Boreal Avian Modelling Project
Biophysical Database - Summary Statistics

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Contents

1 Avian Data Assembly

Background

The boreal region of Canada hosts one of the most diverse bird communities in North America, comprised of more than 300 species. During the summer, more than 300 bird species and up to three billion birds breed in the region, leading to its characterization as a North American bird nursery. Historically, these forests have been subject to little widespread development pressure, and access has been extremely limited, resulting in a corresponding gap in research and monitoring. However, pressures are mounting, and with the rapid development of the boreal forest that is presently occurring, there is an urgent need to understand the impact of changing habitats on boreal bird populations in order to inform management actions. There has been a recent surge of boreal bird studies across Canada, thus it is timely to undertake a synthesis of existing research, and as a first step towards scenario analysis and decision-support, formulate habitat-based predictive models of species abundance and distribution for Canadian boreal forests. We envision a series of spatially-explicit, bird-habitat models, broadly accessible to all organizations interested in boreal conservation planning, and updated regularly with monitoring data and new research results.

Objectives

1. Assemble and organizaton of existing data sets on all boreal forest birds and their habitats through cooperative efforts with boreal bird researchers and associated agencies.

2. Develop spatially-explicit, habitat-based predictive models of species distribution and abundance in the boreal forests of Canada. These models must be capable of producing credible and testable predictions of future distribution and abundance patterns under a complex range of management, landuse and climate change scenarios that will create forest conditions that have little or no current analogue.

3. Build support for development and application of these models to management of boreal forests in Canada through links with our partners. Expand efforts to engage end-users of project products to ensure relevance and applicability.

This report will help us reach our first objective. This document will give insight on the type of data collected, sampling effort across Canada and different protocol used to collected data.

We made great efforts to assemble a comprehensive database of all systematic, spatially referenced, observational data on boreal birds that have been collected in Canada. This report has data from 87 different projects across Canada's Boreal forest.

Each project consisted of sites where studies were conducted (e.g. a site might be a sylvicultural treatment, or a forest stand in a different location). Each Site in turn contained bird count stations, pecise locations where bird were monitored during the breeding season. At each station, information about the time span (period) and distance from the observed number of birds seen and/or heard was recorded. Sampling protocol(number of sites, stations, years and rounds-i.e, repeat surveys within years) varied among projects, and some of the multi-year studies changed sampling protocol from year to year. Flyovers were excuded from the following figures. The statistic software program used for this document was R version 2.7.2 (2008-08-25)and the platform version was i386-pc-mingw32 and $\LaTeX\,2_\varepsilon$.

Summary Statistics

- Total number of bird count stations: 75642
- Total abundance of birds observed: 1568506
- Total bird species richness: 345

1.1 Database Overview

The observational data and covariates are maintained in a relational database. We presently use Microsoft Access as the database engine. There are four key tables (the names of the actual Acccess tables are not currently as shown):

Projects are sets of data contributed by a single owner or entity. Each Project is assigned a unique code (`PCODE`) which links to data sharing agreements on file, and also serves as a key to relate this to other tables.

In principle, all data within a single contributed project were collected under a common survey protocol. The two most important elemenents of a survey protocol are the sampling *duration* in minutes (e.g. 5, 10) and the sampling *distance* or radius in metres (e.g. 50m, 100m, unlimited distance). Secondary aspects of these factors include whether observation were partitioned into finer temporal or distance classes, and what these classes were.

Other components of a sampling protocol include the number of years over which the study was conducted, and the number of visits per year. It turns out that these characteristics are not always uniform for all surveyed locations within a project, and we have not finally determined how to deal with this. For the moment, we record the "official" number of years, and the mean number of visits per location.

Stations are the geographically referenced locations where individual point counts were conducted. Each station is linked to a Project via (`PCODE`) ,and the location is recorded in geographic coordinates. A unique key (`SS`)is assigned to each station. In constructing the key, we used as far as possible the project-specific naming conventions; this allows us preserve some features of the sampling designs for individual projects, and to identify groups of stations that should potentially be grouped in random effects models. We allow one level of grouping within projects, and stations are numbered within groups. There is also a unique numeric identifier (`ID_link`) assigned to each station, independent of the constructed key. This table may also include one or more records spatially locating the station within ecoregions, BCRs or other geographic zonations that can be coded as factors. However, such attributes are not guaranteed to be maintained across database versions, and should properly be located in a separate table linked by (`SS`).

Rounds record the year, calendar date and clock time when data were collected at a station. Clock time is time-zone corrected given the location and date of sampling. For stations with multiple visits within years, a `Round` number is also recorded. Dates are also recorded as Julian dates and relative to the start of the local growing season, as determined by custom interpolated climate data. Times are also recorded relative to local nautical(?) sunrise at the geographic coordinates and date of sampling. Each `Visit` is assigned a unique `PKEY` composed of `SS`, a two-character code for sampling year (e.g. 99 = 1999, 07 = 2007) and the `Round`.

Counts record the actual observations. An observation is defined by a species code and an abundance. Standard OAU codes are used for species. In addition, each observation is assigned a distance class, a interval class, and a behavioural code. The distance classes correspond to the distance classes recognised in the Project protocol. Similarly, the interval class records the time interval during the point count during which the observation was made. The behavioural code is the recorded bahaviour by which the individual bird or birds were detected (e.g. countersinging, flying overhead). These codes and classes are described in detail below.

1.2 Project level summaries

The BAM database contains contributed data from 89 distinct projects. These contributions are summarised in the following Table which shows, for each project, the internal project code, the number of stations and visits for which data were contributed, and the number of years over which sampling occurred. The Years field does not imply that each station was visited over repeated years. A forthcoming document will describe each project in more detail.

PCODE	Stations	Year	TotalVisits
ON	53295	5	53295
RP	2777	4	2777
LP	1663	4	3320
GLDR	1284	7	1284
CF	1043	4	2696
FFBR	631	2	1883
WH	616	2	1142
CW	577	2	577
WAP	573	3	3302
HR	572	2	1114
CL	468	12	18931
PN	446	1	446
MB06	404	1	404
SH	394	1	1177
PA	382	2	765
SKBS	370	1	370
MM94	347	2	730
PF	313	3	509
SRDR	306	1	306
FLPC	260	6	2519
MM95	243	1	243
FG	233	1	417
TTPCD	226	2	226
COMW	179	1	179
DV	162	1	162
AD1	151	3	452
GPMN	147	1	147
WF	146	6	784
COCL	145	1	145
DARV	145	3	648
SWYK	144	1	288
DP	142	1	142
PR	137	1	395
LR	126	1	286
TS	121	4	399
MR	120	2	289
IMBE	113	4	460
MC	110	3	110
EM	106	4	1554
CVME	105	1	105
JL	104	2	231
ML	102	1	200
RUST	97	1	97
BR	88	3	556
DA	88	7	1038
MGLE	82	2	248

WBHS	80	1	80
KX	73	1	73
CLSS	59	1	98
KH	58	1	58
NWSS	58	1	98
FSLE	54	2	216
EHPPC	51	2	52
BM	48	1	48
JS	48	2	288
CHSS	40	1	76
KP	19	4	72
DRAP			
EMB-ASP			
EMB-BS			
EMB-NOISE			
FBMP			
HOBBBS			
KENO			
Lebl			
PERI			
RLMBP			
ROMA			
RUEA			
SKAMP			
GLDRcnrlbl			
GLDRCNRLEXP			
GLDRCNRLHE			
GLDRCNRLHZ			
GLDRCNRLPE			
GLDRMEGO			
GLDROPTILL			
GLDRPCCL01			
GLDRPCCL03			
GLDRPCMC			
GLDRPCMCII			
GLDRRAKL			
GLDRSHL13E			
GLDRSHMRM			
GLDRSVEXP			
GLDRSVSB			
GLDRSVTP			
GLDRSVUPG			

Table 1: Boreal Avian Modelling Project Information

1.3 Station and Round Level Summaries

In this section, we present some views of sampling effort at the station level. Using histograms, we report the number of years of sampling per station (Figure 1) and the number of rounds per year (Figure 2). Note that most stations (%) were visited in only one year, and most stations (%) had only one round per sampling year.

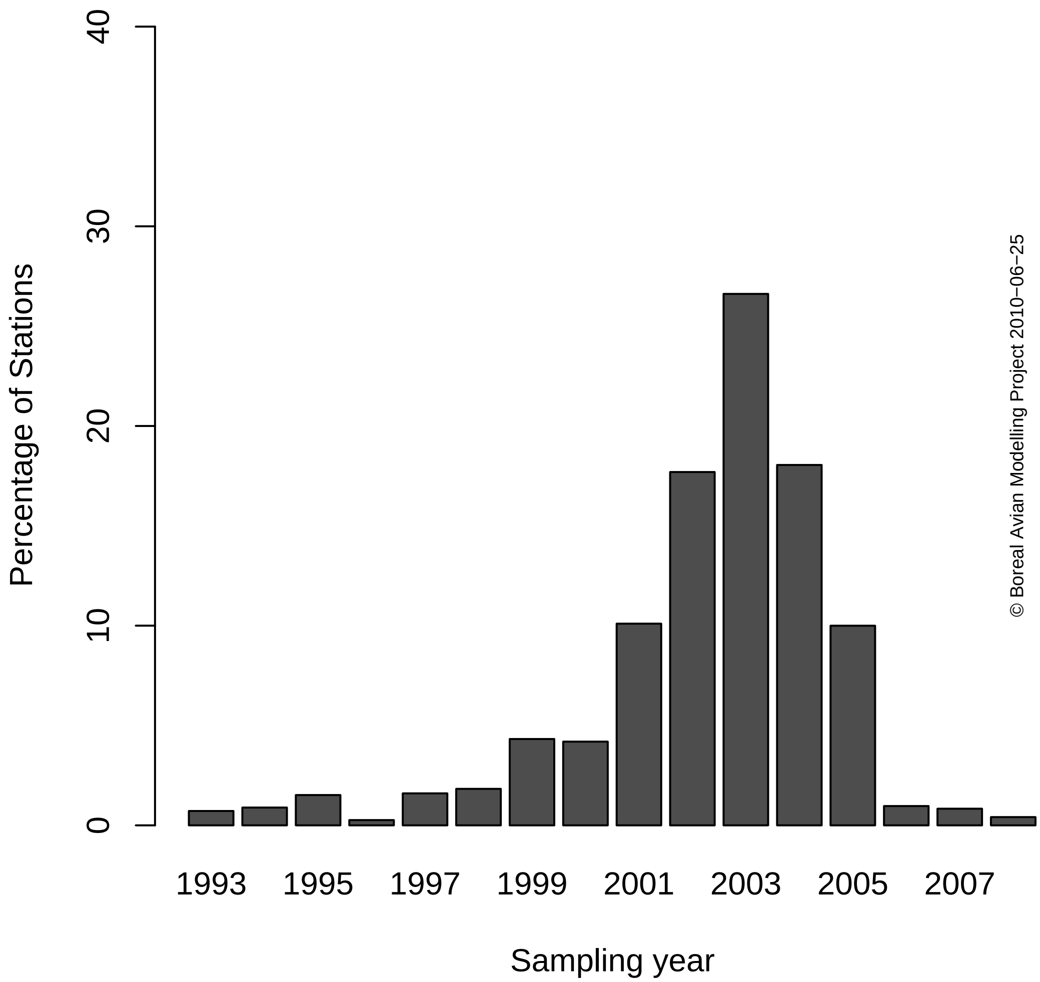

Figure 1: Annual Sampling Effort, by Stations

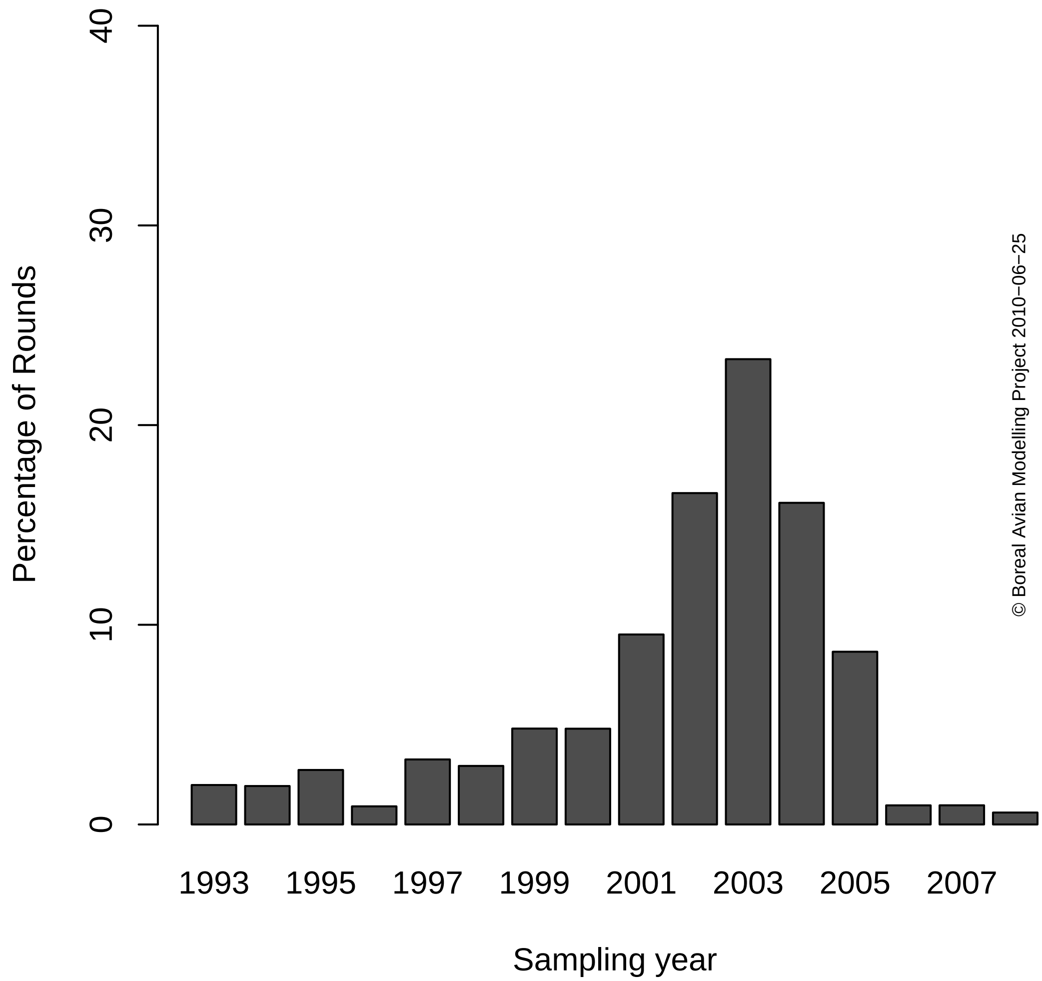

Figure 2: Annual Sampling Effort, by Rounds

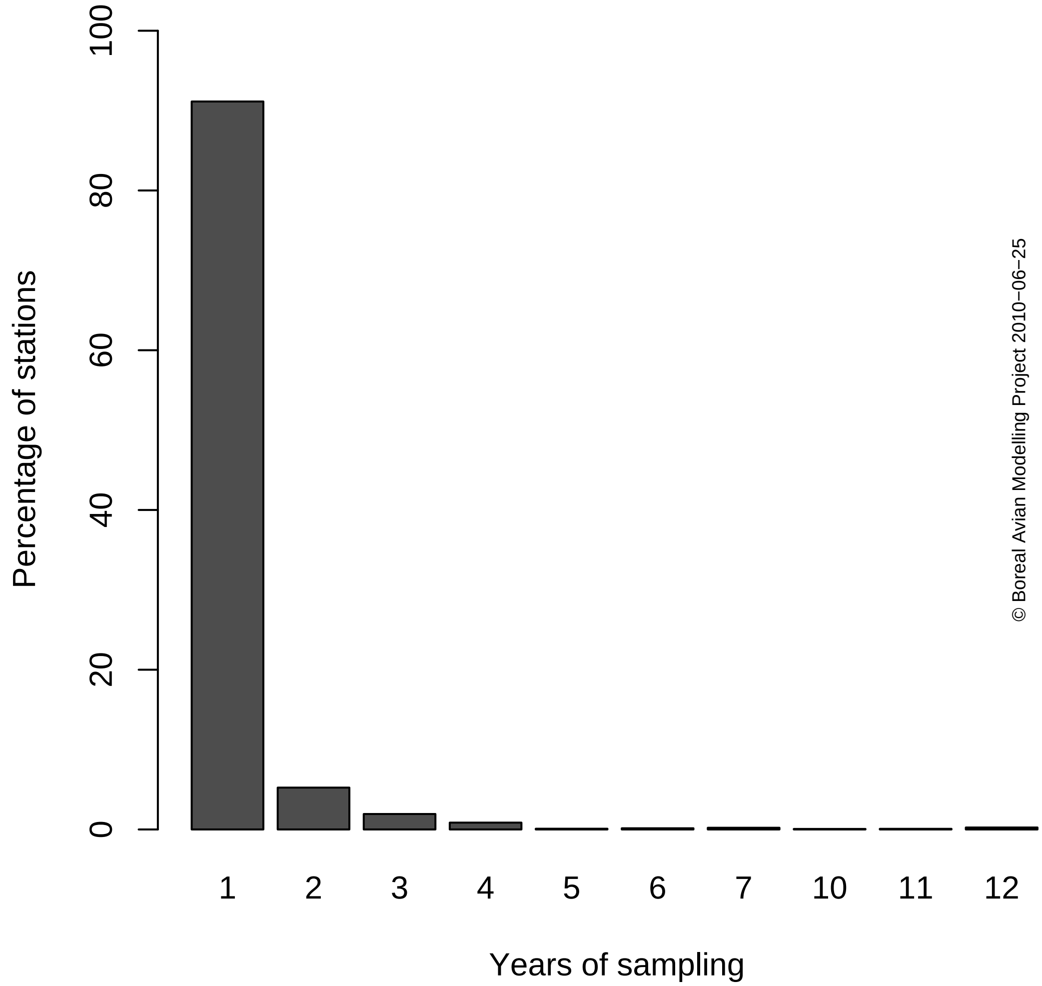

Figure 3: Sampling Years per Station

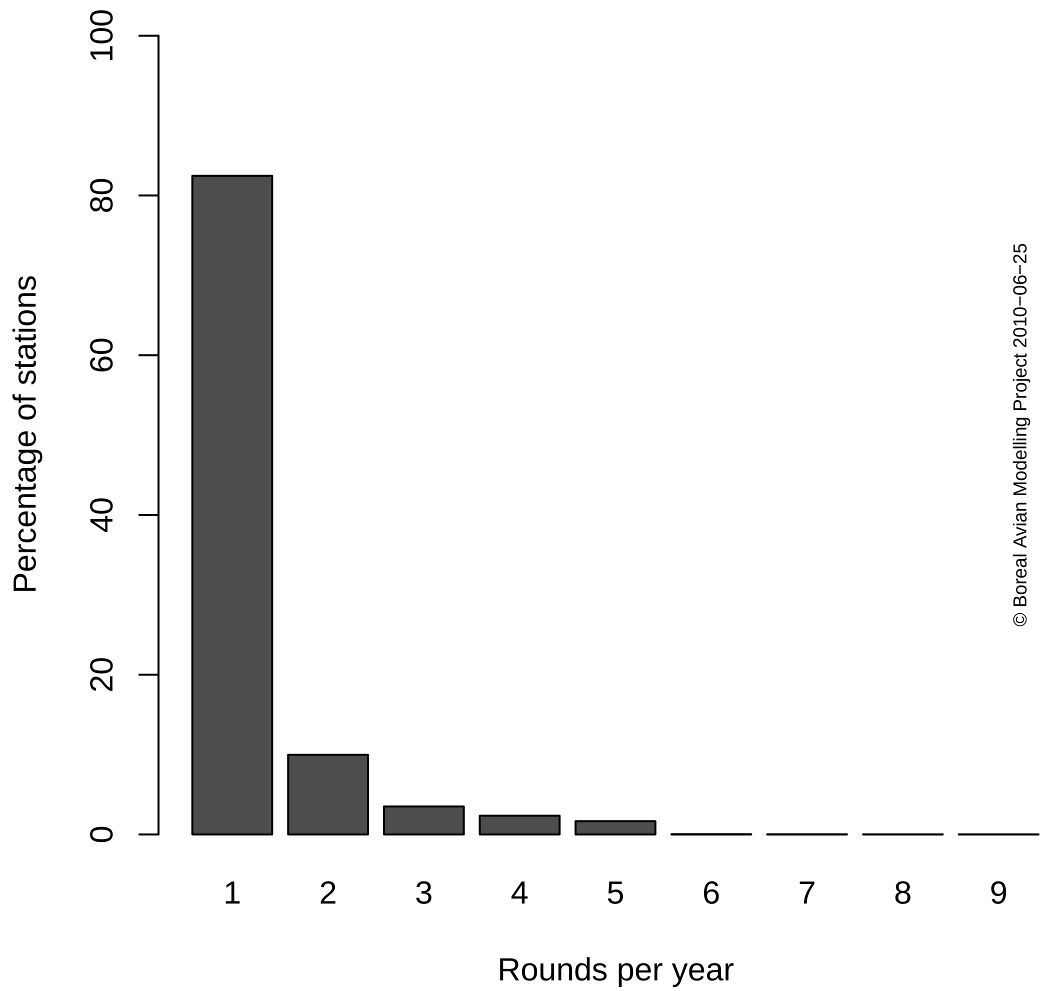

Figure 4: Annual Sampling Rounds per Station

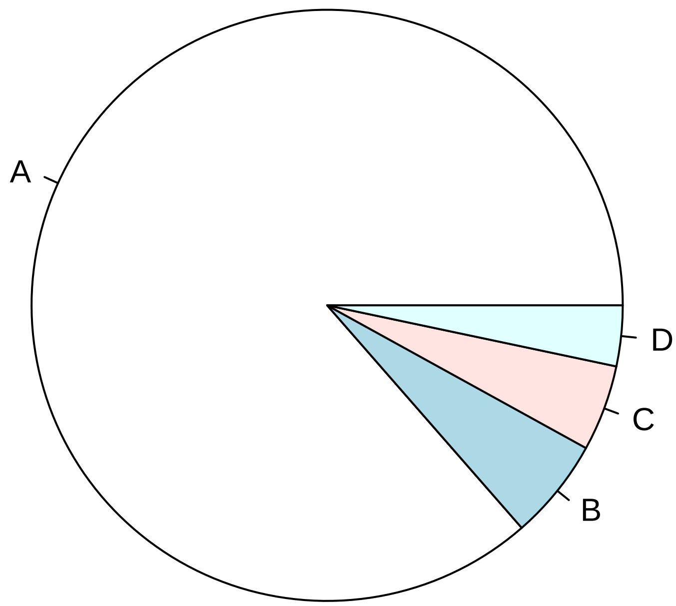

Figure 5: Proportion of Year and Round sampling combination (see Table 2)

Table 2: Year and Round sampling combination

Letter	Year and Round sampling combination
A	Stations with only 1 year and 1 visit
B	Stations with multiple years but only 1 visit per year
C	Stations with only 1 year and multiple visits per year
D	Stations with multiple years and visits per year

1.4 Project protocol Summaries

In this section we describe the protocol categories of sampling duration and distance, and the behavioural codes as present in the Count table. For each attribute, we tabulate the assigned codes with their definitions and frequencies of occurence in the Count table. The frequencies by category (as percentages) are also presented as bar plots. Frequencies are calculated at the unit of individual entries in the Count table, that is, of records of one or more individuals of a single species, each record having a period, distance and behaviour code. There are several other ways to aggregate such data that could be considered.

1.4.1 Detection period classes

Interval	Description	Frequency	Percentage
1	0-5 min	456881	50.23%
4	0-10 min	275251	30.26%
5	0-3 min	94215	10.36%
2	5-10 min	58703	06.45%
11	0-20	8157	00.90%
7	3-5	5901	00.65%
8	unk	3653	00.40%
6	3-10 min	2390	00.26%
9	10-15	2100	00.23%
10	15-20	1811	00.20%
3	Outside of 10 min	452	00.05%

Table 3: Definitions and frequencies of occurrence of detection interval codes

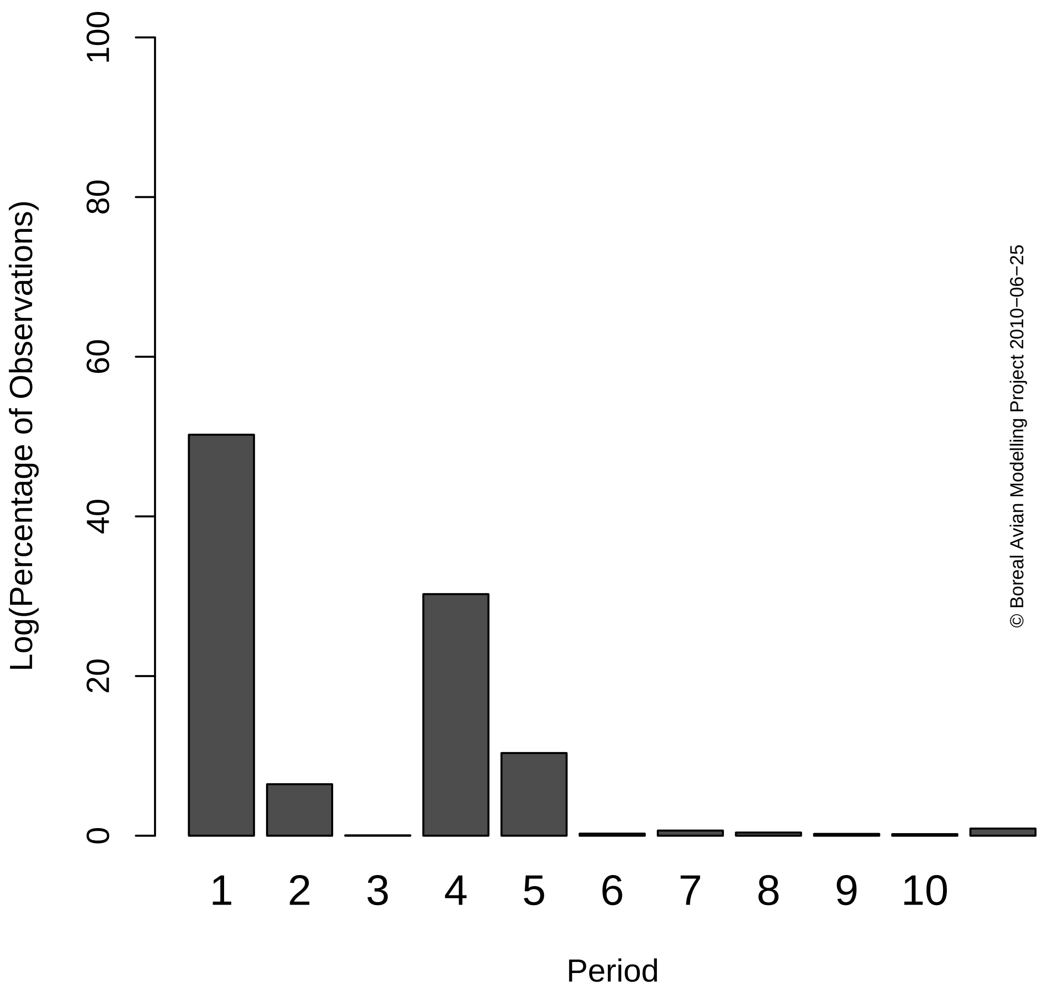

Figure 6: Frequencies of detection intervals

1.4.2 Detection distance classes

Distance	Description	Frequency	Percentage
7	unlimited distance	429082	47.18%
1	0-50m	132506	14.57%
2	50-100m	111899	12.30%
8	0-100	101179	11.12%
3	>100m	76261	08.38%
15	>50M	18838	02.07%
26	0-80	6816	00.75%
12	50-75m	4795	00.53%
18	0-60	4374	00.48%
19	>60	3783	00.42%
13	75-100m	3415	00.38%
24	30-50	2763	00.30%
11	25-50m	2534	00.28%
25	0-75	2264	00.25%
21	100-150	2197	00.24%
10	0-25m	1229	00.14%
16	101-125	993	00.11%
20	>150m	1012	00.11%
6	>>100m (likely diff habitat)	714	00.08%
9	unk	742	00.08%
4	cc edge	677	00.07%
17	126-150	535	00.06%
23	0-30	587	00.06%
5	in forest away from clearcut	318	00.03%
22	100-175	1	00.00%

Table 4: Definitions and frequencies of occurrence of detection distance codes

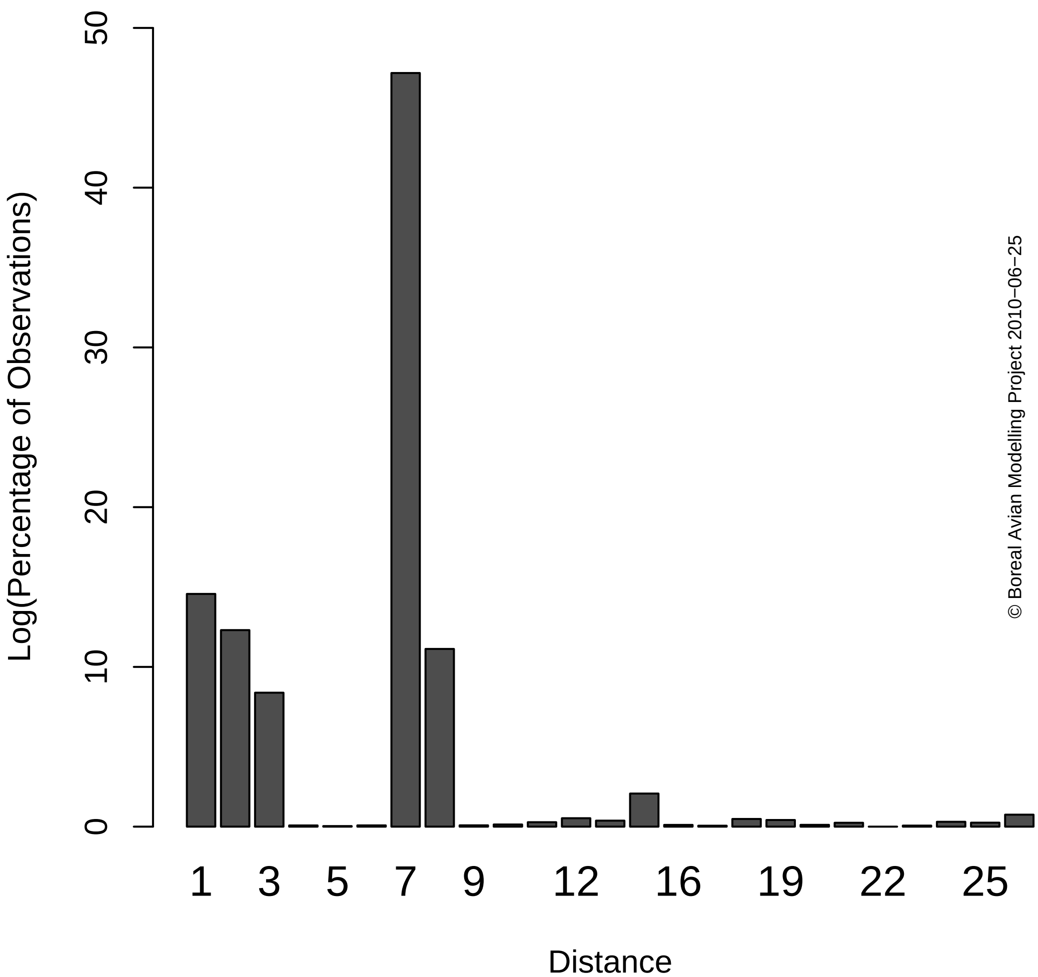

Figure 7: Frequencies of detection distance codes

1.4.3 Detected behaviour classes

Behaviour	Description	Frequency	Percentage
3	Unknown	333237	36.64%
1	Heard	258687	28.44%
6	seen and heard	244953	26.93%
5	none	50385	05.54%
2	Seen	15038	01.65%
4	Excluded	7153	00.79%
7	juvenile observed	54	00.01%
8	Territorial	7	00.00%

Table 5: Definitions and frequencies of occurrence of detected Behaviour classes

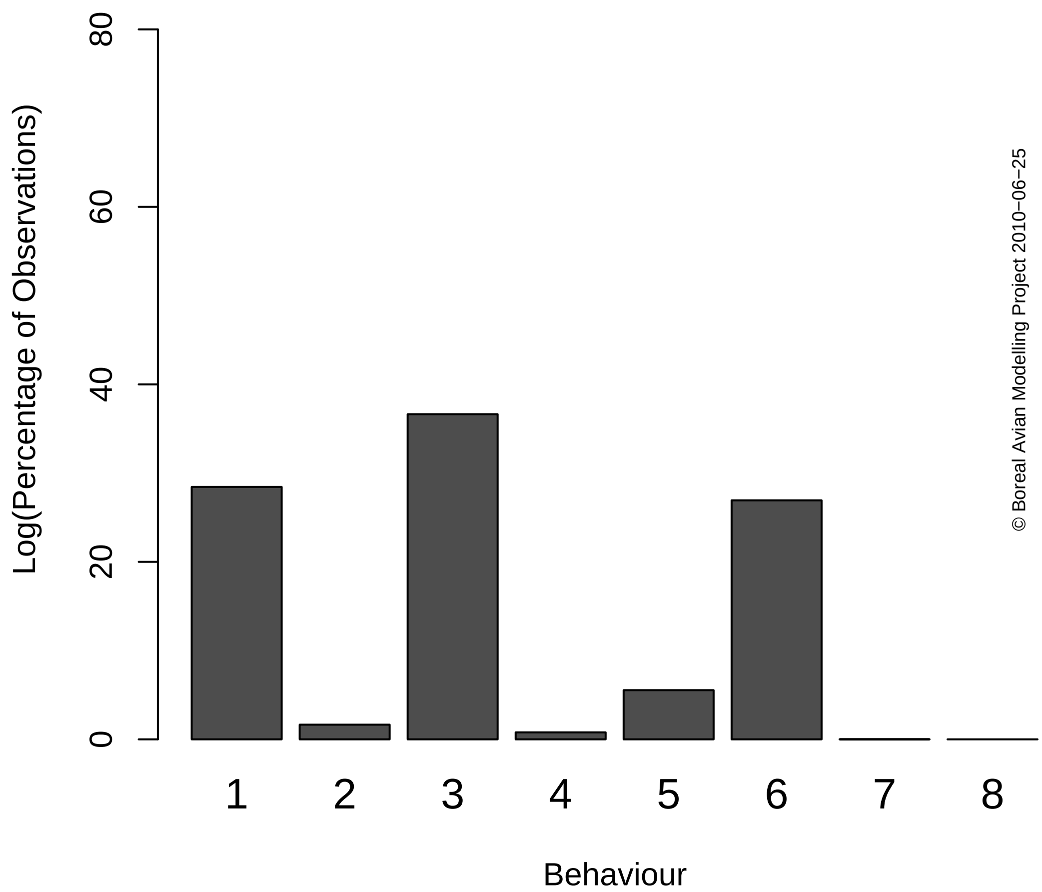

Figure 8: Frequencies of behaviour classes

Behaviour class 4 (Excluded) aggregates a variety of special cases defined in contributed project databases which identify observations that should not be included in analysis. These special cases include: flyovers, squirrels, or observations made before or after the defined sampling interval.

2 Species Abundance

In this section, we present an initial summary of the avian data at the species level. Table below shows total specis abundances calculated from the calculated from the Counts table, as defined in 2.We first determined the unique species codes or other labels occurring in the table. For each unique code, we extracted all matching records and summed the abundance fields to yield label-specific totals. There was no selection based on the protocol or behaviour codes. The table entries include the English common name, the official 4-letter abbreviation consistent with the 50th AOU supplement (cite the two references below which you will have to look up the details and put in the reference section), the total abundance. Prevalence (%) is counted at the rounds level, and values less than 0.001 are recorded as 0.

We note that htis version of the database retains some records for which no official species code could be assigned. These include Unkowns by various groups (woodpeckers, warblers, owls, etc.) and various other categories. For example, code NONE, which indicates visits where no individuals were recorded. This code was not applied consistently in all Projects, so the true number of visits with no observations cannot be determined from this table. In future versions of the database, these non-attributable observations will be represented in a separate table. For the moment, protocols to deal with all exceptional cases have not been defined. A further refinement would be to produce separate tables by taxonomic groups. Accordingly, this section will be refined based on input from the BAM Technical Committee (AUK 126: 705-714, 2009; North American Bird Bander 34:109-110, 2009).

Species	Abundance	Prevalence
WTSP	37691	49
YRWA	29120	38
OVEN	27768	36
REVI	24369	32
SWTH	22467	29
TEWA	20025	26
CHSP	16179	21
RCKI	12965	17
MAWA	12519	16
WIWR	12054	16
HETH	11142	14
NAWA	10980	14
AMRE	9001	12
AMRO	9133	12
BTNW	9086	12
LEFL	9221	12
RBNU	9188	12
DEJU	8768	11
MOWA	8153	11
ALFL	7926	10
YBSA	7661	10
GCKI	6108	8
LISP	6116	8
CORA	5077	7
COYE	5488	7
CSWA	5261	7
GRAJ	5692	7
PISI	5409	7
RBGR	5571	7
YWAR	5383	7
BBWA	4432	6
BCCH	4537	6
BHVI	4649	6

CCSP	4242	6
WETA	4366	6
YBFL	4633	6
AMCR	3504	5
BAWW	3987	5
BLBW	3503	5
CONW	4154	5
SOSP	3709	5
BRCR	2826	4
CEDW	3037	4
NOFL	3268	4
RUGR	2947	4
WAVI	3023	4
WWCR	3385	4
BLJA	2184	3
BOCH	2101	3
CAWA	2368	3
CMWA	1963	3
COLO	2376	3
COSN	2664	3
NOWA	2643	3
OCWA	1948	3
PAWA	2204	3
PHVI	2632	3
RWBL	2099	3
SAVS	2564	3
SWSP	2329	3
VEER	2574	3
AMGO	1553	2
BHCO	1881	2
BTBW	1665	2
EVGR	1599	2
FOSP	1565	2
HAWO	1766	2
HOWR	1300	2
LCSP	1381	2
OSFL	1214	2
PIWO	1677	2
UNWO	1774	2
VESP	1460	2
WIWA	1811	2
ATTW	552	1
BARS	546	1
BBMA	519	1
BBWO	587	1
BLPW	1155	1
CANG	958	1
DOWO	791	1
GRYE	529	1
LEYE	390	1
MALL	595	1
MODO	647	1
NOPA	892	1
PUFI	989	1

RTHA	418	1
SACR	547	1
SORA	639	1
TRES	894	1
VATH	739	1
WCSP	543	1
WEWP	803	1
ABDU	33	0
AGWT	44	0
AMAV	3	0
AMBI	354	0
AMCO	279	0
AMDI	1	0
AMGP	8	0
AMKE	256	0
AMPI	17	0
AMRO	1	0
AMWI	117	0
AMWO	5	0
ARTE	20	0
ATSP	165	0
AWPE	15	0
BADO	62	0
BAEA	57	0
BAGO	2	0
BANS	35	0
BAOR	204	0
BAWA	1	0
BBCU	115	0
BEKI	235	0
BGGN	1	0
BITH	4	0
BLGR	6	0
BLSC	4	0
BLSW	1	0
BLTE	194	0
BOBO	78	0
BOGU	123	0
BOOW	17	0
BOWA	67	0
BRBL	178	0
BRSP	1	0
BRTH	22	0
BUFF	72	0
BWHA	274	0
BWTE	122	0
BWWA	264	0
CAGU	22	0
CAHU	4	0
CANV	9	0
CATE	4	0
CERW	3	0
CHSW	24	0
CLSW	20	0

COEI	8	0
COGO	221	0
COGR	335	0
COHA	10	0
COME	148	0
CONI	105	0
CORE	272	0
COTE	31	0
DCCO	11	0
DUFL	63	0
DUNL	111	0
EABL	38	0
EAGR	7	0
EAKI	185	0
EAME	2	0
EAPH	347	0
EATO	5	0
EAWP	358	0
EUST	165	0
FISP	2	0
FRGU	107	0
GADW	29	0
GBHE	99	0
GCFL	188	0
GCSP	20	0
GCTH	131	0
GGOW	26	0
GHOW	44	0
GLGU	1	0
GRAP	5	0
GRCA	90	0
GRCO	11	0
GRSC	27	0
GWTE	30	0
GWWA	25	0
HAFL	327	0
HASP	12	0
HERG	384	0
HOFI	3	0
HOGR	21	0
HOLA	136	0
HOME	15	0
HORE	8	0
HOSP	137	0
HUGO	35	0
INBU	72	0
KILL	363	0
LALO	42	0
LEOW	5	0
LESA	85	0
LESC	93	0
LSGW	1	0
LTDU	17	0
MAGO	35	0

MAWR	116	0
MEGU	21	0
MERL	98	0
MGWA	219	0
MOBL	56	0
MOCH	1	0
NHOW	43	0
NOFU	1	0
NOGO	54	0
NOHA	113	0
NONE	92	0
NOPI	70	0
NOPO	7	0
NOWH	6	0
NSHO	77	0
NSHR	3	0
NSTS	71	0
NSWO	10	0
OSPR	50	0
PAJA	6	0
PALO	34	0
pawa	1	0
PBGR	209	0
PESA	1	0
PIGR	206	0
PIWA	105	0
PSFL	42	0
PUMA	32	0
RBGU	138	0
RBME	15	0
RBWO	1	0
RECR	172	0
REDH	14	0
RHWO	11	0
RLHA	1	0
RNDU	70	0
RNEP	1	0
RNGR	309	0
RNPH	15	0
ROGO	3	0
ROPI	47	0
ROWR	4	0
RSHA	2	0
RTHU	163	0
RTLO	7	0
RUBL	301	0
RUDU	42	0
RUFF	1	0
RUHU	15	0
SAPH	3	0
SBDO	13	0
SCTA	175	0
SEOW	8	0
SEPL	17	0

SESA	37	0
SEWR	191	0
SMEW	29	0
SMLO	93	0
SNGO	74	0
SOSA	303	0
SPGR	84	0
SPPI	35	0
SPSA	243	0
SPTO	5	0
SSHA	60	0
STGR	18	0
STJA	15	0
STSA	58	0
STSP	11	0
SUSC	15	0
TOSO	132	0
TOWA	345	0
TRUS	6	0
TUDU	3	0
TUSW	34	0
TUVU	43	0
UNAC	1	0
UNAH	2	0
UNBL	7	0
UNCR	1	0
UNDU	10	0
UNDUCK	2	0
UNFL	7	0
UNGU	53	0
UNKN	67	0
UNOW	2	0
UNPA	1	0
UNSH	2	0
UNSP	3	0
UNSW	2	0
UNTERN	1	0
UNTH	19	0
UNTRLL	2	0
UNTTBB	18	0
UNVI	80	0
UNWA	12	0
UNYELLOWLEGS	2	0
UPSA	2	0
VASW	1	0
VGSW	6	0
VIRA	6	0
WBNU	250	0
WEGR	6	0
WEKI	1	0
WEME	65	0
WESA	1	0
WHIM	69	0
WIFL	8	0

WILL	7	0
WIPH	5	0
WIPT	90	0
WISA	1	0
WISN	93	0
WODU	1	0
WOTH	37	0
WPWI	5	0
WTSP	1	0
WWSC	5	0
YBCU	2	0
YERA	35	0
YHBL	149	0
YTVI	1	0

3 The spatial distribution of sampling effort

The purpose of this section is to present graphical summaries of the spatial distribution of sampling effort in the data set. The sampling units in this case are stations, that is, locations where point count surveys were conducted on one or more occaisions, over one year or more years.

The data are presented as an interpolated surface of sampling density, re-projected over a map of Canada for ease of reference. The density surfaces are generated by applying a 2-dimensional filter kernel to the geographic coordinates of a sample of spatial locations. The total sampling effort as of BAM Database v0.9is shown in Figure 9. Other views of the data, stratified by sampling year or protocol, are shown in the following subsections. It is important to note, in interpreting these figures, that the parameters of the filter kernel were chosen to produce visually informative images in the majority of cases, not to portray exact locations nor to facilitate exact comparisons between different maps. It is a consequence of the filtering that some pixels "coloured" at low density may not in fact contain any sampling stations at all.

On each map, we show the boreal region as currently defined by bam, and Provincial and Territorial boundaries within Canada.

The Technical Committee are invited to suggest additional maps and other results to be incorporated in later versions.

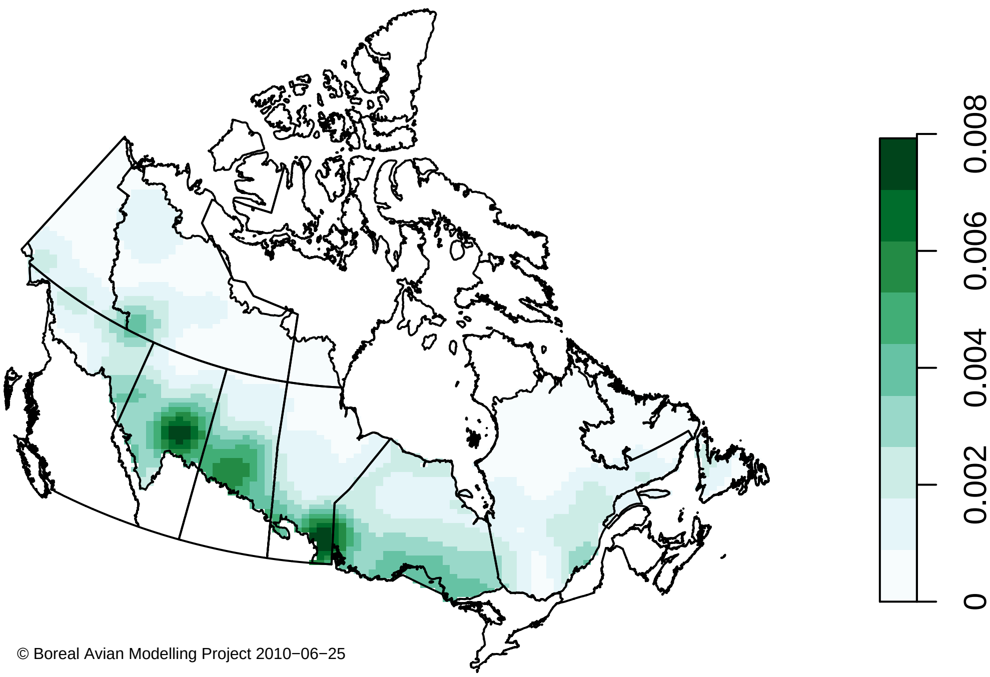

Figure 9: Spatial distribution of Boreal Avian Modelling Project bird of sampling effort

3.1 Sampling density within years

The database contains data collected over an interval of almost 20yr and sampling effort varies widely among years (Figure 10 to Figure 25). To understand the potential to exploit the multi-temporal nature of the data, we must first understand to what degree temporal and spatial variation may be confounded. Here, we present a first view of the problem, by presenting maps of annual sampling densities over the period 1993–2007. Note that the scale of the colour-ramps varies between years.

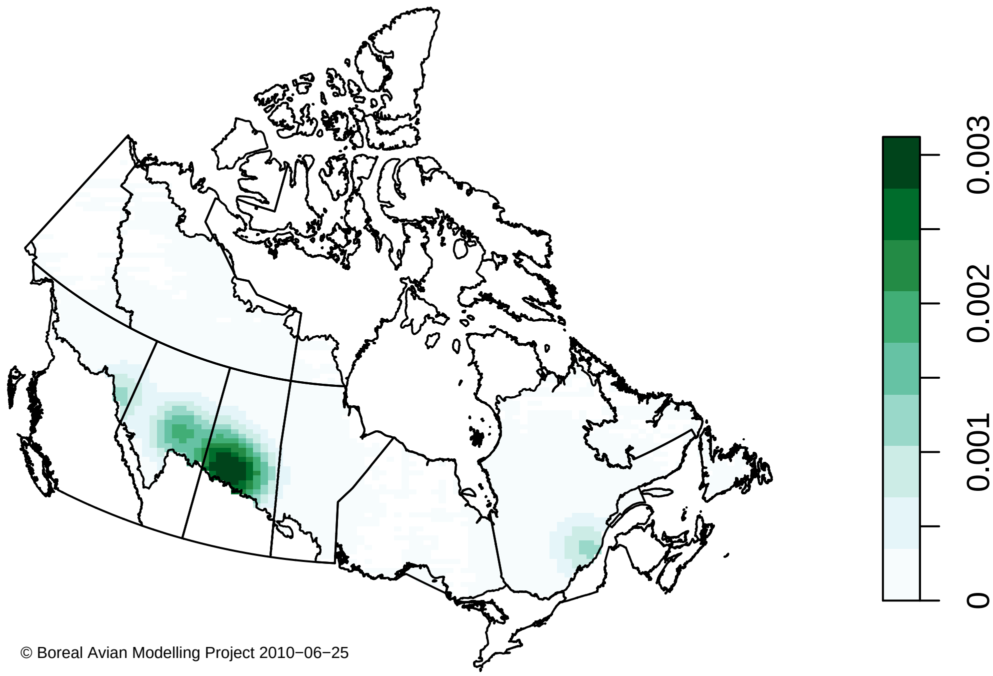

Figure 10: Spatial distribution of the sampling density for 1993

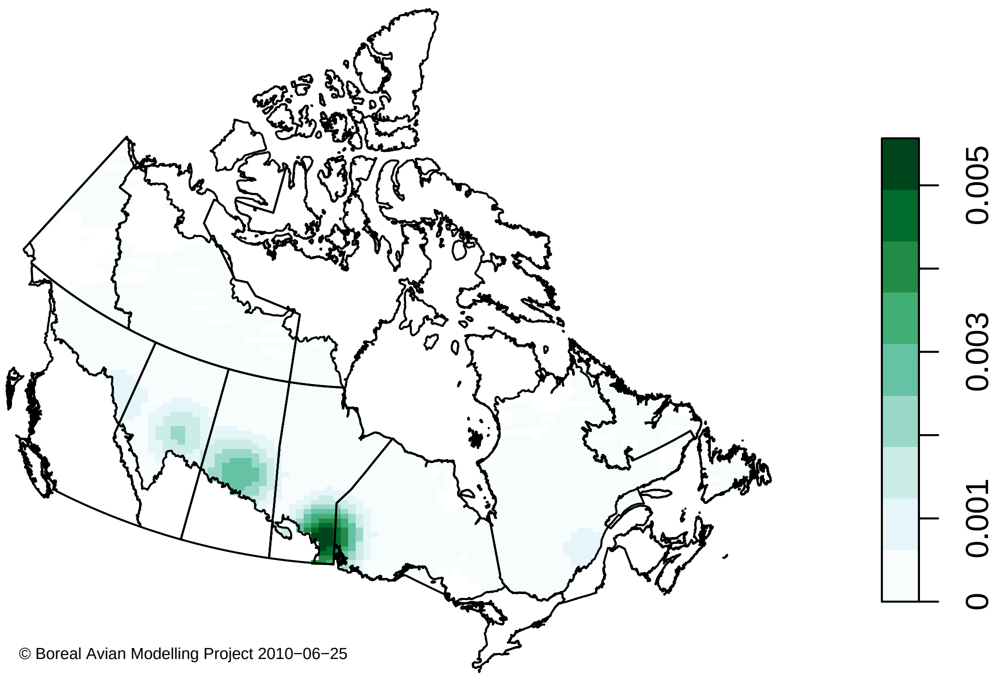

Figure 11: Spatial distribution of the sampling density for 1994

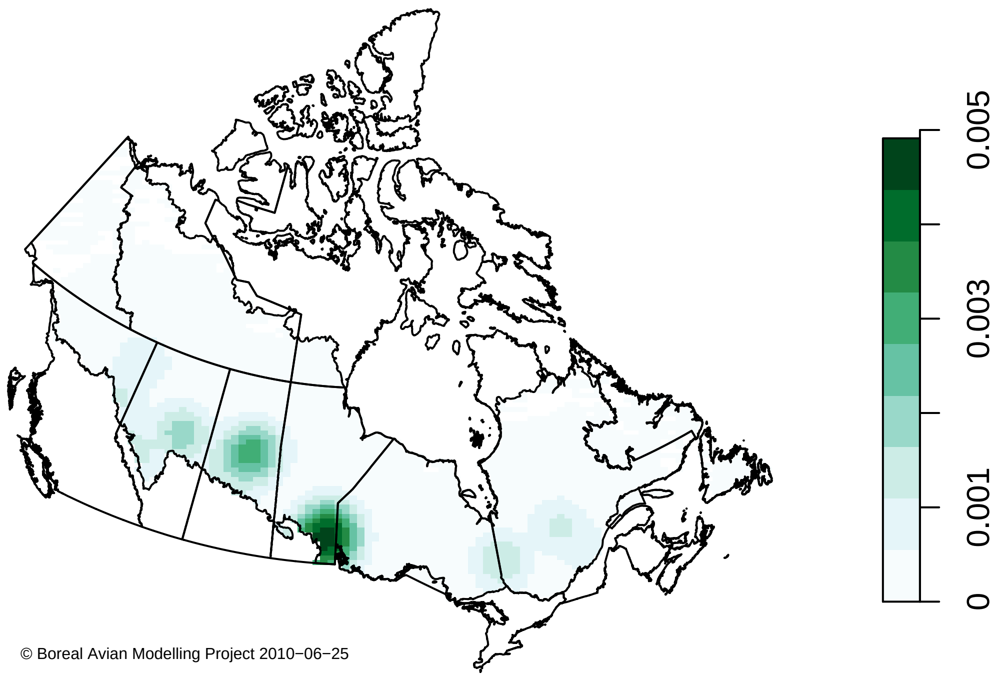

Figure 12: Spatial distribution of the sampling density for 1995

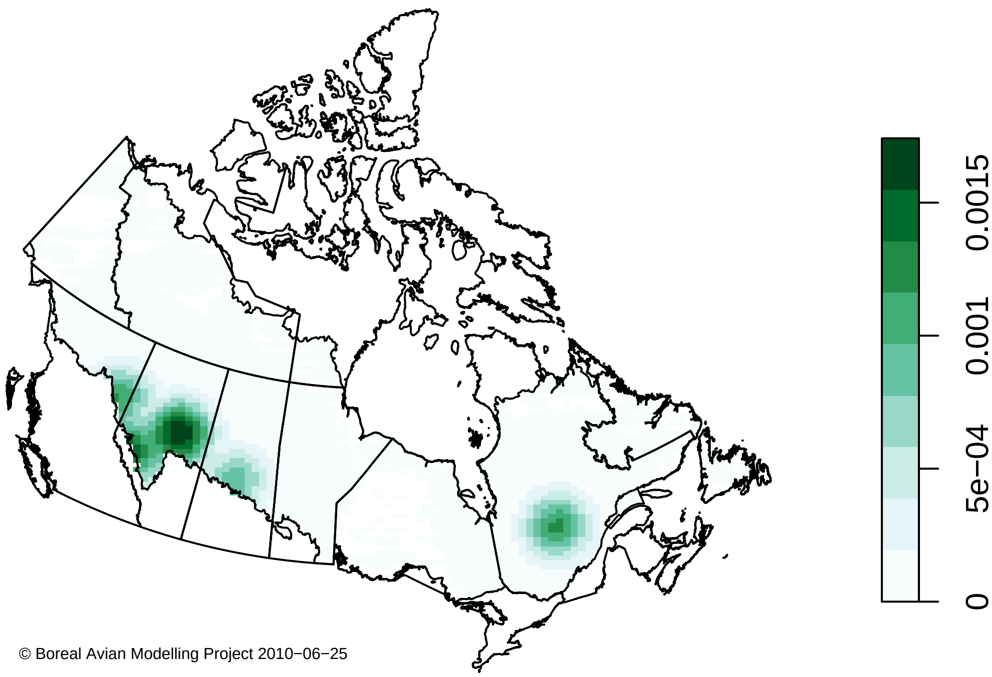

Figure 13: Spatial distribution of the sampling density for 1996

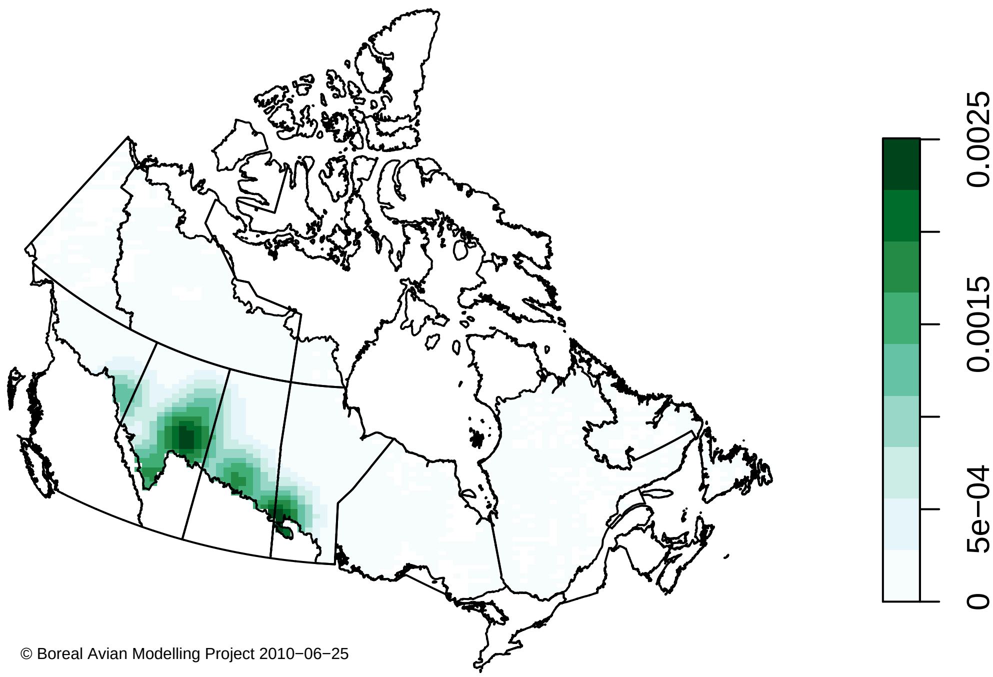

Figure 14: Spatial distribution of the sampling density for 1997

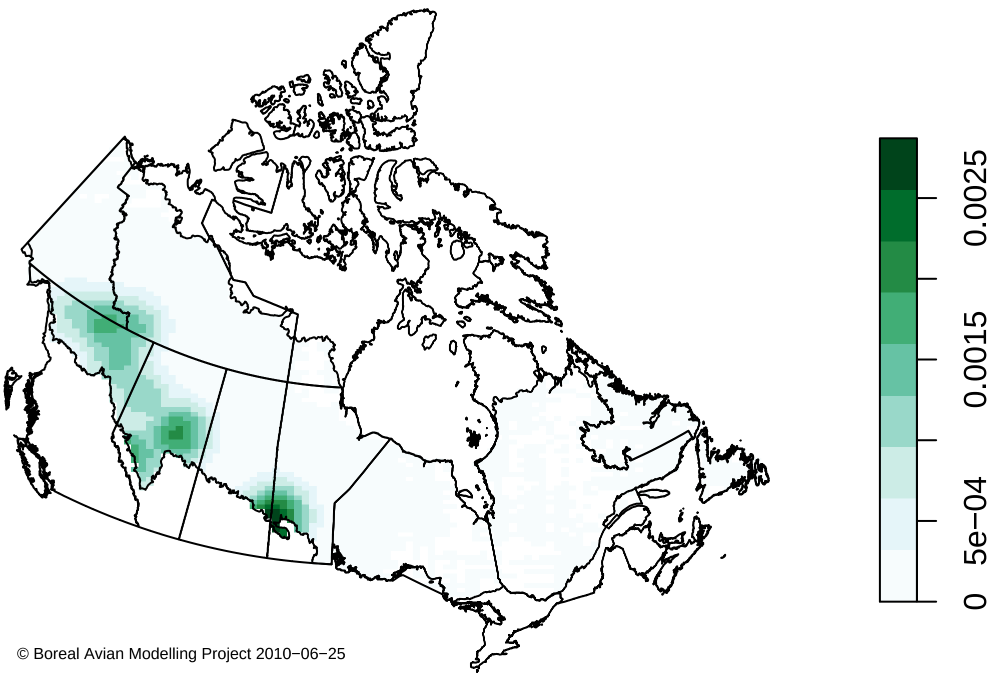

Figure 15: Spatial distribution of the sampling density for 1998

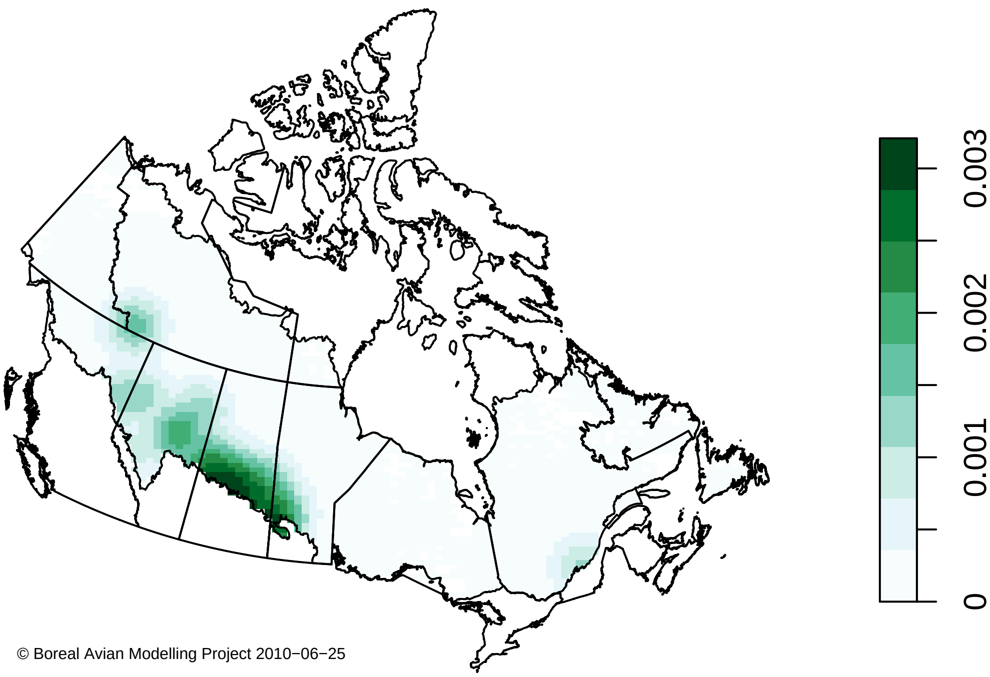

Figure 16: Spatial distribution of the sampling density for 1999

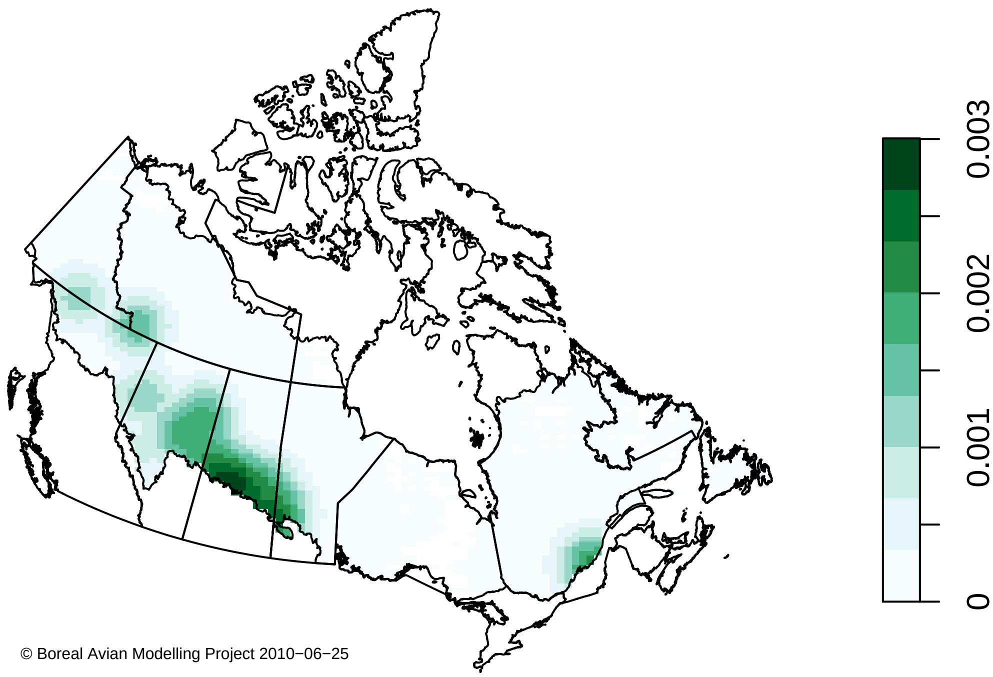

Figure 17: Spatial distribution of the sampling density for 2000

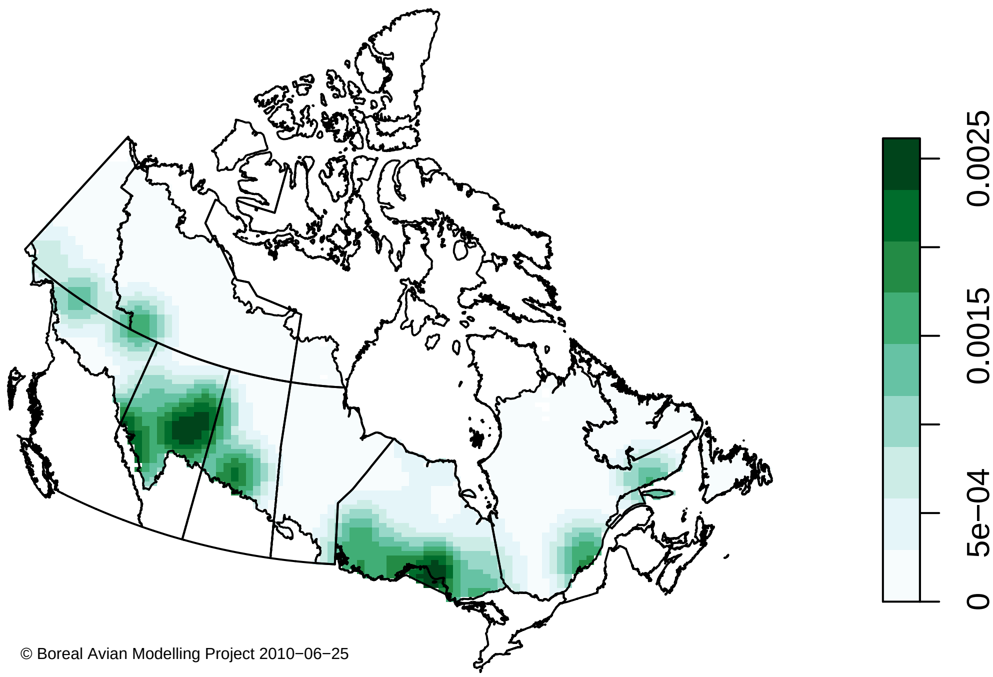

Figure 18: Spatial distribution of the sampling density for 2001

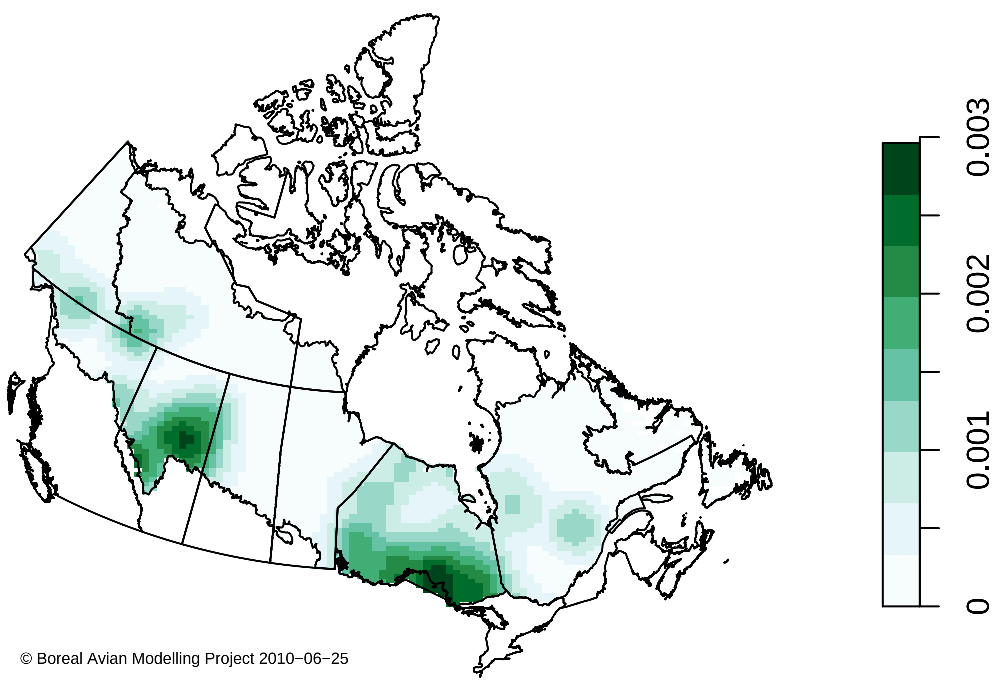

Figure 19: Spatial distribution of the sampling density for 2002

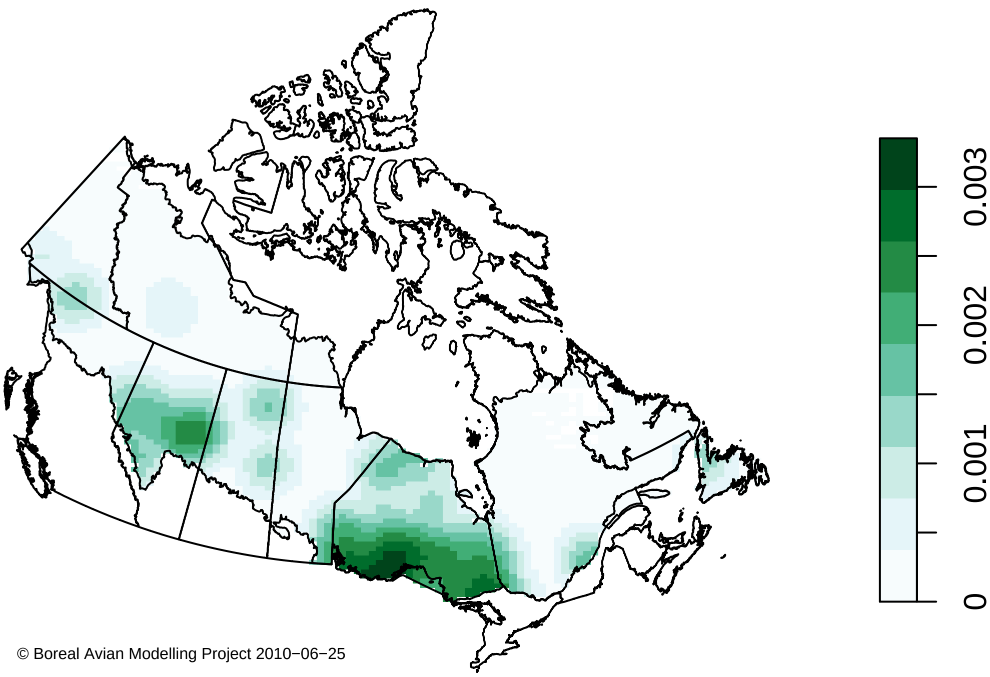

Figure 20: Spatial distribution of the sampling density for 2003

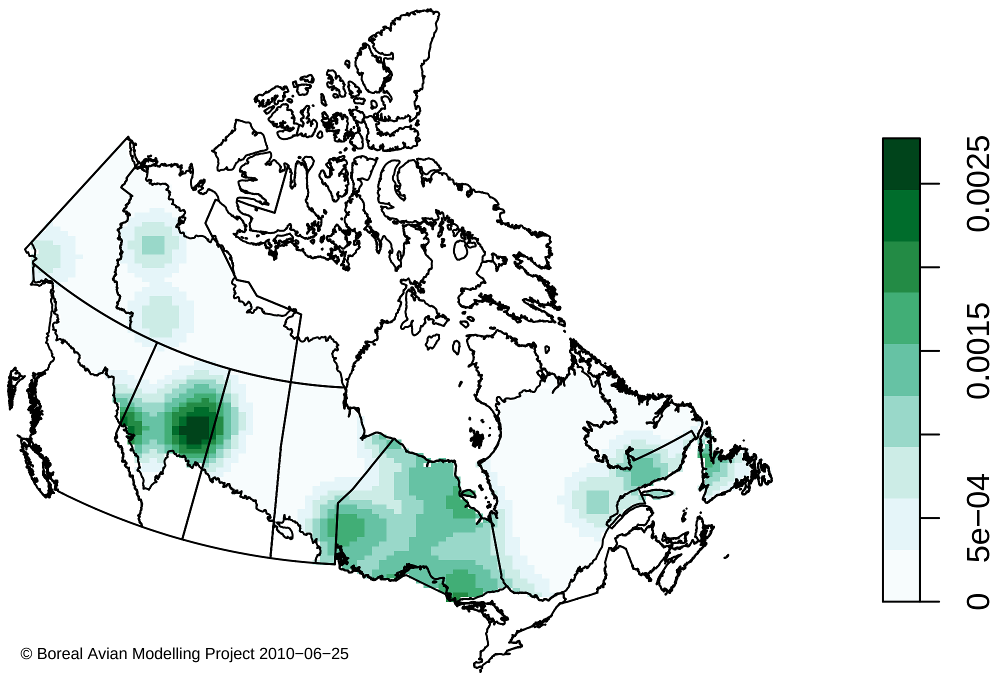

Figure 21: Spatial distribution of the sampling density for 2004

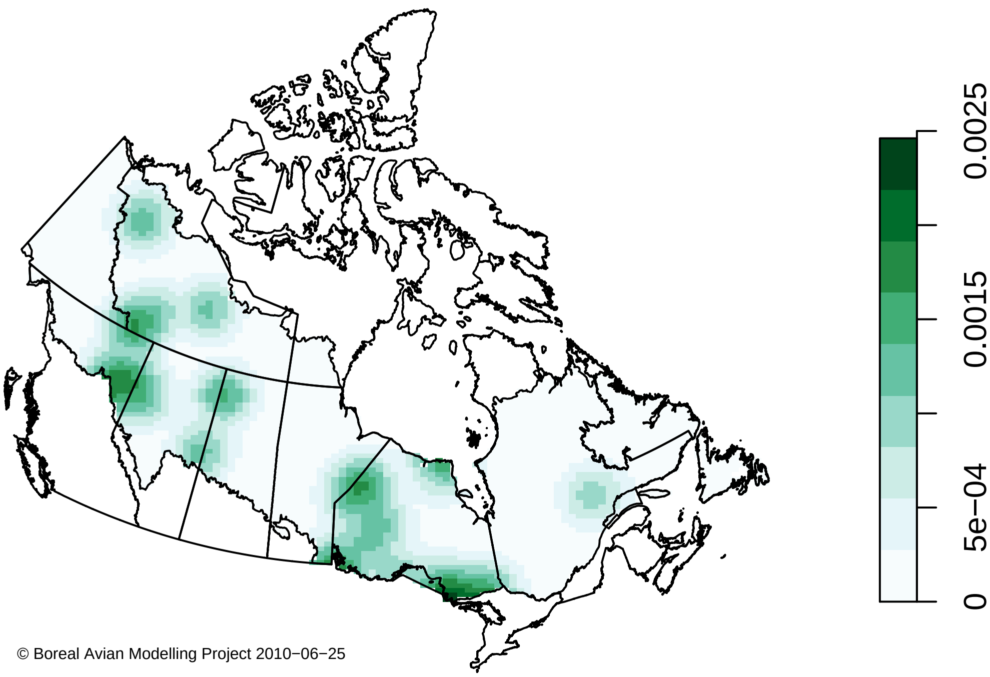

Figure 22: Spatial distribution of the sampling density for 2005

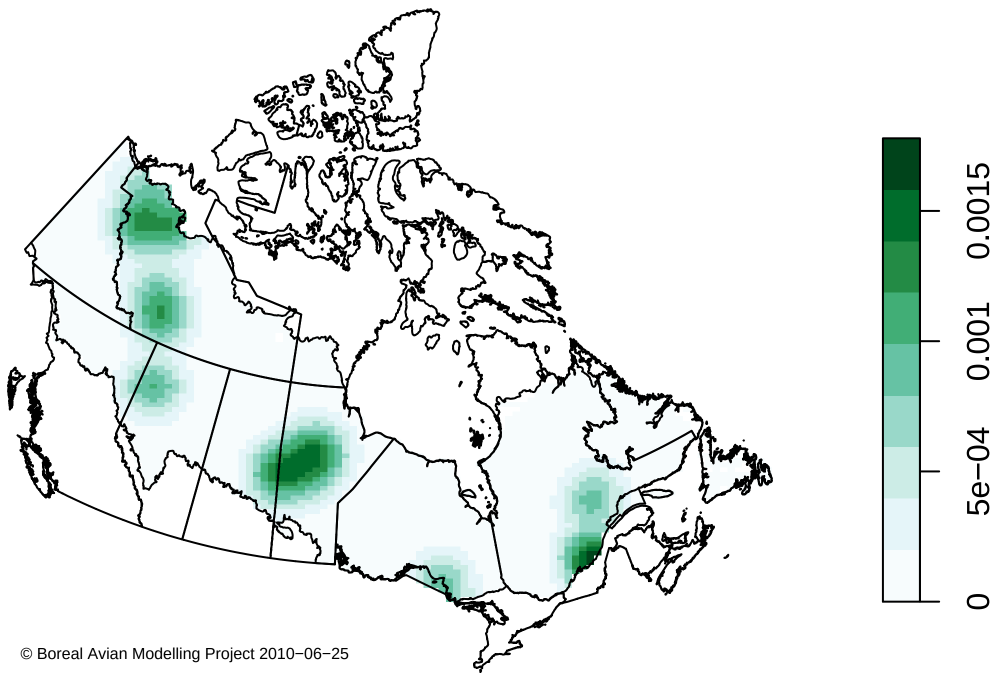

Figure 23: Spatial distribution of the sampling density for 2006

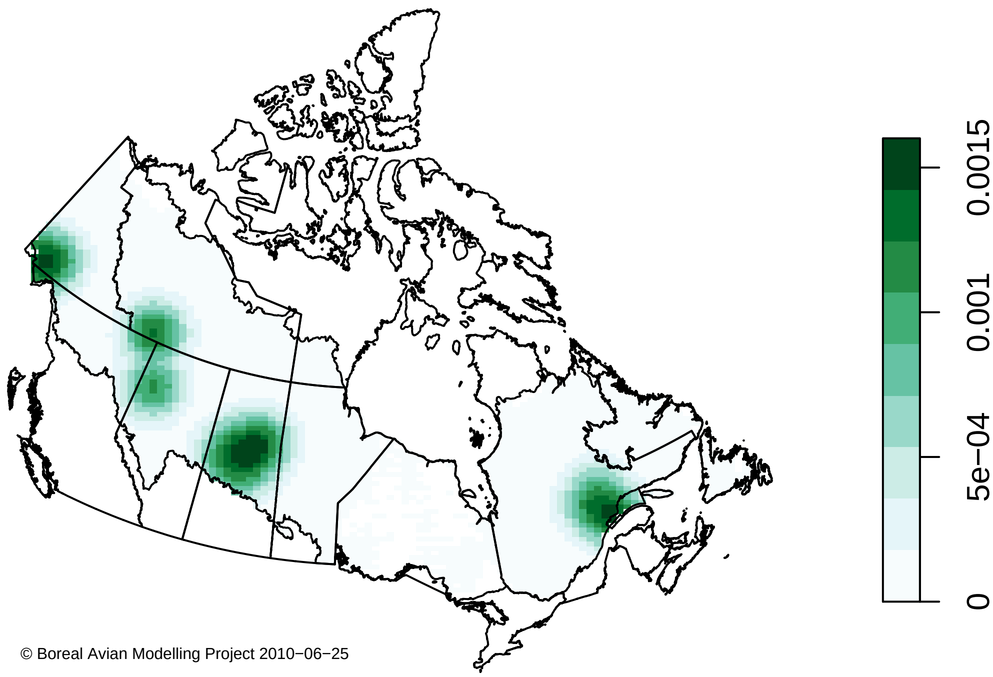

Figure 24: Spatial distribution of the sampling density for 2007

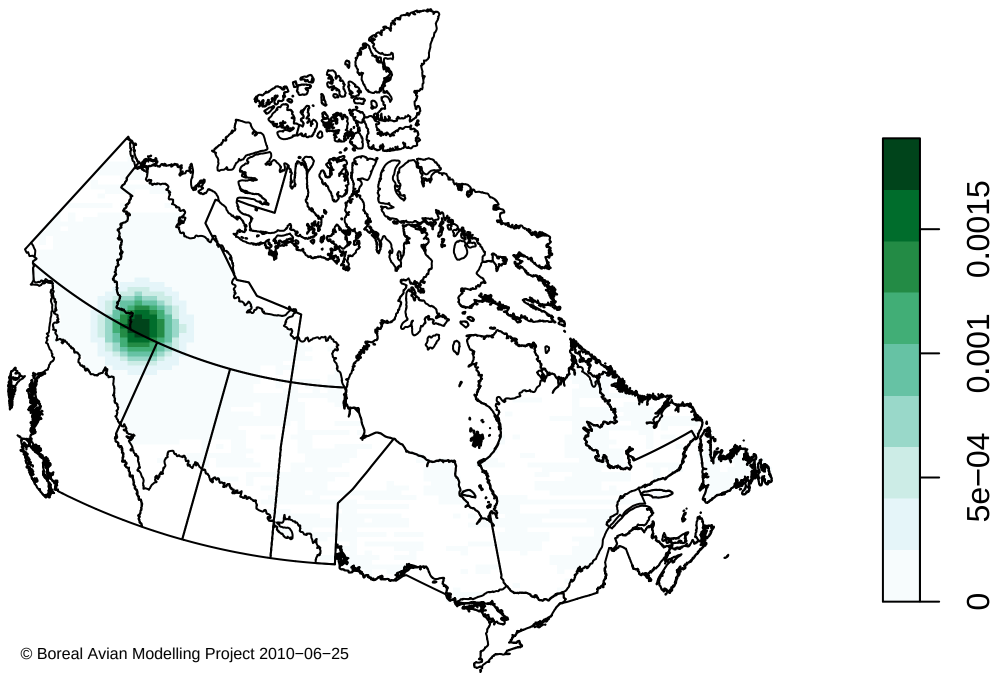

Figure 25: Interpolated sampling density for 2008

3.2 Distribution of stations with multiple rounds within years

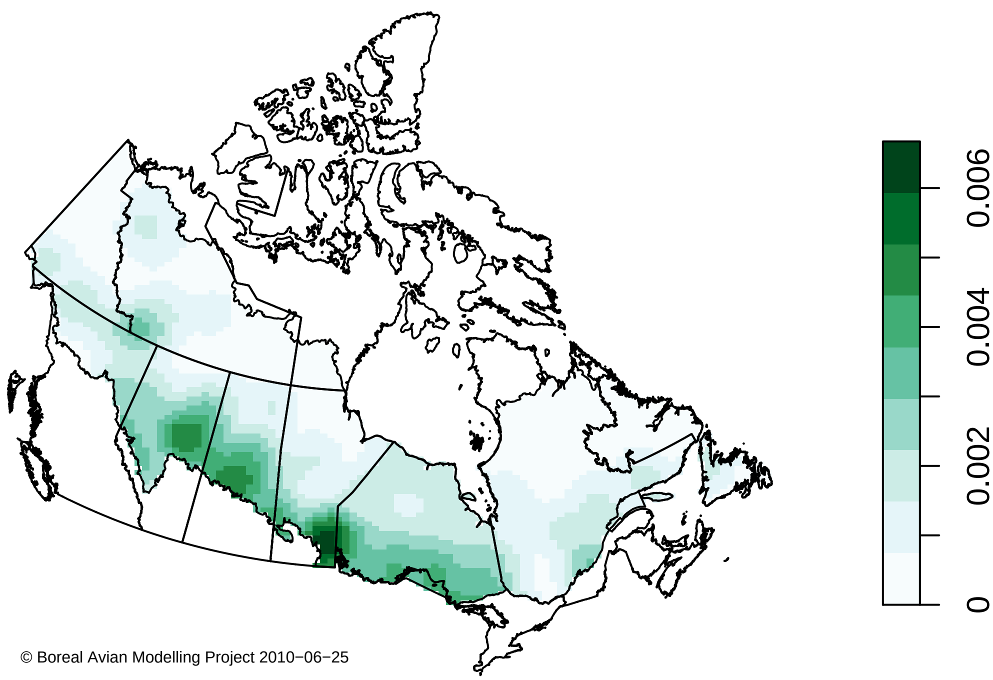

Figure 26: Spatial distribution of the first round

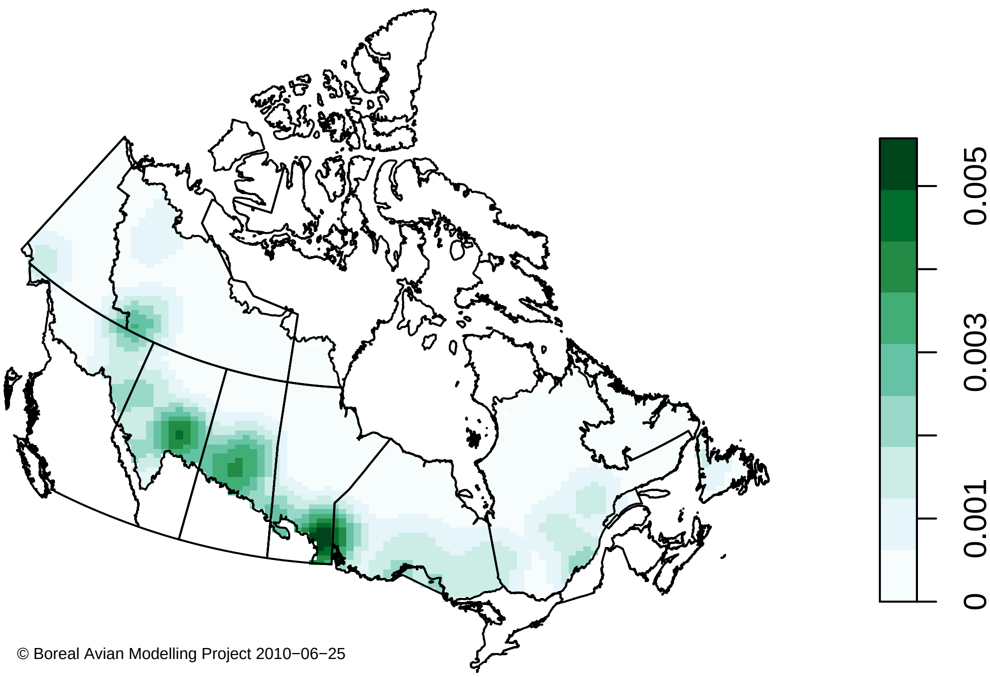

Figure 27: Sampling density of stations with at least 2 rounds within each year

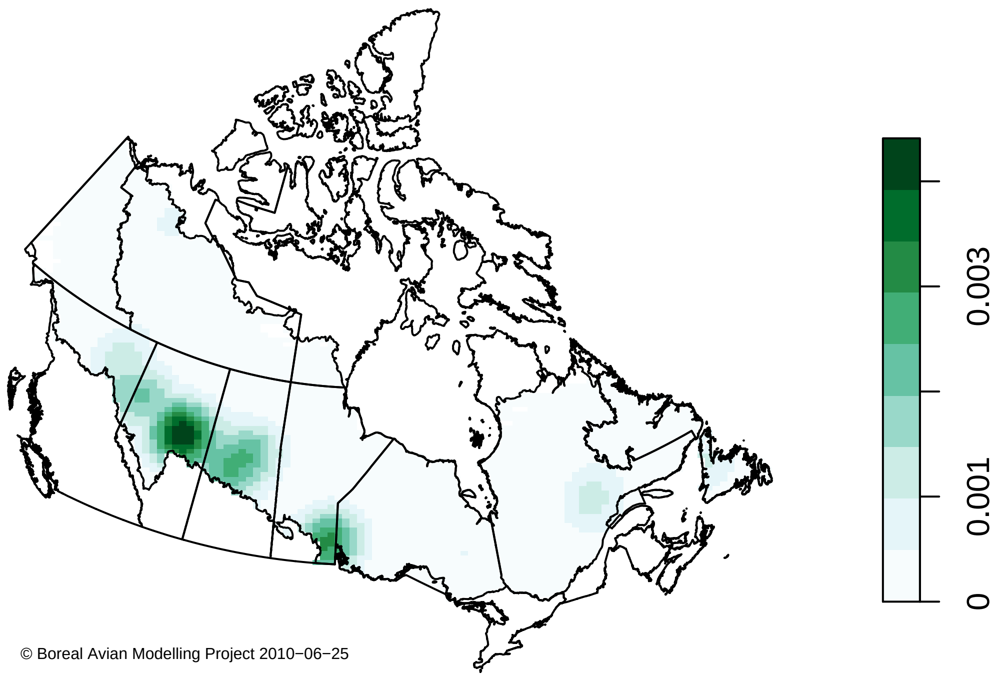

Figure 28: Sampling density of stations with at least 3 rounds within each year

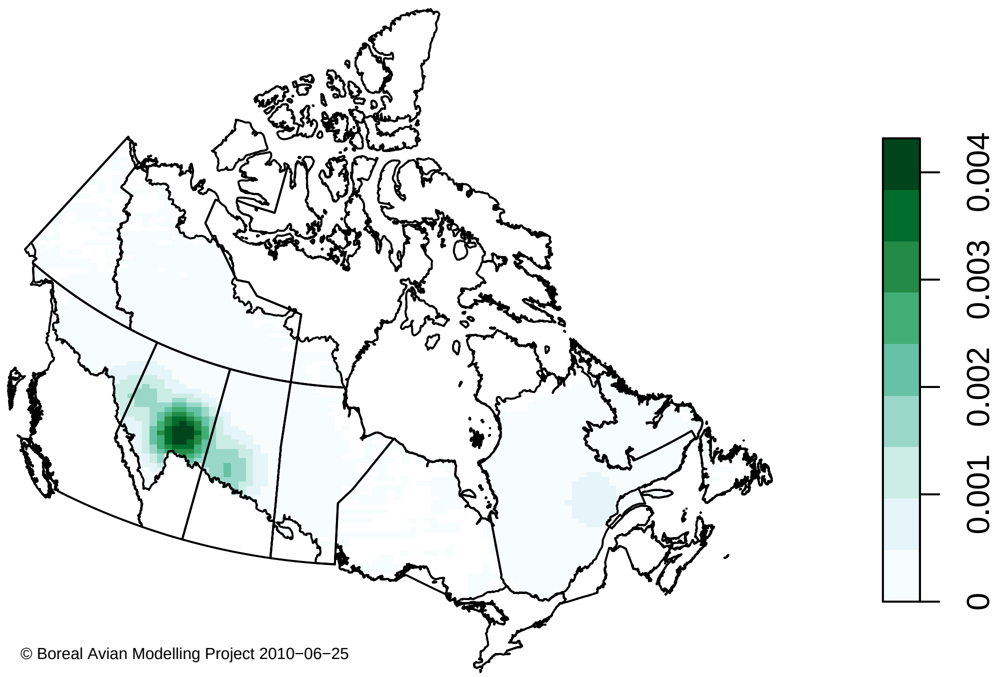

Figure 29: Sampling density of stations with at least 4 rounds within each year

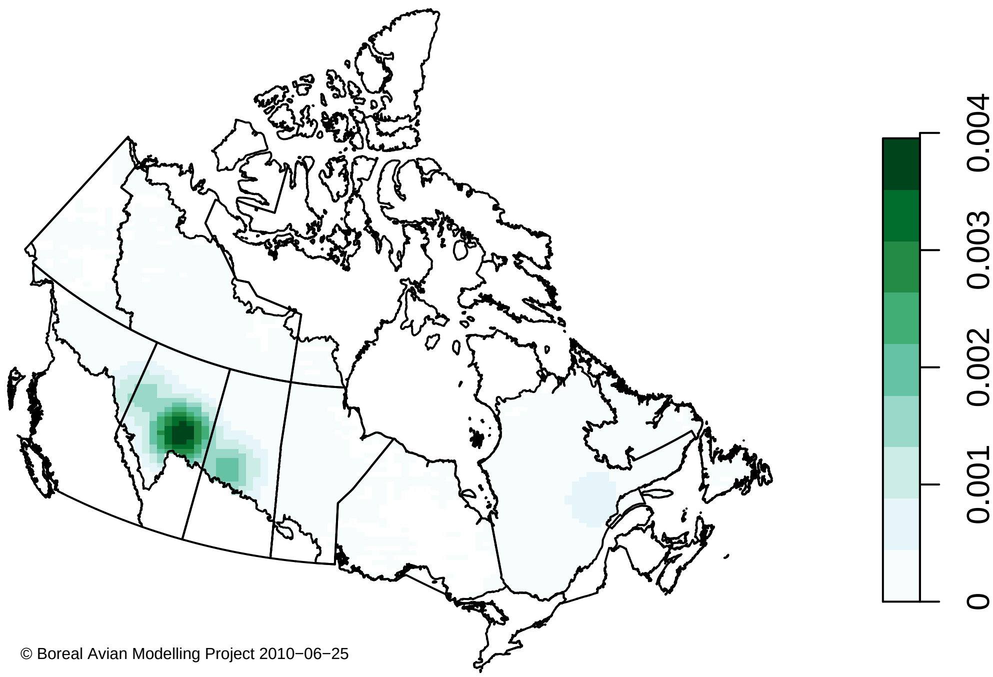

Figure 30: Sampling density of stations with at least 5 rounds within each year

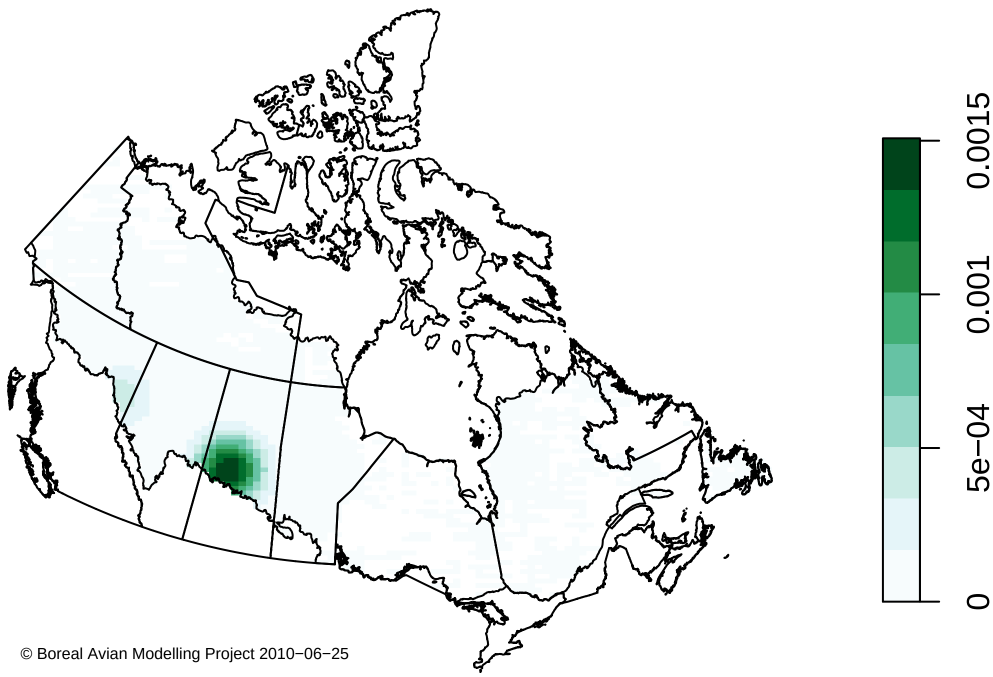

Figure 31: Sampling density of stations with at least 6 rounds within each year

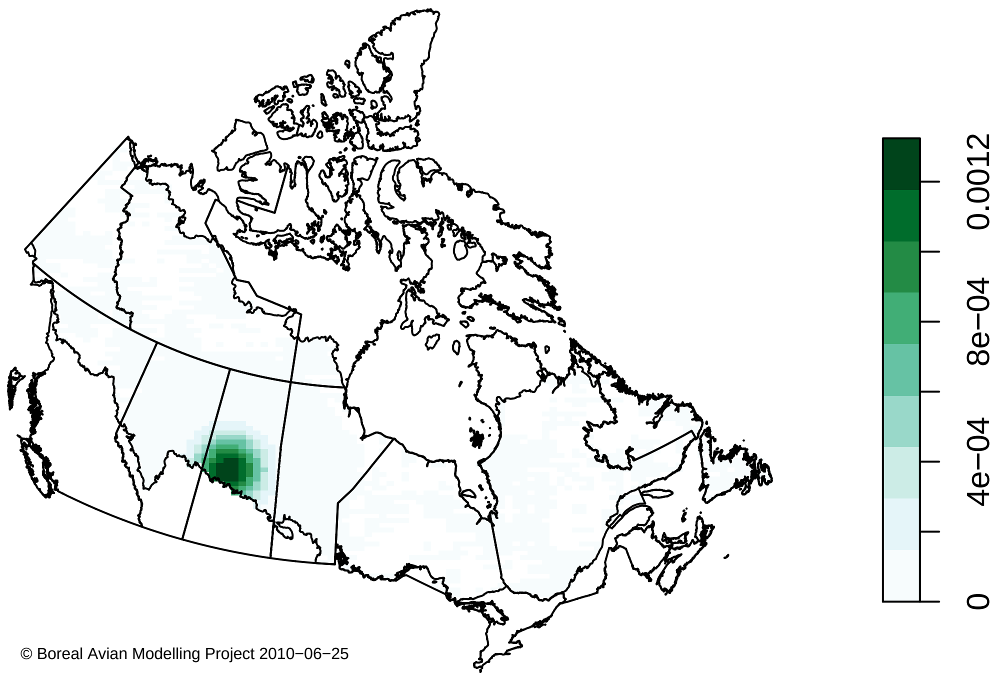

Figure 32: Sampling density of stations with at least 7 rounds within each year

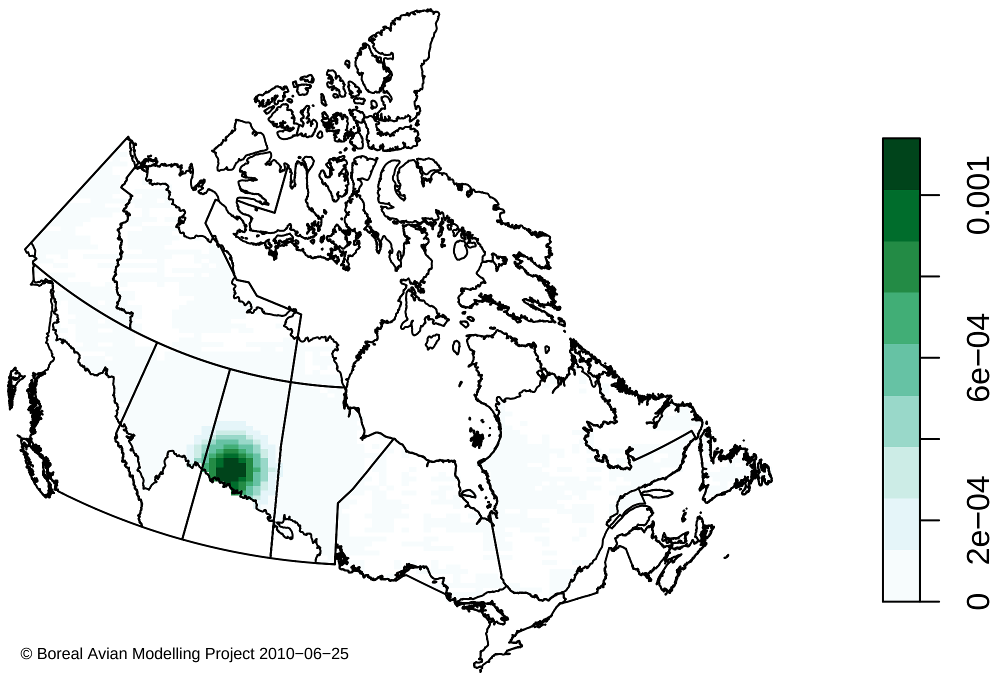

Figure 33: Sampling density of stations with at least 8 rounds within each year

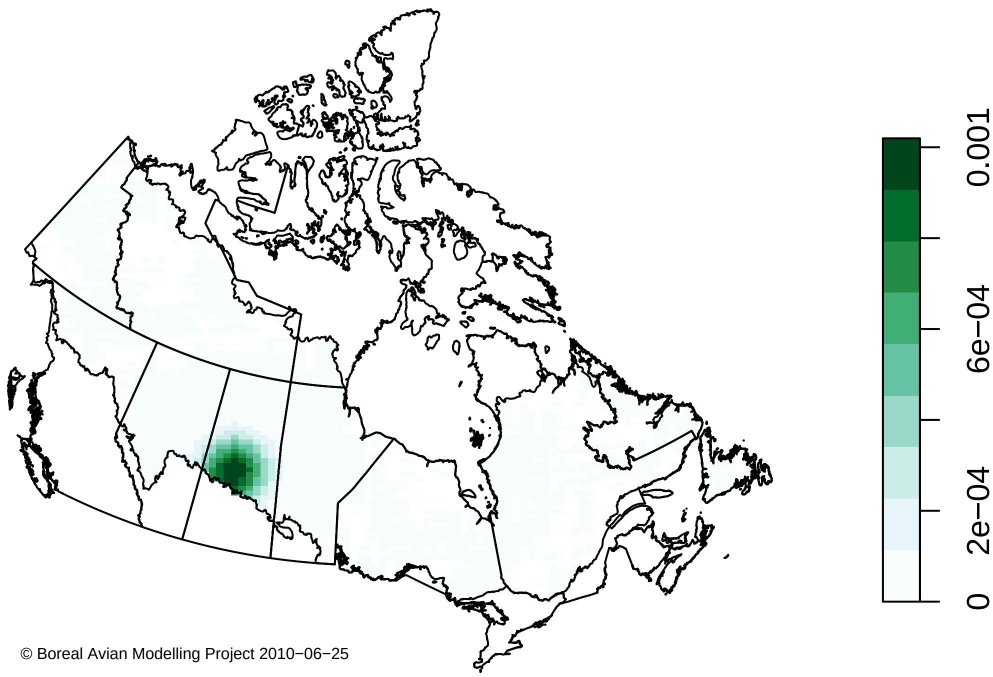

Figure 34: Sampling density of stations with at least 9 rounds within each year

3.3 Spatial distribution of sampling effort by protocal interval class

The sampling protocols vary among projects with respect to the total sampling interval and the temporal precision with which observations were recorded during these intervals. The majority of visits had a total duration of 3, 5, 10 or (rarely) 20 minutes. Within these durations, observations were sometimes recorded by interval class, as between 0-3 and 3-5 minutes within a 5 minute point count survey. The total number of classes is shown in Table **??**. In this section, we show the spatial distribution of rounds for which data were stratified by the more common interval classes.

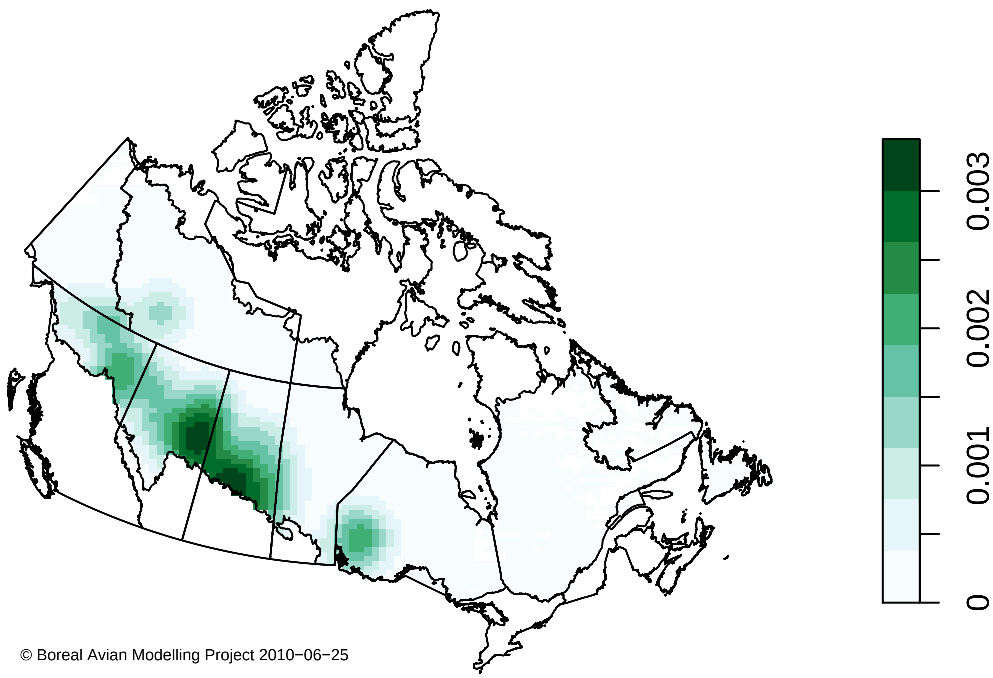

Figure 35: Spatial distribution of 0-3 min duration

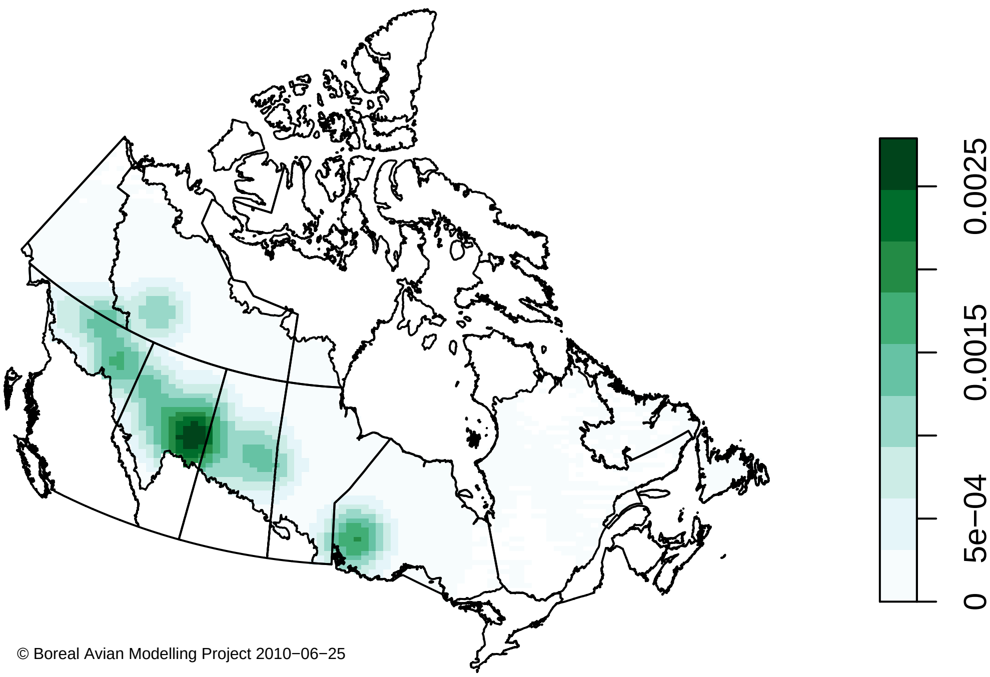

Figure 36: Spatial distribution of 3-5 min duration

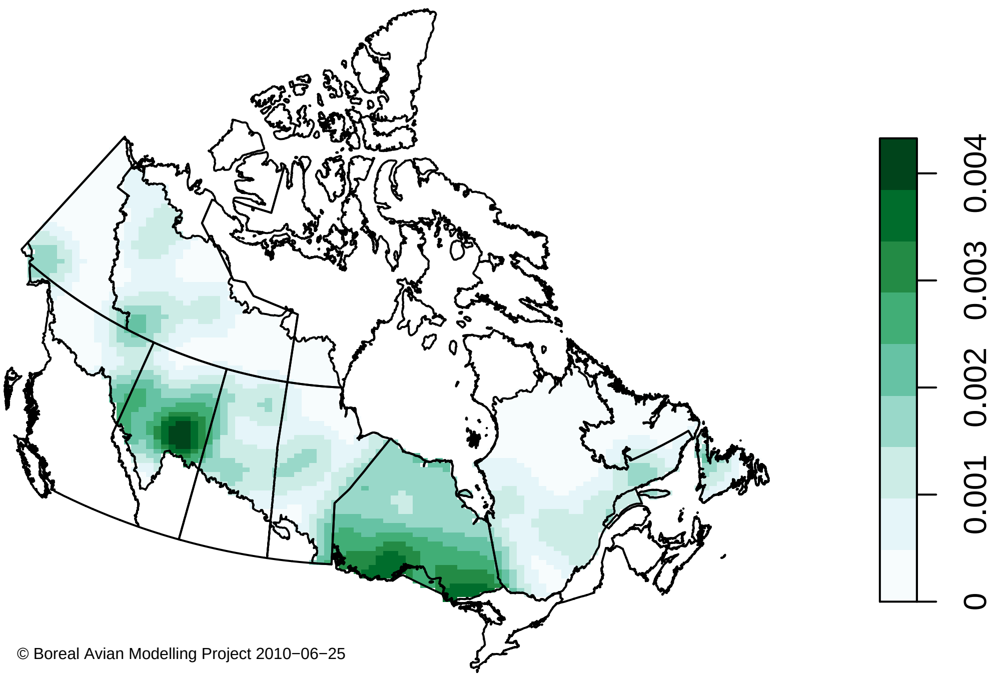

Figure 37: Spatial distribution of 0-5 min duration

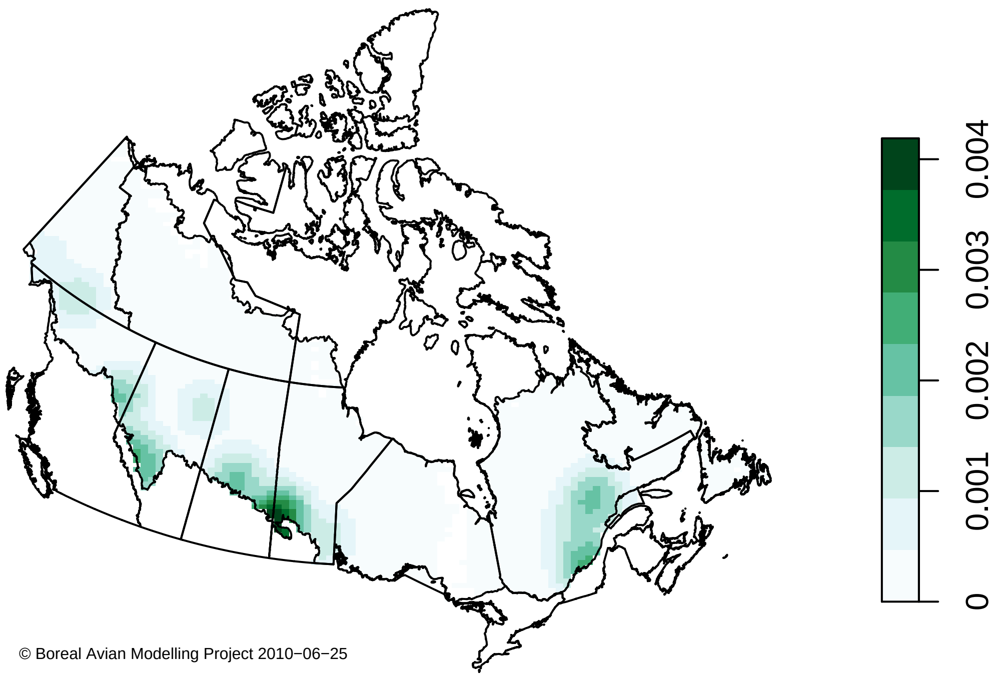

Figure 38: Spatial distribution of 0-10 min duration

3.4 Spatial distribution of sampling effort by protocal distance class

The sampling protocols vary among projects with respect to intended radius over which data were recorded, and the distance classes within that maximum radius. For example, many protocols used an estimated 100m detection radius, but stratified observations as less than 50m, 50-100m and greater than 100m. The total number of classes is shown in Table ??. In this section, we show the spatial distribution of rounds for which data were stratified by the more common distance classes.

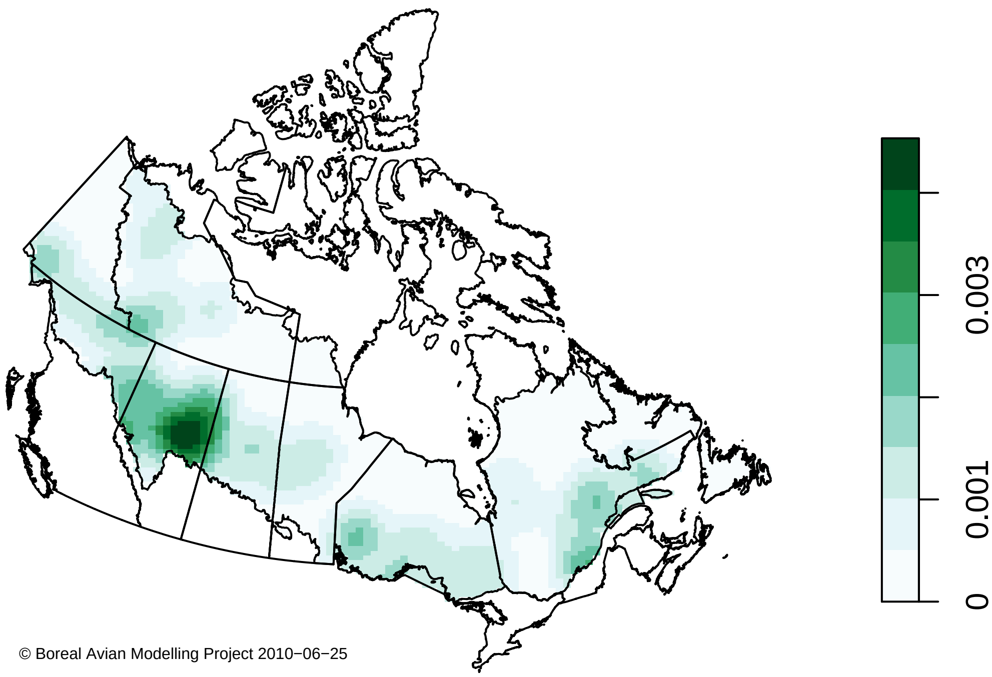

Figure 39: Spatial distribution of 0-50 m distance

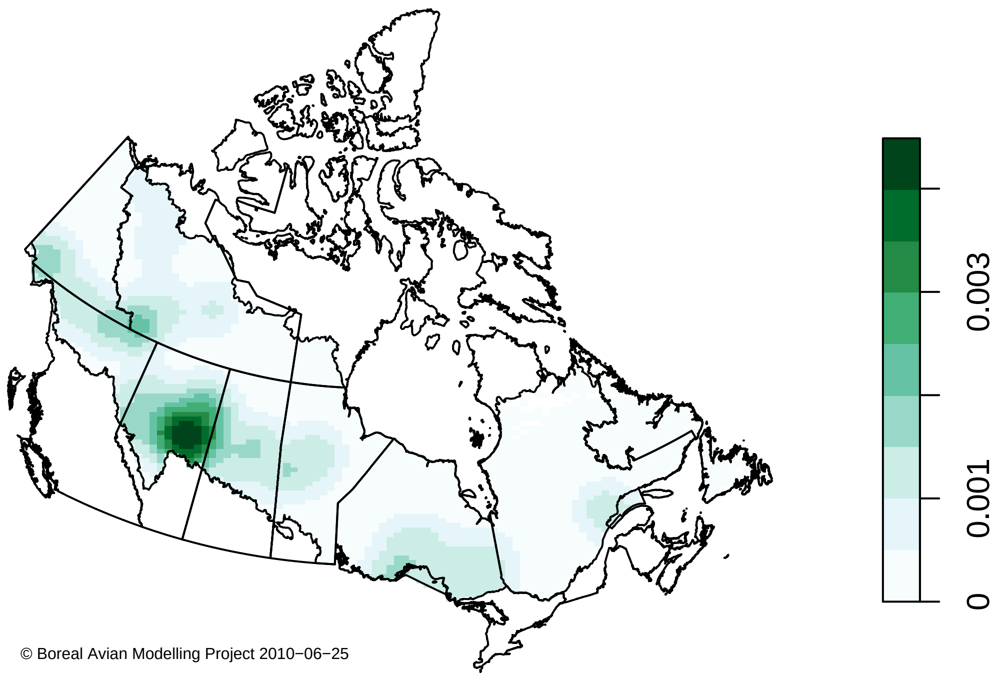

Figure 40: Spatial distribution of 50-100 m distance

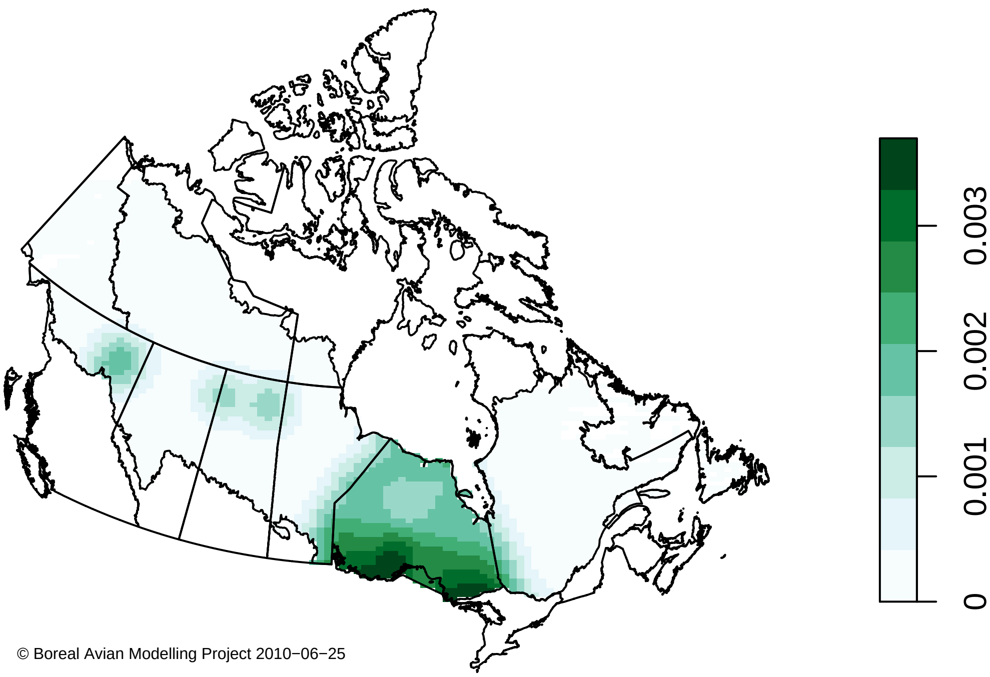

Figure 41: Spatial distribution of 0-100 m distance

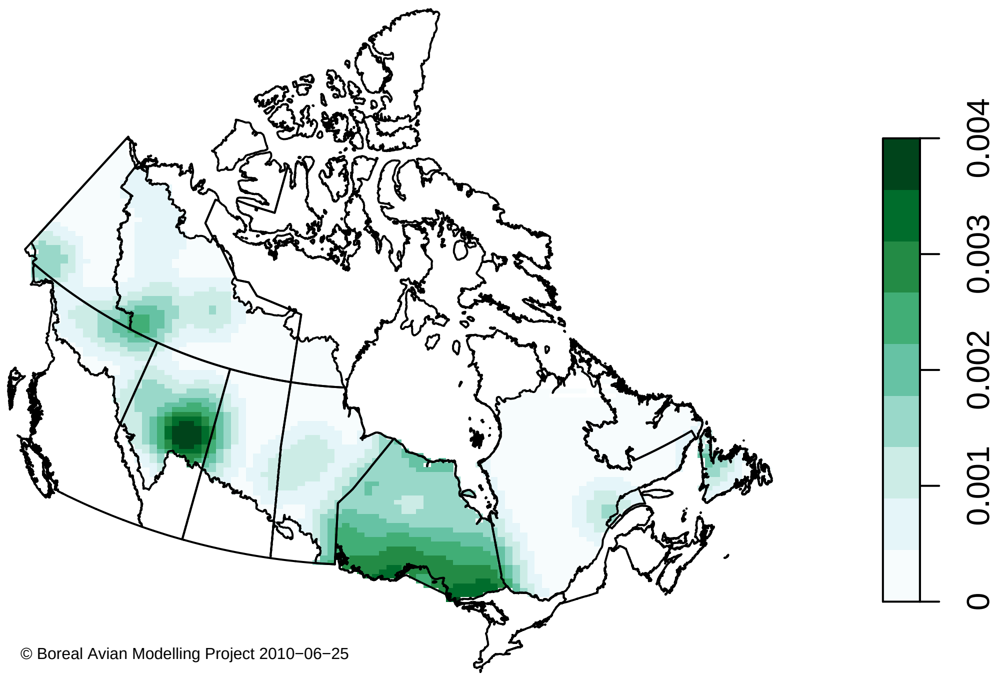

Figure 42: Spatial distribution of 100 + m distance

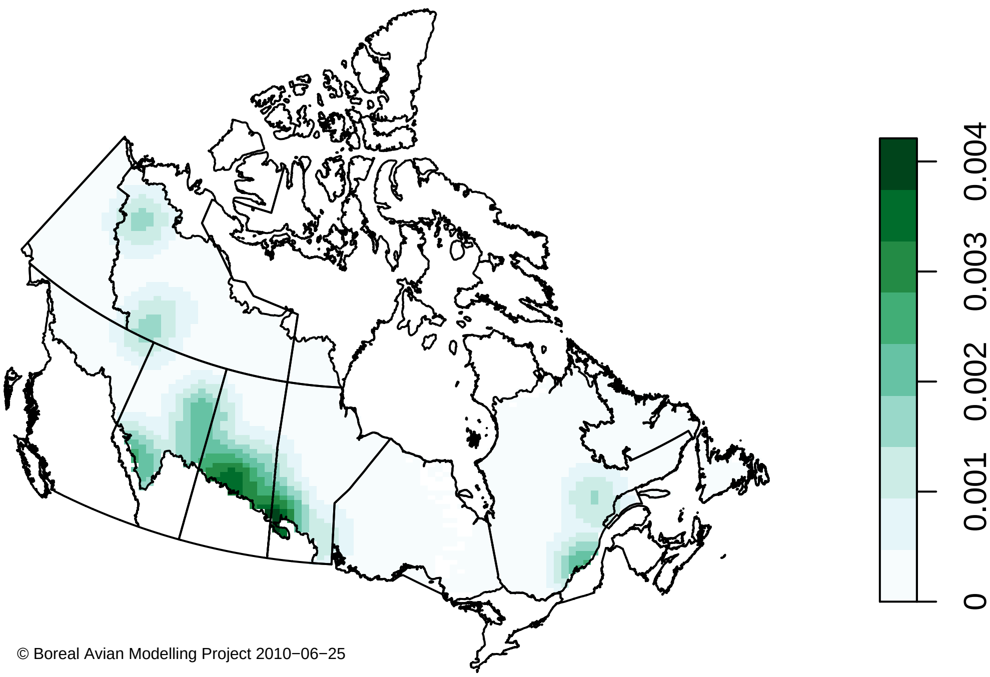

Figure 43: Spatial distribution of unlimited distance

3.5 Sampling effort by protocol classes used in nuisance parameter estimation

Subsets of the data collected at different combinations of distance and interval classes were used to estimate species-specific offsets to correct for these nuisance factors. The various combinations used as of 2010 are summarised in Table 7. The spatial distribution of the data at Station level are the reported in the following maps.

Table 7: Protocol combination used to calculate the correction factor

1	Standard protocol (10 minutes-unlimited-ditance)
2	5 minutes, unlimited-distance 3
3 minutes, unlimited-distance 4	10 minutes, 100 meters distance 5
5 minutes, 100 meters distance 6	10 minutes, 50 meters distance 7
5 minutes, 50 meters distance height	

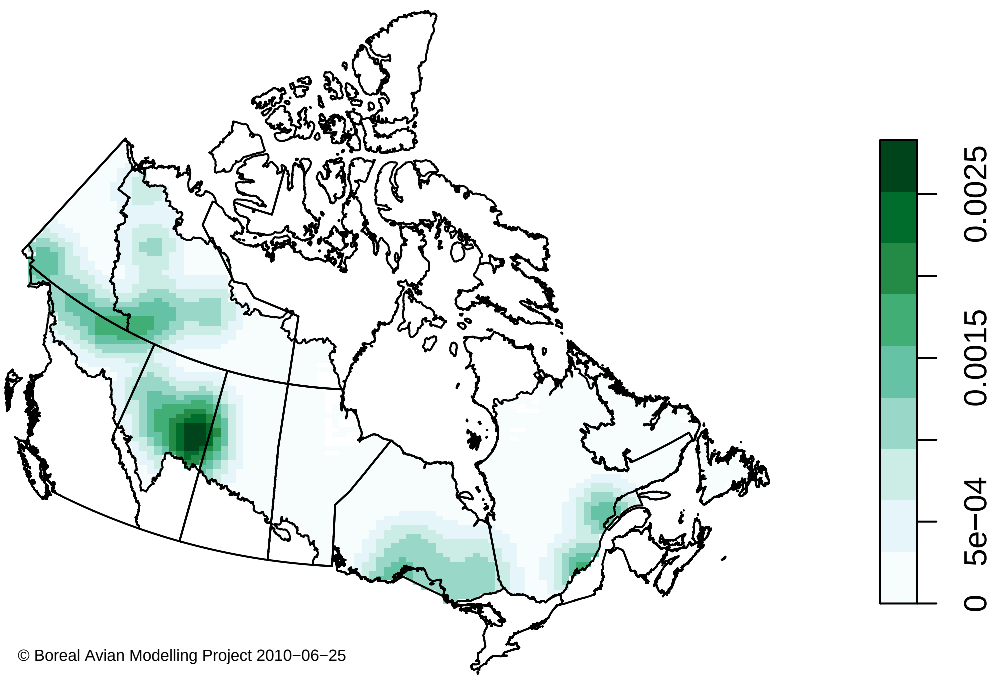

Figure 44: Spatial distribution of standard protocol

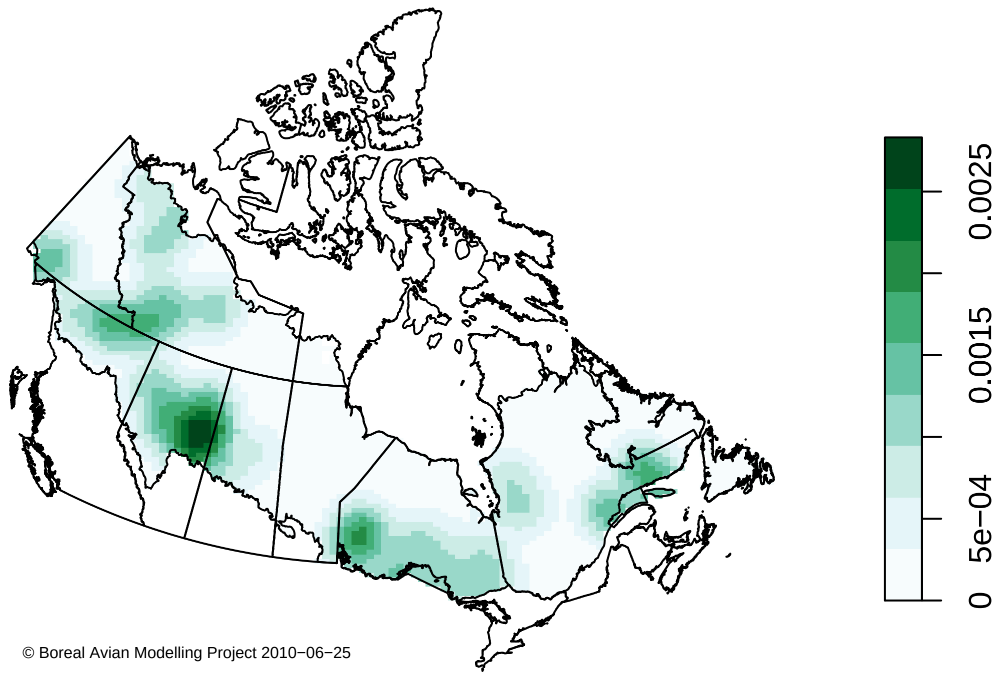

Figure 45: Spatial distribution of 5 minutes/unlimited-distance

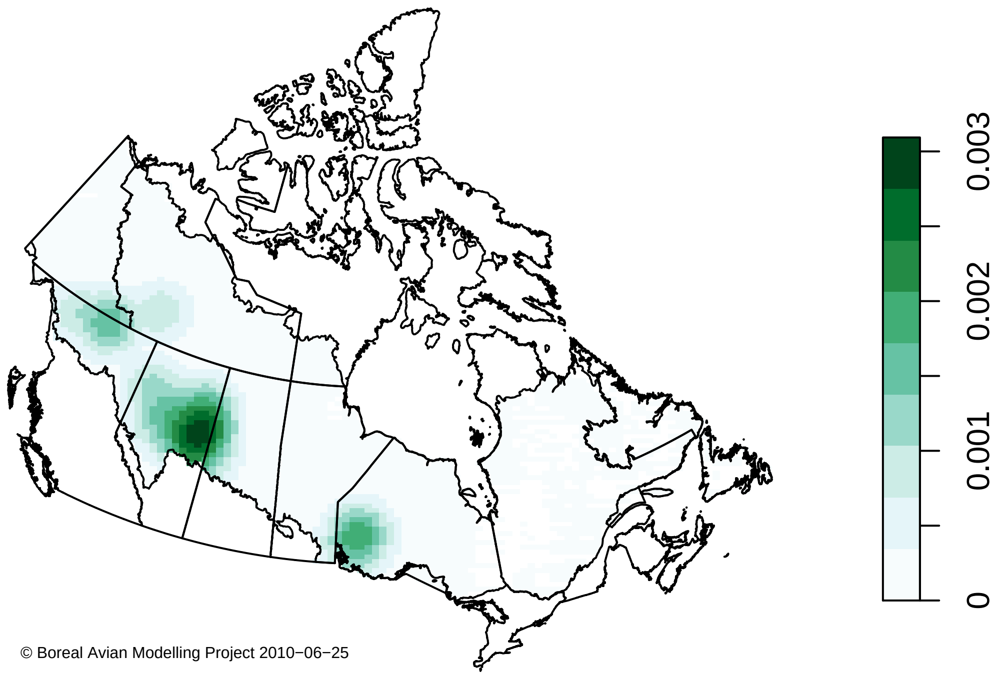

Figure 46: Spatial distribution of 3 minutes/unlimited-distance

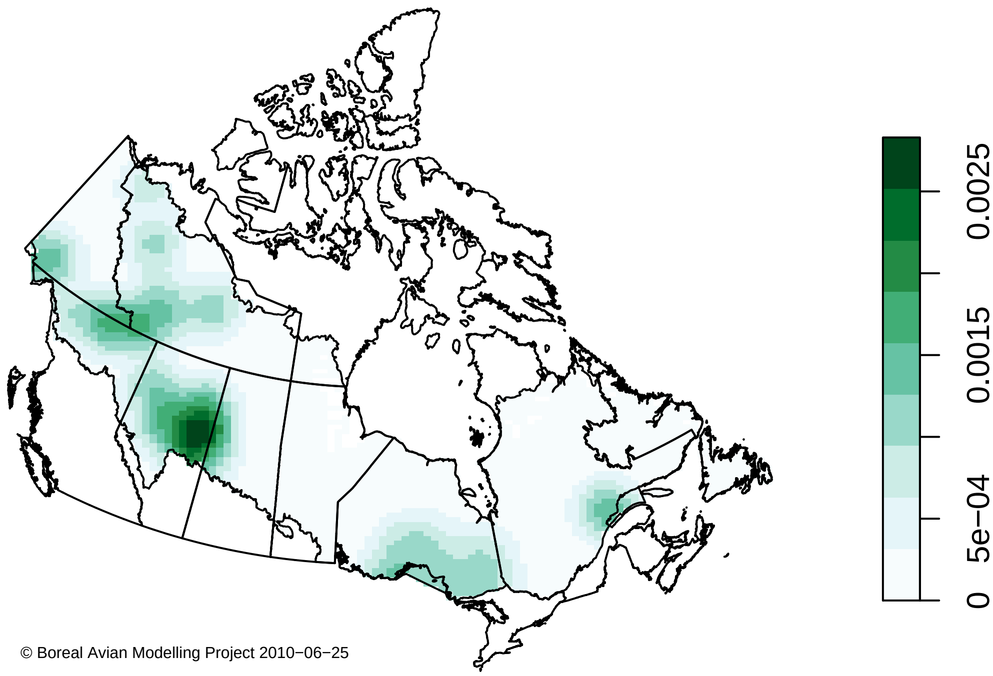

Figure 47: Spatial distribution of 5 and 10 min/100 m

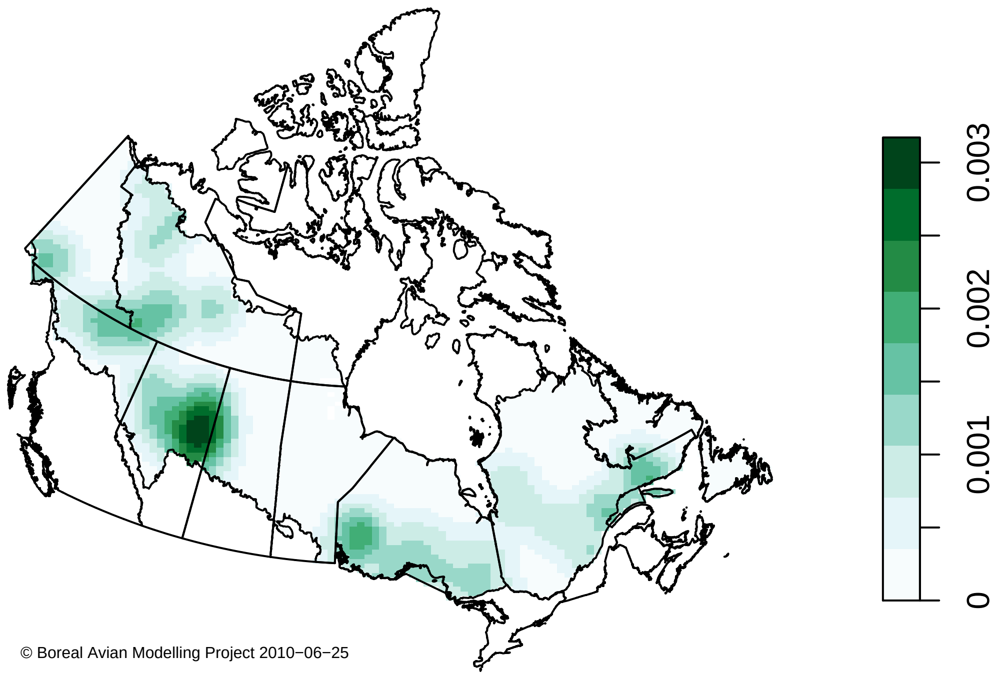

Figure 48: Spatial distribution of 5 and 10 min/50 m

Different distance protocol distribution not included in the correction factor.

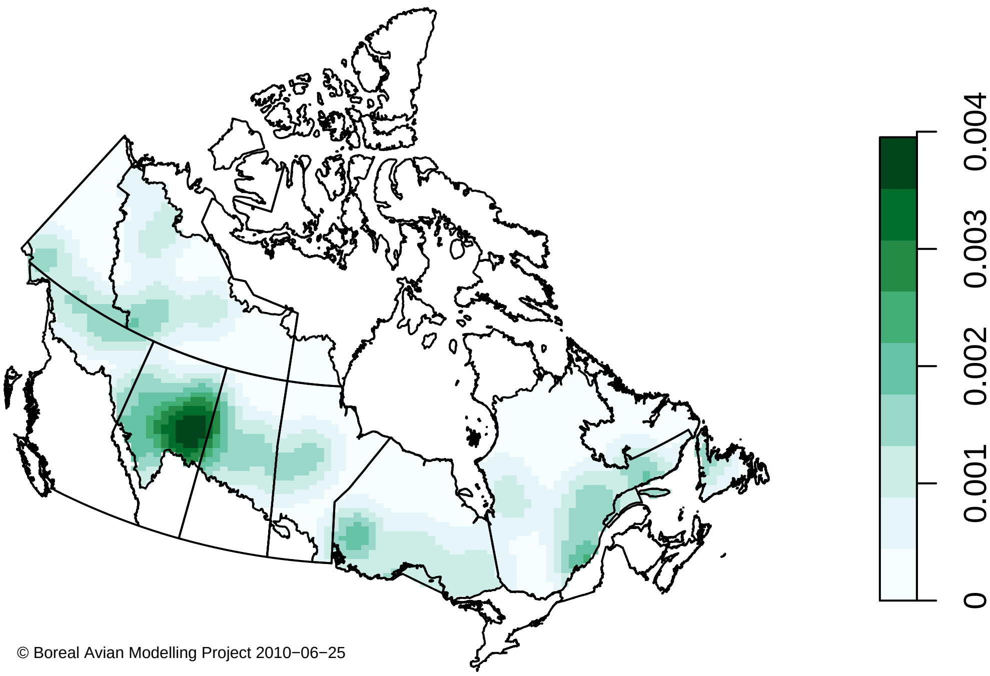

Figure 49: Spatial distribution of 50 m

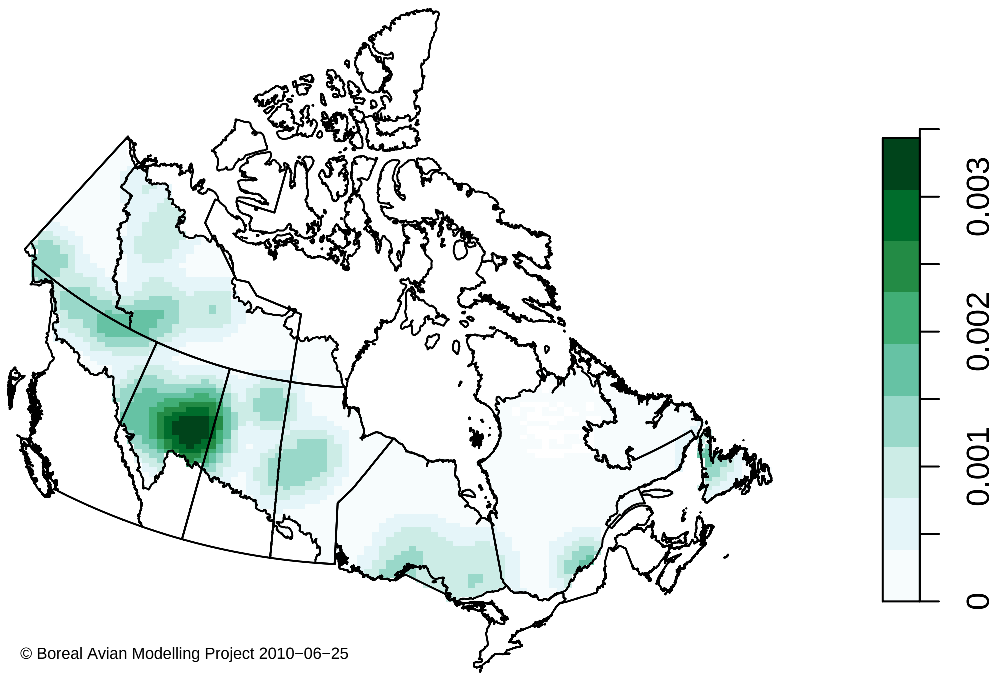

Figure 50: Spatial distribution of 100 m

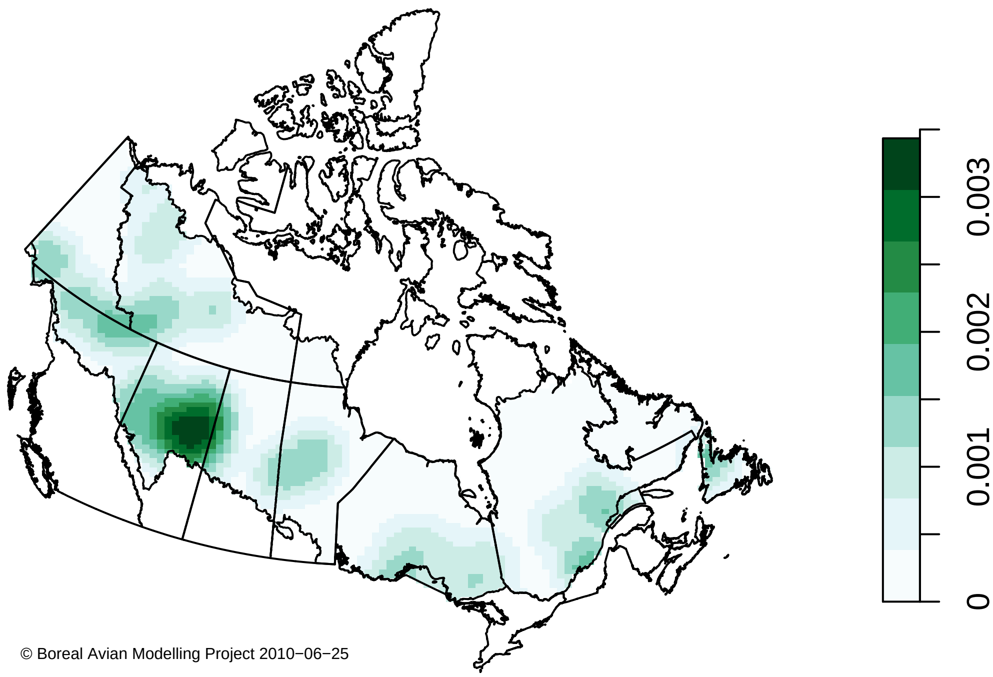

Figure 51: Interpolated sampling density, Multi radius

4 Bird species richness

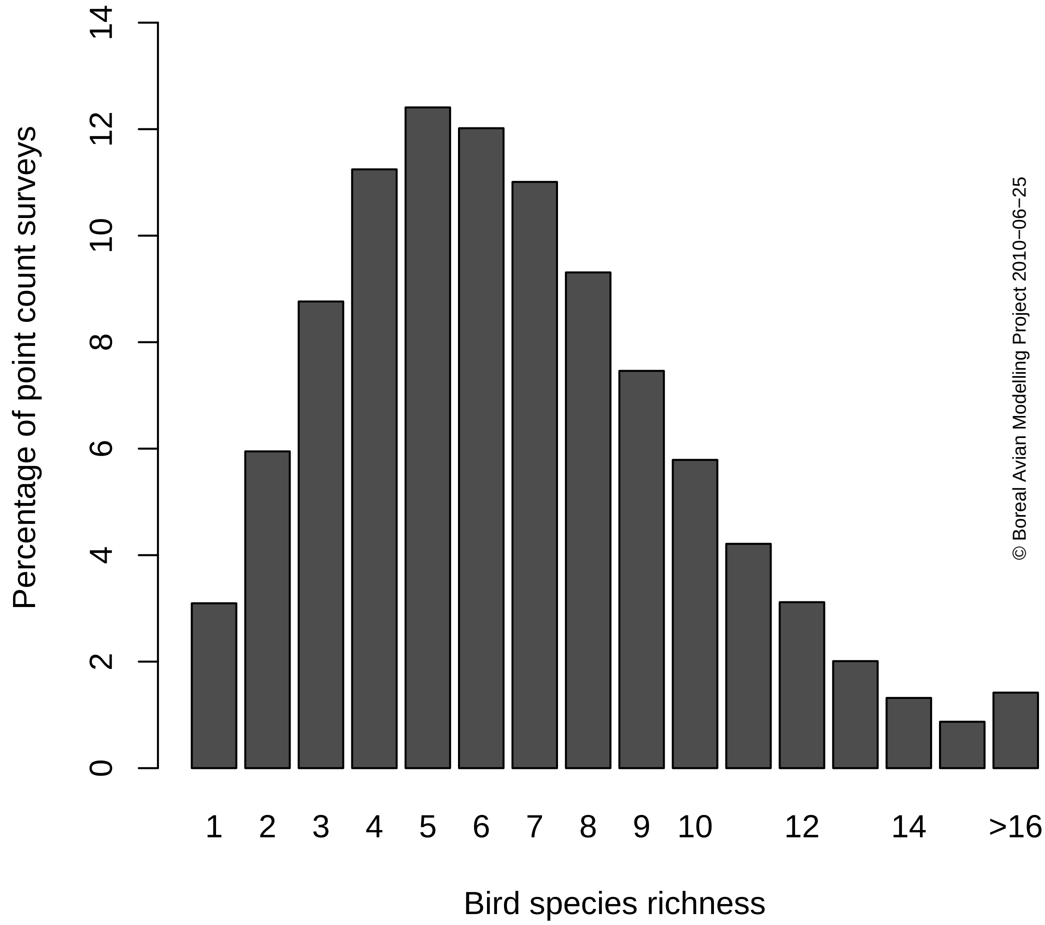

Figure 52: Distribution of bird species richness in point counts for total dataset