AVIAN CONSERVATION & ECOLOGY

VOLUME 16, ISSUE 2, ARTICLE 5

Hawkes, V. C., N. Hentze and T. G. Gerwing. 2021. Trends in avian use of reclaimed boreal forest habitat in Canada's oil sands. *Avian Conservation and Ecology* 16(2):5. https://doi.org/10.5751/ACE-01915-160205

Research Paper

Trends in avian use of reclaimed boreal forest habitat in Canada's oil sands

Virgil C. Hawkes [1], *Nathan Hentze* [1] and *Travis G. Gerwing* [2]
[1]LGL Limited environmental research associates, [2]Department of Biology, University of Victoria

ABSTRACT. Located in the northeastern portion of the Canadian province of Alberta, the Athabasca Oil Sands Region (AOSR) supports large-scale bitumen mining operations. Such development has considerable impacts upon the landscape; however, upland habitat reclamation is underway, providing an opportunity to assess wildlife usage patterns associated with reclaimed habitats relatively early in the reclamation process. Using passerines and woodpeckers as an indicator of wildlife usage of landforms reclaimed to an upland forest type consistent with the surrounding and naturally occurring upland boreal forest, across six oil sands leases in the mineable portion of the oil sands region, we observed that reclaimed areas increased in community similarity to reference mature boreal forest plots over 35 years. Community similarity 35 years post-disturbance between reference and reclaimed sites varied from 20-65%, with an overall average of ~43%. Such low and variable similarity values were expected, as 35 years is early in the recovery process from the perspective of forest succession. Younger plots disturbed by activities other than mining, such as fire and logging (9 to 10 years post-disturbance), were associated with bird communities that were more similar to older reclaimed plots (those >30 years post-reclamation) suggesting that areas not disturbed by mining are progressing along different recovery trajectories than areas disturbed by mining. Given the time it takes for vegetation communities in the boreal to mature, continued research is required to assess the longer-term functionality of reclaimed habitats, the end point of succession in all disturbed habitat types, as well as to determine what level of community similarity between reference and reclaimed plots is satisfactory from an ecological and regulatory perspective. Despite the observed differences between reclaimed habitats and mature forests, reclamation efforts in the mineable portion of the AOSR appear to be contributing to the development of upland boreal forest habitats that resemble those of the surrounding and naturally occurring boreal forest.

Utilisation par les oiseaux de milieux de forêt boréale remis en état dans la région des sables bitumineux du Canada

RÉSUMÉ. Située dans la partie nord-est de la province canadienne de l'Alberta, la région des sables bitumineux de l'Athabasca (RSBA) est le théâtre d'opérations d'exploitation du bitume à grande échelle. Ce type d'exploitation a des répercussions considérables sur le paysage; toutefois, la remise en état d'habitats situés en terrain sec est en cours, ce qui permet d'évaluer les habitudes d'utilisation de la faune associées aux milieux remis en état relativement tôt dans le processus de restauration. Nous avons utilisé les passereaux et les pics comme indicateurs de l'utilisation par la faune de milieux restaurés en un type de forêt poussant en terrain sec ressemblant à la forêt boréale naturelle environnante, dans six concessions de sables bitumineux de la partie exploitable de la RSBA. La similarité entre les communautés des zones restaurées et celles des parcelles de forêt boréale mature de référence a augmenté sur la période de 35 ans. Cette similarité de communautés 35 ans après la perturbation a varié de 20 à 65 %, la moyenne se situant à ~43 %. Des valeurs de similarité aussi faibles et variables étaient prévisibles étant donné que la période de 35 ans correspond au début du processus de rétablissement du point de vue de la succession forestière. Les parcelles plus jeunes et ayant été perturbées par des activités autres que l'exploitation minière, telles que les incendies et l'exploitation forestière (9 à 10 ans après la perturbation), étaient associées à des communautés d'oiseaux davantage similaires à celles de parcelles restaurées plus anciennes (> 30 ans après la restauration), ce qui laisse entrevoir que le rétablissement des zones non perturbées par l'exploitation minière suit une trajectoire différente de celui des zones perturbées par l'exploitation minière. Considérant que les communautés végétales de la région boréale prennent du temps pour arriver à maturité, il est nécessaire de poursuivre les recherches afin d'évaluer la fonctionnalité à long terme des milieux remis en état, d'établir quel est le stade final de la succession dans tous les types d'habitats perturbés, et de déterminer quel niveau de similitude des communautés entre les parcelles de référence et les parcelles remises en état est satisfaisant d'un point de vue écologique et réglementaire. Malgré les différences observées entre les milieux remis en état et les forêts matures, les efforts de remise en état dans la partie exploitable de la RSBA semblent contribuer au rétablissement d'habitats de forêt boréale poussant en terrain sec qui ressemblent à ceux de la forêt boréale naturelle environnante.

Key Words: *Athabasca Oil Sands, Upland boreal forest, Songbirds, Woodpeckers Reclamation, Restoration Ecology*

Address of Correspondent: Virgil C Hawkes, LGL Limited environmental research associates, 9768 Second Street, Sidney, BC , Canada, V8L 3Y8, vhawkes@lgl.com

INTRODUCTION

The boreal forest of Canada is recognized both for its significance as breeding habitat for birds (Blancher and Wells 2005, Wells and Blancher 2011) as well as its economic importance (Bogdanski 2008, Brandt et al. 2013). A large area in northeastern Alberta, the Athabasca Oil Sands Region (AOSR) is associated with bitumen extraction via open pit mining. Approximately 142,000 km² of boreal forest comprise the Alberta oil sands deposits, of which 93,000 km² occur in the AOSR, and ~4,800 km² are potentially accessible to surface mining techniques for bitumen (Gosselin et al. 2010, Audet et al. 2014). The total land area (including forests and wetlands) in the Lower Athabasca region impacted by open pit bitumen extraction increased from 290 km² in 1980 to 1,039 km² in 2018 (COSIA 2020), all of which must be reclaimed post development (EPEA 2009, Audet et al. 2014, Chen et al. 2018, Hawkes and Gerwing 2019). Natural resource extraction (i.e., forestry, oil and gas development, sand, and gravel) has been linked to shifts in community composition and declines of some songbird species in the western boreal forest (van Wilgenburg et al. 2013, Mahon et al. 2016, van Wilgenburg et al. 2018, Mahon et al. 2019). The effectiveness of upland reclamation practices to mitigate these impacts and provide habitat for wildlife, including birds, in a current and post-mining landscape is the focus of ongoing research (Hawkes and Gerwing 2019).

At current planned production rates, the life of a mine for most open pit oil sands operations exceeds 50 years from present. Concurrent with active mining operations, oil sands operators are undertaking progressive reclamation of all disturbed habitats (e.g., upland and lowland forests; wetlands including bogs, fens, treed wetlands, and marshes; shrublands; open grasslands), with most reclamation to date comprised of the creation of upland forest types consistent with the surrounding boreal forest of the region. To determine whether wildlife is returning to and using these reclaimed upland habitats, long-term monitoring of those habitats, as well as suitable analogues, using appropriate study designs at spatial and temporal scales is needed (Hawkes and Gerwing 2019). Long-term monitoring provides data regarding how reclaimed ecosystems develop over time and contributes to an increased understanding of how reclaimed ecosystems function (Audet et al. 2014, Pinno and Hawkes 2015, Hawkes and Gerwing 2019). A large portion of the area disturbed by open pit oil sands operations will be reclaimed over the next 25 years (Gosselin et al. 2010, Rooney et al. 2012, Hawkes and Gerwing 2019), with the majority (~68%) of reclamation occurring after 2035 (Pickard et al. 2013). These time horizons provide unique opportunities to study the return to and use of reclaimed upland habitats by wildlife, including passerines and woodpeckers, particularly with respect to the productivity and function of reclaimed upland habitats. Moreover, land reclamation involving the construction of landforms through the placement of soils followed by revegetation using native plants at the spatiotemporal scale mandated in the AOSR is relatively novel, with no such efforts known from anywhere in the world (Hawkes and Gerwing 2019). Our study evaluates the efficacy of reclaiming landforms to upland forest type to provide habitat for songbirds to better understand developmental trajectories of reclaimed upland habitat.

Bird species richness is highest during the breeding season, when resident species, such as owls, woodpeckers, and corvids are joined by short-, medium- and long-distance migrants, such as breeding waterfowl, waders, falcons, warblers, and flycatchers (Wells and Blancher 2011). Several species in the AOSR are listed as being of conservation concern provincially, federally (e.g., Canada Warbler [*Cardellina canadensis*], Olive-sided Flycatcher [*Contopus cooperi*]), and/or globally (e.g., Rusty Blackbird [*Euphagus carolinus*]). Birds have been used in a variety of studies in the area, ranging from baseline Environmental Assessments to evaluations of the efficacy of reclaimed areas to provide habitat for wildlife (e.g., Hawkes and Gerwing 2019), and assessing habitat-disturbance effects on avian abundance and productivity (Foster et al. 2016, Wilson and Bayne 2019). As such, birds are model organisms for monitoring studies and can be strong indicators of environmental condition (Bibby et al. 2000, Gregory and van Strien 2010, Renwick et al. 2012, Gould and Mackey 2015, Foster et al. 2016, Wilson and Bayne 2019).

Songbird monitoring can (1) be used to measure the effectiveness of restoration and enhancement; (2) provide useful feedback for adaptive management; (3) guide restoration design by providing information on the health and habitat associations of the local bird populations; (4) be cost-effective; and (5) provide education and outreach opportunities (Burnett et al. 2005). Because birds occupy an extremely diverse range of niches within an ecosystem and a relatively high position in the food chain, they are ideal indicators of environmental conditions (DeSante and Geupel 1987, Temple and Wiens 1989, Rich 2002, Foster et al. 2016, Wilson and Bayne 2019). Along with the relative ease of study and cost effectiveness of monitoring, songbird monitoring provides researchers with feedback from a whole community of organisms, not just a single species (Gerwing and Hawkes 2021). Monitoring the dynamics and demography of songbirds at natural, disturbed, and reclaimed habitats can highlight spatial differences in the progression of ecosystem development (Brady and Noske 2010, Hawkes and Gerwing 2019, Wilson and Bayne 2019) and provide valuable data regarding reclamation effectiveness and success. Bird populations are also responsive to environmental changes within limited geographic areas, due in part to their relatively high diversity and niche partitioning by habitat or foraging guilds and can thus be used as indicators of the ecological condition of an area (Hobson and Bayne 2000, Carignan and Villard 2002, Padoa-Schioppa et al. 2006, Venier and Pearce, 2005, Schieck and Song, 2006). Although birds occur in a variety of habitats, the composition of the avian community and the relative abundances of those species vary based on the vegetative structure and environmental conditions of a location (Hobson and Bayne 2000, Schieck and Song 2006, Brady and Noske 2010, Versluijs et al. 2017). For example, wetland areas will host a different suite of species and/or different abundances of species compared to upland habitats. These traits allow for the exploration of natural variability in bird populations and the comparison of bird assemblages from different habitat types within the same study area. To study the return to and use of reclaimed habitats for wildlife, including songbirds and woodpeckers, an early successional wildlife dynamics program was developed and implemented in the region in 2015 (Hawkes and Gerwing 2019). This program is tasked with understanding how wildlife is returning to and using reclaimed upland habitats, as well as assessing the time required for reclaimed plots to provide functional habitat that is similar to naturally occurring upland mature boreal forest (greater than ~70 years old) typical of the region. Data such as these are timely, because while the total area of disturbed land that has been permanently reclaimed is currently small relative to the area of land cleared or disturbed as part of the mine development process (~73 km² vs. 1,039 km² as of 31 Dec. 2018; COSIA 2020), studying patterns of wildlife colonization and occupancy early in the land reclamation process provides data necessary to understand developmental trajectories of reclaimed habitats (Hawkes and Gerwing 2019). Furthermore, study of these reclaimed habitats offers a unique opportunity for adaptative management of the reclamation process relative to the creation of functional wildlife habitat before most habitat reclamation occurs.

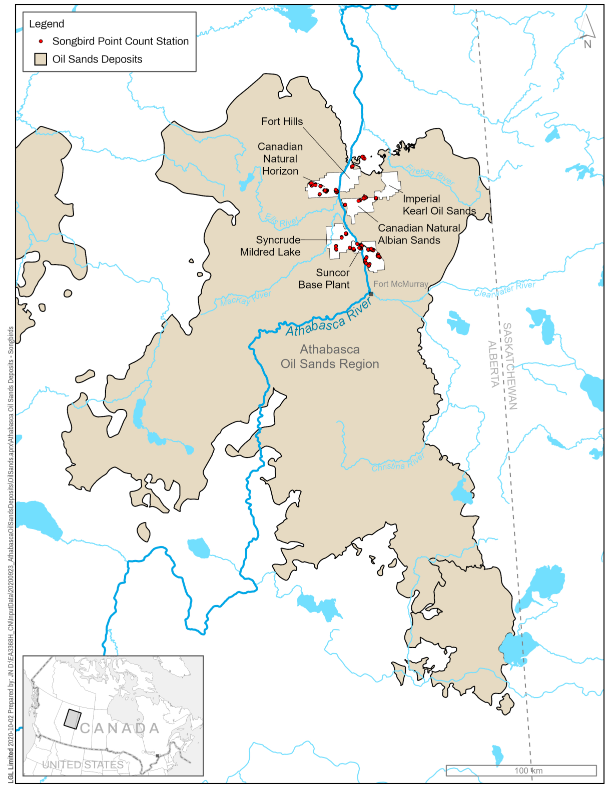
We report on the species assemblages of songbirds and woodpeckers from landforms reclaimed to an upland forest type relative to mature upland forests (the desired end point of upland reclamation in the AOSR) and contrast those results with data collected from various sites recovering from stand-replacing fire, logging, and habitat clearing associated with the development of bitumen mines. Contrasting songbird community assemblages between these habitat types allow us to determine how closely reclaimed habitat represents undisturbed boreal forest and if reclaimed habitats are progressing along developmental trajectories similar to habitats not disturbed by other industries (e.g., logging) (Johnson and Miyanishi 2008, Audet et al. 2014, Hawkes and Gerwing 2019). The responses of birds to energy sector development, logging, and fire have been relatively well studied in the boreal forest of northern Alberta (Bayne et al. 2005, Venier and Pearce 2005, Schieck and Song 2006, Bayne et al. 2016, Wilson and Baye 2019). While some information on the distribution and occurrence of bird species in the mineable portion of the AOSR is available (Foster et al. 2016, Hawkes and Gerwing 2019, Wilson and Bayne 2019), more is required to properly assess bird community responses to ongoing reclamation efforts. Specifically, we aimed to quantify: (1) spatiotemporal variation in bird communities between treatment type and time since reclamation; (2) reclamation trajectories for each treatment type over time since reclamation; and (3) bird species change within a treatment over time since reclamation. These analyses were completed to better understand how species or guilds of birds can be used to assess the effectiveness of upland habitat reclamation in the AOSR.

METHODS

Study Area

The AOSR (Fig. 1) is located ~440km northeast of Edmonton, Alberta, Canada. It is the largest of three oil sands deposits in Alberta and covers ~93,000km² surrounding several communities, the largest of which is Fort McMurray (Gosseling et al. 2010, Hawkes and Gerwing 2019). This area lies in the North America Boreal Plain, a relatively flat region (400-800 m above sea level) that until 10,000 to 12,000 years ago, was covered by the Laurentide ice sheet (Johnson and Miyanishi 2008). Oil sands surface mineable deposits are contained within surface glacial deposits at depths of 30 to 200 m and are composed of loamy till, gravel, and sand [Johnson and Miyanishi 2008]. Along with logging and oil sands development, fire and insect pests continue to be dominant sources of disturbance on this landscape [Johnson and Miyanishi 2008, Hammond et al. 2018).

Fig. 1. Location of the Athabasca Oil Sands Region in northeastern Alberta and the oil sands leases from which data were collected.



Data were collected from six oil sands leases in the mineable portion of the AOSR (Albian Sands, Suncor Base Lease, Fort Hills, Horizon Oil Sands, Kearl, and Syncrude Mildred Lake; Fig. 1) owned/operated by Canadian Natural Resources Limited, Fort Hills Operations, Imperial Oil Ventures, and Suncor Energy Inc. On these leases, songbird communities were assessed in multiple habitat types, henceforth termed "treatments": Mature forest (MF; n=10 plots), reclamation (REC; n=42), cleared (CLR; n=8), logged (LOG; n=3), burned (BRN' n=4), and reclaimed terrestrial habitats adjacent to compensation lakes (COMP; n=6). We recognize that our study is somewhat imbalanced with respect to sample size; however, these limitations do not preclude an assessment of species community similarity relative to these treatments particularly given our focus on reclamation effectiveness on active oil sands mines in the AOSR. Solutions to sample size limitations are being actively pursued and data from those additional sites will be considered in future papers. Sampling units were stratified across the AOSR by lease, and within each lease by treatment. MF are reference areas comprised of mature upland boreal forest (70 to 140 years old) that have not been directly impacted by mining, logging, or forest fires in recent history. MF plots are relatively intact (i.e., few cut lines, roads, or other human-associated disturbance) mixedwood leading to pure coniferous or deciduous mature forest sites that were at least 10 ha in size (Hawkes and Gerwing 2019). The actual size of MF plots sampled ranged in size from 16.9 ha to 74.3 ha (avg. = 34.3 ha).

The REC areas studied here are recreated upland landforms that are intended to recreate an upland boreal forest ecosite type [as per Beckingham and Archibald (1996)] on reconstructed soils that were vegetated with native herbs, forbs, shrubs, and trees to be consistent with species in the naturally occurring and surrounding boreal forest. In most cases, upland reclamation targets dry-poor site types (b and a ecosites) and moist-rich site types (d and e ecosites), but can also target those with very poor to rich nutrient regimes and moisture regimes ranging from xeric to subhygric (Rowland et al. 2009, Pinno and Hawkes 2015, Foster et al. 2016). A typical reclamation prescription for an upland site targeting a b ecosite includes ~ 800 stems/ha aspen (*Populus tremuloides*), 1,150 stems/ha jack pine (*Pinus banksiana*), 130 stems/ha white birch (*Betula papyrifera*), 100 stems/ha Canada buffaloberry (*Shepherdia canadensis*), 60 stems/ha Rose, 125 st/ha alder, 180 st/ha blueberry (*Vaccinium* spp.) and for a d ecosite ~ 60 stems/ha white spruce *(Picea glauca*), 1,900 stems/ha aspen, 145 stems/ha white birch, 10 stems/ha Canada buffaloberry, 10 stems/ha lowbush cranberry (*Viburnum edule*), 35 stems/ha pin cherry (*Prunus pensylvanica*), 7 stems/ha northern black currant (*Ribes hudsonianum*), 10 stems/ha northern goose berry (*Ribes oxyacanthoides*), 55 stems/ha saskatoon (*Amelanchier alnifolia*), 25 stems/ha choke cherry (*Prunus virginiana*), 15 stems/ha prickly rose (*Rosa acicularis*), 71 stems/ha green alder (*Alnus viridis*). In general, if a reclamation area was ≥ 5 ha, non-linear in shape, within 500 m of existing reclamation or natural areas, and was reclaimed using methods that are likely to be used in the future, the site was selected for wildlife monitoring (Hawkes and Gerwing 2019); however, this was not always the case. Some REC sites were as small as 0.96 ha while others were 189.9 ha (avg. 35.9 ha).

CLR habitats (min: 14.8 ha; max: 55.8 ha; avg: 29.6 ha) were cleared of vegetation during initial mine development but not developed any further which enabled vegetation to recover naturally on these sites. LOG habitats (min: 24.6 ha; max: 200.2 ha; avg: 95.9 ha) were clear-cut logged, followed by replanting of native tree species (e.g., Jack Pine to Alberta reforestation standards); soils were intact. BRN habitats (min: 34.4 ha; max: 70.7 ha; avg: 49.1 ha) were disturbed by stand-replacing fire and left to naturally recover. Finally, COMP habitats (min: 0.31 ha; max: 14.9 ha; avg: 8.6 ha) are reclaimed terrestrial habitats adjacent to compensation lakes (lakes built as compensation for fish habitat losses in the region) and were revegetated using the same methods as habitats reclaimed to an upland forest type (Hawkes and Gerwing 2019). Sample plots were established in the approximate center of each habitat patch; however, accessibility and availability of appropriate habitat constrained the selection of sample location in some cases. More information on treatment types, plots, and plot selection can be found in Hawkes and Gerwing (2019).

Data Collection

Bird surveys were conducted in June on all leases and treatments between 2012 and 2019 with start and end dates each year dictated by logistical, environmental, and other factors; surveys began at sunrise and ended within approximately four hours. A total of 248 variable radius point count stations were established within 61 plots (Table 1). Point count stations were selected to cover the areal extent of the plot while being separated by at least 250 m to reduce the possibility of double-counting birds. Larger plots contained a higher number of point count stations, however, maintaining the 250m spacing between stations kept sampling effort roughly equivalent between plots. Eight experienced observers completed point counts, and general survey methods remained consistent among observers, years, and leases. Each station was visited 1 to 3 times per year. Birds detected during a six-minute count period were identified to species, and the sex, age, detection distance estimate from the point count center by distance class (0-15, 15-30, 30-45, 45-60, 60-75, 75-100, and >100 m), direction to the bird, detection type (i.e., visual, song and/or call), and associated microhabitat at the bird's location were recorded. Surveys were completed on days without excessive wind (greater than Beaufort 2; 6-11 km/h) or precipitation and began at sunrise and ended within approximately four hours (Ralph et al. 1993, Ralph et al. 1995).

Data Analysis

For analysis, and when multiple visits to a point count station occurred in a given year, the highest abundance observed for each recorded species over all visits to that station was retained. All point count stations within a plot were then pooled per year so the lowest level of replication was the plot, nested within treatment and year (Table 1). Only passerine (Order Passeriformes; here referred to as songbirds) and woodpecker (Order Piciformes) detections within 75 m of the point count center were retained for analysis, with individuals flying over also excluded excepting swallows. Multivariate community analyses were performed in PRIMER with the PERMANOVA add-on (Anderson et al. 2008, Clarke and Gorley 2015). Univariate regression analyses were performed in R Studio (RStudio Team 2020). In all analyses, a critical level of $\alpha = 0.05$ was used to denote statistical significance.

Spatiotemporal variation in bird communities between treatment type and time since reclamation

A permutational multivariate analysis of covariance, PERMANCOVA (Anderson et al. 2008) was used to quantify the overall spatiotemporal variation of bird communities sampled on each lease and treatment. The response variable for the PERMANCOVA was a resemblance matrix calculated using Bray-Curtis coefficients, and bird community data (species composition and abundance; n = 75 species) were fourth-root transformed to improve assessment of effects of rare and common taxa on community structure (Clarke 1993). In the PERMANCOVA plot, age (age: number of years post-reclamation or disturbance) was included as a covariate, year as a random factor (seven levels), and treatment as a fixed factor (habitat types; six levels). Pair-wise contrasts between treatments were assessed within the PERMANCOVA. Also, as part of the PERMANCOVA, we quantified variance components, the proportion of the multivariate variation accounted for by each variable (Searle et al. 1992, Anderson et al. 2008). PRIMER's CLUSTER routine (Anderson et al. 2008, Clarke and Gorley

Table 1. Number of plots, the lowest level of replication in our study, at each treatment for each year. BRN: Burned; CLR: Cleared; COMP: Compensation Lake Forest; LOG: Logged; MF: Mature Forest; REC: Reclaimed. Age represents the number of years since disturbance ceased or reclamation occurred. MF was never disturbed and as such age is indicated by "- ".

Year	Treatment	Number of Plots	Number of Point Count Stations	Age
2013	BRN	2	6	2,2
2014	BRN	3	9	3,3,3
2015	BRN	3	9	4,4,4
2016	BRN	4	20	5,5,5,5
2017	BRN	4	18	6,6,6,6
2018	BRN	4	18	7,7,7,7
2019	BRN	4	18	8,8,8,8
2014	CLR	1	3	7
2015	CLR	6	17	2,2,8,9,9,16
2016	CLR	2	8	7,8
2017	CLR	7	30	4,4,6,10,11,11,18
2018	CLR	7	29	55,7,11,12,12,19
2019	CLR	5	18	6,6,12,13,20
2013	COMP	3	8	3,3,3
2014	COMP	3	8	4,4,4
2015	COMP	4	11	2,5,5,5
2016	COMP	5	15	3,3,6,6,6
2017	COMP	6	25	4,4,6,7,7,7
2018	COMP	6	24	5,5,7,8,8,8
2019	COMP	6	24	6,6,8,9,9,9
2015	LOG	3	9	4,4,4
2016	LOG	4	20	5,5,5,5
2017	LOG	4	21	6,6,6,6
2018	LOG	4	21	7,7,7,7
2019	LOG	4	21	8,8,8,8
2013	MF	1	3	-
2014	MF	3	9	-
2015	MF	6	17	-
2016	MF	5	22	-
2017	MF	8	39	-
2018	MF	8	40	-
2019	MF	7	33	-
2012	REC	10	30	4,10,14,16,18,18,18,18,19,20
2013	REC	4	11	3,3,3,3
2014	REC	12	35	4,4,4,4,4,5,7,9,11,11,14,26
2015	REC	17	52	1,2,4,5,5,5,5,5,6,8,9,10,12,12,13,15,27
2016	REC	6	21	1,3,6,6,6,6
2017	REC	20	68	2,4,5,6,6,7,7,7,7,7,8,10,11,12,14,14,15,17,29,33
2018	REC	19	68	3,5,7,7,8,8,8,8,8,9,11,12,13,15,15,16,18,30,34
2019	REC	20	71	4,6,7,8,8,9,9,9,9,9,10,12,13,14,16,16,17,19,31,35

2015) was then used to create a dendrogram to graphically represent the observed differences in bird communities between treatments. Bird communities were defined as suites of species co-occurring on the landscape at a given time (Stephens et al. 2016).

Species associations were further assessed with indicator species analysis (ISA; Dufrêne and Legendre 1997, McGeoch and Chown 1998). An indicator value (Indval) was calculated for each species in each treatment. A species was considered an indicator when its Indval differed significantly from random after a Monte Carlo test based on 9,999 permutations. Although Dufrêne and Legendre (1997) suggested an indicator value of 0.25 to designate indicator species, we chose a more conservative threshold level of 0.50 to reveal only reliable strong species-habitat associations. All ISAs were performed in the "indicspecies" package in R (De Cáceres and Legendre 2009). In the context of our study, we are interested in species that can serve as indicators of ecosystem shift and ultimately provide an indication of the relative success of the reclamation practices to provide habitat for wildlife in a manner consistent with the surrounding boreal forest. In our case, we are interested in species that have habitat requirements specific to mature forests (e.g., Canada Warbler) or that can provide an indication of increased habitat structure (e.g., White-throated Sparrow). The indicators selected are those that are associated with a specific habitat type and it is those species that are being tracked relative to developmental trajectories of landforms reclaimed to an upland forest type.

Reclamation trajectories for each treatment type over time since reclamation

To determine if bird community similarity increased with time since reclamation, we compared bird communities at REC sites to MF sites. Before making this contrast, an ANOSIM [Analysis of Similarity, Clarke (1993)] was used to determine if bird communities at MF plots varied by year. ANOSIM is a multivariate test for the null hypothesis of no differences in bird groups between the classes within the variable. As this was not the case (R = 0.03; p = 0.26), data collected at MF plots were pooled. In PRIMER, the Similarities Percentages (SIMPER) (Clarke 1993, Clarke and Ainsworth 1993) routine was used to contrast REC plots to every MF plot, determining the percent similarity of the bird communities. Therefore, each REC plot was contrasted to every MF plot (n = 3501 contrasts). SIMPER calculates the average similarity across all the samples within the group. In turn, it takes each bird species, leaves it out, and recalculates the average similarity (Stephens et al. 2016). By repeating this procedure, the contribution of each bird species to group similarity is derived and the overall per-group similarity by treatment is produced. Percent similarities values were then used as a response variable (Stephens et al. 2016, Hawkes and Gerwing 2019) plotted against the number of years since a REC plot was reclaimed to determine if REC plots are becoming more similar to MF plots with time (Hawkes and Gerwing 2019). A generalized linear mixed effects model (Burhnam et al. 2011), corrected for a skewed distribution via Poisson regression (Richards 2008, O'Hara and Kotze 2010) was used to calculate the trendline.

Non-metric multidimensional scaling plots (nMDS) with 100 restarts (Clarke 1993) were used to visualize how bird communities varied between treatments over time. On nMDS plots, points grouped closer together are more similar than points farther apart, indicating bird communities at individual plots that are more or less similar. Response variables used in the nMDS plot were the resemblance matrices described above. All nMDS graphs, including those discussed below, had a stress (goodness of fit) of ~0.2, and were considered good 2-dimensonal representations of higher dimensional trends (Clarke 1993).

Bird species change within a treatment over time since reclamation

To determine how bird species changed with time within a treatment type, bird community data were grouped into age categories representing time post-reclamation (A: 0-5 years. B: 6-10 years. C: 11-15 years. D: 16-20 years. E: 21-25 years. F: 26-30 years. G: 31-35 years). nMDS plots were then used to visualize changes in bird species within a treatment type over time. Overlaid vectors represent the correlations (Pearson correlation coefficients ≥ 0.4) between a bird species and nMDS axes. Longer vectors represent an increased abundance of that species present at points along that vector. Species identified in the nMDS vectors as informative regarding treatment age (species had a Pearson correlation coefficient of 0.2 or greater) were selected for a comparison of relative abundance by age category for REC and CLR plots. This was only done for REC and CLR plots due to low sample sizes (plots and age categories) in LOG, COMP, and BRN treatments. Abundances were summed for all observations within that age category and corrected by dividing by the number of samples in each age category.

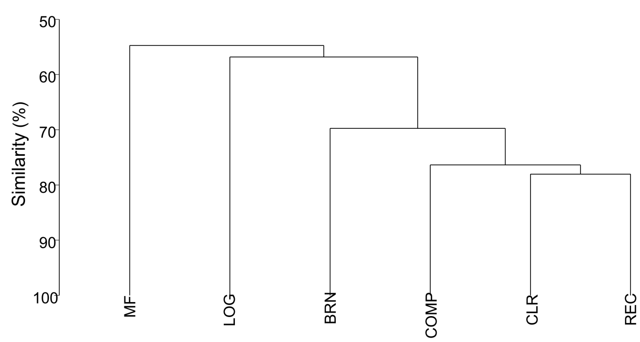
RESULTS

A total of 75 species documented across all leases and habitat types were analyzed (a complete species list is provided in Appendix 1; species analyzed are listed in Appendix 2). This includes 68 passerine species from 16 families and 7 woodpecker species. Families particularly well represented included the warblers (Parulidae) at 18 species and New World Sparrows (Passerelidae) at 10 species. Sparrows were the most abundant group, accounting for 53% of all analyzed observations, and were almost 3 times more abundant than the next most frequently detected group, the warblers, which comprised 18% of all observations. Twelve bird families each comprised <2% of all observations. The most abundant species recorded by those families that comprised >5% of all observations included Clay-colored Sparrow (*Spizella pallida*) (n=1098) and Lincoln's Sparrow (*Melospiza lincolnii*) (n=600) [Passerellidae], Alder Flycatcher (*Empidonax alnorum*) (n=521) [Tyrannidae], Tennessee Warbler (*Leiothlypis peregrina*) (n=433) [Parulidae], and American Robin (*Turdus migratorius*) (n=331) [Turdidae].

Spatiotemporal Variation in Bird Communities Between Treatment Type and Time Since Reclamation

Bird communities varied in a statistically significant way by age, year, and treatment (Table 2). Overall, age and its interaction terms only accounted for 11% of the observed variation in bird communities. Most of the variation was observed between treatments (44%), or plots (residual: 46%). Only 3% was accounted for by year. Differences between treatment types were variable by age (Age X Treatment), but not by year (Year X Treatment). All treatments were statistically different from each other (Table 2 , Fig. 2); however, bird communities were the most similar between REC and CLR (78% similar), while bird communities at MF treatments were less similar when compared to all other treatments (47-61% similarity; Appendix 3-4).

Fig. 2. Cluster dendrogram of bird communities in the Athabasca Oil Sands Region indicating community similarity between treatments. BRN: Burned; CLR: Cleared; COMP: Compensation Lake Forest; LOG: Logged; MF: Mature Forest; REC: Reclaimed.



Certain species of bird were also indicative of each treatment, except CLR which had no indicator above our indicator value threshold of 0.5. The open-country Savannah Sparrow (*Passerculus sandwichensis*) and Clay-colored Sparrow were identified as indicators for REC, while more wetland-associated species of Common Yellowthroat (*Geothlypis trichas*), Song Sparrow (*Melospiza melodia*), and LeConte's Sparrow (*Ammospiza leconteii*) were indicators for the lake-adjacent COMP treatment. The dry LOG treatment was indicated by

Table 2. Permutational multivariate analysis of covariance (PERMANCOVA) determining how bird communities varied between treatment and year, as well as age (time since reclamation or end of disturbance) in the Athabasca Oil Sands Region. Significant and interpretable p values are in bold. BRN: Burned; CLR: Cleared; COMP: Compensation Lake Forest; LOG: Logged; MF: Mature Forest; REC: Reclaimed.

Source	df	MS	Pseudo-F	Unique Permutations	*P*	Variance Components
Age	**1**	**19766**	**12.448**	**9938**	**0.0001**	**2.28**
Age X Treatment	**4**	**3858.1**	**2.9969**	**9880**	**0.0001**	**8.39**
Age X Year	7	1603	1.2028	9837	0.16	0.36
Year	**7**	**3719.1**	**2.7907**	**9842**	**0.0001**	**2.55**
Treatment	**5**	**48510**	**32.142**	**9913**	**0.0001**	**44.72**
MF Vs REC	**1**	**107420.00**	**55.32**	**9950**	**0.0001**	**-**
MF Vs BRN	**1**	**35316.00**	**21.45**	**9929**	**0.0001**	**-**
MF Vs LOG	**1**	**34759.00**	**22.20**	**9917**	**0.0001**	**-**
MF Vs COMP	**1**	**63060.00**	**39.49**	**9926**	**0.0001**	**-**
MF Vs CLR	**1**	**45098.00**	**22.40**	**9938**	**0.0001**	**-**
REC Vs BRN	**1**	**35760.00**	**19.59**	**9928**	**0.0001**	**-**
REC Vs CLR	**1**	**13545.00**	**6.79**	**9949**	**0.0001**	**-**
REC Vs LOG	**1**	**41973.00**	**23.37**	**9934**	**0.0001**	**-**
REC Vs COMP	**1**	**15852.00**	**8.86**	**9946**	**0.0001**	**-**
BRN Vs CLR	**1**	**16542.00**	**9.56**	**9939**	**0.0001**	**-**
BRN Vs COMP	**1**	**19898.00**	**16.14**	**9931**	**0.0001**	**-**
BRN Vs LOG	**1**	**14754.00**	**13.83**	**9941**	**0.0001**	**-**
CLR Vs COMP	**1**	**5504.60**	**3.32**	**9925**	**0.0077**	**-**
CLR Vs LOG	**1**	**31086.00**	**18.96**	**9941**	**0.0001**	**-**
COMP Vs LOG	**1**	**40529.00**	**36.77**	**9945**	**0.0001**	**-**
Year X Treatment	24	1259.9	0.9454	9749	0.69	0
Age X Treatment X Year	No test					
Residual (A.K.A. plot)	201	1332.70				45.99
Total	249					

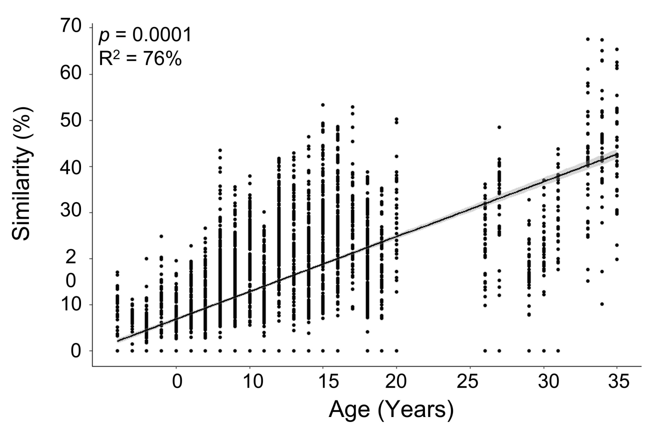
Dark-eyed Junco (*Junco hyemalis*), Vesper Sparrow (*Pooecetes gramineus*), and American Robin. The fire-scarred BRN treatment with its rapid shrub generation was indicated by Hermit Thrush (*Catharus guttatus*), White-throated Sparrow (*Zonotrichia albicollis*), the forest-fire associated Black-backed Woodpecker (*Picoides arcticus*), and Lincoln's Sparrow. Indicator species associated with MF included the forest-dwelling Ovenbird (*Seiurus aurocapilla*), Western Tanager (*Piranga ludoviciana*), Canada Warbler, Swainson's Thrush (*Catharus ustulatus*), Yellow-rumped Warbler (*Setophaga coronata*), and others (Table 3).

Reclamation Trajectories for Each Treatment Type Over Time Since Reclamation

Over time REC plots increased in similarity to MF plots (Fig. 3), with bird communities at the oldest REC plots (35 years) starting to cluster with MF plots (Fig. 4, Appendix 3-4). The regression describing this relationship in Figure 3 is not only significant (p = 0.001), but also explains a substantial proportion of the observed variation (R^2 = 76%). However, there was great variation in similarity with age. Even at 35 years of age, similarity of REC to MF plots varied from 20% to 65%, with an average of 43%.

Regarding other treatments, bird communities at plots recovering from logging (LOG, aged 3-8 years) did not group with MF plots nor with early REC plots, but with older REC plots aged 10-30 years (Fig. 5). Burned plots (aged 2-8 years) exhibited a similar trend, grouping with older REC plots aged 10-18 years. CLR plots aged 9-20 years grouped with older REC plots (20-35 years) and MF plots. Finally, COMP plots (aged 2-9 years) grouped with REC plots of similar ages, but also with REC plots as old as 20 years (Fig. 5, Appendix 3-4).

Fig. 3. Community similarity (%) between reclamation (REC) and mature forest (MF) plots, plotted against increasing years since a plot was reclaimed in the Athabasca Oil Sands Region. Shaded areas around the trendline represent 95% confidence intervals.



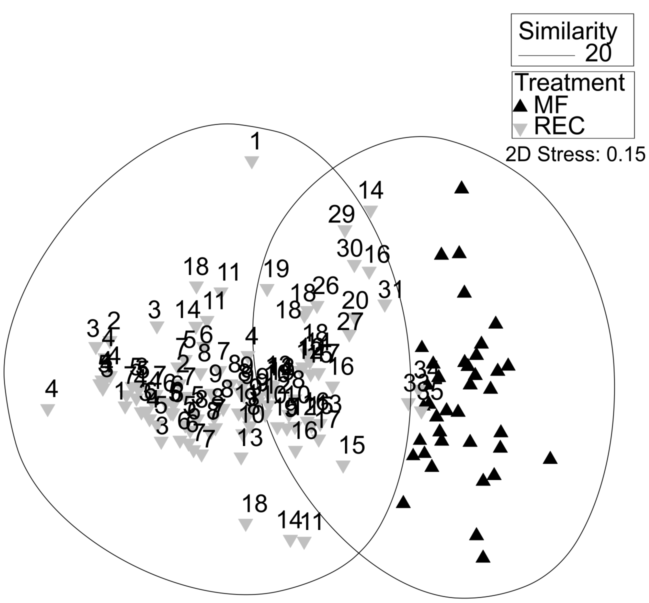
Bird Species Change Within A Treatment Over Time Since Reclamation

Changes in bird community composition varied as a function of time since reclamation or disturbance. Early REC plots (0-20 years post-reclamation) were characterized by high abundances of LeConte's Sparrow (LCSP), Savannah Sparrow (SAVS), and Clay-colored Sparrow (CCSP), while older REC plots (26-35

Table 3. Indicator species for individual treatments (habitat types) based on IndVal statistics and p-values. Only species with IndVal >0.5 included.

Group	Species	IndVal Stat	p-value
Burned (BRN)	Hermit Thrush	0.666	<0.001
	White-throated Sparrow	0.611	<0.001
	Black-backed Woodpecker	0.569	<0.001
	Lincoln's Sparrow	0.513	0.001
Compensation Lake (CMP)	Common Yellowthroat	0.653	<0.001
	Song Sparrow	0.570	<0.001
	LeConte's Sparrow	0.537	<0.001
Logged (LOG)	Dark-eyed Junco	0.838	<0.001
	Vesper Sparrow	0.830	<0.001
	American Robin	0.526	<0.001
Mature Forest (MF)	Ovenbird	0.733	<0.001
	Western Tanager	0.731	<0.001
	Canada Warbler	0.622	<0.001
	Swainson's Thrush	0.617	<0.001
	Yellow-rumped Warbler	0.613	<0.001
	Boreal Chickadee	0.584	<0.001
	Red-breasted Nuthatch	0.571	<0.001
	Tennessee Warbler	0.543	<0.001
	Mourning Warbler	0.526	<0.001
Reclaimed (REC)	Savannah Sparrow	0.623	<0.001
	Clay-colored Sparrow	0.523	<0.001

Fig. 4. Non-metric multidimensional scaling plots (nMDS) showing relationships between bird communities (a) in the Athabasca Oil Sands Region (MF: Mature Forest; REC: Reclaimed). The number above each point is the number of years since the plot was reclaimed. Mature forest points are not presented with an age as they were not reclaimed.



years) exhibited higher abundances of Black-billed Magpie (*Pica hudsonia*, BBMA), White-throated Sparrow (WTSP), Tennessee Warbler (TEWA), and Chipping Sparrow (*Spizella passerina*, CHSP) (Fig. 6). Young CLR plots (0-10 years) were characterized by increased abundances of Savannah Sparrow, LeConte's Sparrow, Clay-colored Sparrow, Tree Swallow (*Tachycineta bicolor*, TRES), Swamp Sparrow (*Melospiza georgina*, SWSP), Song Sparrow (SOSP), Lincoln's Sparrow (LISP), Alder Flycatcher (*Empidonax alnorum*, ALFL), Vesper Sparrow (VESP), and Common Yellowthroat (COYE), while older CLR plots (11-20 years) were characterized by increased abundances of Swainson's Thrush (SWTH), Black-capped Chickadee (*Poecile atricapilus*, BCCH), Blue Jay (*Cyanocitta cristata*, BLJA), Canada Jay (*Perisoreus canadensis*, CAJA), Tennessee Warbler (TEWA), Ovenbird (OVEN), Least Flycatcher (*Empidonax minimus*, LEFL), Red-eyed Vireo (*Vireo olivaceus*, REVI), and Hermit Thrush (HETH) (Fig. 7). Conversely, no patterns are yet evident in species composition with time since reclamation or disturbance from BRN, LOG, and COMP treatments (Fig. 7).

DISCUSSION

We found that bird communities varied significantly by treatment (i.e., disturbance type) and with years since reclamation. Most of the observed variation in bird communities was accounted for by differences between plots (46%), and treatments (44%). Only 3% of the observed variation was associated with differences between years, while time since reclamation (age) and its interaction terms accounted for 11% of the observed variation in bird communities. This is not to suggest that time since reclamation is not an important variable that influences bird communities. Instead, this finding suggests that even years after a disturbance (up to 35 years in our reclamation cases), the disturbance type (i.e., logging, fire, or reclamation) is still the dominant factor in explaining the structure of observed bird communities. Previous work has demonstrated that disturbance type, severity, and frequency are known to influence recovery from disturbance (Reice et al. 1990, Buckling et al. 2000, Vanschoenwinkel et al. 2013, Gerwing et al. 2017, Campbell et al. 2019a) and our results are consistent with these findings.

Fig. 5. Non-metric multidimensional scaling plots (nMDS) showing relationships between bird communities in various reclamation treatments in the Athabasca Oil Sands Region (BRN: Burned; CLR: Cleared; COMP: Compensation Lake Forest; LOG: Logged; MF: Mature Forest; REC: Reclaimed). The number above each point is the number of years since the plot was reclaimed. Mature forest points are not presented with an age as they were not reclaimed. Ellipses encompass points that are 20% similar to each other.

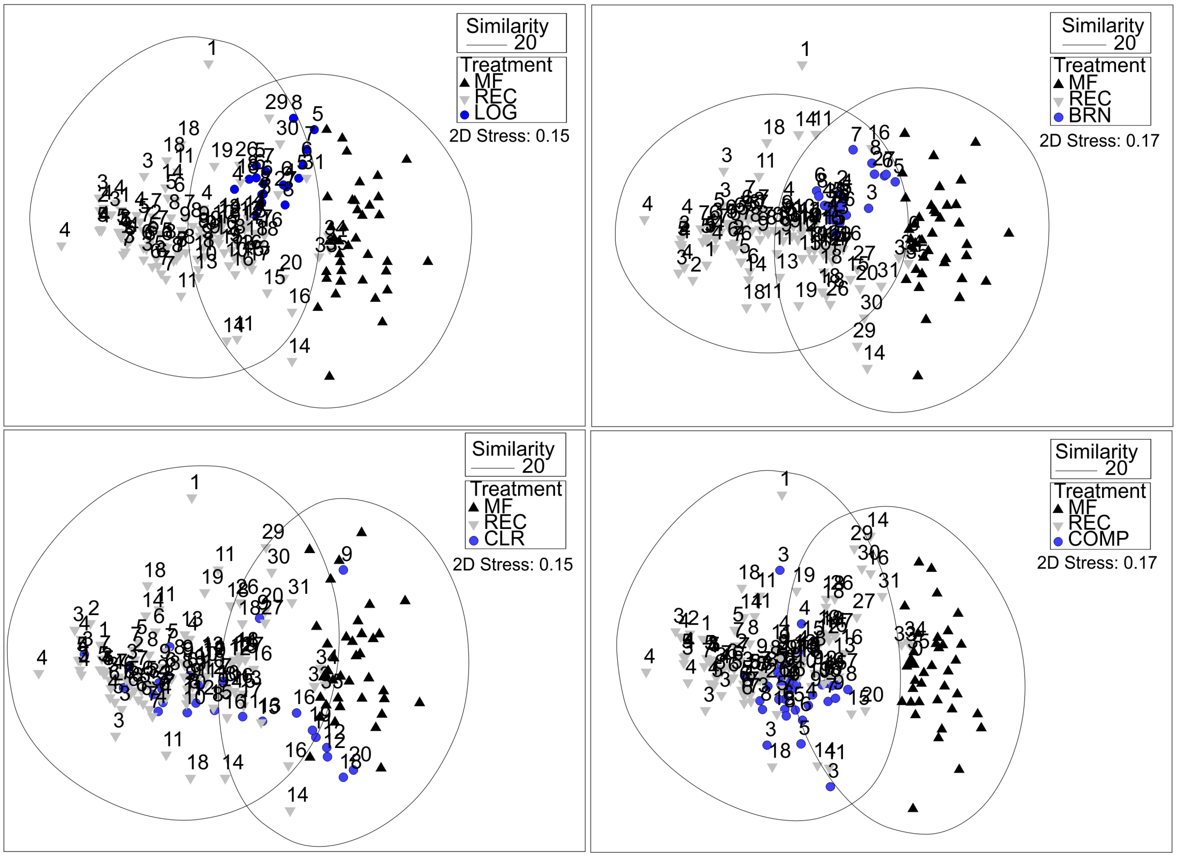
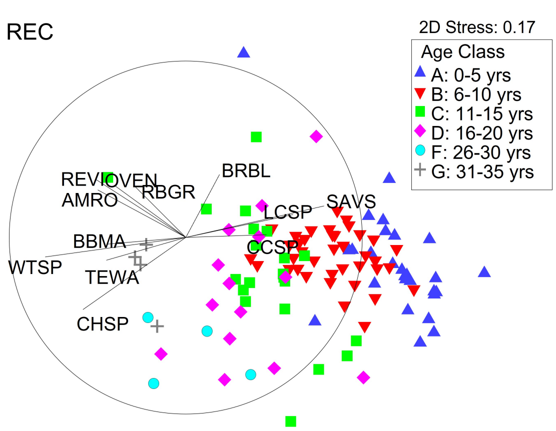


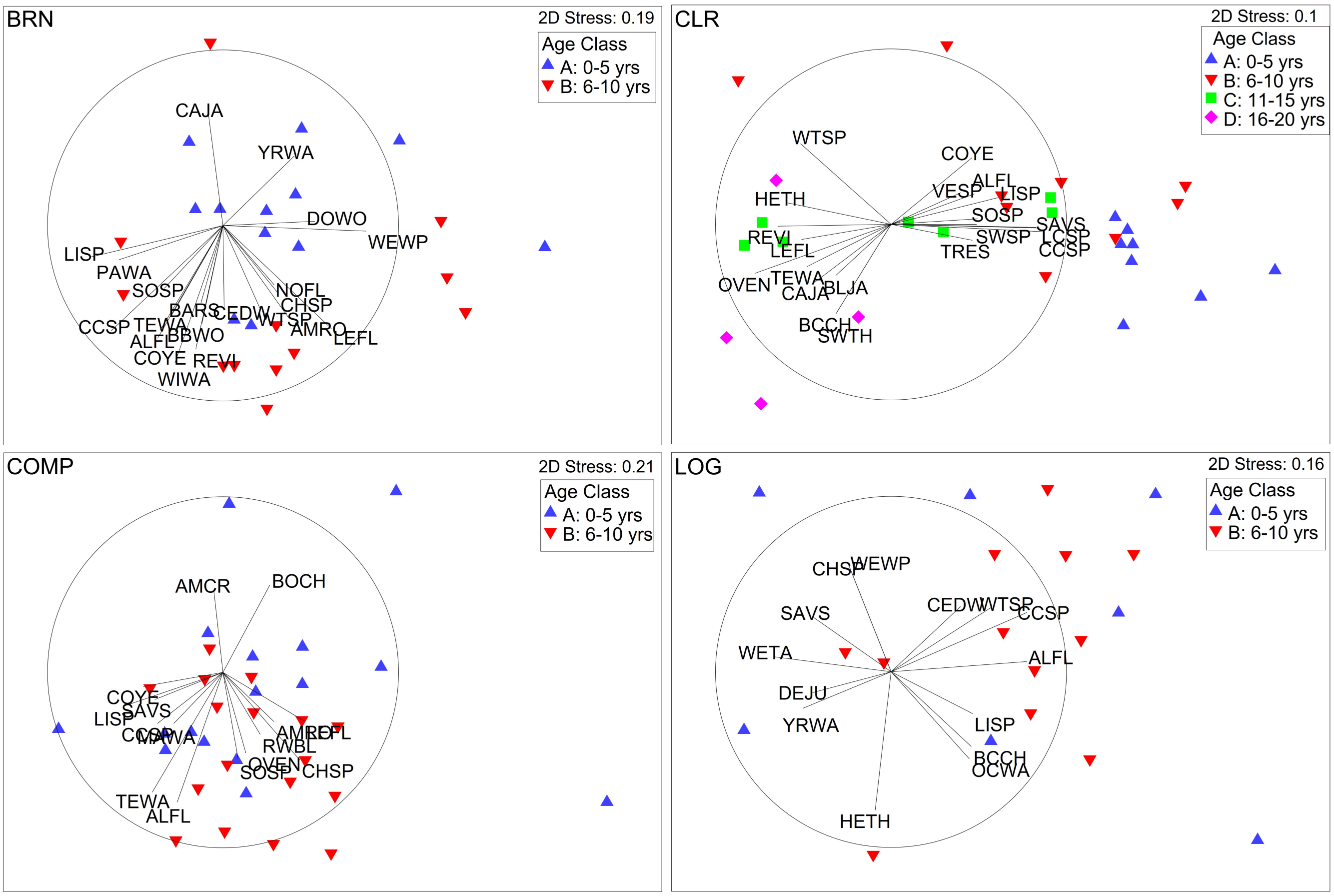
Fig. 6. Non-metric multidimensional scaling plots (nMDS) showing relationships between bird communities in reclaimed (REC) habitat in the Athabasca Oil Sands Region by age class. Vector overlays indicate species with a Pearson correlation coefficient of 0.4 or greater. Circle indicates a correlation of 1. Longer lines indicate a stronger relationship between points along that vector and the identified species.



Overall, bird communities (species composition and abundance) in reclamation sites increased in similarity to mature forest reference plots over time. This supports other observations of bird community succession in the region (e.g., Bayne et al. 2008, Foster et al. 2017, Wilson and Bayne 2019). Wilson and Bayne (2019) observed increasing bird community similarity between reference boreal forest and reclaimed *in situ* well sites, ranging from 7 to 49 years since reclamation. Well sites represent a smaller spatial scale of disturbance than reclaimed sites examined in our study (Bayne et al. 2008, Mahon et al. 2019, Wilson and Bayne 2019); however, both Wilson and Bayne (2019) and our study indicate bird community similarity increases as a function of time since reclamation. Hawkes and Gerwing (2019), using 181 species that included the 75 species of birds used in our dataset as well as additional bird species (identified via wildlife cameras) and small (e.g., rodents) and large (e.g., canids and bears) mammals, reported increasing wildlife community similarity values between mature forest and reclaimed sites with increasing time since reclamation.

While increasing with time, similarity of bird communities between reclaimed and mature forest plots varied greatly at all ages, even at 35 years since reclamation (20% to 65% similarity, average: 43%). Climax communities may not be reached for decades, if ever, due

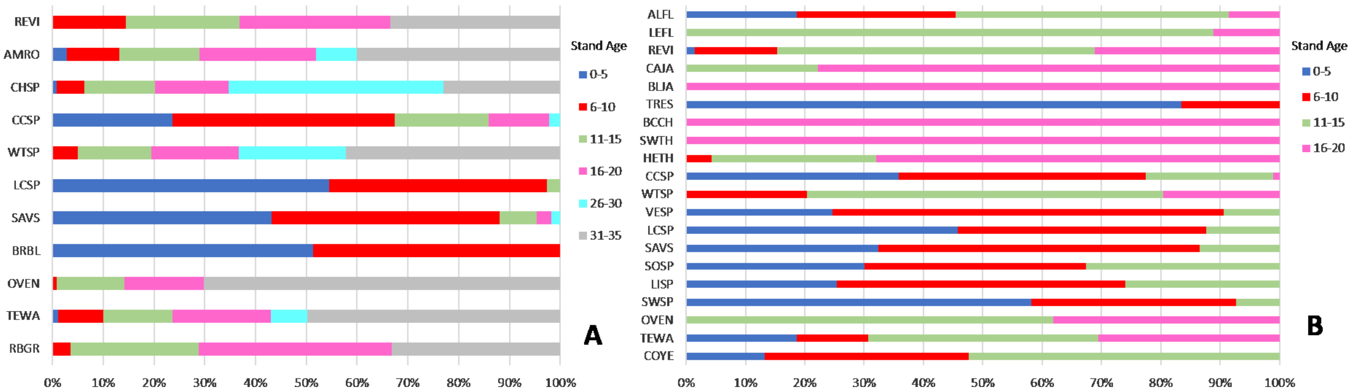
Fig. 7. Non-metric multidimensional scaling plots (nMDS) showing relationships between bird communities in various reclamation treatments in the Athabasca Oil Sands Region (BRN: Burned; CLR: Cleared; COMP: Compensation Lake; LOG: Logged). Vector overlays indicate species with a Pearson correlation coefficient of 0.4 or greater. Longer lines indicate a stronger relationship between points along that vector and the identified species.



to high fire regimes, in the boreal forest. Post-disturbance succession pathways may last 250-300 years, with plant communities requiring 50-100 years to resemble mature forest plots (Cogbill 1985, Bergeron and Dubue 1989, Siitonen et al. 2000, Litvak et al. 2003). Most of our sampled reclaimed plots are categorized as young seral (0 to 20 years old), while a few are immature (21 to 60 or 70 years depending on leading tree species or forest type). Therefore, 35 years post-disturbance is still early in the successional process, and reclaimed plots of this age, while more closely resembling mature forest than younger reclaimed plots, are still associated with a bird community that differs from mature forest stands. Increases in community similarity observed in older reclamation sites are likely a function of changing habitat structure and composition, but this has not yet been fully investigated. Previously reported regional data collected to assess bird community responses post-harvest and post-fire in young seral stands (i.e., those < 30 years of age) may prove useful when considering the development trajectories of landforms reclaimed to an upland forest type. For example, Hobson and Scheick (1999) studied bird communities in post-fire and post-logging stands one, 13 to 15, and 22 to 28 years after impact with those age classes resembling the current age of the reclaimed plots under study. Scheick and Hobson (2000) studied bird community response to various patch sizes and age classes following disturbance. Hannon and Drapeau (2005) evaluated bird community response relative to time since disturbance (fire and logging) to assess timing of convergence relative to disturbance type. In each of these cases, bird community similarity converged with increasing age and increasing patch size, which is consistent with our preliminary findings and our expectations of landforms reclaimed to an upland boreal forest type as they mature.

This study also aimed to establish whether habitats reclaimed to an upland forest prescription were progressing along similar successional pathways as sites impacted by other disturbances, such as stand-replacing fire or clear-cut logging. As all treatments support bird communities that were statistically different (Table 2), each treatment may be progressing along a slightly different developmental trajectory: a finding that is not unexpected, as the nature of a disturbance is an important component in ecosystem recovery (Sousa 1980, Audet et al. 2014, Campbell et al. 2019b, Hawkes and Gerwing 2019). However, commonalities do exist. For instance, while burned, logged, and cleared plots are young seral sites, they cluster with older reclaimed plots (Fig. 4-6). Plots

Fig. 8. Relative abundances of species identified in nMDS vectors (Figure 7) by age category of Reclaimed (A) and Cleared (B) treatments. Relative abundance (sum of observations) of each species is corrected by the number of samples within each age category.



adjacent to compensation lakes generally clustered with reclaimed plots of similar age. The observed similarities between bird communities in treatments with plots of different ages and disturbance history may be a product of soil/plant disturbance intensity (Hawkes and Gerwing 2019). Reclaimed habitats are constructed landforms with a reconstituted soil layer that is overlain with forest floor mineral mix or peat mineral mix, which is the soil layer that was removed after initial vegetation clearing of the mine lease. This material was either stockpiled for later use or used to reclaim habitats via direct placement (Hawkes and Gerwing 2019). While burned, cleared, and logged plots experienced removal or damage of existing vegetation, soil was left relatively intact, aiding in vegetative recovery (Johnson and Miyanishi 2008). As such, similarities between older reclaimed plots and younger burned, logged, and cleared plot bird communities suggests that non-reclaimed, disturbed plots are progressing along a different and possibly faster (owing to the increasing similarity between non-reclaimed plots and mature forests; Fig. 4-6) recovery trajectory due to less intensive disturbance to the soil. Accordingly, compensation lake plots appear to be progressing along a similar reclamation trajectory as reclaimed plots, as both share a similar disturbance history. At this stage in our study, we are cognizant of current sample size limitations and the fact that our study compares upland reclamation in general to mature forests characterized as mixedwood leading to coniferous or deciduous stands. The relatively early phase at which most mines are at in the AOSR precludes more refined comparisons (i.e., specific reclamation practices to create different upland forest types) at this time. Moreover, the goal of upland reclamation is to provide habitat for wildlife in a manner consistent with the surrounding and naturally occurring boreal forest and not necessarily to emulate the range and distribution of all forest types present in the area. The comparisons made in this study are one of several that are possible but at present, represent the majority of upland reclamation that has occurred in the mineable oil sands region to date.

As plots reclaimed to an upland forest type aged, bird community composition changed in unique ways for each treatment. Young, reclaimed plots (0-20 years) were characterized by high abundances of LeConte's Sparrow, Savannah Sparrow, and Clay-colored Sparrow, while older reclaimed (but still immature from a vegetation succession perspective) plots (26-35 years) exhibited greater abundances of White-throated Sparrow, Tennessee Warbler, and Chipping Sparrow (Fig. 6, Fig. 8). Most of these species were identified as indicator species and are good candidates to assess reclamation progress. However, species identified for candidates to assess reclamation progress need to be biologically meaningful based on both quantitative analysis and first-hand biological knowledge of bird use of the respective sites. For example, while Black-billed Magpie characterizes older (7-34 year old) reclaimed plots in the ordination (Fig. 6), the majority of detections are from one oil sands lease. Magpies are common around oil sands operational areas such as lodgings, parking lots, pipelines, landfills, and other human-created structures. Their presence in older reclaimed sites is likely a function of adjacent operational areas in that one lease. In contrast, the remaining characteristic species are widespread throughout our sampling sites suggesting they can be considered good indicators of biological differences.

Some variation in the abundance of these species may reflect differences in microclimate, topography, and/or vegetation structure. For example, we noted higher LeConte's Sparrow abundance in wetter reclaimed sites, and higher Clay-colored Sparrow abundance in sites with greater shrub density, though both are indicative of plots early in the successional process. Likewise, White-throated Sparrow, Tennessee Warbler, and Chipping Sparrow have increased relative abundances in older plots further into the reclamation process, as shrub and tree cover increases, matching their known habitat breadth (Falls and Kopachena 2020, Middleton 2020, Rimmer and McFarland 2020). Additional species show similar results with respect to relative abundance within reclaimed sites of certain ages. For example, Rose-breasted Grosbeak (*Pheucticus ludovicianus*) and Red-eyed Vireo occur in reclaimed sites >5 years old, but most observations occurred in sites >15 years old (Fig. 8). In contrast, Ovenbirds are typically found in mature and closed-canopy forest and may be sensitive to reductions in leaf litter and woody vegetation (Porneluzi et al. 2011, Lankau et al. 2013). Our observations of Ovenbirds in reclaimed sites were predominantly in those >30 years old (Fig. 8). More data from older reclaimed plots are required to determine bird community composition further into the reclamation process; however, both species and their abundance relative to other detected species needs to be considered.

As with reclaimed plots, young, cleared plots (0-10 years) were characterized by increased relative abundances of early-successional species such as Savannah Sparrow, Clay-colored Sparrow, and LeConte's Sparrow, but also more wetland-associated species such as Tree Swallow, Swamp Sparrow, Alder Flycatcher and Common Yellowthroat (Fig. 8). Wetland habitats are not inherent to cleared sites as a treatment type, but generated spontaneously in some cleared sites we sampled, accounting for this expanded suite of characteristic bird species when compared to reclaimed treatments. Older cleared plots (11-20 years) were characterized by increased abundances of species such as Swainson's Thrush, Black-capped Chickadee, Blue Jay, Canada Jay, Tennessee Warbler, Ovenbird, Least Flycatcher, Red-eyed Vireo, and Hermit Thrush (Fig. 7). Reflective of a different (likely faster) succession trajectory compared with reclaimed sites, older cleared sites had increased relative abundances of species more strongly associated with forested habitats (Semenchuk 2007, Hobson and Scheick 1999, Scheick and Hobson 2000, Hannon and Drapeau 2005), such as thrushes, warblers, and jays (Fig. 8). Cleared plot data are limited not only by the number of available data points but also by having no cleared plots exceeding 20 years in age. As such, the high number of species correlated with old or young cleared plots is not as informative as the smaller number of species associated with older and younger reclaimed plots. It is likely that more data, as well as data from older cleared plots, will help refine the list of species that are associated with cleared plots of various ages relative to reclamation. Similarly, we currently lack data from older (>10 years) burned, logged, and compensation lake treatments. As such, no patterns are evident in species composition with time since reclamation for those treatments (Fig. 7). Including older sites (25 to 35 years) post fire and following clearcut logging would provide important data regarding the developmental trajectories of reclaimed habitats and allow for more direct comparisons with other previously reported regional data (e.g., Hobson and Scheick 1999, Scheick and Hobson 2000, Hannon and Drapeau 2005).

Bird communities in reclaimed habitats more strongly resemble those of naturally occurring mature boreal forest, with increasing time since reclamation. Several of the species observed in forested habitats on reclaimed plots, such as Tennessee Warbler and Ovenbird, are those found in mature boreal forest typical of the region (Bayne et al. 2008, Foster et al. 2016, Wilson and Bayne 2019). More time and continued monitoring are required before we can determine if the developmental trajectories of habitats reclaimed to an upland forest type will support bird communities that diverge from those of other types of disturbance (human and natural) or those of existing boreal forest, or if they will converge with mature forest plots. However, it is important to note that data from older reclaimed plots 35+ years post reclamation are limited. As more reclamation sites are developed, and as current sites age, additional trends will undoubtedly be revealed.

Given global changes in species ranges, temperature, precipitation, and biogeochemical cycles (Williams et al. 2007, Choi et al. 2008, Johnson and Miyanishi 2008, Rooney et al. 2012), successional pathways that lead to historic conditions may no longer be possible (Williams et al. 2007, Choi et al. 2008, Johnson and Miyanishi 2008, Audet et al. 2014). As such, reclamation to identical pre-disturbance conditions may not be feasible (Choi et al. 2008, Johnson and Miyanishi 2008, Gosselin et al. 2010, Audet et al. 2014). Legislation requires that oil sands developers return disturbed land to an equivalent land capability; however, it may not fully restore habitat to pre-disturbance conditions (EPEA 2009, Gosselin et al. 2010). Currently, it is not well understood at what point habitats reclaimed to an upland forest type will function in a manner consistent with the naturally occurring and surrounding boreal forest. Furthermore, while community similarity provides an indication of the variation in bird species present on reclaimed versus mature forest plots, it might not correlate well with habitat function or quality (Hannah et al. 2008). Future studies on reclamation effectiveness would thus benefit by incorporating measures of avian productivity and survivorship in reclaimed and mature forest plots over time to better understand the functionality of created habitat, as well as how community similarity relates to habitat functionality or quality.

CONCLUSIONS

The early successional wildlife monitoring program monitors wildlife usage of reclaimed upland boreal forest in the mineable portion of the AOSR. Using bird communities as an indicator of upland reclamation effectiveness, we observed an increase in community similarity between habitats reclaimed to an upland forest type and mature forest as a function of time since reclamation with similarity values ranging from 20 to 65% (average 43%) 35 years following reclamation. Low and variable community similarities were not surprising as 35 years is still early in the reclamation process, particularly when considering vegetation succession. Plots disturbed by activities other than mining, such as stand-replacing fire and logging, were associated with bird communities that were more similar to older reclaimed habitats, suggesting that reclaimed habitats are progressing along different (perhaps slower) recovery trajectories than habitats disturbed by other forces. The degree of similarity observed coupled with an increase in community similarity over time suggests that community similarity, and likely habitat function, should increase with reclamation age, a result consistent with Wilson and Bayne (2019). These data also support the findings of Hawkes and Gerwing (2019), who reported that the degree of similarity observed with respect to wildlife communities using upland reclaimed habitat relative to mature forests increased with time since reclamation. Although there is no expectation that habitat reclaimed to an upland forest type will resemble or function identically to naturally occurring boreal forest, our results indicate that comparable community similarity and by extension, ecological function is possible. Given the time it takes for vegetation communities in the boreal to mature, continued research is required to assess the longer-term functionality of reclaimed habitats, the end point of succession in all disturbed habitat types, as well as to determine what level of community similarity between reference and reclaimed plots is satisfactory from an ecological perspective. Despite this uncertainty and the observed differences between reclaimed habitats and mature forests, reclamation efforts in the mineable portion of the AOSR appear to be recreating habitats that support avian communities, suggesting that, in time, reclaimed upland habitats could support bird communities in a manner consistent with the surrounding and naturally occurring boreal forest.

Responses to this article can be read online at:
https://www.ace-eco.org/issues/responses.php/1915

Acknowledgments:

This project was completed by LGL Limited under contract to Canadian Natural Resources Limited (Horizon Oil Sands), Canadian Natural Upgrading Limited (Albian Sands), Suncor Energy Services Inc., Fort Hills Energy, and Imperial Oil Resources Limited. The following individuals provided site-specific and program-related support: Canadian Natural Resources: Fred Kuzmic, Joanne Hogg, Mark Hornsby, Jamie-Lynn Greter, Devon Versnick-Brown, Gregg Hamilton, Jordan Smith, Kimberley Hoodless, Shawn Filteau, Krista Shea, Stephen Tuttle, Paul Stackhouse, and Janet Feener, and Ira Sherr. Suncor Energy Services: Mark Boulton, Lisa Bridges, Christine Lambert, Correen Luchka, and various Field Services personnel. Fort Hills Energy: Warren Fleming, Tom Wiebe, Westen Macintosh, Troy Barnes, and Steve Mccartney. Imperial Oil Resources Limited: Jeff Shortt, Rhiannon Davies, Lisa Liu, Harold Funk, Tiffany Gandy, and various and Field Services personnel. Some data (i.e., those collected on Syncrude's Mildred Lake Lease) used in this report were obtained under contract to the Cumulative Environmental Management Association (CEMA) in 2010, 2011, and 2012. These data used with permission. Personnel responsible for data collection were Nathan Hentze, Jeremy Gatten, Naira Johnston, Steven, Roias, Andrew Davis, Heather Polan, and Jamie Fenneman. Comments provided by anonymous reviewers enhanced the quality and clarity of this manuscript.

LITERATURE CITED

Anderson, M., R. N. Gorley, and R. K. Clarke. 2008. Permanova+ for Primer: Guide to software and statistical methods. PRIMER-E Ltd, Plymouth, United Kingdom.

Audet, P., B. D. Pinno, and E. Thiffault. 2014. Reclamation of boreal forest after oil sands mining: anticipating novel challenges in novel environments. Canadian Journal of Forest Research 45:364-371. https://doi.org/10.1139/cjfr-2014-0330

Bayne, E. M., L. Habib, and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. Conservation Biology 22:1186-1193. https://doi.org/10.1111/j.1523-1739.2008.00973.x

Bayne, E. M., L. Leston, C. L. Mahon, P. Sólymos, C. Machtans, H. Lankau, J. R. Ball, S. L. van Wilgenburg, S. G. Cumming, T. Fontaine, F. A. Schmiegelow, and S. J. Song. 2016. Boreal bird abundance estimates within different energy sector disturbances vary with point count radius. The Condor 118: 379-390 https://doi.org/10.1650/condor-15-126.1

Bayne, E. M., S. L. van Wilgenburg, S. Boutin, and K. A. Hobson. 2005. Modeling and field-testing of Ovenbird (*Seiurus aurocapillus*) responses to boreal forest dissection by energy sector development at multiple spatial scales. Landscape Ecology 20: 2013-216. https://doi.org/10.1007/s10980-004-2265-9

Bergeron, Y., and M. Dubue. 1988. Succession in the southern part of the Canadian boreal forest. Vegetatio 79:51-63. https://doi.org/10.1007/BF00044848

Bibby, C. J., N. D. Burgess, D. A. Hill, and S. Mustoe. 2000. Bird Census Techniques 2nd ed. Academic Press, London, U.K.

Blancher, P., and J. V. Wells. 2005. The Boreal Forest Region: North American's bird nursery. Boreal Songbird Initiative, Seattle, WA, Canadian Boreal Initiative, Ottawa, ON, and Bird Studies Canada, Port Rowan, ON.

Bogdanski, B. E. C. 2008. Canada's boreal forest economy: economic and socioeconomic issues and research opportunities. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-414. 59 p.

Brady C. J., and Noske R. 2010. Succession in bird and plant communities over a 24 year chronosequence of mine rehabilitation in the Australian monsoon tropics. Restoration Ecology 18: 855-864. https://doi.org/10.1111/j.1526-100X.2008.00511.x

Brandt J. P, M. D. Flannigan, D. G. Maynard, I. D. Thompson, and W. J. A. Volney. 2013. An introduction to Canada's boreal zone: ecosystem processes, health, sustainability, and environmental issues. Environmental Reviews 21(4): 207-226. https://doi.org/10.1139/er-2013-0040

Buckling, A., R. Kassen, G. Bell, and P. B. Rainey. 2000. Disturbance and diversity in experimental microcosms. Nature 408:961-964. https://doi.org/10.1038/35050080

Burnett, R. D., T. Gardali, and G. R. Geupel. 2005. Using songbird monitoring to guide and evaluate riparian restoration in salmonid-focused stream rehabilitation projects. In: Ralph, C. J. and T. D. Rich. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24. Asilomar, CA: US Department of Agriculture, Forest Service, Pacific Southwest Research Station 191: 533-536. https://doi.org/10.2737/psw-gtr-191

Burnham, K. P., D. R. Anderson, and K. P. Huyvaert. 2011. AIC model selection and multimodel inference in behavioral ecology: Some background, observations, and comparisons. Behavioral Ecology and Sociobiology 65:23-35. https://doi.org/10.1007/s00265-010-1029-6

Campbell, M. A., B. Kopach, P. E. Komers, and A. T. Ford. 2019a. Quantifying the impacts of oil sands development on wildlife: perspectives from impact assessments. Environmental Reviews 28 (2). https://doi.org/10.1139/er-2018-0118

Campbell, L., T. Sizmur, F. Juanes, and T. G. Gerwing. 2019b. Passive reclamation of soft-sediment ecosystems on the North Coast of British Columbia, Canada. Journal of Sea Research 155: 101796. https://doi.org/10.1016/j.seares.2019.101796

Carignan, V., and M. A. Villard. 2002. Selecting indicator species to monitor ecological integrity: a review. Environmental

Monitoring and Assessment 78:45-61. https://doi.org/10.1023/A:1016136723584

Chen, H. Y. H., S. R. Biswas, T. M. Sobey, B. W. Brassard, and S. F. Bartels. 2018. Reclamation strategies for mined forest soils and overstorey drive understorey vegetation. Journal of Applied Ecology 55:926-936. https://doi.org/10.1111/1365-2664.13018

Choi, Y. D., V. M. Temperton, E. B. Allen, A. P. Grootjans, M. Halassy, R. J. Hobbs, M. A. Naeth, and K. Torok. 2008. Ecological restoration for future sustainability in a changing environment. Ecoscience 15:53-64. https://doi.org/10.2980/1195-6860(2008)15[53:ERFFSI]2.0.CO;2

Clarke, K. R. 1993. Non-parametric multivariate analyses of changes in community structure. Australian Journal of Ecology 18:117−143. https://doi.org/10.1111/j.1442-9993.1993.tb00438.x

Clarke, K. R., and M. Ainsworth. 1993. A method of linking multivariate community structure to environmental variables. Marine Ecology Progress Series 92:205−219. https://doi.org/10.3354/meps092205

Clarke, K. R., and R. N. Gorley. 2015. PRIMER v7: user manual/tutorial 3rd ed. Primer-E Ltd, Plymouth, United Kingdom.

Cogbill, C. V. 1985. Dynamics of the boreal forests of the Laurentian Highlands, Canada. Canadian Journal of Forest Research 15:252-261. https://doi.org/10.1139/x85-043

COSIA (Canada's Oil Sands Innovation Alliance). 2020. Regional reclamation and disturbance tracking by company, to December 31, 2018. https://cosia.ca/sites/default/files/attachments/Summary_Regional_Rec_Dist_Tracking2018.pdf

De Cáceres, M., and P. Legendre. 2009. Associations between species and groups of sites: indices and statistical inference. Ecology 90(12):3566-3574. https://doi.org/10.1890/08-1823.1

DeSante, D. F., and G. R. Geupel. 1987. Landbird productivity in central coastal California: the relationship to annual rainfall, and a reproductive failure in 1986. Condor 89:636-653.

Dufrêne, M., and P. Legendre. 1997. Species assemblages and indicator species: the need for a flexible asymmetrical approach. Ecological Monographs 67:345-366. https://doi.org/10.2307/2963459

EPEA. 2009. Environmental Protection and Enhancement Act. http://www.qp.alberta.ca/documents/Acts/E12.pdf

Falls, J. B., and J. G. Kopachena. 2020. White-throated Sparrow (*Zonotrichia albicollis*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.whtspa.01

Foster, K. R., C. M. Godwin, P. Pyle, and J. F. Saracco. 2016. Reclamation and habitat-disturbance effects on landbird abundance and productivity indices in the oil sands region of northeastern Alberta, Canada. Restoration Ecology 25:532-538. https://doi.org/10.1111/rec.12478

Gerwing, T. G., and V. C. Hawkes. 2021. Similarity analyses in restoration ecology and how to improve their utility. Restoration Ecology e13368. https://doi.org/10.1111/rec.13368

Gerwing, T. G., A. M. Allen Gerwing, T. Macdonald, K. Cox, F. Juanes, and S. E. Dudas. 2017. Intertidal soft-sediment community does not respond to disturbance as postulated by the intermediate disturbance hypothesis. Journal of Sea Research 129:22-28. https://doi.org/10.1016/j.seares.2017.09.001

Gosselin, P., S. E. Hrudey, M. A. Naeth, A. Plourde, R. Therrien, G. Van Der Kraak, and Z. Xu. 2010. Environmental and health impacts of Canada's oil sands industry. Royal Society of Canada, Ottawa, ON. 438p.

Gould, S. F., and B. G. Mackey. 2015. Site vegetation characteristics are more important than landscape context in determining bird assemblages in revegetation. Restoration Ecology 23:670-680. https://doi.org/10.1111/rec.12222

Gregory, R. D., and A. J. van Strien. 2010. Wild bird indicators: using composite population trends of birds as measures of environmental health. Ornithological Science 9:3-22. https://doi.org/10.2326/osj.9.3

Hammond, J. H. E., P. G. K. Hoffman, B. D. Pinno, J. Pinzon, J. Klimaszewski, and D. J. Hartley. 2018. Response of ground and rove beetles (Coleoptera: Carabidae, Staphylinidae) to operational oil sands mine reclamation in northeastern Alberta, a case study. Journal of Insect Conservation 2018:1-20 https://doi.org/10.1007/s10841-018-0094-4

Hannah, K., F. K. Schmiegelow, and K. E. Aitken. 2008. White-throated Sparrow Response to Forest Harvesting in North-Central Alberta: Results Not So Clear-Cut? Avian Conservation and Ecology 3(1):6. http://dx.doi.org/10.5751/ACE-00238-030106

Hannon, S. J., and P. Drapeau. 2005. Bird responses to burning and logging n the boreal forest of Canada. Studies in Avian Biology 30: 97-115

Hawkes, V. C., and T. G. Gerwing. 2019. Wildlife usage indicates increased similarity between reclaimed upland habitat and mature boreal forest in the Athabasca Oil Sands Region of Alberta, Canada. PloS One 14:e0217556. https://doi.org/10.1371/journal.pone.0217556

Hobson K. A., and E. M. Bayne. 2000. The effects of stand age on avian communities in aspen-dominated forests of central Saskatchewan, Canada. Forest Ecology and Management 136: 121-134. https://doi.org/10.1016/S0378-1127(99)00287-X

Hobson, K. A., and J. Schieck. 1999. Changes in bird communities in boreal mixed wood forest: harvest and wildfire over 30 years. Ecological Applications 9 :849-863. https://doi.org/10.1890/1051-0761(1999)009[0849:cibcib]2.0.co;2

Johnson, E. A., and K. Miyanishi. 2008. Creating new landscapes and ecosystems: The Alberta Oil Sands. Annals of the New York Academy of Sciences 1134:120-145. https://doi.org/10.1196/annals.1439.007

Lankau, H., E. M. Bayne, and C. Machtans. 2013. Ovenbird (*Seiurus aurocapilla*) territory placement near seismic lines is influenced by forest regeneration and conspecific density. Avian Conservation and Ecology 8(1):5. http://dx.doi.org/10.5751/ACE-00596-080105

Litvak, M., S. Miller, S. C. Wofsy, and M. Goulden. 2003. Effect of stand age on whole ecosystem CO2 exchange in the Canadian boreal forest. Journal of Geophysical Research 108:1-11. https://doi.org/10.1029/2001JD000854

Mahon C. L., G. Holloway, P. Sólymos, S. G. Cumming, E. M. Bayne, F. K. A. Schmiegelow, and S. J. Song. 2016. Community structure and niche characteristics of upland and lowland western boreal birds at multiple spatial scales. Forest Ecology and Management 361: 99-116. https://doi.org/10.1016/j.foreco.2015.11.007

Mahon, C. L., G. L. Holloway, E. M. Bayne, and J. D. Toms. 2019. Additive and interactive cumulative effects on boreal landbirds: winners and losers in a multi-stressor landscape. Ecological Applications:e01895. https://doi.org/10.1002/eap.1895

McGeoch, M. A., and S .L. Chown. 1998. Scaling up the value of bioindicators. Trends in Ecology and Evolution 13:46-47. https://doi.org/10.1016/S0169-5347(97)01279-2

Middleton, A. L. 2020. Chipping Sparrow (*Spizella passerina*), version 1.0. In Birds of the World (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.chispa.01

O'Hara, R. B., and D. J. Kotze. 2010. Do not log-transform count data. Methods in Ecology and Evolution 1:118-122. https://doi.org/10.1111/j.2041-210X.2010.00021.x

Padoa-Schioppa, E., M. Baietto, R. Massa, and L. Bottoni. 2006. Bird communities as bioindicators: The focal species concept in agricultural landscapes. Ecological Indicators 6:83-93. https://doi.org/10.1016/j.ecolind.2005.08.006

Pickard, D., A. Hall, C. Murray, L. Frid, C. Schwarz, and N. Ochoski. 2013. Long-term plot network: effectiveness monitoring program. Prepared for the Plot Network Task Group, Terrestrial Subgroup, Reclamation Working Group, Cumulative Environmental Management Association (CEMA), Fort McMurray, AB. 108 pp.

Pinno, B. D., and V. C. Hawkes. 2015. Temporal trends of ecosystem development on different site types in reclaimed boreal forests. Forests 6:2109-2124. https://doi.org/10.3390/f6062109

Porneluzi, P. M., M. A. Van Horn, and T. M. Donovan. 2011. Ovenbird (*Seiurus aurocapilla*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.ovenbi1.01

RStudio Team. 2020. RStudio: Integrated Development Environment for R. RStudio, PBC, Boston, MA. URL http://www.rstudio.com/ https://doi.org/10.4135/9781526472564

Ralph, C. J., and S. Droege. 1995. Monitoring bird populations by point counts. Gen Tech. Rep. PSW-GTR-149. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S Department of Agriculture. 187 pp. https://doi.org/10.2737/PSW-GTR-149

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 41 pp. https://doi.org/10.2737/PSW-GTR-144

Reice, S. R., R. C. Wissmar, and R. J. Naiman. 1990. Disturbance regimes, resilience, and recovery of animal communities and habitats in lotic ecosystems. Environmental Management 14:647-659. https://doi.org/10.1007/BF02394715

Renwick, A.R., A. Johnston, A. Joys, S. E. Newson, D. G., Noble, and J. W. Pearce-Higgins. 2012. Composite bird indicators robust to variation in species selection and habitat specificity. Ecological Indicators 18:200-207. https://doi.org/10.1016/j.ecolind.2011.11.008

Rich, T. D. 2002. Using breeding land birds in the assessment of western riparian systems. Wildlife Society Bulletin 30:1128-1139.

Richards, S. A. 2008. Dealing with overdispersed count data in applied ecology. Journal of Applied Ecology 45:218-227. https://doi.org/10.1111/j.1365-2664.2007.01377.x

Rimmer, C. C., and K. P. McFarland. 2020. Tennessee Warbler (*Leiothlypis peregrina*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.tenwar.01

Rooney, R. C., S. E. Bayley, and D. W. Schindler. 2012. Oil sands mining and reclamation cause massive loss of peatland and stored carbon. Proceedings of the National Academy of Sciences 109:4933-4937. https://doi.org/10.1073/pnas.1117693108

Rowland, S. M., C. E. Prescott, S. J. Grayston, S. A. Quideau, and G. E. Bradfield. 2009. Recreating a functioning forest soil in reclaimed oil sands in northern Alberta: an approach for measuring success in ecological restoration. Journal of Environmental Quality 38:1580-1590. https://doi.org/10.2134/jeq2008.0317

Schieck J., and S. J. Song. 2006. Changes in bird communities throughout succession following fire and harvest in boreal forests of western North America: literature review and meta-analyses. Canadian Journal of Forestry Research 36: 1299-1318. https://doi.org/10.1139/x06-017

Schieck, J., and K. A. Hobson. 2000. Bird communities associated with live residual tree patches within cut blocks and burned habitat in mixedwood boreal forests. Canadian Journal of Forest Research 30:1281-1295. https://doi.org/10.1139/x00-061

Schmiegelow, F. K. A., and M. Mönkkönen. 2002. Habitat loss and fragmentation in dynamic landscapes: avian perspectives from the boreal forest. Ecological Applications 12:375-389. https://doi.org/10.1890/1051-0761(2002)012[0375:hlafid]2.0.co;2

Searle, S. R., G. Casella, and C. E. McCulloch. 1992. Variance Components, New York: John Wiley & Sons.

Semenchuk, G. P. 2007. The Atlas of Breeding Birds of Alberta: A Second Look. Federation of Alberta Naturalists. Edmonton, Alberta.

Siitonen, J., P. Martikainen, P. Punttila, and J. Rauh. 2000. Coarse woody debris and stand characteristics in mature managed and old-growth boreal mesic forests in southern Finland. Forest Ecology and Management 128:211-225. https://doi.org/10.1016/S0378-1127(99)00148-6

Sousa, W. P. 1980. The responses of a community to disturbance: The importance of successional age and species' life histories. Oecologia 45:72-81. https://doi.org/10.1007/BF00346709

Stephens, J. L., E. C. Dinger, J. D. Alexander, S. R. Mohren, C. J. Ralph, and D. A. Sarr. 2016. Bird communities and environmental correlates in southern Oregon and northern

California. USA. PloS One 11:e e0163906. https://doi.org/10.1371/journal.pone.0163906

Temple, S. A., and J. A. Wiens. 1989. Bird Populations and environmental changes: can birds be bio-indicators? American Birds 43:260-270.

van Wilgenburg S. L., K. A. Hobson, and N. Koper. 2013. Estimated avian nest loss associated with oil and gas exploration and extraction in the Western Canadian sedimentary basin. Avian Conservation and Ecology 8(2):9. http://dx.doi.org/10.5751/ACE-00585-080209

van Wilgenburg, S. L., K. A. Hobson, K. J. Kardynal, and E. M. Beck. 2018. Temporal changes in avian abundance in aspen-dominated boreal mixedwood forests of central Saskatchewan, Canada. Avian Conservation and Ecology 13(1):3. http://doi.org/10.5751/ACE-01145-130103

Vanschoenwinkel, B., F. Buschke, and L. Brendonck (2013). Disturbance regime alters the impact of dispersal on alpha and beta diversity in a natural metacommunity. Ecology 94(11) 2547-2557. https://doi.org/10.1890/12-1576.1

Venier L. A., and J. L. Pearce. 2005. Boreal bird community response to jack pine forest succession. Forest Ecology and Management 217:19-36. https://doi.org/10.1016/j.foreco.2005.05.058

Versluijs M., S. Eggers, J. Hjältén, T. Löfroth, and J. M. Roberge. 2017. Ecological restoration in boreal forest modifies the structure of bird assemblages. Forest Ecology and Management 401:75-88. https://doi.org/10.1016/j.foreco.2017.06.055

Wells, J., and P. Blancher. 2011. Global role for sustaining bird populations. Pages 7-22 in J. Wells, editor. Boreal birds of North America: a hemispheric view of their conservation links and significance. Studies in Avian Biology 41. University of California Press, Berkeley, California, USA. https://doi.org/10.1525/9780520950580-005

Williams, J. W., S. T. Jackson, and J. E. Kutzbach. 2007. Projected distributions of novel and disappearing climates by 2100 AD. Proceedings of the National Academy of Sciences 104:5738-5742. https://doi.org/10.1073/pnas.0606292104

Wilson, S. J., and E. B. Bayne. 2019. Songbird community response to regeneration of reclaimed wellsites in the boreal forest of Alberta. Journal of Ecoacoustics 3:#I4B2LF. https://doi.org/10.22261/JEA.I4B2LF

Editor-in-Chief: Keith A.Hobson
Subject Editor: Pierre Drapeau

Sponsored by the Society of Canadian Ornithologists and Birds Canada

Parrainée par la Société des ornithologistes du Canada et Oiseaux Canada

Appendix 1. Bird species codes, common names, and scientific names.

Code	Common Name	Binomial Name
ALFL	Alder Flycatcher	*Empidonax alnorum*
AMCO	American Coot	*Fulica americana*
AMCR	American Crow	*Corvus brachyrhynchos*
AMGO	American Goldfinch	*Spinus tristis*
AMKE	American Kestrel	*Falco sparverius*
AMPI	American Pipit	*Anthus rubescens*
AMRE	American Redstart	*Setophaga ruticilla*
AMRO	American Robin	*Turdus migratorius*
AMWI	American Wigeon	*Mareca americana*
ATTW	American Three-toed Woodpecker	*Picoides dorsalis*
BAEA	Bald Eagle	*Haliaeetus leucocephalus*
BANS	Bank Swallow	*Riparia riparia*
BARS	Barn Swallow	*Hirundo rustica*
BAWW	Black-and-white Warbler	*Mniotilta varia*
BBMA	Black-billed Magpie	*Pica hudsonia*
BBWA	Bay-breasted Warbler	*Setophaga castanea*
BBWO	Black-backed Woodpecker	*Picoides arcticus*
BCCH	Black-capped Chickadee	*Poecile atricapillus*
BEKI	Belted Kingfisher	*Megaceryle alcyon*
BHCO	Brown-headed Cowbird	*Molothrus ater*
BHVI	Blue-headed Vireo	*Vireo solitarius*
BLJA	Blue Jay	*Cyanocitta cristata*
BLPW	Blackpoll Warbler	*Setophaga striata*
BLTE	Black Tern	*Chlidonias niger*
BOCH	Boreal Chickadee	*Poecile hudsonicus*
BOGU	Bonaparte's Gull	*Chroicocephalus philadelphia*
BRBL	Brewer's Blackbird	*Euphagus cyanocephalus*
BRCR	Brown Creeper	*Certhia americana*
BTNW	Black-throated Green Warbler	*Setophaga virens*
BUFF	Bufflehead	*Bucephala albeola*
BWHA	Broad-winged Hawk	*Buteo platypterus*
BWTE	Blue-winged Teal	*Spatula discors*
CAGU	California Gull	*Larus californicus*
CAJA	Canada Jay	*Perisoreus canadensis*
CANG	Canada Goose	*Branta canadensis*
CANV	Canvasback	*Aythya valisineria*
CAWA	Canada Warbler	*Cardellina canadensis*

CCSP	Clay-colored Sparrow	*Spizella pallida*
CEDW	Cedar Waxwing	*Bombycilla cedrorum*
CHSP	Chipping Sparrow	*Spizella passerina*
CLSW	Cliff Swallow	*Petrochelidon pyrrhonota*
CMWA	Cape May Warbler	*Setophaga tigrina*
COGO	Common Goldeneye	*Bucephala clangula*
COGR	Common Grackle	*Quiscalus quiscula*
COLO	Common Loon	*Gavia immer*
COME	Common Merganser	*Mergus merganser*
CONI	Common Nighthawk	*Chordeiles minor*
CONW	Connecticut Warbler	*Oporornis agilis*
CORA	Common Raven	*Corvus corax*
CORE	Common Redpoll	*Acanthis flammea*
COYE	Common Yellowthroat	*Geothlypis trichas*
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*
DEJU	Dark-eyed Junco	*Junco hyemalis*
DOWO	Downy Woodpecker	*Picoides pubescens*
EAGR	Eared Grebe	*Podiceps nigricollis*
EAKI	Eastern Kingbird	*Tyrannus tyrannus*
EUST	European Starling	*Sturnus vulgaris*
EVGR	Evening Grosbeak	*Coccothraustes vespertinus*
FOTE	Forster's Tern	*Sterna forsteri*
FRGU	Franklin's Gull	*Leucophaeus pipixcan*
GADW	Gadwall	*Mareca strepera*
GBHE	Great Blue Heron	*Ardea herodias*
GCKI	Golden-crowned Kinglet	*Regulus satrapa*
GGOW	Great Grey Owl	*Strix nebulosa*
GHOW	Great Horned Owl	*Bubo virginianus*
GLSA	Northern Flying Squirrel	*Glaucomys sabrinus*
GRJA	Gray Jay	*Perisoreus canadensis*
GRSC	Greater Scaup	*Aythya marila*
GRYE	Greater Yellowlegs	*Tringa melanoleuca*
GWFG	Greater White-fronted Goose	*Anser albifrons*
GWTE	Green-winged Teal	*Anas crecca*
HAWO	Hairy Woodpecker	*Dryobates villosus*
HAWO	Hairy Woodpecker	*Picoides villosus*
HERG	Herring Gull	*Larus argentatus*
HETH	Hermit Thrush	*Catharus guttatus*
HOGR	Horned Grebe	*Podiceps auritus*
HOLA	Horned Lark	*Eremophila alpestris*
HOME	Hooded Merganser	*Lophodytes cucullatus*

KILL	Killdeer	*Charadrius vociferus*
LALO	Lapland Longspur	*Calcarius lapponicus*
LCSP	LeConte's Sparrow	*Ammodramus leconteii*
LEFL	Least Flycatcher	*Empidonax minimus*
LEOW	Long-eared Owl	*Asio otus*
LESA	Least Sandpiper	*Calidris minutilla*
LESC	Lesser Scaup	*Aythya affinis*
LEYE	Lesser Yellowlegs	*Tringa flavipes*
LISP	Lincoln's Sparrow	*Melospiza lincolnii*
MALL	Mallard	*Anas platyrhynchos*
MAWA	Magnolia Warbler	*Setophaga magnolia*
MAWR	Marsh Wren	*Cistothorus palustris*
MERL	Merlin	*Falco columbarius*
MOBL	Mountain Bluebird	*Sialia currucoides*
MOWA	Mourning Warbler	*Geothlypis philadelphia*
NAWA	Nashville Warbler	*Oreothlypis ruficapilla*
NHOW	Northern Hawk Owl	*Surnia ulula*
NOFL	Northern Flicker	*Colaptes auratus*
NOHA	Northern Harrier	*Circus hudsonius*
NOPI	Northern Pintail	*Anas acuta*
NOSH	Northern Shoveler	*Spatula clypeata*
NOWA	Northern Waterthrush	*Parkesia noveboracensis*
NSHO	Northern Shoveler	*Spatula clypeata*
OCWA	Orange-crowned Warbler	*Oreothlypis celata*
OSFL	Olive-sided Flycatcher	*Contopus cooperi*
OVEN	Ovenbird	*Seiurus aurocapilla*
PAWA	Palm Warbler	*Setophaga palmarum*
PBGR	Pied-billed Grebe	*Podilymbus podiceps*
PHVI	Philadelphia Vireo	*Vireo philadelphicus*
PISI	Pine Siskin	*Spinus pinus*
PIWO	Pileated Woodpecker	*Dryocopus pileatus*
PUFI	Purple Finch	*Haemorhous purpureus*
RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*
RBGU	Ring-billed Gull	*Larus delawarensis*
RBNU	Red-breasted Nuthatch	*Sitta canadensis*
RCKI	Ruby-crowned Kinglet	*Regulus calendula*
RECR	Red Crossbill	*Loxia curvirostra*
REDH	Redhead	*Aythya americana*
REVI	Red-eyed Vireo	*Vireo olivaceus*
RLHA	Rough-legged Hawk	*Buteo lagopus*
RNDU	Ring-necked Duck	*Aythya collaris*

RNGR	Red-necked Grebe	*Podiceps grisegena*
RTHA	Red-tailed Hawk	*Buteo jamaicensis*
RUBL	Rusty Blackbird	*Euphagus carolinus*
RUDU	Ruddy Duck	*Oxyura jamaicensis*
RUGR	Ruffed Grouse	*Bonasa umbellus*
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*
SACR	Sandhill Crane	*Antigone canadensis*
SAVS	Savannah Sparrow	*Passerculus sandwichensis*
SEWR	Sedge Wren	*Cistothorus platensis*
SMLO	Smith's Longspur	*Calcarius pictus*
SNBU	Snow Bunting	*Plectrophenax nivalis*
SNOW	Snowy Owl	*Bubo scandiacus*
SORA	Sora	*Porzana carolina*
SOREX	Sorex Sp.	*Sorex sp.*
SOSA	Solitary Sandpiper	*Tringa solitaria*
SOSP	Song Sparrow	*Melospiza melodia*
SPGR	Spruce Grouse	*Falcipennis canadensis*
SPSA	Spotted Sandpiper	*Actitis macularius*
SSHA	Sharp-shinned Hawk	*Accipiter striatus*
STGR	Sharp-tailed Grouse	*Tympanuchus phasianellus*
SUSC	Surf Scoter	*Melanitta perspicillata*
SWSP	Swamp Sparrow	*Melospiza georgiana*
SWTH	Swainson's Thrush	*Catharus ustulatus*
TAMI	Least Chipmunk	*Tamias minimus*
TEWA	Tennessee Warbler	*Oreothlypis peregrina*
TRES	Tree Swallow	*Tachycineta bicolor*
TUSW	Tundra Swan	*Cygnus columbianus*
TYPH	Sharp-tailed Grouse	*Tympanuchus phasianellus*
VESP	Vesper Sparrow	*Pooecetes gramineus*
WAVI	Warbling Vireo	*Vireo gilvus*
WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*
WETA	Western Tanager	*Piranga ludoviciana*
WEWP	Western Wood-Pewee	*Contopus sordidulus*
WIPT	Willow Ptarmigan	*Lagopus lagopus*
WISN	Wilson's Snipe	*Gallinago delicata*
WIWA	Wilson's Warbler	*Cardellina pusilla*
WIWR	Winter Wren	*Troglodytes hiemalis*
WTSP	White-throated Sparrow	*Zonotrichia albicollis*
WWCR	White-winged Crossbill	*Loxia leucoptera*
YBFL	Yellow-bellied Flycatcher	*Empidonax flaviventris*
YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*

YEWA	Yellow Warbler	*Setophaga petechia*
YHBL	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
YRWA	Yellow-rumped Warbler	*Setophaga coronata*

Appendix 2. Summary of bird species mean abundance and standard error at each treatment and age combination

Treatment	Species	Age	Mean ± SE
BRN	ALFL	2	0 ± 0
		3	1.00 ± 0.65
		4	3.59 ± 1.39
		5	0.53 ± 0.23
		6	4.71 ± 1.34
	AMCR	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	AMRE	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	AMRO	2	1.25 ± 0.845
		3	2.78 ± 1.03
		4	3.29 ± 1.2
		5	0.91 ± 0.47
		6	4.35 ± 1.06
	ATTW	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BANS	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BARS	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0.18 ± 0.18

BAWW	2	0 ± 0
	3	0 ± 0
	4	0.41 ± 0.41
	5	0 ± 0
	6	0 ± 0
BBMA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BBWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BBWO	2	0.75 ± 0.75
	3	0 ± 0
	4	0 ± 0
	5	1.47 ± 0.65
	6	0.59 ± 0.34
BCCH	2	1.50 ± 1.04
	3	0 ± 0
	4	0 ± 0
	5	0.18 ± 0.18
	6	0 ± 0
BHCO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BHVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BLJA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BOCH	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BRBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BRCR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BTNW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CAJA	2	1.25 ± 1.25
	3	1.44 ± 0.79
	4	0.35 ± 0.35
	5	0.27 ± 0.27
	6	0 ± 0
CAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CCSP	2	0.92 ± 0.92
	3	2.17 ± 0.91
	4	0.53 ± 0.32
	5	4.15 ± 1.05
	6	4.62 ± 1.51
CEDW	2	0 ± 0
	3	0 ± 0
	4	0.41 ± 0.41
	5	0 ± 0
	6	1.03 ± 0.55
CHSP	2	5.00 ± 0.90
	3	2.28 ± 0.78

	4	0.06 ± 0.06
	5	3.29 ± 1.07
	6	4.03 ± 1.12
CLSW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CMWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
COGR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CONW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CORA	2	0 ± 0
	3	0.22 ± 0.22
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
COYE	2	0.33 ± 0.23
	3	0.50 ± 0.39
	4	1.59 ± 0.86
	5	2.12 ± 0.68
	6	2.47 ± 1.03
DEJU	2	0.42 ± 0.42
	3	0 ± 0
	4	0 ± 0
	5	0.62 ± 0.33
	6	0.47 ± 0.41
DOWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0

	5	0.29 ± 0.29
	6	0 ± 0
EAKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
GCKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
HAWO	2	0 ± 0
	3	0.17 ± 0.17
	4	0 ± 0
	5	0.21 ± 0.21
	6	0.35 ± 0.35
HETH	2	2.58 ± 1.34
	3	2.00 ± 0.848
	4	1.53 ± 0.88
	5	0.74 ± 0.37
	6	5.35 ± 1.49
LCSP	2	0.25 ± 0.25
	3	0.39 ± 0.39
	4	0 ± 0
	5	0.03 ± 0.03
	6	1.06 ± 0.61
LEFL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	1.27 ± 0.61
	6	3.26 ± 1.28
LISP	2	2.5 ± 1.03
	3	3.5 ± 1.04
	4	2.94 ± 1.27
	5	3.91 ± 0.80
	6	8.65 ± 2.28
MAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0

	6	0 ± 0
MAWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
MOBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
MOWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
NOFL	2	0.92 ± 0.92
	3	0 ± 0
	4	0.29 ± 0.29
	5	0.21 ± 0.16
	6	1.53 ± 0.64
NOWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
OCWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
OVEN	2	1.08 ± 1.08
	3	0.28 ± 0.28
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0.47 ± 0.26
	6	0.68 ± 0.38

PHVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PISI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PIWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0.38 ± 0.38
	6	0.24 ± 0.24
PUFI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RBGR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.32 ± 0.32
RBNU	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RCKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RECR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
REVI	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	5	0.03 ± 0.03
	6	1.18 ± 0.64
RUBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RWBL	2	0 ± 0
	3	0 ± 0
	4	0.47 ± 0.47
	5	0 ± 0
	6	0 ± 0
SAVS	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SEWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SOSP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SWSP	2	0.83 ± 0.46
	3	0.11 ± 0.11
	4	0.29 ± 0.29
	5	0.50 ± 0.35
	6	1.82 ± 0.97
SWTH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.56 ± 0.45
TEWA	2	0 ± 0
	3	0.22 ± 0.17

	4	1.29 ± 0.79
	5	2.12 ± 0.66
	6	0.97 ± 0.55
TRES	2	0.50 ± 0.50
	3	0.72 ± 0.41
	4	1.82 ± 0.76
	5	0.47 ± 0.47
	6	0.56 ± 0.34
VESP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
WAVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
WETA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.15 ± 0.15
WEWP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0.12 ± 0.09
	6	0.27 ± 0.21
WIWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0.88 ± 0.42
	6	2.68 ± 1.09
WIWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
WTSP	2	6.08 ± 1.76
	3	5.61 ± 1.54
	4	5.18 ± 1.42

		5	6.18 ± 1.18
		6	8.65 ± 1.64
	WWCR	2	0 ± 0
		3	0 ± 0
		4	0.65 ± 0.65
		5	0 ± 0
		6	0 ± 0
	YBFL	2	1.42 ± 0.97
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YBSA	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YEWA	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YRWA	2	0.75 ± 0.75
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0.03 ± 0.03
CLR	ALFL	2	2.22 ± 1.10
		3	0 ± 0
		4	2.31 ± 1.22
		6	0.87 ± 0.52
		7	6.67 ± 2.36
		8	2.17 ± 1.80
		9	1.20 ± 1.20
		10	3.50 ± 1.60
		11	1.83 ± 1.38
		16	2.56 ± 1.69
		18	0 ± 0
	AMCR	2	0 ± 0
		3	0 ± 0
		4	0 ± 0

	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
AMRE	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	1.00 ± 0.91
	16	0 ± 0
	18	0 ± 0
AMRO	2	0.89 ± 0.66
	3	0.13 ± 0.13
	4	0.19 ± 0.19
	6	0 ± 0
	7	1.33 ± 0.88
	8	1.83 ± 1.83
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	2.00 ± 1.56
	18	0 ± 0
ATTW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0

BANS	2	0 ± 0
	3	0 ± 0
	4	0.81 ± 0.81
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BARS	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BAWW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0.89 ± 0.89
	18	0 ± 0
BBMA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0

	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BBWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BBWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BCCH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0.33 ± 0.33
	18	0 ± 0
BHCO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0

	8	0 ± 0
	9	0 ± 0
	10	1.08 ± 1.08
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BHVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BLJA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	2.50 ± 2.50
BOCH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BRBL	2	0 ± 0
	3	0 ± 0

	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	1.00 ± 1.00
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BRCR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
BTNW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CAJA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0.17 ± 0.17
	16	1.22 ± 1.22

	18	1.00 ± 1.00
CAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CCSP	2	10.39 ± 1.89
	3	7.63 ± 2.09
	4	9.19 ± 1.77
	6	6.80 ± 1.94
	7	10.67 ± 5.08
	8	16.17 ± 3.72
	9	0 ± 0
	10	26.25 ± 3.99
	11	1.08 ± 1.08
	16	1.56 ± 1.08
	18	0 ± 0
CEDW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	2.33 ± 1.48
	8	0.83 ± 0.83
	9	0.80 ± 0.80
	10	0.75 ± 0.75
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CHSP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0.667 ± 0.667
	8	0 ± 0
	9	0.8 ± 0.8

	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CLSW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CMWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
COGR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CONW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0

	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
CORA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.58 ± 0.58
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
COYE	2	2.72 ± 1.59
	3	0 ± 0
	4	2.13 ± 0.93
	6	0.6 ± 0.6
	7	7.83 ± 1.25
	8	5.00 ± 2.25
	9	1.20 ± 0.97
	10	14.50 ± 2.92
	11	1.42 ± 1.25
	16	0 ± 0
	18	0 ± 0
DEJU	2	0 ± 0
	3	0 ± 0
	4	1.19 ± 1.19
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
DOWO	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
EAKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
GCKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
HAWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0

	16	0.89 ± 0.89
	18	0 ± 0
HETH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0.60 ± 0.60
	10	0 ± 0
	11	2.00 ± 1.44
	16	0.78 ± 0.55
	18	0 ± 0
LCSP	2	9.06 ± 2.28
	3	2.63 ± 1.02
	4	6.50 ± 1.86
	6	4.13 ± 1.58
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	12.58 ± 4.21
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
LEFL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	2.67 ± 1.25
	16	0.33 ± 0.33
	18	0 ± 0
LISP	2	5.67 ± 2.23
	3	0.75 ± 0.75
	4	4.56 ± 1.29
	6	0.20 ± 0.20
	7	0.83 ± 0.40
	8	3.83 ± 3.64

	9	0 ± 0
	10	16.67 ± 4.86
	11	1.50 ± 1.33
	16	0 ± 0
	18	0 ± 0
MAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
MAWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
MOBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
MOWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0

	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
NOFL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0.20 ± 0.20
	10	0 ± 0
	11	0 ± 0
	16	0.56 ± 0.56
	18	3.50 ± 3.50
NOWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
OCWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	2.00 ± 1.66
	18	0 ± 0

OVEN	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	4.25 ± 1.36
	16	0.56 ± 0.44
	18	0.50 ± 0.50
PAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
PHVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
PISI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0

	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
PIWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
PUFI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
RBGR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0.22 ± 0.22
	18	0 ± 0
RBNU	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0

	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
RCKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
RECR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
REVI	2	0 ± 0
	3	0 ± 0
	4	0.19 ± 0.19
	6	0 ± 0
	7	0.33 ± 0.33
	8	2.33 ± 1.12
	9	0.80 ± 0.80
	10	2.67 ± 1.29
	11	10.17 ± 2.14
	16	4.78 ± 2.09
	18	7.50 ± 7.50
RUBL	2	0 ± 0
	3	0 ± 0

	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
RWBL	2	0.94 ± 0.89
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
SAVS	2	8.67 ± 2.85
	3	4.25 ± 1.42
	4	3.56 ± 1.14
	6	10.93 ± 1.92
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	16.00 ± 4.29
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
SEWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0

	18	0 ± 0
SOSP	2	4.22 ± 1.61
	3	0.25 ± 0.25
	4	3.44 ± 1.26
	6	0 ± 0
	7	1.17 ± 1.17
	8	1.33 ± 1.33
	9	0 ± 0
	10	22.75 ± 7.48
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
SWSP	2	3.22 ± 1.88
	3	1.25 ± 1.25
	4	1.75 ± 0.91
	6	1.00 ± 1.00
	7	1.50 ± 1.50
	8	2.33 ± 1.67
	9	0 ± 0
	10	0 ± 0
	11	0.33 ± 0.33
	16	0 ± 0
	18	0 ± 0
SWTH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0.67 ± 0.67
	18	0 ± 0
TEWA	2	0.67 ± 0.52
	3	0 ± 0
	4	0.56 ± 0.56
	6	0 ± 0
	7	0.17 ± 0.17
	8	0.83 ± 0.54
	9	0.80 ± 0.80

	10	1.42 ± 1.42
	11	1.67 ± 0.84
	16	9.78 ± 4.17
	18	3.50 ± 2.50
TRES	2	2.17 ± 1.04
	3	0 ± 0
	4	2.44 ± 1.23
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.50 ± 0.50
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
VESP	2	0.83 ± 0.83
	3	0 ± 0
	4	0.50 ± 0.50
	6	0.87 ± 0.68
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
WAVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
WETA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0

	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
WEWP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
WIWA	2	0 ± 0
	3	0 ± 0
	4	0.88 ± 0.88
	6	0 ± 0
	7	0 ± 0
	8	1.17 ± 1.17
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	2.67 ± 1.80
	18	0 ± 0
WIWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
WTSP	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	1.00 ± 1.00
	8	0.67 ± 0.67
	9	1.60 ± 0.68
	10	1.25 ± 0.95
	11	2.92 ± 1.13
	16	1.56 ± 0.69
	18	0 ± 0
WWCR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
YBFL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	16	0 ± 0
	18	0 ± 0
YBSA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0

		16	0 ± 0
		18	0 ± 0
	YEWA	2	0 ± 0
		3	0 ± 0
		4	0.63 ± 0.63
		6	0 ± 0
		7	3.00 ± 2.05
		8	2.17 ± 2.17
		9	0 ± 0
		10	1.25 ± 1.25
		11	0 ± 0
		16	0.89 ± 0.89
		18	0 ± 0
	YRWA	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		6	0 ± 0
		7	0 ± 0
		8	0 ± 0
		9	0 ± 0
		10	0 ± 0
		11	0 ± 0
		16	0 ± 0
		18	0 ± 0
COMP	ALFL	2	2.33 ± 1.36
		3	1.73 ± 1.12
		4	1.38 ± 0.44
		5	1.00 ± 0.46
		6	2.00 ± 0.769
		7	2.94 ± 1.54
	AMCR	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0.75 ± 0.75
		6	0 ± 0
		7	0 ± 0
	AMRE	2	0 ± 0
		3	0 ± 0
		4	0 ± 0
		5	0 ± 0
		6	0 ± 0

	7	1.19 ± 0.84
AMRO	2	0 ± 0
	3	0 ± 0
	4	1.00 ± 0.56
	5	0.06 ± 0.06
	6	0.50 ± 0.35
	7	0.69 ± 0.69
ATTW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BANS	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BARS	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BAWW	2	0 ± 0
	3	0 ± 0
	4	0.10 ± 0.10
	5	0 ± 0
	6	0 ± 0
	7	0.06 ± 0.06
BBMA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BBWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0

	6	0 ± 0
	7	0 ± 0
BBWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BCCH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.25 ± 0.25
	7	0 ± 0
BHCO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BHVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BLJA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BOCH	2	0 ± 0
	3	0.20 ± 0.20
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BRBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0

	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BRCR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
BTNW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
CAJA	2	0 ± 0
	3	0 ± 0
	4	0.07 ± 0.07
	5	0.06 ± 0.06
	6	0 ± 0
	7	0 ± 0
CAWA	2	0 ± 0
	3	0.07 ± 0.07
	4	0.17 ± 0.12
	5	0 ± 0
	6	0 ± 0
	7	0.25 ± 0.25
CCSP	2	17.67 ± 3.80
	3	4.47 ± 2.37
	4	9.10 ± 2.02
	5	2.19 ± 1.08
	6	2.34 ± 0.80
	7	6.38 ± 1.41
CEDW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0.13 ± 0.13
	6	0.81 ± 0.53
	7	2.06 ± 0.98
CHSP	2	3.22 ± 1.75
	3	0.60 ± 0.43

	4	1.24 ± 0.64
	5	0 ± 0
	6	1.94 ± 0.73
	7	1.56 ± 0.87
CLSW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
CMWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
COGR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
CONW	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.06 ± 0.06
	7	0 ± 0
CORA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.25 ± 0.25
COYE	2	2.44 ± 1.25
	3	3.47 ± 1.25
	4	4.07 ± 1.05
	5	3.50 ± 1.48
	6	2.34 ± 0.77
	7	10.19 ± 2.33
DEJU	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.06 ± 0.06
	7	0 ± 0
DOWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
EAKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.06 ± 0.06
	7	0 ± 0
GCKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
HAWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
HETH	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.03 ± 0.03
	7	0 ± 0
LCSP	2	10.33 ± 2.63
	3	3.00 ± 1.50
	4	4.86 ± 1.16
	5	3.75 ± 1.38
	6	2.06 ± 0.78
	7	4.81 ± 1.75

LEFL	2	0 ± 0
	3	0.07 ± 0.07
	4	0.38 ± 0.35
	5	0 ± 0
	6	0 ± 0
	7	1.19 ± 0.94
LISP	2	3.11 ± 1.1
	3	4.13 ± 1.25
	4	2.72 ± 0.86
	5	2.00 ± 0.86
	6	3.25 ± 0.80
	7	5.13 ± 2.40
MAWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.31 ± 0.31
	7	0 ± 0
MAWR	2	0 ± 0
	3	0 ± 0
	4	0.10 ± 0.10
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
MOBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
MOWA	2	0 ± 0
	3	0.40 ± 0.40
	4	0.24 ± 0.24
	5	0.38 ± 0.38
	6	0 ± 0
	7	0 ± 0
NOFL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0

	7	1.19 ± 0.95
NOWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
OCWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
OVEN	2	0 ± 0
	3	0 ± 0
	4	0.07 ± 0.07
	5	0.06 ± 0.06
	6	0.28 ± 0.25
	7	0.44 ± 0.44
PAWA	2	0 ± 0
	3	0.13 ± 0.13
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
PHVI	2	0 ± 0
	3	0.40 ± 0.40
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
PISI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
PIWO	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0

	6	0 ± 0
	7	0 ± 0
PUFI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
RBGR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
RBNU	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
RCKI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
RECR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
REVI	2	0 ± 0
	3	0.27 ± 0.27
	4	0.21 ± 0.13
	5	0.18 ± 0.14
	6	0.44 ± 0.31
	7	4.31 ± 1.59
RUBL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0

	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
RWBL	2	0 ± 0
	3	0 ± 0
	4	0.35 ± 0.35
	5	0 ± 0
	6	0.69 ± 0.66
	7	0 ± 0
SAVS	2	5.67 ± 1.29
	3	2.00 ± 1.37
	4	2.38 ± 0.89
	5	1.63 ± 0.98
	6	1.00 ± 0.51
	7	0.75 ± 0.63
SEWR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
SOSP	2	0 ± 0
	3	3.40 ± 1.64
	4	4.24 ± 1.58
	5	0.31 ± 0.25
	6	4.72 ± 1.00
	7	5.56 ± 1.76
SWSP	2	4.56 ± 2.80
	3	2.67 ± 1.74
	4	1.93 ± 0.94
	5	0 ± 0
	6	0.56 ± 0.39
	7	0 ± 0
SWTH	2	0 ± 0
	3	0 ± 0
	4	0.28 ± 0.19
	5	1.88 ± 1.69
	6	0.25 ± 0.25
	7	0 ± 0
TEWA	2	2.56 ± 1.85
	3	0.87 ± 0.41

	4	1.35 ± 0.70
	5	0 ± 0
	6	1.28 ± 0.44
	7	0.63 ± 0.44
TRES	2	1.00 ± 0.58
	3	1.80 ± 0.97
	4	3.14 ± 0.98
	5	0 ± 0
	6	0.59 ± 0.41
	7	0 ± 0
VESP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.34 ± 0.34
	7	0 ± 0
WAVI	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
WETA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
WEWP	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
WIWA	2	0 ± 0
	3	0 ± 0
	4	0.21 ± 0.21
	5	0.50 ± 0.50
	6	0 ± 0
	7	0 ± 0
WIWR	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
WTSP	2	0 ± 0
	3	0 ± 0
	4	1.41 ± 0.51
	5	2.50 ± 1.16
	6	1.34 ± 0.54
	7	0.44 ± 0.30
WWCR	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.06 ± 0.06
YBFL	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.31 ± 0.31
YBSA	2	0 ± 0
	3	0 ± 0
	4	0.24 ± 0.24
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
YEWA	2	0 ± 0
	3	0 ± 0
	4	0.03 ± 0.03
	5	0 ± 0
	6	0 ± 0
	7	0.13 ± 0.13
YRWA	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.13 ± 0.13
	7	0 ± 0

LOG	ALFL	4	0.68 ± 0.31
		5	0.25 ± 0.25
		6	0.90 ± 0.44
	AMCR	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	AMRE	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	AMRO	4	1.96 ± 0.82
		5	3.60 ± 1.10
		6	3.49 ± 0.84
	ATTW	4	0 ± 0
		5	0 ± 0
		6	0.13 ± 0.13
	BANS	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BARS	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BAWW	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BBMA	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BBWA	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BBWO	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BCCH	4	0 ± 0
		5	0.45 ± 0.45
		6	0 ± 0
	BHCO	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	BHVI	4	0 ± 0
		5	0 ± 0

	6	0.33 ± 0.33
BLJA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BOCH	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BRBL	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BRCR	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
BTNW	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CAJA	4	0.46 ± 0.46
	5	0 ± 0
	6	0 ± 0
CAWA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CCSP	4	5.09 ± 1.82
	5	2.45 ± 0.956
	6	2.72 ± 0.83
CEDW	4	0.09 ± 0.09
	5	0 ± 0
	6	0.05 ± 0.05
CHSP	4	2.91 ± 0.73
	5	3.20 ± 1.14
	6	2.87 ± 0.80
CLSW	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CMWA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
COGR	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
CONW	4	0 ± 0

	5	0 ± 0
	6	0 ± 0
CORA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
COYE	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
DEJU	4	3.23 ± 1.29
	5	7.35 ± 1.56
	6	4.54 ± 1.07
DOWO	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
EAKI	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
GCKI	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
HAWO	4	0 ± 0
	5	0 ± 0
	6	0.231 ± 0.231
HETH	4	1.00 ± 1.00
	5	0.55 ± 0.37
	6	0.21 ± 0.13
LCSP	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
LEFL	4	0 ± 0
	5	0.15 ± 0.15
	6	0.62 ± 0.40
LISP	4	0.27 ± 0.23
	5	0.15 ± 0.15
	6	0 ± 0
MAWA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
MAWR	4	0 ± 0
	5	0 ± 0
	6	0 ± 0

MOBL	4	0.27 ± 0.27
	5	0 ± 0
	6	0 ± 0
MOWA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
NOFL	4	0 ± 0
	5	0 ± 0
	6	0.23 ± 0.23
NOWA	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
OCWA	4	0 ± 0
	5	0.50 ± 0.50
	6	0.03 ± 0.03
OVEN	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PAWA	4	0 ± 0
	5	0 ± 0
	6	0.26 ± 0.26
PHVI	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PISI	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PIWO	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
PUFI	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RBGR	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RBNU	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RCKI	4	0 ± 0
	5	0 ± 0

	6	0 ± 0
RECR	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
REVI	4	0.23 ± 0.23
	5	0 ± 0
	6	0.23 ± 0.23
RUBL	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
RWBL	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SAVS	4	0 ± 0
	5	0.2 ± 0.2
	6	0 ± 0
SEWR	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SOSP	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SWSP	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
SWTH	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
TEWA	4	0.64 ± 0.48
	5	1.65 ± 0.76
	6	0.26 ± 0.26
TRES	4	0.77 ± 0.61
	5	0 ± 0
	6	0.13 ± 0.13
VESP	4	1.09 ± 0.50
	5	1.95 ± 1.10
	6	3.03 ± 0.62
WAVI	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
WETA	4	0 ± 0

		5	0.10 ± 0.07
		6	0 ± 0
	WEWP	4	0 ± 0
		5	0.10 ± 0.07
		6	0.10 ± 0.06
	WIWA	4	0 ± 0
		5	0 ± 0
		6	0.33 ± 0.17
	WIWR	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	WTSP	4	3.45 ± 1.13
		5	3.40 ± 1.12
		6	4.64 ± 1.01
	WWCR	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YBFL	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YBSA	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YEWA	4	0 ± 0
		5	0 ± 0
		6	0 ± 0
	YRWA	4	0.64 ± 0.43
		5	0.70 ± 0.47
		6	1.03 ± 0.43
MF	ALFL	-	0.16 ± 0.09
	AMCR	-	0.09 ± 0.06
	AMRE	-	0.47 ± 0.18
	AMRO	-	1.17 ± 0.30
	ATTW	-	0.10 ± 0.07
	BANS	-	0 ± 0
	BARS	-	0 ± 0
	BAWW	-	0.47 ± 0.15
	BBMA	-	0.04 ± 0.04
	BBWA	-	0.04 ± 0.04
	BBWO	-	0.06 ± 0.06
	BCCH	-	0.39 ± 0.15

BHCO	-	0 ± 0
BHVI	-	0.18 ± 0.09
BLJA	-	0.06 ± 0.04
BOCH	-	0.49 ± 0.14
BRBL	-	0 ± 0
BRCR	-	0.340 ± 0.14
BTNW	-	0.25 ± 0.16
CAJA	-	0.62 ± 0.18
CAWA	-	0.78 ± 0.22
CCSP	-	0.02 ± 0.02
CEDW	-	0.26 ± 0.11
CHSP	-	1.46 ± 0.23
CLSW	-	0 ± 0
CMWA	-	0.10 ± 0.07
COGR	-	0 ± 0
CONW	-	0.14 ± 0.06
CORA	-	0 ± 0
COYE	-	0.05 ± 0.05
DEJU	-	0.66 ± 0.18
DOWO	-	0.11 ± 0.11
EAKI	-	0 ± 0
GCKI	-	0.11 ± 0.07
HAWO	-	0.37 ± 0.15
HETH	-	0.08 ± 0.04
LCSP	-	0 ± 0
LEFL	-	1.12 ± 0.33
LISP	-	0.05 ± 0.03
MAWA	-	0.41 ± 0.16
MAWR	-	0 ± 0
MOBL	-	0 ± 0
MOWA	-	0.61 ± 0.17
NOFL	-	0.53 ± 0.22
NOWA	-	0.07 ± 0.07
OCWA	-	0 ± 0
OVEN	-	2.60 ± 0.42
PAWA	-	0.14 ± 0.08
PHVI	-	0.10 ± 0.06
PISI	-	0.04 ± 0.04
PIWO	-	0.04 ± 0.04
PUFI	-	0.02 ± 0.02
RBGR	-	0.42 ± 0.17

	RBNU	-	0.35 ± 0.13
	RCKI	-	0.28 ± 0.10
	RECR	-	0.07 ± 0.07
	REVI	-	1.28 ± 0.32
	RUBL	-	0 ± 0
	RWBL	-	0 ± 0
	SAVS	-	0 ± 0
	SEWR	-	0 ± 0
	SOSP	-	0 ± 0
	SWSP	-	0.08 ± 0.08
	SWTH	-	1.76 ± 0.41
	TEWA	-	2.82 ± 0.34
	TRES	-	0 ± 0
	VESP	-	0 ± 0
	WAVI	-	0.05 ± 0.05
	WETA	-	0.68 ± 0.16
	WEWP	-	0.03 ± 0.03
	WIWA	-	0.01 ± 0.01
	WIWR	-	0.13 ± 0.08
	WTSP	-	2.61 ± 0.34
	WWCR	-	0.37 ± 0.16
	YBFL	-	0.04 ± 0.04
	YBSA	-	0.76 ± 0.24
	YEWA	-	0.08 ± 0.06
	YRWA	-	1.19 ± 0.23
REC	ALFL	1	0 ± 0
		2	0 ± 0
		3	0.12 ± 0.12
		4	0.05 ± 0.05
		5	0.57 ± 0.30
		6	1.71 ± 0.59
		7	3.19 ± 0.86
		8	6.10 ± 1.68
		9	3.78 ± 1.42
		10	8.83 ± 1.72
		11	2.11 ± 1.42
		12	2.85 ± 0.998
		13	2.56 ± 1.02
		14	0.35 ± 0.30
		15	1.46 ± 0.91
		16	0 ± 0

	17	0 ± 0
	18	0.33 ± 0.23
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
AMCR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.21 ± 0.21
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0.78 ± 0.78
	29	0.25 ± 0.25
	33	0 ± 0
AMRE	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0

	10	0 ± 0
	11	1.11 ± 1.11
	12	0 ± 0
	13	0.78 ± 0.78
	14	0 ± 0
	15	0 ± 0
	16	1.33 ± 1.33
	17	0 ± 0
	18	0.58 ± 0.43
	19	0 ± 0
	20	0 ± 0
	26	0.50 ± 0.50
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
AMRO	1	0.14 ± 0.14
	2	0 ± 0
	3	0.31 ± 0.31
	4	0.32 ± 0.32
	5	0.06 ± 0.06
	6	0 ± 0
	7	0.58 ± 0.29
	8	0.33 ± 0.33
	9	1.78 ± 0.73
	10	0.06 ± 0.06
	11	0 ± 0
	12	3.85 ± 1.34
	13	1.89 ± 1.11
	14	3.47 ± 1.55
	15	3.64 ± 2.62
	16	0 ± 0
	17	11.80 ± 7.36
	18	0.08 ± 0.08
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0.67 ± 0.44
	29	0 ± 0
	33	7.00 ± 2.83
ATTW	1	0 ± 0
	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BANS	1	0 ± 0
	2	0 ± 0
	3	0.04 ± 0.04
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0

	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BARS	1	0 ± 0
	2	0 ± 0
	3	1.04 ± 0.76
	4	0 ± 0
	5	0 ± 0
	6	0.05 ± 0.05
	7	0.21 ± 0.21
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BAWW	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0

	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	1.33 ± 1.33
	26	0 ± 0
	27	0.56 ± 0.56
	29	0 ± 0
	33	0 ± 0
BBMA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.21 ± 0.21
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0.05 ± 0.05
	13	0.56 ± 0.56
	14	0 ± 0
	15	0.27 ± 0.27
	16	0 ± 0
	17	0 ± 0
	18	0.08 ± 0.08
	19	0 ± 0
	20	0 ± 0
	26	0.67 ± 0.67
	27	0.44 ± 0.29
	29	0 ± 0
	33	3.83 ± 2.95
BBWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0

	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BBWO	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0

	29	0 ± 0
	33	0 ± 0
BCCH	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BHCO	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.07 ± 0.07
	8	0 ± 0
	9	0 ± 0
	10	0.33 ± 0.33
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0

	16	0 ± 0
	17	2.40 ± 2.40
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BHVI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BLJA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0

	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0.44 ± 0.44
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BOCH	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BRBL	1	0.14 ± 0.14

	2	0 ± 0
	3	1.69 ± 0.73
	4	0.32 ± 0.30
	5	0.06± 0.06
	6	0.46 ± 0.33
	7	0.65 ± 0.43
	8	0.57 ± 0.57
	9	0.22 ± 0.22
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BRCR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0

	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
BTNW	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
CAJA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0

	12	0.50 ± 0.50
	13	2.11 ± 1.46
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0.67 ± 0.67
CAWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
CCSP	1	2.14 ± 1.39
	2	9.73 ± 4.07
	3	2.89 ± 0.79
	4	6.66 ± 0.88

	5	12.00 ± 2.26
	6	14.96 ± 1.53
	7	12.51 ± 1.66
	8	12.86 ± 1.89
	9	7.61 ± 1.63
	10	17.39 ± 2.86
	11	2.78 ± 1.67
	12	4.70 ± 1.42
	13	8.56 ± 1.92
	14	5.18 ± 1.55
	15	6.18 ± 2.85
	16	0 ± 0
	17	12.80 ± 5.45
	18	2.00 ± 1.39
	19	2.67 ± 1.45
	20	2.67 ± 2.67
	26	0.17 ± 0.17
	27	0.67 ± 0.67
	29	0 ± 0
	33	0 ± 0
CEDW	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.24 ± 0.24
	7	0.58 ± 0.42
	8	0 ± 0
	9	0.67 ± 0.49
	10	1.06 ± 1.06
	11	0 ± 0
	12	1.10 ± 0.76
	13	1.89 ± 1.89
	14	0.82 ± 0.82
	15	2.27 ± 1.56
	16	0 ± 0
	17	3.20 ± 3.20
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0

	27	0 ± 0
	29	0.50 ± 0.50
	33	2.33 ± 1.56
CHSP	1	0 ± 0
	2	0.73 ± 0.73
	3	0 ± 0
	4	0.48 ± 0.33
	5	0 ± 0
	6	0.18 ± 0.18
	7	0.19 ± 0.19
	8	2.10 ± 1.21
	9	1.22 ± 0.67
	10	1.94 ± 0.99
	11	1.22 ± 0.91
	12	2.20 ± 0.70
	13	6.11 ± 2.41
	14	5.18 ± 1.59
	15	4.64 ± 2.26
	16	2.00 ± 2.00
	17	3.00 ± 2.00
	18	2.42 ± 0.88
	19	2.00 ± 1.00
	20	2.33 ± 2.33
	26	6.17 ± 2.61
	27	4.22 ± 1.60
	29	2.75 ± 1.55
	33	2.50 ± 1.31
CLSW	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.19 ± 0.19
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0

	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
CMWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0.83 ± 0.83
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
COGR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0.09 ± 0.09

	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
CONW	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0

CORA	1	1.00 ± 1.00
	2	0.55 ± 0.55
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
COYE	1	0 ± 0
	2	0.64 ± 0.64
	3	0.12 ± 0.12
	4	0.34 ± 0.24
	5	0.31 ± 0.22
	6	0.38 ± 0.22
	7	3.28 ± 0.95
	8	0 ± 0
	9	0.28 ± 0.28
	10	1.72 ± 1.17
	11	1.78 ± 1.78
	12	0.20 ± 0.156
	13	0 ± 0
	14	0.53 ± 0.53
	15	0.18 ± 0.18
	16	0 ± 0
	17	0 ± 0

	18	0 ± 0
	19	0 ± 0
	20	0.67 ± 0.33
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
DEJU	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0.22 ± 0.22
	29	0 ± 0
	33	0 ± 0
DOWO	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0

	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
EAKI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
GCKI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0

	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
HAWO	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0

	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
HETH	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0.33 ± 0.33
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
LCSP	1	0 ± 0
	2	2.82 ± 2.08
	3	4.77 ± 1.13
	4	3.50 ± 0.78
	5	4.89 ± 1.16
	6	5.24 ± 1.08
	7	5.91 ± 1.67
	8	1.95 ± 0.94
	9	0 ± 0
	10	0.72 ± 0.72
	11	0.33 ± 0.33
	12	0 ± 0
	13	1.00 ± 1.00

	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
LEFL	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	1.33 ± 0.90
	12	0.65 ± 0.48
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	1.00 ± 1.00
LISP	1	1.00 ± 1.00
	2	5.45 ± 2.37
	3	2.12 ± 0.87
	4	0.80 ± 0.35
	5	4.43 ± 0.94
	6	4.13 ± 0.92

	7	6.26 ± 1.21
	8	6.19 ± 1.68
	9	3.44 ± 0.96
	10	8.33 ± 2.72
	11	0.33 ± 0.33
	12	1.25 ± 0.58
	13	3.22 ± 1.54
	14	0.77 ± 0.389
	15	1.273 ± 0.79
	16	0 ± 0
	17	4.20 ± 2.69
	18	0.83 ± 0.61
	19	1.33 ± 1.33
	20	0 ± 0
	26	0 ± 0
	27	0.22 ± 0.22
	29	0 ± 0
	33	0 ± 0
MAWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0

	33	0 ± 0
MAWR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
MOBL	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0

	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
MOWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
NOFL	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0

	10	0.67 ± 0.67
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	2.20 ± 2.20
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	1.17 ± 1.17
NOWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	2.17 ± 2.17
OCWA	1	0 ± 0
	2	0 ± 0

	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.40 ± 0.40
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0.25 ± 0.25
	19	1.00 ± 1.00
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0.17 ± 0.17
OVEN	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0.70 ± 0.48
	13	0.67 ± 0.67
	14	0.24 ± 0.24
	15	1.09 ± 0.74
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0

	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	6.50 ± 3.75
PAWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
PHVI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0

	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
PISI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.89 ± 0.89
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
PIWO	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0

	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
PUFI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	1.22 ± 1.22
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0

	29	0 ± 0
	33	0 ± 0
RBGR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0.11 ± 0.11
	14	0.47 ± 0.37
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	1.33 ± 1.33
RBNU	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0

	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
RCKI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
RECR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0

	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
REVI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.09 ± 0.09
	7	1.21 ± 0.58
	8	0.52 ± 0.35
	9	0.61 ± 0.42
	10	1.78 ± 0.91
	11	0 ± 0
	12	1.00 ± 0.50
	13	2.11 ± 1.52
	14	0.24 ± 0.14
	15	1.36 ± 1.18
	16	6.33 ± 2.73
	17	0.80 ± 0.80
	18	1.08 ± 0.68
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	4.83 ± 2.27
RUBL	1	0 ± 0

	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.11 ± 0.11
	11	0.33 ± 0.33
	12	0.40 ± 0.40
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
RWBL	1	0 ± 0
	2	0 ± 0
	3	0.73 ± 0.53
	4	0 ± 0
	5	0.66 ± 0.42
	6	0.42 ± 0.30
	7	2.54 ± 0.72
	8	1.00 ± 0.95
	9	3.44 ± 1.73
	10	1.94 ± 1.41
	11	0.78 ± 0.47
	12	0.50 ± 0.37
	13	0 ± 0
	14	0 ± 0
	15	1.45 ± 1.45
	16	1.67 ± 1.67
	17	2.20 ± 2.20
	18	0 ± 0

	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
SAVS	1	7.43 ± 3.84
	2	5.00 ± 2.20
	3	5.65 ± 0.92
	4	8.20 ± 1.33
	5	14.11 ± 2.04
	6	12.16 ± 2.26
	7	7.74 ± 1.30
	8	8.10 ± 1.53
	9	5.72 ± 1.78
	10	4.44 ± 1.57
	11	0.78 ± 0.52
	12	0.70 ± 0.60
	13	0.22 ± 0.22
	14	0.77 ± 0.65
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0.33 ± 0.23
	19	0 ± 0
	20	0 ± 0
	26	0.33 ± 0.33
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
SEWR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0.06 ± 0.05
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0

	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
SOSP	1	0 ± 0
	2	5.00 ± 2.44
	3	0.50 ± 0.50
	4	1.84 ± 0.58
	5	3.09 ± 0.77
	6	2.95 ± 0.60
	7	2.40 ± 0.96
	8	0.95 ± 0.55
	9	0.44 ± 0.25
	10	4.56 ± 1.35
	11	0 ± 0
	12	0.20 ± 0.20
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
SWSP	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0

	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0.91 ± 0.63
	9	0.22 ± 0.22
	10	0 ± 0
	11	0.56 ± 0.56
	12	0.30 ± 0.30
	13	0 ± 0
	14	0.71 ± 0.71
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	1 ± 1
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
SWTH	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0.45 ± 0.45
	13	0.44 ± 0.44
	14	0 ± 0
	15	1.27 ± 1.27
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	1.67 ± 1.67
	26	0 ± 0

	27	0 ± 0
	29	0 ± 0
	33	7.33 ± 4.65
TEWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0.14 ± 0.08
	5	0 ± 0
	6	0.18 ± 0.16
	7	0 ± 0
	8	0.09 ± 0.09
	9	0 ± 0
	10	1.40 ± 0.77
	11	0.22 ± 0.22
	12	0 ± 0
	13	0 ± 0
	14	0.12 ± 0.12
	15	2.55 ± 1.64
	16	0 ± 0
	17	5.60 ± 3.44
	18	0.50 ± 0.50
	19	0 ± 0
	20	0.33 ± 0.33
	26	1.50 ± 1.50
	27	0.89 ± 0.89
	29	0 ± 0
	33	1.67 ± 0.84
TRES	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0.62 ± 0.35
	7	0.37 ± 0.26
	8	0 ± 0
	9	0.94 ± 0.59
	10	0 ± 0
	11	0.90 ± 0.77
	12	0.70 ± 0.50
	13	4.00 ± 2.04
	14	0 ± 0

	15	2.36 ± 1.25
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
VESP	1	0 ± 0
	2	0 ± 0
	3	1.62 ± 0.82
	4	0.27 ± 0.20
	5	0.63 ± 0.47
	6	0.29 ± 0.18
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
WAVI	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0

	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
WETA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0.33 ± 0.33
	29	0 ± 0
	33	0 ± 0

WEWP	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
WIWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0.18 ± 0.18
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.22 ± 0.22
	11	0.44 ± 0.44
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0

	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
WIWR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
WTSP	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0.14 ± 0.14
	9	1.00 ± 0.65
	10	3.72 ± 2.01

	11	0.67 ± 0.67
	12	2.45 ± 0.91
	13	3.11 ± 1.65
	14	4.00 ± 1.65
	15	4.18 ± 1.53
	16	2.67 ± 1.45
	17	9.60 ± 2.98
	18	2.83 ± 1.36
	19	0.33 ± 0.33
	20	6.67 ± 3.28
	26	3.50 ± 1.63
	27	2.56 ± 1.11
	29	0.75 ± 0.75
	33	15.50 ± 4.21
WWCR	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
YBFL	1	0 ± 0
	2	0 ± 0
	3	0 ± 0

	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
YBSA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0.44 ± 0.44
	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0

	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
YEWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0.61 ± 0.61
	11	0 ± 0
	12	0.20 ± 0.20
	13	6.22 ± 2.63
	14	0.12 ± 0.12
	15	1.09 ± 0.10
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	1.33 ± 0.99
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0
YRWA	1	0 ± 0
	2	0 ± 0
	3	0 ± 0
	4	0 ± 0
	5	0 ± 0
	6	0 ± 0
	7	0 ± 0
	8	0 ± 0
	9	0 ± 0
	10	0 ± 0
	11	0 ± 0
	12	0 ± 0
	13	0 ± 0

	14	0 ± 0
	15	0 ± 0
	16	0 ± 0
	17	0 ± 0
	18	0 ± 0
	19	0 ± 0
	20	0 ± 0
	26	0 ± 0
	27	0 ± 0
	29	0 ± 0
	33	0 ± 0

Appendix 3: Summary of similarity values (%) between treatment types in the Athabasca Oil Sands Region. BRN: Burned; CLR: Cleared; COMP: Compensation Lake Forest; LOG: Logged; MF: Mature Forest; REC: Reclaimed.

	BRN	CLR	COMP	LOG	MF
CLR	72				
COMP	71	78			
LOG	67	59	51		
MF	59	49	61	47	
REC	66	78	75	50	57

Appendix 4: Similarities percentages analysis (SIMPER) of bird communities in the Athabasca Oil Sands Region comparing communities between different treatments. Diss/SD: Dissimilarity over standard deviation of dissimilarity. BRN: Burned; CLR: Cleared; COMP: Compensation Lake; LOG: Logged; MF: Mature Forest; REC: Reclaimed.

CLR & COMP						
Average Dissimilarity = 57.31%						
	CLR	COMP				
Species	Abundance	Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
CCSP	1.15	1.25	3.17	1.10	5.53	5.53
SAVS	0.84	0.62	3.10	1.10	5.40	10.93
SOSP	0.66	0.91	3.07	1.14	5.35	16.28
LCSP	0.79	1.00	3.05	1.16	5.33	21.61
COYE	0.81	1.25	2.97	1.11	5.19	26.80
LISP	0.84	1.20	2.89	1.09	5.04	31.84
REVI	0.79	0.50	2.80	1.09	4.88	36.73
TEWA	0.91	0.82	2.55	1.08	4.45	41.17
ALFL	0.91	1.13	2.41	0.94	4.21	45.38
WTSP	0.57	0.72	2.34	1.04	4.08	49.46
CHSP	0.21	0.66	2.32	1.05	4.05	53.51
SWSP	0.39	0.37	1.96	0.88	3.42	56.94
OVEN	0.39	0.28	1.96	0.79	3.42	60.35
AMRO	0.47	0.33	1.94	0.92	3.38	63.74
TRES	0.31	0.45	1.91	0.88	3.34	67.08
LEFL	0.26	0.28	1.63	0.71	2.84	69.92
YEWA	0.35	0.19	1.47	0.77	2.56	72.48
CEDW	0.19	0.32	1.40	0.73	2.45	74.93
HETH	0.22	0.07	1.10	0.50	1.93	76.86
RBGR	0.19	0.12	0.94	0.55	1.64	78.50
WIWA	0.15	0.16	0.90	0.56	1.58	80.08
VESP	0.21	0.03	0.83	0.46	1.45	81.52
NOFL	0.14	0.10	0.82	0.47	1.43	82.96
SWTH	0.07	0.16	0.79	0.46	1.37	84.33
AMRE	0.08	0.13	0.69	0.44	1.21	85.54
CAWA	0.00	0.19	0.69	0.44	1.20	86.74
CAJA	0.11	0.09	0.68	0.44	1.19	87.93
RWBL	0.08	0.15	0.61	0.45	1.07	89.00
COMP & LOG						
Average Dissimilarity = 72.26%						

	COMP	LOG				
Species	Abundance	Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
DEJU	0.06	1.35	4.99	2.39	6.91	6.91
COYE	1.25	0.00	4.73	3.26	6.55	13.46
VESP	0.03	1.17	4.43	2.10	6.13	19.59
LISP	1.20	0.12	4.12	2.20	5.71	25.30
AMRO	0.33	1.30	3.97	1.67	5.49	30.78
LCSP	1.00	0.00	3.77	1.69	5.22	36.00
SOSP	0.91	0.00	3.35	1.32	4.64	40.64
CHSP	0.66	1.19	2.87	1.19	3.97	44.61
TEWA	0.82	0.30	2.73	1.20	3.77	48.38
WTSP	0.72	1.29	2.67	1.09	3.70	52.08
YRWA	0.03	0.66	2.46	1.05	3.40	55.48
CCSP	1.25	1.01	2.41	0.93	3.34	58.82
SAVS	0.62	0.05	2.31	1.00	3.19	62.01
ALFL	1.13	0.83	2.25	0.98	3.12	65.13
HETH	0.07	0.54	2.07	0.89	2.86	67.99
REVI	0.50	0.32	2.02	0.95	2.79	70.78
PAWA	0.09	0.53	2.02	0.82	2.79	73.57
TRES	0.45	0.24	1.79	0.85	2.48	76.05
CEDW	0.32	0.27	1.54	0.81	2.13	78.18
LEFL	0.28	0.26	1.49	0.76	2.06	80.23
SWSP	0.37	0.00	1.23	0.63	1.70	81.93
WIWA	0.16	0.18	0.98	0.59	1.36	83.29
OVEN	0.28	0.00	0.89	0.59	1.23	84.52
WEWP	0.00	0.21	0.82	0.50	1.13	85.66

COMP & MF

Average Dissimilarity = 80.68%

	COMP	MF				
Species	Abundance	Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
CCSP	1.25	0.00	4.15	2.19	5.14	5.14
COYE	1.25	0.06	4.07	2.42	5.04	10.19
LISP	1.20	0.05	3.85	2.27	4.77	14.96
ALFL	1.13	0.11	3.49	1.91	4.33	19.29
LCSP	1.00	0.00	3.36	1.60	4.17	23.45
OVEN	0.28	1.16	3.25	1.51	4.03	27.48
SOSP	0.91	0.00	2.99	1.28	3.71	31.18
YRWA	0.03	0.84	2.76	1.28	3.43	34.61

TEWA	0.82	1.20	2.62	1.15	3.25	37.86
WETA	0.07	0.73	2.24	1.21	2.78	40.64
WTSP	0.72	1.08	2.23	1.09	2.76	43.40
SWTH	0.16	0.72	2.19	1.17	2.71	46.11
CHSP	0.66	0.82	2.13	1.08	2.64	48.75
REVI	0.50	0.58	2.07	1.03	2.56	51.31
SAVS	0.62	0.00	2.06	0.96	2.55	53.86
AMRO	0.33	0.60	2.01	0.98	2.49	56.35
CAWA	0.19	0.55	1.85	0.93	2.29	58.64
CAJA	0.09	0.54	1.74	0.90	2.15	60.79
LEFL	0.28	0.38	1.63	0.81	2.02	62.81
DEJU	0.06	0.42	1.44	0.70	1.79	64.60
HETH	0.07	0.43	1.44	0.75	1.79	66.39
TRES	0.45	0.05	1.42	0.75	1.76	68.14
MOWA	0.12	0.39	1.39	0.74	1.72	69.86
MAWA	0.12	0.37	1.28	0.75	1.59	71.45
BOCH	0.03	0.39	1.27	0.73	1.58	73.03
BCCH	0.06	0.33	1.22	0.65	1.51	74.54
CEDW	0.32	0.16	1.16	0.72	1.44	75.98
SWSP	0.37	0.03	1.14	0.64	1.41	77.40
YBSA	0.13	0.29	1.12	0.66	1.39	78.79
RBNU	0.03	0.38	1.10	0.71	1.36	80.15
BAWW	0.13	0.27	1.05	0.66	1.31	81.46
RBGR	0.12	0.27	1.00	0.64	1.24	82.70
NOFL	0.10	0.25	0.98	0.59	1.21	83.90
YEWA	0.19	0.13	0.89	0.58	1.10	85.00
AMRE	0.13	0.23	0.89	0.61	1.10	86.10
CMWA	0.00	0.24	0.81	0.48	1.01	87.11

CLR & REC

Average Dissimilarity = 64.49%

Species	CLR Abundance	REC Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
SAVS	0.84	1.07	4.08	1.05	6.33	6.33
CCSP	1.15	1.37	3.89	0.96	6.03	12.37
LCSP	0.79	0.56	3.59	1.02	5.57	17.93
TEWA	0.91	0.36	3.54	1.21	5.50	23.43
LISP	0.84	0.97	3.52	1.08	5.46	28.89
REVI	0.79	0.49	3.36	1.04	5.22	34.11
ALFL	0.91	0.75	3.34	1.14	5.18	39.29

COYE	0.81	0.38	3.18	1.12	4.93	44.22
WTSP	0.57	0.62	3.05	1.02	4.73	48.94
SOSP	0.66	0.57	3.04	1.06	4.72	53.66
CHSP	0.21	0.61	2.71	0.92	4.20	57.86
AMRO	0.47	0.56	2.68	0.98	4.16	62.02
OVEN	0.39	0.13	2.15	0.69	3.33	65.35
SWSP	0.39	0.08	1.79	0.73	2.77	68.12
RWBL	0.08	0.40	1.72	0.74	2.67	70.79
YEWA	0.35	0.16	1.61	0.74	2.49	73.28
CEDW	0.19	0.27	1.55	0.68	2.41	75.69
VESP	0.21	0.22	1.55	0.62	2.40	78.09
TRES	0.31	0.16	1.52	0.71	2.36	80.45
LEFL	0.26	0.10	1.41	0.57	2.19	82.64
HETH	0.22	0.01	1.19	0.44	1.84	84.48
RBGR	0.19	0.08	0.99	0.49	1.53	86.01
NOFL	0.14	0.06	0.88	0.42	1.37	87.38
BRBL	0.04	0.14	0.74	0.40	1.15	88.53
WIWA	0.15	0.05	0.69	0.45	1.07	89.60

LOG & REC

Average Dissimilarity = 71.54%

Species	LOG Abundance	REC Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
DEJU	1.35	0.01	5.98	2.49	8.36	8.36
SAVS	0.05	1.07	4.69	1.36	6.55	14.91
VESP	1.17	0.22	4.59	1.63	6.41	21.32
WTSP	1.29	0.62	3.88	1.26	5.42	26.74
LISP	0.12	0.97	3.85	1.37	5.38	32.12
AMRO	1.30	0.56	3.84	1.23	5.37	37.49
CHSP	1.19	0.61	3.57	1.16	4.99	42.47
CCSP	1.01	1.37	3.23	0.98	4.52	46.99
ALFL	0.83	0.75	3.19	1.14	4.46	51.45
YRWA	0.66	0.00	2.86	1.04	4.00	55.45
LCSP	0.00	0.56	2.56	0.77	3.58	59.03
HETH	0.54	0.01	2.39	0.86	3.34	62.37
PAWA	0.53	0.05	2.32	0.78	3.24	65.61
REVI	0.32	0.49	2.29	0.94	3.20	68.80
SOSP	0.00	0.57	2.25	0.88	3.14	71.94
TEWA	0.30	0.36	2.05	0.81	2.86	74.81
CEDW	0.27	0.27	1.72	0.77	2.40	77.21

RWBL	0.00	0.40	1.56	0.71	2.18	79.39
COYE	0.00	0.38	1.43	0.66	2.00	81.39
TRES	0.24	0.16	1.28	0.63	1.79	83.19
LEFL	0.26	0.10	1.26	0.65	1.76	84.95
WEWP	0.21	0.00	0.96	0.50	1.34	86.29
BRBL	0.07	0.14	0.88	0.43	1.23	87.52
WIWA	0.18	0.05	0.79	0.48	1.11	88.63

CLR & BRN

Average Dissimilarity = 65.73%

Species	CLR Abundance	BRN Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
WTSP	0.57	1.55	3.66	1.49	5.56	5.56
CHSP	0.21	1.10	3.43	1.52	5.22	10.78
HETH	0.22	1.11	3.42	1.64	5.20	15.98
CCSP	1.15	0.90	3.21	1.19	4.89	20.87
LISP	0.84	1.21	2.93	1.10	4.46	25.34
SAVS	0.84	0.00	2.88	0.97	4.38	29.72
AMRO	0.47	1.08	2.87	1.27	4.36	34.08
REVI	0.79	0.31	2.73	1.07	4.15	38.23
COYE	0.81	0.78	2.69	1.17	4.10	42.33
LCSP	0.79	0.23	2.68	1.04	4.08	46.40
ALFL	0.91	1.15	2.50	1.01	3.80	50.21
LEFL	0.26	0.62	2.28	0.87	3.47	53.68
TRES	0.31	0.69	2.25	1.07	3.43	57.11
TEWA	0.91	0.81	2.23	1.06	3.40	60.51
SOSP	0.66	0.13	2.15	0.96	3.27	63.78
SWSP	0.39	0.47	1.91	0.96	2.90	66.68
OVEN	0.39	0.08	1.64	0.70	2.50	69.18
PAWA	0.05	0.43	1.57	0.72	2.39	71.57
WIWA	0.15	0.48	1.55	0.84	2.35	73.93
NOFL	0.14	0.40	1.54	0.78	2.34	76.27
CAJA	0.11	0.34	1.52	0.72	2.31	78.58
DEJU	0.04	0.32	1.25	0.64	1.90	80.48
BBWO	0.00	0.40	1.25	0.74	1.90	82.38
YEWA	0.35	0.08	1.19	0.71	1.82	84.19
CEDW	0.19	0.26	1.19	0.69	1.80	86.00
WEWP	0.00	0.20	0.82	0.43	1.25	87.24
VESP	0.21	0.04	0.81	0.47	1.24	88.48
YRWA	0.00	0.17	0.70	0.43	1.07	89.55

RBGR	0.19	0.04	0.70	0.48	1.07	90.62
SWTH	0.07	0.15	0.68	0.45	1.03	91.65

LOG & BRN

Average Dissimilarity = 57.15%

Species	LOG Abundance	BRN Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
VESP	1.17	0.04	4.11	2.07	7.20	7.20
LISP	0.12	1.21	3.94	1.79	6.89	14.09
DEJU	1.35	0.32	3.84	1.67	6.71	20.81
HETH	0.54	1.11	2.64	1.25	4.62	25.43
CCSP	1.01	0.90	2.60	1.08	4.54	29.97
TEWA	0.30	0.81	2.53	1.23	4.43	34.40
COYE	0.00	0.78	2.44	1.15	4.28	38.68
ALFL	0.83	1.15	2.38	1.07	4.17	42.85
TRES	0.24	0.69	2.27	1.14	3.97	46.82
YRWA	0.66	0.17	2.24	1.06	3.92	50.74
PAWA	0.53	0.43	2.18	0.96	3.82	54.56
LEFL	0.26	0.62	2.17	0.92	3.80	58.36
CHSP	1.19	1.10	1.74	0.85	3.04	61.40
AMRO	1.30	1.08	1.61	0.86	2.83	64.23
WIWA	0.18	0.48	1.58	0.85	2.76	66.99
REVI	0.32	0.31	1.48	0.85	2.58	69.57
CAJA	0.11	0.34	1.47	0.73	2.58	72.15
SWSP	0.00	0.47	1.46	0.82	2.55	74.70
NOFL	0.11	0.40	1.43	0.79	2.51	77.21
WTSP	1.29	1.55	1.36	0.93	2.37	79.58
CEDW	0.27	0.26	1.35	0.77	2.36	81.94
WEWP	0.21	0.20	1.28	0.65	2.24	84.19
BBWO	0.00	0.40	1.23	0.75	2.14	86.33
LCSP	0.00	0.23	0.66	0.50	1.15	87.48
SWTH	0.05	0.15	0.58	0.44	1.01	88.49

REC & BRN

Average Dissimilarity = 68.45%

Species	REC Abundance	BRN Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
SAVS	1.07	0.00	4.21	1.34	6.15	6.15
HETH	0.01	1.11	4.12	1.98	6.02	12.17
WTSP	0.62	1.55	3.95	1.31	5.78	17.95

CCSP	1.37	0.90	3.24	1.07	4.73	22.68
ALFL	0.75	1.15	3.12	1.16	4.56	27.24
AMRO	0.56	1.08	3.01	1.23	4.39	31.63
CHSP	0.61	1.10	2.96	1.14	4.33	35.96
LISP	0.97	1.21	2.77	1.03	4.05	40.01
TEWA	0.36	0.81	2.75	1.19	4.01	44.02
COYE	0.38	0.78	2.64	1.13	3.85	47.87
TRES	0.16	0.69	2.51	1.13	3.66	51.53
LCSP	0.56	0.23	2.36	0.84	3.45	54.98
LEFL	0.10	0.62	2.23	0.81	3.25	58.24
SOSP	0.57	0.13	2.06	0.90	3.01	61.25
REVI	0.49	0.31	1.97	0.89	2.88	64.13
PAWA	0.05	0.43	1.67	0.72	2.44	66.57
SWSP	0.08	0.47	1.64	0.84	2.40	68.96
CAJA	0.05	0.34	1.57	0.69	2.29	71.25
RWBL	0.40	0.13	1.55	0.77	2.27	73.52
NOFL	0.06	0.40	1.50	0.75	2.20	75.72
WIWA	0.05	0.48	1.49	0.78	2.18	77.90
CEDW	0.27	0.26	1.41	0.75	2.06	79.96
BBWO	0.00	0.40	1.31	0.73	1.92	81.88
DEJU	0.01	0.32	1.28	0.62	1.87	83.75
WEWP	0.00	0.20	0.88	0.43	1.28	85.03
VESP	0.22	0.04	0.87	0.50	1.27	86.31
YRWA	0.00	0.17	0.76	0.43	1.10	87.41

CLR & LOG

Average Dissimilarity = 74.06%

Species	CLR Abundance	LOG Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
DEJU	0.04	1.35	5.48	2.35	7.40	7.40
VESP	0.21	1.17	4.35	1.66	5.87	13.27
CHSP	0.21	1.19	4.25	1.69	5.74	19.02
AMRO	0.47	1.30	3.76	1.36	5.07	24.09
CCSP	1.15	1.01	3.52	1.14	4.75	28.84
WTSP	0.57	1.29	3.42	1.30	4.61	33.45
SAVS	0.84	0.05	3.24	1.01	4.37	37.82
TEWA	0.91	0.30	3.21	1.33	4.33	42.15
LISP	0.84	0.12	3.04	1.19	4.10	46.26
LCSP	0.79	0.00	3.00	1.01	4.05	50.31
REVI	0.79	0.32	2.97	1.12	4.01	54.32

COYE	0.81	0.00	2.93	1.17	3.95	58.27
ALFL	0.91	0.83	2.68	1.03	3.62	61.89
YRWA	0.00	0.66	2.67	1.04	3.61	65.50
HETH	0.22	0.54	2.40	0.93	3.24	68.74
SOSP	0.66	0.00	2.35	0.95	3.17	71.90
PAWA	0.05	0.53	2.17	0.78	2.93	74.83
OVEN	0.39	0.00	1.76	0.66	2.38	77.21
LEFL	0.26	0.26	1.67	0.74	2.25	79.46
TRES	0.31	0.24	1.57	0.77	2.12	81.58
SWSP	0.39	0.00	1.53	0.72	2.06	83.64
CEDW	0.19	0.27	1.46	0.71	1.98	85.62
YEWA	0.35	0.00	1.22	0.67	1.65	87.27
WIWA	0.15	0.18	1.01	0.58	1.36	88.63
NOFL	0.14	0.11	0.92	0.50	1.24	89.87
WEWP	0.00	0.21	0.89	0.50	1.20	91.07
CAJA	0.11	0.11	0.79	0.46	1.06	92.13

CLR & MF

Average Dissimilarity = 80.86%

	CLR	MF				
Species	Abundance	Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
CCSP	1.15	0.00	3.88	1.28	4.80	4.80
OVEN	0.39	1.16	3.20	1.40	3.96	8.76
YRWA	0.00	0.84	3.01	1.28	3.72	12.48
SAVS	0.84	0.00	2.88	0.95	3.56	16.03
ALFL	0.91	0.11	2.87	1.37	3.54	19.58
LISP	0.84	0.05	2.72	1.15	3.37	22.95
WTSP	0.57	1.08	2.71	1.21	3.35	26.30
LCSP	0.79	0.00	2.67	0.98	3.31	29.61
COYE	0.81	0.06	2.61	1.13	3.23	32.84
CHSP	0.21	0.82	2.58	1.21	3.19	36.03
REVI	0.79	0.58	2.58	1.06	3.19	39.21
TEWA	0.91	1.20	2.54	1.09	3.13	42.35
WETA	0.00	0.73	2.42	1.22	3.00	45.34
SWTH	0.07	0.72	2.38	1.19	2.94	48.29
AMRO	0.47	0.60	2.23	1.00	2.76	51.05
SOSP	0.66	0.00	2.10	0.92	2.60	53.65
CAWA	0.00	0.55	1.92	0.87	2.38	56.03
CAJA	0.11	0.54	1.88	0.89	2.32	58.35
HETH	0.22	0.43	1.82	0.80	2.25	60.60

LEFL	0.26	0.38	1.78	0.78	2.20	62.81
DEJU	0.04	0.42	1.54	0.68	1.91	64.71
SWSP	0.39	0.03	1.39	0.72	1.71	66.43
BCCH	0.07	0.33	1.34	0.64	1.66	68.09
YEWA	0.35	0.13	1.33	0.73	1.64	69.73
BOCH	0.00	0.39	1.31	0.72	1.62	71.35
MOWA	0.00	0.39	1.30	0.68	1.61	72.95
RBGR	0.19	0.27	1.23	0.68	1.52	74.47
MAWA	0.00	0.37	1.21	0.68	1.50	75.97
NOFL	0.14	0.25	1.20	0.62	1.49	77.45
RBNU	0.00	0.38	1.14	0.69	1.42	78.87
TRES	0.31	0.05	1.10	0.64	1.36	80.23
BAWW	0.07	0.27	1.04	0.62	1.29	81.52
CEDW	0.19	0.16	0.99	0.59	1.23	82.75
YBSA	0.00	0.29	0.98	0.57	1.21	83.96
AMRE	0.08	0.23	0.90	0.55	1.11	85.07
CMWA	0.00	0.24	0.88	0.48	1.08	86.15
RCKI	0.00	0.26	0.84	0.53	1.03	87.18
HAWO	0.04	0.24	0.81	0.55	1.00	88.19

LOG & MF

Average Dissimilarity = 72.64%

Species	LOG Abundance	MF Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
VESP	1.17	0.00	4.20	2.13	5.79	5.79
OVEN	0.00	1.16	3.98	2.13	5.47	11.26
DEJU	1.35	0.42	3.64	1.48	5.01	16.27
CCSP	1.01	0.00	3.51	1.44	4.83	21.11
TEWA	0.30	1.20	3.45	1.53	4.75	25.86
AMRO	1.30	0.60	2.86	1.20	3.94	29.79
ALFL	0.83	0.11	2.74	1.28	3.78	33.57
SWTH	0.05	0.72	2.34	1.24	3.22	36.79
CHSP	1.19	0.82	2.32	1.02	3.19	39.99
WETA	0.11	0.73	2.32	1.21	3.19	43.18
YRWA	0.66	0.84	2.30	1.05	3.17	46.34
HETH	0.54	0.43	2.11	0.98	2.91	49.25
REVI	0.32	0.58	1.99	1.00	2.74	51.99
PAWA	0.53	0.13	1.94	0.82	2.67	54.66
WTSP	1.29	1.08	1.90	0.88	2.61	57.27
CAWA	0.00	0.55	1.88	0.90	2.59	59.86

CAJA	0.11	0.54	1.83	0.92	2.52	62.38
LEFL	0.26	0.38	1.67	0.83	2.29	64.68
BOCH	0.00	0.39	1.28	0.74	1.77	66.44
BCCH	0.05	0.33	1.28	0.65	1.76	68.20
MOWA	0.00	0.39	1.27	0.69	1.75	69.96
CEDW	0.27	0.16	1.20	0.69	1.65	71.61
MAWA	0.00	0.37	1.19	0.69	1.63	73.24
RBNU	0.00	0.38	1.13	0.70	1.55	74.79
NOFL	0.11	0.25	1.06	0.61	1.45	76.24
YBSA	0.00	0.29	0.96	0.58	1.32	77.56
BAWW	0.00	0.27	0.93	0.58	1.28	78.84
TRES	0.24	0.05	0.88	0.54	1.22	80.06
CMWA	0.00	0.24	0.86	0.49	1.18	81.24
HAWO	0.05	0.24	0.85	0.57	1.17	82.41
RBGR	0.00	0.27	0.83	0.55	1.14	83.55
RCKI	0.00	0.26	0.82	0.54	1.13	84.68
WEWP	0.21	0.03	0.81	0.52	1.11	85.79
WWCR	0.00	0.22	0.78	0.48	1.07	86.86

COMP & REC

Average Dissimilarity = 59.30%

Species	COMP Abundance	REC Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
COYE	1.25	0.38	4.08	1.48	6.89	6.89
SAVS	0.62	1.07	3.53	1.11	5.95	12.83
LCSP	1.00	0.56	3.32	1.18	5.59	18.43
ALFL	1.13	0.75	3.19	1.16	5.38	23.81
SOSP	0.91	0.57	3.19	1.09	5.38	29.19
TEWA	0.82	0.36	2.97	1.17	5.01	34.20
WTSP	0.72	0.62	2.80	1.13	4.73	38.92
CHSP	0.66	0.61	2.72	1.06	4.58	43.51
LISP	1.20	0.97	2.62	0.96	4.41	47.92
CCSP	1.25	1.37	2.53	0.87	4.26	52.18
REVI	0.50	0.49	2.48	0.98	4.18	56.36
AMRO	0.33	0.56	2.30	0.96	3.87	60.23
TRES	0.45	0.16	1.83	0.79	3.08	63.31
RWBL	0.15	0.40	1.65	0.77	2.79	66.10
CEDW	0.32	0.27	1.63	0.79	2.75	68.85
SWSP	0.37	0.08	1.46	0.67	2.47	71.32
LEFL	0.28	0.10	1.27	0.60	2.14	73.45

OVEN	0.28	0.13	1.21	0.67	2.04	75.49
YEWA	0.19	0.16	1.06	0.59	1.78	77.27
VESP	0.03	0.22	0.90	0.49	1.51	78.79
SWTH	0.16	0.07	0.79	0.46	1.33	80.12
CAWA	0.19	0.02	0.78	0.46	1.31	81.43
WIWA	0.16	0.05	0.70	0.45	1.18	82.61
AMRE	0.13	0.06	0.64	0.42	1.08	83.69
RBGR	0.12	0.08	0.64	0.43	1.08	84.77
MOWA	0.12	0.01	0.59	0.35	1.00	85.77

MF & REC

Average Dissimilarity = 86.27%

Species	MF Abundance	REC Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
CCSP	0.00	1.37	5.24	1.86	6.08	6.08
SAVS	0.00	1.07	4.22	1.30	4.89	10.97
OVEN	1.16	0.13	4.08	1.70	4.73	15.70
TEWA	1.20	0.36	3.68	1.42	4.26	19.96
LISP	0.05	0.97	3.48	1.33	4.03	23.99
YRWA	0.84	0.00	3.20	1.26	3.71	27.70
WTSP	1.08	0.62	3.07	1.18	3.56	31.26
CHSP	0.82	0.61	2.64	1.08	3.06	34.32
ALFL	0.11	0.75	2.57	1.03	2.98	37.30
WETA	0.73	0.02	2.56	1.21	2.96	40.26
SWTH	0.72	0.07	2.53	1.20	2.93	43.20
AMRO	0.60	0.56	2.49	1.02	2.88	46.08
REVI	0.58	0.49	2.38	1.00	2.76	48.83
LCSP	0.00	0.56	2.25	0.75	2.60	51.44
CAWA	0.55	0.02	2.05	0.87	2.37	53.81
SOSP	0.00	0.57	2.00	0.86	2.31	56.12
CAJA	0.54	0.05	1.97	0.87	2.28	58.40
DEJU	0.42	0.01	1.60	0.66	1.86	60.26
HETH	0.43	0.01	1.58	0.71	1.84	62.09
LEFL	0.38	0.10	1.58	0.69	1.83	63.92
RWBL	0.03	0.40	1.42	0.71	1.64	65.56
MOWA	0.39	0.01	1.39	0.68	1.61	67.18
BOCH	0.39	0.00	1.39	0.72	1.61	68.79
COYE	0.06	0.38	1.37	0.68	1.59	70.37
BCCH	0.33	0.03	1.36	0.60	1.58	71.95
MAWA	0.37	0.00	1.28	0.68	1.48	73.44

CEDW	0.16	0.27	1.24	0.67	1.44	74.88
RBNU	0.38	0.01	1.23	0.70	1.42	76.30
BAWW	0.27	0.03	1.06	0.59	1.23	77.53
NOFL	0.25	0.06	1.06	0.54	1.23	78.76
YBSA	0.29	0.01	1.04	0.57	1.21	79.97
RBGR	0.27	0.08	1.04	0.60	1.21	81.17
CMWA	0.24	0.01	0.95	0.48	1.11	82.28
YEWA	0.13	0.16	0.90	0.53	1.05	83.33
RCKI	0.26	0.00	0.88	0.53	1.02	84.35
AMRE	0.23	0.06	0.87	0.54	1.01	85.36

COMP & BRN

Average Dissimilarity = 60.15%

Species	COMP Abundance	BRN Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
HETH	0.07	1.11	3.50	1.89	5.81	5.81
LCSP	1.00	0.23	3.04	1.40	5.06	10.87
WTSP	0.72	1.55	2.93	1.26	4.87	15.74
AMRO	0.33	1.08	2.92	1.42	4.85	20.59
SOSP	0.91	0.13	2.86	1.24	4.76	25.35
COYE	1.25	0.78	2.53	1.09	4.20	29.55
CCSP	1.25	0.90	2.45	1.05	4.08	33.62
CHSP	0.66	1.10	2.38	1.12	3.96	37.59
TEWA	0.82	0.81	2.30	1.16	3.82	41.40
TRES	0.45	0.69	2.17	1.11	3.62	45.02
LEFL	0.28	0.62	2.10	0.91	3.50	48.52
SAVS	0.62	0.00	2.06	0.97	3.43	51.94
REVI	0.50	0.31	1.81	0.92	3.01	54.95
ALFL	1.13	1.15	1.80	0.95	2.99	57.95
SWSP	0.37	0.47	1.78	0.94	2.95	60.90
LISP	1.20	1.21	1.76	0.94	2.92	63.82
PAWA	0.09	0.43	1.49	0.75	2.47	66.29
WIWA	0.16	0.48	1.48	0.84	2.46	68.75
CAJA	0.09	0.34	1.38	0.71	2.29	71.05
NOFL	0.10	0.40	1.35	0.77	2.25	73.30
CEDW	0.32	0.26	1.30	0.80	2.16	75.46
DEJU	0.06	0.32	1.18	0.65	1.96	77.41
BBWO	0.00	0.40	1.17	0.74	1.95	79.36
OVEN	0.28	0.08	0.96	0.64	1.59	80.95
SWTH	0.16	0.15	0.82	0.54	1.37	82.32

WEWP	0.00	0.20	0.75	0.43	1.25	83.58
YEWA	0.19	0.08	0.72	0.54	1.19	84.77
YRWA	0.03	0.17	0.69	0.46	1.15	85.91
RWBL	0.15	0.13	0.68	0.52	1.12	87.04
CAWA	0.19	0.00	0.60	0.45	1.00	88.04

MF & BRN

Average Dissimilarity = 73.03%

Species	MF Abundance	BRN Abundance	Av.Diss	Diss/SD	Contribution (%)	Cumulative %
LISP	0.05	1.21	3.66	1.80	5.01	5.01
OVEN	1.16	0.08	3.40	1.86	4.66	9.67
ALFL	0.11	1.15	3.34	1.71	4.57	14.24
HETH	0.43	1.11	2.64	1.33	3.61	17.85
CCSP	0.00	0.90	2.63	1.31	3.60	21.45
TEWA	1.20	0.81	2.43	1.19	3.33	24.78
YRWA	0.84	0.17	2.40	1.23	3.29	28.07
AMRO	0.60	1.08	2.37	1.20	3.25	31.32
COYE	0.06	0.78	2.21	1.12	3.02	34.34
WETA	0.73	0.04	2.13	1.22	2.92	37.26
SWTH	0.72	0.15	2.11	1.20	2.88	40.14
LEFL	0.38	0.62	2.08	0.94	2.85	42.99
TRES	0.05	0.69	2.08	1.16	2.84	45.83
CHSP	0.82	1.10	1.97	0.99	2.70	48.54
WTSP	1.08	1.55	1.86	0.90	2.55	51.09
REVI	0.58	0.31	1.83	0.99	2.51	53.60
CAJA	0.54	0.34	1.77	0.96	2.43	56.03
CAWA	0.55	0.00	1.69	0.89	2.31	58.34
DEJU	0.42	0.32	1.68	0.85	2.30	60.63
PAWA	0.13	0.43	1.46	0.76	2.00	62.64
NOFL	0.25	0.40	1.45	0.84	1.98	64.62
SWSP	0.03	0.47	1.34	0.82	1.83	66.45
WIWA	0.06	0.48	1.30	0.78	1.77	68.23
BBWO	0.11	0.40	1.21	0.79	1.66	69.89
BCCH	0.33	0.08	1.17	0.67	1.60	71.48
BOCH	0.39	0.00	1.16	0.73	1.59	73.07
MOWA	0.39	0.00	1.15	0.68	1.58	74.65
MAWA	0.37	0.04	1.11	0.71	1.52	76.16
RBNU	0.38	0.00	1.03	0.70	1.40	77.57
CEDW	0.16	0.26	0.98	0.68	1.34	78.91

BAWW	0.27	0.04	0.92	0.60	1.26	80.17
HAWO	0.24	0.13	0.89	0.63	1.21	81.38
YBSA	0.29	0.00	0.87	0.57	1.19	82.56
RBGR	0.27	0.04	0.81	0.58	1.11	83.67
WWCR	0.22	0.04	0.78	0.52	1.07	84.75
CMWA	0.24	0.00	0.77	0.48	1.05	85.80
WEWP	0.03	0.20	0.75	0.45	1.02	86.82
RCKI	0.26	0.00	0.74	0.54	1.02	87.84