmer climate.

6.2.3. Wetland restoration should use the terrain context to set the permanence class target.

As I mentioned above, wetlands with higher permanence were generally situated lower in the landscape. Because wetlands with higher permanence have been the target of wetland restoration in the southern Albertan PPR, it would be beneficial to consider the terrain context of the restoration site before committing to the identity of the permanence class. For example, if a manager plans to restore a wetland, but the restoration site is positioned higher in the landscape, it may be beneficial to aim for a temporary or seasonal permanence class. If the restoration site is position lower in the landscape, the manager could aim for a semi-permanent or permanent permanence class. This practice could increase the likelihood that managers are replicating the natural position of these wetlands, based on the region’s geological history.

6.2.4. Changes in hydroperiod can have large impacts on PPR wetland biota.

Regardless of the driver, any change in wetland hydroperiod can influence the abundance and structure of biota occupying PPR wetlands. The abundances (Chapter 3) and functional dispersion (Chapter 4) of birds and aquatic macroinvertebrates are most sensitive to hydroperiod, and these taxa are likely to see the largest magnitude of change in their diversity and community composition with climate change (Chapter 4). Because general water deficits are forecasted, declining across decades (Werner et al. 2013; Fay et al. 2016), I would expect that plants will eventually evidence similar changes in their community structure. We could expect that as wetland hydroperiods reduce, PPR wetlands will support a larger proportion of upland (i.e. non-wetland dependent) birds and plants because these species are better adapted to drier conditions (Chapter 4). In terms of aquatic macroinvertebrates, we should expect that species with desiccation-tolerant life history strategies, like mosquitoes and fairy shrimps, will become more dominant in PPR wetlands (Chapter 4).

6.2.5. Changes in hydroperiod may not impact the strength of biological interactions of wetland biota.

While it is clear that birds, aquatic macroinvertebrates and plants are sensitive to wetland hydroperiod (Chapter 4), biological interactions are consistent across the hydroperiod gradients (Chapter 3). As such, while we expect that community structure will change with the shortening of hydroperiod forecast for the region, these communities may not change in how strongly they influence each other's abundances.

6.3. Future Work

6.3.1. Would terrain be more important with a finer-scale DEM?

In this work, I used a 25-m DEM to measure terrain metrics, and my results do suggest that terrain is important in dictating wetland permanence class. Particularly in the Grassland, where this 25-m DEM was not sufficient to capture the micro-topographies needed to delineate watersheds, a finer-resolution DEM in my models may have shown terrain to be more important than I observed. Thus, I believe that future work should use finer-scaled DEMs to determine if terrain may be more important than my models suggest.

6.3.2. Are longer-hydroperiod wetlands spatially aggregated because of climate or topography?

In the Grassland Natural Region, a larger proportion of the longer-hydroperiod wetlands are in closer proximity to the Parkland Natural Region, suggesting spatial autocorrelation in my data (Figure 6.1).

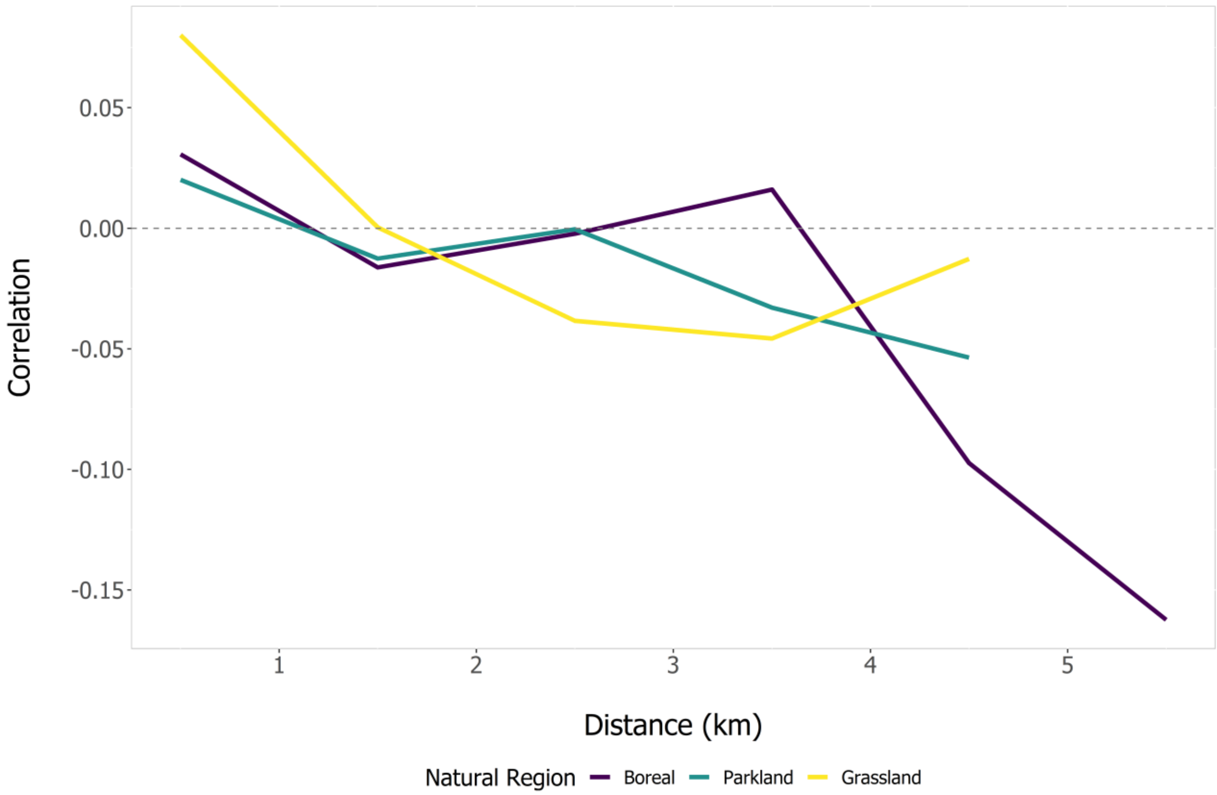

Figure 6.1. Spatial cross-correlograms, measuring spatial autocorrelation in each Natural Region. ¶used the correlog function in the spatial covariance functions (ncf) package (Bjornstad and Cai 2020) for this measure; autocorrelation was significant in each Natural Region (*p*-value <0.001). Autocorrelation values closer to one suggest perfect clustering, where wetlands belonging to the same permanence class are aggregated. Autocorrelation values closer to -1 suggest perfect dispersion, where we are more likely to observe a wetland belong to different permanence class near to a wetland of interest. As shown on the x axis, as we get further away from a wetland (above 1.5 km), we are more likely to observe a wetland belonging to a different permanence class.

One explanation for this trend could be that conditions are cooler in Parkland, and this results in lower evapotranspiration in the more northern wetlands; hence, higher pond permeance. Conversely, regional topographical variation also increases across this latitudinal gradient (Alberta Tourism Parks and Recreation 2015), and this could mean that the higher frequency distribution of longer-hydroperiod wetlands in the more northern Grassland Region is explain by larger regional depressions (i.e., larger volume of water flowing to basins with higher permanence). Because climate is confounded with topography, future work comparing the characteristics of wetlands across longitudinal gradients could isolate the impacts of climate and terrain. If wetlands belonging to the same permanence class are associated with the same ranges of a terrain metric at the same latitude, we could conclude that terrain largely explains this northern bias for longer-hydroperiod wetlands. If climate explains this trend, then we would expect that longer-hydroperiod wetlands would not be associated with any specific ranges of terrain metrics. Instead, we would see increases in wetland permanence as we go northward, regardless of topographic variation.

6.3.3. Would soil mapping and geographical history improve predictions of permanence class in the PPR?

My extreme gradient boosting models had moderately-high error rates, and this may be because my model failed to capture other factors that are critical in delineating permanence class. Wolfe et al. (2019), in modelling PPR wetlands, found that soil and geological history were important in delineating wetlands, and these were drivers I excluded in my models. Perhaps, by including these variables in models predicting permanence class, one could see a massive reduction error rates in future models. Hence, we could better predict the range of conditions under which each permanence class is likely to occur, if future models include soil and geological history.

6.3.4. Is consolidation drainage the true driver of higher permanence wetlands being positioned lower in the landscape?

Prior work in the USPPR suggests that consolidation drainage, which involves draining wetlands positioned higher in the landscape and redirecting the water to wetland lower in the landscape, can increase pond permanence (McCauley et al. 2015; Anteau et al. 2016). As such, we may observe wetlands with higher pond permanence situated lower in the landscape because water within that basin has been re-directed to these wetlands. An alternative explanation could be that these higher, pond-permanence wetlands are situated lower in the landscape because they have a larger quantity of water inputs. Because I did not partition wetlands based on the percentage of surrounding cropland cover, I am unable to ascertain whether this trend is due to consolidation drainage or PPR geological history. To answer this research question, future work should compare the topographic position (at the local and regional level) of wetlands that are surrounded by largely natural cover (<25 %). This work should determine if wetlands positioned lower in the landscape are, in fact, typically classified as semi-permanent/permanent.

6.3.5. How different would plant community structure be with a change in seedbank?

Competition may be stronger driver of vegetation composition than I anticipated. Plants showed the weakest relationship with hydroperiod in my congruence analyses (Chapter 2) and in my structural equation model (Chapter 3). Because my focal wetlands were dominated by perennial plants, they may exhibit priority effects. These perennial plants can use rhizomes to subsidize young shoots and support their persistence, even in growing seasons with unsuitable climates. Thus, if we were to eradicate these perennial plants and their rhizomes, we may observe changes in the identity of plants, assuming all species had equal dispersal abilities. The assembly of this new vegetation community may be dependent on how competitive species are across the water depth gradient and not whether they can establish under some water levels. To test this hypothesis, future work could compare growth rates of wetland plants in monocultures vs growth rates of species planted in polycultures (e.g., Keddy and Ellis 1985; Wetzel and Van

Der Valk 1998; Fraser and Miletti 2008). To test whether species differ in their competitiveness across this water depth gradient, and not necessarily that they are not able to establish under some conditions, this mesocosm (monoculture vs polyculture) should be paired across several water depths. This experiment would help us in understanding the relative importance of species tolerances (i.e., species would not grow at all water depths in a monoculture) and competition (i.e., different species dominate at various water depths) in wetland plant assembly. The benefit of this work is that we could better predict how wetland plants in prairie potholes will respond to a change in hydroperiod due to climate change, depending on which assortment of plants have established.

6.3.6. What is the tipping point for plant communities when hydroperiods have declined?

Regardless of the relative influence of competition versus species tolerances on plant community composition, there is a point at which species that have established will no longer persist when inundation cycles change. It is unclear as to how extreme this change in hydroperiod must be to shift community structure. A short term study reported, interestingly, that there were changes in wetland plant composition after a one-year manipulation of water levels (Harris and Marshall 1963). Thus, a similar manipulative experiment, where ponded water amounts are shortened at various intervals and durations, could help in highlighting the stress points of wetland plants. With an understanding of what these stress points are, we could better predict how prairie pothole wetland plants would respond to changes hydroperiod resulting from climate change.

6.3.7. What is the relative influence of permanence versus hydroperiod on birds and plants?

Because the plants in these wetlands are perennial, the hydroperiod regime during the survey period (2014-2015) could be incongruent with regime that led the current community. In other words, the plants that germinated from the seedbank and competed for resources when the wetland was colonized may not reflect what the hydroperiod regime is in any given year. Thus, there is a legacy effect in these wetlands on plant communities, where in the absence of a perturbation (e.g., fire, full draw down), the plant community composition may be resilient to interannual variation in weather because they have already established. Thus, permanence class will be more strongly related to plant community composition than year-to-year hydroperiod. Because birds are cued by vegetation in selecting where they select to forage and nest (Davis 2005; Madden et al. 2009; Howerter et al. 2014), the influence of permanence class may differ from that of hydroperiod on this taxon. Though my SEM in Chapter 4 modeled hydroperiod, it did not incorporate permanence class, which can differ in its influence on birds and plants. Besides improving model fit, I believe that including permanence class could improve our understanding of how these communities assemble. Thus, future work could build on this SEM, but include pathways that explain the influence of permanence vs hydroperiod on birds and plants.

6.3.8. Is there a difference in the productivity of birds across the hydroperiod gradient?

Though it is clear that wetlands with longer hydroperiods support more diverse bird communities (e.g., Kantrud and Stewart 1984; Daniel et al. 2019), it is unclear whether birds in these wetlands are also more productive. For birds, we often describe productivity in terms of nesting success and clutch size, where birds that are able to produce more fledglings are more productive (e.g., Bernath-Plaisted and Koper 2016; Yoo and Koper 2017; Daniel and Koper 2019). Often, environments with higher bird abundances may not always produce productive bird communities because birds are unable to utilize the local habitat for nesting (Horne 1983; Estades 2001). Because wetlands with higher pond permanence's do support more diverse plant communities (e.g., Chapter 4), we can presume that there is a higher abundance of microhabitats. These microhabitats may provide better concealment for nests (e.g., Marzluff 1988; Davis 2005), reducing the chance that fledglings are predated – the leading cause of nesting failure (e.g., Hobson and Bayne 2000; Drever 2006; Klug et al. 2009). Thus, future work could compare nesting success and clutch sizes in wetlands that vary in permanence class, though having similar surrounding land cover/land use. This work could help us in understanding whether these longer-hydroperiod wetlands are truly more productive habitat for bird communities.

6.4. Conclusion

Wetland permanence class is critically important in determining structure and function of biota. My work shows that wetland biota from multiple taxonomic groups are sensitive to wetland hydroperiod and that wetland hydroperiod is sensitive to climate. Even a simple shift in the timing of precipitation delivery from spring to summer can have a substantial impact on wetland hydroperiod and elicit a rapid response in wetland birds and aquatic macroinvertebrates. But climate does not shape wetland hydroperiod alone. My work also revealed the importance of land use/land cover and terrain in determining hydroperiod. My results will contribute to improved hydroperiod forecasting and raise important questions about the relative importance of interspecific interactions and environmental filters in determining the assembly of wetland communities

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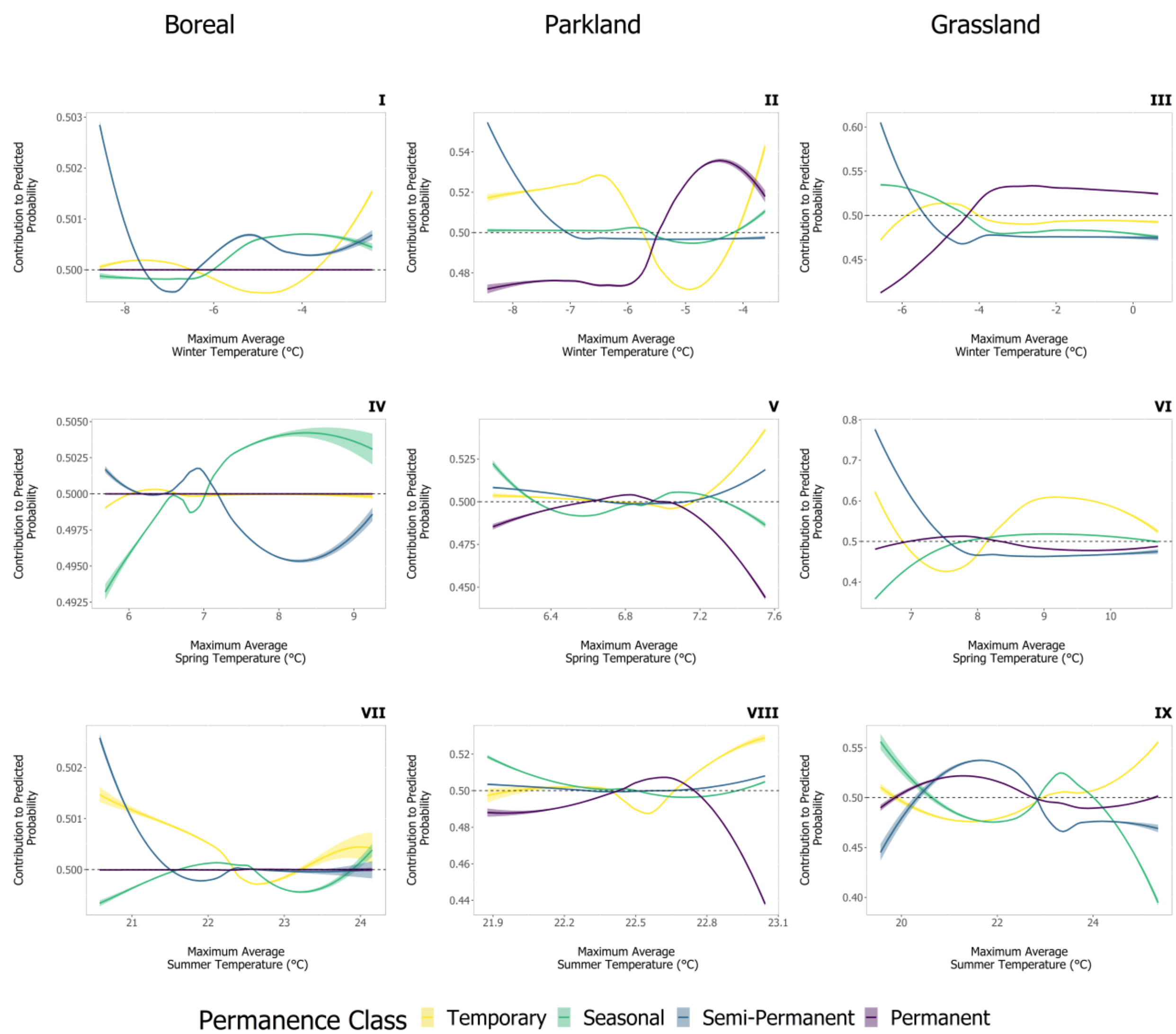
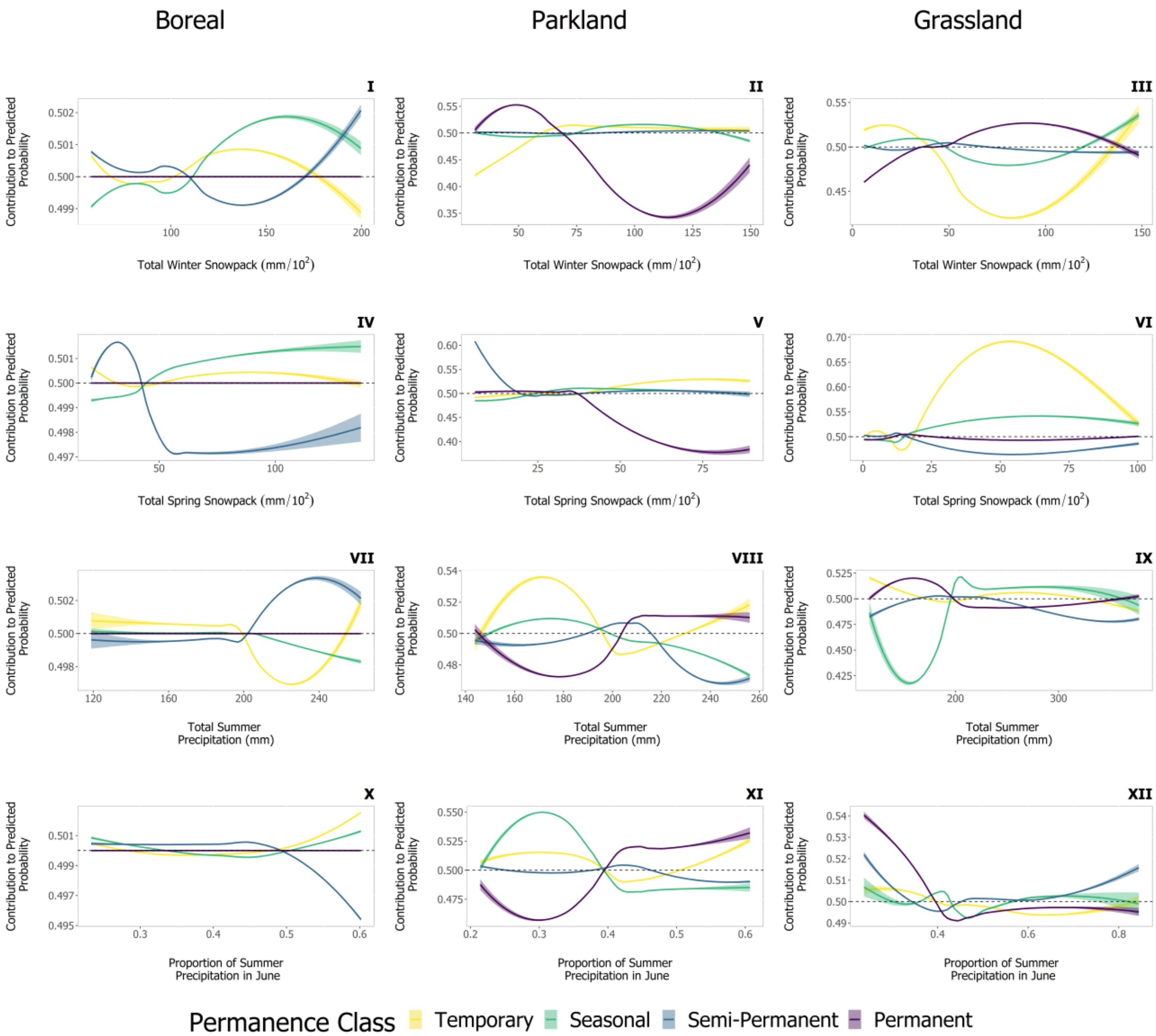
APPENDICES

Appendix 1. Waterfall plots showing predicted probabilities derived from extreme gradient boosting models for wetlands delineated in the 1) Boreal (totaling 12,000 wetlands), 2) Parkland (totaling 12,000 wetlands) and 3) Grassland (totaling 16,000 wetlands) Natural Regions. Probabilities below 0.5 suggest that at this measured value of the metric, observing that permeance class is unlikely. I show 95 % confidence intervals and used a generalized additive model-based trend line.

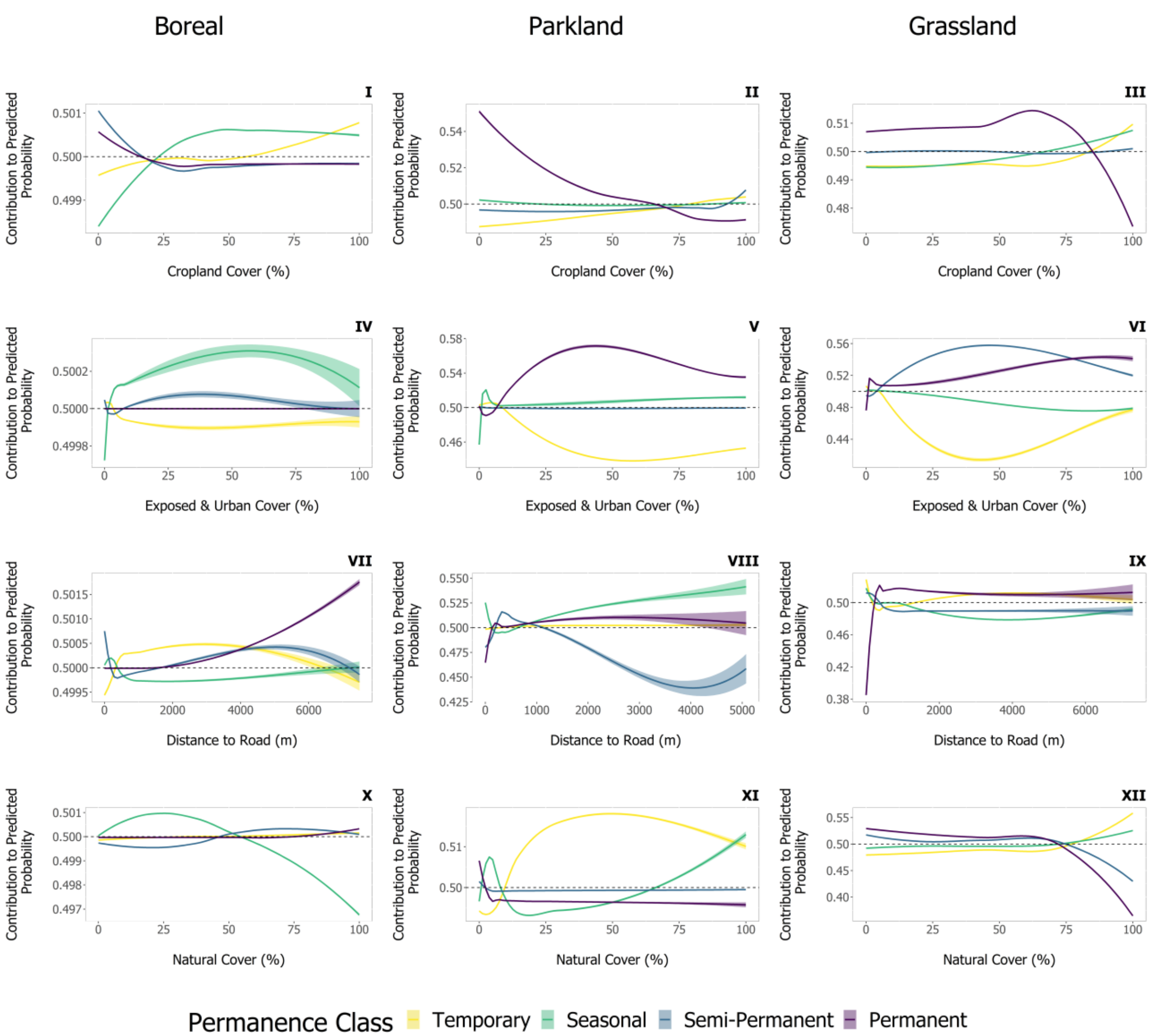
Appendix 1A. Contribution to predicted probability of wetlands classified as temporary, seasonal, semi-permanent and permanent based on precipitation metrics.



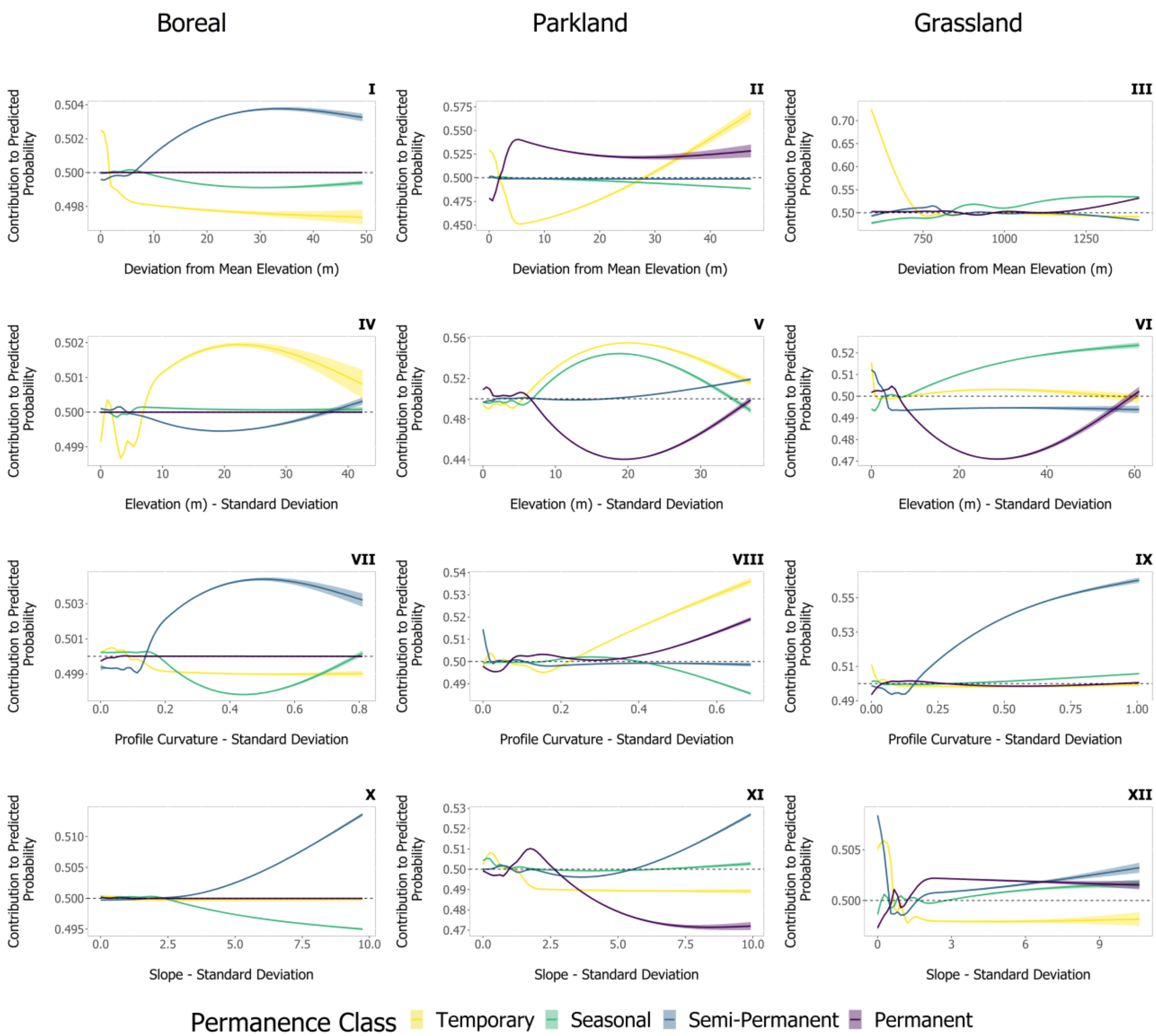
Appendix 1B. Contribution to predicted probability of wetlands classified as temporary, seasonal, semi-permanent and permanent based on temperature metrics.



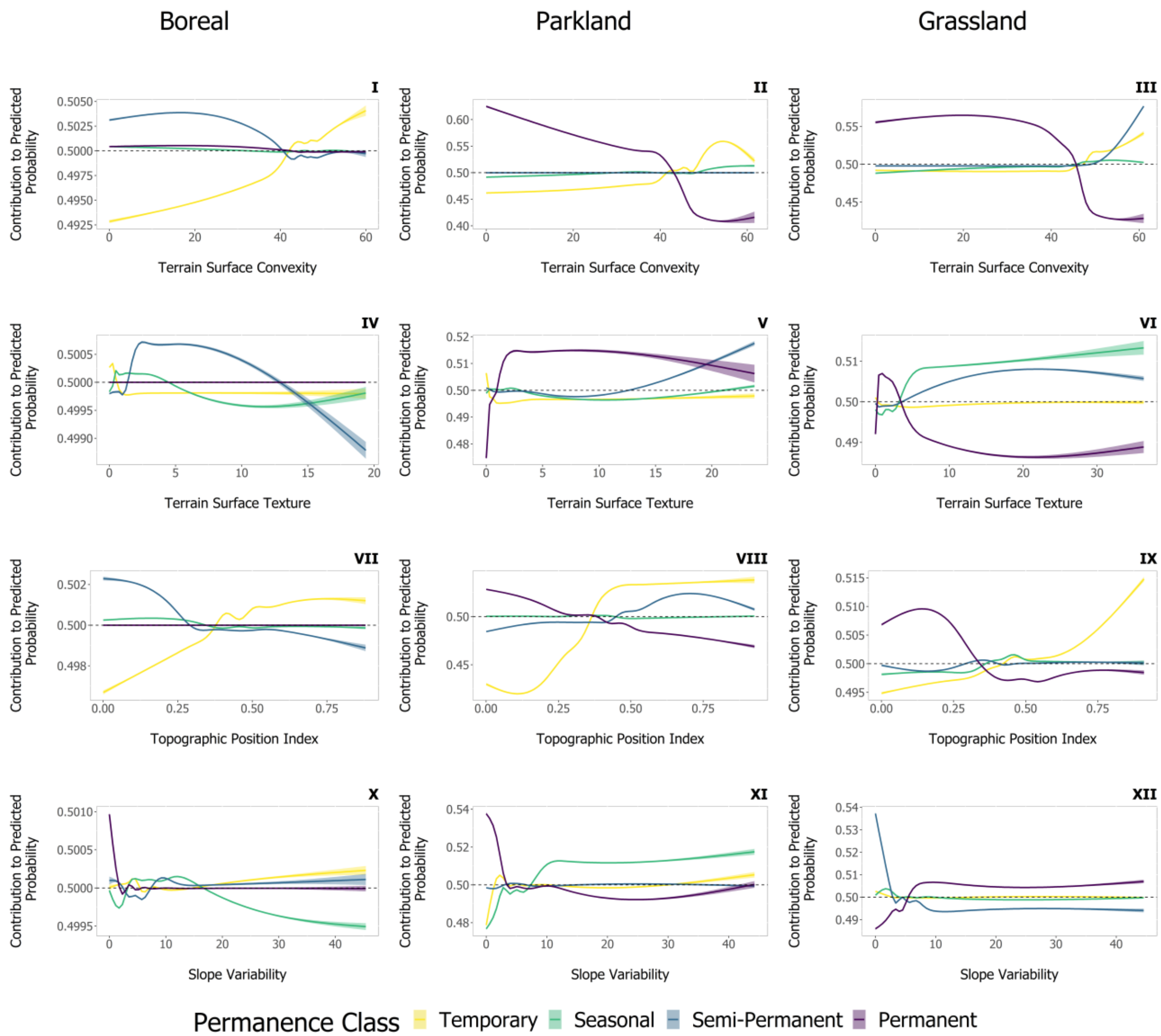
Appendix 1C. Contribution to predicted probability of wetlands classified as temporary, seasonal, semi-permanent and permanent based on land use and land cover metrics.



Appendix 1D. Contribution to predicted probability of wetlands classified as temporary, seasonal, semi-permanent and permanent based on four of eight terrain metrics.



Appendix 1E. Contribution to predicted probability of wetlands classified as temporary, seasonal, semi-permanent and permanent based on four of eight terrain metrics.



Appendix 2. List of taxa/species included in analyses.

Appendix 2A. Code, scientific name, and common name of bird taxa observed at the 96 wetland sites.

Name	Scientific Name	Common Name
ALFL	*Recurvirostra americana*	Alder Flycatcher
AMAV	*Recurvirostra americana*	American Avocet
AMBI	*Botaurus lentiginosus*	American Bittern
AMCO	*Fulica americana*	American Coot
AMCR	*Corvus brachyrhynchos*	American Crow
AMGO	*Spinus tristis*	American Goldfinch
AMRE	*Setophaga ruticilla*	American Redstart
AMRO	*Turdus migratorius*	American Robin
AMWI	*Anas americana*	American Wigeon
BAIS	*Ammodramus bairdii*	Baird's Sparrow
BAOR	*Icterus galbula*	Baltimore Oriole
BARS	*Hirundo rustica*	Barn Swallow
BBMA	*Pica hudsonia*	Black-billed Magpie
BCCH	*Poecile atricapillus*	Black-capped Chickadee
BHCO	*Molothrus ater*	Brown-headed Cowbird
BLJA	*Cyanocitta cristata*	Blue Jay
BLTE	*Chlidonias niger*	Black Tern
BNST	*Himantopus mexicanus*	Black-necked Stilt
BOGU	*Chroicocephalus philadelphia*	Bonaparte's Gull
BRBL	*Euphagus cyanocephalus*	Brewer's Blackbird
BRTH	*Toxostoma rufum*	Brown Thrasher
BUFF	*Bucephala albeola*	Bufflehead
BWTE	*Anas discors*	Blue-winged Teal
CANG	*Branta canadensis*	Canada Goose
CANV	*Aythya valisineria*	Canvasback
CCSP	*Spizella pallida*	Clay-colored Sparrow
CEDW	*Bombycilla cedrorum*	Cedar Waxwing
CHSP	*Spizella passerina*	Chipping Sparrow
CITE	*Anas cyanoptera*	Cinnamon Teal
COGR	*Quiscalus quiscula*	Common Grackle
COLO	*Gavia immer*	Common Loon
CORA	*Corvus corax*	Common Raven
COYE	*Geothlypis trichas*	Common Yellowthroat
DOWO	*Picoides pubescens*	Downy Woodpecker

Name	Scientific Name	Common Name
EAGR	*Podiceps nigricollis*	Eared Grebe
EAKI	*Tyrannus tyrannus*	Eastern Kingbird
EAPH	*Sayornis phoebe*	Eastern Phoebe
EUST	*Sturnus vulgaris*	European Starling
FISP	*Spizella pusilla*	Field Sparrow
FRGU	*Leucophaeus pipixcan*	Franklin's Gull
GADW	*Anas strepera*	Gadwall
GBHE	*Ardea herodias*	Great Blue Heron
GRCA	*Dumetella carolinensis*	Gray Catbird
GRSP	*Ammodramus savannarum*	Grasshopper Sparrow
GWTE	*Anas crecca*	Green-winged Teal
HAWO	*Picoides villosus*	Hairy Woodpecker
HOGR	*Podiceps auritus*	Horned Grebe
HOLA	*Eremophila alpestris*	Horned Lark
HOSP	*Passer domesticus*	House Sparrow
HOWR	*Troglodytes aedon*	House Wren
KILL	*Charadrius vociferus*	Killdeer
LBCU	*Numenius americanus*	Long-billed Curlew
LCSP	*Ammodramus leconteii*	Le Conte's Sparrow
LEFL	*Empidonax minimus*	Least Flycatcher
LESA	*Calidris minutilla*	Least Sandpiper
LESC	*Aythya affinis*	Lesser Scaup
LEYE	*Tringa flavipes*	Lesser Yellowlegs
LISP	*Melospiza lincolnii*	Lincoln's Sparrow
MAGO	*Limosa fedoa*	Marbled Godwit
MALL	*Anas platyrhynchos*	Mallard
MERL	*Falco columbarius*	Merlin
MODO	*Zenaida macroura*	Mourning Dove
NESP	*Ammodramus nelsoni*	Nelson's Sparrow
NOFL	*Colaptes auratus*	Northern Flicker
NOHA	*Circus cyaneus*	Northern Harrier
NOPI	*Anas acuta*	Northern Pintail
NRWS	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow
NSHO	*Anas clypeata*	Northern Shoveler
OVEN	*Seiurus aurocapilla*	Ovenbird
PIWO	*Dryocopus pileatus*	Pileated Woodpecker
RBGR	*Pheucticus ludovicianus*	Rose-breasted Grosbeak
RBGU	*Larus delawarensis*	Ring-billed Gull

Name	Scientific Name	Common Name
RBNU	*Sitta canadensis*	Red-breasted Nuthatch
RCKI	*Regulus calendula*	Ruby-crowned Kinglet
REDH	*Aythya americana*	Redhead
REVI	*Vireo olivaceus*	Red-eyed Vireo
RENP/RHNP	*Phalaropus lobatus*	Red-necked Phalarope
RNDU	*Aythya collaris*	Ring-necked Duck
RTHA	*Buteo jamaicensis*	Red-tailed Hawk
RUBL	*Euphagus carolinus*	Rusty Blackbird
RUDU	*Oxyura jamaicensis*	Ruddy Duck
RUGR	*Bonasa umbellus*	Ruffed Grouse
RWBL	*Agelaius phoeniceus*	Red-winged Blackbird
SACR	*Antigone canadensis*	Sandhill Crane
SAVS	*Passerculus sandwichensis*	Savannah Sparrow
SORA	*Porzana carolina*	Sora
SOSP	*Melospiza melodia*	Song Sparrow
SPPI	*Anthus spragueii*	Sprague's Pipit
SWHA	*Buteo swainsoni*	Swainson's Hawk
SWSP	*Melospiza georgiana*	Swamp Sparrow
SWTH	*Catharus ustulatus*	Swainson's Thrush
TEWA	*Oreothlypis peregrina*	Tennessee Warbler
TRES	*Tachycineta bicolor*	Tree Swallow
UNKN	*Unknown*	Unknown
UPSA	*Bartramia longicauda*	Upland Sandpiper
VESP	*Pooecetes gramineus*	Vesper Sparrow
WAVI	*Vireo gilvus*	Warbling Vireo
WEME	*Sturnella neglecta*	Western Meadowlark
WILL	*Tringa semipalmata*	Willet
WIPH	*Phalaropus tricolor*	Wilson's Phalarope
WISN	*Gallinago delicata*	Wilson's Snipe
WTSP	*Zonotrichia albicollis*	White-throated Sparrow
YEWA	*Setophaga petechia*	Yellow Warbler
YHBL	*Xanthocephalus xanthocephalus*	Yellow-headed Blackbird

Appendix 2B. A list of all aquatic macroinvertebrate taxa identified with taxonomic resolution.

Class	Order	Family
Insecta	Coleoptera	Curculionidae
		Chrysomelidae
		Dytiscidae
		Elmidae
		Gyrinidae
		Haliplidae
		Hydraenidae
		Hydrophilidae
		Phalacridae
		Ptiliidae
		Salpingidae
		Scirtidae
		Staphylinidae
	Diptera	Anthomyiidae
		Ceratopogonidae
		Chaoboridae
		Chironomidae
		Culicidae
		Dixidae
		Dolichopodidae
		Empididae
		Ephydridae
		Psychodidae
		Sciomyzidae
		Stratiomyidae
		Syrphidae
		Tabanidae
		Tipulidae
	Ephemeroptera	Baetidae
		Caenidae
		Siphlonuridae
	Hemiptera	Corixidae
		Gerridae
		Hebridae
		Mesoveliidae
		Notonectidae
		Saldidae
		Veliidae
	Lepidoptera	Noctuidae

Class	Order	Family
		Pyralidae
	Odonata	Aeshnidae
		Coenagrionidae
		Lestidae
		Libellulidae
	Trichoptera	Brachycentridae
	Collembola†	Leptoceridae
		Limnephilidae
Entognatha		
Arachnida	Trombidiformes	Hydrachnidia†
Branchipoda	Anostraca†	
	Conchostraca†	
	Notostraca	Triopsidae
Malacostraca	Amphipoda	
Ostracoda†		
Bivalvia	Veneroida	Sphaeriidae
Gastropoda	Basommatophora	Lymnaeidae
		Planorbidae
Clitellata	Hirudinea†	
Oligochaeta†		
Hydrazoa†		
Nematoda‡		
Tardigrada		

†Not identified to Family level

‡Phylum level

Appendix 2C. Code, scientific name, and common name of plant taxa observed at the 96 wetland sites.

Code	Scientific Name	Common Name
ACHALPIN	*Achillea alpina*	Siberian Yarrow
ACHMILLE	*Achillea millefolium*	Common Yarrow
ACOCALAM	*Acorus calamus*	Sweet-Flag
AGRCRIST	*Agropyron cristatum ssp. pectinatum*	Crested Wheatgrass
AGRGIGAN	*Agrostis gigantea*	Redtop
AGRSCABR	*Agrostis scabra*	Ticklegrass
AGRSTRIA	*Agrimonia striata*	Roadside Agrimony
ALITRIVI	*Alisma triviale*	Northern Water Plantain
ALOAEQUA	*Alopecurus aequalis*	Short-Awn Meadow-Foxtail
ALOPRATE	*Alopecurus pratensis*	Field Meadow-Foxtail
AMARETRO	*Amaranthus retroflexus*	Redroot Pigweed
AMEALNIF	*Amelanchier alnifolia*	Saskatoon Berry
ANAMINIM	*Anagalilis minima*	Chaffweed
ANECANAD	*Anemone canadensis*	Canada Anemone
ANTPARVI	*Antennaria parvifolia*	Small-Leaf Pussytoes
ARNCHAMI	*Arnica chamissonis*	Chamisso Arnica
ARTBIENN	*Artemisia biennis*	Biennial Sagewort
ARTCAMPE	*Artemisia campestris ssp. caudata*	Common Sagewort
ARTLONGI	*Artemisia longifolia*	Longleaf Sagebrush
ARTLUDOV	*Artemisia ludoviciana*	Gray Sagewort
ATRPROST	*Atriplex prostrata*	Triangle Orache
AVEFATUA	*Avena fatua*	Wild Oats
BECSYZIG	*Beckmannia syzigachne ssp. syzigachne*	American Sloughgrass
BIDCERNU	*Bidens cernua*	Nodding Beggarticks
BOLMARIT	*Bolboschoenus maritimus*	Cosmopolitan Bulrush
BRANAPUS	*Brassica napus*	Argentine Canola
BROINERM	*Bromus inermis*	Smooth Brome
CALCANAD	*Calamagrostis canadensis var. canadensis*	Bluejoint
CALIPALU	*Callitriche palustris*	Vernal Water-Starwort
CALLPALU	*Calla palustris*	Water Arum
CALSTRIC	*Calamagrostis stricta ssp. inexpansa*	Slimstem Reedgrass
CALTPALU	*Caltha palustris*	Yellow Marsh Marigold
CAPBURSA	*Capsella bursa-pastoris*	Shepherd's Purse
CARAQUAT	*Carex aquatilis*	Water Sedge

Code	Scientific Name	Common Name
CARATHER	*Carex atherodes*	Awned Sedge
CARATHRO	*Carex athrostachya*	Slender-Beak Sedge
CARBEBBI	*Carex bebbii*	Bebb's Sedge
CARBREVI	*Carex brevior*	Shortbeak Sedge
CARCARVI	*Carum carvi*	Wild Caraway
CARDIAND	*Carex diandra*	Two-Stamened Sedge
CAREX_SP	*Carex sp.*	Sedge
CARLACUS	*Carex lacustris*	Lakebank Sedge
CARPELLI	*Carex pellita*	Woolly Sedge
CARPRAEG	*Carex praegracilis*	Clustered Field Sedge
CARPRATI	*Carex praticola*	Meadow Sedge
CARRETRO	*Carex retrorsa*	Knotsheath Sedge
CARSARTW	*Carex sartwellii*	Sartwell's Sedge
CARSYCHN	*Carex sychnocephala*	Many-Headed Sedge
CARUTRIC	*Carex utriculata*	Northwest Territory Sedge
CERARVEN	*Cerastium arvense*	Field Chickweed
CHAANGUS	*Chamerion angustifolium ssp. angustifolium*	Fireweed
CHEALBUM	*Chenopodium album*	Common Lambsquarters
CHECAPIT	*Chenopodium capitatum*	Strawberry Blite
CHERUBRU	*Chenopodium rubrum*	Red Goosefoot
CICMACUL	*Cicuta maculata var. angustifolia*	Spotted Water Hemlock
CIRARVEN	*Cirsium arvense*	Canada Thistle
CIRVULGA	*Cirsium vulgare*	Bull Thistle
COLLINEA	*Collomia linearis*	Narrow-Leaf Mountain Trumpet
COMPALUS	*Comarum palustre*	Purple Marshlocks
CORSERIC	*Cornus sericea ssp. sericea*	Red Osier Dogwood
CRETECTO	*Crepis tectorum*	Narrow-Leaf Hawk's Beard
DESCESPI	*Deschampsia cespitosa ssp. cespitosa*	Tufted Hairgrass
DESSOPHI	*Descurainia sophia*	Flaxweed Tansymustard
ECHCRUSG	*Echinochloa crus-galli*	Barnyard Grass
ELACOMMU	*Elaeagnus commutata*	Silverberry
ELEACICU	*Eleocharis acicularis*	Needle Spikerush
ELEPALUS	*Eleocharis palustris*	Creeping Spikerush
ELYREPEN	*Elymus repens*	Quackgrass
ELYTRACH	*Elymus trachycaulus*	Slender Wheatgrass
EPICAMPE	*Epilobium campestre*	Smooth Spike-Primrose
EPICILIA	*Epilobium ciliatum ssp. glandulosum*	Fringed Willow-Herb

Code	Scientific Name	Common Name
EPILEPTO	*Epilobium leptophyllum*	Bog Willow-Herb
EPIPALUS	*Epilobium palustre*	Marsh Willow-Herb
EQUARVEN	*Equisetum arvense*	Common Horsetail
EQUFLUVI	*Equisetum fluviatile*	River Horsetail
EQUHYMAL	*Equisetum hyemale ssp. affine*	Scouring Horsetail
EQUPALUS	*Equisetum palustre*	Marsh Horsetail
EQUPRATE	*Equisetum pratense*	Meadow Horsetail
ERIGRACI	*Eriophorum gracile*	Slender Cotton-Grass
ERILONCH	*Erigeron lonchophyllus*	Low-Meadow Fleabane
ERIPHILA	*Erigeron philadelphicus*	Philadelphia Fleabane
ERUGALLI	*Erucastrum gallicum*	Common Dog-Mustard
ERYCHEIR	*Erysimum cheiranthoides*	Wallflower Mustard
EURCONSP	*Eurybia conspicua*	Western Showy Aster
FAGESCUL	*Fagopyrum esculentum*	Common Buckwheat
FALCONVO	*Fallopia convolvulus*	Black Bindweed
FALSCAND	*Fallopia scandens*	Climbing False Buckwheat
FESSAXIM	*Festuca saximontana*	Rocky Mountain Fescue
FRAVESCA	*Fragaria vesca*	Woodland Strawberry
FRAVIRGI	*Fragaria virginiana ssp. glauca*	Wild Strawberry
GALTETRA	*Galeopsis tetrahit*	Brittle-Stem Hedge-Nettle
GALTRIFI	*Galium trifidum*	Small Bedstraw
GALTRIFL	*Galium triflorum*	Sweet Bedstraw
GEUALEPP	*Geum aleppicum*	Yellow Avens
GEUMACRO	*Geum macrophyllum var. princisum*	Large-Leaf Avens
GEURIVAL	*Geum rivale*	Purple Avens
GLYBOREA	*Glyceria borealis*	Northern Manna Grass
GLYGRAND	*Glyceria grandis*	American Manna Grass
GLYSTRIA	*Glyceria striata*	Fowl Manna Grass
GRANEGLE	*Gratiola neglecta*	Clammy Hedge-Hyssop
GRISQUAR	*Grindelia squarrosa*	Curlytop Gumweed
HIEUMBAL	*Hieracium umbellatum*	Canadian Hawkweed
HIPVULGA	*Hippuris vulgaris*	Common Mare's Tail
HORJUBAT	*Hordeum jubatum*	Foxtail Barley
HORVULGA	*Hordeum vulgare*	Common Barley
JUNBALTI	*Juncus balticus ssp. ater*	Baltic Rush
JUNLONGI	*Juncus longistylus*	Long-Style Rush
JUNNODOS	*Juncus nodosus*	Jointed Rush
JUNVASEY	*Juncus vaseyi*	Vasey's Rush
KRALANAT	*Krascheninnikovia lanata*	Winterfat

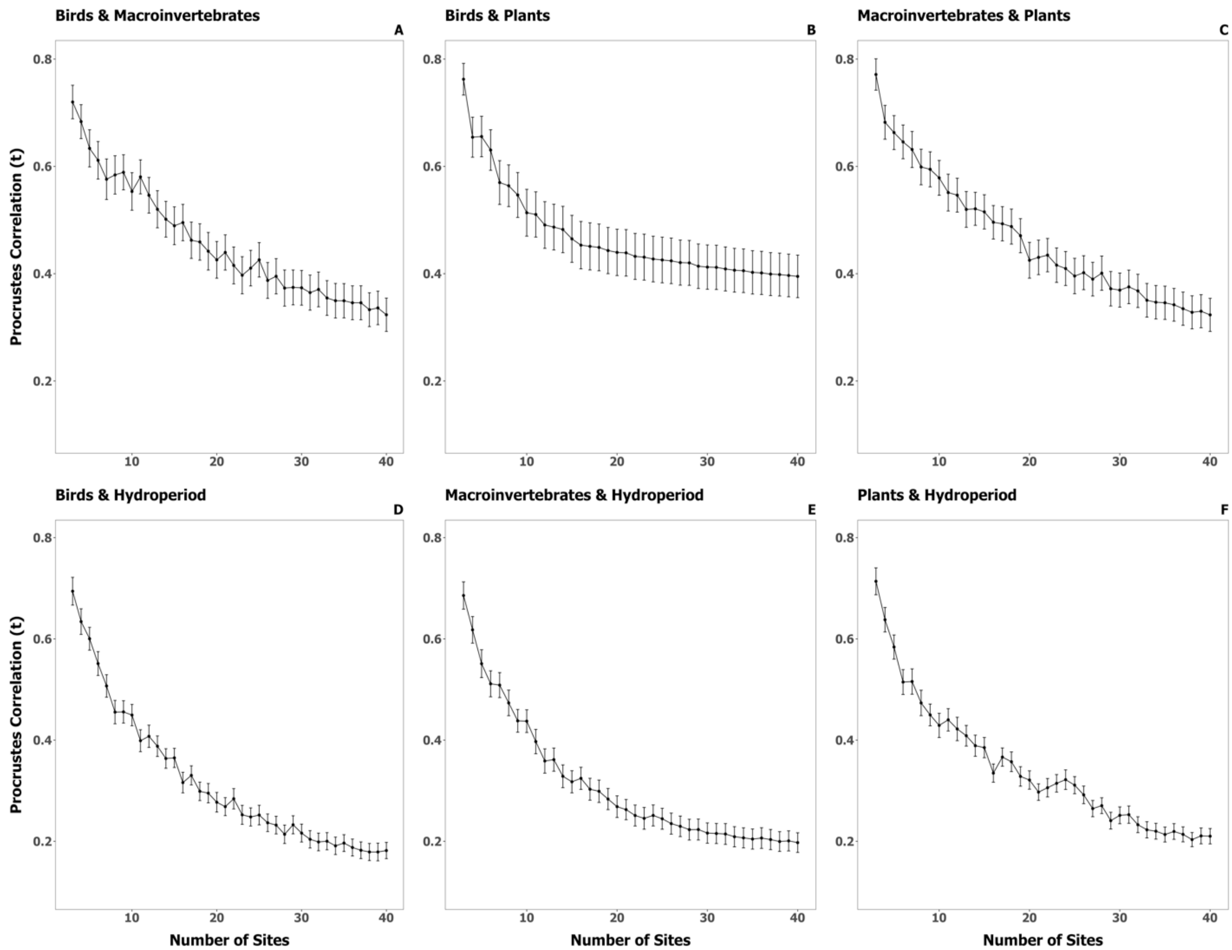
Code	Scientific Name	Common Name
LACSERRI	*Lactuca serriola*	Prickly Lettuce
LATOCHRO	*Lathyrus othroleucus*	Cream Peavine
LEMMINOR	*Lemna minor*	Common Duckweed
LEMTRISU	*Lemna trisulca*	Ivy-Leaf Duckweed
LINUSITA	*Linum usitatissimum*	Common Flax
LYCASPER	*Lycopus asper*	Rough Water Hore-Hound
LYSCILIA	*Lysimachia ciliata*	Fringed Yellow Loosestrife
LYSMARIT	*Lysimachia maritima*	Sea Milkwort
LYSTHYRS	*Lysimachia thyrsiflora*	Tufted Yellow Loosestrife
MAISTELL	*Maianthemum stellatum*	False Solomon's Seal
MALNEGLE	*Malva neglecta*	Roundleaf Mallow
MEDSATIV	*Medicago sativa*	Alfalfa
MELALBUS	*Melilotus albus*	White Sweet-Clover
MELIL_SP	*Melilotus sp.*	Sweet-Clover
MENARVEN	*Mentha arvensis*	Wild Mint
MONNUTTA	*Monolepis nuttalliana*	Nuttall's Poverty-Weed
MUHRICHA	*Muhlenbergia richardsonis*	Mat Muhly
MULOBLON	*Mulgedium oblongifolium*	Blue Lettuce
PENPROCE	*Penstemon procerus*	Pincushion Beardtongue
PERAMPHI	*Persicaria amphibia*	Water Knotweed
PERLAPAT	*Persicaria lapathifolia*	Curlytop Knotweed
PETFRIGI	*Petasites frigidus var. sagittatus*	Arctic Sweet Colt's-Foot
PHAARUND	*Phalaris arundinacea*	Reed Canary Grass
PHLPRATE	*Phleum pratense*	Common Timothy
PLAHYPER	*Platanthera hyperborea*	Northern Bog Orchid
PLAMAJOR	*Plantago major*	Broadleaf Plantain
PLASCOUL	*Plagiobothrys scouleri*	Scouler's Popcornflower
POAPALUS	*Poa palustris*	Fowl Bluegrass
POAPRATE	*Poa pratensis*	Kentucky Bluegrass
POLAVICU	*Polygonum aviculare ssp. depressum*	Prostrate Knotweed
POLRAMOS	*Polygonum ramosissimum*	Bushy Knotweed
POPBALSA	*Populus balsamifera*	Balsam Poplar
POPTREMU	*Populus tremuloides*	Trembling Aspen
POTANSER	*Potentilla anserina*	Silverweed Cinquefoil
POTGRAMI	*Potamogeton gramineus*	Variableleaf Pondweed
POTNORVE	*Potentilla norvegica*	Norwegian Cinquefoil
POTRICHA	*Potamogeton richardsonii*	Richardson's Pondweed
POTRIVAL	*Potentilla rivalis*	Brook Cinquefoil
PYRASARI	*Pyrola asarifolia*	Pink Wintergreen

Code	Scientific Name	Common Name
RANAQUAT	*Ranunculus aquatilis var. diffusus*	Water Buttercup
RANCYMBA	*Ranunculus cymbalaria*	Alkali Buttercup
RANGMELI	*Ranunculus gmelinii*	Gmelin's Buttercup
RANMACOU	*Ranunculus macounii*	Macoun's Buttercup
RANSCELE	*Ranunculus sceleratus var. multifidus*	Celeryleaf Buttercup
RANUN_SP	*Ranunculus sp.*	Buttercup
RIBLACUS	*Ribes lacustre*	Prickly Currant
RIBOXYAC	*Ribes oxyacanthoides*	Canadian Gooseberry
RORPALUS	*Rorippa palustris*	Marsh Yellowcress
ROSACICU	*Rosa acicularis ssp. sayi*	Prickly Rose
RUBPUBES	*Rubus pubescens*	Dwarf Red Raspberry
RUBSACHA	*Rubus sachalinensis var. sachalinensis*	Common Red Raspberry
RUMBRITA	*Rumex britannica*	Greater Water Dock
RUMCRISP	*Rumex crispus*	Curly Dock
RUMEX_SP	*Rumex sp.*	Dock
RUMFUEGI	*Rumex fueginus*	Golden Dock
RUMOCCID	*Rumex occidentalis*	Western Dock
RUMSALIC	*Rumex salicifolius*	Willow Dock
SAGCUNEA	*Sagittaria cuneata*	Arum-Leaf Arrowhead
SALBEBBI	*Salix bebbiana*	Bebb's Willow
SALDISCO	*Salix discolor*	Pussy Willow
SALEXIGU	*Salix exigua*	Sandbar Willow
SALIX_SP	*Salix sp.*	Willow
SALLASIA	*Salix lasiandra var. lasiandra*	Pacific Willow
SALLUCID	*Salix lucida*	Shining Willow
SALMACCA	*Salix maccalliana*	McCalla's Willow
SALPETIO	*Salix petiolaris*	Meadow Willow
SALPLANI	*Salix planifolia*	Plain-Leaf Willow
SALPSEUD	*Salix pseudomonticola*	False Mountain Willow
SALPYRIF	*Salix pyrifolia*	Balsam Willow
SALRUBRA	*Salicornia rubra*	Red Samphire
SALSERIS	*Salix serissima*	Autumn Willow
SCHACUTU	*Schoenoplectus acutus var. acutus*	Hard-Stem Bulrush
SCHOE_SP	*Schoenoplectus sp.*	Bulrush
SCHPUNGE	*Schoenoplectus pungens var. pungens*	Common Three-Square Bulrush
SCHTABER	*Schoenoplectus tabernaemontani*	Soft-Stem Bulrush

Code	Scientific Name	Common Name
SCIMICRO	*Scirpus microcarpus*	Panicled Bulrush
SCOFESTU	*Scolochloa festucacea*	Common Rivergrass
SCUGALER	*Scutellaria galericulata*	Marsh Skullcap
Sd_Forb	-	Unidentifiable seedling/forb
SENVULGA	*Senecio vulgaris*	Common Groundsel
SISMONTA	*Sisyrinchium montanum*	Mountain Blue-Eyed Grass
SIUSUAVE	*Sium suave*	Common Water Parsnip
SOLALTIS	*Solidago altissima ssp. gilvocanescens*	Canada Goldenrod
SONARVEN	*Sonchus arvensis*	Perennial Sow-Thistle
SONASPER	*Sonchus asper*	Prickly Sow-Thistle
SONOLERA	*Sonchus oleraceus*	Annual Sow-Thistle
SPAANGUS	*Sparganium angustifolium*	Narrow-Leaf Bur-Reed
SPAEURYC	*Sparganium eurycarpum*	Giant Bur-Reed
SPESALIN	*Spergularia salina*	Salt Sandspurry
SPHINTER	*Sphenopholis intermedia*	Slender Wedgegrass
SPOCRYPT	*Sporobolus cryptandrus*	Sand Dropseed
STAPILOS	*Stachys pilosa var. pilosa*	Hairy Hedgenettle
STELONGI	*Stellaria longifolia*	Long-Leag Starwort
STEMEDIA	*Stellaria media*	Common Chickweed
SUACALCE	*Suaeda calceoliformis*	Paiuteweed
SYMBOREA	*Symphyotrichum boreale*	Northern Bog Aster
SYMERICO	*Symphyotrichum ericoides var. pansum*	White Heath Aster
SYMLANCE	*Symphyotrichum lanceolatum var. hesperium*	White Panicle Aster
SYMOCCID	*Symphoricarpos occidentalis*	Western Snowberry
SYMPUNIC	*Symphyotrichum puniceum var. puniceum*	Purplestem Aster
TANVULGA	*Tanacetum vulgare*	Common Tansy
TAROFFIC	*Taraxacum officinale*	Common Dandelion
TEPPALUS	*Tephroseris palustris*	Marsh Fleabane
THLARVEN	*Thlaspi arvense*	Field Pennycress
TRADUBIU	*Tragopogon dubius*	Goat's Beard
TRIHYBRI	*Trifolium hybridum*	Alsike Clover
TRIMARIT	*Triglochin maritima*	Seaside Arrow-Grass
TYPLATIF	*Typha latifolia*	Common Cattail
UNKASTER	*Asteraceae*	Unidentifiable Asteraceae
UNKBRASS	*Brassicaceae*	Unidentifiable Brassicaceae
UNKCARYO	*Caryophyllaceae*	Unidentifiable Caryophyllaceae

Code	Scientific Name	Common Name
UNKPOACE	*Poaceae*	Unidentifiable Poaceae
URTDIOCA	*Urtica dioica ssp. gracilis*	Stinging Nettle
UTRVULGA	*Utricularia vulgaris ssp. macrorhiza*	Common Bladderwort
VERPEREG	*Veronica peregrina*	Purslane Speedwell
VERSCUTE	*Veronica scutellata*	Marsh Speedwell
VICAMERI	*Vicia americana*	American Vetch
VIOADUNC	*Viola adunca*	Early Blue Violet
VIOCANAD	*Viola canadensis*	Canada White Violet
VIOSOROR	*Viola sororia var. affinis*	Common Blue Violet

Appendix 3. Measures of congruence for *n* = 3 to 40 randomly selected sites, averaged across 100 iterations.



Regardless of *n,* I measured congruence between the same sites, either between taxon (A – C) or between each taxon and our proxies for hydroperiod (D – F). Here, I show the mean and standard error. Because of computational time, I limited the number of iterations to 100, though I used 1000 iterations in all other analyses requiring permutation. With a larger number of iterations, I expect smaller errors, but the same trends in the mean.

Appendix 4. Results from my Procrustes Analysis.

Appendix 4A. Results from my balanced, rarefied dataset for the 1000 iterations. This includes cross-taxon comparisons.

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
1	0.791	0.005	0.794	0.001	0.819	0.002	0.647	0.271	0.699	0.001	0.704	0.014	0.712	0.001	0.670	0.016	0.676	0.072
2	0.837	0.001	0.835	0.001	0.819	0.001	0.656	0.061	0.671	0.017	0.704	0.013	0.691	0.020	0.659	0.002	0.676	0.078
3	0.816	0.001	0.814	0.001	0.819	0.001	0.693	0.001	0.669	0.002	0.704	0.010	0.659	0.192	0.685	0.002	0.676	0.064
4	0.827	0.001	0.820	0.001	0.819	0.002	0.688	0.025	0.670	0.001	0.704	0.006	0.673	0.023	0.665	0.001	0.676	0.059
5	0.821	0.001	0.791	0.001	0.819	0.001	0.708	0.001	0.675	0.014	0.704	0.010	0.645	0.105	0.649	0.170	0.676	0.070
6	0.803	0.001	0.796	0.003	0.819	0.001	0.687	0.001	0.663	0.004	0.704	0.013	0.641	0.041	0.657	0.075	0.676	0.078
7	0.831	0.001	0.796	0.001	0.819	0.004	0.693	0.002	0.704	0.001	0.704	0.010	0.665	0.006	0.686	0.001	0.676	0.062
8	0.824	0.001	0.801	0.001	0.819	0.002	0.691	0.005	0.677	0.015	0.704	0.005	0.670	0.059	0.698	0.001	0.676	0.072
9	0.812	0.001	0.838	0.001	0.819	0.001	0.717	0.001	0.688	0.001	0.704	0.009	0.673	0.006	0.655	0.018	0.676	0.059
10	0.787	0.001	0.826	0.001	0.819	0.002	0.706	0.003	0.690	0.001	0.704	0.012	0.666	0.002	0.684	0.001	0.676	0.075
11	0.818	0.001	0.794	0.001	0.819	0.001	0.666	0.229	0.659	0.009	0.704	0.004	0.687	0.019	0.645	0.108	0.676	0.070
12	0.838	0.001	0.810	0.001	0.819	0.001	0.654	0.023	0.687	0.005	0.704	0.011	0.686	0.004	0.610	0.094	0.676	0.058
13	0.809	0.006	0.817	0.001	0.819	0.001	0.700	0.003	0.643	0.193	0.704	0.010	0.645	0.279	0.653	0.013	0.676	0.057
14	0.813	0.001	0.832	0.001	0.819	0.002	0.669	0.082	0.666	0.002	0.704	0.005	0.659	0.051	0.677	0.007	0.676	0.060
15	0.825	0.001	0.813	0.001	0.819	0.002	0.635	0.752	0.659	0.136	0.704	0.011	0.646	0.148	0.688	0.006	0.676	0.063
16	0.836	0.001	0.818	0.001	0.819	0.002	0.664	0.197	0.684	0.001	0.704	0.011	0.642	0.087	0.678	0.003	0.676	0.067
17	0.850	0.001	0.829	0.001	0.819	0.002	0.731	0.001	0.660	0.009	0.704	0.010	0.710	0.001	0.636	0.090	0.676	0.065
18	0.851	0.001	0.819	0.001	0.819	0.002	0.690	0.043	0.646	0.177	0.704	0.008	0.690	0.003	0.632	0.181	0.676	0.074
19	0.846	0.001	0.823	0.001	0.819	0.002	0.677	0.006	0.694	0.003	0.704	0.009	0.632	0.321	0.682	0.006	0.676	0.062
20	0.816	0.001	0.812	0.001	0.819	0.003	0.678	0.023	0.644	0.220	0.704	0.009	0.643	0.348	0.676	0.001	0.676	0.064
21	0.822	0.002	0.814	0.001	0.819	0.003	0.684	0.011	0.692	0.001	0.704	0.008	0.671	0.149	0.684	0.011	0.676	0.061
22	0.797	0.001	0.800	0.004	0.819	0.001	0.672	0.020	0.653	0.018	0.704	0.008	0.657	0.034	0.628	0.037	0.676	0.063
23	0.842	0.001	0.816	0.001	0.819	0.001	0.665	0.082	0.667	0.003	0.704	0.009	0.667	0.059	0.619	0.141	0.676	0.062
24	0.818	0.001	0.808	0.001	0.819	0.002	0.660	0.071	0.689	0.007	0.704	0.010	0.653	0.071	0.663	0.016	0.676	0.065

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
25	0.813	0.001	0.803	0.001	0.819	0.001	0.670	0.039	0.693	0.003	0.704	0.007	0.692	0.013	0.666	0.015	0.676	0.070
26	0.833	0.001	0.795	0.001	0.819	0.001	0.639	0.170	0.715	0.001	0.704	0.011	0.651	0.004	0.655	0.021	0.676	0.071
27	0.826	0.001	0.812	0.001	0.819	0.001	0.673	0.015	0.676	0.027	0.704	0.010	0.699	0.001	0.648	0.124	0.676	0.080
28	0.821	0.003	0.822	0.001	0.819	0.001	0.661	0.011	0.678	0.001	0.704	0.004	0.671	0.019	0.653	0.072	0.676	0.082
29	0.839	0.001	0.800	0.001	0.819	0.001	0.708	0.002	0.650	0.275	0.704	0.011	0.709	0.002	0.639	0.019	0.676	0.058
30	0.820	0.001	0.797	0.001	0.819	0.001	0.675	0.006	0.710	0.001	0.704	0.008	0.683	0.009	0.653	0.006	0.676	0.071
31	0.812	0.001	0.792	0.001	0.819	0.001	0.660	0.021	0.680	0.013	0.704	0.010	0.687	0.001	0.696	0.001	0.676	0.055
32	0.821	0.001	0.850	0.001	0.819	0.001	0.677	0.007	0.689	0.013	0.704	0.009	0.655	0.032	0.677	0.003	0.676	0.064
33	0.829	0.001	0.818	0.001	0.819	0.002	0.663	0.125	0.652	0.029	0.704	0.006	0.692	0.007	0.672	0.028	0.676	0.082
34	0.843	0.001	0.821	0.001	0.819	0.001	0.684	0.015	0.659	0.065	0.704	0.010	0.677	0.026	0.661	0.013	0.676	0.072
35	0.810	0.001	0.822	0.001	0.819	0.001	0.686	0.105	0.628	0.204	0.704	0.006	0.689	0.077	0.655	0.032	0.676	0.073
36	0.842	0.001	0.827	0.001	0.819	0.002	0.671	0.054	0.662	0.029	0.704	0.015	0.652	0.014	0.675	0.094	0.676	0.078
37	0.823	0.001	0.815	0.001	0.819	0.002	0.650	0.021	0.654	0.015	0.704	0.005	0.681	0.006	0.654	0.015	0.676	0.076
38	0.821	0.001	0.821	0.001	0.819	0.003	0.697	0.007	0.673	0.116	0.704	0.008	0.677	0.016	0.679	0.010	0.676	0.060
39	0.835	0.001	0.806	0.001	0.819	0.001	0.660	0.118	0.671	0.003	0.704	0.011	0.679	0.004	0.690	0.001	0.676	0.072
40	0.827	0.001	0.818	0.001	0.819	0.003	0.649	0.052	0.655	0.174	0.704	0.015	0.658	0.174	0.681	0.007	0.676	0.063
41	0.828	0.001	0.803	0.001	0.819	0.001	0.689	0.019	0.698	0.001	0.704	0.011	0.677	0.004	0.675	0.013	0.676	0.064
42	0.826	0.001	0.800	0.001	0.819	0.001	0.684	0.012	0.660	0.002	0.704	0.011	0.656	0.029	0.679	0.019	0.676	0.067
43	0.817	0.001	0.800	0.001	0.819	0.001	0.708	0.001	0.672	0.021	0.704	0.007	0.630	0.263	0.665	0.022	0.676	0.064
44	0.815	0.001	0.792	0.003	0.819	0.003	0.684	0.117	0.676	0.001	0.704	0.006	0.656	0.079	0.699	0.001	0.676	0.059
45	0.817	0.001	0.819	0.001	0.819	0.001	0.672	0.008	0.645	0.171	0.704	0.011	0.694	0.002	0.681	0.001	0.676	0.064
46	0.809	0.045	0.808	0.001	0.819	0.002	0.673	0.013	0.656	0.170	0.704	0.005	0.645	0.138	0.687	0.001	0.676	0.062
47	0.828	0.001	0.798	0.001	0.819	0.003	0.630	0.751	0.669	0.009	0.704	0.005	0.722	0.001	0.653	0.271	0.676	0.067
48	0.845	0.001	0.832	0.001	0.819	0.002	0.712	0.003	0.691	0.014	0.704	0.011	0.664	0.011	0.657	0.014	0.676	0.071
49	0.833	0.001	0.781	0.001	0.819	0.001	0.683	0.049	0.668	0.110	0.704	0.008	0.645	0.275	0.672	0.002	0.676	0.066
50	0.835	0.001	0.801	0.001	0.819	0.001	0.682	0.029	0.659	0.022	0.704	0.008	0.700	0.004	0.680	0.002	0.676	0.066
51	0.823	0.001	0.831	0.001	0.819	0.002	0.685	0.033	0.663	0.231	0.704	0.005	0.650	0.103	0.679	0.010	0.676	0.060
52	0.793	0.001	0.803	0.001	0.819	0.002	0.702	0.002	0.676	0.009	0.704	0.001	0.699	0.001	0.676	0.001	0.676	0.080

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
53	0.821	0.001	0.808	0.001	0.819	0.001	0.691	0.001	0.665	0.001	0.704	0.008	0.672	0.009	0.684	0.010	0.676	0.062
54	0.812	0.001	0.819	0.001	0.819	0.002	0.644	0.183	0.677	0.027	0.704	0.010	0.678	0.016	0.663	0.006	0.676	0.059
55	0.833	0.001	0.796	0.001	0.819	0.003	0.719	0.001	0.642	0.300	0.704	0.007	0.634	0.101	0.650	0.068	0.676	0.057
56	0.836	0.001	0.792	0.001	0.819	0.002	0.665	0.122	0.673	0.030	0.704	0.009	0.683	0.002	0.635	0.033	0.676	0.062
57	0.822	0.001	0.815	0.001	0.819	0.002	0.688	0.044	0.665	0.081	0.704	0.010	0.669	0.010	0.656	0.006	0.676	0.067
58	0.818	0.001	0.804	0.001	0.819	0.002	0.680	0.037	0.684	0.002	0.704	0.012	0.641	0.018	0.624	0.148	0.676	0.060
59	0.831	0.001	0.788	0.001	0.819	0.003	0.668	0.136	0.665	0.014	0.704	0.007	0.665	0.015	0.629	0.253	0.676	0.061
60	0.817	0.002	0.834	0.001	0.819	0.001	0.676	0.002	0.667	0.004	0.704	0.010	0.666	0.006	0.656	0.006	0.676	0.068
61	0.813	0.001	0.817	0.001	0.819	0.001	0.670	0.006	0.689	0.002	0.704	0.012	0.700	0.001	0.649	0.032	0.676	0.082
62	0.823	0.001	0.822	0.001	0.819	0.001	0.692	0.018	0.680	0.002	0.704	0.014	0.681	0.004	0.662	0.012	0.676	0.063
63	0.833	0.001	0.825	0.001	0.819	0.003	0.708	0.001	0.669	0.122	0.704	0.009	0.687	0.009	0.659	0.031	0.676	0.061
64	0.840	0.001	0.841	0.001	0.819	0.004	0.679	0.006	0.681	0.002	0.704	0.005	0.645	0.286	0.634	0.081	0.676	0.069
65	0.847	0.001	0.828	0.001	0.819	0.003	0.689	0.005	0.658	0.048	0.704	0.006	0.660	0.081	0.633	0.020	0.676	0.066
66	0.821	0.001	0.792	0.003	0.819	0.001	0.640	0.534	0.688	0.052	0.704	0.008	0.644	0.027	0.683	0.003	0.676	0.073
67	0.822	0.001	0.806	0.001	0.819	0.001	0.636	0.450	0.690	0.007	0.704	0.006	0.668	0.025	0.689	0.001	0.676	0.077
68	0.841	0.001	0.820	0.001	0.819	0.002	0.671	0.135	0.659	0.045	0.704	0.011	0.696	0.001	0.645	0.026	0.676	0.068
69	0.815	0.001	0.800	0.001	0.819	0.001	0.698	0.004	0.657	0.036	0.704	0.007	0.606	0.957	0.660	0.013	0.676	0.070
70	0.825	0.001	0.799	0.001	0.819	0.002	0.676	0.015	0.668	0.011	0.704	0.007	0.670	0.032	0.647	0.025	0.676	0.067
71	0.839	0.001	0.801	0.001	0.819	0.002	0.668	0.135	0.672	0.010	0.704	0.015	0.686	0.029	0.687	0.001	0.676	0.068
72	0.833	0.001	0.800	0.001	0.819	0.001	0.664	0.018	0.669	0.034	0.704	0.008	0.693	0.011	0.612	0.133	0.676	0.076
73	0.833	0.001	0.800	0.001	0.819	0.002	0.698	0.002	0.712	0.001	0.704	0.010	0.675	0.030	0.666	0.002	0.676	0.070
74	0.834	0.001	0.822	0.001	0.819	0.005	0.703	0.001	0.667	0.009	0.704	0.008	0.636	0.143	0.661	0.004	0.676	0.070
75	0.834	0.001	0.795	0.001	0.819	0.003	0.675	0.102	0.671	0.004	0.704	0.012	0.655	0.090	0.645	0.117	0.676	0.056
76	0.841	0.001	0.802	0.001	0.819	0.003	0.656	0.026	0.681	0.001	0.704	0.011	0.690	0.002	0.665	0.009	0.676	0.062
77	0.846	0.001	0.800	0.001	0.819	0.001	0.662	0.043	0.660	0.010	0.704	0.008	0.626	0.055	0.686	0.005	0.676	0.069
78	0.823	0.001	0.813	0.001	0.819	0.002	0.672	0.215	0.703	0.001	0.704	0.007	0.698	0.017	0.663	0.027	0.676	0.077
79	0.821	0.001	0.796	0.001	0.819	0.001	0.723	0.001	0.656	0.114	0.704	0.009	0.625	0.364	0.687	0.030	0.676	0.067
80	0.826	0.001	0.786	0.001	0.819	0.001	0.669	0.116	0.685	0.003	0.704	0.012	0.689	0.007	0.678	0.026	0.676	0.089

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
81	0.834	0.001	0.830	0.001	0.819	0.002	0.681	0.022	0.697	0.011	0.704	0.013	0.664	0.049	0.644	0.085	0.676	0.054
82	0.830	0.001	0.837	0.001	0.819	0.002	0.670	0.020	0.650	0.093	0.704	0.007	0.654	0.099	0.637	0.073	0.676	0.058
83	0.816	0.001	0.802	0.001	0.819	0.001	0.680	0.008	0.669	0.013	0.704	0.009	0.674	0.014	0.671	0.006	0.676	0.064
84	0.810	0.001	0.804	0.001	0.819	0.001	0.667	0.031	0.669	0.003	0.704	0.007	0.657	0.004	0.668	0.006	0.676	0.066
85	0.834	0.001	0.804	0.001	0.819	0.002	0.681	0.008	0.676	0.008	0.704	0.007	0.666	0.090	0.653	0.036	0.676	0.065
86	0.802	0.001	0.820	0.001	0.819	0.004	0.682	0.104	0.660	0.025	0.704	0.011	0.654	0.006	0.652	0.203	0.676	0.073
87	0.818	0.001	0.832	0.001	0.819	0.003	0.648	0.057	0.649	0.013	0.704	0.009	0.657	0.033	0.689	0.002	0.676	0.066
88	0.844	0.001	0.799	0.001	0.819	0.002	0.640	0.105	0.701	0.001	0.704	0.010	0.663	0.019	0.666	0.025	0.676	0.061
89	0.807	0.004	0.835	0.001	0.819	0.001	0.698	0.003	0.669	0.034	0.704	0.010	0.681	0.002	0.669	0.025	0.676	0.056
90	0.809	0.001	0.816	0.001	0.819	0.001	0.706	0.001	0.666	0.257	0.704	0.016	0.682	0.002	0.672	0.002	0.676	0.072
91	0.811	0.002	0.791	0.002	0.819	0.002	0.678	0.012	0.675	0.002	0.704	0.012	0.650	0.052	0.657	0.109	0.676	0.058
92	0.818	0.001	0.808	0.001	0.819	0.003	0.688	0.115	0.662	0.006	0.704	0.009	0.666	0.023	0.650	0.047	0.676	0.092
93	0.833	0.001	0.798	0.001	0.819	0.002	0.649	0.162	0.727	0.001	0.704	0.010	0.646	0.053	0.664	0.010	0.676	0.072
94	0.845	0.001	0.842	0.001	0.819	0.002	0.662	0.005	0.657	0.363	0.704	0.008	0.675	0.009	0.695	0.001	0.676	0.054
95	0.794	0.001	0.824	0.001	0.819	0.001	0.660	0.042	0.698	0.002	0.704	0.006	0.637	0.294	0.652	0.114	0.676	0.070
96	0.843	0.001	0.805	0.001	0.819	0.001	0.685	0.197	0.643	0.020	0.704	0.008	0.672	0.010	0.696	0.003	0.676	0.063
97	0.823	0.001	0.811	0.001	0.819	0.001	0.684	0.004	0.659	0.011	0.704	0.009	0.650	0.159	0.627	0.029	0.676	0.062
98	0.826	0.001	0.798	0.001	0.819	0.004	0.706	0.001	0.647	0.102	0.704	0.008	0.672	0.016	0.671	0.018	0.676	0.072
99	0.822	0.001	0.805	0.001	0.819	0.002	0.672	0.005	0.680	0.016	0.704	0.008	0.683	0.040	0.661	0.044	0.676	0.058
100	0.842	0.001	0.805	0.001	0.819	0.002	0.678	0.015	0.678	0.021	0.704	0.010	0.647	0.181	0.654	0.033	0.676	0.080
101	0.836	0.001	0.807	0.001	0.819	0.004	0.687	0.028	0.650	0.072	0.704	0.008	0.679	0.002	0.651	0.006	0.676	0.084
102	0.845	0.001	0.807	0.001	0.819	0.005	0.721	0.001	0.653	0.164	0.704	0.009	0.680	0.010	0.675	0.006	0.676	0.066
103	0.832	0.001	0.819	0.001	0.819	0.001	0.676	0.005	0.679	0.010	0.704	0.006	0.628	0.202	0.673	0.018	0.676	0.078
104	0.820	0.004	0.805	0.001	0.819	0.002	0.667	0.101	0.687	0.004	0.704	0.009	0.676	0.086	0.673	0.008	0.676	0.060
105	0.828	0.001	0.807	0.001	0.819	0.001	0.705	0.017	0.662	0.003	0.704	0.007	0.661	0.004	0.660	0.025	0.676	0.074
106	0.818	0.001	0.830	0.001	0.819	0.001	0.713	0.001	0.680	0.002	0.704	0.012	0.657	0.053	0.636	0.020	0.676	0.048
107	0.809	0.001	0.817	0.001	0.819	0.001	0.665	0.045	0.657	0.010	0.704	0.005	0.653	0.141	0.684	0.001	0.676	0.056
108	0.830	0.001	0.797	0.002	0.819	0.001	0.663	0.035	0.648	0.176	0.704	0.006	0.702	0.002	0.666	0.001	0.676	0.060

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
109	0.831	0.001	0.832	0.001	0.819	0.003	0.680	0.001	0.653	0.025	0.704	0.009	0.686	0.004	0.675	0.006	0.676	0.076
110	0.796	0.001	0.802	0.001	0.819	0.001	0.683	0.001	0.696	0.001	0.704	0.013	0.675	0.022	0.674	0.001	0.676	0.057
111	0.809	0.001	0.815	0.001	0.819	0.002	0.702	0.001	0.667	0.001	0.704	0.008	0.622	0.483	0.648	0.012	0.676	0.068
112	0.834	0.001	0.800	0.001	0.819	0.001	0.675	0.213	0.708	0.001	0.704	0.008	0.624	0.451	0.694	0.001	0.676	0.063
113	0.821	0.001	0.830	0.001	0.819	0.003	0.682	0.003	0.691	0.001	0.704	0.009	0.650	0.122	0.685	0.005	0.676	0.062
114	0.834	0.001	0.836	0.001	0.819	0.002	0.714	0.001	0.684	0.004	0.704	0.010	0.677	0.033	0.657	0.004	0.676	0.072
115	0.813	0.001	0.824	0.001	0.819	0.001	0.688	0.006	0.702	0.002	0.704	0.005	0.666	0.005	0.662	0.002	0.676	0.070
116	0.829	0.001	0.790	0.001	0.819	0.004	0.689	0.007	0.673	0.004	0.704	0.006	0.660	0.011	0.659	0.018	0.676	0.062
117	0.824	0.001	0.810	0.001	0.819	0.002	0.699	0.001	0.681	0.005	0.704	0.009	0.669	0.066	0.653	0.040	0.676	0.063
118	0.812	0.001	0.812	0.001	0.819	0.001	0.731	0.001	0.662	0.003	0.704	0.010	0.662	0.075	0.644	0.057	0.676	0.075
119	0.816	0.001	0.801	0.001	0.819	0.001	0.680	0.003	0.654	0.034	0.704	0.010	0.674	0.003	0.689	0.002	0.676	0.069
120	0.843	0.001	0.817	0.001	0.819	0.001	0.666	0.002	0.680	0.001	0.704	0.006	0.676	0.005	0.658	0.077	0.676	0.070
121	0.832	0.001	0.823	0.001	0.819	0.002	0.670	0.004	0.690	0.002	0.704	0.011	0.668	0.019	0.663	0.009	0.676	0.076
122	0.829	0.001	0.839	0.001	0.819	0.002	0.671	0.214	0.668	0.084	0.704	0.008	0.714	0.001	0.670	0.009	0.676	0.062
123	0.819	0.001	0.813	0.001	0.819	0.002	0.690	0.138	0.681	0.001	0.704	0.011	0.680	0.010	0.686	0.001	0.676	0.059
124	0.838	0.001	0.797	0.001	0.819	0.001	0.696	0.004	0.667	0.041	0.704	0.015	0.683	0.021	0.659	0.038	0.676	0.081
125	0.804	0.001	0.816	0.001	0.819	0.001	0.683	0.005	0.660	0.006	0.704	0.013	0.676	0.020	0.660	0.006	0.676	0.077
126	0.834	0.001	0.813	0.001	0.819	0.002	0.684	0.002	0.663	0.075	0.704	0.012	0.651	0.040	0.667	0.022	0.676	0.074
127	0.841	0.001	0.825	0.001	0.819	0.003	0.685	0.013	0.689	0.001	0.704	0.007	0.690	0.002	0.670	0.026	0.676	0.071
128	0.820	0.001	0.792	0.001	0.819	0.001	0.676	0.049	0.658	0.028	0.704	0.011	0.655	0.070	0.647	0.007	0.676	0.069
129	0.827	0.001	0.820	0.001	0.819	0.003	0.693	0.001	0.661	0.080	0.704	0.008	0.695	0.006	0.715	0.001	0.676	0.061
130	0.830	0.001	0.807	0.001	0.819	0.002	0.662	0.048	0.681	0.002	0.704	0.009	0.647	0.084	0.681	0.003	0.676	0.072
131	0.822	0.001	0.806	0.001	0.819	0.001	0.676	0.013	0.683	0.002	0.704	0.006	0.693	0.003	0.635	0.093	0.676	0.070
132	0.840	0.001	0.815	0.001	0.819	0.003	0.685	0.001	0.712	0.001	0.704	0.007	0.687	0.008	0.672	0.006	0.676	0.066
133	0.807	0.001	0.796	0.001	0.819	0.001	0.665	0.003	0.678	0.076	0.704	0.007	0.674	0.009	0.629	0.089	0.676	0.067
134	0.871	0.001	0.806	0.001	0.819	0.002	0.698	0.001	0.665	0.079	0.704	0.010	0.636	0.321	0.642	0.017	0.676	0.064
135	0.836	0.001	0.814	0.001	0.819	0.002	0.690	0.048	0.684	0.007	0.704	0.008	0.679	0.016	0.670	0.031	0.676	0.062
136	0.819	0.001	0.832	0.001	0.819	0.002	0.674	0.002	0.675	0.006	0.704	0.009	0.678	0.006	0.692	0.001	0.676	0.062

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
137	0.844	0.001	0.805	0.001	0.819	0.002	0.673	0.076	0.679	0.004	0.704	0.011	0.678	0.003	0.668	0.005	0.676	0.064
138	0.840	0.001	0.792	0.001	0.819	0.001	0.671	0.023	0.654	0.447	0.704	0.013	0.705	0.001	0.666	0.002	0.676	0.067
139	0.795	0.003	0.839	0.001	0.819	0.001	0.668	0.019	0.686	0.002	0.704	0.017	0.671	0.003	0.696	0.007	0.676	0.081
140	0.838	0.001	0.812	0.001	0.819	0.002	0.676	0.009	0.666	0.157	0.704	0.012	0.700	0.002	0.666	0.011	0.676	0.072
141	0.841	0.001	0.851	0.001	0.819	0.002	0.697	0.003	0.699	0.001	0.704	0.008	0.685	0.023	0.644	0.013	0.676	0.061
142	0.822	0.001	0.816	0.001	0.819	0.002	0.673	0.266	0.652	0.452	0.704	0.009	0.699	0.001	0.667	0.005	0.676	0.063
143	0.839	0.001	0.833	0.001	0.819	0.001	0.689	0.040	0.666	0.021	0.704	0.009	0.657	0.014	0.640	0.115	0.676	0.067
144	0.807	0.001	0.827	0.001	0.819	0.002	0.673	0.024	0.680	0.002	0.704	0.009	0.723	0.001	0.652	0.014	0.676	0.067
145	0.842	0.001	0.825	0.001	0.819	0.003	0.706	0.003	0.691	0.002	0.704	0.003	0.656	0.097	0.662	0.002	0.676	0.075
146	0.823	0.001	0.836	0.001	0.819	0.001	0.739	0.001	0.669	0.006	0.704	0.003	0.681	0.002	0.628	0.222	0.676	0.079
147	0.821	0.001	0.832	0.001	0.819	0.003	0.681	0.008	0.675	0.015	0.704	0.009	0.633	0.063	0.660	0.010	0.676	0.079
148	0.811	0.002	0.796	0.001	0.819	0.002	0.656	0.087	0.677	0.030	0.704	0.006	0.685	0.006	0.645	0.029	0.676	0.063
149	0.816	0.001	0.843	0.001	0.819	0.003	0.689	0.140	0.656	0.012	0.704	0.006	0.649	0.008	0.683	0.011	0.676	0.066
150	0.792	0.001	0.819	0.001	0.819	0.003	0.707	0.001	0.686	0.001	0.704	0.007	0.706	0.001	0.700	0.001	0.676	0.068
151	0.839	0.001	0.812	0.002	0.819	0.002	0.688	0.015	0.669	0.010	0.704	0.012	0.633	0.281	0.653	0.040	0.676	0.071
152	0.825	0.001	0.815	0.001	0.819	0.001	0.684	0.003	0.711	0.001	0.704	0.010	0.707	0.001	0.687	0.006	0.676	0.070
153	0.838	0.001	0.808	0.001	0.819	0.001	0.694	0.002	0.669	0.043	0.704	0.008	0.705	0.001	0.661	0.015	0.676	0.053
154	0.832	0.001	0.827	0.001	0.819	0.001	0.654	0.023	0.700	0.001	0.704	0.007	0.676	0.010	0.633	0.025	0.676	0.056
155	0.817	0.001	0.830	0.001	0.819	0.002	0.685	0.003	0.659	0.006	0.704	0.009	0.664	0.114	0.672	0.018	0.676	0.061
156	0.823	0.001	0.825	0.001	0.819	0.002	0.665	0.026	0.658	0.014	0.704	0.007	0.655	0.411	0.664	0.024	0.676	0.068
157	0.833	0.001	0.835	0.001	0.819	0.002	0.673	0.040	0.666	0.026	0.704	0.011	0.684	0.001	0.675	0.008	0.676	0.061
158	0.814	0.001	0.827	0.001	0.819	0.003	0.677	0.003	0.667	0.028	0.704	0.011	0.705	0.003	0.653	0.012	0.676	0.072
159	0.829	0.001	0.827	0.001	0.819	0.002	0.694	0.002	0.656	0.052	0.704	0.009	0.640	0.072	0.660	0.052	0.676	0.068
160	0.796	0.002	0.817	0.001	0.819	0.002	0.704	0.004	0.667	0.011	0.704	0.011	0.661	0.043	0.654	0.018	0.676	0.064
161	0.810	0.001	0.801	0.001	0.819	0.001	0.652	0.113	0.677	0.004	0.704	0.011	0.679	0.004	0.658	0.008	0.676	0.075
162	0.857	0.001	0.827	0.001	0.819	0.002	0.689	0.003	0.677	0.018	0.704	0.012	0.652	0.275	0.635	0.063	0.676	0.071
163	0.832	0.001	0.834	0.001	0.819	0.001	0.651	0.286	0.679	0.015	0.704	0.009	0.669	0.010	0.679	0.004	0.676	0.072
164	0.817	0.002	0.843	0.001	0.819	0.002	0.701	0.002	0.674	0.005	0.704	0.009	0.640	0.192	0.669	0.015	0.676	0.076

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
165	0.815	0.001	0.808	0.001	0.819	0.002	0.694	0.002	0.645	0.009	0.704	0.010	0.694	0.001	0.650	0.024	0.676	0.067
166	0.832	0.001	0.824	0.001	0.819	0.002	0.697	0.016	0.655	0.032	0.704	0.004	0.657	0.155	0.653	0.036	0.676	0.078
167	0.816	0.001	0.795	0.001	0.819	0.002	0.719	0.001	0.646	0.146	0.704	0.007	0.668	0.275	0.684	0.007	0.676	0.078
168	0.856	0.001	0.815	0.001	0.819	0.001	0.720	0.003	0.672	0.009	0.704	0.012	0.668	0.025	0.649	0.020	0.676	0.065
169	0.811	0.001	0.802	0.001	0.819	0.001	0.675	0.007	0.648	0.091	0.704	0.006	0.726	0.001	0.673	0.003	0.676	0.062
170	0.825	0.001	0.812	0.001	0.819	0.001	0.702	0.003	0.683	0.003	0.704	0.007	0.681	0.003	0.657	0.003	0.676	0.058
171	0.849	0.001	0.798	0.001	0.819	0.002	0.694	0.003	0.632	0.504	0.704	0.011	0.660	0.058	0.692	0.001	0.676	0.080
172	0.829	0.001	0.822	0.001	0.819	0.002	0.691	0.002	0.662	0.026	0.704	0.011	0.703	0.003	0.661	0.022	0.676	0.065
173	0.827	0.001	0.821	0.001	0.819	0.001	0.691	0.001	0.689	0.002	0.704	0.005	0.640	0.545	0.624	0.075	0.676	0.067
174	0.805	0.001	0.820	0.001	0.819	0.002	0.664	0.021	0.694	0.001	0.704	0.009	0.691	0.009	0.647	0.054	0.676	0.063
175	0.818	0.001	0.828	0.001	0.819	0.002	0.668	0.042	0.662	0.008	0.704	0.006	0.687	0.004	0.696	0.004	0.676	0.075
176	0.815	0.001	0.797	0.001	0.819	0.001	0.694	0.006	0.661	0.021	0.704	0.006	0.717	0.001	0.663	0.010	0.676	0.056
177	0.833	0.001	0.825	0.001	0.819	0.003	0.708	0.058	0.649	0.148	0.704	0.010	0.638	0.088	0.649	0.192	0.676	0.067
178	0.807	0.002	0.811	0.001	0.819	0.002	0.700	0.001	0.677	0.004	0.704	0.009	0.683	0.007	0.652	0.010	0.676	0.074
179	0.816	0.001	0.816	0.001	0.819	0.002	0.688	0.001	0.662	0.023	0.704	0.013	0.642	0.105	0.672	0.004	0.676	0.067
180	0.823	0.001	0.794	0.001	0.819	0.003	0.684	0.008	0.672	0.011	0.704	0.008	0.657	0.148	0.697	0.002	0.676	0.072
181	0.832	0.001	0.796	0.001	0.819	0.002	0.659	0.009	0.674	0.013	0.704	0.005	0.604	0.251	0.649	0.005	0.676	0.080
182	0.812	0.001	0.813	0.001	0.819	0.002	0.662	0.357	0.633	0.267	0.704	0.005	0.688	0.004	0.676	0.021	0.676	0.080
183	0.835	0.001	0.780	0.001	0.819	0.004	0.679	0.007	0.681	0.001	0.704	0.013	0.645	0.035	0.668	0.009	0.676	0.071
184	0.813	0.001	0.789	0.001	0.819	0.001	0.648	0.391	0.662	0.005	0.704	0.012	0.667	0.020	0.641	0.216	0.676	0.065
185	0.841	0.001	0.807	0.001	0.819	0.001	0.674	0.112	0.659	0.177	0.704	0.009	0.655	0.093	0.693	0.002	0.676	0.056
186	0.843	0.001	0.793	0.001	0.819	0.001	0.664	0.134	0.672	0.012	0.704	0.007	0.682	0.031	0.683	0.006	0.676	0.063
187	0.816	0.001	0.821	0.001	0.819	0.002	0.703	0.001	0.669	0.016	0.704	0.009	0.675	0.026	0.622	0.309	0.676	0.065
188	0.813	0.006	0.812	0.001	0.819	0.004	0.716	0.011	0.654	0.003	0.704	0.011	0.654	0.535	0.625	0.208	0.676	0.061
189	0.836	0.001	0.795	0.014	0.819	0.003	0.656	0.015	0.657	0.028	0.704	0.009	0.702	0.006	0.696	0.001	0.676	0.080
190	0.825	0.001	0.824	0.001	0.819	0.001	0.680	0.018	0.663	0.001	0.704	0.012	0.671	0.001	0.654	0.145	0.676	0.066
191	0.825	0.001	0.807	0.001	0.819	0.002	0.709	0.001	0.690	0.002	0.704	0.003	0.693	0.003	0.677	0.003	0.676	0.064
192	0.804	0.001	0.837	0.001	0.819	0.002	0.686	0.116	0.697	0.009	0.704	0.008	0.661	0.201	0.676	0.003	0.676	0.067

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
193	0.794	0.006	0.824	0.001	0.819	0.003	0.667	0.030	0.678	0.016	0.704	0.016	0.646	0.078	0.626	0.080	0.676	0.060
194	0.852	0.001	0.815	0.001	0.819	0.002	0.662	0.012	0.666	0.048	0.704	0.006	0.694	0.001	0.638	0.100	0.676	0.059
195	0.818	0.001	0.806	0.001	0.819	0.001	0.658	0.254	0.673	0.056	0.704	0.011	0.676	0.003	0.647	0.070	0.676	0.054
196	0.806	0.001	0.807	0.001	0.819	0.002	0.691	0.055	0.638	0.496	0.704	0.011	0.695	0.003	0.684	0.006	0.676	0.070
197	0.821	0.001	0.821	0.001	0.819	0.002	0.674	0.016	0.681	0.006	0.704	0.008	0.665	0.041	0.684	0.002	0.676	0.073
198	0.814	0.006	0.823	0.001	0.819	0.002	0.685	0.003	0.691	0.002	0.704	0.007	0.708	0.001	0.662	0.008	0.676	0.077
199	0.841	0.001	0.815	0.001	0.819	0.003	0.677	0.007	0.663	0.032	0.704	0.013	0.696	0.029	0.628	0.294	0.676	0.072
200	0.845	0.001	0.831	0.001	0.819	0.002	0.693	0.027	0.678	0.009	0.704	0.012	0.692	0.004	0.674	0.001	0.676	0.063
201	0.827	0.001	0.840	0.001	0.819	0.001	0.677	0.006	0.679	0.003	0.704	0.013	0.663	0.142	0.653	0.035	0.676	0.061
202	0.832	0.001	0.787	0.002	0.819	0.002	0.669	0.002	0.665	0.047	0.704	0.012	0.722	0.001	0.647	0.005	0.676	0.069
203	0.838	0.001	0.796	0.001	0.819	0.002	0.695	0.001	0.653	0.150	0.704	0.009	0.690	0.003	0.634	0.050	0.676	0.063
204	0.838	0.001	0.830	0.001	0.819	0.001	0.682	0.051	0.645	0.044	0.704	0.008	0.666	0.066	0.639	0.071	0.676	0.064
205	0.824	0.001	0.806	0.001	0.819	0.001	0.673	0.005	0.672	0.003	0.704	0.006	0.722	0.001	0.635	0.031	0.676	0.058
206	0.825	0.001	0.795	0.001	0.819	0.002	0.686	0.002	0.704	0.001	0.704	0.009	0.611	0.594	0.671	0.037	0.676	0.061
207	0.824	0.001	0.819	0.001	0.819	0.003	0.705	0.008	0.692	0.001	0.704	0.010	0.642	0.121	0.646	0.103	0.676	0.071
208	0.813	0.001	0.795	0.001	0.819	0.001	0.686	0.006	0.680	0.019	0.704	0.008	0.673	0.081	0.656	0.080	0.676	0.077
209	0.807	0.007	0.803	0.001	0.819	0.001	0.733	0.001	0.699	0.002	0.704	0.008	0.635	0.409	0.660	0.019	0.676	0.064
210	0.832	0.001	0.818	0.001	0.819	0.001	0.696	0.005	0.666	0.004	0.704	0.009	0.687	0.004	0.644	0.031	0.676	0.069
211	0.831	0.001	0.814	0.001	0.819	0.002	0.679	0.048	0.691	0.005	0.704	0.008	0.663	0.007	0.675	0.013	0.676	0.077
212	0.839	0.001	0.828	0.001	0.819	0.002	0.696	0.001	0.668	0.006	0.704	0.009	0.678	0.001	0.637	0.046	0.676	0.064
213	0.819	0.001	0.836	0.001	0.819	0.001	0.705	0.002	0.691	0.001	0.704	0.008	0.706	0.001	0.673	0.010	0.676	0.062
214	0.823	0.001	0.831	0.001	0.819	0.002	0.709	0.008	0.654	0.038	0.704	0.013	0.622	0.723	0.660	0.038	0.676	0.073
215	0.829	0.001	0.844	0.001	0.819	0.003	0.709	0.002	0.673	0.034	0.704	0.009	0.674	0.019	0.657	0.041	0.676	0.053
216	0.824	0.004	0.816	0.001	0.819	0.001	0.663	0.041	0.687	0.002	0.704	0.005	0.645	0.033	0.662	0.039	0.676	0.074
217	0.839	0.001	0.837	0.001	0.819	0.002	0.686	0.004	0.681	0.001	0.704	0.011	0.712	0.001	0.678	0.007	0.676	0.066
218	0.831	0.001	0.829	0.001	0.819	0.001	0.675	0.009	0.667	0.046	0.704	0.010	0.614	0.243	0.627	0.087	0.676	0.068
219	0.824	0.001	0.799	0.001	0.819	0.001	0.665	0.053	0.666	0.121	0.704	0.005	0.678	0.021	0.646	0.024	0.676	0.061
220	0.842	0.001	0.818	0.001	0.819	0.001	0.689	0.025	0.680	0.003	0.704	0.014	0.680	0.004	0.663	0.008	0.676	0.074

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
221	0.797	0.001	0.821	0.001	0.819	0.002	0.660	0.040	0.660	0.028	0.704	0.008	0.686	0.152	0.655	0.228	0.676	0.070
222	0.835	0.001	0.804	0.001	0.819	0.001	0.715	0.001	0.662	0.023	0.704	0.007	0.688	0.025	0.668	0.010	0.676	0.050
223	0.799	0.002	0.793	0.001	0.819	0.002	0.663	0.030	0.653	0.046	0.704	0.009	0.678	0.094	0.679	0.001	0.676	0.064
224	0.828	0.001	0.801	0.001	0.819	0.001	0.686	0.003	0.684	0.001	0.704	0.010	0.679	0.016	0.645	0.084	0.676	0.064
225	0.831	0.001	0.811	0.001	0.819	0.001	0.689	0.002	0.680	0.002	0.704	0.009	0.660	0.012	0.648	0.015	0.676	0.063
226	0.829	0.001	0.817	0.001	0.819	0.003	0.666	0.039	0.663	0.007	0.704	0.013	0.690	0.005	0.687	0.003	0.676	0.069
227	0.844	0.001	0.807	0.001	0.819	0.002	0.711	0.001	0.681	0.006	0.704	0.006	0.648	0.229	0.674	0.013	0.676	0.069
228	0.816	0.003	0.795	0.001	0.819	0.001	0.682	0.022	0.669	0.115	0.704	0.007	0.702	0.001	0.653	0.118	0.676	0.074
229	0.851	0.001	0.810	0.001	0.819	0.004	0.680	0.169	0.659	0.008	0.704	0.009	0.662	0.030	0.635	0.015	0.676	0.061
230	0.836	0.001	0.810	0.001	0.819	0.002	0.657	0.021	0.661	0.088	0.704	0.014	0.679	0.118	0.662	0.009	0.676	0.061
231	0.801	0.001	0.807	0.002	0.819	0.001	0.689	0.030	0.656	0.420	0.704	0.014	0.683	0.083	0.685	0.003	0.676	0.069
232	0.811	0.002	0.807	0.001	0.819	0.001	0.666	0.037	0.703	0.001	0.704	0.009	0.696	0.009	0.652	0.045	0.676	0.063
233	0.832	0.001	0.810	0.001	0.819	0.002	0.674	0.192	0.698	0.001	0.704	0.009	0.657	0.082	0.670	0.028	0.676	0.071
234	0.827	0.001	0.815	0.001	0.819	0.003	0.701	0.009	0.655	0.005	0.704	0.011	0.651	0.153	0.633	0.116	0.676	0.051
235	0.837	0.001	0.802	0.001	0.819	0.002	0.697	0.003	0.689	0.001	0.704	0.014	0.694	0.002	0.685	0.007	0.676	0.065
236	0.822	0.001	0.783	0.001	0.819	0.004	0.679	0.003	0.689	0.008	0.704	0.011	0.693	0.002	0.633	0.115	0.676	0.063
237	0.815	0.001	0.794	0.001	0.819	0.001	0.704	0.001	0.678	0.009	0.704	0.012	0.678	0.011	0.696	0.005	0.676	0.066
238	0.827	0.001	0.826	0.001	0.819	0.001	0.683	0.011	0.693	0.001	0.704	0.010	0.653	0.338	0.624	0.326	0.676	0.071
239	0.849	0.001	0.819	0.001	0.819	0.001	0.689	0.001	0.642	0.444	0.704	0.007	0.644	0.008	0.652	0.016	0.676	0.067
240	0.836	0.001	0.767	0.001	0.819	0.002	0.641	0.116	0.671	0.018	0.704	0.009	0.659	0.171	0.635	0.074	0.676	0.055
241	0.831	0.001	0.811	0.001	0.819	0.002	0.690	0.002	0.675	0.003	0.704	0.007	0.662	0.002	0.686	0.004	0.676	0.067
242	0.816	0.002	0.819	0.001	0.819	0.001	0.688	0.019	0.668	0.005	0.704	0.008	0.653	0.072	0.671	0.004	0.676	0.058
243	0.848	0.001	0.808	0.001	0.819	0.003	0.675	0.011	0.680	0.055	0.704	0.012	0.664	0.020	0.648	0.015	0.676	0.077
244	0.841	0.001	0.831	0.001	0.819	0.002	0.673	0.074	0.696	0.001	0.704	0.010	0.717	0.001	0.670	0.014	0.676	0.071
245	0.816	0.001	0.797	0.001	0.819	0.001	0.680	0.071	0.661	0.014	0.704	0.008	0.697	0.001	0.643	0.123	0.676	0.081
246	0.804	0.001	0.810	0.001	0.819	0.002	0.680	0.025	0.652	0.071	0.704	0.006	0.689	0.002	0.691	0.001	0.676	0.065
247	0.826	0.001	0.804	0.001	0.819	0.001	0.670	0.019	0.698	0.001	0.704	0.006	0.672	0.002	0.690	0.001	0.676	0.063
248	0.830	0.001	0.821	0.001	0.819	0.002	0.671	0.018	0.649	0.183	0.704	0.012	0.642	0.194	0.692	0.002	0.676	0.055

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
249	0.823	0.001	0.818	0.001	0.819	0.001	0.681	0.046	0.664	0.029	0.704	0.008	0.685	0.003	0.618	0.530	0.676	0.073
250	0.842	0.001	0.818	0.001	0.819	0.003	0.656	0.005	0.674	0.001	0.704	0.007	0.658	0.007	0.686	0.001	0.676	0.061
251	0.823	0.001	0.818	0.001	0.819	0.002	0.685	0.006	0.668	0.018	0.704	0.009	0.646	0.067	0.657	0.013	0.676	0.059
252	0.838	0.001	0.787	0.001	0.819	0.002	0.663	0.174	0.659	0.008	0.704	0.009	0.648	0.111	0.657	0.037	0.676	0.078
253	0.813	0.001	0.811	0.001	0.819	0.002	0.694	0.009	0.657	0.043	0.704	0.009	0.683	0.040	0.703	0.003	0.676	0.074
254	0.814	0.002	0.817	0.001	0.819	0.002	0.680	0.012	0.669	0.010	0.704	0.007	0.697	0.001	0.670	0.001	0.676	0.064
255	0.813	0.001	0.814	0.001	0.819	0.002	0.712	0.001	0.671	0.126	0.704	0.008	0.659	0.033	0.658	0.010	0.676	0.065
256	0.833	0.002	0.805	0.001	0.819	0.001	0.702	0.001	0.650	0.508	0.704	0.008	0.695	0.011	0.702	0.001	0.676	0.075
257	0.826	0.001	0.823	0.001	0.819	0.001	0.674	0.028	0.661	0.044	0.704	0.006	0.671	0.028	0.639	0.129	0.676	0.073
258	0.830	0.001	0.785	0.001	0.819	0.003	0.685	0.042	0.674	0.002	0.704	0.009	0.675	0.032	0.684	0.001	0.676	0.058
259	0.827	0.001	0.806	0.002	0.819	0.001	0.670	0.261	0.687	0.009	0.704	0.008	0.676	0.009	0.682	0.003	0.676	0.060
260	0.846	0.001	0.823	0.001	0.819	0.002	0.710	0.001	0.675	0.030	0.704	0.013	0.641	0.062	0.681	0.009	0.676	0.065
261	0.839	0.001	0.811	0.001	0.819	0.001	0.709	0.002	0.656	0.075	0.704	0.011	0.676	0.002	0.656	0.035	0.676	0.066
262	0.837	0.001	0.825	0.001	0.819	0.001	0.656	0.100	0.682	0.001	0.704	0.012	0.679	0.001	0.630	0.224	0.676	0.078
263	0.837	0.001	0.790	0.001	0.819	0.001	0.701	0.001	0.676	0.003	0.704	0.009	0.643	0.215	0.677	0.006	0.676	0.069
264	0.825	0.001	0.803	0.001	0.819	0.001	0.698	0.154	0.682	0.002	0.704	0.009	0.685	0.004	0.659	0.008	0.676	0.071
265	0.821	0.001	0.800	0.001	0.819	0.001	0.666	0.018	0.663	0.026	0.704	0.009	0.657	0.015	0.655	0.065	0.676	0.063
266	0.836	0.001	0.796	0.001	0.819	0.001	0.708	0.001	0.684	0.010	0.704	0.010	0.666	0.068	0.685	0.004	0.676	0.069
267	0.840	0.001	0.801	0.001	0.819	0.001	0.691	0.001	0.667	0.072	0.704	0.014	0.677	0.016	0.663	0.055	0.676	0.071
268	0.817	0.001	0.816	0.001	0.819	0.001	0.662	0.018	0.656	0.011	0.704	0.012	0.680	0.007	0.683	0.004	0.676	0.061
269	0.819	0.001	0.790	0.004	0.819	0.001	0.714	0.001	0.690	0.006	0.704	0.005	0.718	0.001	0.653	0.026	0.676	0.053
270	0.835	0.001	0.832	0.001	0.819	0.002	0.698	0.072	0.663	0.128	0.704	0.005	0.650	0.115	0.644	0.011	0.676	0.070
271	0.828	0.001	0.826	0.001	0.819	0.004	0.677	0.001	0.659	0.021	0.704	0.008	0.681	0.012	0.679	0.006	0.676	0.061
272	0.823	0.001	0.825	0.001	0.819	0.001	0.732	0.001	0.662	0.186	0.704	0.011	0.695	0.006	0.660	0.011	0.676	0.056
273	0.810	0.001	0.805	0.001	0.819	0.001	0.684	0.014	0.660	0.038	0.704	0.006	0.680	0.095	0.663	0.005	0.676	0.066
274	0.817	0.001	0.808	0.001	0.819	0.002	0.675	0.002	0.662	0.014	0.704	0.009	0.659	0.078	0.626	0.119	0.676	0.084
275	0.813	0.001	0.793	0.001	0.819	0.002	0.677	0.004	0.669	0.018	0.704	0.009	0.689	0.001	0.653	0.090	0.676	0.076
276	0.804	0.002	0.806	0.001	0.819	0.002	0.711	0.003	0.656	0.023	0.704	0.008	0.641	0.213	0.662	0.014	0.676	0.067

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
277	0.832	0.001	0.813	0.001	0.819	0.002	0.679	0.045	0.673	0.014	0.704	0.010	0.662	0.033	0.677	0.010	0.676	0.060
278	0.832	0.001	0.845	0.001	0.819	0.001	0.717	0.001	0.666	0.019	0.704	0.009	0.692	0.004	0.688	0.004	0.676	0.059
279	0.801	0.001	0.812	0.001	0.819	0.003	0.691	0.003	0.702	0.001	0.704	0.009	0.669	0.029	0.663	0.049	0.676	0.075
280	0.830	0.001	0.833	0.001	0.819	0.001	0.683	0.097	0.668	0.001	0.704	0.007	0.668	0.022	0.681	0.022	0.676	0.079
281	0.832	0.001	0.841	0.001	0.819	0.003	0.651	0.012	0.664	0.022	0.704	0.014	0.678	0.053	0.714	0.001	0.676	0.065
282	0.833	0.001	0.819	0.001	0.819	0.001	0.691	0.026	0.669	0.006	0.704	0.010	0.695	0.002	0.657	0.102	0.676	0.073
283	0.799	0.001	0.802	0.001	0.819	0.001	0.681	0.001	0.662	0.046	0.704	0.009	0.661	0.072	0.649	0.017	0.676	0.071
284	0.818	0.001	0.823	0.001	0.819	0.001	0.690	0.042	0.675	0.041	0.704	0.004	0.707	0.001	0.640	0.042	0.676	0.056
285	0.836	0.001	0.798	0.001	0.819	0.001	0.659	0.177	0.668	0.004	0.704	0.006	0.644	0.014	0.710	0.002	0.676	0.070
286	0.829	0.001	0.820	0.001	0.819	0.001	0.673	0.018	0.636	0.191	0.704	0.011	0.679	0.004	0.671	0.016	0.676	0.061
287	0.818	0.001	0.812	0.001	0.819	0.001	0.708	0.003	0.693	0.001	0.704	0.011	0.668	0.010	0.649	0.064	0.676	0.071
288	0.831	0.001	0.812	0.001	0.819	0.002	0.673	0.028	0.700	0.002	0.704	0.007	0.662	0.195	0.697	0.001	0.676	0.057
289	0.824	0.001	0.829	0.001	0.819	0.002	0.672	0.024	0.653	0.305	0.704	0.013	0.697	0.103	0.676	0.012	0.676	0.073
290	0.827	0.001	0.798	0.001	0.819	0.001	0.695	0.002	0.684	0.019	0.704	0.007	0.605	0.350	0.653	0.045	0.676	0.061
291	0.791	0.002	0.839	0.001	0.819	0.001	0.707	0.001	0.678	0.017	0.704	0.013	0.681	0.003	0.634	0.093	0.676	0.067
292	0.828	0.001	0.810	0.001	0.819	0.001	0.683	0.002	0.636	0.026	0.704	0.009	0.650	0.015	0.675	0.001	0.676	0.076
293	0.822	0.001	0.811	0.001	0.819	0.001	0.695	0.001	0.663	0.085	0.704	0.005	0.668	0.027	0.646	0.030	0.676	0.083
294	0.809	0.001	0.803	0.001	0.819	0.001	0.679	0.007	0.664	0.035	0.704	0.007	0.649	0.094	0.635	0.163	0.676	0.064
295	0.824	0.001	0.824	0.001	0.819	0.001	0.697	0.003	0.653	0.075	0.704	0.017	0.641	0.086	0.668	0.001	0.676	0.063
296	0.829	0.001	0.840	0.001	0.819	0.001	0.664	0.020	0.682	0.002	0.704	0.006	0.723	0.001	0.667	0.006	0.676	0.065
297	0.804	0.001	0.783	0.002	0.819	0.003	0.725	0.001	0.667	0.030	0.704	0.008	0.645	0.206	0.637	0.047	0.676	0.065
298	0.812	0.001	0.816	0.001	0.819	0.001	0.695	0.001	0.682	0.008	0.704	0.012	0.652	0.012	0.700	0.001	0.676	0.062
299	0.832	0.001	0.809	0.001	0.819	0.002	0.686	0.001	0.689	0.001	0.704	0.005	0.698	0.001	0.681	0.001	0.676	0.079
300	0.836	0.001	0.798	0.001	0.819	0.001	0.693	0.001	0.654	0.181	0.704	0.013	0.700	0.012	0.653	0.015	0.676	0.082
301	0.793	0.001	0.802	0.001	0.819	0.001	0.698	0.002	0.682	0.001	0.704	0.013	0.667	0.321	0.665	0.008	0.676	0.076
302	0.842	0.001	0.817	0.001	0.819	0.003	0.660	0.456	0.673	0.001	0.704	0.006	0.631	0.183	0.653	0.041	0.676	0.060
303	0.870	0.001	0.798	0.001	0.819	0.001	0.654	0.044	0.677	0.002	0.704	0.009	0.669	0.121	0.695	0.003	0.676	0.075
304	0.830	0.001	0.811	0.001	0.819	0.002	0.669	0.496	0.688	0.001	0.704	0.005	0.674	0.005	0.677	0.012	0.676	0.078

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
305	0.825	0.001	0.814	0.001	0.819	0.004	0.707	0.003	0.671	0.073	0.704	0.008	0.616	0.295	0.667	0.007	0.676	0.075
306	0.826	0.001	0.829	0.001	0.819	0.002	0.670	0.097	0.686	0.003	0.704	0.012	0.689	0.036	0.644	0.042	0.676	0.078
307	0.855	0.001	0.815	0.001	0.819	0.002	0.686	0.002	0.669	0.051	0.704	0.010	0.662	0.005	0.678	0.001	0.676	0.068
308	0.843	0.001	0.808	0.001	0.819	0.002	0.634	0.307	0.686	0.001	0.704	0.006	0.599	0.629	0.683	0.003	0.676	0.083
309	0.828	0.001	0.823	0.001	0.819	0.001	0.676	0.079	0.662	0.070	0.704	0.006	0.632	0.083	0.656	0.005	0.676	0.053
310	0.835	0.001	0.831	0.001	0.819	0.002	0.666	0.056	0.683	0.002	0.704	0.010	0.693	0.002	0.633	0.148	0.676	0.067
311	0.822	0.001	0.811	0.001	0.819	0.001	0.687	0.070	0.662	0.247	0.704	0.013	0.732	0.001	0.678	0.002	0.676	0.071
312	0.849	0.001	0.813	0.001	0.819	0.004	0.679	0.021	0.670	0.005	0.704	0.009	0.690	0.001	0.656	0.020	0.676	0.071
313	0.819	0.001	0.805	0.001	0.819	0.002	0.686	0.027	0.655	0.094	0.704	0.008	0.647	0.096	0.639	0.058	0.676	0.055
314	0.823	0.001	0.817	0.001	0.819	0.001	0.672	0.139	0.691	0.006	0.704	0.012	0.656	0.143	0.651	0.229	0.676	0.070
315	0.835	0.001	0.784	0.003	0.819	0.001	0.669	0.007	0.686	0.001	0.704	0.007	0.644	0.075	0.671	0.007	0.676	0.074
316	0.837	0.001	0.827	0.001	0.819	0.003	0.688	0.008	0.655	0.013	0.704	0.007	0.668	0.005	0.657	0.022	0.676	0.054
317	0.824	0.001	0.829	0.001	0.819	0.001	0.670	0.001	0.674	0.001	0.704	0.004	0.698	0.002	0.669	0.003	0.676	0.080
318	0.855	0.001	0.801	0.001	0.819	0.001	0.653	0.141	0.683	0.007	0.704	0.006	0.703	0.001	0.689	0.002	0.676	0.072
319	0.845	0.001	0.822	0.001	0.819	0.002	0.698	0.004	0.672	0.005	0.704	0.012	0.638	0.090	0.635	0.082	0.676	0.075
320	0.798	0.001	0.804	0.001	0.819	0.001	0.647	0.106	0.674	0.017	0.704	0.009	0.681	0.011	0.681	0.005	0.676	0.055
321	0.824	0.001	0.822	0.001	0.819	0.002	0.680	0.009	0.678	0.002	0.704	0.014	0.658	0.027	0.657	0.005	0.676	0.054
322	0.828	0.001	0.807	0.001	0.819	0.002	0.695	0.007	0.678	0.012	0.704	0.010	0.706	0.002	0.669	0.007	0.676	0.066
323	0.807	0.001	0.784	0.001	0.819	0.003	0.674	0.022	0.671	0.006	0.704	0.010	0.654	0.023	0.671	0.002	0.676	0.081
324	0.821	0.001	0.813	0.001	0.819	0.002	0.687	0.028	0.679	0.039	0.704	0.006	0.667	0.299	0.654	0.107	0.676	0.075
325	0.813	0.001	0.807	0.001	0.819	0.002	0.671	0.113	0.689	0.008	0.704	0.011	0.665	0.079	0.673	0.002	0.676	0.078
326	0.846	0.001	0.796	0.004	0.819	0.003	0.720	0.001	0.691	0.002	0.704	0.012	0.675	0.023	0.723	0.001	0.676	0.066
327	0.808	0.002	0.802	0.001	0.819	0.001	0.697	0.003	0.686	0.001	0.704	0.007	0.638	0.553	0.634	0.152	0.676	0.072
328	0.829	0.001	0.780	0.004	0.819	0.001	0.642	0.200	0.669	0.002	0.704	0.016	0.673	0.003	0.588	0.392	0.676	0.060
329	0.821	0.001	0.818	0.001	0.819	0.001	0.697	0.009	0.646	0.133	0.704	0.010	0.689	0.014	0.666	0.003	0.676	0.066
330	0.822	0.001	0.823	0.001	0.819	0.001	0.667	0.078	0.648	0.095	0.704	0.009	0.651	0.037	0.648	0.053	0.676	0.053
331	0.814	0.001	0.820	0.001	0.819	0.001	0.652	0.004	0.651	0.006	0.704	0.010	0.688	0.142	0.663	0.003	0.676	0.063
332	0.827	0.001	0.800	0.001	0.819	0.002	0.680	0.004	0.653	0.114	0.704	0.011	0.650	0.292	0.639	0.012	0.676	0.064

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
333	0.826	0.002	0.816	0.001	0.819	0.001	0.654	0.038	0.680	0.006	0.704	0.008	0.693	0.003	0.649	0.067	0.676	0.077
334	0.812	0.001	0.820	0.001	0.819	0.001	0.687	0.007	0.673	0.004	0.704	0.010	0.676	0.042	0.662	0.019	0.676	0.060
335	0.819	0.001	0.814	0.001	0.819	0.003	0.671	0.009	0.665	0.008	0.704	0.009	0.673	0.005	0.657	0.126	0.676	0.065
336	0.824	0.001	0.808	0.001	0.819	0.001	0.700	0.001	0.686	0.002	0.704	0.010	0.654	0.273	0.688	0.002	0.676	0.069
337	0.825	0.001	0.827	0.001	0.819	0.001	0.697	0.001	0.669	0.006	0.704	0.005	0.666	0.079	0.644	0.057	0.676	0.061
338	0.803	0.004	0.815	0.001	0.819	0.002	0.675	0.037	0.650	0.097	0.704	0.012	0.645	0.015	0.626	0.130	0.676	0.052
339	0.811	0.001	0.773	0.001	0.819	0.003	0.684	0.001	0.655	0.025	0.704	0.013	0.694	0.006	0.642	0.010	0.676	0.075
340	0.818	0.001	0.823	0.001	0.819	0.004	0.709	0.001	0.671	0.005	0.704	0.010	0.704	0.001	0.700	0.001	0.676	0.069
341	0.846	0.001	0.803	0.001	0.819	0.003	0.679	0.004	0.660	0.231	0.704	0.012	0.629	0.526	0.649	0.032	0.676	0.069
342	0.827	0.001	0.799	0.001	0.819	0.002	0.674	0.021	0.701	0.001	0.704	0.009	0.656	0.008	0.652	0.007	0.676	0.078
343	0.823	0.001	0.820	0.001	0.819	0.001	0.665	0.083	0.652	0.082	0.704	0.012	0.624	0.896	0.622	0.299	0.676	0.063
344	0.822	0.001	0.815	0.002	0.819	0.001	0.693	0.007	0.681	0.016	0.704	0.010	0.614	0.378	0.648	0.020	0.676	0.065
345	0.824	0.001	0.819	0.001	0.819	0.001	0.739	0.001	0.682	0.002	0.704	0.017	0.650	0.063	0.638	0.417	0.676	0.064
346	0.805	0.001	0.803	0.001	0.819	0.002	0.668	0.042	0.677	0.001	0.704	0.009	0.679	0.080	0.664	0.028	0.676	0.060
347	0.818	0.001	0.814	0.001	0.819	0.001	0.683	0.021	0.671	0.006	0.704	0.009	0.652	0.253	0.647	0.011	0.676	0.063
348	0.827	0.001	0.842	0.001	0.819	0.001	0.650	0.012	0.701	0.002	0.704	0.013	0.681	0.090	0.643	0.054	0.676	0.070
349	0.837	0.001	0.811	0.001	0.819	0.001	0.669	0.090	0.687	0.001	0.704	0.005	0.644	0.217	0.645	0.021	0.676	0.066
350	0.850	0.001	0.810	0.001	0.819	0.002	0.679	0.006	0.689	0.015	0.704	0.007	0.685	0.033	0.641	0.066	0.676	0.071
351	0.820	0.001	0.813	0.001	0.819	0.004	0.704	0.001	0.663	0.042	0.704	0.007	0.635	0.357	0.672	0.002	0.676	0.066
352	0.810	0.002	0.800	0.001	0.819	0.001	0.650	0.426	0.689	0.058	0.704	0.007	0.669	0.008	0.648	0.010	0.676	0.070
353	0.826	0.001	0.810	0.001	0.819	0.002	0.698	0.007	0.676	0.001	0.704	0.004	0.646	0.027	0.648	0.013	0.676	0.047
354	0.820	0.001	0.829	0.001	0.819	0.002	0.682	0.003	0.684	0.001	0.704	0.012	0.679	0.027	0.683	0.006	0.676	0.070
355	0.815	0.001	0.839	0.001	0.819	0.001	0.678	0.010	0.699	0.001	0.704	0.008	0.644	0.062	0.648	0.096	0.676	0.067
356	0.801	0.004	0.816	0.001	0.819	0.002	0.694	0.017	0.666	0.062	0.704	0.008	0.683	0.002	0.653	0.018	0.676	0.054
357	0.815	0.001	0.808	0.001	0.819	0.003	0.677	0.023	0.687	0.004	0.704	0.009	0.615	0.409	0.636	0.079	0.676	0.072
358	0.814	0.001	0.820	0.001	0.819	0.003	0.678	0.168	0.699	0.001	0.704	0.009	0.681	0.004	0.615	0.382	0.676	0.066
359	0.813	0.001	0.814	0.001	0.819	0.002	0.658	0.059	0.692	0.003	0.704	0.008	0.701	0.007	0.674	0.004	0.676	0.072
360	0.828	0.001	0.822	0.001	0.819	0.001	0.689	0.016	0.686	0.002	0.704	0.008	0.672	0.008	0.655	0.084	0.676	0.068

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
361	0.811	0.001	0.839	0.001	0.819	0.001	0.717	0.004	0.696	0.001	0.704	0.007	0.604	0.234	0.642	0.088	0.676	0.065
362	0.817	0.001	0.809	0.001	0.819	0.001	0.709	0.001	0.649	0.031	0.704	0.012	0.643	0.047	0.668	0.008	0.676	0.063
363	0.821	0.001	0.804	0.001	0.819	0.001	0.687	0.069	0.671	0.018	0.704	0.007	0.690	0.020	0.643	0.029	0.676	0.074
364	0.832	0.001	0.811	0.001	0.819	0.001	0.648	0.054	0.673	0.004	0.704	0.012	0.703	0.008	0.647	0.038	0.676	0.064
365	0.824	0.001	0.802	0.001	0.819	0.004	0.696	0.018	0.699	0.003	0.704	0.016	0.655	0.032	0.678	0.007	0.676	0.077
366	0.824	0.001	0.845	0.001	0.819	0.001	0.663	0.576	0.647	0.005	0.704	0.008	0.670	0.079	0.674	0.008	0.676	0.055
367	0.821	0.001	0.817	0.001	0.819	0.003	0.715	0.001	0.685	0.002	0.704	0.012	0.690	0.020	0.640	0.058	0.676	0.080
368	0.796	0.001	0.832	0.001	0.819	0.001	0.691	0.031	0.663	0.006	0.704	0.009	0.676	0.039	0.682	0.008	0.676	0.078
369	0.834	0.001	0.829	0.001	0.819	0.001	0.687	0.005	0.665	0.265	0.704	0.012	0.673	0.021	0.668	0.008	0.676	0.074
370	0.820	0.001	0.823	0.001	0.819	0.001	0.685	0.006	0.667	0.032	0.704	0.009	0.659	0.074	0.651	0.127	0.676	0.070
371	0.821	0.001	0.808	0.001	0.819	0.002	0.670	0.005	0.666	0.023	0.704	0.009	0.696	0.009	0.667	0.008	0.676	0.060
372	0.832	0.001	0.808	0.001	0.819	0.002	0.698	0.012	0.684	0.002	0.704	0.008	0.674	0.003	0.667	0.002	0.676	0.070
373	0.838	0.001	0.826	0.001	0.819	0.003	0.708	0.001	0.680	0.005	0.704	0.015	0.684	0.005	0.702	0.003	0.676	0.060
374	0.837	0.001	0.837	0.001	0.819	0.001	0.716	0.001	0.678	0.002	0.704	0.011	0.683	0.018	0.662	0.018	0.676	0.067
375	0.830	0.001	0.817	0.001	0.819	0.001	0.674	0.017	0.667	0.045	0.704	0.009	0.671	0.006	0.633	0.032	0.676	0.063
376	0.792	0.008	0.816	0.001	0.819	0.002	0.684	0.017	0.660	0.017	0.704	0.004	0.685	0.010	0.645	0.028	0.676	0.071
377	0.835	0.001	0.810	0.001	0.819	0.003	0.679	0.016	0.663	0.008	0.704	0.013	0.696	0.003	0.696	0.001	0.676	0.057
378	0.829	0.005	0.804	0.001	0.819	0.001	0.678	0.004	0.680	0.001	0.704	0.011	0.664	0.106	0.665	0.024	0.676	0.071
379	0.845	0.001	0.788	0.001	0.819	0.003	0.684	0.002	0.681	0.001	0.704	0.008	0.629	0.451	0.660	0.002	0.676	0.070
380	0.827	0.001	0.834	0.001	0.819	0.002	0.674	0.045	0.687	0.016	0.704	0.016	0.670	0.013	0.676	0.001	0.676	0.068
381	0.849	0.001	0.838	0.001	0.819	0.001	0.668	0.076	0.667	0.035	0.704	0.013	0.663	0.016	0.685	0.004	0.676	0.076
382	0.817	0.001	0.801	0.001	0.819	0.001	0.714	0.001	0.647	0.499	0.704	0.007	0.650	0.348	0.669	0.004	0.676	0.047
383	0.807	0.001	0.819	0.001	0.819	0.002	0.683	0.004	0.654	0.018	0.704	0.005	0.678	0.062	0.672	0.063	0.676	0.074
384	0.811	0.001	0.823	0.001	0.819	0.003	0.690	0.001	0.665	0.003	0.704	0.011	0.659	0.009	0.653	0.045	0.676	0.080
385	0.805	0.002	0.789	0.001	0.819	0.002	0.676	0.005	0.661	0.009	0.704	0.008	0.676	0.024	0.695	0.002	0.676	0.056
386	0.805	0.001	0.800	0.001	0.819	0.002	0.696	0.019	0.663	0.013	0.704	0.007	0.657	0.013	0.641	0.099	0.676	0.072
387	0.852	0.001	0.831	0.001	0.819	0.002	0.659	0.035	0.699	0.001	0.704	0.010	0.642	0.113	0.622	0.070	0.676	0.056
388	0.828	0.001	0.832	0.001	0.819	0.003	0.672	0.035	0.680	0.004	0.704	0.011	0.631	0.285	0.664	0.006	0.676	0.062

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
389	0.825	0.001	0.811	0.001	0.819	0.001	0.705	0.001	0.638	0.120	0.704	0.013	0.695	0.016	0.639	0.009	0.676	0.073
390	0.836	0.001	0.800	0.001	0.819	0.001	0.667	0.031	0.668	0.030	0.704	0.010	0.665	0.017	0.632	0.093	0.676	0.063
391	0.802	0.017	0.780	0.002	0.819	0.001	0.669	0.145	0.641	0.061	0.704	0.010	0.675	0.011	0.623	0.182	0.676	0.079
392	0.805	0.001	0.817	0.001	0.819	0.002	0.671	0.350	0.657	0.023	0.704	0.006	0.685	0.005	0.649	0.045	0.676	0.063
393	0.828	0.001	0.813	0.001	0.819	0.001	0.707	0.001	0.674	0.003	0.704	0.005	0.662	0.017	0.651	0.035	0.676	0.064
394	0.811	0.001	0.802	0.001	0.819	0.004	0.651	0.159	0.682	0.036	0.704	0.011	0.665	0.050	0.689	0.001	0.676	0.067
395	0.815	0.001	0.802	0.001	0.819	0.001	0.704	0.001	0.688	0.001	0.704	0.010	0.720	0.002	0.638	0.040	0.676	0.062
396	0.851	0.001	0.804	0.001	0.819	0.001	0.658	0.008	0.668	0.030	0.704	0.011	0.700	0.001	0.648	0.008	0.676	0.080
397	0.814	0.001	0.806	0.001	0.819	0.003	0.662	0.099	0.657	0.091	0.704	0.008	0.667	0.015	0.647	0.004	0.676	0.073
398	0.831	0.001	0.803	0.001	0.819	0.005	0.688	0.003	0.660	0.038	0.704	0.011	0.690	0.008	0.706	0.001	0.676	0.063
399	0.822	0.001	0.837	0.001	0.819	0.001	0.681	0.001	0.696	0.001	0.704	0.016	0.699	0.002	0.659	0.082	0.676	0.064
400	0.822	0.001	0.803	0.001	0.819	0.003	0.686	0.022	0.682	0.003	0.704	0.009	0.685	0.047	0.654	0.029	0.676	0.067
401	0.817	0.001	0.811	0.001	0.819	0.002	0.660	0.011	0.669	0.016	0.704	0.007	0.687	0.009	0.633	0.173	0.676	0.069
402	0.807	0.001	0.814	0.001	0.819	0.002	0.691	0.001	0.662	0.138	0.704	0.012	0.639	0.168	0.667	0.011	0.676	0.075
403	0.812	0.001	0.824	0.001	0.819	0.003	0.703	0.001	0.689	0.001	0.704	0.007	0.665	0.036	0.688	0.005	0.676	0.059
404	0.807	0.001	0.801	0.001	0.819	0.001	0.667	0.023	0.676	0.034	0.704	0.007	0.671	0.003	0.639	0.067	0.676	0.061
405	0.830	0.001	0.812	0.001	0.819	0.002	0.665	0.048	0.651	0.323	0.704	0.013	0.688	0.005	0.664	0.011	0.676	0.078
406	0.786	0.008	0.817	0.001	0.819	0.002	0.674	0.001	0.650	0.116	0.704	0.006	0.663	0.052	0.664	0.168	0.676	0.045
407	0.816	0.001	0.819	0.001	0.819	0.003	0.679	0.003	0.677	0.007	0.704	0.011	0.660	0.018	0.655	0.053	0.676	0.060
408	0.818	0.001	0.839	0.001	0.819	0.002	0.697	0.014	0.657	0.065	0.704	0.010	0.680	0.014	0.670	0.031	0.676	0.055
409	0.842	0.001	0.804	0.001	0.819	0.001	0.678	0.029	0.657	0.065	0.704	0.011	0.706	0.001	0.677	0.029	0.676	0.068
410	0.830	0.001	0.811	0.001	0.819	0.001	0.687	0.004	0.679	0.001	0.704	0.013	0.698	0.004	0.708	0.002	0.676	0.072
411	0.850	0.001	0.833	0.001	0.819	0.002	0.709	0.001	0.703	0.001	0.704	0.008	0.668	0.008	0.713	0.001	0.676	0.071
412	0.822	0.001	0.809	0.001	0.819	0.002	0.687	0.016	0.684	0.001	0.704	0.006	0.691	0.003	0.697	0.001	0.676	0.057
413	0.842	0.001	0.795	0.001	0.819	0.001	0.661	0.114	0.663	0.078	0.704	0.007	0.676	0.056	0.655	0.028	0.676	0.070
414	0.825	0.001	0.811	0.001	0.819	0.002	0.672	0.003	0.706	0.002	0.704	0.013	0.684	0.029	0.679	0.001	0.676	0.084
415	0.823	0.001	0.833	0.001	0.819	0.002	0.692	0.015	0.669	0.150	0.704	0.007	0.658	0.064	0.659	0.039	0.676	0.065
416	0.814	0.001	0.826	0.001	0.819	0.001	0.707	0.001	0.650	0.285	0.704	0.012	0.660	0.046	0.638	0.116	0.676	0.056

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
417	0.819	0.001	0.805	0.001	0.819	0.001	0.706	0.001	0.669	0.044	0.704	0.009	0.684	0.002	0.683	0.003	0.676	0.069
418	0.811	0.001	0.831	0.001	0.819	0.002	0.680	0.005	0.685	0.001	0.704	0.006	0.684	0.004	0.661	0.005	0.676	0.082
419	0.831	0.001	0.814	0.001	0.819	0.002	0.702	0.002	0.649	0.006	0.704	0.010	0.606	0.228	0.648	0.006	0.676	0.070
420	0.811	0.001	0.815	0.001	0.819	0.002	0.694	0.004	0.678	0.085	0.704	0.016	0.658	0.175	0.637	0.019	0.676	0.063
421	0.812	0.001	0.833	0.001	0.819	0.001	0.687	0.002	0.657	0.091	0.704	0.006	0.640	0.057	0.683	0.006	0.676	0.065
422	0.836	0.001	0.794	0.001	0.819	0.001	0.709	0.004	0.666	0.002	0.704	0.012	0.672	0.029	0.677	0.008	0.676	0.066
423	0.839	0.001	0.799	0.001	0.819	0.001	0.662	0.055	0.662	0.014	0.704	0.008	0.650	0.071	0.646	0.197	0.676	0.062
424	0.824	0.001	0.812	0.001	0.819	0.002	0.697	0.008	0.674	0.003	0.704	0.013	0.631	0.357	0.646	0.057	0.676	0.070
425	0.834	0.001	0.817	0.001	0.819	0.002	0.680	0.014	0.701	0.002	0.704	0.006	0.679	0.002	0.685	0.003	0.676	0.078
426	0.815	0.001	0.820	0.001	0.819	0.001	0.701	0.004	0.678	0.026	0.704	0.007	0.680	0.005	0.660	0.037	0.676	0.053
427	0.814	0.003	0.831	0.001	0.819	0.001	0.708	0.001	0.663	0.003	0.704	0.008	0.675	0.004	0.667	0.012	0.676	0.070
428	0.835	0.001	0.792	0.001	0.819	0.003	0.691	0.002	0.700	0.002	0.704	0.010	0.670	0.027	0.646	0.176	0.676	0.079
429	0.813	0.002	0.821	0.001	0.819	0.001	0.704	0.001	0.693	0.024	0.704	0.009	0.682	0.009	0.672	0.008	0.676	0.069
430	0.816	0.001	0.818	0.001	0.819	0.002	0.681	0.021	0.699	0.002	0.704	0.015	0.699	0.001	0.636	0.093	0.676	0.063
431	0.809	0.001	0.804	0.001	0.819	0.003	0.692	0.029	0.667	0.034	0.704	0.011	0.654	0.118	0.656	0.013	0.676	0.066
432	0.835	0.001	0.823	0.001	0.819	0.002	0.682	0.003	0.658	0.046	0.704	0.007	0.672	0.002	0.681	0.037	0.676	0.057
433	0.814	0.001	0.830	0.001	0.819	0.002	0.694	0.005	0.711	0.001	0.704	0.008	0.677	0.003	0.652	0.056	0.676	0.058
434	0.806	0.001	0.828	0.001	0.819	0.003	0.692	0.028	0.671	0.002	0.704	0.011	0.665	0.028	0.636	0.059	0.676	0.066
435	0.834	0.001	0.789	0.001	0.819	0.002	0.701	0.001	0.714	0.001	0.704	0.014	0.688	0.007	0.678	0.031	0.676	0.068
436	0.848	0.001	0.812	0.001	0.819	0.001	0.685	0.089	0.640	0.021	0.704	0.005	0.684	0.028	0.656	0.005	0.676	0.060
437	0.793	0.002	0.803	0.001	0.819	0.001	0.671	0.003	0.666	0.020	0.704	0.008	0.681	0.079	0.634	0.046	0.676	0.068
438	0.822	0.001	0.809	0.001	0.819	0.002	0.698	0.055	0.662	0.003	0.704	0.011	0.683	0.072	0.675	0.006	0.676	0.058
439	0.828	0.001	0.797	0.002	0.819	0.003	0.680	0.022	0.693	0.002	0.704	0.018	0.685	0.001	0.640	0.096	0.676	0.071
440	0.830	0.001	0.794	0.001	0.819	0.001	0.690	0.052	0.705	0.003	0.704	0.006	0.636	0.329	0.690	0.002	0.676	0.065
441	0.820	0.001	0.822	0.001	0.819	0.002	0.681	0.005	0.667	0.015	0.704	0.007	0.673	0.005	0.693	0.001	0.676	0.069
442	0.820	0.001	0.833	0.001	0.819	0.002	0.698	0.079	0.664	0.006	0.704	0.008	0.703	0.001	0.686	0.005	0.676	0.064
443	0.807	0.002	0.799	0.001	0.819	0.001	0.706	0.001	0.673	0.006	0.704	0.014	0.718	0.001	0.665	0.003	0.676	0.068
444	0.829	0.001	0.818	0.001	0.819	0.003	0.691	0.026	0.672	0.053	0.704	0.011	0.630	0.043	0.680	0.003	0.676	0.055

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
445	0.811	0.001	0.845	0.001	0.819	0.001	0.647	0.290	0.666	0.028	0.704	0.011	0.629	0.076	0.687	0.004	0.676	0.049
446	0.818	0.001	0.811	0.001	0.819	0.002	0.661	0.298	0.675	0.005	0.704	0.010	0.680	0.008	0.645	0.210	0.676	0.076
447	0.816	0.003	0.821	0.001	0.819	0.003	0.665	0.111	0.687	0.025	0.704	0.006	0.658	0.151	0.677	0.005	0.676	0.058
448	0.838	0.001	0.834	0.001	0.819	0.002	0.692	0.001	0.690	0.003	0.704	0.016	0.703	0.009	0.619	0.157	0.676	0.059
449	0.810	0.002	0.835	0.001	0.819	0.001	0.687	0.071	0.690	0.001	0.704	0.007	0.619	0.783	0.628	0.242	0.676	0.059
450	0.825	0.001	0.812	0.001	0.819	0.003	0.689	0.001	0.675	0.002	0.704	0.008	0.692	0.013	0.651	0.008	0.676	0.061
451	0.825	0.001	0.812	0.001	0.819	0.002	0.697	0.003	0.659	0.074	0.704	0.011	0.667	0.028	0.666	0.005	0.676	0.064
452	0.837	0.001	0.805	0.001	0.819	0.001	0.675	0.011	0.662	0.023	0.704	0.009	0.677	0.010	0.664	0.008	0.676	0.062
453	0.800	0.001	0.809	0.001	0.819	0.001	0.698	0.016	0.671	0.002	0.704	0.014	0.660	0.008	0.650	0.045	0.676	0.061
454	0.848	0.001	0.815	0.001	0.819	0.002	0.691	0.007	0.665	0.009	0.704	0.012	0.641	0.220	0.663	0.064	0.676	0.081
455	0.828	0.001	0.799	0.001	0.819	0.001	0.682	0.068	0.664	0.040	0.704	0.008	0.650	0.046	0.660	0.030	0.676	0.065
456	0.805	0.001	0.821	0.001	0.819	0.002	0.689	0.023	0.645	0.227	0.704	0.011	0.634	0.052	0.685	0.001	0.676	0.059
457	0.820	0.001	0.796	0.001	0.819	0.003	0.696	0.001	0.678	0.016	0.704	0.007	0.697	0.004	0.660	0.019	0.676	0.068
458	0.809	0.007	0.823	0.001	0.819	0.001	0.658	0.006	0.682	0.002	0.704	0.009	0.656	0.128	0.688	0.001	0.676	0.071
459	0.814	0.001	0.808	0.001	0.819	0.003	0.665	0.491	0.678	0.001	0.704	0.007	0.683	0.002	0.650	0.061	0.676	0.074
460	0.811	0.002	0.787	0.001	0.819	0.001	0.693	0.001	0.693	0.004	0.704	0.009	0.668	0.008	0.650	0.016	0.676	0.060
461	0.830	0.001	0.811	0.001	0.819	0.002	0.672	0.009	0.664	0.155	0.704	0.012	0.676	0.093	0.686	0.005	0.676	0.060
462	0.835	0.001	0.825	0.001	0.819	0.002	0.718	0.001	0.687	0.006	0.704	0.010	0.633	0.090	0.653	0.037	0.676	0.065
463	0.811	0.001	0.810	0.001	0.819	0.003	0.666	0.005	0.675	0.007	0.704	0.012	0.622	0.138	0.673	0.001	0.676	0.076
464	0.837	0.001	0.826	0.001	0.819	0.002	0.659	0.072	0.690	0.001	0.704	0.005	0.673	0.007	0.694	0.001	0.676	0.085
465	0.812	0.001	0.775	0.001	0.819	0.003	0.664	0.019	0.693	0.005	0.704	0.007	0.688	0.004	0.668	0.005	0.676	0.072
466	0.825	0.001	0.801	0.001	0.819	0.002	0.676	0.002	0.649	0.087	0.704	0.015	0.639	0.244	0.660	0.014	0.676	0.071
467	0.822	0.001	0.774	0.002	0.819	0.001	0.743	0.001	0.691	0.004	0.704	0.009	0.644	0.069	0.647	0.168	0.676	0.070
468	0.823	0.001	0.804	0.001	0.819	0.001	0.686	0.016	0.645	0.393	0.704	0.009	0.693	0.009	0.659	0.051	0.676	0.062
469	0.824	0.001	0.796	0.001	0.819	0.001	0.695	0.004	0.670	0.032	0.704	0.004	0.616	0.252	0.649	0.033	0.676	0.078
470	0.828	0.001	0.825	0.001	0.819	0.001	0.705	0.003	0.694	0.002	0.704	0.011	0.659	0.016	0.671	0.012	0.676	0.069
471	0.822	0.001	0.805	0.001	0.819	0.001	0.707	0.001	0.660	0.235	0.704	0.011	0.669	0.030	0.663	0.005	0.676	0.054
472	0.829	0.001	0.821	0.001	0.819	0.002	0.690	0.006	0.652	0.036	0.704	0.011	0.701	0.001	0.634	0.058	0.676	0.074

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
473	0.811	0.001	0.807	0.003	0.819	0.002	0.683	0.024	0.675	0.005	0.704	0.007	0.655	0.079	0.644	0.040	0.676	0.068
474	0.810	0.001	0.798	0.001	0.819	0.001	0.668	0.015	0.688	0.001	0.704	0.009	0.665	0.009	0.663	0.011	0.676	0.065
475	0.822	0.001	0.827	0.001	0.819	0.001	0.682	0.021	0.659	0.046	0.704	0.008	0.660	0.055	0.675	0.003	0.676	0.084
476	0.819	0.001	0.804	0.001	0.819	0.001	0.686	0.010	0.656	0.331	0.704	0.007	0.685	0.001	0.659	0.044	0.676	0.054
477	0.809	0.001	0.820	0.001	0.819	0.002	0.684	0.039	0.683	0.008	0.704	0.008	0.668	0.005	0.656	0.010	0.676	0.076
478	0.817	0.001	0.801	0.001	0.819	0.001	0.702	0.009	0.666	0.018	0.704	0.005	0.656	0.006	0.665	0.015	0.676	0.078
479	0.838	0.001	0.797	0.001	0.819	0.001	0.663	0.028	0.667	0.017	0.704	0.013	0.651	0.195	0.656	0.060	0.676	0.054
480	0.835	0.001	0.806	0.001	0.819	0.003	0.710	0.002	0.682	0.001	0.704	0.009	0.644	0.056	0.651	0.028	0.676	0.077
481	0.831	0.001	0.825	0.001	0.819	0.001	0.681	0.003	0.679	0.017	0.704	0.006	0.666	0.135	0.652	0.003	0.676	0.075
482	0.825	0.001	0.815	0.001	0.819	0.001	0.684	0.009	0.670	0.004	0.704	0.010	0.692	0.001	0.668	0.028	0.676	0.068
483	0.853	0.001	0.797	0.001	0.819	0.001	0.679	0.013	0.680	0.001	0.704	0.011	0.670	0.032	0.665	0.039	0.676	0.079
484	0.823	0.001	0.798	0.001	0.819	0.001	0.670	0.073	0.662	0.072	0.704	0.007	0.670	0.016	0.643	0.042	0.676	0.084
485	0.825	0.001	0.821	0.001	0.819	0.003	0.663	0.074	0.686	0.001	0.704	0.009	0.671	0.017	0.665	0.008	0.676	0.070
486	0.844	0.001	0.822	0.001	0.819	0.001	0.722	0.001	0.693	0.001	0.704	0.009	0.649	0.053	0.673	0.010	0.676	0.071
487	0.809	0.002	0.807	0.001	0.819	0.001	0.662	0.034	0.668	0.044	0.704	0.011	0.641	0.246	0.670	0.013	0.676	0.065
488	0.823	0.001	0.789	0.001	0.819	0.002	0.692	0.006	0.662	0.135	0.704	0.007	0.662	0.305	0.713	0.001	0.676	0.060
489	0.822	0.001	0.805	0.001	0.819	0.001	0.685	0.007	0.676	0.011	0.704	0.008	0.678	0.005	0.669	0.027	0.676	0.067
490	0.813	0.001	0.819	0.001	0.819	0.004	0.687	0.003	0.706	0.001	0.704	0.009	0.666	0.018	0.645	0.040	0.676	0.065
491	0.841	0.001	0.810	0.001	0.819	0.001	0.693	0.007	0.681	0.008	0.704	0.008	0.642	0.201	0.678	0.002	0.676	0.074
492	0.834	0.001	0.807	0.001	0.819	0.001	0.684	0.150	0.659	0.007	0.704	0.011	0.664	0.049	0.644	0.013	0.676	0.063
493	0.829	0.001	0.813	0.001	0.819	0.002	0.663	0.211	0.658	0.015	0.704	0.012	0.640	0.582	0.657	0.038	0.676	0.062
494	0.827	0.001	0.838	0.001	0.819	0.001	0.677	0.008	0.656	0.223	0.704	0.011	0.662	0.011	0.706	0.001	0.676	0.077
495	0.817	0.001	0.803	0.001	0.819	0.001	0.685	0.008	0.662	0.050	0.704	0.012	0.656	0.013	0.680	0.021	0.676	0.063
496	0.840	0.001	0.810	0.001	0.819	0.001	0.662	0.024	0.662	0.017	0.704	0.007	0.702	0.001	0.648	0.079	0.676	0.062
497	0.833	0.001	0.792	0.001	0.819	0.001	0.692	0.015	0.658	0.034	0.704	0.012	0.682	0.004	0.650	0.014	0.676	0.071
498	0.811	0.001	0.834	0.001	0.819	0.001	0.667	0.144	0.674	0.042	0.704	0.006	0.667	0.011	0.671	0.014	0.676	0.080
499	0.832	0.001	0.797	0.001	0.819	0.002	0.687	0.018	0.681	0.003	0.704	0.015	0.671	0.031	0.651	0.059	0.676	0.073
500	0.832	0.001	0.811	0.002	0.819	0.001	0.669	0.029	0.692	0.002	0.704	0.011	0.644	0.018	0.684	0.009	0.676	0.076

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
501	0.825	0.001	0.806	0.001	0.819	0.001	0.677	0.004	0.663	0.085	0.704	0.014	0.703	0.001	0.656	0.044	0.676	0.066
502	0.841	0.001	0.793	0.001	0.819	0.001	0.714	0.001	0.686	0.001	0.704	0.007	0.682	0.003	0.664	0.007	0.676	0.060
503	0.832	0.001	0.837	0.001	0.819	0.002	0.680	0.016	0.668	0.005	0.704	0.013	0.687	0.028	0.685	0.003	0.676	0.070
504	0.829	0.002	0.806	0.001	0.819	0.001	0.653	0.037	0.686	0.002	0.704	0.011	0.703	0.004	0.613	0.232	0.676	0.062
505	0.836	0.001	0.816	0.001	0.819	0.002	0.692	0.003	0.690	0.002	0.704	0.008	0.671	0.057	0.684	0.003	0.676	0.062
506	0.833	0.001	0.819	0.001	0.819	0.003	0.662	0.041	0.657	0.137	0.704	0.007	0.689	0.040	0.674	0.002	0.676	0.056
507	0.818	0.001	0.784	0.002	0.819	0.001	0.685	0.008	0.677	0.004	0.704	0.013	0.651	0.051	0.697	0.003	0.676	0.069
508	0.820	0.003	0.806	0.001	0.819	0.001	0.698	0.002	0.669	0.008	0.704	0.010	0.649	0.198	0.631	0.256	0.676	0.057
509	0.847	0.001	0.802	0.001	0.819	0.001	0.684	0.027	0.677	0.004	0.704	0.006	0.678	0.010	0.655	0.021	0.676	0.067
510	0.828	0.001	0.817	0.001	0.819	0.001	0.678	0.005	0.681	0.002	0.704	0.007	0.660	0.048	0.681	0.002	0.676	0.075
511	0.837	0.001	0.804	0.001	0.819	0.001	0.652	0.017	0.673	0.021	0.704	0.006	0.669	0.038	0.643	0.013	0.676	0.064
512	0.815	0.001	0.792	0.001	0.819	0.001	0.679	0.070	0.690	0.001	0.704	0.006	0.661	0.103	0.635	0.093	0.676	0.078
513	0.825	0.001	0.828	0.001	0.819	0.004	0.632	0.026	0.686	0.003	0.704	0.004	0.701	0.004	0.679	0.012	0.676	0.072
514	0.798	0.001	0.811	0.002	0.819	0.001	0.647	0.420	0.659	0.017	0.704	0.010	0.705	0.001	0.689	0.004	0.676	0.067
515	0.832	0.001	0.824	0.001	0.819	0.003	0.694	0.008	0.700	0.004	0.704	0.005	0.666	0.007	0.643	0.018	0.676	0.079
516	0.832	0.001	0.786	0.001	0.819	0.003	0.707	0.001	0.660	0.006	0.704	0.007	0.690	0.016	0.686	0.001	0.676	0.081
517	0.828	0.001	0.805	0.001	0.819	0.001	0.702	0.017	0.676	0.011	0.704	0.009	0.671	0.008	0.685	0.002	0.676	0.072
518	0.822	0.001	0.795	0.002	0.819	0.002	0.682	0.004	0.641	0.055	0.704	0.013	0.658	0.017	0.638	0.033	0.676	0.074
519	0.807	0.001	0.813	0.001	0.819	0.001	0.660	0.005	0.687	0.001	0.704	0.010	0.677	0.003	0.672	0.003	0.676	0.069
520	0.829	0.001	0.803	0.001	0.819	0.001	0.696	0.004	0.693	0.007	0.704	0.012	0.633	0.677	0.658	0.055	0.676	0.060
521	0.830	0.001	0.832	0.001	0.819	0.002	0.698	0.002	0.687	0.015	0.704	0.005	0.692	0.001	0.651	0.074	0.676	0.080
522	0.836	0.001	0.811	0.001	0.819	0.003	0.714	0.001	0.667	0.013	0.704	0.007	0.688	0.004	0.702	0.001	0.676	0.066
523	0.803	0.001	0.816	0.001	0.819	0.001	0.669	0.022	0.648	0.491	0.704	0.005	0.626	0.259	0.695	0.001	0.676	0.072
524	0.816	0.001	0.817	0.001	0.819	0.003	0.670	0.033	0.676	0.026	0.704	0.008	0.664	0.009	0.644	0.040	0.676	0.064
525	0.814	0.003	0.800	0.001	0.819	0.001	0.725	0.001	0.685	0.034	0.704	0.006	0.649	0.326	0.687	0.003	0.676	0.075
526	0.824	0.001	0.810	0.001	0.819	0.001	0.704	0.001	0.674	0.002	0.704	0.010	0.667	0.015	0.688	0.056	0.676	0.070
527	0.836	0.001	0.806	0.001	0.819	0.001	0.663	0.043	0.669	0.015	0.704	0.008	0.690	0.008	0.675	0.018	0.676	0.076
528	0.831	0.001	0.815	0.001	0.819	0.001	0.713	0.001	0.666	0.016	0.704	0.009	0.652	0.003	0.683	0.002	0.676	0.061

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
529	0.825	0.001	0.816	0.001	0.819	0.001	0.686	0.004	0.655	0.033	0.704	0.008	0.688	0.001	0.668	0.004	0.676	0.058
530	0.813	0.001	0.827	0.001	0.819	0.003	0.714	0.003	0.679	0.001	0.704	0.008	0.685	0.024	0.647	0.030	0.676	0.077
531	0.838	0.001	0.816	0.001	0.819	0.002	0.700	0.009	0.676	0.002	0.704	0.005	0.684	0.004	0.657	0.011	0.676	0.076
532	0.837	0.001	0.831	0.001	0.819	0.003	0.657	0.161	0.670	0.041	0.704	0.006	0.666	0.046	0.666	0.017	0.676	0.062
533	0.817	0.001	0.805	0.001	0.819	0.001	0.651	0.208	0.651	0.244	0.704	0.007	0.650	0.060	0.714	0.001	0.676	0.074
534	0.822	0.001	0.804	0.002	0.819	0.002	0.670	0.066	0.676	0.002	0.704	0.012	0.648	0.317	0.681	0.002	0.676	0.068
535	0.841	0.001	0.811	0.001	0.819	0.001	0.687	0.001	0.697	0.004	0.704	0.005	0.697	0.001	0.671	0.006	0.676	0.055
536	0.818	0.001	0.796	0.001	0.819	0.001	0.694	0.002	0.672	0.001	0.704	0.008	0.648	0.009	0.686	0.013	0.676	0.066
537	0.843	0.001	0.821	0.001	0.819	0.004	0.661	0.166	0.669	0.026	0.704	0.009	0.660	0.445	0.646	0.059	0.676	0.074
538	0.828	0.001	0.815	0.001	0.819	0.002	0.676	0.010	0.676	0.045	0.704	0.010	0.741	0.001	0.664	0.033	0.676	0.067
539	0.827	0.001	0.801	0.001	0.819	0.002	0.665	0.050	0.669	0.004	0.704	0.010	0.667	0.030	0.670	0.001	0.676	0.078
540	0.797	0.001	0.814	0.001	0.819	0.002	0.682	0.009	0.642	0.165	0.704	0.008	0.681	0.002	0.687	0.017	0.676	0.081
541	0.824	0.001	0.845	0.001	0.819	0.002	0.654	0.249	0.667	0.028	0.704	0.008	0.638	0.180	0.666	0.004	0.676	0.082
542	0.852	0.001	0.804	0.001	0.819	0.002	0.682	0.017	0.689	0.010	0.704	0.010	0.665	0.030	0.665	0.019	0.676	0.065
543	0.841	0.001	0.815	0.001	0.819	0.001	0.697	0.016	0.662	0.015	0.704	0.010	0.690	0.012	0.676	0.001	0.676	0.065
544	0.849	0.001	0.814	0.001	0.819	0.002	0.699	0.002	0.696	0.001	0.704	0.014	0.644	0.134	0.634	0.034	0.676	0.067
545	0.813	0.001	0.806	0.001	0.819	0.003	0.679	0.014	0.647	0.253	0.704	0.011	0.669	0.001	0.670	0.002	0.676	0.064
546	0.821	0.001	0.813	0.001	0.819	0.001	0.702	0.001	0.697	0.001	0.704	0.007	0.708	0.001	0.644	0.009	0.676	0.071
547	0.814	0.002	0.813	0.001	0.819	0.002	0.714	0.001	0.653	0.018	0.704	0.004	0.689	0.009	0.644	0.034	0.676	0.068
548	0.842	0.001	0.834	0.001	0.819	0.003	0.703	0.002	0.705	0.002	0.704	0.014	0.680	0.026	0.632	0.070	0.676	0.066
549	0.816	0.001	0.841	0.001	0.819	0.002	0.695	0.006	0.660	0.109	0.704	0.008	0.621	0.110	0.644	0.033	0.676	0.057
550	0.824	0.001	0.812	0.001	0.819	0.002	0.667	0.082	0.675	0.014	0.704	0.008	0.679	0.071	0.700	0.001	0.676	0.081
551	0.836	0.001	0.815	0.001	0.819	0.003	0.688	0.006	0.674	0.001	0.704	0.015	0.658	0.060	0.674	0.005	0.676	0.073
552	0.819	0.001	0.814	0.001	0.819	0.001	0.687	0.003	0.670	0.007	0.704	0.005	0.669	0.230	0.668	0.044	0.676	0.075
553	0.823	0.001	0.831	0.001	0.819	0.001	0.685	0.043	0.732	0.001	0.704	0.007	0.652	0.011	0.622	0.044	0.676	0.080
554	0.812	0.001	0.810	0.001	0.819	0.003	0.676	0.002	0.686	0.002	0.704	0.007	0.696	0.001	0.634	0.038	0.676	0.072
555	0.827	0.001	0.827	0.001	0.819	0.002	0.672	0.048	0.652	0.047	0.704	0.011	0.654	0.110	0.662	0.022	0.676	0.067
556	0.819	0.002	0.853	0.001	0.819	0.002	0.681	0.005	0.647	0.130	0.704	0.012	0.681	0.001	0.625	0.031	0.676	0.062

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
557	0.828	0.001	0.818	0.001	0.819	0.001	0.704	0.004	0.671	0.002	0.704	0.007	0.672	0.015	0.664	0.038	0.676	0.074
558	0.799	0.001	0.803	0.001	0.819	0.003	0.679	0.047	0.683	0.002	0.704	0.009	0.640	0.151	0.630	0.135	0.676	0.063
559	0.830	0.001	0.807	0.001	0.819	0.001	0.665	0.077	0.671	0.002	0.704	0.012	0.664	0.085	0.658	0.016	0.676	0.084
560	0.831	0.001	0.792	0.001	0.819	0.002	0.682	0.002	0.689	0.003	0.704	0.010	0.663	0.052	0.628	0.034	0.676	0.071
561	0.847	0.001	0.804	0.001	0.819	0.001	0.697	0.001	0.673	0.018	0.704	0.008	0.658	0.228	0.643	0.030	0.676	0.065
562	0.820	0.001	0.817	0.001	0.819	0.002	0.686	0.002	0.642	0.046	0.704	0.009	0.666	0.112	0.676	0.001	0.676	0.076
563	0.835	0.001	0.799	0.001	0.819	0.002	0.704	0.008	0.691	0.001	0.704	0.011	0.641	0.052	0.629	0.080	0.676	0.060
564	0.828	0.001	0.814	0.001	0.819	0.002	0.692	0.024	0.665	0.003	0.704	0.008	0.690	0.004	0.656	0.078	0.676	0.057
565	0.835	0.001	0.811	0.001	0.819	0.001	0.691	0.010	0.684	0.003	0.704	0.010	0.634	0.116	0.664	0.004	0.676	0.067
566	0.824	0.001	0.804	0.001	0.819	0.003	0.701	0.001	0.660	0.105	0.704	0.008	0.674	0.021	0.669	0.018	0.676	0.065
567	0.815	0.001	0.821	0.001	0.819	0.001	0.696	0.001	0.678	0.016	0.704	0.011	0.681	0.022	0.686	0.001	0.676	0.073
568	0.820	0.001	0.829	0.001	0.819	0.002	0.691	0.004	0.681	0.003	0.704	0.008	0.694	0.002	0.667	0.069	0.676	0.059
569	0.835	0.001	0.806	0.001	0.819	0.001	0.678	0.002	0.672	0.002	0.704	0.005	0.670	0.124	0.648	0.023	0.676	0.062
570	0.827	0.001	0.795	0.001	0.819	0.001	0.675	0.016	0.666	0.034	0.704	0.011	0.682	0.035	0.631	0.246	0.676	0.072
571	0.849	0.001	0.827	0.001	0.819	0.004	0.677	0.329	0.650	0.080	0.704	0.013	0.693	0.004	0.653	0.192	0.676	0.075
572	0.822	0.001	0.816	0.001	0.819	0.001	0.669	0.023	0.673	0.001	0.704	0.007	0.682	0.059	0.625	0.029	0.676	0.073
573	0.848	0.001	0.807	0.001	0.819	0.001	0.661	0.125	0.653	0.055	0.704	0.009	0.659	0.015	0.651	0.015	0.676	0.048
574	0.833	0.001	0.820	0.001	0.819	0.002	0.662	0.039	0.645	0.120	0.704	0.004	0.657	0.051	0.672	0.002	0.676	0.069
575	0.859	0.001	0.829	0.001	0.819	0.002	0.670	0.017	0.684	0.001	0.704	0.006	0.719	0.001	0.669	0.007	0.676	0.068
576	0.825	0.001	0.818	0.001	0.819	0.001	0.651	0.107	0.678	0.002	0.704	0.012	0.677	0.091	0.637	0.039	0.676	0.069
577	0.829	0.001	0.779	0.001	0.819	0.002	0.708	0.008	0.669	0.029	0.704	0.007	0.671	0.015	0.630	0.099	0.676	0.061
578	0.820	0.001	0.789	0.001	0.819	0.001	0.652	0.198	0.676	0.062	0.704	0.012	0.672	0.088	0.697	0.003	0.676	0.068
579	0.841	0.001	0.828	0.001	0.819	0.002	0.671	0.013	0.641	0.154	0.704	0.006	0.643	0.262	0.726	0.001	0.676	0.070
580	0.830	0.001	0.799	0.001	0.819	0.001	0.689	0.005	0.647	0.165	0.704	0.012	0.668	0.020	0.645	0.010	0.676	0.067
581	0.833	0.001	0.838	0.001	0.819	0.002	0.703	0.001	0.691	0.001	0.704	0.007	0.725	0.001	0.652	0.029	0.676	0.063
582	0.803	0.001	0.823	0.001	0.819	0.001	0.688	0.001	0.666	0.029	0.704	0.004	0.698	0.002	0.614	0.488	0.676	0.069
583	0.832	0.001	0.815	0.001	0.819	0.003	0.698	0.012	0.674	0.004	0.704	0.019	0.642	0.087	0.629	0.090	0.676	0.068
584	0.832	0.001	0.794	0.001	0.819	0.003	0.675	0.001	0.709	0.001	0.704	0.008	0.700	0.003	0.674	0.012	0.676	0.061

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
585	0.832	0.001	0.808	0.001	0.819	0.002	0.684	0.002	0.662	0.075	0.704	0.006	0.650	0.183	0.656	0.050	0.676	0.064
586	0.818	0.001	0.801	0.001	0.819	0.003	0.700	0.001	0.666	0.003	0.704	0.008	0.643	0.157	0.667	0.010	0.676	0.072
587	0.814	0.001	0.827	0.001	0.819	0.001	0.655	0.027	0.659	0.005	0.704	0.008	0.666	0.014	0.659	0.005	0.676	0.086
588	0.840	0.001	0.820	0.001	0.819	0.001	0.682	0.021	0.677	0.002	0.704	0.010	0.682	0.004	0.648	0.181	0.676	0.073
589	0.817	0.001	0.818	0.001	0.819	0.001	0.657	0.040	0.657	0.123	0.704	0.007	0.697	0.001	0.683	0.001	0.676	0.070
590	0.838	0.001	0.813	0.001	0.819	0.001	0.670	0.008	0.674	0.049	0.704	0.009	0.634	0.088	0.651	0.163	0.676	0.070
591	0.836	0.001	0.810	0.001	0.819	0.001	0.712	0.001	0.684	0.037	0.704	0.009	0.689	0.008	0.652	0.007	0.676	0.075
592	0.831	0.001	0.816	0.001	0.819	0.001	0.676	0.019	0.667	0.060	0.704	0.013	0.641	0.037	0.653	0.011	0.676	0.063
593	0.823	0.001	0.805	0.001	0.819	0.002	0.671	0.125	0.655	0.051	0.704	0.008	0.655	0.011	0.680	0.006	0.676	0.062
594	0.807	0.001	0.808	0.001	0.819	0.003	0.710	0.014	0.686	0.003	0.704	0.010	0.657	0.011	0.717	0.001	0.676	0.073
595	0.825	0.002	0.793	0.002	0.819	0.003	0.693	0.003	0.677	0.035	0.704	0.014	0.654	0.496	0.618	0.101	0.676	0.054
596	0.815	0.001	0.795	0.001	0.819	0.001	0.681	0.061	0.692	0.022	0.704	0.016	0.683	0.216	0.663	0.097	0.676	0.064
597	0.832	0.001	0.830	0.001	0.819	0.002	0.708	0.001	0.686	0.002	0.704	0.004	0.680	0.024	0.695	0.008	0.676	0.084
598	0.853	0.001	0.805	0.001	0.819	0.001	0.695	0.001	0.677	0.002	0.704	0.010	0.704	0.001	0.683	0.002	0.676	0.082
599	0.837	0.001	0.830	0.001	0.819	0.001	0.723	0.002	0.658	0.202	0.704	0.011	0.664	0.103	0.693	0.001	0.676	0.075
600	0.827	0.001	0.815	0.001	0.819	0.002	0.680	0.006	0.673	0.002	0.704	0.015	0.707	0.002	0.644	0.069	0.676	0.076
601	0.845	0.001	0.818	0.001	0.819	0.002	0.678	0.004	0.665	0.013	0.704	0.008	0.637	0.265	0.678	0.001	0.676	0.054
602	0.830	0.001	0.809	0.001	0.819	0.002	0.658	0.230	0.664	0.022	0.704	0.008	0.663	0.051	0.643	0.030	0.676	0.078
603	0.830	0.001	0.823	0.001	0.819	0.004	0.654	0.174	0.658	0.016	0.704	0.009	0.650	0.009	0.689	0.001	0.676	0.080
604	0.831	0.001	0.808	0.001	0.819	0.001	0.658	0.087	0.664	0.058	0.704	0.007	0.662	0.001	0.625	0.048	0.676	0.053
605	0.844	0.001	0.810	0.001	0.819	0.001	0.695	0.001	0.692	0.001	0.704	0.009	0.616	0.319	0.657	0.019	0.676	0.070
606	0.835	0.001	0.809	0.001	0.819	0.001	0.677	0.091	0.682	0.005	0.704	0.010	0.645	0.021	0.665	0.012	0.676	0.069
607	0.799	0.003	0.794	0.002	0.819	0.001	0.693	0.003	0.641	0.518	0.704	0.010	0.665	0.072	0.669	0.014	0.676	0.074
608	0.841	0.001	0.833	0.001	0.819	0.002	0.710	0.001	0.653	0.038	0.704	0.008	0.664	0.032	0.646	0.362	0.676	0.064
609	0.849	0.001	0.828	0.001	0.819	0.002	0.686	0.024	0.682	0.003	0.704	0.012	0.699	0.005	0.644	0.082	0.676	0.079
610	0.844	0.001	0.804	0.001	0.819	0.002	0.651	0.018	0.716	0.001	0.704	0.011	0.652	0.032	0.632	0.128	0.676	0.071
611	0.837	0.001	0.818	0.001	0.819	0.003	0.653	0.013	0.662	0.367	0.704	0.007	0.657	0.038	0.688	0.001	0.676	0.062
612	0.821	0.001	0.797	0.001	0.819	0.002	0.685	0.017	0.685	0.014	0.704	0.004	0.659	0.058	0.614	0.667	0.676	0.078

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
613	0.819	0.001	0.799	0.001	0.819	0.002	0.686	0.002	0.699	0.007	0.704	0.009	0.691	0.007	0.646	0.108	0.676	0.062
614	0.814	0.002	0.781	0.001	0.819	0.002	0.714	0.003	0.657	0.007	0.704	0.011	0.669	0.003	0.682	0.008	0.676	0.061
615	0.829	0.001	0.801	0.001	0.819	0.003	0.669	0.173	0.681	0.009	0.704	0.008	0.685	0.008	0.613	0.309	0.676	0.078
616	0.814	0.001	0.789	0.001	0.819	0.001	0.692	0.006	0.683	0.003	0.704	0.009	0.674	0.001	0.638	0.030	0.676	0.064
617	0.833	0.001	0.836	0.001	0.819	0.002	0.683	0.004	0.678	0.003	0.704	0.011	0.638	0.128	0.674	0.003	0.676	0.072
618	0.838	0.001	0.792	0.001	0.819	0.001	0.677	0.014	0.677	0.010	0.704	0.003	0.670	0.059	0.648	0.008	0.676	0.073
619	0.836	0.001	0.820	0.001	0.819	0.003	0.673	0.011	0.640	0.429	0.704	0.009	0.642	0.103	0.691	0.002	0.676	0.074
620	0.821	0.001	0.809	0.001	0.819	0.001	0.682	0.056	0.670	0.016	0.704	0.010	0.669	0.039	0.667	0.005	0.676	0.075
621	0.834	0.001	0.791	0.001	0.819	0.002	0.687	0.009	0.650	0.070	0.704	0.007	0.660	0.149	0.651	0.145	0.676	0.073
622	0.840	0.001	0.798	0.001	0.819	0.001	0.701	0.006	0.679	0.045	0.704	0.008	0.671	0.007	0.641	0.038	0.676	0.065
623	0.836	0.001	0.824	0.001	0.819	0.002	0.675	0.005	0.670	0.001	0.704	0.007	0.681	0.003	0.662	0.011	0.676	0.058
624	0.826	0.001	0.839	0.001	0.819	0.002	0.722	0.001	0.667	0.020	0.704	0.008	0.719	0.001	0.681	0.003	0.676	0.084
625	0.806	0.001	0.827	0.001	0.819	0.002	0.651	0.105	0.640	0.556	0.704	0.008	0.681	0.006	0.647	0.039	0.676	0.062
626	0.844	0.001	0.794	0.001	0.819	0.002	0.672	0.002	0.644	0.076	0.704	0.006	0.676	0.002	0.676	0.006	0.676	0.061
627	0.841	0.001	0.825	0.001	0.819	0.001	0.662	0.031	0.693	0.001	0.704	0.008	0.639	0.374	0.655	0.006	0.676	0.056
628	0.802	0.001	0.826	0.001	0.819	0.001	0.686	0.001	0.658	0.050	0.704	0.012	0.652	0.116	0.635	0.224	0.676	0.075
629	0.811	0.001	0.805	0.001	0.819	0.001	0.683	0.003	0.682	0.008	0.704	0.007	0.692	0.031	0.673	0.033	0.676	0.060
630	0.801	0.006	0.826	0.001	0.819	0.001	0.668	0.048	0.675	0.100	0.704	0.008	0.656	0.114	0.657	0.061	0.676	0.068
631	0.841	0.001	0.829	0.001	0.819	0.001	0.696	0.003	0.657	0.108	0.704	0.008	0.633	0.093	0.667	0.019	0.676	0.068
632	0.812	0.001	0.819	0.001	0.819	0.001	0.701	0.003	0.669	0.031	0.704	0.007	0.674	0.046	0.668	0.010	0.676	0.069
633	0.820	0.001	0.802	0.001	0.819	0.002	0.724	0.001	0.698	0.003	0.704	0.007	0.671	0.001	0.667	0.033	0.676	0.076
634	0.829	0.001	0.793	0.001	0.819	0.001	0.698	0.001	0.656	0.067	0.704	0.006	0.620	0.441	0.658	0.003	0.676	0.064
635	0.820	0.001	0.793	0.001	0.819	0.002	0.667	0.086	0.660	0.029	0.704	0.009	0.657	0.018	0.667	0.005	0.676	0.074
636	0.835	0.002	0.815	0.001	0.819	0.001	0.682	0.045	0.643	0.018	0.704	0.009	0.644	0.018	0.686	0.007	0.676	0.050
637	0.817	0.001	0.820	0.001	0.819	0.002	0.697	0.006	0.681	0.002	0.704	0.012	0.686	0.001	0.607	0.539	0.676	0.066
638	0.837	0.001	0.809	0.001	0.819	0.004	0.672	0.106	0.656	0.023	0.704	0.013	0.639	0.073	0.690	0.003	0.676	0.082
639	0.827	0.001	0.813	0.001	0.819	0.001	0.682	0.036	0.655	0.578	0.704	0.006	0.665	0.109	0.632	0.145	0.676	0.070
640	0.824	0.001	0.824	0.001	0.819	0.001	0.664	0.011	0.662	0.002	0.704	0.009	0.661	0.174	0.645	0.105	0.676	0.083

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
641	0.843	0.001	0.810	0.001	0.819	0.002	0.665	0.017	0.661	0.008	0.704	0.009	0.666	0.038	0.660	0.002	0.676	0.071
642	0.824	0.001	0.818	0.001	0.819	0.003	0.695	0.003	0.674	0.022	0.704	0.006	0.690	0.003	0.659	0.015	0.676	0.073
643	0.838	0.001	0.792	0.001	0.819	0.002	0.666	0.190	0.647	0.046	0.704	0.008	0.667	0.007	0.656	0.041	0.676	0.068
644	0.816	0.001	0.825	0.001	0.819	0.002	0.675	0.002	0.693	0.001	0.704	0.015	0.673	0.035	0.678	0.003	0.676	0.063
645	0.832	0.001	0.803	0.001	0.819	0.001	0.706	0.001	0.655	0.070	0.704	0.010	0.665	0.019	0.666	0.034	0.676	0.068
646	0.830	0.001	0.823	0.001	0.819	0.003	0.675	0.059	0.665	0.048	0.704	0.008	0.621	0.199	0.688	0.005	0.676	0.068
647	0.833	0.001	0.815	0.001	0.819	0.002	0.684	0.008	0.662	0.046	0.704	0.010	0.653	0.009	0.675	0.004	0.676	0.070
648	0.823	0.001	0.822	0.001	0.819	0.003	0.691	0.039	0.674	0.024	0.704	0.010	0.683	0.002	0.667	0.007	0.676	0.054
649	0.822	0.001	0.808	0.001	0.819	0.002	0.691	0.033	0.681	0.002	0.704	0.007	0.655	0.116	0.661	0.002	0.676	0.058
650	0.855	0.001	0.790	0.001	0.819	0.003	0.652	0.201	0.660	0.258	0.704	0.012	0.691	0.002	0.668	0.040	0.676	0.075
651	0.822	0.001	0.829	0.001	0.819	0.003	0.701	0.001	0.667	0.031	0.704	0.008	0.684	0.006	0.670	0.001	0.676	0.061
652	0.840	0.001	0.816	0.001	0.819	0.004	0.647	0.099	0.661	0.026	0.704	0.008	0.665	0.009	0.672	0.005	0.676	0.055
653	0.823	0.001	0.816	0.001	0.819	0.002	0.673	0.013	0.683	0.001	0.704	0.010	0.658	0.188	0.639	0.040	0.676	0.060
654	0.819	0.001	0.787	0.001	0.819	0.001	0.680	0.001	0.694	0.008	0.704	0.011	0.634	0.218	0.684	0.004	0.676	0.075
655	0.824	0.001	0.812	0.001	0.819	0.001	0.686	0.021	0.670	0.019	0.704	0.008	0.663	0.051	0.644	0.141	0.676	0.071
656	0.822	0.001	0.800	0.001	0.819	0.002	0.698	0.002	0.677	0.015	0.704	0.011	0.652	0.044	0.656	0.030	0.676	0.070
657	0.834	0.001	0.810	0.001	0.819	0.001	0.703	0.005	0.655	0.083	0.704	0.009	0.652	0.112	0.667	0.021	0.676	0.072
658	0.817	0.001	0.801	0.001	0.819	0.003	0.672	0.010	0.677	0.003	0.704	0.008	0.628	0.222	0.651	0.028	0.676	0.057
659	0.806	0.001	0.806	0.001	0.819	0.001	0.686	0.004	0.689	0.004	0.704	0.017	0.664	0.085	0.667	0.015	0.676	0.076
660	0.819	0.001	0.816	0.001	0.819	0.002	0.683	0.066	0.666	0.070	0.704	0.014	0.688	0.003	0.683	0.009	0.676	0.048
661	0.805	0.001	0.814	0.001	0.819	0.003	0.684	0.002	0.652	0.007	0.704	0.009	0.668	0.010	0.670	0.002	0.676	0.055
662	0.818	0.001	0.811	0.001	0.819	0.001	0.701	0.001	0.664	0.129	0.704	0.006	0.697	0.007	0.685	0.010	0.676	0.071
663	0.827	0.001	0.804	0.001	0.819	0.002	0.691	0.016	0.676	0.002	0.704	0.009	0.687	0.001	0.683	0.007	0.676	0.063
664	0.837	0.001	0.818	0.001	0.819	0.002	0.653	0.105	0.657	0.017	0.704	0.004	0.680	0.006	0.639	0.146	0.676	0.065
665	0.820	0.001	0.816	0.001	0.819	0.002	0.673	0.023	0.694	0.003	0.704	0.009	0.722	0.011	0.665	0.030	0.676	0.073
666	0.841	0.001	0.797	0.002	0.819	0.002	0.645	0.167	0.662	0.023	0.704	0.010	0.676	0.025	0.683	0.008	0.676	0.064
667	0.832	0.001	0.810	0.001	0.819	0.004	0.692	0.026	0.655	0.044	0.704	0.008	0.677	0.040	0.644	0.025	0.676	0.069
668	0.832	0.001	0.796	0.002	0.819	0.002	0.703	0.004	0.668	0.062	0.704	0.005	0.662	0.003	0.688	0.002	0.676	0.074

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
669	0.843	0.001	0.819	0.001	0.819	0.002	0.692	0.006	0.676	0.002	0.704	0.013	0.660	0.209	0.656	0.012	0.676	0.075
670	0.830	0.001	0.795	0.001	0.819	0.001	0.686	0.012	0.656	0.034	0.704	0.005	0.666	0.104	0.664	0.011	0.676	0.074
671	0.831	0.001	0.800	0.001	0.819	0.002	0.681	0.164	0.666	0.002	0.704	0.008	0.664	0.103	0.676	0.035	0.676	0.065
672	0.811	0.002	0.826	0.001	0.819	0.001	0.678	0.007	0.679	0.006	0.704	0.009	0.685	0.002	0.656	0.046	0.676	0.061
673	0.828	0.001	0.804	0.002	0.819	0.001	0.707	0.001	0.665	0.027	0.704	0.005	0.667	0.026	0.668	0.009	0.676	0.068
674	0.833	0.001	0.822	0.001	0.819	0.002	0.682	0.004	0.681	0.007	0.704	0.011	0.686	0.008	0.664	0.027	0.676	0.074
675	0.858	0.001	0.818	0.001	0.819	0.002	0.682	0.001	0.664	0.008	0.704	0.010	0.666	0.104	0.629	0.323	0.676	0.073
676	0.808	0.001	0.829	0.001	0.819	0.001	0.715	0.004	0.666	0.043	0.704	0.008	0.651	0.029	0.609	0.183	0.676	0.062
677	0.831	0.001	0.824	0.001	0.819	0.001	0.707	0.004	0.645	0.298	0.704	0.009	0.675	0.005	0.658	0.025	0.676	0.070
678	0.825	0.001	0.803	0.008	0.819	0.001	0.647	0.200	0.654	0.218	0.704	0.007	0.670	0.021	0.642	0.018	0.676	0.080
679	0.825	0.001	0.810	0.001	0.819	0.004	0.682	0.001	0.692	0.001	0.704	0.012	0.693	0.024	0.655	0.010	0.676	0.067
680	0.834	0.001	0.809	0.001	0.819	0.001	0.721	0.010	0.685	0.002	0.704	0.012	0.634	0.185	0.666	0.004	0.676	0.059
681	0.835	0.001	0.799	0.001	0.819	0.001	0.652	0.397	0.667	0.018	0.704	0.019	0.700	0.004	0.635	0.075	0.676	0.049
682	0.834	0.001	0.839	0.001	0.819	0.002	0.718	0.001	0.702	0.001	0.704	0.014	0.655	0.018	0.668	0.004	0.676	0.062
683	0.842	0.001	0.816	0.001	0.819	0.001	0.698	0.001	0.667	0.012	0.704	0.007	0.641	0.063	0.672	0.005	0.676	0.061
684	0.817	0.001	0.799	0.001	0.819	0.002	0.690	0.022	0.675	0.009	0.704	0.005	0.706	0.001	0.660	0.021	0.676	0.065
685	0.835	0.001	0.793	0.001	0.819	0.003	0.678	0.075	0.672	0.008	0.704	0.010	0.691	0.006	0.663	0.014	0.676	0.069
686	0.840	0.001	0.800	0.001	0.819	0.002	0.647	0.315	0.684	0.003	0.704	0.015	0.696	0.009	0.694	0.001	0.676	0.066
687	0.812	0.002	0.830	0.001	0.819	0.001	0.672	0.001	0.655	0.007	0.704	0.007	0.644	0.077	0.662	0.035	0.676	0.070
688	0.819	0.001	0.792	0.004	0.819	0.001	0.689	0.001	0.654	0.046	0.704	0.009	0.678	0.003	0.688	0.001	0.676	0.078
689	0.824	0.002	0.821	0.001	0.819	0.001	0.659	0.337	0.669	0.004	0.704	0.013	0.688	0.001	0.649	0.057	0.676	0.073
690	0.825	0.001	0.819	0.001	0.819	0.001	0.670	0.027	0.675	0.004	0.704	0.008	0.683	0.005	0.681	0.003	0.676	0.070
691	0.807	0.005	0.798	0.002	0.819	0.001	0.724	0.001	0.674	0.003	0.704	0.002	0.693	0.004	0.675	0.004	0.676	0.073
692	0.813	0.001	0.819	0.001	0.819	0.004	0.716	0.003	0.674	0.009	0.704	0.005	0.646	0.069	0.658	0.007	0.676	0.073
693	0.818	0.001	0.807	0.001	0.819	0.001	0.692	0.001	0.681	0.002	0.704	0.008	0.648	0.099	0.674	0.024	0.676	0.064
694	0.795	0.001	0.807	0.001	0.819	0.001	0.678	0.001	0.666	0.010	0.704	0.008	0.642	0.181	0.664	0.038	0.676	0.073
695	0.817	0.001	0.801	0.001	0.819	0.003	0.684	0.099	0.677	0.001	0.704	0.009	0.651	0.146	0.648	0.094	0.676	0.068
696	0.797	0.001	0.848	0.001	0.819	0.001	0.692	0.014	0.687	0.014	0.704	0.009	0.690	0.004	0.667	0.010	0.676	0.059

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
697	0.839	0.001	0.795	0.001	0.819	0.002	0.676	0.030	0.669	0.041	0.704	0.010	0.667	0.114	0.662	0.002	0.676	0.060
698	0.834	0.001	0.800	0.001	0.819	0.003	0.706	0.001	0.671	0.008	0.704	0.009	0.677	0.142	0.654	0.010	0.676	0.079
699	0.812	0.003	0.829	0.001	0.819	0.005	0.711	0.001	0.663	0.005	0.704	0.009	0.681	0.001	0.633	0.118	0.676	0.074
700	0.822	0.001	0.822	0.001	0.819	0.002	0.714	0.001	0.653	0.284	0.704	0.010	0.644	0.172	0.700	0.002	0.676	0.071
701	0.843	0.001	0.804	0.001	0.819	0.003	0.655	0.089	0.680	0.001	0.704	0.012	0.624	0.182	0.662	0.042	0.676	0.070
702	0.831	0.001	0.797	0.004	0.819	0.001	0.703	0.001	0.679	0.004	0.704	0.009	0.678	0.006	0.643	0.083	0.676	0.078
703	0.833	0.001	0.787	0.001	0.819	0.001	0.670	0.569	0.681	0.007	0.704	0.015	0.645	0.115	0.662	0.017	0.676	0.067
704	0.814	0.001	0.817	0.001	0.819	0.002	0.653	0.844	0.695	0.003	0.704	0.005	0.632	0.029	0.651	0.015	0.676	0.071
705	0.819	0.001	0.816	0.001	0.819	0.002	0.683	0.007	0.703	0.002	0.704	0.009	0.654	0.182	0.614	0.448	0.676	0.062
706	0.824	0.002	0.808	0.001	0.819	0.001	0.701	0.001	0.712	0.001	0.704	0.008	0.670	0.018	0.635	0.126	0.676	0.075
707	0.837	0.001	0.799	0.001	0.819	0.002	0.676	0.002	0.686	0.007	0.704	0.008	0.659	0.029	0.623	0.116	0.676	0.073
708	0.794	0.001	0.820	0.001	0.819	0.002	0.676	0.051	0.642	0.195	0.704	0.011	0.628	0.427	0.655	0.009	0.676	0.070
709	0.830	0.001	0.812	0.001	0.819	0.001	0.699	0.004	0.672	0.001	0.704	0.008	0.670	0.062	0.664	0.010	0.676	0.066
710	0.806	0.001	0.800	0.001	0.819	0.001	0.700	0.001	0.696	0.006	0.704	0.009	0.642	0.277	0.632	0.081	0.676	0.066
711	0.836	0.001	0.824	0.001	0.819	0.001	0.690	0.032	0.676	0.004	0.704	0.006	0.630	0.101	0.651	0.039	0.676	0.072
712	0.811	0.001	0.834	0.001	0.819	0.002	0.656	0.157	0.670	0.004	0.704	0.007	0.706	0.001	0.667	0.016	0.676	0.062
713	0.813	0.001	0.821	0.001	0.819	0.001	0.692	0.001	0.687	0.001	0.704	0.008	0.712	0.001	0.642	0.200	0.676	0.061
714	0.820	0.001	0.822	0.001	0.819	0.001	0.644	0.308	0.689	0.001	0.704	0.009	0.704	0.001	0.659	0.006	0.676	0.067
715	0.822	0.001	0.790	0.001	0.819	0.001	0.699	0.007	0.674	0.001	0.704	0.006	0.666	0.005	0.679	0.002	0.676	0.072
716	0.848	0.001	0.790	0.001	0.819	0.003	0.669	0.052	0.682	0.003	0.704	0.007	0.686	0.002	0.655	0.100	0.676	0.070
717	0.822	0.001	0.807	0.001	0.819	0.001	0.680	0.001	0.653	0.107	0.704	0.012	0.634	0.139	0.684	0.004	0.676	0.067
718	0.831	0.001	0.809	0.001	0.819	0.001	0.676	0.051	0.651	0.014	0.704	0.007	0.643	0.070	0.713	0.001	0.676	0.066
719	0.838	0.001	0.793	0.002	0.819	0.002	0.693	0.001	0.685	0.002	0.704	0.007	0.656	0.015	0.635	0.204	0.676	0.060
720	0.792	0.002	0.788	0.001	0.819	0.005	0.660	0.033	0.703	0.002	0.704	0.008	0.678	0.013	0.628	0.098	0.676	0.069
721	0.835	0.001	0.810	0.001	0.819	0.001	0.709	0.001	0.668	0.011	0.704	0.010	0.664	0.032	0.656	0.013	0.676	0.075
722	0.830	0.001	0.789	0.004	0.819	0.001	0.696	0.001	0.672	0.005	0.704	0.007	0.648	0.132	0.644	0.016	0.676	0.062
723	0.823	0.001	0.814	0.001	0.819	0.003	0.676	0.006	0.689	0.001	0.704	0.006	0.666	0.008	0.670	0.005	0.676	0.075
724	0.806	0.001	0.823	0.001	0.819	0.003	0.689	0.001	0.671	0.046	0.704	0.006	0.711	0.002	0.700	0.001	0.676	0.059

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
725	0.825	0.001	0.815	0.001	0.819	0.002	0.651	0.198	0.712	0.001	0.704	0.010	0.687	0.006	0.661	0.045	0.676	0.067
726	0.799	0.003	0.804	0.001	0.819	0.002	0.679	0.014	0.661	0.034	0.704	0.010	0.694	0.005	0.664	0.023	0.676	0.094
727	0.819	0.001	0.799	0.001	0.819	0.002	0.665	0.035	0.647	0.356	0.704	0.006	0.695	0.001	0.677	0.003	0.676	0.073
728	0.832	0.001	0.817	0.001	0.819	0.001	0.695	0.001	0.683	0.002	0.704	0.009	0.648	0.103	0.689	0.001	0.676	0.050
729	0.817	0.001	0.826	0.001	0.819	0.001	0.700	0.002	0.649	0.128	0.704	0.006	0.677	0.009	0.667	0.014	0.676	0.058
730	0.819	0.001	0.808	0.001	0.819	0.002	0.672	0.005	0.669	0.099	0.704	0.007	0.720	0.001	0.669	0.007	0.676	0.061
731	0.822	0.001	0.819	0.001	0.819	0.002	0.683	0.013	0.710	0.001	0.704	0.010	0.686	0.001	0.655	0.046	0.676	0.069
732	0.846	0.001	0.827	0.001	0.819	0.003	0.671	0.101	0.688	0.001	0.704	0.010	0.673	0.023	0.658	0.027	0.676	0.065
733	0.832	0.001	0.798	0.001	0.819	0.001	0.676	0.003	0.656	0.030	0.704	0.006	0.662	0.280	0.669	0.007	0.676	0.060
734	0.845	0.001	0.818	0.001	0.819	0.001	0.672	0.127	0.654	0.005	0.704	0.006	0.660	0.013	0.631	0.336	0.676	0.076
735	0.821	0.001	0.803	0.001	0.819	0.001	0.666	0.011	0.672	0.064	0.704	0.012	0.662	0.067	0.637	0.055	0.676	0.072
736	0.803	0.001	0.807	0.001	0.819	0.001	0.662	0.022	0.669	0.034	0.704	0.011	0.647	0.389	0.669	0.001	0.676	0.062
737	0.827	0.001	0.822	0.001	0.819	0.002	0.677	0.003	0.663	0.027	0.704	0.006	0.714	0.001	0.654	0.020	0.676	0.069
738	0.809	0.001	0.802	0.001	0.819	0.001	0.704	0.007	0.674	0.005	0.704	0.011	0.713	0.003	0.646	0.269	0.676	0.079
739	0.826	0.001	0.824	0.001	0.819	0.002	0.713	0.001	0.692	0.009	0.704	0.007	0.662	0.020	0.690	0.003	0.676	0.079
740	0.824	0.001	0.826	0.001	0.819	0.001	0.678	0.086	0.664	0.073	0.704	0.007	0.646	0.131	0.641	0.091	0.676	0.056
741	0.835	0.001	0.781	0.001	0.819	0.003	0.696	0.006	0.663	0.004	0.704	0.015	0.715	0.003	0.630	0.057	0.676	0.066
742	0.819	0.002	0.806	0.001	0.819	0.001	0.700	0.002	0.676	0.008	0.704	0.009	0.716	0.001	0.639	0.132	0.676	0.054
743	0.835	0.001	0.812	0.001	0.819	0.001	0.682	0.037	0.691	0.001	0.704	0.007	0.707	0.001	0.653	0.021	0.676	0.078
744	0.823	0.001	0.808	0.002	0.819	0.002	0.685	0.004	0.651	0.027	0.704	0.008	0.685	0.042	0.653	0.067	0.676	0.056
745	0.818	0.001	0.784	0.001	0.819	0.001	0.698	0.056	0.711	0.001	0.704	0.005	0.710	0.001	0.665	0.010	0.676	0.072
746	0.804	0.001	0.790	0.001	0.819	0.001	0.687	0.018	0.666	0.046	0.704	0.009	0.667	0.019	0.654	0.043	0.676	0.056
747	0.843	0.001	0.800	0.001	0.819	0.005	0.683	0.017	0.662	0.013	0.704	0.008	0.664	0.079	0.645	0.052	0.676	0.072
748	0.838	0.001	0.821	0.001	0.819	0.001	0.724	0.001	0.670	0.011	0.704	0.004	0.670	0.018	0.660	0.009	0.676	0.065
749	0.824	0.001	0.808	0.001	0.819	0.001	0.719	0.001	0.653	0.159	0.704	0.011	0.651	0.041	0.689	0.003	0.676	0.062
750	0.815	0.001	0.818	0.001	0.819	0.002	0.693	0.001	0.679	0.001	0.704	0.009	0.621	0.329	0.643	0.041	0.676	0.079
751	0.815	0.001	0.800	0.001	0.819	0.002	0.635	0.196	0.682	0.074	0.704	0.012	0.661	0.096	0.671	0.002	0.676	0.064
752	0.835	0.001	0.812	0.001	0.819	0.002	0.679	0.186	0.675	0.019	0.704	0.010	0.681	0.029	0.669	0.018	0.676	0.075

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
753	0.816	0.001	0.813	0.002	0.819	0.002	0.676	0.071	0.677	0.001	0.704	0.009	0.618	0.262	0.650	0.018	0.676	0.066
754	0.837	0.001	0.821	0.001	0.819	0.001	0.696	0.013	0.658	0.009	0.704	0.011	0.673	0.014	0.690	0.003	0.676	0.075
755	0.844	0.001	0.810	0.001	0.819	0.001	0.668	0.080	0.653	0.018	0.704	0.007	0.659	0.003	0.675	0.004	0.676	0.081
756	0.831	0.001	0.822	0.001	0.819	0.002	0.676	0.003	0.675	0.018	0.704	0.010	0.726	0.001	0.655	0.050	0.676	0.069
757	0.824	0.002	0.813	0.001	0.819	0.003	0.684	0.016	0.687	0.002	0.704	0.011	0.648	0.500	0.674	0.004	0.676	0.066
758	0.852	0.001	0.811	0.001	0.819	0.002	0.656	0.094	0.683	0.015	0.704	0.010	0.648	0.067	0.647	0.043	0.676	0.051
759	0.824	0.001	0.807	0.001	0.819	0.001	0.662	0.031	0.673	0.005	0.704	0.010	0.652	0.010	0.651	0.049	0.676	0.081
760	0.835	0.001	0.831	0.001	0.819	0.002	0.691	0.006	0.690	0.002	0.704	0.011	0.682	0.005	0.672	0.003	0.676	0.076
761	0.823	0.002	0.831	0.001	0.819	0.004	0.683	0.005	0.648	0.051	0.704	0.009	0.694	0.018	0.622	0.239	0.676	0.063
762	0.796	0.002	0.809	0.001	0.819	0.004	0.693	0.023	0.660	0.029	0.704	0.012	0.674	0.008	0.692	0.002	0.676	0.068
763	0.825	0.001	0.824	0.001	0.819	0.002	0.674	0.009	0.675	0.018	0.704	0.011	0.669	0.016	0.630	0.037	0.676	0.056
764	0.821	0.001	0.805	0.001	0.819	0.001	0.700	0.001	0.693	0.001	0.704	0.009	0.653	0.129	0.648	0.127	0.676	0.060
765	0.829	0.001	0.811	0.001	0.819	0.002	0.679	0.044	0.677	0.049	0.704	0.008	0.681	0.006	0.711	0.001	0.676	0.073
766	0.817	0.001	0.818	0.001	0.819	0.001	0.691	0.003	0.673	0.014	0.704	0.006	0.688	0.005	0.662	0.049	0.676	0.067
767	0.806	0.001	0.805	0.001	0.819	0.002	0.699	0.001	0.684	0.020	0.704	0.008	0.664	0.095	0.646	0.087	0.676	0.060
768	0.839	0.001	0.805	0.001	0.819	0.003	0.677	0.004	0.690	0.001	0.704	0.011	0.658	0.046	0.640	0.044	0.676	0.066
769	0.833	0.001	0.817	0.001	0.819	0.002	0.686	0.001	0.687	0.001	0.704	0.009	0.648	0.417	0.673	0.001	0.676	0.069
770	0.776	0.002	0.814	0.001	0.819	0.002	0.694	0.008	0.673	0.022	0.704	0.008	0.631	0.487	0.664	0.010	0.676	0.070
771	0.815	0.003	0.804	0.001	0.819	0.001	0.689	0.011	0.706	0.001	0.704	0.001	0.677	0.011	0.658	0.008	0.676	0.077
772	0.835	0.001	0.781	0.002	0.819	0.001	0.675	0.099	0.687	0.014	0.704	0.015	0.648	0.214	0.678	0.004	0.676	0.065
773	0.832	0.001	0.836	0.001	0.819	0.001	0.675	0.003	0.655	0.039	0.704	0.014	0.686	0.031	0.651	0.011	0.676	0.062
774	0.808	0.003	0.829	0.001	0.819	0.001	0.718	0.001	0.677	0.002	0.704	0.012	0.616	0.197	0.702	0.002	0.676	0.056
775	0.839	0.001	0.825	0.001	0.819	0.001	0.683	0.001	0.690	0.006	0.704	0.011	0.698	0.006	0.638	0.087	0.676	0.065
776	0.843	0.001	0.797	0.001	0.819	0.002	0.675	0.023	0.671	0.025	0.704	0.011	0.685	0.002	0.682	0.009	0.676	0.082
777	0.843	0.002	0.792	0.001	0.819	0.002	0.697	0.003	0.677	0.006	0.704	0.009	0.655	0.032	0.650	0.212	0.676	0.069
778	0.812	0.001	0.825	0.001	0.819	0.001	0.671	0.009	0.678	0.008	0.704	0.008	0.699	0.004	0.664	0.008	0.676	0.076
779	0.828	0.001	0.826	0.001	0.819	0.002	0.719	0.001	0.653	0.030	0.704	0.007	0.628	0.588	0.662	0.020	0.676	0.075
780	0.800	0.001	0.821	0.001	0.819	0.001	0.681	0.006	0.671	0.042	0.704	0.003	0.671	0.013	0.653	0.003	0.676	0.071

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
781	0.851	0.001	0.826	0.001	0.819	0.001	0.665	0.112	0.688	0.006	0.704	0.007	0.652	0.138	0.658	0.013	0.676	0.071
782	0.843	0.001	0.836	0.001	0.819	0.002	0.638	0.148	0.682	0.005	0.704	0.006	0.653	0.153	0.659	0.017	0.676	0.081
783	0.813	0.003	0.818	0.001	0.819	0.001	0.680	0.022	0.676	0.003	0.704	0.013	0.649	0.033	0.707	0.001	0.676	0.073
784	0.811	0.001	0.794	0.001	0.819	0.003	0.664	0.019	0.702	0.017	0.704	0.011	0.681	0.022	0.680	0.003	0.676	0.064
785	0.801	0.001	0.809	0.001	0.819	0.003	0.672	0.032	0.674	0.018	0.704	0.014	0.688	0.002	0.689	0.002	0.676	0.074
786	0.822	0.001	0.815	0.001	0.819	0.001	0.663	0.008	0.689	0.002	0.704	0.008	0.647	0.024	0.666	0.007	0.676	0.055
787	0.849	0.001	0.828	0.001	0.819	0.002	0.659	0.344	0.689	0.001	0.704	0.007	0.631	0.281	0.673	0.010	0.676	0.059
788	0.842	0.001	0.808	0.001	0.819	0.002	0.710	0.001	0.692	0.003	0.704	0.008	0.719	0.001	0.647	0.120	0.676	0.056
789	0.811	0.001	0.825	0.001	0.819	0.002	0.712	0.001	0.662	0.031	0.704	0.009	0.648	0.249	0.692	0.001	0.676	0.072
790	0.839	0.001	0.810	0.001	0.819	0.001	0.704	0.004	0.662	0.038	0.704	0.011	0.675	0.016	0.663	0.003	0.676	0.066
791	0.831	0.001	0.823	0.001	0.819	0.001	0.683	0.036	0.679	0.003	0.704	0.013	0.676	0.050	0.701	0.001	0.676	0.078
792	0.812	0.001	0.834	0.001	0.819	0.001	0.682	0.208	0.669	0.002	0.704	0.007	0.692	0.033	0.665	0.003	0.676	0.074
793	0.828	0.001	0.811	0.001	0.819	0.001	0.681	0.007	0.702	0.001	0.704	0.014	0.660	0.031	0.627	0.095	0.676	0.062
794	0.831	0.001	0.814	0.001	0.819	0.003	0.659	0.125	0.686	0.001	0.704	0.009	0.728	0.001	0.666	0.014	0.676	0.070
795	0.797	0.002	0.817	0.001	0.819	0.001	0.696	0.004	0.663	0.014	0.704	0.008	0.635	0.229	0.667	0.053	0.676	0.071
796	0.830	0.001	0.820	0.001	0.819	0.001	0.659	0.064	0.670	0.001	0.704	0.009	0.676	0.075	0.667	0.007	0.676	0.064
797	0.807	0.001	0.833	0.001	0.819	0.002	0.676	0.226	0.666	0.020	0.704	0.008	0.691	0.003	0.653	0.084	0.676	0.061
798	0.809	0.001	0.828	0.001	0.819	0.001	0.704	0.001	0.687	0.002	0.704	0.010	0.691	0.033	0.657	0.005	0.676	0.079
799	0.821	0.001	0.822	0.001	0.819	0.003	0.709	0.006	0.679	0.001	0.704	0.005	0.656	0.012	0.640	0.061	0.676	0.072
800	0.812	0.001	0.811	0.001	0.819	0.002	0.708	0.001	0.692	0.001	0.704	0.005	0.653	0.015	0.657	0.093	0.676	0.068
801	0.817	0.001	0.822	0.001	0.819	0.002	0.683	0.001	0.681	0.001	0.704	0.006	0.674	0.021	0.666	0.006	0.676	0.075
802	0.835	0.001	0.827	0.001	0.819	0.001	0.712	0.005	0.688	0.002	0.704	0.007	0.690	0.009	0.687	0.004	0.676	0.061
803	0.808	0.001	0.826	0.001	0.819	0.003	0.642	0.141	0.663	0.009	0.704	0.008	0.678	0.025	0.678	0.023	0.676	0.059
804	0.804	0.001	0.816	0.001	0.819	0.002	0.707	0.010	0.694	0.001	0.704	0.004	0.672	0.020	0.666	0.012	0.676	0.067
805	0.839	0.001	0.832	0.001	0.819	0.001	0.678	0.003	0.676	0.013	0.704	0.006	0.675	0.036	0.661	0.022	0.676	0.061
806	0.820	0.001	0.775	0.002	0.819	0.001	0.702	0.001	0.659	0.012	0.704	0.010	0.694	0.003	0.680	0.002	0.676	0.062
807	0.821	0.001	0.817	0.001	0.819	0.003	0.692	0.016	0.686	0.002	0.704	0.012	0.695	0.003	0.683	0.002	0.676	0.061
808	0.827	0.013	0.822	0.001	0.819	0.001	0.690	0.001	0.682	0.005	0.704	0.008	0.666	0.141	0.629	0.062	0.676	0.066

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
809	0.839	0.001	0.830	0.001	0.819	0.001	0.705	0.001	0.663	0.079	0.704	0.009	0.702	0.003	0.647	0.022	0.676	0.067
810	0.832	0.001	0.805	0.001	0.819	0.002	0.697	0.001	0.680	0.008	0.704	0.014	0.619	0.020	0.694	0.002	0.676	0.064
811	0.828	0.001	0.803	0.001	0.819	0.002	0.661	0.162	0.676	0.004	0.704	0.008	0.636	0.247	0.627	0.256	0.676	0.076
812	0.790	0.001	0.834	0.001	0.819	0.001	0.679	0.266	0.647	0.036	0.704	0.004	0.665	0.017	0.630	0.127	0.676	0.055
813	0.834	0.001	0.815	0.001	0.819	0.001	0.710	0.008	0.681	0.001	0.704	0.013	0.692	0.001	0.638	0.032	0.676	0.082
814	0.830	0.001	0.808	0.001	0.819	0.001	0.695	0.012	0.673	0.008	0.704	0.011	0.628	0.681	0.653	0.028	0.676	0.060
815	0.825	0.001	0.835	0.001	0.819	0.001	0.698	0.002	0.661	0.030	0.704	0.009	0.680	0.014	0.643	0.218	0.676	0.057
816	0.813	0.001	0.813	0.001	0.819	0.003	0.676	0.186	0.676	0.297	0.704	0.006	0.675	0.024	0.672	0.005	0.676	0.067
817	0.814	0.001	0.824	0.001	0.819	0.001	0.711	0.001	0.672	0.012	0.704	0.014	0.678	0.010	0.631	0.166	0.676	0.061
818	0.819	0.001	0.827	0.001	0.819	0.002	0.688	0.002	0.652	0.037	0.704	0.012	0.658	0.003	0.689	0.002	0.676	0.065
819	0.823	0.001	0.805	0.001	0.819	0.002	0.652	0.236	0.666	0.051	0.704	0.014	0.674	0.004	0.704	0.001	0.676	0.072
820	0.856	0.001	0.814	0.001	0.819	0.001	0.672	0.001	0.662	0.006	0.704	0.007	0.657	0.025	0.662	0.005	0.676	0.071
821	0.820	0.001	0.791	0.001	0.819	0.002	0.660	0.044	0.712	0.001	0.704	0.009	0.685	0.005	0.674	0.007	0.676	0.064
822	0.809	0.001	0.814	0.001	0.819	0.002	0.700	0.002	0.656	0.015	0.704	0.009	0.662	0.002	0.691	0.016	0.676	0.054
823	0.836	0.001	0.819	0.001	0.819	0.001	0.665	0.028	0.671	0.003	0.704	0.010	0.698	0.003	0.672	0.005	0.676	0.062
824	0.838	0.001	0.786	0.001	0.819	0.001	0.670	0.036	0.664	0.009	0.704	0.012	0.659	0.045	0.648	0.054	0.676	0.079
825	0.819	0.001	0.803	0.001	0.819	0.002	0.666	0.081	0.670	0.001	0.704	0.006	0.658	0.011	0.651	0.161	0.676	0.078
826	0.817	0.001	0.803	0.001	0.819	0.002	0.690	0.005	0.679	0.001	0.704	0.011	0.613	0.174	0.692	0.002	0.676	0.073
827	0.806	0.001	0.828	0.001	0.819	0.001	0.678	0.001	0.656	0.101	0.704	0.009	0.676	0.018	0.626	0.174	0.676	0.067
828	0.834	0.001	0.817	0.001	0.819	0.001	0.685	0.004	0.664	0.006	0.704	0.009	0.679	0.019	0.662	0.030	0.676	0.070
829	0.836	0.001	0.814	0.001	0.819	0.001	0.667	0.028	0.691	0.009	0.704	0.011	0.701	0.001	0.645	0.032	0.676	0.069
830	0.820	0.001	0.857	0.001	0.819	0.002	0.698	0.001	0.655	0.025	0.704	0.011	0.689	0.008	0.656	0.036	0.676	0.057
831	0.806	0.001	0.794	0.001	0.819	0.002	0.670	0.146	0.646	0.012	0.704	0.008	0.677	0.063	0.666	0.168	0.676	0.079
832	0.831	0.001	0.791	0.002	0.819	0.002	0.668	0.273	0.640	0.134	0.704	0.009	0.705	0.002	0.679	0.002	0.676	0.066
833	0.828	0.001	0.826	0.001	0.819	0.003	0.688	0.005	0.687	0.008	0.704	0.010	0.669	0.007	0.658	0.014	0.676	0.090
834	0.836	0.001	0.807	0.001	0.819	0.001	0.699	0.001	0.695	0.029	0.704	0.009	0.693	0.005	0.653	0.030	0.676	0.074
835	0.811	0.001	0.819	0.001	0.819	0.003	0.673	0.001	0.688	0.002	0.704	0.007	0.667	0.004	0.661	0.008	0.676	0.071
836	0.841	0.001	0.800	0.001	0.819	0.001	0.656	0.554	0.668	0.017	0.704	0.008	0.623	0.152	0.661	0.020	0.676	0.082

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
837	0.857	0.001	0.816	0.001	0.819	0.003	0.711	0.003	0.683	0.003	0.704	0.004	0.679	0.045	0.678	0.009	0.676	0.069
838	0.796	0.002	0.817	0.001	0.819	0.001	0.671	0.008	0.660	0.064	0.704	0.013	0.692	0.001	0.664	0.016	0.676	0.066
839	0.848	0.001	0.825	0.001	0.819	0.001	0.664	0.002	0.680	0.001	0.704	0.008	0.687	0.008	0.615	0.191	0.676	0.064
840	0.828	0.001	0.845	0.001	0.819	0.001	0.672	0.002	0.689	0.003	0.704	0.010	0.665	0.003	0.628	0.234	0.676	0.053
841	0.830	0.001	0.807	0.001	0.819	0.003	0.690	0.005	0.693	0.001	0.704	0.010	0.685	0.002	0.645	0.075	0.676	0.068
842	0.827	0.001	0.837	0.001	0.819	0.002	0.689	0.007	0.680	0.003	0.704	0.006	0.660	0.115	0.669	0.017	0.676	0.073
843	0.845	0.001	0.797	0.002	0.819	0.001	0.704	0.001	0.700	0.001	0.704	0.010	0.662	0.005	0.667	0.005	0.676	0.057
844	0.818	0.001	0.808	0.001	0.819	0.001	0.697	0.002	0.695	0.004	0.704	0.008	0.686	0.001	0.646	0.012	0.676	0.060
845	0.833	0.001	0.803	0.001	0.819	0.002	0.679	0.012	0.670	0.044	0.704	0.008	0.670	0.027	0.636	0.109	0.676	0.059
846	0.823	0.001	0.814	0.001	0.819	0.003	0.694	0.003	0.673	0.004	0.704	0.007	0.668	0.047	0.693	0.003	0.676	0.083
847	0.808	0.001	0.833	0.001	0.819	0.001	0.711	0.001	0.680	0.010	0.704	0.006	0.632	0.097	0.626	0.041	0.676	0.066
848	0.815	0.001	0.804	0.001	0.819	0.003	0.677	0.003	0.658	0.050	0.704	0.010	0.696	0.018	0.664	0.026	0.676	0.064
849	0.826	0.001	0.820	0.001	0.819	0.004	0.694	0.058	0.652	0.022	0.704	0.012	0.660	0.055	0.656	0.009	0.676	0.078
850	0.835	0.001	0.792	0.001	0.819	0.001	0.704	0.001	0.646	0.023	0.704	0.012	0.636	0.204	0.682	0.002	0.676	0.059
851	0.811	0.001	0.814	0.001	0.819	0.001	0.684	0.007	0.666	0.005	0.704	0.010	0.671	0.149	0.653	0.027	0.676	0.059
852	0.837	0.001	0.804	0.001	0.819	0.001	0.660	0.010	0.676	0.009	0.704	0.009	0.702	0.005	0.632	0.171	0.676	0.071
853	0.808	0.001	0.835	0.001	0.819	0.002	0.638	0.017	0.684	0.003	0.704	0.008	0.675	0.048	0.640	0.215	0.676	0.057
854	0.811	0.002	0.823	0.001	0.819	0.002	0.661	0.178	0.677	0.039	0.704	0.010	0.706	0.003	0.681	0.003	0.676	0.079
855	0.838	0.001	0.792	0.001	0.819	0.001	0.674	0.020	0.655	0.024	0.704	0.011	0.663	0.268	0.661	0.027	0.676	0.077
856	0.827	0.001	0.838	0.001	0.819	0.001	0.704	0.001	0.665	0.034	0.704	0.007	0.709	0.001	0.632	0.363	0.676	0.058
857	0.826	0.001	0.835	0.001	0.819	0.002	0.691	0.070	0.674	0.009	0.704	0.008	0.664	0.030	0.670	0.001	0.676	0.077
858	0.841	0.001	0.808	0.001	0.819	0.001	0.722	0.001	0.685	0.018	0.704	0.012	0.696	0.008	0.652	0.007	0.676	0.074
859	0.808	0.001	0.805	0.001	0.819	0.001	0.674	0.075	0.700	0.001	0.704	0.009	0.665	0.032	0.685	0.003	0.676	0.057
860	0.821	0.002	0.828	0.001	0.819	0.003	0.682	0.098	0.669	0.003	0.704	0.010	0.682	0.007	0.670	0.033	0.676	0.087
861	0.818	0.001	0.827	0.001	0.819	0.001	0.647	0.209	0.677	0.046	0.704	0.006	0.693	0.004	0.663	0.010	0.676	0.062
862	0.825	0.001	0.790	0.001	0.819	0.001	0.683	0.005	0.684	0.001	0.704	0.011	0.655	0.115	0.634	0.163	0.676	0.067
863	0.817	0.001	0.792	0.002	0.819	0.002	0.666	0.004	0.674	0.004	0.704	0.011	0.672	0.028	0.670	0.001	0.676	0.071
864	0.836	0.001	0.799	0.001	0.819	0.002	0.703	0.011	0.685	0.002	0.704	0.007	0.691	0.001	0.666	0.007	0.676	0.075

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
865	0.823	0.001	0.816	0.001	0.819	0.001	0.660	0.058	0.689	0.001	0.704	0.009	0.707	0.001	0.669	0.004	0.676	0.070
866	0.830	0.001	0.798	0.001	0.819	0.003	0.700	0.002	0.684	0.016	0.704	0.008	0.654	0.132	0.685	0.004	0.676	0.058
867	0.827	0.001	0.820	0.001	0.819	0.002	0.678	0.016	0.677	0.003	0.704	0.008	0.706	0.001	0.620	0.102	0.676	0.074
868	0.829	0.001	0.817	0.001	0.819	0.001	0.650	0.129	0.657	0.176	0.704	0.012	0.701	0.003	0.684	0.007	0.676	0.066
869	0.831	0.001	0.810	0.001	0.819	0.001	0.646	0.525	0.674	0.008	0.704	0.010	0.641	0.352	0.672	0.015	0.676	0.059
870	0.805	0.002	0.793	0.001	0.819	0.001	0.722	0.001	0.643	0.406	0.704	0.008	0.710	0.004	0.653	0.126	0.676	0.078
871	0.805	0.003	0.823	0.001	0.819	0.001	0.676	0.056	0.666	0.015	0.704	0.011	0.648	0.040	0.652	0.135	0.676	0.066
872	0.828	0.001	0.815	0.001	0.819	0.001	0.662	0.291	0.695	0.003	0.704	0.009	0.701	0.002	0.642	0.133	0.676	0.059
873	0.831	0.001	0.826	0.001	0.819	0.002	0.683	0.001	0.685	0.002	0.704	0.003	0.665	0.044	0.648	0.068	0.676	0.078
874	0.810	0.001	0.788	0.001	0.819	0.002	0.688	0.009	0.660	0.013	0.704	0.009	0.672	0.129	0.639	0.123	0.676	0.064
875	0.805	0.001	0.822	0.001	0.819	0.001	0.706	0.002	0.658	0.033	0.704	0.016	0.676	0.009	0.649	0.070	0.676	0.070
876	0.835	0.001	0.818	0.001	0.819	0.001	0.664	0.006	0.682	0.003	0.704	0.008	0.669	0.058	0.678	0.006	0.676	0.054
877	0.820	0.001	0.812	0.001	0.819	0.002	0.677	0.079	0.693	0.001	0.704	0.008	0.655	0.148	0.661	0.019	0.676	0.056
878	0.819	0.001	0.827	0.001	0.819	0.001	0.674	0.008	0.683	0.001	0.704	0.008	0.676	0.048	0.700	0.001	0.676	0.069
879	0.815	0.002	0.832	0.001	0.819	0.002	0.641	0.250	0.665	0.042	0.704	0.013	0.666	0.031	0.642	0.031	0.676	0.057
880	0.820	0.001	0.833	0.001	0.819	0.001	0.651	0.557	0.657	0.011	0.704	0.009	0.684	0.001	0.630	0.447	0.676	0.066
881	0.842	0.001	0.835	0.001	0.819	0.002	0.708	0.001	0.642	0.230	0.704	0.012	0.652	0.015	0.693	0.001	0.676	0.061
882	0.827	0.001	0.812	0.001	0.819	0.001	0.693	0.004	0.661	0.003	0.704	0.013	0.699	0.003	0.639	0.203	0.676	0.068
883	0.831	0.001	0.820	0.001	0.819	0.002	0.696	0.004	0.671	0.020	0.704	0.008	0.629	0.149	0.646	0.019	0.676	0.076
884	0.821	0.001	0.810	0.002	0.819	0.003	0.677	0.010	0.659	0.029	0.704	0.011	0.672	0.011	0.653	0.063	0.676	0.066
885	0.854	0.001	0.825	0.001	0.819	0.001	0.669	0.001	0.700	0.001	0.704	0.009	0.652	0.009	0.677	0.003	0.676	0.065
886	0.816	0.001	0.810	0.001	0.819	0.003	0.678	0.017	0.681	0.004	0.704	0.009	0.655	0.193	0.675	0.004	0.676	0.069
887	0.852	0.001	0.810	0.001	0.819	0.002	0.694	0.009	0.647	0.128	0.704	0.011	0.658	0.105	0.610	0.370	0.676	0.074
888	0.816	0.001	0.824	0.002	0.819	0.002	0.697	0.001	0.711	0.001	0.704	0.008	0.690	0.002	0.697	0.001	0.676	0.064
889	0.820	0.001	0.800	0.001	0.819	0.001	0.668	0.193	0.686	0.003	0.704	0.005	0.669	0.005	0.668	0.004	0.676	0.085
890	0.821	0.001	0.815	0.001	0.819	0.002	0.697	0.001	0.673	0.043	0.704	0.010	0.662	0.018	0.664	0.021	0.676	0.065
891	0.847	0.001	0.796	0.001	0.819	0.003	0.667	0.016	0.686	0.002	0.704	0.010	0.690	0.002	0.671	0.002	0.676	0.057
892	0.830	0.001	0.806	0.001	0.819	0.002	0.694	0.002	0.660	0.042	0.704	0.013	0.636	0.367	0.659	0.006	0.676	0.063

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
893	0.830	0.001	0.824	0.001	0.819	0.001	0.695	0.001	0.659	0.079	0.704	0.007	0.667	0.006	0.685	0.005	0.676	0.074
894	0.812	0.002	0.837	0.001	0.819	0.001	0.641	0.072	0.658	0.024	0.704	0.005	0.669	0.002	0.653	0.018	0.676	0.072
895	0.835	0.001	0.820	0.001	0.819	0.001	0.684	0.017	0.681	0.055	0.704	0.012	0.705	0.011	0.667	0.030	0.676	0.059
896	0.840	0.001	0.809	0.001	0.819	0.002	0.670	0.036	0.672	0.037	0.704	0.013	0.623	0.343	0.705	0.003	0.676	0.080
897	0.829	0.001	0.820	0.001	0.819	0.002	0.687	0.025	0.687	0.001	0.704	0.006	0.666	0.002	0.673	0.049	0.676	0.059
898	0.828	0.001	0.813	0.001	0.819	0.002	0.683	0.003	0.656	0.077	0.704	0.008	0.705	0.002	0.674	0.011	0.676	0.069
899	0.813	0.003	0.824	0.001	0.819	0.001	0.687	0.002	0.691	0.003	0.704	0.010	0.713	0.001	0.684	0.008	0.676	0.067
900	0.838	0.001	0.814	0.001	0.819	0.002	0.632	0.487	0.679	0.010	0.704	0.011	0.661	0.124	0.676	0.009	0.676	0.054
901	0.842	0.001	0.808	0.001	0.819	0.001	0.666	0.065	0.682	0.016	0.704	0.010	0.675	0.037	0.636	0.024	0.676	0.071
902	0.855	0.001	0.820	0.001	0.819	0.002	0.711	0.001	0.680	0.003	0.704	0.007	0.662	0.041	0.680	0.003	0.676	0.080
903	0.814	0.001	0.811	0.001	0.819	0.001	0.655	0.038	0.664	0.002	0.704	0.007	0.701	0.003	0.689	0.001	0.676	0.064
904	0.831	0.001	0.813	0.001	0.819	0.002	0.684	0.007	0.676	0.014	0.704	0.008	0.687	0.006	0.646	0.026	0.676	0.076
905	0.845	0.001	0.838	0.001	0.819	0.004	0.686	0.036	0.663	0.117	0.704	0.015	0.693	0.009	0.663	0.049	0.676	0.074
906	0.812	0.034	0.821	0.001	0.819	0.003	0.642	0.098	0.671	0.009	0.704	0.013	0.685	0.011	0.678	0.003	0.676	0.071
907	0.828	0.001	0.787	0.002	0.819	0.002	0.679	0.060	0.691	0.012	0.704	0.019	0.694	0.001	0.666	0.013	0.676	0.063
908	0.814	0.001	0.797	0.002	0.819	0.002	0.699	0.005	0.697	0.001	0.704	0.009	0.675	0.012	0.670	0.006	0.676	0.056
909	0.840	0.001	0.791	0.001	0.819	0.002	0.695	0.005	0.674	0.001	0.704	0.012	0.659	0.036	0.647	0.161	0.676	0.069
910	0.836	0.001	0.811	0.001	0.819	0.001	0.654	0.128	0.647	0.071	0.704	0.012	0.681	0.016	0.691	0.004	0.676	0.059
911	0.802	0.001	0.837	0.001	0.819	0.002	0.630	0.270	0.646	0.028	0.704	0.008	0.652	0.174	0.642	0.018	0.676	0.060
912	0.831	0.001	0.819	0.001	0.819	0.001	0.696	0.002	0.678	0.015	0.704	0.012	0.675	0.006	0.686	0.002	0.676	0.065
913	0.820	0.001	0.815	0.001	0.819	0.003	0.667	0.019	0.680	0.001	0.704	0.006	0.653	0.045	0.659	0.247	0.676	0.087
914	0.822	0.001	0.817	0.001	0.819	0.002	0.681	0.044	0.683	0.005	0.704	0.010	0.675	0.012	0.669	0.012	0.676	0.067
915	0.831	0.001	0.808	0.001	0.819	0.001	0.681	0.049	0.663	0.015	0.704	0.004	0.640	0.215	0.640	0.079	0.676	0.066
916	0.827	0.001	0.784	0.001	0.819	0.002	0.693	0.001	0.670	0.027	0.704	0.007	0.702	0.012	0.670	0.005	0.676	0.065
917	0.829	0.001	0.843	0.001	0.819	0.002	0.681	0.003	0.678	0.002	0.704	0.008	0.691	0.009	0.644	0.186	0.676	0.068
918	0.809	0.001	0.818	0.001	0.819	0.001	0.694	0.028	0.671	0.092	0.704	0.006	0.665	0.003	0.630	0.052	0.676	0.066
919	0.844	0.001	0.803	0.001	0.819	0.005	0.674	0.005	0.674	0.002	0.704	0.005	0.651	0.030	0.616	0.161	0.676	0.055
920	0.826	0.001	0.829	0.001	0.819	0.001	0.671	0.036	0.680	0.015	0.704	0.009	0.684	0.041	0.643	0.074	0.676	0.067

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
921	0.815	0.001	0.832	0.001	0.819	0.001	0.718	0.004	0.677	0.005	0.704	0.009	0.656	0.015	0.676	0.008	0.676	0.062
922	0.834	0.001	0.786	0.001	0.819	0.002	0.662	0.128	0.668	0.005	0.704	0.009	0.682	0.004	0.663	0.004	0.676	0.080
923	0.810	0.001	0.813	0.001	0.819	0.004	0.661	0.215	0.686	0.002	0.704	0.007	0.649	0.047	0.626	0.018	0.676	0.064
924	0.846	0.001	0.819	0.001	0.819	0.003	0.689	0.001	0.649	0.023	0.704	0.009	0.670	0.008	0.637	0.215	0.676	0.065
925	0.825	0.005	0.798	0.001	0.819	0.002	0.665	0.006	0.654	0.008	0.704	0.015	0.682	0.008	0.691	0.003	0.676	0.069
926	0.834	0.001	0.822	0.001	0.819	0.001	0.642	0.494	0.655	0.106	0.704	0.013	0.625	0.316	0.686	0.002	0.676	0.061
927	0.812	0.011	0.826	0.001	0.819	0.001	0.692	0.011	0.670	0.019	0.704	0.007	0.651	0.023	0.662	0.019	0.676	0.072
928	0.828	0.001	0.811	0.001	0.819	0.001	0.670	0.093	0.707	0.002	0.704	0.010	0.676	0.056	0.664	0.003	0.676	0.057
929	0.818	0.001	0.795	0.001	0.819	0.002	0.715	0.001	0.712	0.001	0.704	0.007	0.703	0.012	0.667	0.009	0.676	0.082
930	0.822	0.002	0.814	0.001	0.819	0.002	0.656	0.116	0.674	0.002	0.704	0.013	0.651	0.205	0.696	0.002	0.676	0.085
931	0.814	0.001	0.795	0.002	0.819	0.001	0.716	0.001	0.680	0.001	0.704	0.011	0.656	0.040	0.672	0.022	0.676	0.069
932	0.842	0.001	0.808	0.001	0.819	0.001	0.660	0.013	0.666	0.012	0.704	0.015	0.707	0.003	0.704	0.002	0.676	0.062
933	0.822	0.001	0.808	0.001	0.819	0.001	0.667	0.004	0.680	0.003	0.704	0.010	0.665	0.051	0.639	0.029	0.676	0.067
934	0.804	0.001	0.822	0.001	0.819	0.002	0.683	0.006	0.682	0.114	0.704	0.010	0.699	0.001	0.670	0.006	0.676	0.067
935	0.825	0.001	0.809	0.001	0.819	0.002	0.634	0.353	0.672	0.014	0.704	0.003	0.690	0.003	0.647	0.029	0.676	0.076
936	0.811	0.001	0.811	0.001	0.819	0.003	0.727	0.001	0.703	0.001	0.704	0.007	0.685	0.022	0.710	0.002	0.676	0.074
937	0.850	0.001	0.834	0.001	0.819	0.001	0.707	0.001	0.676	0.035	0.704	0.004	0.692	0.001	0.693	0.002	0.676	0.077
938	0.843	0.001	0.816	0.001	0.819	0.001	0.630	0.471	0.689	0.001	0.704	0.010	0.680	0.017	0.664	0.024	0.676	0.083
939	0.828	0.001	0.812	0.001	0.819	0.001	0.672	0.006	0.675	0.003	0.704	0.012	0.650	0.020	0.682	0.004	0.676	0.080
940	0.812	0.001	0.827	0.001	0.819	0.001	0.650	0.168	0.672	0.072	0.704	0.010	0.630	0.181	0.665	0.117	0.676	0.067
941	0.831	0.001	0.805	0.001	0.819	0.001	0.701	0.013	0.672	0.033	0.704	0.004	0.664	0.085	0.689	0.013	0.676	0.078
942	0.837	0.001	0.816	0.001	0.819	0.002	0.693	0.001	0.692	0.001	0.704	0.008	0.673	0.014	0.643	0.010	0.676	0.072
943	0.832	0.001	0.803	0.001	0.819	0.001	0.650	0.321	0.690	0.001	0.704	0.008	0.674	0.071	0.698	0.001	0.676	0.076
944	0.799	0.001	0.807	0.001	0.819	0.002	0.694	0.004	0.689	0.006	0.704	0.009	0.667	0.019	0.676	0.001	0.676	0.083
945	0.824	0.001	0.805	0.003	0.819	0.001	0.697	0.001	0.681	0.001	0.704	0.007	0.698	0.001	0.688	0.003	0.676	0.060
946	0.821	0.001	0.788	0.001	0.819	0.002	0.676	0.014	0.692	0.001	0.704	0.002	0.670	0.062	0.645	0.107	0.676	0.065
947	0.828	0.001	0.801	0.001	0.819	0.001	0.681	0.006	0.681	0.001	0.704	0.008	0.639	0.022	0.680	0.007	0.676	0.066
948	0.846	0.001	0.841	0.001	0.819	0.001	0.691	0.017	0.709	0.001	0.704	0.008	0.646	0.030	0.660	0.016	0.676	0.061

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
949	0.824	0.001	0.787	0.001	0.819	0.001	0.652	0.009	0.697	0.017	0.704	0.007	0.679	0.035	0.640	0.151	0.676	0.074
950	0.846	0.001	0.816	0.001	0.819	0.002	0.696	0.003	0.670	0.008	0.704	0.010	0.707	0.001	0.659	0.059	0.676	0.081
951	0.827	0.001	0.846	0.001	0.819	0.001	0.672	0.015	0.644	0.084	0.704	0.009	0.654	0.036	0.671	0.040	0.676	0.055
952	0.840	0.001	0.780	0.001	0.819	0.003	0.672	0.038	0.670	0.072	0.704	0.007	0.659	0.007	0.611	0.226	0.676	0.066
953	0.840	0.001	0.780	0.001	0.819	0.001	0.653	0.059	0.649	0.075	0.704	0.015	0.672	0.007	0.651	0.016	0.676	0.062
954	0.843	0.001	0.825	0.001	0.819	0.001	0.693	0.015	0.688	0.017	0.704	0.010	0.669	0.015	0.683	0.001	0.676	0.073
955	0.842	0.001	0.807	0.001	0.819	0.003	0.666	0.067	0.666	0.087	0.704	0.009	0.696	0.027	0.668	0.030	0.676	0.070
956	0.839	0.001	0.801	0.001	0.819	0.003	0.695	0.002	0.666	0.016	0.704	0.004	0.662	0.040	0.658	0.017	0.676	0.089
957	0.801	0.002	0.819	0.001	0.819	0.001	0.692	0.024	0.675	0.038	0.704	0.010	0.676	0.203	0.657	0.007	0.676	0.063
958	0.835	0.001	0.811	0.001	0.819	0.002	0.690	0.002	0.664	0.061	0.704	0.011	0.657	0.011	0.666	0.028	0.676	0.064
959	0.831	0.001	0.786	0.001	0.819	0.001	0.680	0.107	0.726	0.001	0.704	0.013	0.699	0.001	0.651	0.065	0.676	0.078
960	0.820	0.001	0.823	0.001	0.819	0.002	0.676	0.006	0.694	0.002	0.704	0.012	0.644	0.161	0.652	0.007	0.676	0.070
961	0.839	0.001	0.817	0.001	0.819	0.002	0.704	0.002	0.663	0.304	0.704	0.010	0.690	0.012	0.658	0.168	0.676	0.065
962	0.832	0.001	0.820	0.001	0.819	0.001	0.643	0.061	0.682	0.001	0.704	0.008	0.671	0.326	0.656	0.049	0.676	0.064
963	0.833	0.001	0.816	0.001	0.819	0.002	0.673	0.309	0.662	0.184	0.704	0.007	0.700	0.001	0.668	0.003	0.676	0.067
964	0.821	0.001	0.792	0.001	0.819	0.002	0.639	0.093	0.661	0.044	0.704	0.008	0.654	0.090	0.684	0.002	0.676	0.074
965	0.839	0.001	0.815	0.001	0.819	0.002	0.691	0.023	0.690	0.035	0.704	0.009	0.654	0.036	0.683	0.002	0.676	0.067
966	0.828	0.002	0.789	0.001	0.819	0.003	0.695	0.011	0.652	0.017	0.704	0.009	0.660	0.003	0.667	0.014	0.676	0.072
967	0.823	0.001	0.794	0.001	0.819	0.001	0.684	0.187	0.687	0.001	0.704	0.006	0.651	0.296	0.697	0.003	0.676	0.056
968	0.820	0.001	0.792	0.001	0.819	0.002	0.674	0.051	0.658	0.189	0.704	0.005	0.685	0.001	0.690	0.002	0.676	0.061
969	0.830	0.001	0.809	0.002	0.819	0.003	0.705	0.001	0.678	0.006	0.704	0.008	0.648	0.264	0.657	0.012	0.676	0.060
970	0.830	0.001	0.809	0.001	0.819	0.001	0.675	0.033	0.651	0.092	0.704	0.011	0.647	0.064	0.641	0.152	0.676	0.064
971	0.822	0.001	0.813	0.001	0.819	0.002	0.702	0.001	0.698	0.001	0.704	0.007	0.627	0.248	0.673	0.002	0.676	0.054
972	0.816	0.001	0.793	0.001	0.819	0.002	0.692	0.053	0.674	0.013	0.704	0.009	0.633	0.411	0.630	0.300	0.676	0.076
973	0.834	0.001	0.810	0.001	0.819	0.001	0.720	0.001	0.698	0.003	0.704	0.009	0.660	0.066	0.663	0.059	0.676	0.067
974	0.823	0.001	0.808	0.001	0.819	0.002	0.710	0.001	0.677	0.001	0.704	0.009	0.691	0.001	0.631	0.034	0.676	0.074
975	0.836	0.001	0.826	0.001	0.819	0.002	0.667	0.002	0.671	0.002	0.704	0.009	0.665	0.088	0.622	0.520	0.676	0.068
976	0.831	0.001	0.814	0.001	0.819	0.003	0.688	0.039	0.649	0.102	0.704	0.007	0.621	0.180	0.683	0.001	0.676	0.085

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
977	0.805	0.002	0.809	0.001	0.819	0.002	0.688	0.008	0.663	0.003	0.704	0.009	0.716	0.001	0.647	0.029	0.676	0.075
978	0.812	0.006	0.808	0.001	0.819	0.001	0.686	0.006	0.685	0.070	0.704	0.004	0.664	0.159	0.673	0.004	0.676	0.068
979	0.812	0.001	0.836	0.001	0.819	0.002	0.696	0.006	0.674	0.041	0.704	0.004	0.665	0.070	0.657	0.047	0.676	0.078
980	0.842	0.001	0.807	0.001	0.819	0.002	0.692	0.003	0.671	0.001	0.704	0.006	0.644	0.262	0.669	0.025	0.676	0.062
981	0.813	0.001	0.821	0.001	0.819	0.004	0.695	0.004	0.681	0.036	0.704	0.008	0.666	0.022	0.688	0.002	0.676	0.061
982	0.842	0.001	0.787	0.001	0.819	0.001	0.671	0.043	0.689	0.002	0.704	0.004	0.679	0.020	0.655	0.059	0.676	0.068
983	0.839	0.001	0.805	0.001	0.819	0.003	0.702	0.007	0.682	0.001	0.704	0.009	0.663	0.021	0.653	0.027	0.676	0.060
984	0.815	0.001	0.792	0.001	0.819	0.001	0.701	0.003	0.711	0.001	0.704	0.012	0.650	0.139	0.693	0.003	0.676	0.074
985	0.836	0.001	0.822	0.001	0.819	0.002	0.658	0.075	0.665	0.078	0.704	0.006	0.719	0.001	0.651	0.004	0.676	0.055
986	0.806	0.001	0.805	0.001	0.819	0.002	0.721	0.001	0.665	0.013	0.704	0.010	0.675	0.056	0.653	0.173	0.676	0.062
987	0.823	0.001	0.810	0.001	0.819	0.001	0.703	0.001	0.690	0.001	0.704	0.004	0.670	0.163	0.624	0.105	0.676	0.064
988	0.811	0.002	0.797	0.001	0.819	0.002	0.681	0.012	0.678	0.031	0.704	0.005	0.702	0.006	0.668	0.008	0.676	0.072
989	0.809	0.002	0.824	0.001	0.819	0.001	0.659	0.164	0.636	0.534	0.704	0.010	0.687	0.012	0.638	0.080	0.676	0.061
990	0.836	0.001	0.782	0.002	0.819	0.003	0.666	0.016	0.671	0.040	0.704	0.011	0.649	0.043	0.653	0.016	0.676	0.065
991	0.824	0.001	0.816	0.001	0.819	0.001	0.669	0.008	0.710	0.006	0.704	0.008	0.672	0.005	0.669	0.030	0.676	0.064
992	0.797	0.002	0.825	0.001	0.819	0.002	0.690	0.001	0.675	0.048	0.704	0.009	0.649	0.078	0.655	0.022	0.676	0.083
993	0.831	0.001	0.824	0.001	0.819	0.001	0.702	0.002	0.645	0.190	0.704	0.009	0.644	0.073	0.610	0.382	0.676	0.065
994	0.831	0.001	0.832	0.001	0.819	0.003	0.666	0.032	0.682	0.003	0.704	0.007	0.681	0.001	0.686	0.002	0.676	0.078
995	0.796	0.011	0.832	0.001	0.819	0.001	0.694	0.006	0.663	0.060	0.704	0.009	0.661	0.056	0.674	0.002	0.676	0.069
996	0.816	0.001	0.813	0.001	0.819	0.002	0.667	0.048	0.693	0.012	0.704	0.006	0.648	0.026	0.666	0.037	0.676	0.074
997	0.832	0.001	0.800	0.001	0.819	0.002	0.689	0.001	0.655	0.140	0.704	0.005	0.660	0.016	0.682	0.002	0.676	0.064
998	0.845	0.001	0.811	0.001	0.819	0.001	0.671	0.013	0.659	0.005	0.704	0.011	0.647	0.332	0.661	0.024	0.676	0.084
999	0.829	0.001	0.809	0.001	0.819	0.001	0.666	0.004	0.663	0.004	0.704	0.009	0.684	0.003	0.664	0.006	0.676	0.073
1000	0.805	0.006	0.798	0.001	0.819	0.002	0.674	0.184	0.657	0.023	0.704	0.014	0.686	0.002	0.650	0.031	0.676	0.061
Mean	0.825	0.001	0.812	0.001	0.819	0.002	0.683	0.047	0.673	0.040	0.704	0.009	0.670	0.071	0.662	0.045	0.676	0.068
Standard Error	8.3E x10^1	1.3E x10^3	8.1E x10^1	1.1E x10^3	8.2E x10^1	1.8E x10^3	6.8E x10^1	4.7E x10^2	6.7E x10^1	4.0E x10^2	7.0E x10^1	9.1E x10^3	6.7E x10^1	7.1E x10^2	6.6E x10^1	4.5E x10^2	6.8E x10^1	6.8E x10^2

Appendix 4B. Results from my balanced, rarefied dataset for the 1000 iterations. This includes comparisons between each taxon and our proxies for hydroperiod.

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
1	0.381	0.005	0.334	0.362	0.387	0.003	0.398	0.004	0.348	0.173	0.289	0.891	0.376	0.042	0.391	0.037	0.450	0.003
2	0.383	0.001	0.312	0.638	0.387	0.004	0.319	0.188	0.323	0.524	0.289	0.884	0.380	0.048	0.357	0.085	0.450	0.002
3	0.371	0.024	0.307	0.673	0.387	0.005	0.316	0.292	0.350	0.141	0.289	0.892	0.411	0.005	0.385	0.028	0.450	0.002
4	0.351	0.021	0.346	0.206	0.387	0.003	0.333	0.175	0.353	0.141	0.289	0.896	0.454	0.002	0.323	0.317	0.450	0.001
5	0.362	0.021	0.358	0.080	0.387	0.004	0.350	0.104	0.355	0.115	0.289	0.898	0.397	0.016	0.395	0.012	0.450	0.002
6	0.364	0.028	0.341	0.150	0.387	0.001	0.345	0.034	0.338	0.184	0.289	0.883	0.414	0.003	0.394	0.018	0.450	0.002
7	0.377	0.008	0.340	0.293	0.387	0.003	0.347	0.059	0.401	0.001	0.289	0.894	0.477	0.001	0.373	0.053	0.450	0.001
8	0.387	0.004	0.321	0.503	0.387	0.002	0.349	0.086	0.321	0.475	0.289	0.898	0.412	0.002	0.356	0.134	0.450	0.001
9	0.372	0.012	0.336	0.155	0.387	0.005	0.310	0.201	0.370	0.044	0.289	0.877	0.379	0.037	0.393	0.011	0.450	0.001
10	0.372	0.002	0.352	0.103	0.387	0.006	0.354	0.085	0.306	0.629	0.289	0.888	0.443	0.001	0.380	0.027	0.450	0.004
11	0.350	0.144	0.286	0.698	0.387	0.008	0.361	0.063	0.339	0.290	0.289	0.887	0.404	0.004	0.392	0.027	0.450	0.002
12	0.398	0.005	0.318	0.430	0.387	0.007	0.359	0.047	0.348	0.141	0.289	0.882	0.352	0.111	0.356	0.119	0.450	0.001
13	0.362	0.029	0.329	0.331	0.387	0.005	0.352	0.064	0.321	0.464	0.289	0.904	0.421	0.004	0.377	0.053	0.450	0.002
14	0.409	0.002	0.339	0.141	0.387	0.005	0.381	0.004	0.326	0.386	0.289	0.900	0.393	0.009	0.370	0.042	0.450	0.001
15	0.398	0.001	0.331	0.220	0.387	0.004	0.342	0.118	0.350	0.085	0.289	0.892	0.364	0.062	0.376	0.048	0.450	0.001
16	0.349	0.087	0.351	0.079	0.387	0.004	0.348	0.024	0.391	0.016	0.289	0.886	0.345	0.166	0.363	0.069	0.450	0.002
17	0.443	0.001	0.346	0.183	0.387	0.001	0.369	0.025	0.372	0.034	0.289	0.895	0.437	0.002	0.330	0.188	0.450	0.002
18	0.393	0.001	0.345	0.158	0.387	0.002	0.344	0.128	0.334	0.303	0.289	0.900	0.364	0.039	0.292	0.553	0.450	0.001
19	0.334	0.035	0.324	0.543	0.387	0.003	0.357	0.053	0.405	0.002	0.289	0.886	0.415	0.008	0.387	0.026	0.450	0.002
20	0.410	0.001	0.327	0.375	0.387	0.005	0.359	0.031	0.314	0.619	0.289	0.884	0.432	0.001	0.348	0.194	0.450	0.002
21	0.323	0.212	0.310	0.694	0.387	0.006	0.339	0.267	0.341	0.241	0.289	0.881	0.450	0.001	0.358	0.099	0.450	0.001
22	0.354	0.011	0.338	0.217	0.387	0.008	0.359	0.003	0.362	0.044	0.289	0.902	0.412	0.005	0.362	0.100	0.450	0.001
23	0.388	0.002	0.326	0.316	0.387	0.003	0.343	0.180	0.325	0.292	0.289	0.908	0.384	0.015	0.378	0.047	0.450	0.001
24	0.386	0.004	0.334	0.248	0.387	0.003	0.383	0.016	0.319	0.509	0.289	0.896	0.406	0.015	0.362	0.084	0.450	0.002
25	0.354	0.048	0.333	0.150	0.387	0.004	0.350	0.093	0.365	0.030	0.289	0.892	0.444	0.002	0.375	0.056	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
26	0.407	0.001	0.317	0.548	0.387	0.001	0.373	0.026	0.364	0.040	0.289	0.883	0.449	0.001	0.338	0.195	0.450	0.002
27	0.341	0.034	0.338	0.254	0.387	0.001	0.373	0.006	0.300	0.699	0.289	0.894	0.432	0.002	0.376	0.072	0.450	0.001
28	0.361	0.033	0.341	0.168	0.387	0.002	0.363	0.032	0.302	0.619	0.289	0.886	0.476	0.001	0.374	0.081	0.450	0.001
29	0.321	0.132	0.337	0.305	0.387	0.005	0.322	0.257	0.344	0.137	0.289	0.895	0.401	0.010	0.369	0.073	0.450	0.001
30	0.381	0.013	0.360	0.050	0.387	0.004	0.354	0.053	0.337	0.245	0.289	0.888	0.372	0.039	0.326	0.297	0.450	0.001
31	0.375	0.003	0.315	0.634	0.387	0.003	0.309	0.583	0.309	0.524	0.289	0.883	0.498	0.001	0.378	0.036	0.450	0.001
32	0.405	0.001	0.332	0.351	0.387	0.006	0.331	0.234	0.418	0.001	0.289	0.880	0.435	0.001	0.354	0.093	0.450	0.002
33	0.368	0.035	0.329	0.486	0.387	0.002	0.370	0.015	0.312	0.612	0.289	0.895	0.364	0.027	0.348	0.174	0.450	0.001
34	0.332	0.144	0.322	0.478	0.387	0.004	0.408	0.002	0.347	0.177	0.289	0.885	0.414	0.002	0.318	0.386	0.450	0.001
35	0.365	0.026	0.305	0.768	0.387	0.005	0.373	0.018	0.352	0.121	0.289	0.888	0.434	0.001	0.331	0.247	0.450	0.001
36	0.383	0.009	0.362	0.041	0.387	0.003	0.332	0.175	0.316	0.523	0.289	0.882	0.446	0.003	0.372	0.061	0.450	0.001
37	0.349	0.079	0.347	0.051	0.387	0.003	0.318	0.541	0.327	0.316	0.289	0.897	0.428	0.002	0.389	0.017	0.450	0.001
38	0.380	0.005	0.332	0.264	0.387	0.003	0.323	0.347	0.338	0.246	0.289	0.895	0.415	0.005	0.374	0.066	0.450	0.001
39	0.398	0.001	0.331	0.273	0.387	0.005	0.348	0.039	0.368	0.020	0.289	0.916	0.423	0.005	0.354	0.094	0.450	0.002
40	0.318	0.162	0.327	0.370	0.387	0.006	0.373	0.035	0.349	0.115	0.289	0.908	0.385	0.025	0.394	0.022	0.450	0.004
41	0.345	0.077	0.331	0.279	0.387	0.003	0.379	0.009	0.359	0.065	0.289	0.893	0.353	0.066	0.389	0.019	0.450	0.001
42	0.373	0.009	0.309	0.708	0.387	0.001	0.341	0.092	0.344	0.161	0.289	0.884	0.454	0.001	0.356	0.125	0.450	0.001
43	0.383	0.002	0.338	0.218	0.387	0.003	0.340	0.136	0.301	0.733	0.289	0.900	0.446	0.002	0.351	0.162	0.450	0.002
44	0.368	0.035	0.327	0.374	0.387	0.003	0.391	0.008	0.355	0.023	0.289	0.893	0.350	0.030	0.418	0.009	0.450	0.001
45	0.313	0.177	0.307	0.625	0.387	0.005	0.337	0.212	0.327	0.367	0.289	0.898	0.448	0.001	0.356	0.108	0.450	0.002
46	0.394	0.002	0.296	0.849	0.387	0.003	0.320	0.222	0.333	0.124	0.289	0.893	0.398	0.020	0.364	0.105	0.450	0.001
47	0.346	0.056	0.316	0.428	0.387	0.004	0.363	0.025	0.315	0.367	0.289	0.881	0.409	0.008	0.388	0.035	0.450	0.003
48	0.324	0.458	0.329	0.349	0.387	0.002	0.320	0.250	0.332	0.330	0.289	0.896	0.424	0.001	0.358	0.122	0.450	0.001
49	0.347	0.089	0.358	0.027	0.387	0.003	0.394	0.004	0.333	0.314	0.289	0.892	0.431	0.003	0.377	0.043	0.450	0.001
50	0.354	0.040	0.346	0.141	0.387	0.003	0.333	0.238	0.329	0.219	0.289	0.907	0.440	0.002	0.343	0.220	0.450	0.001
51	0.352	0.039	0.334	0.267	0.387	0.003	0.350	0.084	0.354	0.136	0.289	0.893	0.497	0.001	0.350	0.158	0.450	0.002
52	0.348	0.088	0.320	0.413	0.387	0.001	0.361	0.031	0.351	0.134	0.289	0.876	0.412	0.005	0.373	0.034	0.450	0.001
53	0.420	0.001	0.316	0.545	0.387	0.003	0.334	0.041	0.347	0.132	0.289	0.887	0.348	0.058	0.351	0.150	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
54	0.371	0.006	0.325	0.508	0.387	0.006	0.351	0.074	0.359	0.045	0.289	0.894	0.360	0.046	0.393	0.012	0.450	0.001
55	0.368	0.020	0.321	0.351	0.387	0.004	0.343	0.104	0.341	0.230	0.289	0.883	0.447	0.006	0.327	0.279	0.450	0.001
56	0.329	0.243	0.328	0.314	0.387	0.002	0.323	0.273	0.333	0.189	0.289	0.885	0.474	0.001	0.330	0.234	0.450	0.002
57	0.371	0.009	0.297	0.678	0.387	0.004	0.315	0.260	0.328	0.356	0.289	0.905	0.366	0.037	0.330	0.190	0.450	0.001
58	0.354	0.033	0.310	0.633	0.387	0.004	0.344	0.044	0.341	0.155	0.289	0.910	0.436	0.001	0.307	0.526	0.450	0.001
59	0.351	0.110	0.345	0.177	0.387	0.003	0.359	0.070	0.332	0.266	0.289	0.893	0.472	0.001	0.357	0.107	0.450	0.001
60	0.381	0.003	0.370	0.030	0.387	0.002	0.339	0.120	0.353	0.086	0.289	0.897	0.472	0.001	0.390	0.022	0.450	0.001
61	0.346	0.028	0.301	0.477	0.387	0.002	0.363	0.021	0.370	0.035	0.289	0.887	0.380	0.029	0.332	0.148	0.450	0.002
62	0.373	0.015	0.321	0.552	0.387	0.005	0.368	0.011	0.305	0.701	0.289	0.911	0.375	0.048	0.362	0.065	0.450	0.001
63	0.374	0.005	0.344	0.152	0.387	0.004	0.315	0.519	0.324	0.252	0.289	0.880	0.457	0.001	0.341	0.180	0.450	0.001
64	0.342	0.043	0.348	0.143	0.387	0.005	0.339	0.112	0.387	0.008	0.289	0.881	0.459	0.001	0.408	0.015	0.450	0.001
65	0.375	0.004	0.338	0.311	0.387	0.005	0.355	0.045	0.330	0.372	0.289	0.889	0.406	0.012	0.323	0.313	0.450	0.001
66	0.353	0.028	0.328	0.455	0.387	0.003	0.410	0.001	0.364	0.050	0.289	0.889	0.399	0.013	0.366	0.067	0.450	0.001
67	0.357	0.036	0.371	0.019	0.387	0.002	0.327	0.303	0.358	0.037	0.289	0.879	0.392	0.010	0.378	0.069	0.450	0.001
68	0.396	0.003	0.316	0.593	0.387	0.002	0.364	0.020	0.353	0.056	0.289	0.902	0.362	0.038	0.361	0.092	0.450	0.001
69	0.359	0.028	0.332	0.268	0.387	0.004	0.399	0.007	0.347	0.149	0.289	0.888	0.395	0.012	0.311	0.479	0.450	0.001
70	0.365	0.006	0.342	0.193	0.387	0.002	0.349	0.108	0.334	0.192	0.289	0.892	0.440	0.001	0.388	0.013	0.450	0.004
71	0.360	0.044	0.347	0.165	0.387	0.002	0.385	0.004	0.299	0.826	0.289	0.899	0.356	0.075	0.428	0.001	0.450	0.001
72	0.343	0.067	0.356	0.102	0.387	0.006	0.316	0.305	0.347	0.206	0.289	0.903	0.425	0.004	0.369	0.069	0.450	0.002
73	0.343	0.140	0.331	0.372	0.387	0.002	0.331	0.230	0.333	0.281	0.289	0.905	0.389	0.017	0.385	0.020	0.450	0.001
74	0.408	0.001	0.321	0.383	0.387	0.006	0.397	0.003	0.301	0.379	0.289	0.914	0.478	0.001	0.385	0.023	0.450	0.004
75	0.329	0.153	0.352	0.051	0.387	0.003	0.361	0.034	0.343	0.123	0.289	0.895	0.440	0.003	0.383	0.020	0.450	0.003
76	0.374	0.001	0.328	0.398	0.387	0.007	0.363	0.036	0.349	0.079	0.289	0.902	0.463	0.001	0.357	0.063	0.450	0.003
77	0.326	0.298	0.348	0.161	0.387	0.004	0.285	0.786	0.341	0.280	0.289	0.895	0.461	0.001	0.299	0.618	0.450	0.001
78	0.376	0.005	0.328	0.397	0.387	0.002	0.342	0.096	0.355	0.068	0.289	0.909	0.406	0.002	0.360	0.101	0.450	0.001
79	0.360	0.054	0.341	0.259	0.387	0.001	0.322	0.451	0.324	0.329	0.289	0.881	0.462	0.001	0.311	0.301	0.450	0.002
80	0.376	0.009	0.311	0.429	0.387	0.004	0.418	0.001	0.349	0.140	0.289	0.886	0.403	0.005	0.359	0.117	0.450	0.001
81	0.390	0.002	0.336	0.317	0.387	0.004	0.333	0.163	0.348	0.141	0.289	0.892	0.434	0.001	0.377	0.047	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
82	0.358	0.008	0.355	0.108	0.387	0.003	0.319	0.044	0.378	0.034	0.289	0.913	0.393	0.035	0.375	0.055	0.450	0.001
83	0.396	0.001	0.329	0.331	0.387	0.008	0.299	0.710	0.360	0.056	0.289	0.905	0.385	0.016	0.354	0.145	0.450	0.001
84	0.373	0.007	0.341	0.167	0.387	0.004	0.330	0.221	0.359	0.068	0.289	0.894	0.380	0.048	0.379	0.054	0.450	0.001
85	0.333	0.131	0.341	0.112	0.387	0.006	0.336	0.272	0.351	0.152	0.289	0.900	0.449	0.002	0.375	0.049	0.450	0.003
86	0.356	0.062	0.327	0.441	0.387	0.003	0.314	0.170	0.379	0.016	0.289	0.894	0.411	0.009	0.357	0.099	0.450	0.001
87	0.307	0.398	0.330	0.405	0.387	0.002	0.328	0.344	0.341	0.100	0.289	0.898	0.418	0.003	0.332	0.194	0.450	0.001
88	0.397	0.001	0.320	0.479	0.387	0.002	0.327	0.229	0.333	0.291	0.289	0.905	0.382	0.016	0.351	0.146	0.450	0.001
89	0.363	0.021	0.326	0.457	0.387	0.002	0.351	0.123	0.369	0.016	0.289	0.912	0.443	0.002	0.319	0.255	0.450	0.001
90	0.364	0.013	0.323	0.388	0.387	0.006	0.361	0.020	0.359	0.064	0.289	0.890	0.434	0.002	0.336	0.223	0.450	0.001
91	0.389	0.002	0.320	0.560	0.387	0.001	0.314	0.483	0.351	0.148	0.289	0.888	0.407	0.013	0.360	0.103	0.450	0.002
92	0.322	0.101	0.322	0.468	0.387	0.003	0.367	0.019	0.370	0.030	0.289	0.876	0.425	0.003	0.358	0.115	0.450	0.002
93	0.346	0.111	0.318	0.547	0.387	0.003	0.352	0.062	0.346	0.165	0.289	0.895	0.441	0.003	0.373	0.065	0.450	0.001
94	0.337	0.221	0.339	0.178	0.387	0.001	0.308	0.277	0.343	0.115	0.289	0.879	0.469	0.001	0.302	0.501	0.450	0.001
95	0.367	0.004	0.323	0.406	0.387	0.004	0.291	0.563	0.321	0.542	0.289	0.894	0.401	0.012	0.365	0.114	0.450	0.001
96	0.384	0.007	0.311	0.501	0.387	0.002	0.335	0.236	0.331	0.320	0.289	0.904	0.445	0.001	0.342	0.210	0.450	0.002
97	0.359	0.019	0.351	0.107	0.387	0.001	0.339	0.119	0.319	0.474	0.289	0.874	0.400	0.007	0.370	0.064	0.450	0.002
98	0.363	0.003	0.309	0.689	0.387	0.004	0.340	0.140	0.367	0.069	0.289	0.899	0.389	0.014	0.365	0.070	0.450	0.001
99	0.398	0.001	0.374	0.012	0.387	0.002	0.370	0.032	0.340	0.257	0.289	0.889	0.404	0.005	0.325	0.296	0.450	0.002
100	0.400	0.001	0.304	0.655	0.387	0.004	0.358	0.027	0.364	0.045	0.289	0.904	0.378	0.019	0.394	0.019	0.450	0.001
101	0.360	0.020	0.337	0.261	0.387	0.001	0.342	0.087	0.358	0.074	0.289	0.881	0.358	0.078	0.301	0.531	0.450	0.002
102	0.373	0.008	0.343	0.157	0.387	0.006	0.399	0.004	0.307	0.711	0.289	0.887	0.477	0.001	0.395	0.009	0.450	0.002
103	0.418	0.001	0.336	0.184	0.387	0.001	0.340	0.132	0.388	0.006	0.289	0.903	0.408	0.003	0.332	0.252	0.450	0.001
104	0.366	0.028	0.325	0.359	0.387	0.003	0.352	0.072	0.402	0.002	0.289	0.887	0.422	0.004	0.416	0.005	0.450	0.001
105	0.341	0.065	0.307	0.618	0.387	0.004	0.356	0.031	0.364	0.056	0.289	0.895	0.445	0.001	0.346	0.157	0.450	0.002
106	0.338	0.206	0.338	0.216	0.387	0.003	0.350	0.013	0.378	0.007	0.289	0.905	0.390	0.030	0.373	0.054	0.450	0.001
107	0.369	0.028	0.324	0.543	0.387	0.004	0.364	0.035	0.371	0.029	0.289	0.899	0.455	0.001	0.353	0.118	0.450	0.002
108	0.357	0.033	0.329	0.345	0.387	0.009	0.332	0.162	0.360	0.076	0.289	0.885	0.380	0.033	0.359	0.077	0.450	0.001
109	0.311	0.557	0.351	0.162	0.387	0.006	0.335	0.193	0.334	0.199	0.289	0.903	0.430	0.004	0.362	0.110	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
110	0.366	0.011	0.352	0.164	0.387	0.004	0.352	0.067	0.332	0.221	0.289	0.900	0.385	0.025	0.390	0.027	0.450	0.002
111	0.343	0.080	0.343	0.133	0.387	0.005	0.371	0.005	0.305	0.641	0.289	0.898	0.373	0.059	0.285	0.574	0.450	0.001
112	0.401	0.001	0.343	0.204	0.387	0.006	0.349	0.102	0.353	0.124	0.289	0.883	0.450	0.002	0.375	0.036	0.450	0.001
113	0.400	0.002	0.344	0.132	0.387	0.002	0.343	0.080	0.368	0.078	0.289	0.901	0.423	0.007	0.398	0.011	0.450	0.001
114	0.334	0.084	0.342	0.221	0.387	0.002	0.364	0.029	0.332	0.282	0.289	0.888	0.371	0.068	0.320	0.405	0.450	0.002
115	0.356	0.034	0.343	0.222	0.387	0.001	0.321	0.505	0.318	0.508	0.289	0.894	0.383	0.025	0.375	0.042	0.450	0.001
116	0.369	0.017	0.314	0.667	0.387	0.003	0.315	0.382	0.337	0.265	0.289	0.889	0.361	0.051	0.403	0.012	0.450	0.002
117	0.385	0.008	0.326	0.359	0.387	0.003	0.300	0.708	0.349	0.135	0.289	0.906	0.423	0.004	0.344	0.178	0.450	0.002
118	0.373	0.011	0.352	0.088	0.387	0.001	0.321	0.163	0.306	0.764	0.289	0.891	0.399	0.011	0.378	0.044	0.450	0.001
119	0.367	0.009	0.358	0.056	0.387	0.004	0.374	0.018	0.306	0.590	0.289	0.889	0.395	0.012	0.386	0.035	0.450	0.002
120	0.345	0.051	0.340	0.208	0.387	0.001	0.370	0.035	0.335	0.219	0.289	0.891	0.416	0.004	0.392	0.018	0.450	0.002
121	0.321	0.393	0.334	0.235	0.387	0.006	0.327	0.130	0.339	0.264	0.289	0.899	0.388	0.016	0.371	0.067	0.450	0.002
122	0.349	0.084	0.298	0.745	0.387	0.004	0.349	0.119	0.347	0.128	0.289	0.898	0.396	0.019	0.396	0.026	0.450	0.001
123	0.374	0.007	0.331	0.324	0.387	0.005	0.366	0.039	0.328	0.280	0.289	0.885	0.361	0.061	0.347	0.114	0.450	0.002
124	0.393	0.002	0.323	0.319	0.387	0.003	0.309	0.214	0.372	0.021	0.289	0.900	0.488	0.001	0.356	0.086	0.450	0.001
125	0.375	0.001	0.350	0.069	0.387	0.004	0.343	0.093	0.309	0.569	0.289	0.902	0.426	0.003	0.370	0.055	0.450	0.003
126	0.362	0.048	0.275	0.977	0.387	0.007	0.406	0.002	0.333	0.311	0.289	0.886	0.420	0.003	0.324	0.404	0.450	0.001
127	0.363	0.020	0.315	0.598	0.387	0.002	0.340	0.128	0.345	0.194	0.289	0.897	0.366	0.039	0.368	0.049	0.450	0.001
128	0.340	0.121	0.313	0.703	0.387	0.003	0.358	0.026	0.356	0.089	0.289	0.902	0.358	0.043	0.410	0.006	0.450	0.002
129	0.304	0.457	0.301	0.507	0.387	0.003	0.359	0.038	0.349	0.079	0.289	0.894	0.413	0.003	0.391	0.027	0.450	0.002
130	0.365	0.015	0.327	0.252	0.387	0.004	0.322	0.459	0.362	0.088	0.289	0.891	0.423	0.002	0.309	0.399	0.450	0.003
131	0.369	0.066	0.329	0.298	0.387	0.008	0.379	0.018	0.330	0.391	0.289	0.906	0.368	0.030	0.392	0.011	0.450	0.001
132	0.390	0.002	0.287	0.892	0.387	0.003	0.345	0.102	0.327	0.396	0.289	0.880	0.441	0.003	0.358	0.093	0.450	0.002
133	0.317	0.440	0.310	0.703	0.387	0.005	0.384	0.005	0.322	0.531	0.289	0.874	0.373	0.075	0.390	0.021	0.450	0.003
134	0.347	0.093	0.324	0.456	0.387	0.002	0.331	0.105	0.336	0.243	0.289	0.901	0.442	0.003	0.329	0.229	0.450	0.001
135	0.334	0.140	0.316	0.577	0.387	0.003	0.405	0.001	0.364	0.041	0.289	0.890	0.453	0.001	0.327	0.214	0.450	0.003
136	0.351	0.038	0.352	0.108	0.387	0.002	0.341	0.118	0.307	0.682	0.289	0.891	0.494	0.001	0.390	0.017	0.450	0.001
137	0.393	0.005	0.346	0.220	0.387	0.005	0.364	0.024	0.329	0.396	0.289	0.900	0.377	0.060	0.342	0.199	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
138	0.337	0.195	0.323	0.228	0.387	0.003	0.346	0.110	0.343	0.085	0.289	0.914	0.474	0.001	0.380	0.028	0.450	0.001
139	0.407	0.001	0.305	0.446	0.387	0.007	0.329	0.229	0.366	0.019	0.289	0.911	0.420	0.004	0.338	0.259	0.450	0.004
140	0.357	0.020	0.311	0.683	0.387	0.003	0.358	0.091	0.345	0.132	0.289	0.917	0.478	0.001	0.333	0.235	0.450	0.001
141	0.403	0.002	0.287	0.941	0.387	0.002	0.345	0.152	0.317	0.437	0.289	0.893	0.404	0.006	0.382	0.020	0.450	0.003
142	0.391	0.002	0.348	0.080	0.387	0.004	0.346	0.062	0.348	0.117	0.289	0.881	0.469	0.001	0.360	0.100	0.450	0.002
143	0.345	0.097	0.330	0.458	0.387	0.002	0.369	0.011	0.341	0.223	0.289	0.895	0.420	0.007	0.394	0.015	0.450	0.001
144	0.363	0.011	0.286	0.898	0.387	0.005	0.330	0.216	0.380	0.015	0.289	0.868	0.458	0.001	0.334	0.305	0.450	0.003
145	0.353	0.048	0.332	0.336	0.387	0.002	0.351	0.065	0.310	0.611	0.289	0.893	0.407	0.007	0.320	0.375	0.450	0.002
146	0.344	0.099	0.334	0.231	0.387	0.005	0.349	0.034	0.359	0.078	0.289	0.906	0.453	0.001	0.382	0.021	0.450	0.001
147	0.320	0.132	0.323	0.490	0.387	0.002	0.293	0.874	0.345	0.141	0.289	0.892	0.481	0.001	0.388	0.029	0.450	0.001
148	0.345	0.035	0.343	0.162	0.387	0.004	0.386	0.006	0.357	0.079	0.289	0.902	0.374	0.038	0.412	0.005	0.450	0.002
149	0.352	0.046	0.311	0.686	0.387	0.005	0.394	0.002	0.340	0.234	0.289	0.905	0.382	0.031	0.330	0.299	0.450	0.002
150	0.374	0.005	0.276	0.863	0.387	0.003	0.367	0.028	0.345	0.203	0.289	0.881	0.437	0.001	0.342	0.236	0.450	0.001
151	0.336	0.102	0.312	0.516	0.387	0.003	0.327	0.244	0.346	0.153	0.289	0.898	0.377	0.039	0.373	0.061	0.450	0.001
152	0.403	0.002	0.333	0.414	0.387	0.006	0.375	0.016	0.327	0.435	0.289	0.897	0.410	0.007	0.366	0.057	0.450	0.001
153	0.333	0.180	0.325	0.560	0.387	0.003	0.375	0.018	0.341	0.256	0.289	0.887	0.436	0.001	0.341	0.156	0.450	0.001
154	0.343	0.107	0.323	0.431	0.387	0.003	0.349	0.050	0.332	0.313	0.289	0.893	0.452	0.002	0.394	0.025	0.450	0.001
155	0.404	0.002	0.323	0.502	0.387	0.006	0.390	0.007	0.337	0.301	0.289	0.890	0.449	0.001	0.297	0.618	0.450	0.002
156	0.371	0.024	0.336	0.256	0.387	0.002	0.346	0.087	0.344	0.224	0.289	0.897	0.387	0.018	0.407	0.007	0.450	0.002
157	0.322	0.368	0.309	0.578	0.387	0.004	0.388	0.003	0.306	0.600	0.289	0.884	0.464	0.001	0.344	0.108	0.450	0.002
158	0.341	0.162	0.330	0.434	0.387	0.003	0.334	0.208	0.344	0.179	0.289	0.899	0.410	0.010	0.345	0.195	0.450	0.002
159	0.363	0.039	0.310	0.548	0.387	0.004	0.399	0.001	0.342	0.172	0.289	0.889	0.353	0.089	0.326	0.315	0.450	0.001
160	0.400	0.003	0.350	0.167	0.387	0.002	0.347	0.065	0.348	0.208	0.289	0.892	0.400	0.011	0.339	0.229	0.450	0.001
161	0.357	0.044	0.322	0.526	0.387	0.003	0.327	0.205	0.342	0.178	0.289	0.893	0.399	0.008	0.365	0.076	0.450	0.001
162	0.352	0.013	0.332	0.289	0.387	0.004	0.319	0.141	0.318	0.453	0.289	0.895	0.437	0.002	0.295	0.667	0.450	0.001
163	0.353	0.013	0.310	0.679	0.387	0.002	0.323	0.194	0.325	0.272	0.289	0.903	0.455	0.001	0.322	0.251	0.450	0.004
164	0.344	0.032	0.360	0.056	0.387	0.001	0.318	0.258	0.390	0.007	0.289	0.879	0.420	0.003	0.379	0.060	0.450	0.002
165	0.392	0.002	0.316	0.581	0.387	0.004	0.373	0.009	0.327	0.262	0.289	0.873	0.494	0.001	0.374	0.047	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
166	0.349	0.090	0.355	0.103	0.387	0.004	0.363	0.011	0.339	0.252	0.289	0.895	0.405	0.018	0.371	0.086	0.450	0.001
167	0.388	0.002	0.308	0.746	0.387	0.003	0.421	0.001	0.378	0.009	0.289	0.895	0.388	0.029	0.357	0.129	0.450	0.001
168	0.403	0.003	0.351	0.112	0.387	0.005	0.314	0.649	0.375	0.010	0.289	0.885	0.435	0.001	0.353	0.098	0.450	0.001
169	0.346	0.063	0.292	0.787	0.387	0.002	0.376	0.013	0.344	0.148	0.289	0.877	0.458	0.002	0.365	0.067	0.450	0.001
170	0.384	0.006	0.300	0.784	0.387	0.006	0.347	0.045	0.334	0.237	0.289	0.882	0.422	0.007	0.370	0.066	0.450	0.005
171	0.347	0.067	0.355	0.099	0.387	0.001	0.367	0.017	0.358	0.063	0.289	0.889	0.463	0.001	0.347	0.123	0.450	0.001
172	0.352	0.048	0.308	0.699	0.387	0.004	0.329	0.420	0.300	0.464	0.289	0.888	0.439	0.004	0.352	0.131	0.450	0.001
173	0.354	0.040	0.348	0.097	0.387	0.003	0.366	0.015	0.328	0.248	0.289	0.896	0.424	0.004	0.332	0.190	0.450	0.001
174	0.358	0.010	0.333	0.275	0.387	0.004	0.388	0.008	0.367	0.049	0.289	0.882	0.340	0.175	0.377	0.073	0.450	0.001
175	0.385	0.004	0.331	0.351	0.387	0.006	0.314	0.499	0.331	0.364	0.289	0.882	0.411	0.002	0.363	0.092	0.450	0.001
176	0.395	0.002	0.376	0.010	0.387	0.003	0.334	0.133	0.355	0.096	0.289	0.890	0.440	0.002	0.358	0.087	0.450	0.001
177	0.347	0.033	0.320	0.489	0.387	0.004	0.343	0.079	0.348	0.127	0.289	0.875	0.385	0.013	0.369	0.071	0.450	0.001
178	0.367	0.005	0.320	0.608	0.387	0.004	0.363	0.029	0.348	0.139	0.289	0.911	0.468	0.001	0.366	0.101	0.450	0.001
179	0.365	0.016	0.310	0.498	0.387	0.003	0.362	0.022	0.348	0.098	0.289	0.903	0.386	0.034	0.364	0.094	0.450	0.002
180	0.393	0.003	0.341	0.252	0.387	0.003	0.328	0.135	0.314	0.487	0.289	0.905	0.378	0.049	0.345	0.225	0.450	0.003
181	0.369	0.002	0.315	0.493	0.387	0.003	0.309	0.482	0.367	0.029	0.289	0.910	0.415	0.003	0.345	0.203	0.450	0.001
182	0.364	0.028	0.344	0.144	0.387	0.004	0.332	0.239	0.335	0.276	0.289	0.886	0.429	0.004	0.389	0.023	0.450	0.002
183	0.384	0.004	0.304	0.587	0.387	0.004	0.384	0.005	0.349	0.110	0.289	0.883	0.479	0.001	0.339	0.229	0.450	0.002
184	0.375	0.006	0.329	0.388	0.387	0.003	0.378	0.004	0.340	0.189	0.289	0.887	0.448	0.002	0.410	0.012	0.450	0.001
185	0.348	0.150	0.300	0.698	0.387	0.004	0.375	0.013	0.339	0.208	0.289	0.878	0.374	0.033	0.379	0.053	0.450	0.001
186	0.398	0.001	0.328	0.276	0.387	0.002	0.314	0.306	0.327	0.405	0.289	0.890	0.443	0.002	0.382	0.028	0.450	0.002
187	0.374	0.011	0.339	0.163	0.387	0.002	0.344	0.219	0.352	0.148	0.289	0.889	0.515	0.001	0.385	0.040	0.450	0.003
188	0.416	0.001	0.312	0.652	0.387	0.002	0.333	0.330	0.365	0.010	0.289	0.887	0.426	0.001	0.332	0.268	0.450	0.002
189	0.398	0.003	0.307	0.724	0.387	0.003	0.372	0.008	0.350	0.142	0.289	0.899	0.426	0.004	0.373	0.046	0.450	0.001
190	0.363	0.001	0.319	0.262	0.387	0.002	0.334	0.276	0.385	0.010	0.289	0.887	0.423	0.003	0.369	0.079	0.450	0.002
191	0.350	0.062	0.327	0.266	0.387	0.003	0.322	0.299	0.374	0.010	0.289	0.897	0.469	0.001	0.383	0.038	0.450	0.001
192	0.449	0.001	0.318	0.249	0.387	0.003	0.332	0.311	0.342	0.149	0.289	0.906	0.382	0.015	0.322	0.291	0.450	0.001
193	0.350	0.192	0.328	0.377	0.387	0.001	0.361	0.070	0.349	0.126	0.289	0.906	0.394	0.007	0.370	0.079	0.450	0.003

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
194	0.382	0.006	0.326	0.424	0.387	0.007	0.309	0.489	0.371	0.026	0.289	0.878	0.415	0.005	0.402	0.007	0.450	0.001
195	0.396	0.002	0.318	0.563	0.387	0.006	0.317	0.370	0.346	0.240	0.289	0.892	0.498	0.001	0.351	0.118	0.450	0.002
196	0.417	0.001	0.311	0.602	0.387	0.002	0.326	0.334	0.342	0.198	0.289	0.899	0.408	0.012	0.360	0.096	0.450	0.001
197	0.385	0.004	0.319	0.630	0.387	0.003	0.394	0.001	0.308	0.563	0.289	0.885	0.469	0.001	0.389	0.041	0.450	0.002
198	0.437	0.001	0.334	0.283	0.387	0.004	0.369	0.015	0.342	0.129	0.289	0.882	0.451	0.001	0.364	0.096	0.450	0.002
199	0.334	0.201	0.317	0.251	0.387	0.003	0.353	0.039	0.370	0.026	0.289	0.891	0.463	0.001	0.343	0.212	0.450	0.002
200	0.338	0.216	0.338	0.182	0.387	0.004	0.372	0.008	0.370	0.020	0.289	0.890	0.423	0.001	0.346	0.166	0.450	0.001
201	0.368	0.030	0.288	0.760	0.387	0.008	0.345	0.030	0.357	0.040	0.289	0.892	0.395	0.027	0.346	0.142	0.450	0.003
202	0.369	0.013	0.312	0.501	0.387	0.006	0.324	0.268	0.358	0.066	0.289	0.895	0.416	0.009	0.364	0.059	0.450	0.001
203	0.376	0.003	0.328	0.017	0.387	0.002	0.310	0.621	0.371	0.045	0.289	0.885	0.398	0.008	0.376	0.038	0.450	0.001
204	0.373	0.011	0.314	0.581	0.387	0.005	0.368	0.012	0.336	0.292	0.289	0.901	0.425	0.001	0.345	0.207	0.450	0.002
205	0.374	0.005	0.321	0.413	0.387	0.003	0.312	0.175	0.312	0.613	0.289	0.873	0.415	0.009	0.414	0.006	0.450	0.002
206	0.353	0.030	0.336	0.368	0.387	0.002	0.358	0.053	0.363	0.085	0.289	0.891	0.440	0.002	0.353	0.135	0.450	0.001
207	0.341	0.056	0.351	0.165	0.387	0.001	0.363	0.044	0.344	0.057	0.289	0.899	0.458	0.002	0.333	0.292	0.450	0.002
208	0.319	0.063	0.342	0.212	0.387	0.002	0.361	0.036	0.363	0.046	0.289	0.874	0.410	0.006	0.296	0.586	0.450	0.001
209	0.364	0.031	0.334	0.310	0.387	0.004	0.382	0.003	0.324	0.326	0.289	0.899	0.435	0.003	0.345	0.192	0.450	0.001
210	0.362	0.006	0.311	0.608	0.387	0.004	0.365	0.036	0.349	0.154	0.289	0.900	0.381	0.009	0.380	0.044	0.450	0.002
211	0.347	0.064	0.308	0.633	0.387	0.004	0.290	0.759	0.371	0.027	0.289	0.883	0.402	0.018	0.392	0.017	0.450	0.002
212	0.371	0.023	0.327	0.291	0.387	0.003	0.369	0.020	0.306	0.506	0.289	0.892	0.404	0.012	0.292	0.698	0.450	0.001
213	0.343	0.090	0.348	0.091	0.387	0.004	0.330	0.311	0.339	0.274	0.289	0.899	0.448	0.001	0.290	0.623	0.450	0.001
214	0.361	0.046	0.343	0.169	0.387	0.005	0.316	0.308	0.368	0.076	0.289	0.886	0.412	0.009	0.355	0.119	0.450	0.001
215	0.348	0.059	0.325	0.372	0.387	0.003	0.385	0.006	0.298	0.779	0.289	0.909	0.396	0.016	0.385	0.036	0.450	0.001
216	0.383	0.004	0.328	0.288	0.387	0.003	0.347	0.116	0.321	0.536	0.289	0.895	0.456	0.001	0.337	0.242	0.450	0.002
217	0.361	0.023	0.322	0.198	0.387	0.004	0.361	0.014	0.372	0.028	0.289	0.892	0.512	0.001	0.387	0.025	0.450	0.001
218	0.390	0.003	0.294	0.914	0.387	0.001	0.352	0.014	0.344	0.043	0.289	0.870	0.412	0.005	0.398	0.006	0.450	0.001
219	0.358	0.032	0.356	0.108	0.387	0.003	0.329	0.240	0.359	0.061	0.289	0.903	0.473	0.001	0.313	0.509	0.450	0.002
220	0.360	0.057	0.337	0.234	0.387	0.001	0.380	0.006	0.383	0.002	0.289	0.898	0.397	0.009	0.355	0.114	0.450	0.003
221	0.380	0.012	0.304	0.799	0.387	0.005	0.368	0.012	0.367	0.065	0.289	0.905	0.449	0.001	0.407	0.012	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
222	0.361	0.009	0.324	0.331	0.387	0.003	0.347	0.055	0.352	0.176	0.289	0.899	0.390	0.029	0.389	0.035	0.450	0.001
223	0.410	0.001	0.324	0.486	0.387	0.001	0.361	0.054	0.337	0.159	0.289	0.907	0.486	0.001	0.277	0.758	0.450	0.001
224	0.332	0.088	0.327	0.386	0.387	0.004	0.328	0.134	0.339	0.171	0.289	0.895	0.419	0.005	0.404	0.008	0.450	0.001
225	0.387	0.001	0.344	0.147	0.387	0.006	0.378	0.006	0.316	0.386	0.289	0.913	0.439	0.003	0.332	0.276	0.450	0.001
226	0.352	0.068	0.352	0.056	0.387	0.004	0.386	0.003	0.363	0.086	0.289	0.887	0.360	0.039	0.355	0.067	0.450	0.001
227	0.363	0.021	0.309	0.564	0.387	0.002	0.358	0.010	0.333	0.164	0.289	0.890	0.410	0.011	0.368	0.064	0.450	0.002
228	0.395	0.002	0.372	0.006	0.387	0.006	0.370	0.012	0.340	0.244	0.289	0.895	0.411	0.008	0.397	0.010	0.450	0.001
229	0.389	0.002	0.306	0.695	0.387	0.003	0.359	0.038	0.369	0.025	0.289	0.902	0.419	0.005	0.285	0.693	0.450	0.001
230	0.371	0.021	0.341	0.161	0.387	0.004	0.360	0.023	0.350	0.136	0.289	0.892	0.434	0.002	0.387	0.053	0.450	0.003
231	0.376	0.010	0.326	0.368	0.387	0.003	0.384	0.004	0.361	0.031	0.289	0.892	0.403	0.006	0.357	0.108	0.450	0.001
232	0.434	0.001	0.298	0.683	0.387	0.005	0.320	0.490	0.389	0.013	0.289	0.880	0.399	0.023	0.298	0.625	0.450	0.003
233	0.394	0.002	0.319	0.723	0.387	0.002	0.330	0.196	0.375	0.010	0.289	0.895	0.436	0.001	0.385	0.022	0.450	0.002
234	0.357	0.045	0.318	0.322	0.387	0.004	0.328	0.059	0.366	0.033	0.289	0.900	0.442	0.002	0.376	0.068	0.450	0.001
235	0.382	0.004	0.338	0.231	0.387	0.003	0.329	0.234	0.359	0.061	0.289	0.882	0.351	0.112	0.353	0.178	0.450	0.002
236	0.372	0.005	0.315	0.565	0.387	0.002	0.360	0.040	0.328	0.225	0.289	0.897	0.416	0.003	0.329	0.152	0.450	0.001
237	0.336	0.059	0.318	0.434	0.387	0.005	0.317	0.473	0.348	0.025	0.289	0.902	0.343	0.122	0.361	0.100	0.450	0.001
238	0.371	0.014	0.332	0.393	0.387	0.002	0.373	0.015	0.316	0.464	0.289	0.884	0.440	0.001	0.356	0.118	0.450	0.002
239	0.340	0.153	0.359	0.092	0.387	0.003	0.331	0.213	0.391	0.012	0.289	0.900	0.423	0.004	0.330	0.248	0.450	0.001
240	0.373	0.013	0.363	0.062	0.387	0.004	0.321	0.279	0.356	0.104	0.289	0.896	0.357	0.046	0.413	0.005	0.450	0.002
241	0.367	0.019	0.352	0.050	0.387	0.004	0.332	0.097	0.352	0.060	0.289	0.895	0.411	0.007	0.318	0.451	0.450	0.001
242	0.411	0.001	0.314	0.611	0.387	0.004	0.386	0.001	0.379	0.005	0.289	0.879	0.385	0.030	0.389	0.024	0.450	0.001
243	0.334	0.283	0.322	0.337	0.387	0.003	0.298	0.414	0.359	0.086	0.289	0.898	0.429	0.003	0.306	0.396	0.450	0.001
244	0.339	0.072	0.310	0.598	0.387	0.004	0.341	0.068	0.338	0.330	0.289	0.904	0.435	0.002	0.385	0.020	0.450	0.001
245	0.367	0.040	0.348	0.083	0.387	0.003	0.410	0.004	0.343	0.140	0.289	0.885	0.391	0.015	0.367	0.070	0.450	0.002
246	0.343	0.134	0.317	0.448	0.387	0.003	0.370	0.006	0.349	0.101	0.289	0.885	0.363	0.066	0.386	0.028	0.450	0.001
247	0.371	0.015	0.334	0.336	0.387	0.002	0.368	0.025	0.335	0.275	0.289	0.905	0.461	0.002	0.378	0.038	0.450	0.002
248	0.374	0.019	0.332	0.389	0.387	0.004	0.353	0.039	0.316	0.567	0.289	0.898	0.436	0.001	0.317	0.380	0.450	0.002
249	0.392	0.002	0.334	0.298	0.387	0.002	0.325	0.303	0.343	0.161	0.289	0.884	0.475	0.001	0.341	0.230	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
250	0.358	0.016	0.308	0.548	0.387	0.005	0.320	0.269	0.325	0.414	0.289	0.882	0.438	0.002	0.381	0.049	0.450	0.001
251	0.353	0.039	0.330	0.217	0.387	0.002	0.356	0.039	0.331	0.368	0.289	0.888	0.424	0.003	0.352	0.132	0.450	0.001
252	0.347	0.044	0.336	0.245	0.387	0.001	0.311	0.378	0.335	0.220	0.289	0.904	0.415	0.006	0.350	0.134	0.450	0.002
253	0.371	0.012	0.347	0.192	0.387	0.004	0.355	0.052	0.337	0.187	0.289	0.886	0.397	0.004	0.360	0.047	0.450	0.003
254	0.359	0.011	0.339	0.142	0.387	0.001	0.369	0.018	0.327	0.274	0.289	0.898	0.405	0.006	0.306	0.583	0.450	0.003
255	0.329	0.112	0.345	0.106	0.387	0.003	0.376	0.008	0.335	0.381	0.289	0.895	0.380	0.034	0.269	0.903	0.450	0.001
256	0.327	0.067	0.356	0.079	0.387	0.003	0.356	0.042	0.320	0.169	0.289	0.899	0.451	0.001	0.363	0.070	0.450	0.002
257	0.360	0.055	0.323	0.332	0.387	0.004	0.329	0.220	0.393	0.008	0.289	0.895	0.441	0.002	0.401	0.022	0.450	0.002
258	0.377	0.007	0.341	0.197	0.387	0.007	0.346	0.091	0.340	0.207	0.289	0.891	0.491	0.001	0.357	0.084	0.450	0.002
259	0.364	0.008	0.300	0.828	0.387	0.005	0.350	0.092	0.319	0.548	0.289	0.884	0.467	0.001	0.341	0.234	0.450	0.002
260	0.397	0.001	0.334	0.238	0.387	0.005	0.343	0.117	0.352	0.105	0.289	0.905	0.393	0.011	0.395	0.023	0.450	0.002
261	0.433	0.001	0.319	0.546	0.387	0.010	0.355	0.087	0.343	0.189	0.289	0.890	0.452	0.001	0.365	0.077	0.450	0.002
262	0.336	0.215	0.323	0.469	0.387	0.002	0.373	0.031	0.318	0.626	0.289	0.914	0.366	0.029	0.361	0.081	0.450	0.003
263	0.374	0.008	0.379	0.015	0.387	0.004	0.341	0.135	0.353	0.122	0.289	0.889	0.447	0.003	0.382	0.034	0.450	0.001
264	0.392	0.003	0.323	0.296	0.387	0.001	0.325	0.348	0.338	0.210	0.289	0.883	0.406	0.010	0.403	0.004	0.450	0.002
265	0.359	0.006	0.328	0.059	0.387	0.003	0.340	0.128	0.356	0.082	0.289	0.895	0.456	0.001	0.293	0.508	0.450	0.003
266	0.391	0.002	0.324	0.194	0.387	0.004	0.370	0.010	0.337	0.191	0.289	0.883	0.396	0.004	0.390	0.033	0.450	0.002
267	0.367	0.002	0.352	0.145	0.387	0.003	0.355	0.062	0.332	0.265	0.289	0.903	0.372	0.030	0.368	0.040	0.450	0.004
268	0.358	0.015	0.316	0.485	0.387	0.003	0.367	0.019	0.342	0.127	0.289	0.897	0.445	0.001	0.326	0.261	0.450	0.001
269	0.373	0.012	0.310	0.589	0.387	0.004	0.337	0.138	0.339	0.187	0.289	0.892	0.445	0.001	0.378	0.063	0.450	0.001
270	0.372	0.034	0.326	0.101	0.387	0.002	0.368	0.019	0.318	0.361	0.289	0.888	0.385	0.020	0.402	0.021	0.450	0.001
271	0.339	0.115	0.335	0.239	0.387	0.002	0.349	0.075	0.361	0.044	0.289	0.911	0.352	0.052	0.276	0.718	0.450	0.002
272	0.393	0.002	0.340	0.243	0.387	0.003	0.355	0.046	0.320	0.569	0.289	0.896	0.396	0.019	0.400	0.012	0.450	0.001
273	0.370	0.018	0.295	0.647	0.387	0.003	0.288	0.787	0.309	0.599	0.289	0.905	0.452	0.002	0.395	0.022	0.450	0.002
274	0.416	0.001	0.315	0.594	0.387	0.002	0.346	0.083	0.346	0.098	0.289	0.883	0.483	0.001	0.398	0.013	0.450	0.001
275	0.373	0.005	0.311	0.560	0.387	0.004	0.368	0.011	0.325	0.471	0.289	0.884	0.428	0.004	0.353	0.120	0.450	0.001
276	0.375	0.004	0.334	0.319	0.387	0.001	0.362	0.030	0.345	0.125	0.289	0.893	0.445	0.003	0.352	0.093	0.450	0.001
277	0.328	0.343	0.335	0.247	0.387	0.005	0.336	0.066	0.336	0.285	0.289	0.881	0.405	0.013	0.363	0.069	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
278	0.347	0.141	0.327	0.438	0.387	0.003	0.382	0.007	0.329	0.436	0.289	0.897	0.397	0.011	0.330	0.291	0.450	0.001
279	0.386	0.001	0.332	0.287	0.387	0.003	0.336	0.201	0.360	0.071	0.289	0.882	0.372	0.024	0.396	0.019	0.450	0.002
280	0.351	0.022	0.328	0.254	0.387	0.002	0.328	0.292	0.326	0.378	0.289	0.899	0.434	0.002	0.332	0.220	0.450	0.002
281	0.357	0.017	0.326	0.381	0.387	0.003	0.339	0.109	0.364	0.015	0.289	0.879	0.441	0.001	0.361	0.102	0.450	0.002
282	0.350	0.034	0.361	0.037	0.387	0.002	0.381	0.007	0.358	0.040	0.289	0.879	0.374	0.041	0.360	0.077	0.450	0.001
283	0.359	0.068	0.317	0.656	0.387	0.005	0.378	0.007	0.362	0.042	0.289	0.895	0.430	0.001	0.355	0.120	0.450	0.002
284	0.366	0.009	0.337	0.162	0.387	0.003	0.402	0.007	0.372	0.032	0.289	0.888	0.494	0.001	0.346	0.124	0.450	0.002
285	0.387	0.004	0.340	0.208	0.387	0.004	0.384	0.006	0.389	0.012	0.289	0.914	0.340	0.141	0.226	0.974	0.450	0.001
286	0.333	0.358	0.363	0.044	0.387	0.004	0.364	0.031	0.360	0.057	0.289	0.891	0.444	0.002	0.376	0.039	0.450	0.001
287	0.401	0.001	0.298	0.864	0.387	0.003	0.326	0.185	0.372	0.016	0.289	0.899	0.384	0.013	0.304	0.494	0.450	0.001
288	0.344	0.169	0.326	0.449	0.387	0.004	0.332	0.168	0.325	0.268	0.289	0.884	0.420	0.005	0.406	0.009	0.450	0.001
289	0.326	0.313	0.319	0.315	0.387	0.006	0.336	0.069	0.351	0.102	0.289	0.899	0.392	0.012	0.363	0.106	0.450	0.001
290	0.368	0.028	0.322	0.518	0.387	0.002	0.341	0.087	0.381	0.010	0.289	0.894	0.331	0.120	0.330	0.375	0.450	0.002
291	0.388	0.004	0.347	0.107	0.387	0.005	0.366	0.038	0.323	0.258	0.289	0.893	0.433	0.001	0.324	0.376	0.450	0.001
292	0.329	0.257	0.340	0.262	0.387	0.004	0.334	0.099	0.325	0.415	0.289	0.902	0.451	0.001	0.339	0.193	0.450	0.001
293	0.382	0.006	0.326	0.247	0.387	0.004	0.342	0.174	0.332	0.346	0.289	0.893	0.408	0.007	0.401	0.012	0.450	0.001
294	0.391	0.003	0.308	0.740	0.387	0.002	0.340	0.086	0.305	0.655	0.289	0.919	0.402	0.005	0.339	0.239	0.450	0.001
295	0.382	0.002	0.301	0.614	0.387	0.004	0.351	0.046	0.341	0.227	0.289	0.902	0.362	0.085	0.393	0.025	0.450	0.003
296	0.352	0.061	0.302	0.781	0.387	0.004	0.332	0.147	0.336	0.279	0.289	0.909	0.420	0.005	0.367	0.058	0.450	0.001
297	0.384	0.009	0.343	0.234	0.387	0.004	0.317	0.469	0.341	0.241	0.289	0.905	0.350	0.072	0.415	0.003	0.450	0.001
298	0.393	0.001	0.340	0.319	0.387	0.004	0.341	0.128	0.381	0.028	0.289	0.883	0.436	0.001	0.363	0.066	0.450	0.001
299	0.424	0.001	0.338	0.225	0.387	0.002	0.320	0.232	0.364	0.071	0.289	0.894	0.368	0.042	0.348	0.078	0.450	0.002
300	0.370	0.011	0.320	0.433	0.387	0.004	0.400	0.003	0.324	0.389	0.289	0.897	0.376	0.015	0.374	0.051	0.450	0.001
301	0.417	0.001	0.343	0.189	0.387	0.004	0.298	0.818	0.345	0.103	0.289	0.895	0.426	0.003	0.350	0.150	0.450	0.002
302	0.351	0.022	0.355	0.100	0.387	0.001	0.339	0.222	0.357	0.021	0.289	0.903	0.410	0.005	0.278	0.795	0.450	0.001
303	0.370	0.010	0.319	0.610	0.387	0.001	0.309	0.509	0.336	0.318	0.289	0.903	0.369	0.047	0.317	0.421	0.450	0.001
304	0.345	0.108	0.349	0.099	0.387	0.003	0.337	0.122	0.362	0.096	0.289	0.919	0.373	0.032	0.313	0.426	0.450	0.002
305	0.395	0.003	0.321	0.379	0.387	0.003	0.327	0.234	0.345	0.171	0.289	0.900	0.437	0.002	0.322	0.365	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
306	0.353	0.050	0.305	0.750	0.387	0.005	0.343	0.092	0.361	0.033	0.289	0.884	0.424	0.001	0.364	0.087	0.450	0.001
307	0.350	0.021	0.326	0.338	0.387	0.005	0.375	0.006	0.378	0.033	0.289	0.888	0.437	0.001	0.326	0.301	0.450	0.001
308	0.367	0.016	0.318	0.596	0.387	0.004	0.333	0.046	0.317	0.529	0.289	0.886	0.420	0.002	0.409	0.012	0.450	0.003
309	0.382	0.005	0.319	0.290	0.387	0.002	0.382	0.009	0.357	0.044	0.289	0.891	0.436	0.002	0.259	0.915	0.450	0.001
310	0.365	0.025	0.337	0.259	0.387	0.002	0.317	0.283	0.343	0.281	0.289	0.884	0.405	0.008	0.330	0.276	0.450	0.001
311	0.363	0.012	0.330	0.362	0.387	0.005	0.386	0.003	0.369	0.051	0.289	0.892	0.397	0.012	0.312	0.510	0.450	0.002
312	0.373	0.006	0.352	0.126	0.387	0.003	0.358	0.061	0.352	0.086	0.289	0.891	0.446	0.002	0.318	0.453	0.450	0.002
313	0.342	0.072	0.307	0.546	0.387	0.005	0.311	0.623	0.378	0.016	0.289	0.882	0.497	0.001	0.404	0.014	0.450	0.003
314	0.350	0.089	0.310	0.682	0.387	0.002	0.323	0.186	0.335	0.211	0.289	0.899	0.427	0.001	0.375	0.033	0.450	0.001
315	0.385	0.003	0.324	0.336	0.387	0.003	0.335	0.149	0.345	0.139	0.289	0.900	0.468	0.001	0.349	0.184	0.450	0.002
316	0.359	0.051	0.348	0.156	0.387	0.007	0.364	0.038	0.325	0.473	0.289	0.872	0.394	0.015	0.325	0.219	0.450	0.001
317	0.368	0.014	0.340	0.121	0.387	0.007	0.324	0.186	0.334	0.338	0.289	0.889	0.474	0.001	0.411	0.010	0.450	0.002
318	0.349	0.032	0.341	0.199	0.387	0.007	0.350	0.046	0.370	0.029	0.289	0.899	0.418	0.003	0.373	0.062	0.450	0.001
319	0.353	0.035	0.344	0.170	0.387	0.003	0.317	0.404	0.336	0.305	0.289	0.879	0.409	0.011	0.345	0.230	0.450	0.002
320	0.373	0.004	0.333	0.242	0.387	0.002	0.363	0.035	0.354	0.131	0.289	0.893	0.467	0.001	0.318	0.458	0.450	0.002
321	0.387	0.001	0.327	0.487	0.387	0.002	0.353	0.041	0.360	0.060	0.289	0.897	0.418	0.001	0.315	0.327	0.450	0.001
322	0.376	0.001	0.297	0.813	0.387	0.006	0.334	0.166	0.321	0.254	0.289	0.873	0.413	0.006	0.425	0.004	0.450	0.002
323	0.322	0.413	0.280	0.946	0.387	0.002	0.336	0.205	0.350	0.166	0.289	0.909	0.362	0.063	0.342	0.184	0.450	0.001
324	0.403	0.001	0.304	0.854	0.387	0.003	0.339	0.073	0.346	0.203	0.289	0.897	0.408	0.007	0.342	0.179	0.450	0.001
325	0.377	0.007	0.316	0.498	0.387	0.002	0.382	0.022	0.351	0.074	0.289	0.890	0.468	0.001	0.382	0.037	0.450	0.002
326	0.358	0.060	0.339	0.314	0.387	0.003	0.368	0.016	0.330	0.390	0.289	0.901	0.454	0.001	0.397	0.026	0.450	0.001
327	0.354	0.038	0.309	0.676	0.387	0.003	0.351	0.072	0.312	0.505	0.289	0.891	0.447	0.001	0.362	0.083	0.450	0.002
328	0.378	0.011	0.343	0.183	0.387	0.005	0.382	0.005	0.331	0.375	0.289	0.902	0.432	0.003	0.359	0.110	0.450	0.002
329	0.383	0.005	0.337	0.212	0.387	0.004	0.349	0.086	0.351	0.097	0.289	0.897	0.369	0.085	0.319	0.209	0.450	0.001
330	0.341	0.234	0.314	0.663	0.387	0.005	0.319	0.335	0.346	0.165	0.289	0.894	0.322	0.223	0.364	0.079	0.450	0.002
331	0.380	0.004	0.369	0.034	0.387	0.002	0.368	0.022	0.336	0.317	0.289	0.895	0.418	0.005	0.399	0.013	0.450	0.001
332	0.337	0.147	0.316	0.482	0.387	0.005	0.346	0.104	0.415	0.001	0.289	0.898	0.417	0.008	0.402	0.009	0.450	0.001
333	0.401	0.003	0.335	0.185	0.387	0.007	0.323	0.175	0.318	0.423	0.289	0.892	0.405	0.003	0.357	0.121	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
334	0.391	0.003	0.336	0.261	0.387	0.003	0.295	0.339	0.325	0.331	0.289	0.890	0.419	0.007	0.334	0.248	0.450	0.001
335	0.357	0.038	0.318	0.500	0.387	0.002	0.342	0.058	0.289	0.888	0.289	0.874	0.330	0.121	0.375	0.072	0.450	0.001
336	0.378	0.004	0.351	0.079	0.387	0.002	0.304	0.434	0.322	0.350	0.289	0.896	0.394	0.008	0.386	0.025	0.450	0.004
337	0.373	0.017	0.340	0.262	0.387	0.004	0.338	0.121	0.344	0.146	0.289	0.892	0.378	0.019	0.373	0.056	0.450	0.001
338	0.369	0.008	0.343	0.246	0.387	0.004	0.380	0.006	0.356	0.063	0.289	0.891	0.398	0.004	0.341	0.211	0.450	0.001
339	0.362	0.015	0.320	0.399	0.387	0.003	0.376	0.011	0.360	0.079	0.289	0.899	0.390	0.029	0.321	0.393	0.450	0.001
340	0.377	0.008	0.333	0.394	0.387	0.001	0.339	0.124	0.350	0.115	0.289	0.898	0.482	0.001	0.419	0.006	0.450	0.001
341	0.396	0.004	0.335	0.189	0.387	0.006	0.326	0.282	0.360	0.055	0.289	0.899	0.454	0.001	0.350	0.095	0.450	0.002
342	0.393	0.004	0.327	0.268	0.387	0.001	0.319	0.200	0.343	0.177	0.289	0.891	0.457	0.001	0.383	0.038	0.450	0.001
343	0.409	0.002	0.353	0.135	0.387	0.004	0.373	0.015	0.316	0.525	0.289	0.891	0.401	0.013	0.304	0.554	0.450	0.002
344	0.311	0.250	0.319	0.605	0.387	0.003	0.326	0.220	0.317	0.406	0.289	0.896	0.439	0.004	0.388	0.015	0.450	0.001
345	0.367	0.007	0.347	0.170	0.387	0.003	0.320	0.334	0.342	0.165	0.289	0.891	0.456	0.001	0.380	0.039	0.450	0.001
346	0.375	0.002	0.325	0.272	0.387	0.004	0.316	0.097	0.343	0.278	0.289	0.905	0.436	0.001	0.376	0.065	0.450	0.003
347	0.387	0.002	0.343	0.223	0.387	0.005	0.313	0.419	0.344	0.097	0.289	0.885	0.430	0.006	0.382	0.039	0.450	0.001
348	0.379	0.006	0.327	0.334	0.387	0.002	0.306	0.333	0.330	0.351	0.289	0.893	0.345	0.160	0.296	0.683	0.450	0.002
349	0.345	0.170	0.315	0.467	0.387	0.003	0.368	0.051	0.367	0.052	0.289	0.901	0.356	0.071	0.350	0.142	0.450	0.001
350	0.392	0.001	0.308	0.717	0.387	0.001	0.351	0.040	0.349	0.145	0.289	0.888	0.449	0.001	0.380	0.031	0.450	0.001
351	0.366	0.012	0.310	0.640	0.387	0.003	0.349	0.082	0.357	0.036	0.289	0.881	0.395	0.013	0.351	0.099	0.450	0.003
352	0.324	0.279	0.315	0.446	0.387	0.001	0.341	0.091	0.350	0.181	0.289	0.887	0.416	0.002	0.400	0.014	0.450	0.002
353	0.378	0.008	0.345	0.111	0.387	0.005	0.357	0.067	0.351	0.100	0.289	0.891	0.362	0.063	0.402	0.013	0.450	0.003
354	0.361	0.008	0.342	0.147	0.387	0.002	0.393	0.003	0.302	0.704	0.289	0.890	0.472	0.001	0.419	0.009	0.450	0.001
355	0.370	0.025	0.297	0.881	0.387	0.005	0.369	0.032	0.336	0.218	0.289	0.890	0.405	0.001	0.370	0.039	0.450	0.002
356	0.336	0.148	0.329	0.239	0.387	0.002	0.343	0.156	0.341	0.135	0.289	0.912	0.432	0.004	0.393	0.019	0.450	0.001
357	0.375	0.005	0.352	0.094	0.387	0.002	0.333	0.107	0.370	0.048	0.289	0.902	0.410	0.007	0.318	0.320	0.450	0.001
358	0.348	0.070	0.321	0.255	0.387	0.002	0.333	0.115	0.329	0.196	0.289	0.884	0.363	0.063	0.340	0.242	0.450	0.002
359	0.390	0.001	0.336	0.300	0.387	0.005	0.348	0.123	0.355	0.083	0.289	0.861	0.476	0.001	0.340	0.078	0.450	0.001
360	0.357	0.029	0.345	0.119	0.387	0.002	0.359	0.067	0.360	0.029	0.289	0.894	0.440	0.001	0.402	0.018	0.450	0.001
361	0.373	0.007	0.316	0.630	0.387	0.001	0.350	0.119	0.315	0.443	0.289	0.909	0.333	0.244	0.322	0.354	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
362	0.350	0.078	0.340	0.225	0.387	0.003	0.378	0.010	0.334	0.328	0.289	0.902	0.412	0.002	0.370	0.079	0.450	0.002
363	0.370	0.004	0.326	0.225	0.387	0.006	0.297	0.568	0.351	0.087	0.289	0.893	0.430	0.002	0.335	0.251	0.450	0.002
364	0.371	0.015	0.376	0.022	0.387	0.001	0.343	0.090	0.347	0.211	0.289	0.884	0.432	0.005	0.360	0.097	0.450	0.001
365	0.382	0.007	0.332	0.220	0.387	0.002	0.348	0.031	0.348	0.162	0.289	0.893	0.450	0.001	0.376	0.065	0.450	0.001
366	0.404	0.001	0.316	0.331	0.387	0.004	0.375	0.009	0.361	0.056	0.289	0.889	0.446	0.003	0.329	0.349	0.450	0.002
367	0.359	0.009	0.296	0.732	0.387	0.002	0.380	0.012	0.310	0.657	0.289	0.897	0.435	0.003	0.402	0.008	0.450	0.003
368	0.372	0.007	0.342	0.168	0.387	0.002	0.328	0.227	0.354	0.119	0.289	0.890	0.381	0.035	0.417	0.002	0.450	0.002
369	0.376	0.022	0.330	0.420	0.387	0.004	0.365	0.026	0.338	0.213	0.289	0.906	0.478	0.001	0.383	0.051	0.450	0.001
370	0.364	0.003	0.318	0.424	0.387	0.006	0.344	0.070	0.299	0.805	0.289	0.884	0.378	0.014	0.419	0.004	0.450	0.002
371	0.395	0.003	0.319	0.655	0.387	0.001	0.373	0.004	0.361	0.063	0.289	0.894	0.445	0.001	0.344	0.167	0.450	0.002
372	0.350	0.065	0.325	0.351	0.387	0.002	0.339	0.046	0.283	0.738	0.289	0.887	0.410	0.006	0.387	0.040	0.450	0.002
373	0.334	0.281	0.339	0.216	0.387	0.003	0.327	0.199	0.368	0.037	0.289	0.887	0.437	0.006	0.356	0.101	0.450	0.002
374	0.379	0.006	0.325	0.376	0.387	0.003	0.324	0.300	0.311	0.640	0.289	0.890	0.410	0.005	0.372	0.060	0.450	0.002
375	0.330	0.217	0.322	0.345	0.387	0.002	0.334	0.129	0.315	0.537	0.289	0.878	0.432	0.002	0.309	0.453	0.450	0.001
376	0.377	0.006	0.319	0.497	0.387	0.003	0.373	0.010	0.355	0.110	0.289	0.893	0.429	0.002	0.395	0.015	0.450	0.002
377	0.337	0.205	0.306	0.683	0.387	0.002	0.340	0.056	0.371	0.028	0.289	0.899	0.455	0.001	0.343	0.215	0.450	0.002
378	0.352	0.044	0.342	0.231	0.387	0.003	0.357	0.079	0.323	0.424	0.289	0.909	0.383	0.024	0.365	0.057	0.450	0.001
379	0.364	0.013	0.325	0.318	0.387	0.002	0.350	0.058	0.309	0.745	0.289	0.888	0.396	0.022	0.340	0.203	0.450	0.002
380	0.356	0.064	0.308	0.711	0.387	0.003	0.351	0.100	0.336	0.057	0.289	0.908	0.364	0.045	0.375	0.064	0.450	0.001
381	0.337	0.069	0.318	0.472	0.387	0.002	0.309	0.562	0.335	0.337	0.289	0.882	0.412	0.010	0.350	0.119	0.450	0.001
382	0.378	0.001	0.322	0.440	0.387	0.002	0.347	0.133	0.324	0.342	0.289	0.902	0.399	0.009	0.327	0.273	0.450	0.001
383	0.432	0.001	0.345	0.201	0.387	0.003	0.419	0.001	0.313	0.544	0.289	0.883	0.353	0.126	0.365	0.071	0.450	0.001
384	0.373	0.004	0.346	0.175	0.387	0.002	0.378	0.006	0.358	0.055	0.289	0.893	0.441	0.004	0.407	0.011	0.450	0.001
385	0.370	0.019	0.312	0.681	0.387	0.004	0.365	0.046	0.357	0.092	0.289	0.887	0.453	0.002	0.292	0.704	0.450	0.002
386	0.405	0.002	0.328	0.323	0.387	0.002	0.345	0.073	0.355	0.068	0.289	0.888	0.474	0.001	0.313	0.443	0.450	0.001
387	0.345	0.078	0.324	0.365	0.387	0.002	0.333	0.138	0.328	0.306	0.289	0.891	0.405	0.009	0.369	0.051	0.450	0.002
388	0.399	0.004	0.320	0.581	0.387	0.002	0.342	0.164	0.302	0.700	0.289	0.886	0.391	0.017	0.390	0.039	0.450	0.001
389	0.373	0.017	0.342	0.241	0.387	0.001	0.339	0.149	0.334	0.173	0.289	0.882	0.384	0.024	0.336	0.202	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
390	0.347	0.125	0.312	0.425	0.387	0.003	0.346	0.070	0.328	0.287	0.289	0.903	0.343	0.188	0.362	0.090	0.450	0.001
391	0.376	0.003	0.360	0.076	0.387	0.005	0.344	0.109	0.341	0.265	0.289	0.894	0.293	0.434	0.356	0.095	0.450	0.002
392	0.368	0.008	0.337	0.209	0.387	0.002	0.409	0.001	0.350	0.089	0.289	0.892	0.396	0.020	0.324	0.294	0.450	0.001
393	0.383	0.001	0.290	0.836	0.387	0.005	0.360	0.010	0.333	0.314	0.289	0.895	0.413	0.005	0.364	0.105	0.450	0.004
394	0.399	0.001	0.326	0.358	0.387	0.005	0.359	0.036	0.347	0.139	0.289	0.904	0.450	0.001	0.340	0.228	0.450	0.001
395	0.367	0.017	0.349	0.104	0.387	0.004	0.326	0.338	0.328	0.417	0.289	0.906	0.423	0.006	0.310	0.431	0.450	0.001
396	0.311	0.455	0.322	0.311	0.387	0.002	0.344	0.110	0.330	0.312	0.289	0.898	0.493	0.001	0.365	0.072	0.450	0.002
397	0.325	0.354	0.321	0.360	0.387	0.003	0.310	0.438	0.296	0.832	0.289	0.892	0.355	0.042	0.413	0.008	0.450	0.001
398	0.385	0.001	0.361	0.048	0.387	0.004	0.375	0.013	0.329	0.321	0.289	0.899	0.422	0.005	0.320	0.312	0.450	0.002
399	0.381	0.009	0.352	0.063	0.387	0.002	0.364	0.030	0.343	0.155	0.289	0.901	0.412	0.005	0.379	0.058	0.450	0.001
400	0.360	0.072	0.293	0.907	0.387	0.005	0.313	0.280	0.320	0.336	0.289	0.888	0.413	0.006	0.372	0.048	0.450	0.002
401	0.352	0.058	0.348	0.159	0.387	0.003	0.320	0.327	0.315	0.435	0.289	0.874	0.427	0.003	0.372	0.059	0.450	0.002
402	0.435	0.001	0.340	0.233	0.387	0.008	0.419	0.001	0.331	0.257	0.289	0.886	0.387	0.023	0.393	0.022	0.450	0.001
403	0.359	0.019	0.339	0.121	0.387	0.005	0.303	0.292	0.335	0.165	0.289	0.900	0.433	0.002	0.364	0.095	0.450	0.001
404	0.368	0.013	0.310	0.669	0.387	0.002	0.369	0.037	0.324	0.461	0.289	0.892	0.369	0.067	0.385	0.039	0.450	0.002
405	0.370	0.022	0.304	0.671	0.387	0.003	0.393	0.004	0.354	0.069	0.289	0.884	0.407	0.004	0.359	0.081	0.450	0.001
406	0.351	0.073	0.327	0.397	0.387	0.007	0.368	0.015	0.318	0.512	0.289	0.915	0.399	0.020	0.356	0.121	0.450	0.001
407	0.401	0.001	0.303	0.681	0.387	0.004	0.316	0.233	0.349	0.067	0.289	0.898	0.446	0.001	0.379	0.033	0.450	0.002
408	0.359	0.014	0.326	0.319	0.387	0.004	0.313	0.540	0.330	0.335	0.289	0.882	0.467	0.001	0.344	0.199	0.450	0.002
409	0.359	0.027	0.320	0.350	0.387	0.004	0.333	0.190	0.330	0.379	0.289	0.898	0.396	0.017	0.346	0.213	0.450	0.001
410	0.354	0.034	0.312	0.560	0.387	0.005	0.346	0.148	0.356	0.089	0.289	0.909	0.399	0.007	0.372	0.071	0.450	0.001
411	0.374	0.012	0.315	0.547	0.387	0.004	0.358	0.030	0.319	0.447	0.289	0.886	0.435	0.004	0.389	0.015	0.450	0.003
412	0.394	0.003	0.320	0.539	0.387	0.002	0.338	0.085	0.341	0.180	0.289	0.885	0.434	0.002	0.387	0.017	0.450	0.003
413	0.324	0.285	0.324	0.432	0.387	0.003	0.355	0.082	0.347	0.209	0.289	0.899	0.450	0.001	0.310	0.422	0.450	0.001
414	0.366	0.027	0.338	0.233	0.387	0.003	0.344	0.064	0.358	0.036	0.289	0.898	0.416	0.001	0.383	0.054	0.450	0.001
415	0.336	0.053	0.337	0.227	0.387	0.005	0.307	0.242	0.356	0.167	0.289	0.900	0.453	0.001	0.398	0.013	0.450	0.002
416	0.347	0.084	0.319	0.392	0.387	0.003	0.336	0.287	0.332	0.337	0.289	0.914	0.447	0.002	0.355	0.121	0.450	0.002
417	0.331	0.245	0.320	0.536	0.387	0.006	0.396	0.004	0.338	0.266	0.289	0.905	0.431	0.003	0.368	0.057	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
418	0.373	0.009	0.341	0.247	0.387	0.004	0.356	0.015	0.325	0.437	0.289	0.890	0.432	0.002	0.374	0.057	0.450	0.001
419	0.355	0.091	0.353	0.147	0.387	0.003	0.328	0.119	0.368	0.033	0.289	0.902	0.438	0.002	0.413	0.006	0.450	0.001
420	0.385	0.001	0.290	0.874	0.387	0.003	0.331	0.073	0.341	0.243	0.289	0.908	0.400	0.005	0.281	0.714	0.450	0.001
421	0.353	0.031	0.351	0.156	0.387	0.001	0.365	0.030	0.346	0.131	0.289	0.903	0.405	0.006	0.378	0.046	0.450	0.001
422	0.362	0.027	0.301	0.826	0.387	0.002	0.325	0.341	0.315	0.440	0.289	0.895	0.477	0.001	0.392	0.027	0.450	0.001
423	0.366	0.011	0.333	0.294	0.387	0.002	0.346	0.045	0.377	0.010	0.289	0.884	0.357	0.094	0.344	0.186	0.450	0.001
424	0.349	0.056	0.313	0.358	0.387	0.006	0.311	0.731	0.304	0.639	0.289	0.895	0.435	0.002	0.280	0.839	0.450	0.001
425	0.391	0.007	0.331	0.346	0.387	0.004	0.337	0.119	0.379	0.019	0.289	0.895	0.415	0.008	0.341	0.186	0.450	0.002
426	0.358	0.024	0.310	0.677	0.387	0.007	0.338	0.101	0.366	0.025	0.289	0.894	0.420	0.005	0.381	0.033	0.450	0.001
427	0.359	0.026	0.278	0.964	0.387	0.002	0.346	0.052	0.334	0.255	0.289	0.904	0.410	0.006	0.354	0.121	0.450	0.002
428	0.398	0.001	0.343	0.071	0.387	0.003	0.388	0.001	0.346	0.164	0.289	0.880	0.468	0.001	0.395	0.023	0.450	0.001
429	0.362	0.005	0.323	0.414	0.387	0.006	0.333	0.207	0.359	0.057	0.289	0.886	0.370	0.045	0.306	0.536	0.450	0.001
430	0.337	0.184	0.330	0.341	0.387	0.003	0.305	0.177	0.371	0.023	0.289	0.921	0.430	0.001	0.365	0.079	0.450	0.003
431	0.368	0.013	0.337	0.254	0.387	0.003	0.380	0.009	0.350	0.140	0.289	0.907	0.434	0.002	0.360	0.087	0.450	0.001
432	0.337	0.087	0.323	0.434	0.387	0.002	0.372	0.044	0.330	0.306	0.289	0.884	0.365	0.035	0.345	0.184	0.450	0.001
433	0.388	0.003	0.312	0.460	0.387	0.002	0.326	0.364	0.355	0.137	0.289	0.895	0.300	0.273	0.332	0.220	0.450	0.001
434	0.362	0.027	0.325	0.270	0.387	0.002	0.303	0.380	0.321	0.291	0.289	0.884	0.387	0.018	0.339	0.240	0.450	0.001
435	0.385	0.004	0.346	0.166	0.387	0.003	0.367	0.011	0.328	0.359	0.289	0.885	0.422	0.001	0.362	0.109	0.450	0.001
436	0.338	0.081	0.329	0.406	0.387	0.004	0.341	0.081	0.334	0.191	0.289	0.905	0.442	0.001	0.302	0.566	0.450	0.001
437	0.302	0.174	0.316	0.507	0.387	0.002	0.385	0.004	0.352	0.043	0.289	0.887	0.409	0.002	0.383	0.037	0.450	0.001
438	0.382	0.011	0.320	0.482	0.387	0.003	0.307	0.434	0.336	0.194	0.289	0.901	0.423	0.001	0.429	0.006	0.450	0.001
439	0.351	0.050	0.318	0.501	0.387	0.002	0.340	0.167	0.350	0.155	0.289	0.883	0.445	0.001	0.342	0.149	0.450	0.001
440	0.391	0.003	0.329	0.228	0.387	0.006	0.358	0.051	0.367	0.057	0.289	0.893	0.504	0.001	0.317	0.438	0.450	0.002
441	0.403	0.001	0.304	0.759	0.387	0.004	0.378	0.009	0.290	0.803	0.289	0.884	0.461	0.003	0.382	0.027	0.450	0.002
442	0.379	0.013	0.335	0.355	0.387	0.004	0.367	0.008	0.341	0.203	0.289	0.914	0.482	0.002	0.349	0.111	0.450	0.001
443	0.387	0.002	0.316	0.693	0.387	0.003	0.343	0.034	0.327	0.442	0.289	0.911	0.334	0.185	0.387	0.030	0.450	0.003
444	0.368	0.016	0.312	0.384	0.387	0.003	0.333	0.222	0.346	0.186	0.289	0.917	0.444	0.001	0.382	0.036	0.450	0.001
445	0.365	0.046	0.326	0.432	0.387	0.001	0.357	0.048	0.357	0.087	0.289	0.891	0.365	0.031	0.306	0.496	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
446	0.379	0.011	0.342	0.227	0.387	0.002	0.310	0.533	0.351	0.061	0.289	0.903	0.425	0.002	0.410	0.008	0.450	0.001
447	0.378	0.017	0.312	0.518	0.387	0.001	0.353	0.042	0.355	0.112	0.289	0.895	0.361	0.031	0.347	0.172	0.450	0.001
448	0.377	0.003	0.332	0.210	0.387	0.004	0.349	0.060	0.355	0.133	0.289	0.881	0.450	0.003	0.369	0.082	0.450	0.001
449	0.331	0.243	0.328	0.285	0.387	0.005	0.316	0.166	0.362	0.068	0.289	0.873	0.404	0.010	0.367	0.064	0.450	0.001
450	0.379	0.009	0.313	0.517	0.387	0.005	0.398	0.002	0.344	0.192	0.289	0.896	0.403	0.005	0.342	0.154	0.450	0.001
451	0.348	0.129	0.336	0.224	0.387	0.005	0.352	0.037	0.368	0.044	0.289	0.914	0.405	0.006	0.405	0.017	0.450	0.001
452	0.358	0.047	0.343	0.223	0.387	0.002	0.367	0.015	0.346	0.169	0.289	0.886	0.420	0.004	0.352	0.130	0.450	0.001
453	0.378	0.009	0.357	0.080	0.387	0.003	0.319	0.527	0.341	0.223	0.289	0.897	0.454	0.002	0.342	0.184	0.450	0.001
454	0.356	0.010	0.321	0.384	0.387	0.001	0.345	0.095	0.352	0.147	0.289	0.880	0.441	0.001	0.360	0.127	0.450	0.001
455	0.348	0.049	0.330	0.339	0.387	0.006	0.387	0.010	0.393	0.003	0.289	0.890	0.395	0.006	0.384	0.040	0.450	0.002
456	0.351	0.053	0.366	0.052	0.387	0.003	0.364	0.028	0.309	0.558	0.289	0.893	0.378	0.036	0.382	0.037	0.450	0.001
457	0.349	0.039	0.335	0.279	0.387	0.003	0.351	0.027	0.361	0.079	0.289	0.880	0.395	0.009	0.325	0.206	0.450	0.001
458	0.373	0.019	0.340	0.253	0.387	0.008	0.305	0.705	0.379	0.011	0.289	0.908	0.413	0.007	0.310	0.373	0.450	0.001
459	0.358	0.015	0.336	0.202	0.387	0.002	0.350	0.010	0.395	0.004	0.289	0.904	0.430	0.002	0.330	0.278	0.450	0.002
460	0.364	0.015	0.342	0.180	0.387	0.003	0.363	0.033	0.369	0.020	0.289	0.901	0.391	0.018	0.366	0.067	0.450	0.001
461	0.367	0.014	0.306	0.630	0.387	0.004	0.364	0.041	0.323	0.305	0.289	0.888	0.421	0.005	0.361	0.100	0.450	0.004
462	0.361	0.023	0.337	0.179	0.387	0.003	0.342	0.090	0.303	0.626	0.289	0.911	0.455	0.001	0.370	0.073	0.450	0.001
463	0.351	0.082	0.310	0.699	0.387	0.003	0.325	0.270	0.292	0.208	0.289	0.906	0.420	0.002	0.327	0.277	0.450	0.001
464	0.411	0.001	0.354	0.092	0.387	0.004	0.361	0.025	0.382	0.005	0.289	0.876	0.423	0.002	0.333	0.232	0.450	0.002
465	0.404	0.001	0.348	0.188	0.387	0.004	0.339	0.079	0.340	0.355	0.289	0.897	0.379	0.028	0.363	0.092	0.450	0.001
466	0.339	0.125	0.313	0.714	0.387	0.005	0.365	0.021	0.396	0.002	0.289	0.905	0.410	0.010	0.383	0.059	0.450	0.003
467	0.366	0.021	0.307	0.725	0.387	0.004	0.362	0.025	0.334	0.243	0.289	0.885	0.392	0.010	0.396	0.011	0.450	0.001
468	0.364	0.023	0.312	0.450	0.387	0.003	0.334	0.293	0.338	0.265	0.289	0.887	0.338	0.099	0.385	0.021	0.450	0.001
469	0.369	0.034	0.321	0.359	0.387	0.006	0.359	0.025	0.342	0.224	0.289	0.897	0.418	0.001	0.347	0.124	0.450	0.001
470	0.382	0.005	0.327	0.408	0.387	0.003	0.434	0.001	0.398	0.004	0.289	0.887	0.428	0.002	0.387	0.028	0.450	0.001
471	0.346	0.093	0.347	0.197	0.387	0.002	0.384	0.004	0.311	0.572	0.289	0.885	0.400	0.013	0.292	0.648	0.450	0.002
472	0.380	0.007	0.320	0.457	0.387	0.002	0.365	0.027	0.315	0.462	0.289	0.903	0.408	0.012	0.342	0.192	0.450	0.001
473	0.369	0.010	0.310	0.642	0.387	0.002	0.362	0.051	0.356	0.109	0.289	0.918	0.499	0.001	0.356	0.130	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
474	0.361	0.012	0.338	0.134	0.387	0.007	0.314	0.261	0.338	0.248	0.289	0.894	0.409	0.010	0.389	0.019	0.450	0.001
475	0.402	0.001	0.342	0.207	0.387	0.004	0.353	0.073	0.315	0.512	0.289	0.900	0.363	0.033	0.346	0.201	0.450	0.001
476	0.393	0.003	0.314	0.612	0.387	0.005	0.345	0.111	0.355	0.040	0.289	0.890	0.395	0.008	0.392	0.013	0.450	0.002
477	0.363	0.035	0.311	0.703	0.387	0.002	0.325	0.163	0.359	0.085	0.289	0.908	0.469	0.001	0.367	0.093	0.450	0.001
478	0.378	0.002	0.343	0.230	0.387	0.005	0.322	0.385	0.327	0.323	0.289	0.890	0.376	0.028	0.333	0.291	0.450	0.002
479	0.366	0.009	0.322	0.580	0.387	0.003	0.338	0.176	0.336	0.097	0.289	0.873	0.426	0.002	0.313	0.348	0.450	0.001
480	0.349	0.018	0.347	0.109	0.387	0.006	0.361	0.030	0.338	0.314	0.289	0.898	0.366	0.039	0.276	0.712	0.450	0.002
481	0.358	0.011	0.325	0.496	0.387	0.001	0.349	0.092	0.383	0.023	0.289	0.902	0.375	0.010	0.387	0.033	0.450	0.001
482	0.387	0.007	0.306	0.733	0.387	0.003	0.337	0.077	0.320	0.322	0.289	0.881	0.380	0.034	0.380	0.028	0.450	0.002
483	0.383	0.006	0.299	0.811	0.387	0.003	0.346	0.075	0.342	0.162	0.289	0.903	0.487	0.002	0.385	0.023	0.450	0.001
484	0.371	0.009	0.361	0.064	0.387	0.001	0.331	0.301	0.315	0.472	0.289	0.885	0.404	0.015	0.386	0.026	0.450	0.001
485	0.371	0.007	0.326	0.404	0.387	0.007	0.349	0.068	0.365	0.056	0.289	0.885	0.400	0.009	0.329	0.237	0.450	0.001
486	0.389	0.006	0.337	0.162	0.387	0.002	0.348	0.089	0.305	0.739	0.289	0.899	0.371	0.022	0.355	0.166	0.450	0.001
487	0.340	0.186	0.331	0.334	0.387	0.003	0.350	0.056	0.352	0.098	0.289	0.889	0.402	0.008	0.371	0.076	0.450	0.001
488	0.360	0.029	0.342	0.192	0.387	0.003	0.326	0.327	0.374	0.027	0.289	0.886	0.392	0.011	0.399	0.018	0.450	0.002
489	0.362	0.025	0.328	0.370	0.387	0.004	0.392	0.003	0.329	0.396	0.289	0.885	0.453	0.001	0.350	0.140	0.450	0.002
490	0.371	0.019	0.339	0.178	0.387	0.002	0.364	0.030	0.379	0.034	0.289	0.899	0.444	0.001	0.393	0.016	0.450	0.002
491	0.368	0.018	0.326	0.422	0.387	0.004	0.331	0.151	0.345	0.160	0.289	0.897	0.400	0.012	0.380	0.030	0.450	0.001
492	0.334	0.188	0.289	0.595	0.387	0.002	0.350	0.073	0.326	0.396	0.289	0.909	0.388	0.015	0.337	0.153	0.450	0.001
493	0.372	0.004	0.335	0.360	0.387	0.003	0.316	0.446	0.325	0.282	0.289	0.895	0.421	0.002	0.349	0.178	0.450	0.003
494	0.371	0.020	0.279	0.932	0.387	0.003	0.320	0.296	0.328	0.431	0.289	0.909	0.349	0.157	0.408	0.012	0.450	0.002
495	0.400	0.001	0.351	0.176	0.387	0.003	0.333	0.277	0.352	0.109	0.289	0.887	0.391	0.021	0.383	0.050	0.450	0.003
496	0.404	0.001	0.374	0.017	0.387	0.002	0.325	0.266	0.368	0.032	0.289	0.900	0.400	0.003	0.397	0.014	0.450	0.002
497	0.350	0.113	0.353	0.113	0.387	0.003	0.290	0.834	0.391	0.004	0.289	0.902	0.416	0.002	0.396	0.026	0.450	0.002
498	0.372	0.020	0.328	0.272	0.387	0.004	0.314	0.212	0.335	0.265	0.289	0.895	0.419	0.003	0.291	0.673	0.450	0.002
499	0.379	0.002	0.335	0.190	0.387	0.006	0.345	0.126	0.315	0.630	0.289	0.899	0.408	0.002	0.329	0.326	0.450	0.001
500	0.347	0.057	0.339	0.176	0.387	0.005	0.346	0.103	0.360	0.073	0.289	0.892	0.378	0.023	0.346	0.137	0.450	0.002
501	0.359	0.026	0.354	0.117	0.387	0.004	0.345	0.127	0.324	0.301	0.289	0.894	0.440	0.002	0.361	0.106	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
502	0.370	0.024	0.366	0.056	0.387	0.008	0.344	0.131	0.367	0.060	0.289	0.904	0.425	0.003	0.379	0.045	0.450	0.001
503	0.374	0.003	0.312	0.588	0.387	0.003	0.343	0.117	0.354	0.056	0.289	0.890	0.425	0.002	0.372	0.049	0.450	0.001
504	0.382	0.004	0.306	0.676	0.387	0.006	0.394	0.006	0.336	0.337	0.289	0.876	0.458	0.002	0.380	0.039	0.450	0.001
505	0.407	0.003	0.376	0.030	0.387	0.003	0.335	0.219	0.344	0.141	0.289	0.896	0.397	0.006	0.367	0.063	0.450	0.002
506	0.407	0.005	0.326	0.448	0.387	0.002	0.355	0.058	0.334	0.213	0.289	0.891	0.388	0.011	0.388	0.035	0.450	0.001
507	0.376	0.008	0.328	0.355	0.387	0.006	0.353	0.034	0.342	0.027	0.289	0.887	0.460	0.001	0.389	0.034	0.450	0.002
508	0.376	0.010	0.312	0.656	0.387	0.002	0.391	0.002	0.389	0.008	0.289	0.909	0.431	0.002	0.382	0.047	0.450	0.002
509	0.347	0.062	0.306	0.568	0.387	0.004	0.417	0.001	0.363	0.011	0.289	0.886	0.388	0.018	0.373	0.057	0.450	0.002
510	0.391	0.004	0.331	0.391	0.387	0.004	0.328	0.234	0.321	0.295	0.289	0.882	0.433	0.003	0.363	0.100	0.450	0.002
511	0.369	0.005	0.339	0.209	0.387	0.002	0.396	0.004	0.334	0.297	0.289	0.908	0.443	0.001	0.376	0.053	0.450	0.001
512	0.369	0.010	0.317	0.455	0.387	0.001	0.335	0.204	0.327	0.171	0.289	0.879	0.433	0.004	0.320	0.333	0.450	0.001
513	0.353	0.064	0.310	0.678	0.387	0.003	0.319	0.178	0.362	0.041	0.289	0.882	0.486	0.001	0.382	0.022	0.450	0.001
514	0.360	0.033	0.304	0.694	0.387	0.001	0.324	0.346	0.325	0.275	0.289	0.903	0.379	0.043	0.372	0.067	0.450	0.001
515	0.333	0.097	0.322	0.353	0.387	0.001	0.318	0.293	0.339	0.123	0.289	0.904	0.388	0.025	0.400	0.021	0.450	0.001
516	0.361	0.017	0.323	0.462	0.387	0.004	0.335	0.220	0.327	0.149	0.289	0.900	0.409	0.007	0.420	0.004	0.450	0.001
517	0.349	0.082	0.350	0.081	0.387	0.004	0.367	0.009	0.368	0.033	0.289	0.868	0.418	0.003	0.422	0.003	0.450	0.001
518	0.326	0.268	0.313	0.510	0.387	0.003	0.329	0.159	0.318	0.443	0.289	0.907	0.420	0.008	0.358	0.108	0.450	0.002
519	0.328	0.228	0.350	0.107	0.387	0.002	0.357	0.024	0.354	0.102	0.289	0.894	0.375	0.037	0.388	0.032	0.450	0.001
520	0.305	0.568	0.344	0.160	0.387	0.005	0.341	0.147	0.377	0.027	0.289	0.889	0.429	0.002	0.335	0.186	0.450	0.001
521	0.358	0.012	0.313	0.569	0.387	0.004	0.343	0.119	0.354	0.097	0.289	0.906	0.377	0.032	0.350	0.092	0.450	0.001
522	0.349	0.070	0.302	0.635	0.387	0.002	0.372	0.013	0.331	0.422	0.289	0.897	0.433	0.001	0.341	0.265	0.450	0.001
523	0.365	0.014	0.359	0.064	0.387	0.005	0.343	0.095	0.309	0.300	0.289	0.905	0.415	0.008	0.391	0.025	0.450	0.001
524	0.358	0.048	0.319	0.443	0.387	0.004	0.342	0.106	0.367	0.021	0.289	0.903	0.382	0.039	0.358	0.169	0.450	0.001
525	0.356	0.036	0.339	0.250	0.387	0.004	0.342	0.077	0.340	0.245	0.289	0.894	0.419	0.005	0.372	0.051	0.450	0.002
526	0.379	0.002	0.336	0.171	0.387	0.003	0.343	0.028	0.302	0.642	0.289	0.869	0.397	0.006	0.367	0.081	0.450	0.001
527	0.345	0.072	0.318	0.628	0.387	0.001	0.345	0.102	0.378	0.026	0.289	0.894	0.447	0.001	0.362	0.091	0.450	0.002
528	0.393	0.001	0.313	0.631	0.387	0.001	0.304	0.673	0.357	0.125	0.289	0.882	0.439	0.003	0.341	0.256	0.450	0.003
529	0.338	0.194	0.334	0.226	0.387	0.004	0.354	0.014	0.333	0.342	0.289	0.895	0.414	0.003	0.348	0.185	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
530	0.398	0.004	0.323	0.489	0.387	0.003	0.312	0.526	0.331	0.163	0.289	0.889	0.385	0.008	0.369	0.067	0.450	0.001
531	0.384	0.003	0.355	0.071	0.387	0.003	0.376	0.005	0.384	0.025	0.289	0.888	0.418	0.004	0.343	0.162	0.450	0.001
532	0.390	0.002	0.313	0.546	0.387	0.002	0.310	0.270	0.355	0.135	0.289	0.881	0.413	0.002	0.344	0.198	0.450	0.001
533	0.380	0.006	0.313	0.702	0.387	0.002	0.349	0.108	0.334	0.302	0.289	0.908	0.395	0.016	0.361	0.084	0.450	0.002
534	0.363	0.015	0.319	0.520	0.387	0.002	0.326	0.369	0.379	0.028	0.289	0.896	0.412	0.002	0.409	0.016	0.450	0.001
535	0.359	0.044	0.330	0.236	0.387	0.004	0.338	0.134	0.331	0.373	0.289	0.901	0.393	0.009	0.322	0.425	0.450	0.001
536	0.349	0.119	0.336	0.176	0.387	0.005	0.337	0.307	0.367	0.037	0.289	0.905	0.417	0.003	0.324	0.328	0.450	0.003
537	0.314	0.364	0.330	0.366	0.387	0.005	0.324	0.309	0.381	0.006	0.289	0.899	0.425	0.002	0.390	0.046	0.450	0.001
538	0.382	0.005	0.336	0.219	0.387	0.005	0.288	0.742	0.368	0.029	0.289	0.898	0.444	0.003	0.354	0.134	0.450	0.001
539	0.400	0.005	0.323	0.583	0.387	0.005	0.322	0.377	0.349	0.193	0.289	0.897	0.419	0.005	0.359	0.134	0.450	0.001
540	0.375	0.006	0.322	0.204	0.387	0.004	0.350	0.074	0.357	0.144	0.289	0.901	0.404	0.021	0.334	0.262	0.450	0.001
541	0.408	0.001	0.356	0.118	0.387	0.007	0.304	0.491	0.296	0.827	0.289	0.902	0.507	0.001	0.368	0.054	0.450	0.003
542	0.369	0.014	0.339	0.111	0.387	0.003	0.340	0.130	0.357	0.050	0.289	0.886	0.436	0.003	0.323	0.359	0.450	0.002
543	0.364	0.026	0.305	0.644	0.387	0.003	0.427	0.001	0.337	0.263	0.289	0.883	0.391	0.009	0.319	0.421	0.450	0.001
544	0.351	0.068	0.330	0.312	0.387	0.003	0.372	0.005	0.349	0.152	0.289	0.892	0.372	0.022	0.334	0.316	0.450	0.001
545	0.363	0.024	0.321	0.489	0.387	0.002	0.350	0.055	0.366	0.034	0.289	0.893	0.380	0.020	0.342	0.184	0.450	0.001
546	0.373	0.019	0.345	0.128	0.387	0.005	0.359	0.036	0.363	0.032	0.289	0.886	0.378	0.021	0.342	0.164	0.450	0.001
547	0.381	0.001	0.338	0.137	0.387	0.003	0.321	0.166	0.361	0.073	0.289	0.881	0.482	0.001	0.361	0.105	0.450	0.002
548	0.339	0.105	0.316	0.597	0.387	0.003	0.377	0.006	0.349	0.171	0.289	0.890	0.439	0.001	0.410	0.007	0.450	0.001
549	0.393	0.001	0.332	0.103	0.387	0.004	0.345	0.107	0.322	0.291	0.289	0.879	0.366	0.059	0.388	0.028	0.450	0.001
550	0.358	0.015	0.345	0.214	0.387	0.003	0.374	0.008	0.332	0.255	0.289	0.891	0.407	0.006	0.382	0.024	0.450	0.001
551	0.340	0.082	0.310	0.631	0.387	0.004	0.339	0.131	0.323	0.418	0.289	0.886	0.444	0.002	0.316	0.467	0.450	0.001
552	0.367	0.029	0.327	0.239	0.387	0.002	0.339	0.121	0.343	0.124	0.289	0.884	0.384	0.009	0.342	0.225	0.450	0.002
553	0.413	0.001	0.351	0.118	0.387	0.003	0.373	0.013	0.320	0.533	0.289	0.897	0.400	0.010	0.328	0.245	0.450	0.001
554	0.361	0.011	0.308	0.724	0.387	0.002	0.331	0.076	0.360	0.047	0.289	0.876	0.437	0.001	0.338	0.174	0.450	0.001
555	0.402	0.002	0.326	0.263	0.387	0.005	0.309	0.588	0.349	0.094	0.289	0.885	0.459	0.001	0.355	0.109	0.450	0.002
556	0.351	0.026	0.334	0.286	0.387	0.004	0.357	0.039	0.330	0.291	0.289	0.907	0.330	0.274	0.299	0.602	0.450	0.001
557	0.371	0.009	0.349	0.158	0.387	0.006	0.333	0.184	0.329	0.191	0.289	0.891	0.417	0.004	0.393	0.013	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
558	0.338	0.133	0.320	0.375	0.387	0.007	0.342	0.105	0.332	0.370	0.289	0.890	0.416	0.005	0.374	0.072	0.450	0.001
559	0.390	0.005	0.315	0.398	0.387	0.004	0.351	0.092	0.318	0.478	0.289	0.889	0.384	0.035	0.317	0.417	0.450	0.002
560	0.355	0.072	0.351	0.131	0.387	0.005	0.366	0.009	0.308	0.691	0.289	0.895	0.457	0.001	0.369	0.079	0.450	0.002
561	0.351	0.047	0.324	0.346	0.387	0.002	0.342	0.095	0.364	0.041	0.289	0.901	0.395	0.018	0.362	0.104	0.450	0.001
562	0.360	0.031	0.351	0.161	0.387	0.002	0.332	0.109	0.394	0.005	0.289	0.886	0.363	0.052	0.381	0.040	0.450	0.001
563	0.348	0.088	0.312	0.593	0.387	0.004	0.395	0.002	0.338	0.225	0.289	0.895	0.416	0.005	0.322	0.421	0.450	0.002
564	0.351	0.036	0.346	0.060	0.387	0.004	0.387	0.001	0.392	0.005	0.289	0.894	0.360	0.044	0.345	0.130	0.450	0.001
565	0.388	0.005	0.311	0.644	0.387	0.003	0.315	0.228	0.322	0.550	0.289	0.892	0.391	0.015	0.358	0.121	0.450	0.002
566	0.348	0.013	0.356	0.070	0.387	0.001	0.366	0.028	0.332	0.151	0.289	0.902	0.387	0.014	0.365	0.055	0.450	0.003
567	0.330	0.360	0.332	0.362	0.387	0.002	0.409	0.001	0.341	0.126	0.289	0.896	0.364	0.062	0.369	0.081	0.450	0.001
568	0.326	0.182	0.327	0.380	0.387	0.002	0.339	0.165	0.335	0.281	0.289	0.887	0.369	0.067	0.327	0.320	0.450	0.002
569	0.367	0.019	0.320	0.450	0.387	0.002	0.333	0.264	0.322	0.344	0.289	0.901	0.448	0.001	0.385	0.039	0.450	0.001
570	0.378	0.005	0.309	0.288	0.387	0.004	0.352	0.059	0.337	0.260	0.289	0.890	0.451	0.001	0.390	0.021	0.450	0.001
571	0.375	0.004	0.317	0.467	0.387	0.002	0.379	0.003	0.351	0.120	0.289	0.888	0.413	0.003	0.385	0.035	0.450	0.001
572	0.402	0.003	0.318	0.602	0.387	0.005	0.361	0.051	0.373	0.019	0.289	0.878	0.383	0.010	0.380	0.046	0.450	0.002
573	0.373	0.009	0.304	0.777	0.387	0.003	0.335	0.177	0.345	0.113	0.289	0.888	0.433	0.003	0.289	0.551	0.450	0.002
574	0.389	0.003	0.352	0.038	0.387	0.003	0.351	0.111	0.331	0.387	0.289	0.889	0.419	0.005	0.387	0.025	0.450	0.001
575	0.359	0.019	0.305	0.624	0.387	0.006	0.319	0.596	0.372	0.034	0.289	0.890	0.429	0.001	0.371	0.097	0.450	0.001
576	0.390	0.002	0.319	0.261	0.387	0.002	0.347	0.093	0.327	0.455	0.289	0.900	0.435	0.002	0.359	0.085	0.450	0.001
577	0.354	0.044	0.338	0.267	0.387	0.003	0.360	0.017	0.351	0.036	0.289	0.891	0.331	0.181	0.317	0.400	0.450	0.002
578	0.359	0.024	0.324	0.296	0.387	0.006	0.376	0.012	0.368	0.048	0.289	0.899	0.449	0.001	0.417	0.008	0.450	0.001
579	0.348	0.111	0.294	0.849	0.387	0.009	0.336	0.056	0.333	0.258	0.289	0.895	0.426	0.001	0.435	0.002	0.450	0.001
580	0.334	0.190	0.352	0.103	0.387	0.004	0.328	0.240	0.345	0.055	0.289	0.883	0.472	0.001	0.329	0.307	0.450	0.003
581	0.391	0.006	0.346	0.151	0.387	0.005	0.372	0.023	0.368	0.042	0.289	0.885	0.378	0.012	0.278	0.831	0.450	0.001
582	0.416	0.001	0.375	0.024	0.387	0.005	0.336	0.135	0.335	0.238	0.289	0.921	0.403	0.010	0.354	0.191	0.450	0.002
583	0.356	0.059	0.285	0.874	0.387	0.001	0.353	0.039	0.347	0.205	0.289	0.887	0.416	0.002	0.386	0.017	0.450	0.003
584	0.373	0.005	0.329	0.398	0.387	0.005	0.391	0.003	0.343	0.103	0.289	0.898	0.362	0.061	0.415	0.004	0.450	0.001
585	0.374	0.013	0.306	0.701	0.387	0.002	0.348	0.084	0.331	0.277	0.289	0.894	0.441	0.002	0.337	0.192	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
586	0.345	0.046	0.326	0.286	0.387	0.002	0.326	0.118	0.313	0.658	0.289	0.888	0.431	0.003	0.341	0.208	0.450	0.001
587	0.366	0.004	0.334	0.299	0.387	0.004	0.373	0.013	0.334	0.238	0.289	0.896	0.453	0.001	0.370	0.045	0.450	0.002
588	0.358	0.016	0.322	0.408	0.387	0.006	0.361	0.074	0.372	0.008	0.289	0.895	0.451	0.002	0.303	0.422	0.450	0.002
589	0.409	0.001	0.308	0.642	0.387	0.004	0.360	0.030	0.343	0.199	0.289	0.889	0.429	0.005	0.405	0.006	0.450	0.001
590	0.380	0.007	0.344	0.221	0.387	0.003	0.325	0.327	0.320	0.455	0.289	0.897	0.362	0.071	0.370	0.054	0.450	0.001
591	0.301	0.375	0.356	0.103	0.387	0.003	0.367	0.044	0.354	0.108	0.289	0.896	0.431	0.003	0.397	0.008	0.450	0.001
592	0.348	0.089	0.353	0.136	0.387	0.003	0.327	0.094	0.365	0.062	0.289	0.898	0.464	0.001	0.331	0.239	0.450	0.001
593	0.367	0.023	0.341	0.157	0.387	0.004	0.316	0.519	0.349	0.123	0.289	0.890	0.396	0.015	0.340	0.180	0.450	0.003
594	0.384	0.001	0.370	0.026	0.387	0.003	0.359	0.028	0.311	0.586	0.289	0.888	0.439	0.001	0.370	0.087	0.450	0.002
595	0.380	0.006	0.346	0.146	0.387	0.001	0.357	0.075	0.361	0.064	0.289	0.894	0.422	0.001	0.382	0.054	0.450	0.002
596	0.367	0.038	0.339	0.285	0.387	0.004	0.337	0.131	0.333	0.294	0.289	0.891	0.368	0.070	0.366	0.056	0.450	0.001
597	0.377	0.007	0.335	0.211	0.387	0.002	0.334	0.297	0.331	0.329	0.289	0.891	0.371	0.057	0.346	0.179	0.450	0.001
598	0.384	0.010	0.327	0.308	0.387	0.004	0.333	0.166	0.341	0.192	0.289	0.889	0.438	0.001	0.321	0.234	0.450	0.001
599	0.370	0.024	0.324	0.428	0.387	0.003	0.345	0.086	0.338	0.253	0.289	0.894	0.388	0.026	0.387	0.038	0.450	0.001
600	0.339	0.131	0.334	0.291	0.387	0.003	0.381	0.006	0.360	0.101	0.289	0.899	0.406	0.006	0.323	0.361	0.450	0.001
601	0.366	0.015	0.316	0.498	0.387	0.005	0.364	0.033	0.320	0.423	0.289	0.907	0.383	0.014	0.303	0.547	0.450	0.002
602	0.372	0.016	0.324	0.424	0.387	0.004	0.343	0.146	0.340	0.238	0.289	0.905	0.436	0.001	0.279	0.788	0.450	0.001
603	0.335	0.080	0.328	0.341	0.387	0.004	0.347	0.039	0.337	0.228	0.289	0.900	0.459	0.001	0.327	0.354	0.450	0.002
604	0.339	0.131	0.362	0.047	0.387	0.004	0.341	0.183	0.335	0.204	0.289	0.900	0.427	0.003	0.379	0.044	0.450	0.002
605	0.386	0.006	0.319	0.658	0.387	0.003	0.391	0.001	0.325	0.362	0.289	0.886	0.365	0.073	0.369	0.048	0.450	0.001
606	0.386	0.002	0.309	0.759	0.387	0.003	0.344	0.101	0.325	0.511	0.289	0.890	0.367	0.034	0.364	0.089	0.450	0.001
607	0.351	0.032	0.350	0.098	0.387	0.002	0.309	0.683	0.303	0.693	0.289	0.879	0.356	0.046	0.392	0.023	0.450	0.001
608	0.388	0.009	0.292	0.883	0.387	0.003	0.348	0.050	0.316	0.549	0.289	0.890	0.451	0.001	0.396	0.028	0.450	0.002
609	0.344	0.194	0.338	0.223	0.387	0.003	0.361	0.027	0.353	0.068	0.289	0.906	0.392	0.019	0.371	0.073	0.450	0.001
610	0.343	0.081	0.307	0.688	0.387	0.006	0.362	0.066	0.314	0.638	0.289	0.909	0.453	0.001	0.329	0.360	0.450	0.001
611	0.348	0.041	0.312	0.509	0.387	0.004	0.357	0.027	0.351	0.141	0.289	0.900	0.364	0.038	0.356	0.072	0.450	0.001
612	0.334	0.085	0.339	0.237	0.387	0.003	0.316	0.241	0.320	0.402	0.289	0.890	0.325	0.233	0.317	0.468	0.450	0.001
613	0.390	0.006	0.336	0.181	0.387	0.003	0.316	0.137	0.374	0.012	0.289	0.894	0.363	0.069	0.339	0.187	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
614	0.345	0.114	0.325	0.290	0.387	0.004	0.367	0.003	0.375	0.034	0.289	0.889	0.444	0.002	0.377	0.026	0.450	0.001
615	0.378	0.018	0.327	0.293	0.387	0.006	0.376	0.023	0.335	0.137	0.289	0.889	0.457	0.001	0.369	0.052	0.450	0.002
616	0.355	0.012	0.335	0.394	0.387	0.004	0.390	0.003	0.337	0.275	0.289	0.869	0.437	0.001	0.389	0.017	0.450	0.001
617	0.390	0.002	0.342	0.227	0.387	0.002	0.410	0.001	0.332	0.283	0.289	0.887	0.424	0.002	0.389	0.021	0.450	0.001
618	0.395	0.003	0.351	0.134	0.387	0.002	0.320	0.260	0.390	0.005	0.289	0.889	0.382	0.008	0.394	0.014	0.450	0.002
619	0.372	0.011	0.288	0.896	0.387	0.001	0.371	0.018	0.328	0.312	0.289	0.902	0.378	0.033	0.364	0.092	0.450	0.001
620	0.376	0.010	0.341	0.245	0.387	0.006	0.358	0.042	0.394	0.004	0.289	0.897	0.412	0.007	0.358	0.112	0.450	0.001
621	0.339	0.043	0.309	0.724	0.387	0.006	0.345	0.105	0.348	0.129	0.289	0.901	0.386	0.011	0.414	0.006	0.450	0.001
622	0.358	0.042	0.325	0.391	0.387	0.003	0.350	0.073	0.354	0.191	0.289	0.894	0.402	0.018	0.360	0.084	0.450	0.002
623	0.364	0.024	0.317	0.572	0.387	0.004	0.380	0.005	0.316	0.576	0.289	0.901	0.402	0.002	0.355	0.108	0.450	0.001
624	0.370	0.003	0.364	0.046	0.387	0.001	0.398	0.004	0.315	0.261	0.289	0.892	0.423	0.002	0.327	0.255	0.450	0.002
625	0.412	0.001	0.337	0.206	0.387	0.004	0.363	0.021	0.347	0.164	0.289	0.896	0.352	0.074	0.390	0.034	0.450	0.002
626	0.395	0.002	0.360	0.055	0.387	0.011	0.358	0.034	0.353	0.096	0.289	0.883	0.428	0.003	0.315	0.461	0.450	0.001
627	0.389	0.001	0.335	0.172	0.387	0.002	0.388	0.002	0.354	0.169	0.289	0.898	0.413	0.006	0.370	0.067	0.450	0.002
628	0.376	0.001	0.319	0.605	0.387	0.005	0.324	0.197	0.342	0.192	0.289	0.889	0.456	0.002	0.384	0.041	0.450	0.001
629	0.374	0.007	0.324	0.429	0.387	0.004	0.380	0.009	0.362	0.025	0.289	0.904	0.410	0.004	0.365	0.079	0.450	0.001
630	0.368	0.020	0.313	0.471	0.387	0.005	0.341	0.095	0.368	0.038	0.289	0.893	0.393	0.012	0.354	0.094	0.450	0.001
631	0.370	0.008	0.318	0.572	0.387	0.002	0.371	0.019	0.313	0.640	0.289	0.905	0.351	0.033	0.386	0.018	0.450	0.004
632	0.355	0.008	0.280	0.965	0.387	0.005	0.379	0.005	0.332	0.315	0.289	0.894	0.330	0.180	0.320	0.323	0.450	0.001
633	0.352	0.119	0.336	0.272	0.387	0.001	0.344	0.189	0.356	0.187	0.289	0.897	0.384	0.020	0.321	0.309	0.450	0.001
634	0.382	0.004	0.338	0.232	0.387	0.002	0.326	0.327	0.356	0.074	0.289	0.881	0.369	0.065	0.352	0.194	0.450	0.001
635	0.387	0.002	0.334	0.410	0.387	0.005	0.305	0.574	0.327	0.278	0.289	0.902	0.411	0.003	0.369	0.053	0.450	0.001
636	0.362	0.030	0.308	0.515	0.387	0.007	0.369	0.023	0.370	0.006	0.289	0.900	0.449	0.002	0.347	0.179	0.450	0.002
637	0.367	0.018	0.313	0.650	0.387	0.006	0.366	0.027	0.343	0.174	0.289	0.903	0.449	0.001	0.374	0.052	0.450	0.001
638	0.399	0.004	0.324	0.335	0.387	0.002	0.373	0.004	0.343	0.034	0.289	0.909	0.411	0.006	0.369	0.086	0.450	0.003
639	0.385	0.008	0.332	0.411	0.387	0.005	0.380	0.017	0.354	0.114	0.289	0.874	0.413	0.004	0.358	0.099	0.450	0.002
640	0.314	0.353	0.335	0.215	0.387	0.002	0.359	0.018	0.342	0.163	0.289	0.898	0.418	0.001	0.354	0.157	0.450	0.001
641	0.346	0.035	0.311	0.779	0.387	0.002	0.367	0.010	0.319	0.483	0.289	0.903	0.458	0.001	0.372	0.039	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
642	0.381	0.010	0.303	0.485	0.387	0.002	0.352	0.043	0.349	0.087	0.289	0.859	0.372	0.025	0.381	0.036	0.450	0.001
643	0.368	0.008	0.340	0.151	0.387	0.004	0.328	0.189	0.351	0.110	0.289	0.895	0.351	0.138	0.391	0.019	0.450	0.001
644	0.341	0.012	0.301	0.383	0.387	0.003	0.321	0.140	0.351	0.117	0.289	0.903	0.431	0.001	0.377	0.047	0.450	0.002
645	0.389	0.004	0.378	0.017	0.387	0.006	0.351	0.029	0.372	0.054	0.289	0.890	0.392	0.007	0.369	0.060	0.450	0.001
646	0.320	0.472	0.329	0.349	0.387	0.002	0.334	0.155	0.367	0.026	0.289	0.905	0.470	0.001	0.319	0.423	0.450	0.001
647	0.359	0.039	0.356	0.092	0.387	0.002	0.310	0.592	0.335	0.157	0.289	0.897	0.379	0.021	0.319	0.358	0.450	0.002
648	0.365	0.021	0.310	0.676	0.387	0.005	0.376	0.011	0.357	0.107	0.289	0.879	0.352	0.139	0.330	0.311	0.450	0.002
649	0.356	0.042	0.349	0.105	0.387	0.004	0.362	0.043	0.352	0.078	0.289	0.886	0.480	0.001	0.341	0.209	0.450	0.002
650	0.342	0.143	0.328	0.352	0.387	0.001	0.351	0.015	0.341	0.171	0.289	0.889	0.435	0.001	0.359	0.119	0.450	0.001
651	0.379	0.007	0.324	0.391	0.387	0.005	0.336	0.182	0.352	0.072	0.289	0.903	0.438	0.001	0.407	0.007	0.450	0.002
652	0.350	0.119	0.338	0.107	0.387	0.005	0.362	0.018	0.352	0.117	0.289	0.880	0.459	0.001	0.383	0.031	0.450	0.002
653	0.367	0.030	0.327	0.255	0.387	0.004	0.344	0.135	0.337	0.297	0.289	0.879	0.339	0.061	0.410	0.006	0.450	0.002
654	0.347	0.077	0.313	0.418	0.387	0.003	0.358	0.055	0.352	0.064	0.289	0.906	0.469	0.003	0.379	0.031	0.450	0.002
655	0.351	0.103	0.319	0.440	0.387	0.001	0.346	0.110	0.389	0.009	0.289	0.908	0.408	0.007	0.338	0.191	0.450	0.001
656	0.395	0.001	0.324	0.374	0.387	0.005	0.368	0.011	0.345	0.120	0.289	0.875	0.362	0.085	0.364	0.078	0.450	0.001
657	0.370	0.005	0.343	0.249	0.387	0.004	0.305	0.648	0.341	0.203	0.289	0.894	0.409	0.002	0.329	0.287	0.450	0.001
658	0.398	0.001	0.323	0.471	0.387	0.003	0.362	0.045	0.315	0.621	0.289	0.901	0.402	0.015	0.397	0.015	0.450	0.003
659	0.346	0.047	0.329	0.318	0.387	0.003	0.352	0.060	0.342	0.116	0.289	0.902	0.461	0.001	0.368	0.082	0.450	0.001
660	0.347	0.162	0.341	0.251	0.387	0.004	0.332	0.295	0.363	0.063	0.289	0.893	0.481	0.001	0.344	0.203	0.450	0.001
661	0.401	0.001	0.337	0.240	0.387	0.001	0.349	0.042	0.324	0.286	0.289	0.904	0.361	0.032	0.280	0.803	0.450	0.001
662	0.408	0.001	0.323	0.432	0.387	0.002	0.363	0.033	0.340	0.183	0.289	0.887	0.398	0.007	0.372	0.060	0.450	0.002
663	0.386	0.005	0.350	0.116	0.387	0.002	0.300	0.638	0.337	0.280	0.289	0.883	0.418	0.002	0.358	0.102	0.450	0.001
664	0.403	0.002	0.345	0.113	0.387	0.003	0.369	0.048	0.372	0.017	0.289	0.892	0.378	0.050	0.394	0.018	0.450	0.004
665	0.387	0.002	0.333	0.273	0.387	0.003	0.332	0.364	0.346	0.105	0.289	0.877	0.421	0.007	0.399	0.017	0.450	0.001
666	0.357	0.026	0.315	0.518	0.387	0.001	0.307	0.421	0.326	0.235	0.289	0.907	0.458	0.001	0.343	0.183	0.450	0.002
667	0.386	0.002	0.340	0.177	0.387	0.004	0.350	0.050	0.295	0.682	0.289	0.892	0.457	0.001	0.380	0.033	0.450	0.001
668	0.334	0.128	0.311	0.770	0.387	0.003	0.363	0.018	0.325	0.331	0.289	0.884	0.467	0.001	0.359	0.125	0.450	0.001
669	0.340	0.133	0.363	0.049	0.387	0.001	0.352	0.046	0.316	0.337	0.289	0.870	0.412	0.007	0.330	0.259	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
670	0.362	0.006	0.346	0.136	0.387	0.006	0.342	0.153	0.316	0.403	0.289	0.889	0.451	0.002	0.370	0.058	0.450	0.001
671	0.321	0.316	0.324	0.273	0.387	0.006	0.336	0.100	0.342	0.237	0.289	0.906	0.409	0.005	0.350	0.175	0.450	0.002
672	0.367	0.004	0.327	0.225	0.387	0.004	0.336	0.230	0.364	0.042	0.289	0.898	0.434	0.003	0.363	0.085	0.450	0.001
673	0.377	0.009	0.360	0.056	0.387	0.007	0.324	0.076	0.335	0.236	0.289	0.896	0.451	0.001	0.390	0.026	0.450	0.002
674	0.358	0.012	0.312	0.540	0.387	0.004	0.387	0.005	0.341	0.150	0.289	0.890	0.402	0.003	0.382	0.042	0.450	0.002
675	0.385	0.001	0.310	0.696	0.387	0.003	0.335	0.137	0.330	0.265	0.289	0.884	0.402	0.021	0.389	0.010	0.450	0.002
676	0.348	0.015	0.290	0.602	0.387	0.002	0.322	0.489	0.352	0.145	0.289	0.892	0.399	0.010	0.406	0.009	0.450	0.002
677	0.335	0.083	0.341	0.189	0.387	0.002	0.352	0.040	0.353	0.067	0.289	0.902	0.434	0.001	0.391	0.037	0.450	0.004
678	0.372	0.009	0.327	0.478	0.387	0.003	0.339	0.019	0.330	0.324	0.289	0.912	0.374	0.029	0.416	0.003	0.450	0.003
679	0.348	0.038	0.389	0.004	0.387	0.004	0.360	0.034	0.352	0.102	0.289	0.896	0.427	0.001	0.358	0.098	0.450	0.002
680	0.333	0.190	0.352	0.115	0.387	0.006	0.330	0.358	0.324	0.438	0.289	0.900	0.438	0.002	0.399	0.012	0.450	0.001
681	0.340	0.156	0.337	0.222	0.387	0.004	0.367	0.019	0.351	0.165	0.289	0.897	0.450	0.001	0.365	0.073	0.450	0.002
682	0.372	0.020	0.316	0.514	0.387	0.005	0.287	0.803	0.324	0.360	0.289	0.904	0.433	0.003	0.318	0.392	0.450	0.002
683	0.395	0.002	0.334	0.236	0.387	0.002	0.349	0.046	0.316	0.580	0.289	0.898	0.372	0.056	0.384	0.027	0.450	0.001
684	0.364	0.010	0.310	0.348	0.387	0.003	0.321	0.532	0.351	0.104	0.289	0.882	0.413	0.005	0.393	0.026	0.450	0.001
685	0.363	0.035	0.328	0.396	0.387	0.003	0.351	0.073	0.306	0.701	0.289	0.898	0.373	0.028	0.422	0.004	0.450	0.001
686	0.378	0.004	0.321	0.248	0.387	0.004	0.348	0.020	0.310	0.310	0.289	0.905	0.435	0.001	0.314	0.456	0.450	0.003
687	0.369	0.014	0.324	0.427	0.387	0.004	0.309	0.471	0.375	0.014	0.289	0.890	0.423	0.005	0.274	0.886	0.450	0.001
688	0.336	0.201	0.300	0.852	0.387	0.005	0.359	0.053	0.298	0.622	0.289	0.895	0.390	0.018	0.407	0.013	0.450	0.001
689	0.391	0.008	0.307	0.601	0.387	0.003	0.366	0.027	0.341	0.210	0.289	0.894	0.361	0.063	0.345	0.205	0.450	0.001
690	0.346	0.098	0.325	0.421	0.387	0.004	0.340	0.169	0.320	0.416	0.289	0.890	0.418	0.005	0.372	0.061	0.450	0.002
691	0.388	0.002	0.328	0.395	0.387	0.005	0.328	0.168	0.332	0.415	0.289	0.881	0.371	0.014	0.371	0.037	0.450	0.001
692	0.386	0.001	0.311	0.561	0.387	0.003	0.381	0.007	0.359	0.024	0.289	0.893	0.465	0.001	0.372	0.049	0.450	0.001
693	0.383	0.009	0.348	0.149	0.387	0.003	0.323	0.337	0.363	0.027	0.289	0.890	0.406	0.005	0.332	0.176	0.450	0.001
694	0.328	0.317	0.327	0.336	0.387	0.001	0.336	0.187	0.329	0.403	0.289	0.907	0.359	0.038	0.369	0.057	0.450	0.002
695	0.359	0.068	0.333	0.260	0.387	0.002	0.376	0.001	0.304	0.562	0.289	0.895	0.411	0.001	0.321	0.412	0.450	0.002
696	0.356	0.010	0.320	0.335	0.387	0.003	0.355	0.029	0.359	0.078	0.289	0.892	0.424	0.003	0.367	0.090	0.450	0.001
697	0.350	0.025	0.327	0.298	0.387	0.004	0.366	0.035	0.363	0.047	0.289	0.889	0.394	0.004	0.294	0.703	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
698	0.355	0.047	0.360	0.074	0.387	0.003	0.370	0.015	0.376	0.036	0.289	0.884	0.407	0.005	0.361	0.091	0.450	0.001
699	0.376	0.008	0.334	0.268	0.387	0.003	0.414	0.001	0.325	0.502	0.289	0.895	0.364	0.066	0.396	0.024	0.450	0.001
700	0.356	0.010	0.289	0.880	0.387	0.002	0.348	0.076	0.386	0.004	0.289	0.896	0.392	0.013	0.339	0.245	0.450	0.002
701	0.371	0.012	0.316	0.449	0.387	0.003	0.374	0.009	0.329	0.435	0.289	0.883	0.434	0.001	0.362	0.085	0.450	0.002
702	0.357	0.047	0.338	0.369	0.387	0.003	0.320	0.216	0.354	0.116	0.289	0.885	0.384	0.026	0.398	0.021	0.450	0.001
703	0.367	0.029	0.311	0.649	0.387	0.005	0.369	0.063	0.346	0.082	0.289	0.902	0.422	0.006	0.389	0.022	0.450	0.001
704	0.369	0.010	0.316	0.554	0.387	0.003	0.321	0.267	0.352	0.052	0.289	0.876	0.414	0.004	0.366	0.053	0.450	0.002
705	0.372	0.015	0.339	0.188	0.387	0.003	0.355	0.076	0.362	0.065	0.289	0.892	0.443	0.002	0.284	0.593	0.450	0.002
706	0.357	0.060	0.340	0.215	0.387	0.005	0.378	0.005	0.356	0.149	0.289	0.887	0.398	0.011	0.357	0.108	0.450	0.001
707	0.339	0.054	0.336	0.328	0.387	0.002	0.304	0.451	0.338	0.217	0.289	0.872	0.416	0.006	0.363	0.084	0.450	0.001
708	0.376	0.011	0.348	0.060	0.387	0.003	0.346	0.117	0.340	0.096	0.289	0.910	0.450	0.001	0.394	0.016	0.450	0.002
709	0.365	0.005	0.319	0.490	0.387	0.004	0.316	0.414	0.357	0.050	0.289	0.895	0.405	0.007	0.398	0.017	0.450	0.001
710	0.315	0.464	0.320	0.524	0.387	0.005	0.332	0.177	0.348	0.188	0.289	0.884	0.410	0.010	0.359	0.107	0.450	0.001
711	0.368	0.031	0.345	0.190	0.387	0.006	0.337	0.173	0.327	0.303	0.289	0.876	0.462	0.001	0.338	0.282	0.450	0.001
712	0.352	0.036	0.307	0.724	0.387	0.001	0.339	0.152	0.308	0.603	0.289	0.879	0.392	0.019	0.339	0.156	0.450	0.001
713	0.367	0.014	0.369	0.023	0.387	0.003	0.378	0.026	0.354	0.097	0.289	0.910	0.351	0.038	0.331	0.292	0.450	0.001
714	0.327	0.058	0.331	0.299	0.387	0.005	0.349	0.063	0.382	0.015	0.289	0.888	0.422	0.003	0.384	0.036	0.450	0.001
715	0.341	0.191	0.328	0.276	0.387	0.004	0.373	0.013	0.292	0.693	0.289	0.893	0.386	0.012	0.398	0.013	0.450	0.002
716	0.377	0.007	0.321	0.539	0.387	0.002	0.308	0.471	0.351	0.115	0.289	0.893	0.403	0.014	0.342	0.204	0.450	0.003
717	0.413	0.001	0.314	0.549	0.387	0.005	0.340	0.052	0.397	0.003	0.289	0.883	0.431	0.001	0.386	0.038	0.450	0.002
718	0.414	0.002	0.321	0.277	0.387	0.003	0.329	0.188	0.308	0.811	0.289	0.885	0.436	0.001	0.301	0.546	0.450	0.001
719	0.349	0.085	0.332	0.136	0.387	0.004	0.310	0.412	0.365	0.032	0.289	0.897	0.384	0.011	0.416	0.006	0.450	0.001
720	0.351	0.080	0.304	0.744	0.387	0.001	0.323	0.270	0.381	0.026	0.289	0.899	0.481	0.001	0.339	0.245	0.450	0.001
721	0.402	0.002	0.342	0.064	0.387	0.001	0.370	0.028	0.348	0.048	0.289	0.889	0.415	0.010	0.329	0.390	0.450	0.003
722	0.332	0.118	0.335	0.253	0.387	0.004	0.319	0.417	0.343	0.159	0.289	0.883	0.377	0.014	0.302	0.438	0.450	0.001
723	0.365	0.013	0.290	0.854	0.387	0.001	0.352	0.045	0.369	0.013	0.289	0.890	0.444	0.002	0.337	0.218	0.450	0.001
724	0.374	0.012	0.343	0.131	0.387	0.004	0.349	0.095	0.350	0.101	0.289	0.895	0.428	0.005	0.291	0.706	0.450	0.001
725	0.394	0.001	0.325	0.485	0.387	0.005	0.357	0.036	0.324	0.485	0.289	0.893	0.381	0.024	0.328	0.214	0.450	0.003

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
726	0.369	0.005	0.335	0.271	0.387	0.001	0.323	0.307	0.330	0.363	0.289	0.890	0.364	0.017	0.374	0.075	0.450	0.001
727	0.388	0.004	0.305	0.519	0.387	0.004	0.311	0.372	0.326	0.436	0.289	0.906	0.372	0.058	0.343	0.215	0.450	0.001
728	0.364	0.021	0.379	0.021	0.387	0.003	0.313	0.171	0.338	0.234	0.289	0.890	0.393	0.019	0.364	0.043	0.450	0.001
729	0.403	0.003	0.336	0.333	0.387	0.005	0.344	0.058	0.317	0.358	0.289	0.875	0.437	0.002	0.322	0.354	0.450	0.001
730	0.365	0.012	0.336	0.256	0.387	0.003	0.343	0.117	0.366	0.053	0.289	0.888	0.436	0.005	0.362	0.067	0.450	0.001
731	0.378	0.002	0.319	0.582	0.387	0.002	0.334	0.153	0.329	0.253	0.289	0.888	0.374	0.021	0.368	0.063	0.450	0.001
732	0.418	0.001	0.340	0.246	0.387	0.002	0.362	0.036	0.352	0.153	0.289	0.892	0.425	0.003	0.394	0.017	0.450	0.003
733	0.364	0.013	0.305	0.539	0.387	0.004	0.338	0.170	0.362	0.054	0.289	0.893	0.420	0.004	0.377	0.062	0.450	0.002
734	0.381	0.003	0.299	0.845	0.387	0.001	0.328	0.151	0.345	0.186	0.289	0.898	0.453	0.002	0.352	0.126	0.450	0.001
735	0.378	0.004	0.308	0.352	0.387	0.003	0.357	0.044	0.322	0.405	0.289	0.902	0.513	0.001	0.393	0.019	0.450	0.002
736	0.396	0.001	0.337	0.143	0.387	0.003	0.418	0.001	0.363	0.051	0.289	0.899	0.504	0.001	0.322	0.283	0.450	0.002
737	0.396	0.001	0.324	0.331	0.387	0.003	0.366	0.018	0.330	0.395	0.289	0.884	0.409	0.008	0.339	0.233	0.450	0.001
738	0.343	0.101	0.330	0.389	0.387	0.001	0.363	0.044	0.341	0.329	0.289	0.880	0.390	0.010	0.315	0.426	0.450	0.002
739	0.374	0.011	0.322	0.409	0.387	0.001	0.339	0.112	0.318	0.478	0.289	0.896	0.415	0.010	0.381	0.027	0.450	0.001
740	0.350	0.123	0.336	0.247	0.387	0.003	0.373	0.011	0.353	0.109	0.289	0.881	0.411	0.002	0.357	0.094	0.450	0.002
741	0.385	0.002	0.298	0.879	0.387	0.003	0.317	0.232	0.360	0.066	0.289	0.901	0.402	0.008	0.380	0.035	0.450	0.001
742	0.318	0.190	0.315	0.462	0.387	0.001	0.332	0.241	0.340	0.219	0.289	0.917	0.436	0.002	0.391	0.024	0.450	0.002
743	0.376	0.004	0.348	0.160	0.387	0.004	0.335	0.205	0.358	0.064	0.289	0.881	0.468	0.001	0.378	0.033	0.450	0.001
744	0.415	0.001	0.305	0.667	0.387	0.006	0.379	0.010	0.343	0.082	0.289	0.902	0.418	0.005	0.401	0.008	0.450	0.002
745	0.358	0.017	0.333	0.277	0.387	0.002	0.398	0.002	0.346	0.178	0.289	0.893	0.404	0.007	0.448	0.002	0.450	0.002
746	0.409	0.001	0.337	0.166	0.387	0.001	0.333	0.145	0.322	0.532	0.289	0.908	0.428	0.004	0.346	0.132	0.450	0.002
747	0.302	0.556	0.324	0.276	0.387	0.003	0.355	0.062	0.356	0.096	0.289	0.882	0.430	0.003	0.376	0.096	0.450	0.001
748	0.369	0.015	0.293	0.796	0.387	0.003	0.369	0.016	0.343	0.171	0.289	0.885	0.406	0.008	0.361	0.110	0.450	0.002
749	0.344	0.190	0.327	0.296	0.387	0.004	0.383	0.009	0.351	0.095	0.289	0.883	0.341	0.096	0.355	0.129	0.450	0.002
750	0.395	0.002	0.340	0.218	0.387	0.003	0.344	0.101	0.345	0.209	0.289	0.872	0.471	0.001	0.361	0.071	0.450	0.002
751	0.364	0.023	0.334	0.181	0.387	0.002	0.353	0.026	0.331	0.132	0.289	0.883	0.445	0.001	0.301	0.455	0.450	0.002
752	0.372	0.009	0.317	0.675	0.387	0.004	0.313	0.271	0.325	0.272	0.289	0.892	0.455	0.001	0.309	0.508	0.450	0.001
753	0.346	0.060	0.313	0.478	0.387	0.003	0.337	0.053	0.340	0.152	0.289	0.890	0.409	0.003	0.336	0.203	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
754	0.363	0.012	0.338	0.192	0.387	0.004	0.362	0.067	0.349	0.137	0.289	0.892	0.395	0.011	0.390	0.031	0.450	0.004
755	0.348	0.058	0.342	0.159	0.387	0.006	0.350	0.027	0.358	0.107	0.289	0.897	0.358	0.050	0.353	0.103	0.450	0.002
756	0.376	0.007	0.341	0.248	0.387	0.001	0.330	0.327	0.335	0.164	0.289	0.889	0.361	0.036	0.306	0.399	0.450	0.001
757	0.380	0.008	0.356	0.078	0.387	0.005	0.363	0.027	0.323	0.359	0.289	0.906	0.427	0.001	0.303	0.475	0.450	0.001
758	0.324	0.110	0.318	0.469	0.387	0.005	0.328	0.287	0.372	0.030	0.289	0.885	0.459	0.001	0.339	0.174	0.450	0.003
759	0.364	0.048	0.303	0.799	0.387	0.004	0.313	0.589	0.325	0.455	0.289	0.899	0.410	0.010	0.349	0.156	0.450	0.001
760	0.371	0.015	0.308	0.635	0.387	0.005	0.372	0.014	0.361	0.087	0.289	0.879	0.423	0.001	0.376	0.040	0.450	0.001
761	0.374	0.009	0.317	0.605	0.387	0.004	0.377	0.007	0.315	0.312	0.289	0.903	0.457	0.002	0.369	0.038	0.450	0.001
762	0.380	0.008	0.308	0.665	0.387	0.003	0.329	0.350	0.350	0.064	0.289	0.910	0.428	0.004	0.372	0.069	0.450	0.002
763	0.319	0.235	0.333	0.257	0.387	0.002	0.331	0.061	0.386	0.007	0.289	0.893	0.392	0.012	0.375	0.054	0.450	0.001
764	0.387	0.006	0.362	0.026	0.387	0.001	0.318	0.105	0.354	0.096	0.289	0.889	0.450	0.001	0.354	0.110	0.450	0.001
765	0.344	0.150	0.296	0.784	0.387	0.005	0.346	0.059	0.361	0.041	0.289	0.889	0.448	0.003	0.346	0.179	0.450	0.001
766	0.357	0.094	0.315	0.626	0.387	0.005	0.301	0.545	0.320	0.249	0.289	0.914	0.391	0.017	0.386	0.014	0.450	0.001
767	0.347	0.079	0.296	0.908	0.387	0.002	0.347	0.168	0.281	0.862	0.289	0.898	0.421	0.009	0.390	0.014	0.450	0.003
768	0.405	0.001	0.326	0.289	0.387	0.005	0.341	0.050	0.357	0.066	0.289	0.883	0.408	0.009	0.384	0.022	0.450	0.001
769	0.344	0.126	0.314	0.548	0.387	0.003	0.367	0.012	0.374	0.014	0.289	0.875	0.477	0.001	0.405	0.009	0.450	0.001
770	0.409	0.002	0.319	0.438	0.387	0.003	0.315	0.479	0.322	0.461	0.289	0.884	0.370	0.069	0.356	0.107	0.450	0.001
771	0.313	0.386	0.308	0.668	0.387	0.005	0.365	0.042	0.351	0.090	0.289	0.874	0.443	0.001	0.355	0.117	0.450	0.001
772	0.315	0.632	0.337	0.247	0.387	0.006	0.352	0.031	0.351	0.114	0.289	0.890	0.379	0.014	0.363	0.078	0.450	0.001
773	0.389	0.001	0.356	0.141	0.387	0.006	0.355	0.035	0.388	0.025	0.289	0.896	0.422	0.003	0.334	0.303	0.450	0.001
774	0.366	0.012	0.315	0.608	0.387	0.002	0.342	0.116	0.353	0.159	0.289	0.880	0.357	0.052	0.389	0.032	0.450	0.003
775	0.352	0.066	0.322	0.457	0.387	0.003	0.374	0.015	0.336	0.237	0.289	0.891	0.409	0.004	0.365	0.065	0.450	0.001
776	0.391	0.004	0.317	0.612	0.387	0.007	0.358	0.033	0.361	0.054	0.289	0.893	0.345	0.081	0.381	0.045	0.450	0.001
777	0.341	0.124	0.305	0.812	0.387	0.008	0.318	0.486	0.316	0.529	0.289	0.901	0.411	0.006	0.295	0.652	0.450	0.002
778	0.337	0.122	0.319	0.472	0.387	0.004	0.355	0.045	0.309	0.354	0.289	0.900	0.395	0.016	0.367	0.085	0.450	0.001
779	0.316	0.493	0.308	0.657	0.387	0.005	0.347	0.095	0.359	0.066	0.289	0.885	0.411	0.007	0.366	0.064	0.450	0.002
780	0.377	0.009	0.306	0.783	0.387	0.003	0.334	0.021	0.297	0.687	0.289	0.889	0.315	0.249	0.330	0.234	0.450	0.001
781	0.358	0.013	0.344	0.131	0.387	0.004	0.324	0.309	0.355	0.046	0.289	0.905	0.419	0.001	0.346	0.157	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
782	0.347	0.062	0.356	0.136	0.387	0.006	0.346	0.094	0.372	0.021	0.289	0.880	0.383	0.022	0.377	0.046	0.450	0.001
783	0.358	0.051	0.314	0.563	0.387	0.004	0.333	0.073	0.357	0.071	0.289	0.916	0.448	0.001	0.305	0.508	0.450	0.001
784	0.395	0.002	0.296	0.542	0.387	0.002	0.402	0.003	0.345	0.200	0.289	0.900	0.379	0.045	0.381	0.043	0.450	0.004
785	0.388	0.001	0.319	0.402	0.387	0.002	0.401	0.002	0.328	0.248	0.289	0.894	0.435	0.001	0.347	0.188	0.450	0.001
786	0.378	0.011	0.331	0.408	0.387	0.004	0.366	0.006	0.327	0.387	0.289	0.894	0.461	0.001	0.354	0.084	0.450	0.002
787	0.371	0.004	0.356	0.045	0.387	0.003	0.347	0.080	0.358	0.036	0.289	0.891	0.417	0.005	0.362	0.090	0.450	0.002
788	0.352	0.036	0.313	0.497	0.387	0.003	0.313	0.268	0.358	0.101	0.289	0.896	0.422	0.002	0.278	0.769	0.450	0.001
789	0.373	0.022	0.318	0.572	0.387	0.003	0.388	0.006	0.352	0.153	0.289	0.897	0.418	0.006	0.361	0.075	0.450	0.001
790	0.325	0.070	0.327	0.282	0.387	0.003	0.318	0.280	0.359	0.070	0.289	0.893	0.391	0.019	0.385	0.046	0.450	0.001
791	0.409	0.001	0.317	0.696	0.387	0.007	0.358	0.053	0.371	0.038	0.289	0.898	0.459	0.001	0.352	0.123	0.450	0.002
792	0.353	0.025	0.310	0.499	0.387	0.004	0.416	0.002	0.370	0.023	0.289	0.884	0.439	0.006	0.381	0.026	0.450	0.001
793	0.364	0.046	0.315	0.542	0.387	0.001	0.324	0.336	0.369	0.075	0.289	0.894	0.439	0.002	0.362	0.061	0.450	0.001
794	0.350	0.019	0.308	0.584	0.387	0.004	0.347	0.060	0.335	0.144	0.289	0.875	0.376	0.009	0.385	0.040	0.450	0.003
795	0.370	0.010	0.287	0.930	0.387	0.002	0.303	0.474	0.358	0.084	0.289	0.906	0.463	0.001	0.329	0.244	0.450	0.001
796	0.376	0.007	0.342	0.242	0.387	0.003	0.342	0.088	0.356	0.058	0.289	0.901	0.433	0.004	0.361	0.076	0.450	0.001
797	0.333	0.066	0.324	0.500	0.387	0.003	0.330	0.182	0.339	0.214	0.289	0.900	0.432	0.003	0.258	0.727	0.450	0.003
798	0.388	0.003	0.327	0.331	0.387	0.006	0.341	0.183	0.343	0.174	0.289	0.885	0.408	0.008	0.412	0.015	0.450	0.002
799	0.361	0.013	0.315	0.598	0.387	0.002	0.385	0.003	0.344	0.143	0.289	0.898	0.356	0.061	0.352	0.109	0.450	0.001
800	0.384	0.006	0.309	0.585	0.387	0.004	0.342	0.121	0.342	0.220	0.289	0.895	0.449	0.001	0.404	0.009	0.450	0.001
801	0.371	0.007	0.357	0.094	0.387	0.004	0.321	0.328	0.296	0.586	0.289	0.893	0.390	0.016	0.352	0.148	0.450	0.002
802	0.356	0.044	0.338	0.221	0.387	0.005	0.363	0.031	0.379	0.006	0.289	0.893	0.440	0.001	0.401	0.013	0.450	0.001
803	0.372	0.007	0.319	0.373	0.387	0.001	0.368	0.013	0.332	0.215	0.289	0.895	0.341	0.081	0.393	0.029	0.450	0.002
804	0.395	0.004	0.354	0.082	0.387	0.003	0.328	0.378	0.374	0.013	0.289	0.878	0.446	0.001	0.291	0.753	0.450	0.001
805	0.376	0.002	0.317	0.447	0.387	0.005	0.391	0.006	0.367	0.029	0.289	0.882	0.394	0.004	0.381	0.041	0.450	0.002
806	0.381	0.015	0.286	0.962	0.387	0.002	0.318	0.325	0.338	0.199	0.289	0.885	0.438	0.002	0.402	0.013	0.450	0.004
807	0.362	0.019	0.315	0.547	0.387	0.002	0.374	0.008	0.347	0.106	0.289	0.895	0.368	0.074	0.371	0.060	0.450	0.002
808	0.338	0.133	0.340	0.211	0.387	0.007	0.390	0.003	0.341	0.234	0.289	0.881	0.372	0.021	0.289	0.702	0.450	0.001
809	0.351	0.097	0.341	0.246	0.387	0.001	0.356	0.085	0.320	0.300	0.289	0.884	0.429	0.002	0.406	0.010	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
810	0.347	0.046	0.342	0.161	0.387	0.002	0.371	0.021	0.316	0.434	0.289	0.885	0.389	0.026	0.386	0.032	0.450	0.001
811	0.387	0.001	0.303	0.776	0.387	0.004	0.352	0.081	0.367	0.036	0.289	0.879	0.417	0.002	0.370	0.063	0.450	0.001
812	0.382	0.005	0.301	0.856	0.387	0.008	0.311	0.530	0.344	0.208	0.289	0.900	0.441	0.001	0.379	0.039	0.450	0.001
813	0.388	0.001	0.336	0.237	0.387	0.005	0.364	0.019	0.300	0.647	0.289	0.887	0.420	0.007	0.345	0.167	0.450	0.001
814	0.378	0.003	0.332	0.097	0.387	0.004	0.333	0.219	0.371	0.068	0.289	0.899	0.382	0.017	0.406	0.006	0.450	0.001
815	0.349	0.037	0.345	0.136	0.387	0.002	0.380	0.004	0.355	0.138	0.289	0.892	0.403	0.011	0.380	0.041	0.450	0.002
816	0.366	0.011	0.306	0.501	0.387	0.002	0.337	0.104	0.347	0.192	0.289	0.896	0.401	0.014	0.409	0.009	0.450	0.001
817	0.352	0.022	0.329	0.354	0.387	0.002	0.321	0.258	0.337	0.212	0.289	0.888	0.440	0.001	0.365	0.054	0.450	0.002
818	0.362	0.058	0.324	0.494	0.387	0.002	0.331	0.154	0.334	0.259	0.289	0.901	0.436	0.002	0.376	0.037	0.450	0.002
819	0.404	0.001	0.336	0.270	0.387	0.002	0.336	0.202	0.344	0.192	0.289	0.887	0.426	0.001	0.321	0.331	0.450	0.001
820	0.365	0.013	0.343	0.182	0.387	0.001	0.335	0.139	0.323	0.276	0.289	0.896	0.462	0.001	0.387	0.021	0.450	0.004
821	0.369	0.011	0.381	0.017	0.387	0.008	0.336	0.235	0.375	0.017	0.289	0.909	0.445	0.001	0.337	0.178	0.450	0.001
822	0.346	0.152	0.317	0.546	0.387	0.006	0.339	0.126	0.301	0.558	0.289	0.893	0.444	0.003	0.343	0.222	0.450	0.001
823	0.318	0.366	0.323	0.293	0.387	0.002	0.331	0.299	0.399	0.002	0.289	0.898	0.456	0.001	0.356	0.076	0.450	0.004
824	0.406	0.002	0.334	0.245	0.387	0.002	0.348	0.041	0.288	0.762	0.289	0.908	0.390	0.027	0.388	0.035	0.450	0.001
825	0.383	0.010	0.337	0.344	0.387	0.003	0.370	0.010	0.321	0.374	0.289	0.898	0.419	0.004	0.360	0.108	0.450	0.001
826	0.363	0.018	0.306	0.725	0.387	0.004	0.403	0.002	0.379	0.016	0.289	0.876	0.390	0.015	0.364	0.085	0.450	0.001
827	0.394	0.001	0.333	0.161	0.387	0.005	0.320	0.226	0.326	0.434	0.289	0.899	0.413	0.006	0.290	0.696	0.450	0.002
828	0.379	0.002	0.317	0.522	0.387	0.002	0.318	0.121	0.326	0.300	0.289	0.884	0.422	0.006	0.338	0.300	0.450	0.001
829	0.372	0.018	0.339	0.298	0.387	0.003	0.373	0.012	0.345	0.156	0.289	0.894	0.391	0.009	0.382	0.042	0.450	0.001
830	0.348	0.015	0.320	0.417	0.387	0.006	0.321	0.158	0.323	0.379	0.289	0.889	0.442	0.002	0.370	0.039	0.450	0.002
831	0.375	0.002	0.362	0.055	0.387	0.004	0.373	0.014	0.325	0.360	0.289	0.894	0.428	0.004	0.389	0.033	0.450	0.001
832	0.327	0.129	0.353	0.114	0.387	0.004	0.345	0.261	0.367	0.077	0.289	0.881	0.435	0.002	0.378	0.036	0.450	0.001
833	0.357	0.052	0.313	0.583	0.387	0.003	0.341	0.272	0.347	0.159	0.289	0.894	0.379	0.032	0.357	0.081	0.450	0.001
834	0.355	0.016	0.338	0.209	0.387	0.002	0.348	0.105	0.370	0.027	0.289	0.906	0.389	0.025	0.394	0.022	0.450	0.001
835	0.346	0.035	0.310	0.730	0.387	0.003	0.372	0.018	0.385	0.006	0.289	0.879	0.370	0.033	0.372	0.047	0.450	0.003
836	0.376	0.007	0.326	0.251	0.387	0.005	0.364	0.026	0.374	0.021	0.289	0.910	0.429	0.006	0.392	0.022	0.450	0.003
837	0.328	0.145	0.290	0.803	0.387	0.003	0.332	0.228	0.348	0.095	0.289	0.901	0.386	0.015	0.350	0.159	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
838	0.354	0.052	0.325	0.385	0.387	0.005	0.345	0.117	0.368	0.047	0.289	0.896	0.420	0.004	0.381	0.029	0.450	0.002
839	0.388	0.001	0.335	0.302	0.387	0.001	0.309	0.481	0.391	0.009	0.289	0.903	0.330	0.148	0.343	0.174	0.450	0.001
840	0.401	0.002	0.326	0.501	0.387	0.005	0.353	0.022	0.338	0.214	0.289	0.903	0.383	0.020	0.344	0.135	0.450	0.002
841	0.342	0.090	0.352	0.117	0.387	0.002	0.405	0.002	0.357	0.084	0.289	0.887	0.405	0.009	0.366	0.065	0.450	0.001
842	0.385	0.013	0.352	0.081	0.387	0.007	0.354	0.063	0.352	0.100	0.289	0.857	0.353	0.089	0.417	0.008	0.450	0.002
843	0.354	0.037	0.353	0.103	0.387	0.005	0.319	0.347	0.350	0.089	0.289	0.891	0.429	0.005	0.346	0.127	0.450	0.001
844	0.346	0.020	0.310	0.677	0.387	0.005	0.345	0.099	0.340	0.182	0.289	0.887	0.460	0.003	0.346	0.115	0.450	0.002
845	0.331	0.207	0.303	0.820	0.387	0.002	0.341	0.183	0.358	0.109	0.289	0.892	0.397	0.006	0.377	0.041	0.450	0.001
846	0.360	0.030	0.336	0.208	0.387	0.003	0.369	0.008	0.376	0.014	0.289	0.898	0.498	0.001	0.402	0.006	0.450	0.001
847	0.399	0.001	0.295	0.375	0.387	0.001	0.368	0.019	0.384	0.026	0.289	0.906	0.439	0.001	0.382	0.048	0.450	0.002
848	0.384	0.002	0.354	0.092	0.387	0.003	0.357	0.091	0.359	0.063	0.289	0.895	0.386	0.044	0.405	0.007	0.450	0.001
849	0.390	0.001	0.347	0.222	0.387	0.005	0.368	0.040	0.344	0.176	0.289	0.894	0.391	0.013	0.362	0.117	0.450	0.002
850	0.364	0.007	0.345	0.198	0.387	0.006	0.366	0.012	0.347	0.192	0.289	0.879	0.414	0.012	0.393	0.024	0.450	0.001
851	0.386	0.002	0.319	0.502	0.387	0.003	0.312	0.459	0.304	0.701	0.289	0.892	0.389	0.019	0.386	0.027	0.450	0.001
852	0.422	0.001	0.340	0.302	0.387	0.004	0.387	0.016	0.349	0.105	0.289	0.895	0.382	0.016	0.327	0.286	0.450	0.003
853	0.350	0.077	0.384	0.009	0.387	0.003	0.385	0.002	0.340	0.179	0.289	0.877	0.403	0.006	0.344	0.189	0.450	0.001
854	0.359	0.025	0.323	0.499	0.387	0.001	0.353	0.048	0.380	0.024	0.289	0.901	0.433	0.002	0.363	0.080	0.450	0.002
855	0.357	0.031	0.338	0.260	0.387	0.004	0.368	0.021	0.353	0.078	0.289	0.907	0.395	0.005	0.302	0.584	0.450	0.001
856	0.351	0.067	0.319	0.546	0.387	0.004	0.343	0.030	0.324	0.330	0.289	0.884	0.440	0.002	0.367	0.069	0.450	0.001
857	0.402	0.002	0.326	0.517	0.387	0.004	0.332	0.151	0.372	0.028	0.289	0.921	0.425	0.008	0.401	0.015	0.450	0.001
858	0.385	0.005	0.335	0.166	0.387	0.002	0.355	0.021	0.407	0.001	0.289	0.870	0.417	0.002	0.368	0.088	0.450	0.001
859	0.330	0.057	0.321	0.521	0.387	0.002	0.336	0.140	0.372	0.018	0.289	0.886	0.429	0.001	0.426	0.006	0.450	0.002
860	0.384	0.004	0.345	0.211	0.387	0.002	0.315	0.343	0.354	0.100	0.289	0.921	0.462	0.001	0.343	0.180	0.450	0.001
861	0.353	0.039	0.365	0.036	0.387	0.004	0.322	0.292	0.351	0.119	0.289	0.907	0.382	0.016	0.342	0.218	0.450	0.001
862	0.322	0.478	0.314	0.667	0.387	0.003	0.362	0.017	0.328	0.381	0.289	0.894	0.436	0.001	0.390	0.030	0.450	0.001
863	0.375	0.010	0.347	0.192	0.387	0.003	0.381	0.012	0.352	0.125	0.289	0.908	0.357	0.091	0.386	0.029	0.450	0.002
864	0.357	0.065	0.295	0.832	0.387	0.005	0.333	0.093	0.301	0.776	0.289	0.908	0.478	0.001	0.320	0.384	0.450	0.001
865	0.388	0.005	0.335	0.181	0.387	0.001	0.335	0.142	0.338	0.189	0.289	0.902	0.462	0.001	0.312	0.414	0.450	0.002

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
866	0.373	0.009	0.326	0.349	0.387	0.003	0.350	0.051	0.358	0.080	0.289	0.893	0.413	0.004	0.383	0.044	0.450	0.003
867	0.361	0.036	0.314	0.490	0.387	0.002	0.341	0.067	0.358	0.093	0.289	0.904	0.435	0.003	0.361	0.106	0.450	0.001
868	0.396	0.002	0.347	0.203	0.387	0.003	0.384	0.003	0.345	0.165	0.289	0.885	0.405	0.007	0.385	0.020	0.450	0.002
869	0.365	0.013	0.337	0.280	0.387	0.003	0.351	0.114	0.329	0.256	0.289	0.883	0.462	0.001	0.374	0.040	0.450	0.001
870	0.369	0.009	0.348	0.126	0.387	0.003	0.375	0.007	0.319	0.582	0.289	0.885	0.385	0.019	0.338	0.159	0.450	0.001
871	0.360	0.014	0.333	0.241	0.387	0.003	0.366	0.037	0.326	0.499	0.289	0.903	0.420	0.005	0.407	0.008	0.450	0.001
872	0.360	0.015	0.356	0.081	0.387	0.001	0.327	0.325	0.324	0.351	0.289	0.867	0.416	0.003	0.298	0.575	0.450	0.001
873	0.344	0.022	0.339	0.165	0.387	0.003	0.359	0.036	0.346	0.156	0.289	0.899	0.436	0.001	0.385	0.038	0.450	0.001
874	0.338	0.132	0.308	0.635	0.387	0.003	0.390	0.002	0.382	0.015	0.289	0.900	0.403	0.011	0.380	0.040	0.450	0.003
875	0.313	0.406	0.324	0.538	0.387	0.007	0.342	0.181	0.350	0.165	0.289	0.895	0.410	0.008	0.299	0.582	0.450	0.001
876	0.350	0.095	0.304	0.721	0.387	0.006	0.389	0.011	0.312	0.650	0.289	0.913	0.438	0.001	0.346	0.187	0.450	0.002
877	0.354	0.049	0.344	0.150	0.387	0.001	0.309	0.543	0.330	0.321	0.289	0.893	0.410	0.006	0.321	0.310	0.450	0.001
878	0.394	0.002	0.344	0.116	0.387	0.007	0.325	0.282	0.325	0.328	0.289	0.877	0.352	0.061	0.358	0.086	0.450	0.001
879	0.330	0.330	0.331	0.336	0.387	0.005	0.379	0.006	0.315	0.386	0.289	0.887	0.456	0.001	0.385	0.044	0.450	0.002
880	0.347	0.119	0.327	0.347	0.387	0.004	0.312	0.414	0.320	0.449	0.289	0.890	0.399	0.005	0.373	0.060	0.450	0.001
881	0.366	0.006	0.351	0.137	0.387	0.003	0.364	0.030	0.353	0.096	0.289	0.904	0.456	0.002	0.360	0.078	0.450	0.002
882	0.362	0.045	0.341	0.107	0.387	0.002	0.399	0.001	0.329	0.155	0.289	0.882	0.452	0.001	0.346	0.183	0.450	0.002
883	0.362	0.035	0.315	0.656	0.387	0.003	0.345	0.130	0.313	0.567	0.289	0.887	0.473	0.001	0.353	0.108	0.450	0.001
884	0.314	0.501	0.353	0.156	0.387	0.002	0.343	0.081	0.394	0.001	0.289	0.895	0.441	0.001	0.338	0.172	0.450	0.001
885	0.324	0.251	0.322	0.418	0.387	0.005	0.336	0.018	0.371	0.023	0.289	0.883	0.463	0.002	0.376	0.043	0.450	0.001
886	0.392	0.002	0.311	0.683	0.387	0.008	0.366	0.031	0.357	0.093	0.289	0.905	0.386	0.002	0.354	0.142	0.450	0.001
887	0.407	0.001	0.308	0.706	0.387	0.003	0.321	0.457	0.328	0.409	0.289	0.909	0.412	0.002	0.361	0.107	0.450	0.002
888	0.398	0.001	0.301	0.752	0.387	0.001	0.343	0.114	0.315	0.374	0.289	0.897	0.381	0.021	0.365	0.087	0.450	0.001
889	0.387	0.004	0.326	0.368	0.387	0.003	0.396	0.002	0.341	0.213	0.289	0.895	0.427	0.002	0.408	0.010	0.450	0.004
890	0.313	0.097	0.330	0.404	0.387	0.004	0.315	0.402	0.330	0.344	0.289	0.899	0.405	0.004	0.343	0.210	0.450	0.001
891	0.362	0.014	0.321	0.610	0.387	0.004	0.398	0.001	0.340	0.199	0.289	0.895	0.429	0.001	0.362	0.081	0.450	0.002
892	0.370	0.018	0.341	0.191	0.387	0.003	0.375	0.009	0.343	0.280	0.289	0.900	0.441	0.003	0.354	0.127	0.450	0.001
893	0.378	0.003	0.335	0.292	0.387	0.004	0.373	0.013	0.309	0.624	0.289	0.886	0.459	0.001	0.310	0.343	0.450	0.001

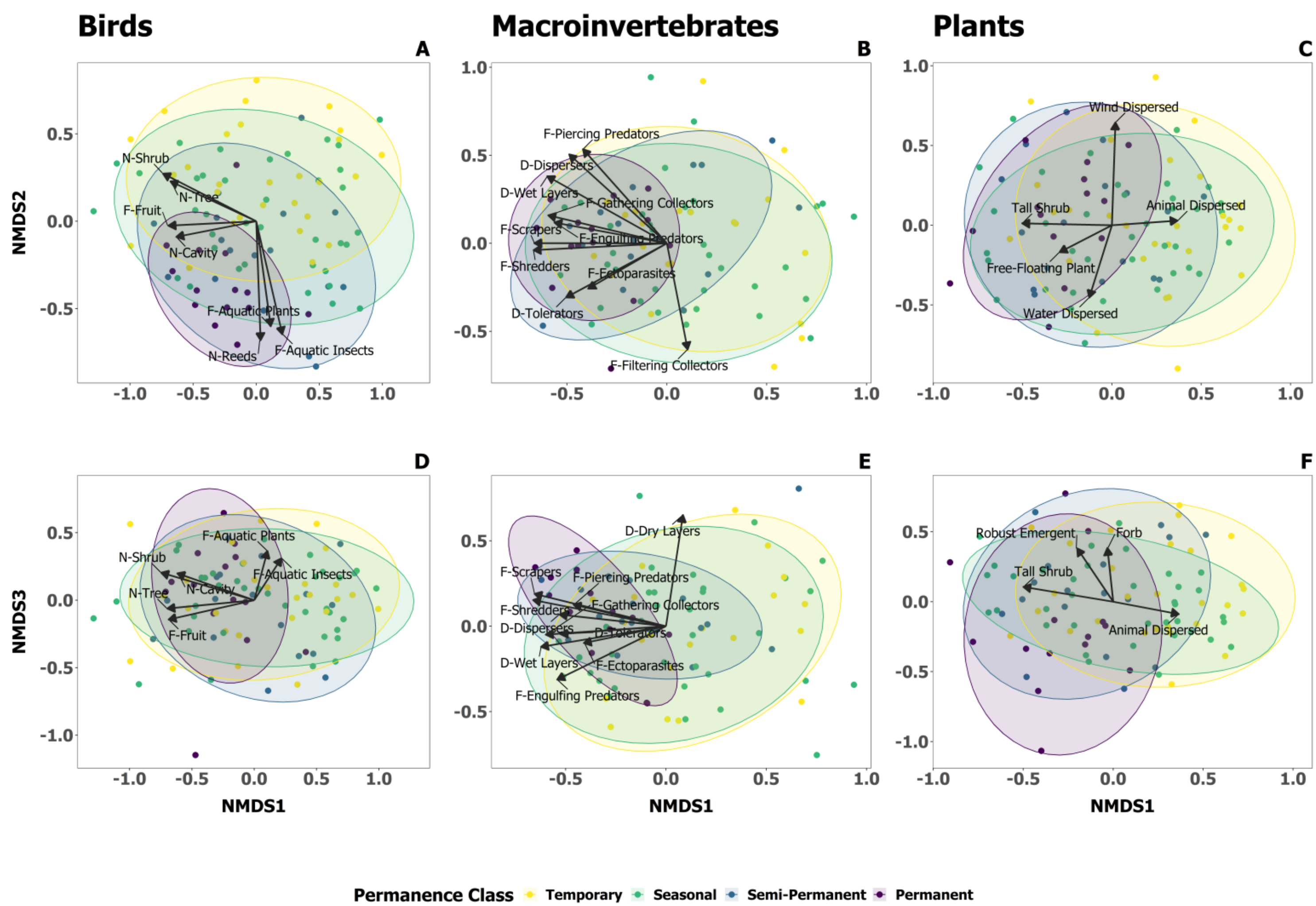
Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
894	0.389	0.001	0.347	0.132	0.387	0.001	0.362	0.038	0.354	0.099	0.289	0.864	0.446	0.002	0.372	0.053	0.450	0.001
895	0.358	0.041	0.299	0.808	0.387	0.002	0.365	0.022	0.363	0.092	0.289	0.892	0.471	0.001	0.322	0.344	0.450	0.001
896	0.369	0.010	0.327	0.292	0.387	0.001	0.332	0.173	0.332	0.341	0.289	0.890	0.390	0.007	0.368	0.078	0.450	0.001
897	0.409	0.001	0.318	0.536	0.387	0.008	0.386	0.003	0.328	0.344	0.289	0.882	0.397	0.005	0.315	0.395	0.450	0.001
898	0.329	0.344	0.323	0.376	0.387	0.001	0.320	0.522	0.329	0.245	0.289	0.910	0.453	0.001	0.379	0.025	0.450	0.001
899	0.360	0.040	0.354	0.050	0.387	0.001	0.321	0.154	0.368	0.038	0.289	0.909	0.361	0.062	0.375	0.068	0.450	0.001
900	0.421	0.001	0.339	0.288	0.387	0.002	0.395	0.004	0.367	0.055	0.289	0.902	0.498	0.001	0.367	0.071	0.450	0.001
901	0.336	0.097	0.375	0.009	0.387	0.003	0.367	0.027	0.315	0.483	0.289	0.890	0.438	0.002	0.290	0.662	0.450	0.001
902	0.371	0.010	0.317	0.517	0.387	0.005	0.331	0.249	0.341	0.292	0.289	0.890	0.362	0.092	0.322	0.387	0.450	0.003
903	0.370	0.019	0.338	0.216	0.387	0.003	0.302	0.608	0.326	0.478	0.289	0.883	0.424	0.003	0.407	0.022	0.450	0.002
904	0.366	0.022	0.319	0.447	0.387	0.005	0.371	0.015	0.351	0.102	0.289	0.912	0.418	0.004	0.395	0.017	0.450	0.001
905	0.331	0.085	0.341	0.227	0.387	0.004	0.331	0.165	0.334	0.211	0.289	0.894	0.471	0.001	0.379	0.052	0.450	0.002
906	0.353	0.041	0.338	0.127	0.387	0.002	0.340	0.123	0.358	0.074	0.289	0.903	0.405	0.011	0.367	0.087	0.450	0.002
907	0.381	0.008	0.328	0.243	0.387	0.004	0.376	0.005	0.344	0.216	0.289	0.890	0.362	0.059	0.365	0.096	0.450	0.001
908	0.375	0.011	0.348	0.110	0.387	0.005	0.374	0.006	0.346	0.089	0.289	0.909	0.339	0.047	0.365	0.081	0.450	0.001
909	0.364	0.036	0.335	0.260	0.387	0.001	0.351	0.008	0.320	0.397	0.289	0.892	0.421	0.005	0.379	0.053	0.450	0.002
910	0.335	0.121	0.322	0.316	0.387	0.003	0.356	0.056	0.327	0.272	0.289	0.881	0.384	0.024	0.344	0.167	0.450	0.001
911	0.393	0.001	0.359	0.074	0.387	0.006	0.352	0.057	0.358	0.116	0.289	0.875	0.398	0.015	0.385	0.040	0.450	0.001
912	0.359	0.039	0.319	0.397	0.387	0.004	0.377	0.016	0.339	0.196	0.289	0.896	0.414	0.005	0.375	0.049	0.450	0.001
913	0.338	0.124	0.340	0.221	0.387	0.005	0.349	0.037	0.359	0.110	0.289	0.884	0.428	0.005	0.384	0.038	0.450	0.002
914	0.375	0.008	0.319	0.504	0.387	0.004	0.387	0.006	0.330	0.414	0.289	0.895	0.446	0.001	0.402	0.016	0.450	0.002
915	0.327	0.178	0.355	0.079	0.387	0.004	0.382	0.003	0.324	0.113	0.289	0.899	0.420	0.004	0.392	0.020	0.450	0.001
916	0.341	0.075	0.341	0.170	0.387	0.005	0.316	0.474	0.327	0.444	0.289	0.868	0.360	0.106	0.382	0.069	0.450	0.002
917	0.365	0.008	0.329	0.142	0.387	0.002	0.354	0.087	0.336	0.282	0.289	0.879	0.373	0.047	0.414	0.011	0.450	0.001
918	0.372	0.005	0.327	0.308	0.387	0.003	0.331	0.161	0.316	0.477	0.289	0.897	0.379	0.029	0.377	0.030	0.450	0.001
919	0.380	0.011	0.357	0.070	0.387	0.001	0.351	0.046	0.371	0.032	0.289	0.883	0.442	0.002	0.356	0.112	0.450	0.001
920	0.373	0.006	0.317	0.402	0.387	0.005	0.328	0.162	0.335	0.214	0.289	0.896	0.422	0.002	0.372	0.052	0.450	0.001
921	0.355	0.041	0.302	0.733	0.387	0.003	0.367	0.014	0.358	0.063	0.289	0.897	0.338	0.214	0.383	0.044	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
922	0.400	0.001	0.335	0.279	0.387	0.003	0.395	0.004	0.381	0.012	0.289	0.896	0.346	0.119	0.365	0.087	0.450	0.001
923	0.356	0.037	0.327	0.439	0.387	0.004	0.336	0.054	0.317	0.449	0.289	0.904	0.436	0.001	0.391	0.017	0.450	0.001
924	0.396	0.002	0.311	0.589	0.387	0.004	0.308	0.611	0.333	0.301	0.289	0.895	0.420	0.003	0.358	0.114	0.450	0.001
925	0.379	0.011	0.313	0.528	0.387	0.003	0.320	0.417	0.335	0.252	0.289	0.899	0.442	0.001	0.412	0.007	0.450	0.001
926	0.318	0.433	0.320	0.367	0.387	0.003	0.358	0.043	0.311	0.616	0.289	0.895	0.389	0.013	0.333	0.295	0.450	0.001
927	0.337	0.137	0.342	0.180	0.387	0.004	0.365	0.033	0.327	0.316	0.289	0.893	0.370	0.056	0.404	0.008	0.450	0.001
928	0.371	0.028	0.324	0.264	0.387	0.005	0.305	0.645	0.315	0.598	0.289	0.886	0.443	0.002	0.354	0.085	0.450	0.001
929	0.346	0.046	0.337	0.144	0.387	0.009	0.366	0.011	0.357	0.071	0.289	0.896	0.430	0.003	0.373	0.083	0.450	0.002
930	0.352	0.063	0.332	0.341	0.387	0.005	0.354	0.077	0.368	0.047	0.289	0.905	0.408	0.011	0.304	0.431	0.450	0.003
931	0.374	0.001	0.307	0.728	0.387	0.003	0.307	0.650	0.368	0.032	0.289	0.912	0.461	0.001	0.323	0.340	0.450	0.002
932	0.351	0.074	0.361	0.030	0.387	0.004	0.331	0.054	0.395	0.008	0.289	0.888	0.376	0.034	0.347	0.173	0.450	0.001
933	0.345	0.069	0.355	0.113	0.387	0.001	0.352	0.078	0.313	0.256	0.289	0.894	0.454	0.001	0.363	0.068	0.450	0.002
934	0.373	0.003	0.340	0.168	0.387	0.002	0.304	0.062	0.328	0.437	0.289	0.894	0.429	0.002	0.353	0.126	0.450	0.001
935	0.359	0.058	0.297	0.850	0.387	0.003	0.321	0.393	0.362	0.101	0.289	0.911	0.422	0.006	0.357	0.145	0.450	0.001
936	0.372	0.008	0.340	0.220	0.387	0.002	0.334	0.135	0.340	0.116	0.289	0.889	0.457	0.002	0.388	0.038	0.450	0.002
937	0.364	0.015	0.316	0.668	0.387	0.004	0.322	0.591	0.327	0.338	0.289	0.900	0.387	0.018	0.353	0.098	0.450	0.001
938	0.348	0.106	0.359	0.067	0.387	0.006	0.332	0.037	0.352	0.081	0.289	0.899	0.388	0.006	0.375	0.055	0.450	0.002
939	0.355	0.048	0.308	0.630	0.387	0.002	0.349	0.129	0.380	0.024	0.289	0.885	0.462	0.001	0.405	0.012	0.450	0.001
940	0.352	0.061	0.315	0.308	0.387	0.002	0.364	0.020	0.304	0.578	0.289	0.896	0.377	0.041	0.336	0.238	0.450	0.002
941	0.375	0.001	0.319	0.493	0.387	0.002	0.353	0.082	0.317	0.462	0.289	0.897	0.437	0.002	0.289	0.636	0.450	0.001
942	0.364	0.052	0.349	0.155	0.387	0.004	0.341	0.069	0.335	0.306	0.289	0.897	0.398	0.013	0.320	0.359	0.450	0.003
943	0.402	0.002	0.313	0.500	0.387	0.003	0.339	0.090	0.295	0.790	0.289	0.893	0.417	0.006	0.354	0.105	0.450	0.002
944	0.384	0.007	0.325	0.402	0.387	0.006	0.368	0.025	0.365	0.049	0.289	0.878	0.433	0.002	0.353	0.106	0.450	0.003
945	0.356	0.018	0.348	0.190	0.387	0.003	0.361	0.044	0.356	0.108	0.289	0.894	0.418	0.006	0.385	0.041	0.450	0.001
946	0.366	0.018	0.327	0.377	0.387	0.006	0.315	0.271	0.358	0.109	0.289	0.902	0.403	0.016	0.378	0.046	0.450	0.001
947	0.412	0.001	0.326	0.297	0.387	0.004	0.368	0.026	0.348	0.038	0.289	0.892	0.468	0.001	0.372	0.053	0.450	0.001
948	0.353	0.070	0.362	0.046	0.387	0.005	0.361	0.025	0.351	0.128	0.289	0.883	0.458	0.001	0.352	0.170	0.450	0.001
949	0.345	0.127	0.321	0.486	0.387	0.002	0.310	0.613	0.315	0.623	0.289	0.907	0.382	0.039	0.351	0.142	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
950	0.386	0.005	0.333	0.293	0.387	0.002	0.321	0.414	0.324	0.429	0.289	0.886	0.369	0.066	0.347	0.176	0.450	0.003
951	0.375	0.010	0.312	0.371	0.387	0.004	0.331	0.291	0.352	0.123	0.289	0.899	0.443	0.001	0.246	0.943	0.450	0.001
952	0.406	0.001	0.322	0.290	0.387	0.004	0.355	0.070	0.353	0.053	0.289	0.894	0.414	0.006	0.398	0.015	0.450	0.001
953	0.333	0.117	0.331	0.283	0.387	0.003	0.368	0.012	0.335	0.272	0.289	0.884	0.401	0.005	0.320	0.441	0.450	0.002
954	0.386	0.008	0.317	0.650	0.387	0.003	0.342	0.150	0.379	0.024	0.289	0.892	0.407	0.007	0.361	0.073	0.450	0.001
955	0.389	0.005	0.303	0.808	0.387	0.002	0.412	0.002	0.374	0.037	0.289	0.910	0.428	0.002	0.382	0.022	0.450	0.002
956	0.435	0.001	0.327	0.391	0.387	0.003	0.362	0.034	0.347	0.117	0.289	0.886	0.450	0.001	0.318	0.262	0.450	0.002
957	0.347	0.136	0.295	0.888	0.387	0.003	0.332	0.303	0.315	0.386	0.289	0.902	0.413	0.007	0.346	0.186	0.450	0.002
958	0.364	0.019	0.363	0.042	0.387	0.002	0.358	0.056	0.372	0.028	0.289	0.913	0.458	0.001	0.332	0.293	0.450	0.001
959	0.394	0.001	0.347	0.083	0.387	0.003	0.312	0.274	0.312	0.564	0.289	0.902	0.431	0.001	0.386	0.027	0.450	0.001
960	0.342	0.119	0.354	0.090	0.387	0.004	0.364	0.016	0.312	0.343	0.289	0.891	0.435	0.001	0.391	0.040	0.450	0.002
961	0.410	0.001	0.356	0.096	0.387	0.003	0.332	0.189	0.380	0.021	0.289	0.897	0.405	0.009	0.335	0.261	0.450	0.001
962	0.384	0.002	0.345	0.198	0.387	0.003	0.328	0.245	0.349	0.119	0.289	0.905	0.407	0.013	0.303	0.528	0.450	0.001
963	0.355	0.031	0.307	0.539	0.387	0.008	0.382	0.015	0.351	0.202	0.289	0.913	0.410	0.006	0.362	0.100	0.450	0.002
964	0.347	0.057	0.320	0.268	0.387	0.006	0.339	0.072	0.329	0.349	0.289	0.896	0.415	0.006	0.391	0.016	0.450	0.001
965	0.361	0.050	0.360	0.060	0.387	0.004	0.347	0.044	0.300	0.530	0.289	0.898	0.459	0.001	0.372	0.046	0.450	0.001
966	0.343	0.039	0.300	0.811	0.387	0.004	0.318	0.409	0.316	0.486	0.289	0.879	0.399	0.010	0.299	0.527	0.450	0.002
967	0.350	0.107	0.328	0.455	0.387	0.007	0.435	0.001	0.361	0.089	0.289	0.902	0.351	0.101	0.343	0.173	0.450	0.002
968	0.378	0.012	0.350	0.110	0.387	0.002	0.383	0.007	0.333	0.229	0.289	0.887	0.402	0.006	0.375	0.020	0.450	0.001
969	0.369	0.006	0.346	0.126	0.387	0.006	0.302	0.292	0.373	0.030	0.289	0.884	0.416	0.003	0.341	0.230	0.450	0.001
970	0.391	0.001	0.298	0.635	0.387	0.001	0.328	0.101	0.355	0.077	0.289	0.877	0.419	0.005	0.366	0.060	0.450	0.002
971	0.345	0.019	0.325	0.293	0.387	0.002	0.367	0.038	0.301	0.846	0.289	0.887	0.399	0.014	0.363	0.096	0.450	0.001
972	0.407	0.001	0.332	0.167	0.387	0.004	0.368	0.027	0.343	0.149	0.289	0.883	0.425	0.003	0.450	0.001	0.450	0.002
973	0.331	0.279	0.294	0.860	0.387	0.006	0.376	0.003	0.354	0.114	0.289	0.887	0.421	0.003	0.364	0.063	0.450	0.001
974	0.320	0.278	0.327	0.423	0.387	0.003	0.341	0.117	0.346	0.225	0.289	0.877	0.451	0.001	0.363	0.083	0.450	0.001
975	0.378	0.008	0.353	0.062	0.387	0.003	0.322	0.412	0.343	0.170	0.289	0.894	0.428	0.005	0.381	0.039	0.450	0.002
976	0.404	0.001	0.332	0.261	0.387	0.007	0.360	0.023	0.361	0.056	0.289	0.897	0.415	0.009	0.349	0.121	0.450	0.001
977	0.348	0.031	0.323	0.626	0.387	0.003	0.359	0.064	0.347	0.199	0.289	0.891	0.407	0.004	0.329	0.245	0.450	0.001

Iteration	Birds & Plants						Birds & Aquatic Macroinvertebrates						Plants & Aquatic Macroinvertebrates					
	Overall		Temporary		Permanent		Overall		Temporary		Permanent		Overall		Temporary		Permanent	
	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value	r	*p*-value
978	0.377	0.001	0.299	0.814	0.387	0.003	0.330	0.217	0.353	0.073	0.289	0.909	0.415	0.007	0.330	0.263	0.450	0.001
979	0.356	0.023	0.310	0.652	0.387	0.003	0.335	0.145	0.362	0.089	0.289	0.895	0.416	0.001	0.374	0.059	0.450	0.001
980	0.376	0.010	0.339	0.207	0.387	0.002	0.327	0.208	0.325	0.295	0.289	0.897	0.400	0.002	0.367	0.047	0.450	0.001
981	0.339	0.153	0.324	0.524	0.387	0.003	0.336	0.168	0.322	0.549	0.289	0.885	0.412	0.003	0.346	0.121	0.450	0.003
982	0.335	0.216	0.329	0.384	0.387	0.006	0.320	0.530	0.357	0.062	0.289	0.881	0.369	0.035	0.357	0.144	0.450	0.002
983	0.351	0.049	0.338	0.257	0.387	0.002	0.351	0.063	0.354	0.061	0.289	0.901	0.372	0.039	0.357	0.122	0.450	0.003
984	0.383	0.002	0.328	0.358	0.387	0.003	0.327	0.130	0.328	0.213	0.289	0.880	0.373	0.066	0.328	0.328	0.450	0.003
985	0.347	0.083	0.303	0.744	0.387	0.003	0.351	0.069	0.347	0.194	0.289	0.893	0.434	0.002	0.388	0.030	0.450	0.001
986	0.364	0.013	0.301	0.459	0.387	0.005	0.340	0.232	0.359	0.075	0.289	0.902	0.444	0.001	0.408	0.010	0.450	0.001
987	0.319	0.182	0.334	0.198	0.387	0.002	0.355	0.008	0.363	0.050	0.289	0.904	0.381	0.015	0.369	0.061	0.450	0.003
988	0.335	0.218	0.342	0.154	0.387	0.003	0.324	0.254	0.340	0.140	0.289	0.871	0.417	0.001	0.355	0.106	0.450	0.001
989	0.365	0.030	0.334	0.217	0.387	0.008	0.352	0.055	0.350	0.088	0.289	0.887	0.423	0.002	0.355	0.091	0.450	0.001
990	0.361	0.024	0.308	0.401	0.387	0.003	0.375	0.025	0.353	0.166	0.289	0.898	0.391	0.018	0.367	0.076	0.450	0.001
991	0.385	0.007	0.312	0.364	0.387	0.003	0.359	0.040	0.363	0.075	0.289	0.889	0.406	0.008	0.357	0.129	0.450	0.001
992	0.387	0.001	0.337	0.157	0.387	0.002	0.378	0.009	0.339	0.127	0.289	0.892	0.396	0.016	0.375	0.062	0.450	0.003
993	0.373	0.014	0.328	0.508	0.387	0.002	0.335	0.051	0.338	0.276	0.289	0.904	0.440	0.001	0.367	0.090	0.450	0.001
994	0.374	0.003	0.350	0.195	0.387	0.006	0.397	0.002	0.363	0.029	0.289	0.891	0.421	0.001	0.389	0.012	0.450	0.001
995	0.377	0.011	0.358	0.054	0.387	0.006	0.329	0.302	0.338	0.297	0.289	0.889	0.496	0.001	0.400	0.005	0.450	0.001
996	0.347	0.078	0.349	0.140	0.387	0.004	0.377	0.016	0.366	0.030	0.289	0.903	0.421	0.005	0.349	0.111	0.450	0.001
997	0.355	0.049	0.324	0.347	0.387	0.003	0.364	0.027	0.342	0.115	0.289	0.895	0.465	0.001	0.355	0.113	0.450	0.001
998	0.360	0.036	0.323	0.514	0.387	0.007	0.337	0.113	0.344	0.148	0.289	0.901	0.361	0.075	0.322	0.286	0.450	0.002
999	0.343	0.135	0.364	0.057	0.387	0.004	0.360	0.012	0.334	0.340	0.289	0.895	0.394	0.008	0.366	0.065	0.450	0.002
1000	0.348	0.115	0.309	0.717	0.387	0.003	0.349	0.085	0.363	0.038	0.289	0.882	0.406	0.012	0.391	0.015	0.450	0.001
Mean	0.366	0.051	0.328	0.369	0.387	0.003	0.348	0.137	0.344	0.218	0.289	0.893	0.415	0.017	0.360	0.149	0.450	0.002
Standard Error	7.5E x10^4	2.8E x10^3	5.8E x10^4	7.1E x10^3	1.2E x10^7	5.2E x10^5	8.0E x10^4	5.1E x10^3	6.9E x10^4	6.0E x10^3	2.1E x10^6	3.1E x10^4	1.1E x10^3	1.1E x10^3	1.0E x10^3	5.4E x10^3	1.2E x10^7	2.3E x10^5

Appendix 5. Three-dimensional nonmetric multidimensional scaling (NMDS) analysis of birds, macroinvertebrates and plants at our 96 study wetlands, with sites grouped by permanence class.



Before implementing the NMDS, I square-root transformed our bird and macroinvertebrate data. For plants, I used an arcsine square-root transformation. Following, I relativized the transformed community relative abundances by their respective column maximums. Next, to implement the NMDS, we used the "metaMDS" function under the vegan package (Oksanen et al. 2017) [3]in R. I used Bray-Curtis dissimilarity and allowed the algorithm a maximum of 100 tries to find two convergent solution. Before implementing the final NMDS, we ran the function 100 times, increasing the number of axes from one to ten. Thereafter, we used a screeplot to determine the optimal number of axes, which was specified in the final NMDS. For all taxa, stress was moderate (birds – 17.03, macroinvertebrates – 17.16, plants – 19.16), and the NMDSs stabilized in fewer than 50 iterations (birds – 47, macroinvertebrates – 20, plants – 41). I included vectors on the total abundance of species/families by functional traits (see Appendix 6, for a full list of functional traits) with correlations that were greater than 0.1 for one or both axes. Vectors shown indicate feeding behaviours/primary diet (F), nesting habitat (N), desiccation strategy (D), plant wetland indicator status and plant seed dispersal mechanism. The ellipses are 90 % confidence intervals for sites by permanence class. The hydroperiod gradient is shown on NMDS 1 for aquatic macroinvertebrates and plants and NMDS 2 for birds.

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[3] Oksanen J, Blanchet FG, Kindt R, et al (2017) vegan: Community Ecology Package. R Packag. version 2.4-2 1.

Appendix 6. Trait descriptions used in estimating total abundance of species/families by functional traits.

Appendix 6A. List of bird functional traits; traits values are reported in Anderson (2017).

Group Class	Group Code	Meaning
Diet Classification	Carniv	Carnivore
Diet Classification	Herbiv	Herbivore
Diet Classification	Omniv	Omnivore
Migration Habitat	Res	Resident
Migration Habitat	TrpclMgr	Tropical Migrant
Primary Diet	AqInsect	Aquatic Insects
Primary Diet	AqPlnts	Aquatic Plants
Primary Diet	Carrion	Carrion
Primary Diet	Fish	Fish
Primary Diet	Fruit	Fruit
Primary Diet	Grains	Grains
Primary Diet	Insects	Insects
Primary Diet	Nuts	Nuts
Primary Diet	Plants	Plants
Primary Diet	Seeds	Seeds
Primary Diet	SmAnml	Small Animals
Primary Feeding Habit	ArlFrgr	Aerial Forager
Primary Feeding Habit	ArlPrst	Aerial Pursuit
Primary Feeding Habit	BrkGln	Bark Gleaner
Primary Feeding Habit	Dbblr	Dabbler
Primary Feeding Habit	FlgGln	Foliage Gleaner
Primary Feeding Habit	GrndFrg	Ground Forager
Primary Feeding Habit	GrndGln	Ground Gleaner
Primary Feeding Habit	HPatrol	Hawk and Patrol
Primary Feeding Habit	HvrGln	Hovers and Gleaners
Primary Feeding Habit	Insect	Insectivore
Primary Feeding Habit	Prbs	Probbing
Primary Feeding Habit	SrfcDvr	Surface Diver
Primary Feeding Habit	Stlkng	Stalking
Primary Habitat	Field	Field
Primary Habitat	Forest	Forest
Primary Habitat	Grsslnd	Grassland
Primary Habitat	LkPd	Lake or Pond
Primary Habitat	Marsh	Marsh
Primary Habitat	OpnWood	Open Woodland
Primary Habitat	RvrStrm	River or Stream
Primary Habitat	Scrub	Scrub
Primary Habitat	Shrln	Shoreline

Group Class	Group Code	Meaning
Primary Nesting Location	Bank	Bank
Primary Nesting Location	Cavity	Cavity
Primary Nesting Location	Fltng	Floating
Primary Nesting Location	Grnd	Ground
Primary Nesting Location	Reeds	Reeds
Primary Nesting Location	Shrb	Shrub
Primary Nesting Location	Strctr	Structure
Primary Nesting Location	Tree	Tree
Wetland Status	Facul	Facultative
Wetland Status	FaculDry	Facultative Dry
Wetland Status	FaculWet	Facultative Wet

Appendix 6B. List of aquatic macroinvertebrates functional traits; traits values are reported in Gleason (2017).

Group Class	Group Code	Meaning
Feeding Groups	ENGULF	Engulfing Predators
Feeding Groups	FCOLL	Filtering Collectors
Feeding Groups	GCOLL	Gathering Collectors
Feeding Groups	SCRAPE	Scrapers
Feeding Groups	SHRED	Shreddders
Feeding Groups	PARA	Ecotoparasites
Feeding Groups	PIERCE	Piercing Predators
Behavioural Guilds	BUR	Burrowers
Behavioural Guilds	CLIMB	Climber
Behavioural Guilds	CLING	Clinger
Behavioural Guilds	DIVER	Diver
Behavioural Guilds	SKATE	Skater
Behavioural Guilds	SPRAWLER	Sprawler
Behavioural Guilds	SWIM	Swimmer
Desiccation Strategy Groups	TOLE	Tolerators
Desiccation Strategy Groups	WETL	Wet Layers
Desiccation Strategy Groups	DRYL	Dry Layers
Desiccation Strategy Groups	DISP	Dispersers

Appendix 6C. List of plant functional traits; traits values are reported in Bolding (2018).

Group Class	Group Code	Meaning
Wetland Plant Indicator Status	Forb	Forb
Wetland Plant Indicator Status	Graminoid	Graminoid
Wetland Plant Indicator Status	Vine	Vine
Wetland Plant Indicator Status	Hardwood	Hardwood
Wetland Plant Indicator Status	Tall_Shrub	Tall Shrub
Wetland Plant Indicator Status	Low_Shrub	Low Shrub
Wetland Plant Indicator Status	BroadLeaf_Emergent	BroadLeaf Emergent
Wetland Plant Indicator Status	Floating_Plant	Floating Plant
Wetland Plant Indicator Status	FreeFloating_Plant	FreeFloating Plant
Wetland Plant Indicator Status	NarrowLeaf_Emergent	NarrowLeaf Emergent
Wetland Plant Indicator Status	Robust_Emergent	Robust Emergent
Wetland Plant Indicator Status	Submersed_Plant	Submersed Plant
Vegetative Reproduction	Vegetative_Reproduction	Vegetative Reproduction
Nitrogen Fixing	Nitrogen_Fixer	Nitrogen Fixer
Litter Decomposal	Recalcitrant_Litter	Recalcitrant Litter
Native Status	Native_Graminoid	Native Graminoid
Native Status	Exotic_Graminoid	Exotic Graminoid
Native Status	Native_Perennials	Native Perennials
Native Status	Exotic_Perennials	Exotic Perennials
Native Status	Native_Annuals_Biennials	Native Annuals Biennials
Native Status	Exotic_Annuals_Biennials	Exotic Annuals and Biennials
Dispersal Mechanism	Anemochory	Anemochory
Dispersal Mechanism	Hydrochory	Hydrochory
Dispersal Mechanism	Zoochory	Zoochory
Dispersal Mechanism	Multiple_Dispersal	Multiple Dispersal