

Appendix 2 – Extended results

This an appendix to Knufinke, Helldin, Bhardwaj, Olsson: Temporal patterns of humans and ungulates at bridges – Co-existence or disturbance? In this appendix the results are described more in detail. This appendix includes further diagrams that are not included in the main report.

Appendix 2A Description of temporal patterns

1) All bridges in Norrbotten combined

1a) Diurnal patterns

The hourly diagram of analyzed periods in Norrbotten was showing more or less equally distributed activity patterns. The least animals were active at 00 o'clock (3 events) whereas the most events (29) were recorded at 17 o'clock. Reindeer activity was the highest in the daytime, from 08 to 18 o'clock. Moose on the other hand seemed to have been more active in the evening, dusk, dawn and early morning hours, from 17 to 08 o'clock. The activity of roe deer seemed to have been primarily bound to the dawn and morning hours.

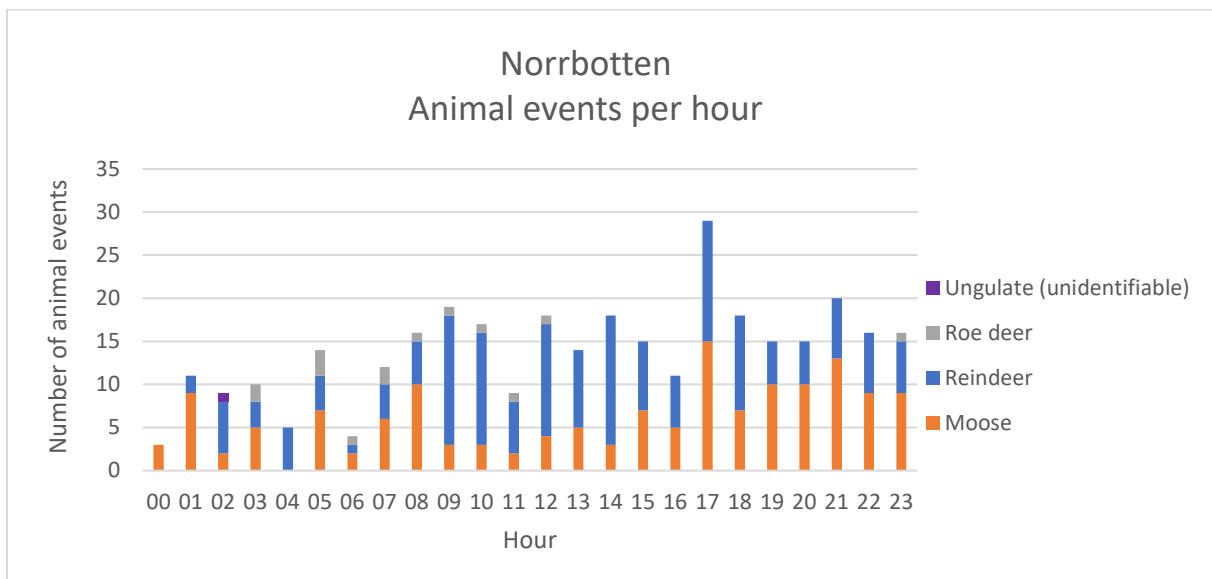


Figure 1: Animal events per hour in Norrbotten

The combined human activity in Norrbotten was showing a very clear pattern. Only a few human events were recorded in the late night hours and the early morning hours between 23 and 08 o'clock. The peak in the human activity was in the mid of the day, at 13 and 14 o'clock. The types of activity seemed not to have been related to the time of the day.

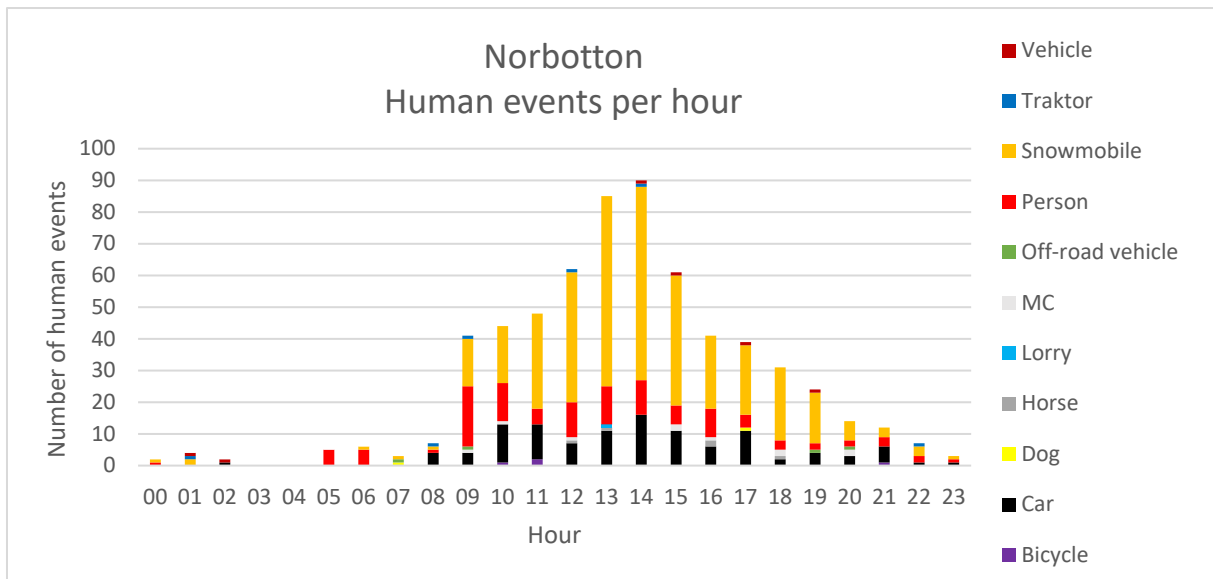


Figure 2: Human events per hour in Norrbotten

1b) Patterns over the week

Just like the diurnal pattern, the weekly animal usage of the crossing structures and their surroundings at Norrbotten was showing no strict patterns. Both moose and reindeer were recorded at every weekday. Roe deer on the other hand were only recorded from Wednesday to Sunday. The highest number of animal events took place on Tuesdays (55 events), followed by Mondays (54 events).

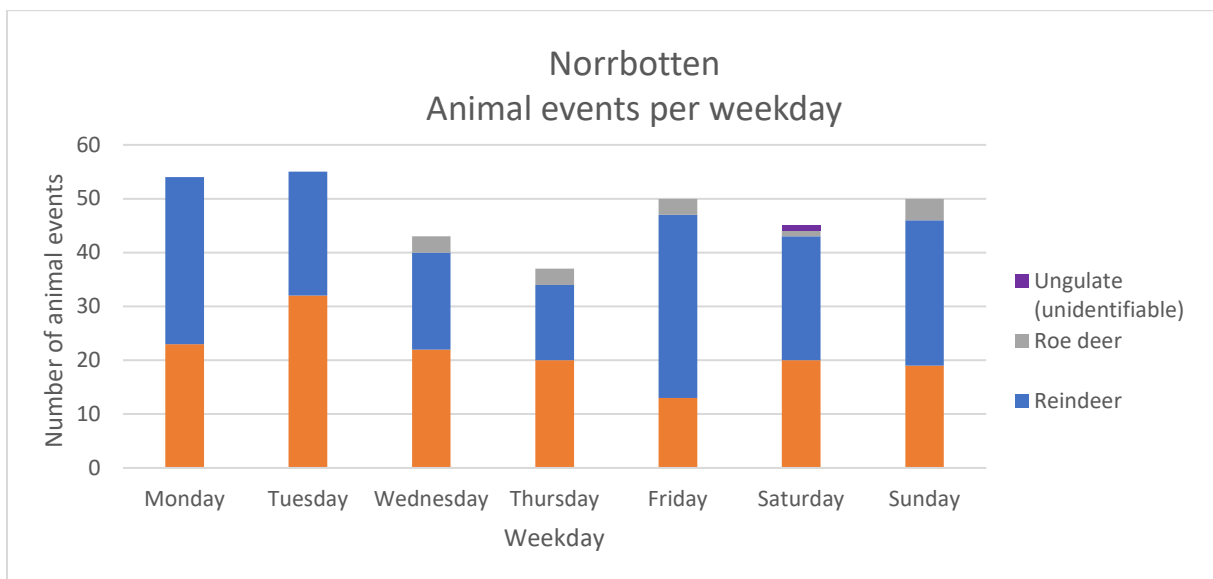


Figure 3: Animal events per weekday in Norrbotten

In comparison to the animal's weekly usage, the humans showed a clear preference for the weekends. Snowmobiles made up a big share at every weekday, however, their biggest share was on the weekends. With 100 of 150 events on Saturdays and 102 of 145 events in Sundays they made up the lion's share of human events at weekends. Cars and pedestrians were always making up a similar share at each day.

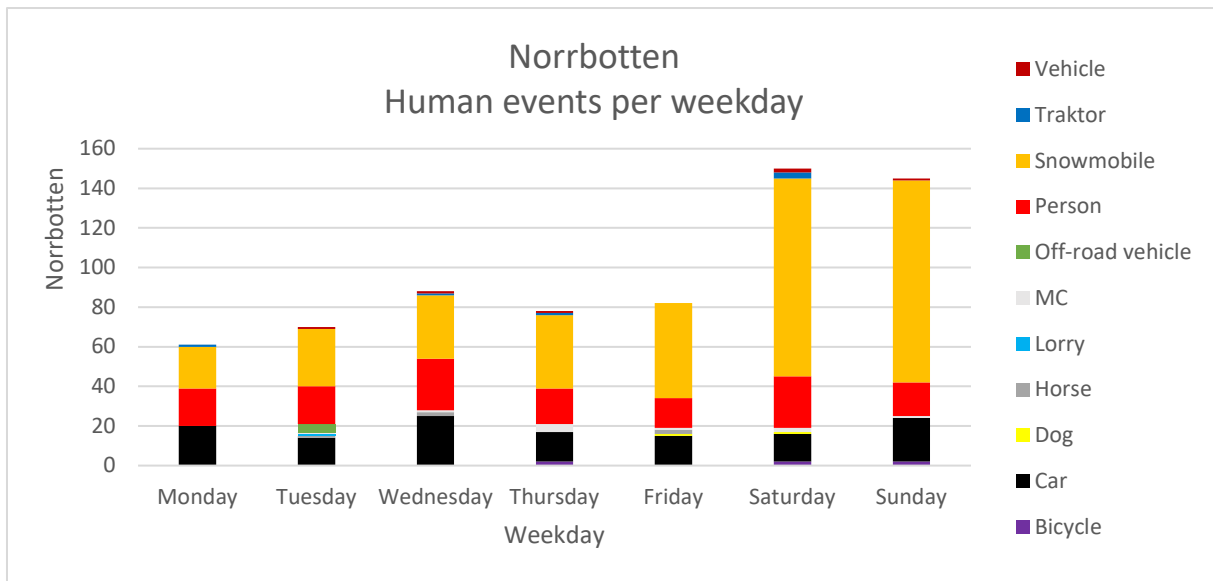


Figure 4: Human events per weekday in Norrbotten

1c) Patterns over the winter

Unlike the hourly and weekdayly animals use in Norrbotten, the monthly use was showing clear differences in the usage. Animals were mostly active in December and least active in March. Both moose and reindeer were recorded in every month, nevertheless their abundance changed. Moose's peak were from December to February with 40, 31 and 40 events. The reindeer on the other hand showed peaks of activity in November (28 events), December (42 events), February (29 events) and April (29 events). Roe deer activity was concentrated on April (five events) and June (8 events), however one roe deer event was also recorded in January.

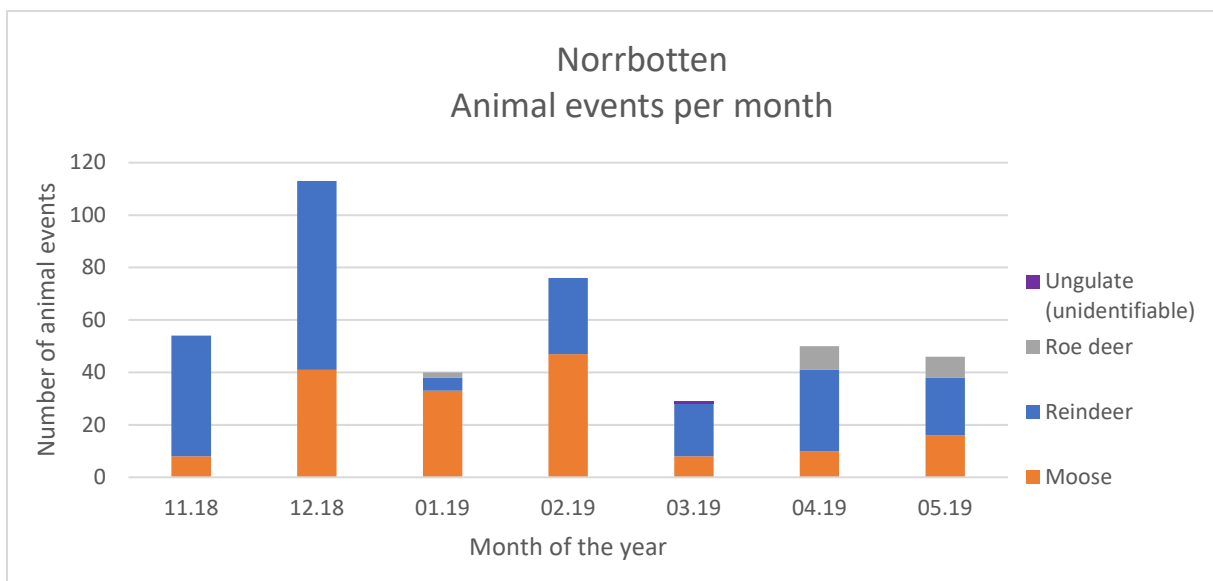


Figure 5: Animal events per month in Norrbotten

The monthly human events were showing a preference for the later winter and the beginning of spring. With 21 human events the lowest activity was in December, the highest activity in

March (185 events). From January to April snowmobiles made up a big or the biggest share of all human events. In the periods of the highest snowmobile use (February to April) the use of cars was relatively low in contrast to previous and following months, where more cars were recorded.

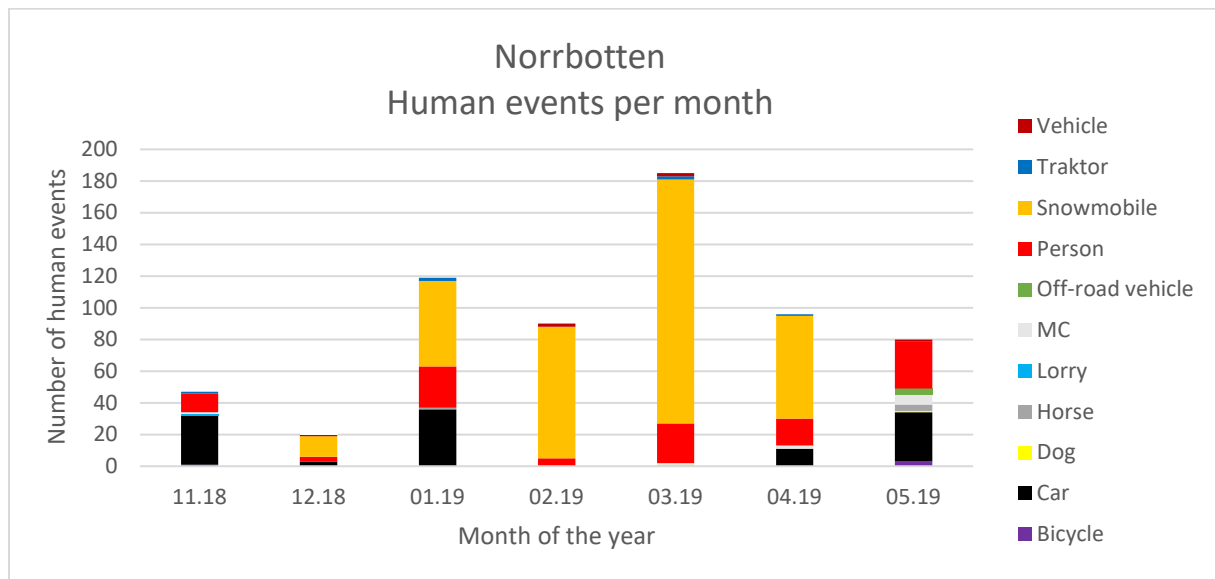


Figure 6: Human events per month in Norrbotten

2) Harrioja

2a) Diurnal patterns

Harrioja was used by all three occurring ungulate species. Reindeer made up the biggest part of the events with 27 events in total, followed by seven moose and three roe deer crossing events. The hourly animal use at Harrioja was showing very low rate of use in the later night and early morning hours (00-06 o'clock). The reindeer started to use Harrioja from 07 o'clock on, resulting in a peak at 14 o'clock with 5 animal events in the study period. From then on reindeer use was reduced again, with an interruption at 21 o'clock with four reindeer events. Moose used Harrioja at 3 o'clock and in between of 17 and 21 o'clock. Two events took place at 18 o'clock and 20 o'clock respectively. Roe deer use at Harrioja was rare. The use took place at 7 o'clock (two events) and 23 o'clock (one event).

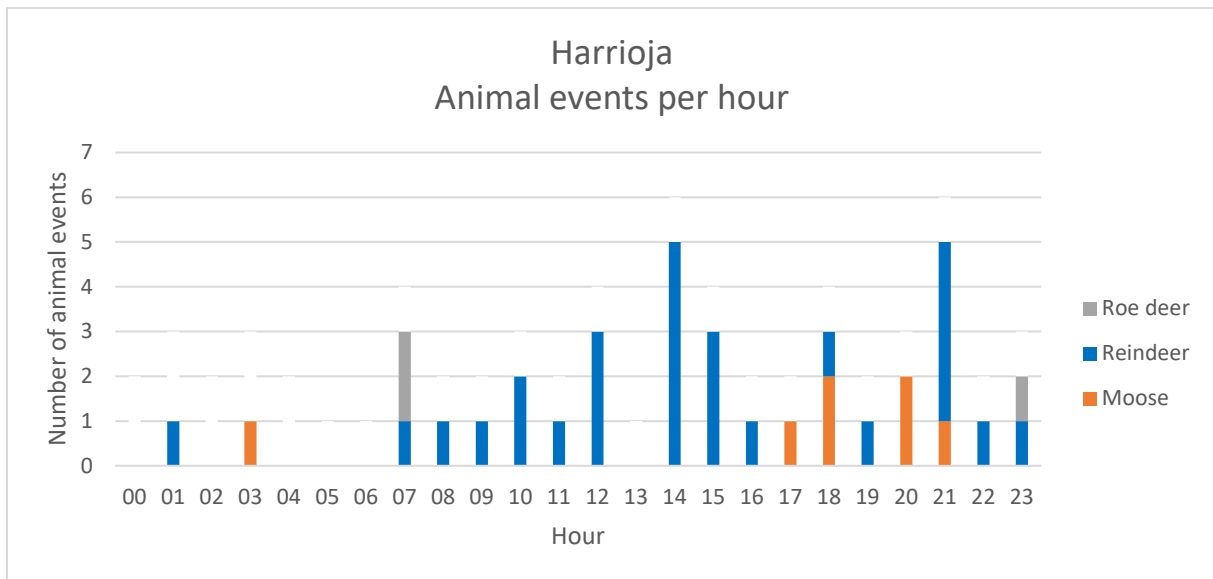


Figure 7: Animal events per hour in Harrioja

In total 93 human use events were photographed at Harrioja. The biggest amount of human use were snowmobiles with 61 usage events, followed by 17 cars and 10 pedestrians. Humans were primarily active from 8 to 19 o'clock with a very clear peak in the mid of the day, from 12 to 15 o'clock, resulting in a maximum of 16 human crossing from 14:00 to 14:59.

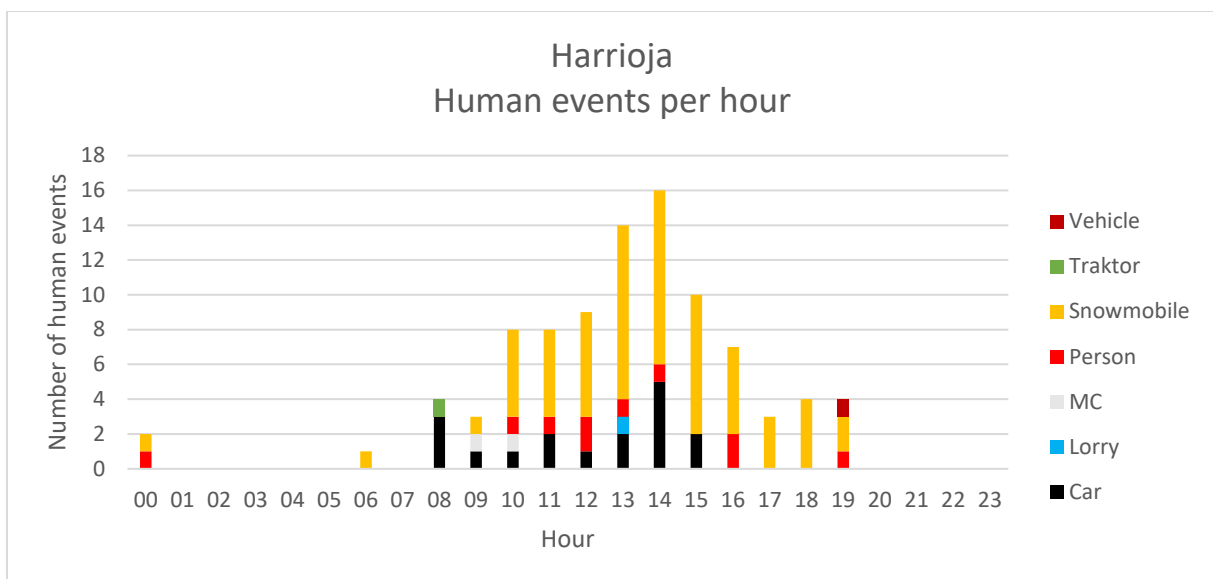


Figure 8: Human events per hour in Harrioja

2b) Patterns over the week

Ungulates used Harrioja every day, except for Thursday. In general, the activity was higher in the week in comparison to the weekend. Both reindeer and moose were active on weekdays and on the weekend, whereas roe deer were only active on weekdays.

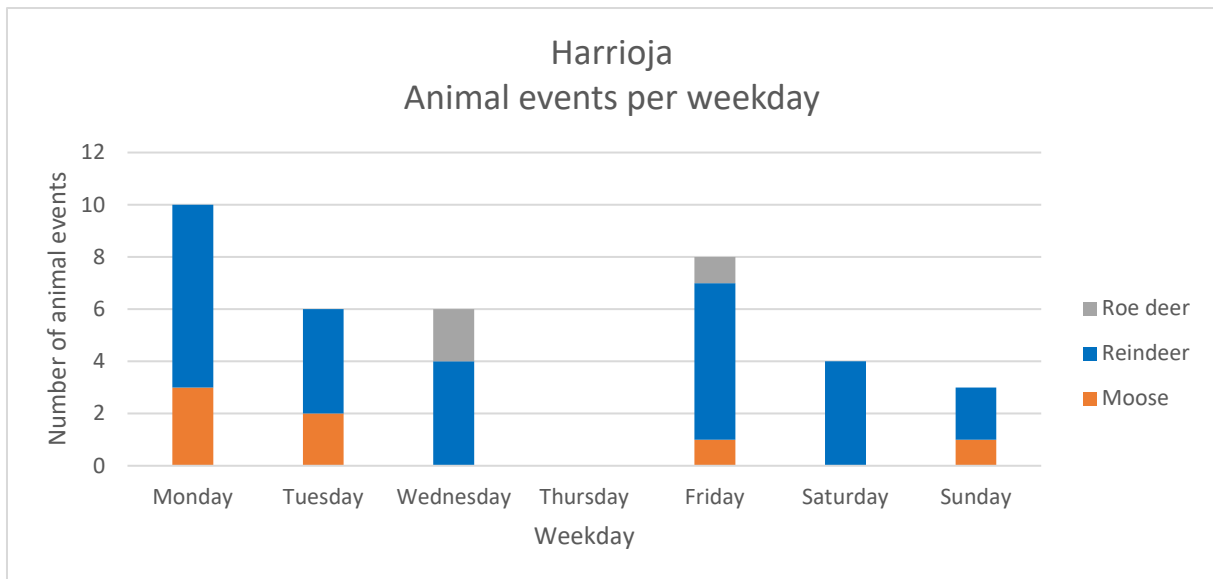


Figure 9: Animal events per weekday in Harrioja

Humans at Harrioja were active throughout the week. The Human use, especially with Snowmobiles was showing a very clear weekly pattern, with values multiple times in the weekend higher (19 events at Saturdays and 25 events at Sundays) compared to weekdays. Other human activities at Harrioja did not show such clear patterns.

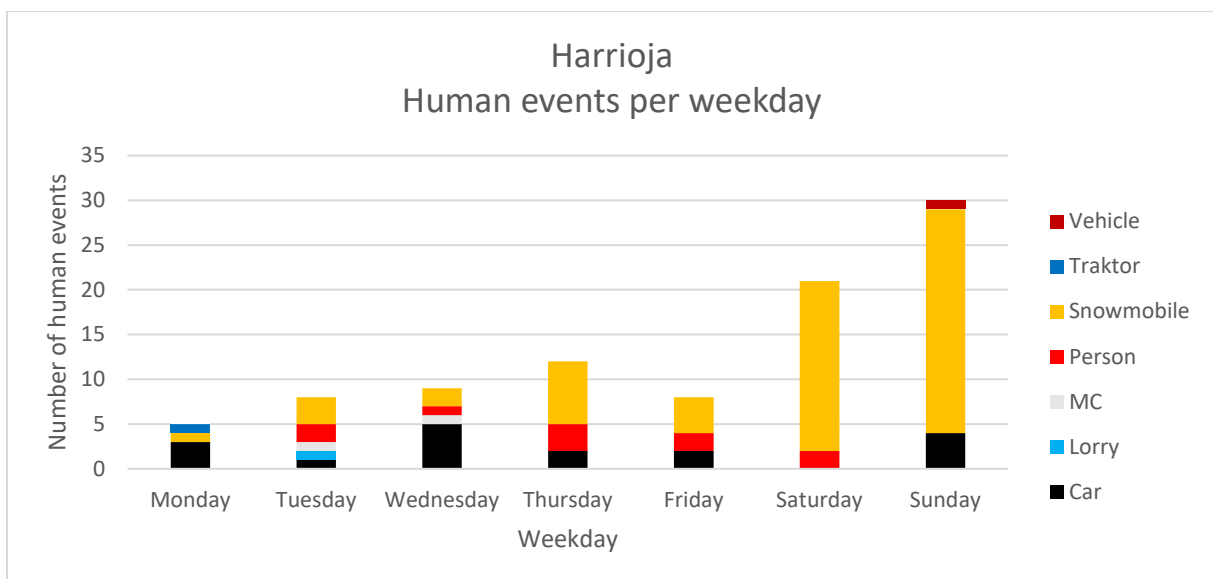


Figure 10: Human events per weekday in Harrioja

2c) Patterns over the winter

Animals use at Harrioja showed a very clear patterns for monthly usage. Reindeer were using the area in every month but showed higher activity in November (eight events) and December (nine events), even though the survey only started in the middle of November. The usage in the other months was more or less constant with one to four animal events per month. Moose were only detected in December, January and March, with a maximum of four moose events in December. Roe deer were only photographed in spring, resulting in one roe deer event in April and two events in May.

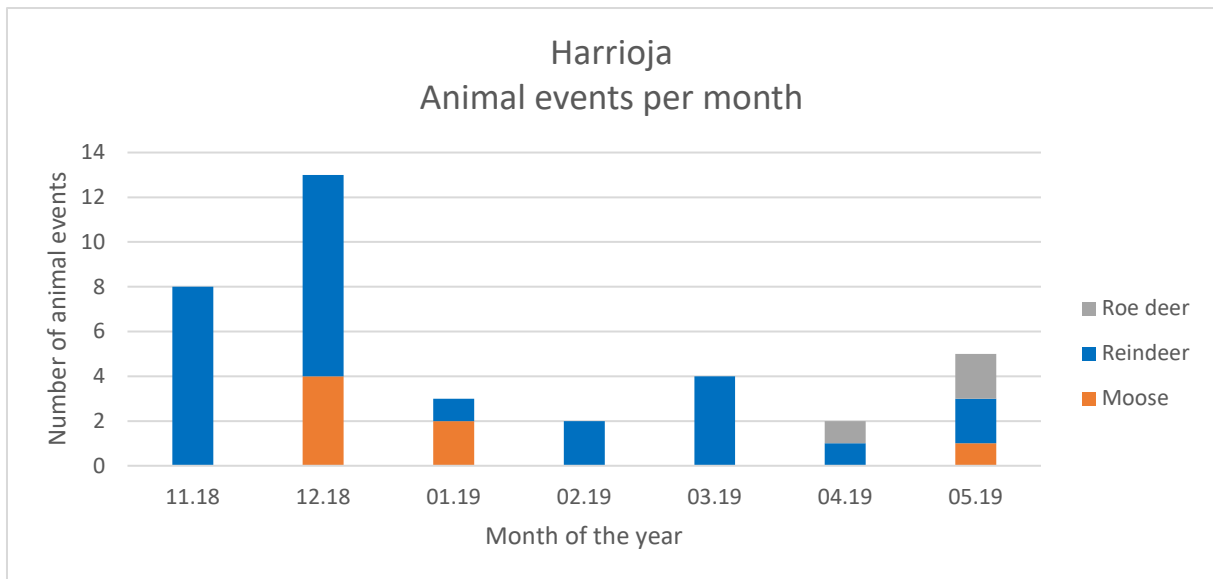


Figure 11: Animal events per month in Harrioja

The human usage at Harrioja was not only showing patterns in hourly and weekly use, but also in the monthly activity. Human use had three peaks, 22 events in November, 20 in February and 29 in March. However, the human activity in November compared to February/March was quite different. Whereas 17 of the 22 events in November were cars, 19 events in February and 26 events in March were humans were using snowmobiles.

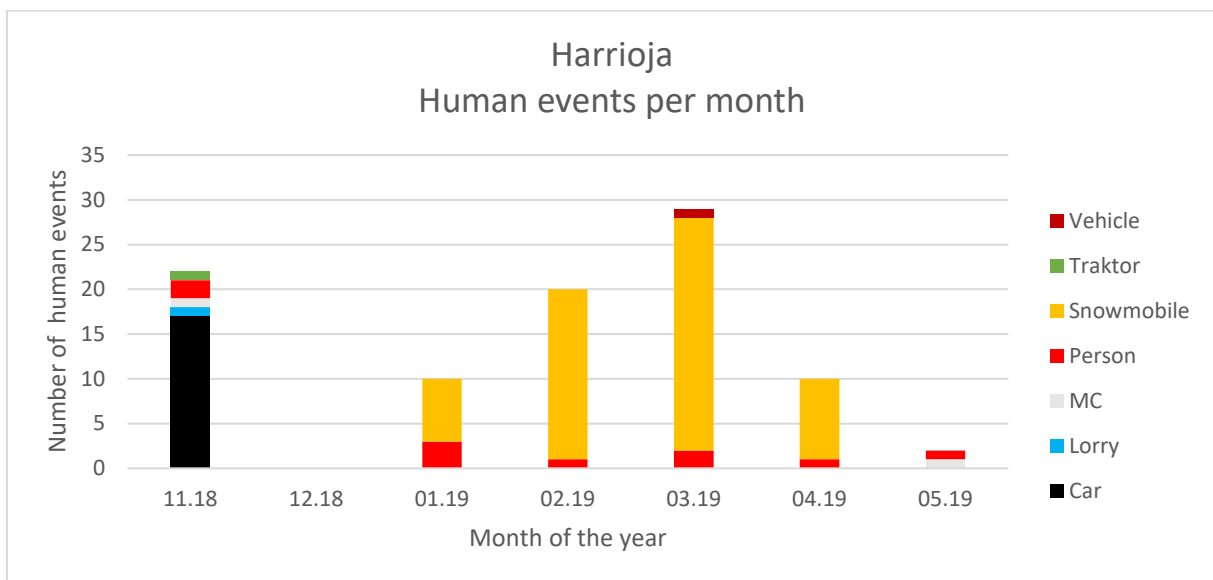


Figure 12: Human events per month in Harrioja

3) Mertainen

3a) Diurnal patterns

Animal use for both species, moose and reindeer, in Mertainen was round the clock, except for 01 o'clock without showing a very clear pattern. However, reindeer seemed to be more active in the daytime. Reindeer activity was the highest at 17 o'clock with seven reindeer events. The highest peak in moose activity was at 19 o'clock with 5 moose events, followed by two hours break resulting in another peak with four moose events at 23 o'clock.

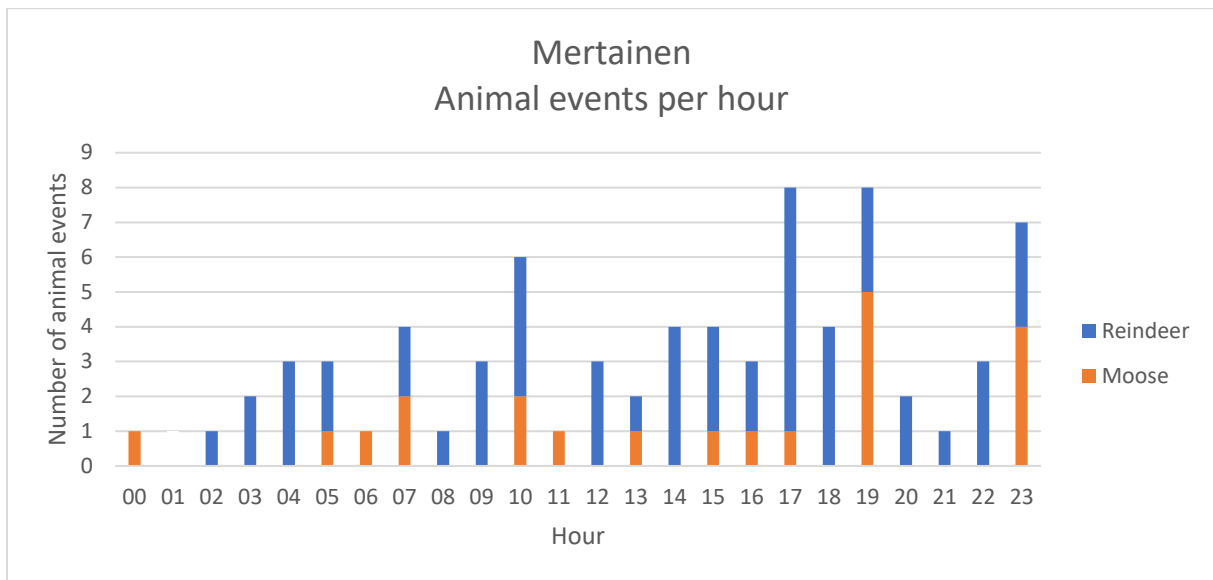


Figure 13: Animal events per hour in Mertainen

Human activity showed a peak in the mid of the day and one odd very high activity period at nine, resulting in eighteen activity events. Ten of these events were pedestrians and seven humans on snowmobiles.

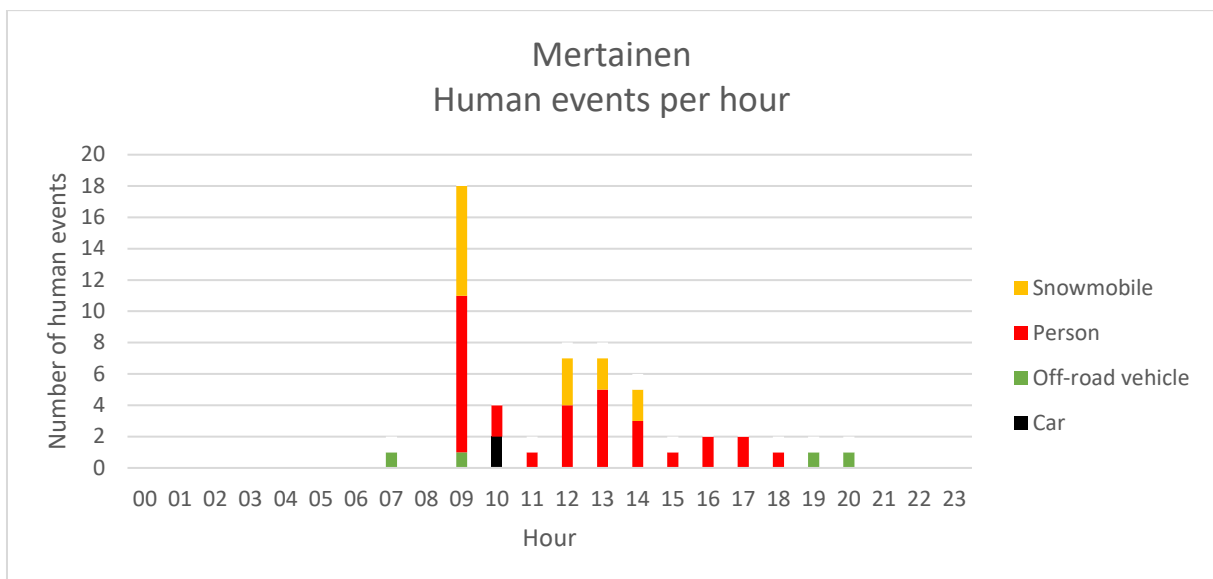


Figure 14: Human events per hour in Mertainen

3b) Patterns over the week

The animal's activity in Mertainen was showing weekdays of relatively high and low values. Events were frequently from Friday to Monday. Reindeer were active on every weekday and showed a peak on Friday (18 events), whereas moose were not active on Wednesdays and Sundays. Moose activity showed more or less equally high peaks at Monday (seven events), Friday (five events) and Saturday (six events).

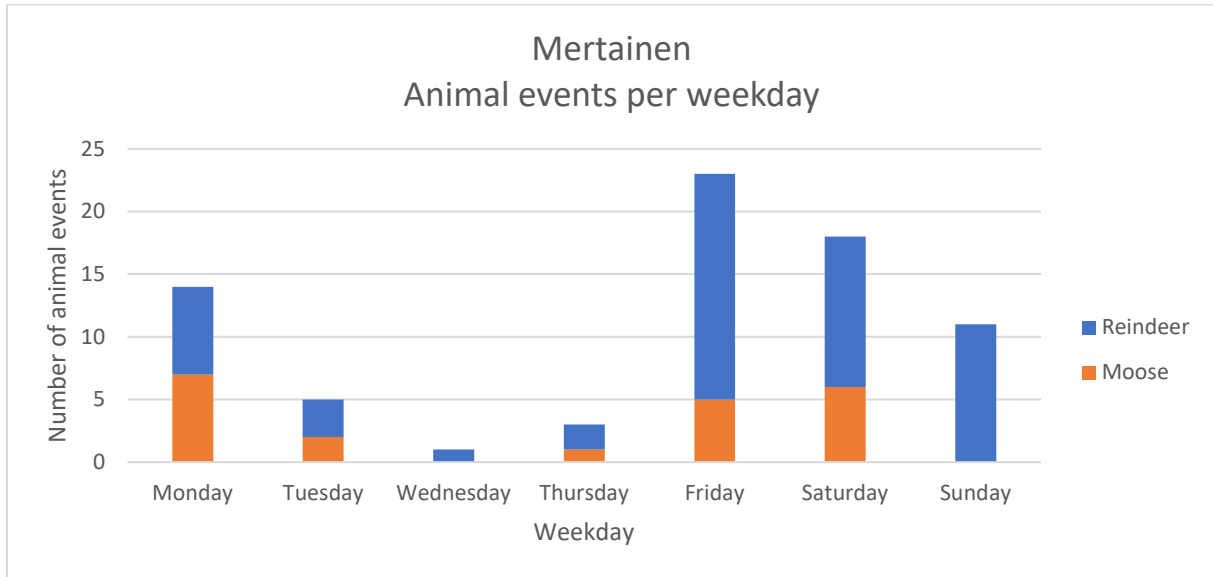


Figure 15: Animal events per weekday in Mertainen

Human activity in Mertainen was showing a contrary pattern compared to the animals' pattern. Humans were mostly active from Tuesday to Thursday, with the lowest values on Saturday and Sunday.

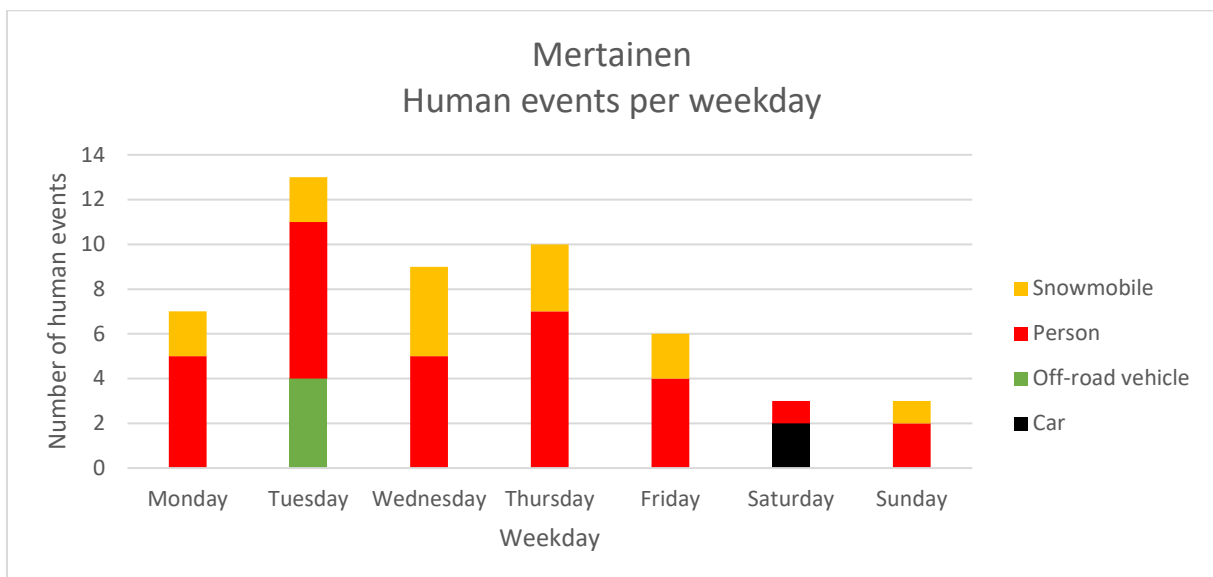


Figure 16: Human events per weekday in Mertainen

3c) Patterns over the winter

The animals at Mertainen showed a highly monthly activity pattern. Both reindeer and moose showed their highest peak in February, with 17 moose and 24 reindeer events. The second highest number of events in both species was in April with two (moose) and 14 (reindeer) events. Reindeer were recorded every month, except for November, whereas moose were not detected in November, December and March.

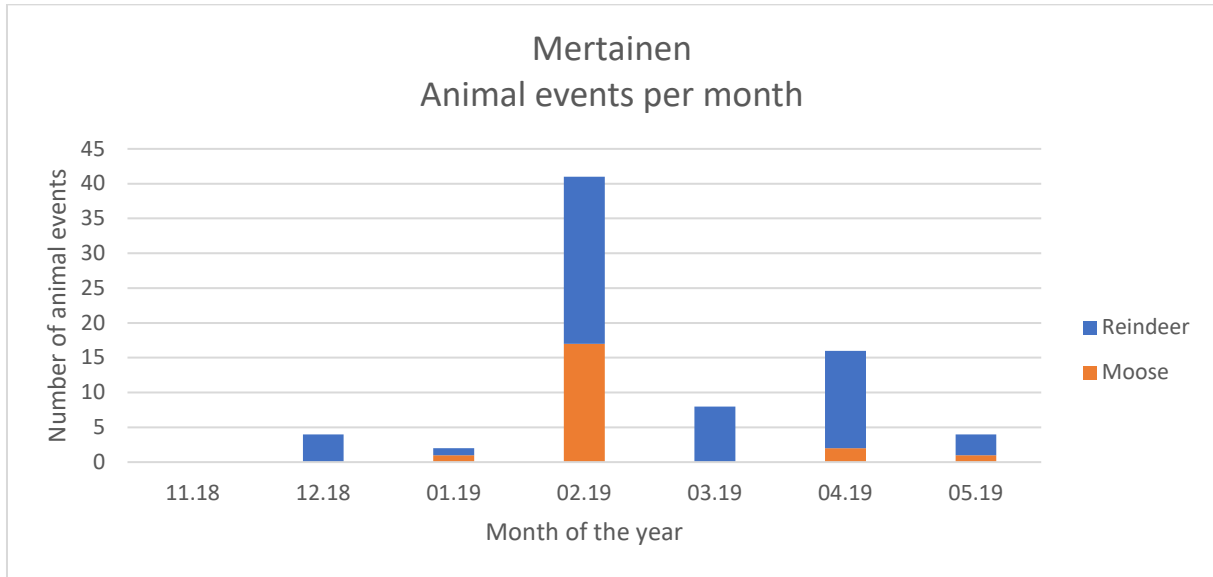


Figure 17: Animal events per month in Mertainen

Humans also showed clear patterns in the monthly use. Very low activity periods in November (two events) and December (one event) were followed by periods with slightly more activity from January to March with five events each. The monthly peak was in April with nine pedestrians and ten snowmobile users.

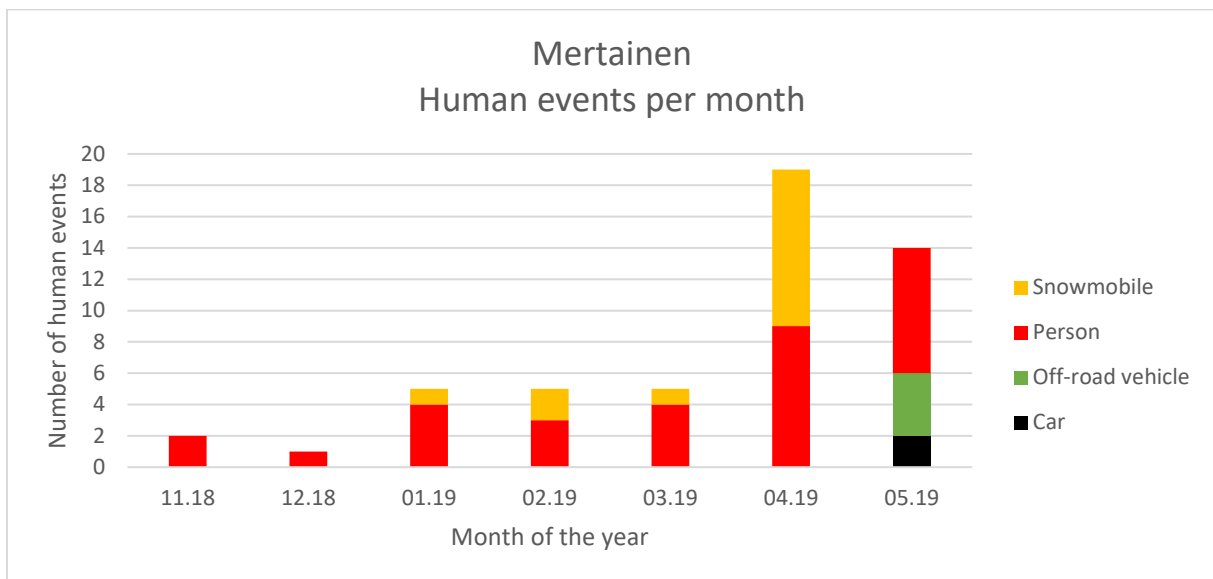


Figure 18: Human events per month in Mertainen

4) Sattaolja

4a) Diurnal patterns

The animal activity in Sattaolja was with an exception and no activity at four, all around the clock. Moose are active in 21 of these 24 hour-categories, with the highest value at 21 o'clock. Moose activity was also high at 01 (eight events), 08 (eight events), 17 (nine events), 20 (seven events) and 22 o'clock (eight events). Reindeer activity was mostly limited on the daytime, with the highest values from 09 to 18 o'clock (one to six reindeer events per hour). The six roe deer recordings took place in the night and morning hours. Five of these six roe deer detections (except for 03 o'clock) were single events.

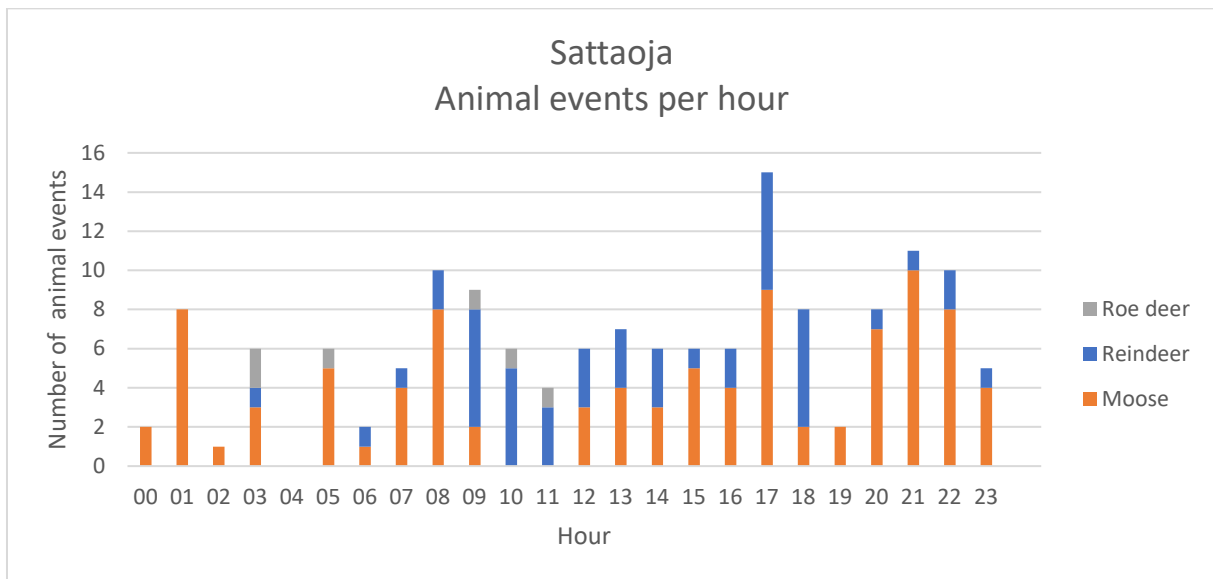


Figure 19: Animal events per hour in Sattaolja

Humans in Sattaolja showed a clear daily pattern with high peaks in the late morning and early afternoon hours. Pedestrians (29 events) and snowmobiles (27 events) made up the biggest shares. Four crossing events each, at 05 and six o'clock stick out of this pattern.

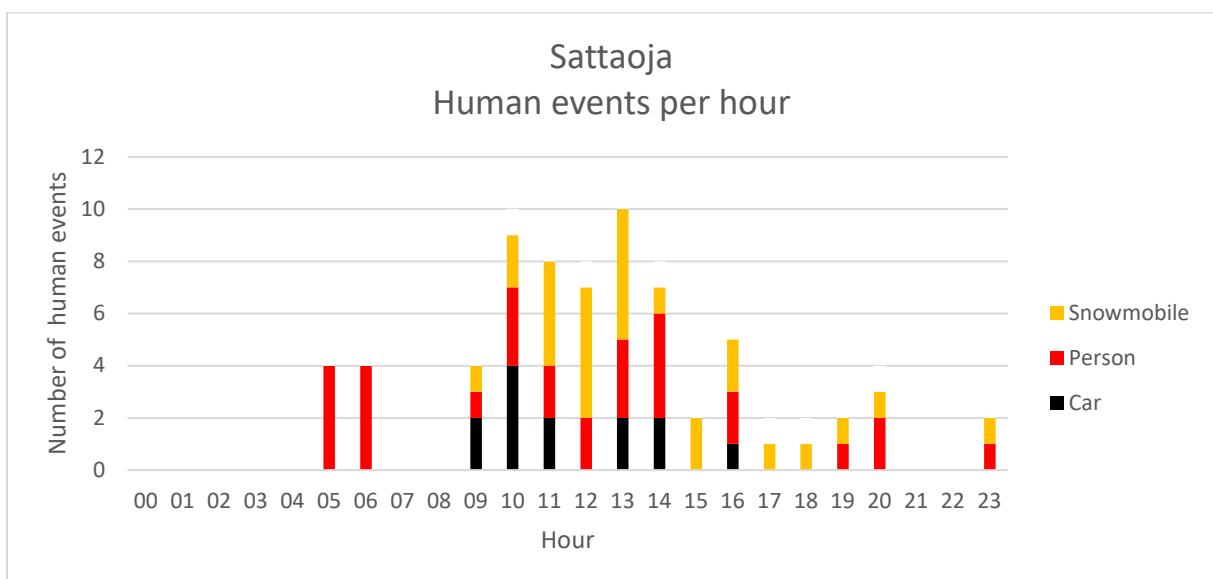


Figure 20: Human events per hour in Sattaolja

4b) Patterns over the week

Animals at Sattaoja showed no clear weekly pattern. Reindeer and moose were active on every weekday. Roe deer were active from Wednesday to Friday, but with only one or two events registered each. Moose on the other hand showed lowest usage on Fridays (four events) and highest usage on Tuesdays (22 events) and Wednesdays (20 events). Reindeer showed a slightly different usage, the highest value was at Monday (12 events), followed by Tuesday (nine events) and Wednesday and Friday (seven events each).

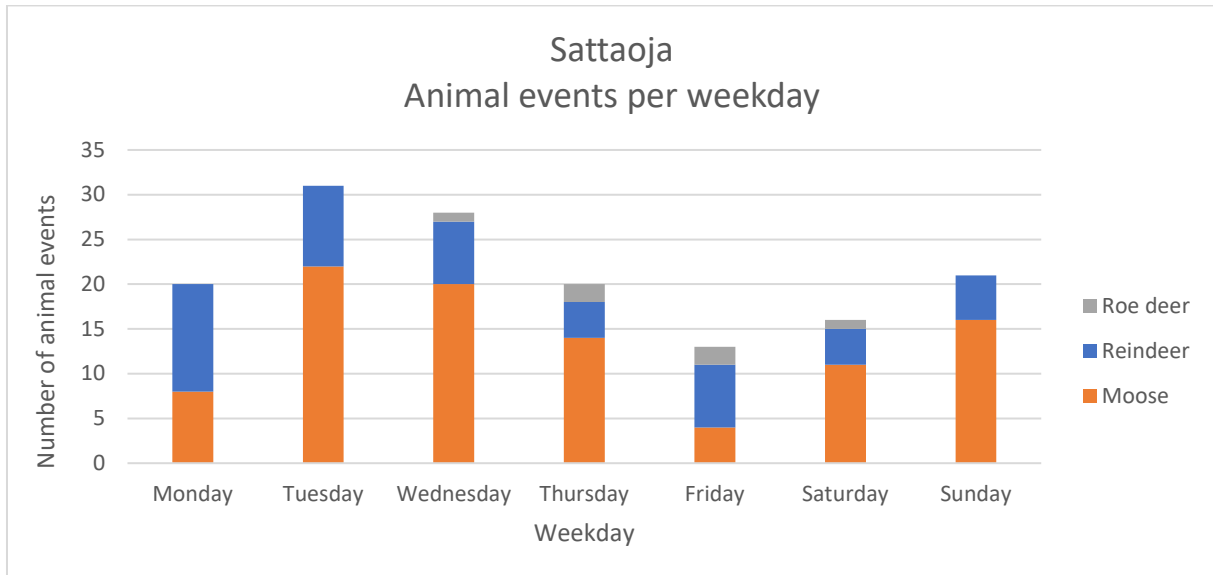


Figure 21: Animal events per weekday in Sattaoja

Human use at Sattaoja was showing no clear weekly pattern. Wednesday showed the highest human activity with four cars, nine persons and 6 snowmobiles, summing up to a total of 19 human events. Saturday was the day with the second most human activity (17 events).

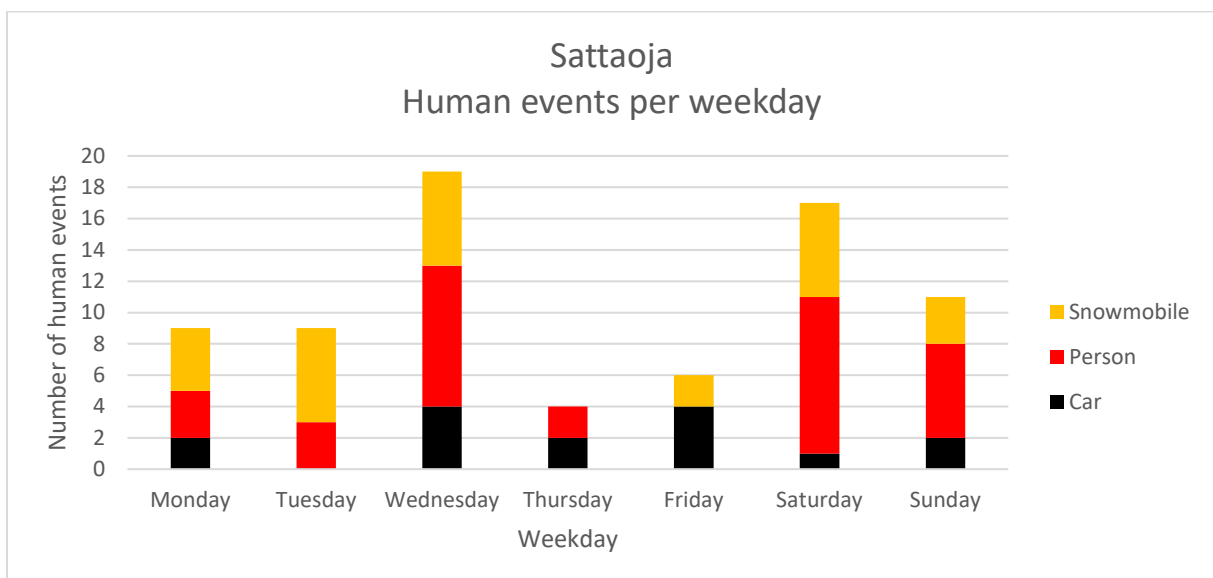


Figure 22: Human events per weekday in Sattaoja

4c) Patterns over the winter

Animal activity was showing the highest peaks in the mid of the winter. 35 moose and 11 reindeer events were recorded in December, followed by 24 moose, but only two reindeer events in January. With 10 and 13 events in February and March respectively the activity was low and rising to a total of 20 (eight moose and 12 reindeer) in April. Followed by a slightly decrease to 17 events with each six moose and roe deer respectively and five reindeer events and May.

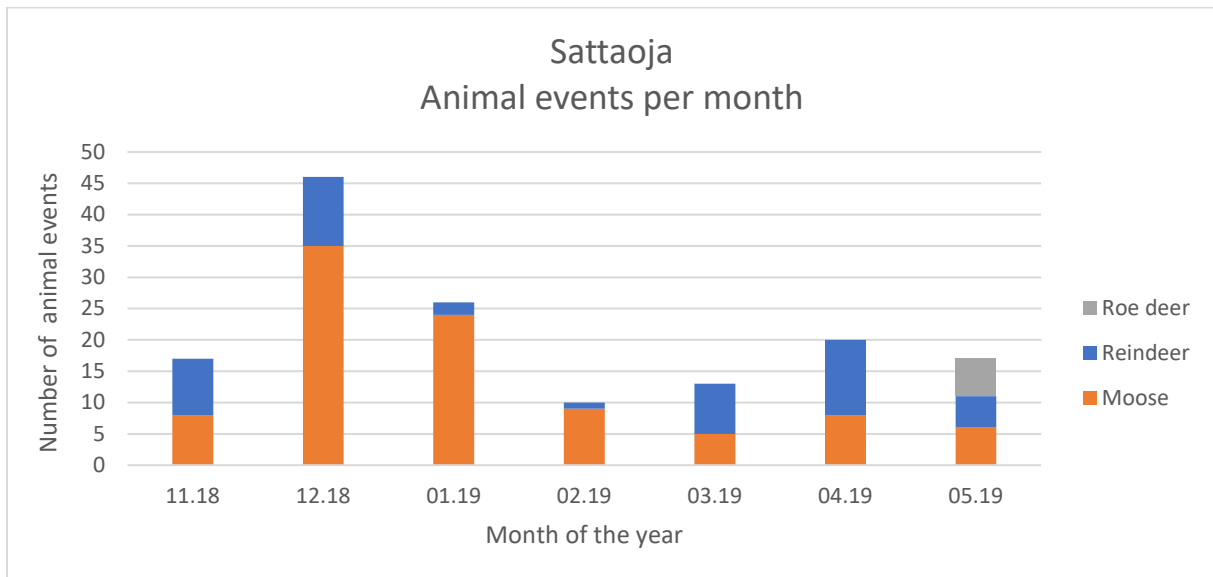


Figure 23: Animal events per month in Sattaoja

Human activity in Sattaoja had sequent high and low periods. Activity in November (18 events), January (15 events), March (16 events) and May (23 events), were followed by months with a low number of events. This led to six events in December, five in February and four in March. Snowmobile activity in Sattaoja was limited to December to April, with a peak in March (10 snowmobile events).

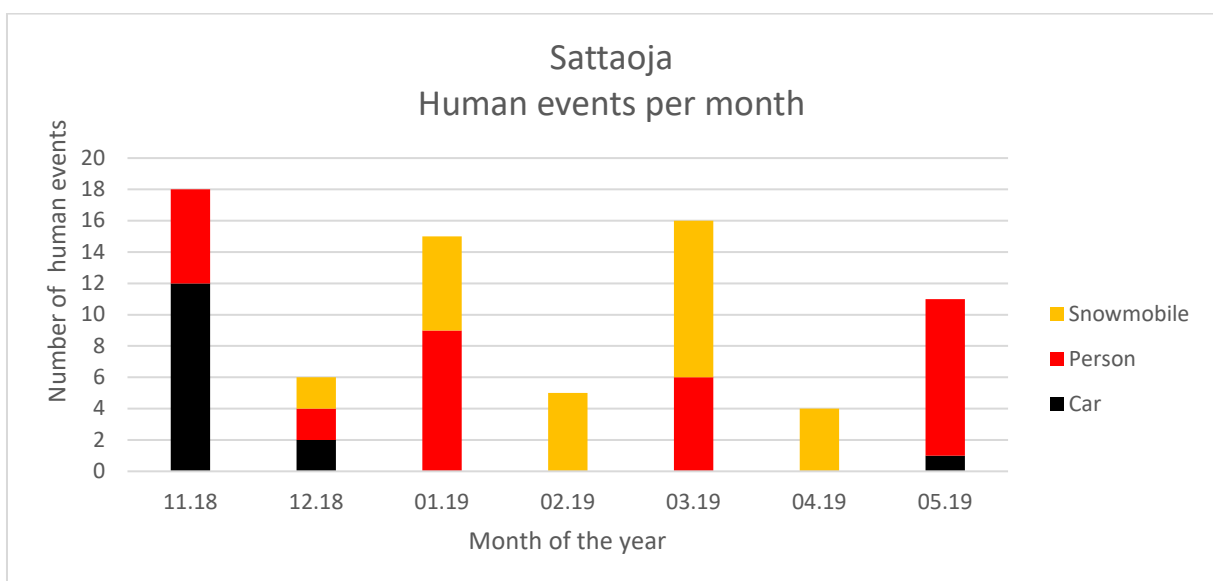


Figure 24: Human events per month in Sattaoja

5) Sangijärvi

5a) Diurnal patterns

The animal activity in Sangijärvi was unequally distributed. Reindeer activity showed peaks at 02, 12 and 13 o'clock (5, 4 and 4 events). These peaks were interrupted by periods with no or low activity from 15-01 o'clock and 03-08 o'clock. Like the reindeer, the moose's activity was round the clock with interruptions. Roe deer were primarily active in the morning hours from 05 to 08 but one event at 12 o'clock was also recorded.

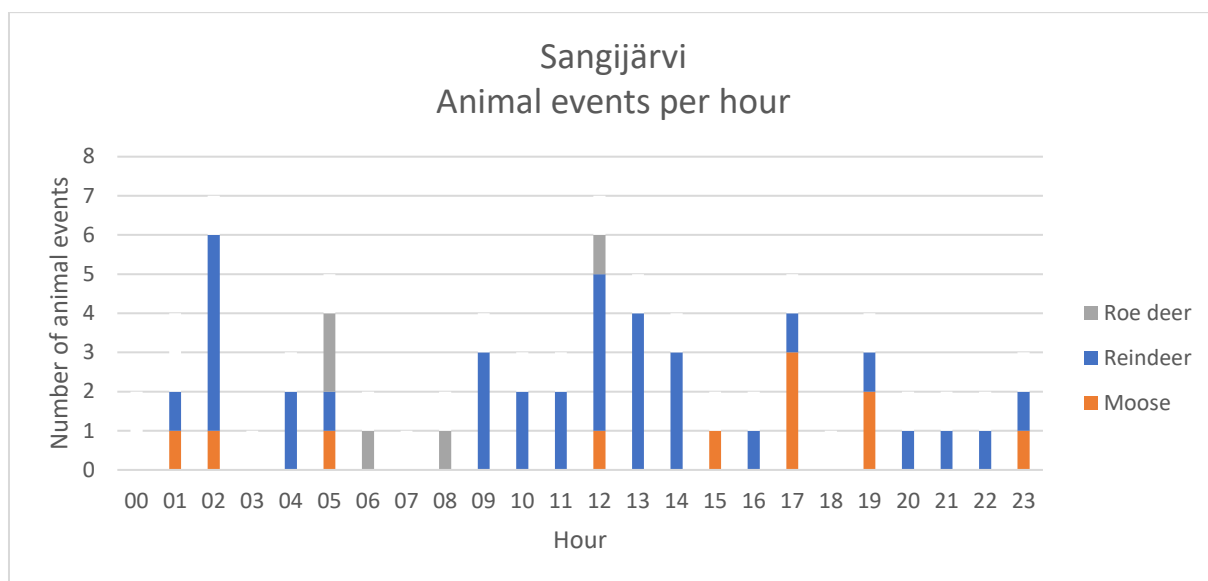


Figure 25: Animal events per weekday in Sangijärvi

The human activity at Sangijärvi was showing clear preference for the late morning hours until the late afternoon. The biggest amount of the overall human activity were snowmobiles (67 of 90 human activity events), followed by pedestrians (12 events).

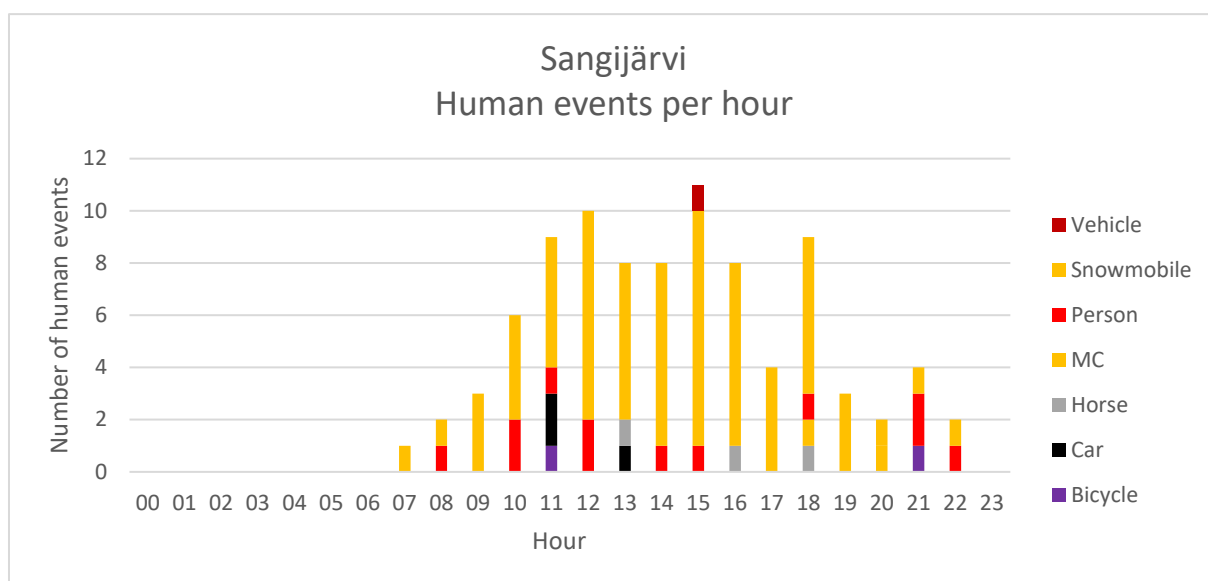


Figure 26: Human events per hour in Sangijärvi

5b) Patterns over the week

Animals did not show any clear use pattern. Moose and reindeer were active on every day, whereas roe deer were not active Monday and Saturday. Saturdays showed lowest amount of animal events (one moose and three reindeer events), Monday, Tuesday, Wednesday and Friday showed a similar number of events (8, 10, 9, 8 events). Thursdays and Sundays showed peaks of animal usage with 13 animal (two moose and roe deer each and 9 reindeer) events on Thursdays and 15 (two moose, nine reindeer and 4 roe deer) events on Sundays.

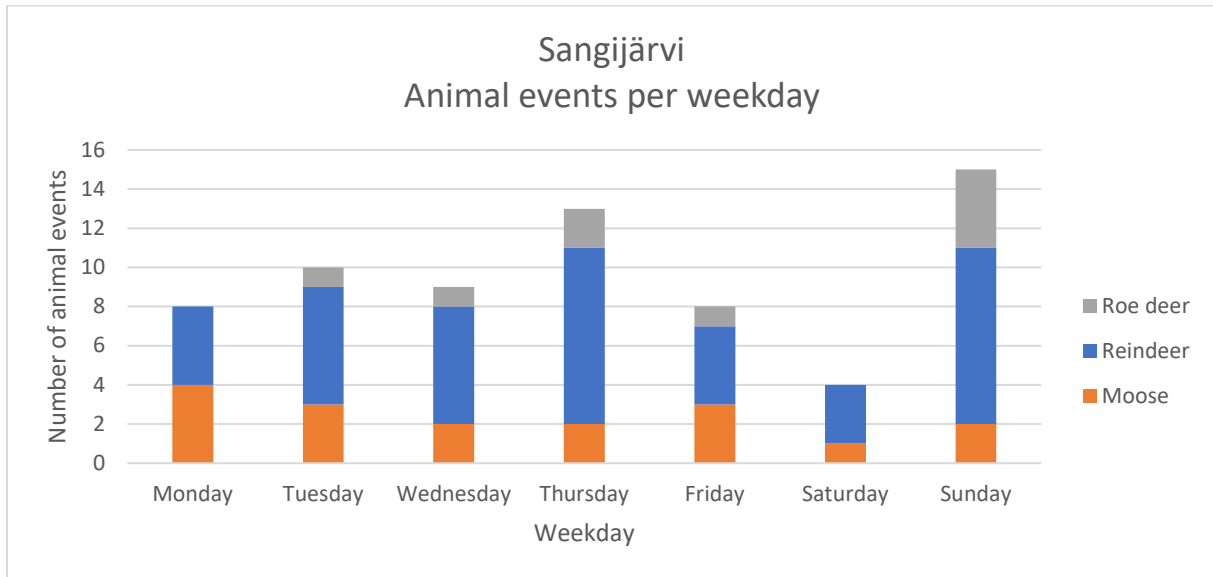


Figure 27: Animal events per weekday in Sangijärvi

Human activity was in general higher at the weekend and lower in the week. The lowest activity was on Mondays (six events), followed by Tuesdays and Thursdays (10 events each) and Wednesdays and Fridays (11 events each). The activity in the weekends increased to 18 events on Saturdays and 24 on Sundays. On everyday snowmobile use was making up the biggest share of events.

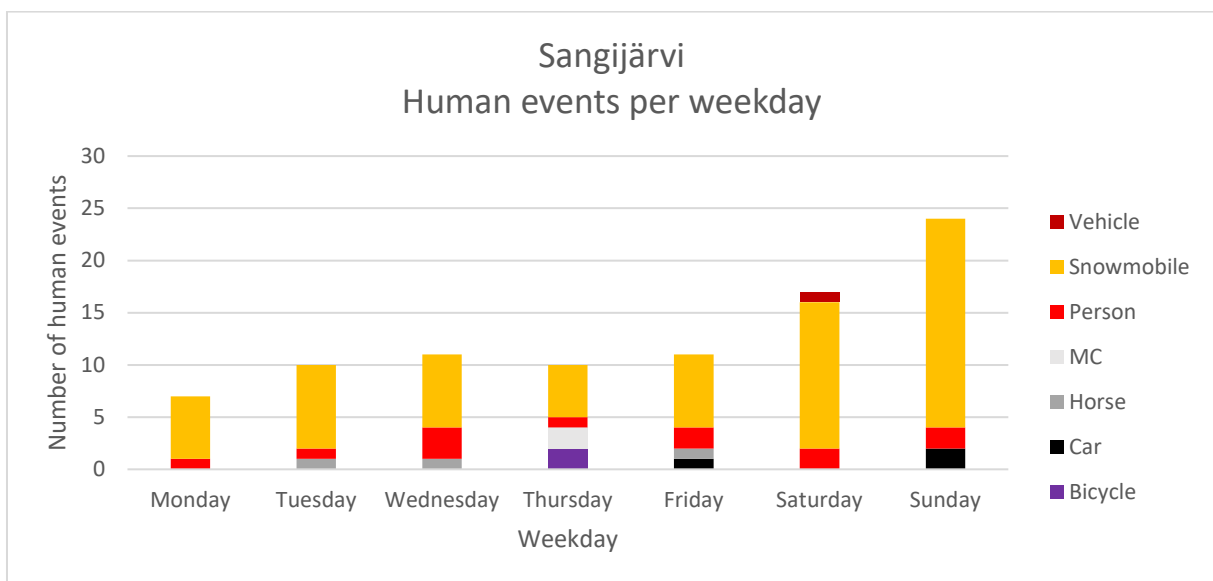


Figure 28: Human events per weekday in Sangijärvi

5c) Patterns over the winter

The animal events in a monthly perspective in Sangijärvi were unequally distributed. The most animal events were recorded on November (11 events) and December (18 events) for reindeer and in February for moose (seven events). All in all, no species was recorded over the whole period. Reindeer were not recorded from January to March, whereas moose were only recorded from December to March. One roe deer event was recorded in January, the other four events were in April.

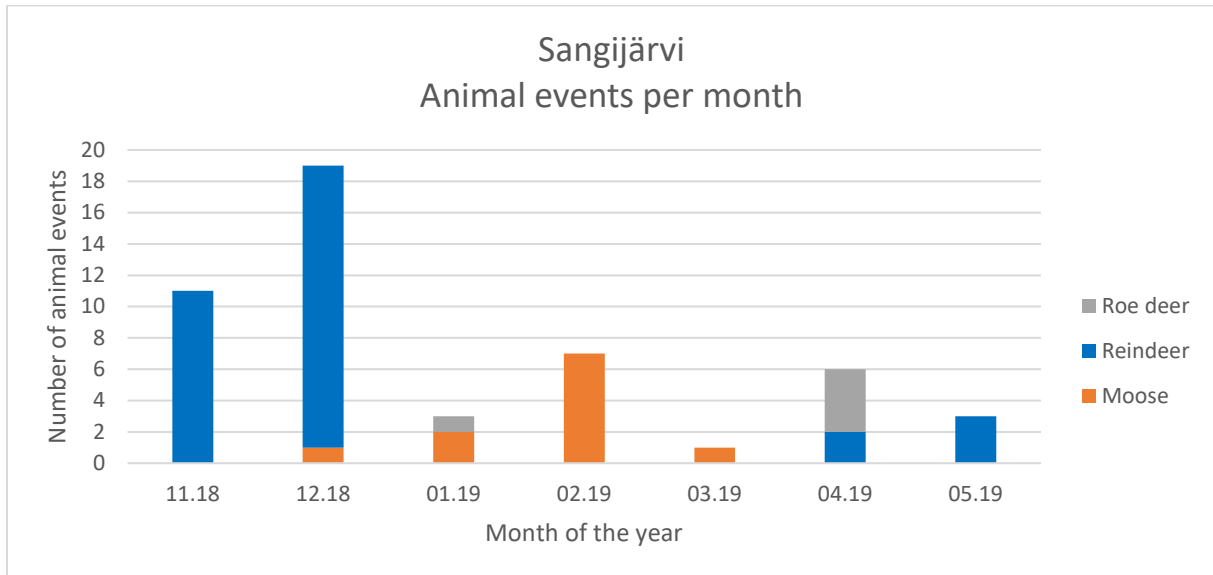


Figure 29: Animal events per month in Sangijärvi

Human use in Sattaoja was reaching from a minimum of five events in November to a maximum of 28 events in March. Snowmobiles in Sattaoja were not used in November and May but made up the lions share in the number of events in the other months.

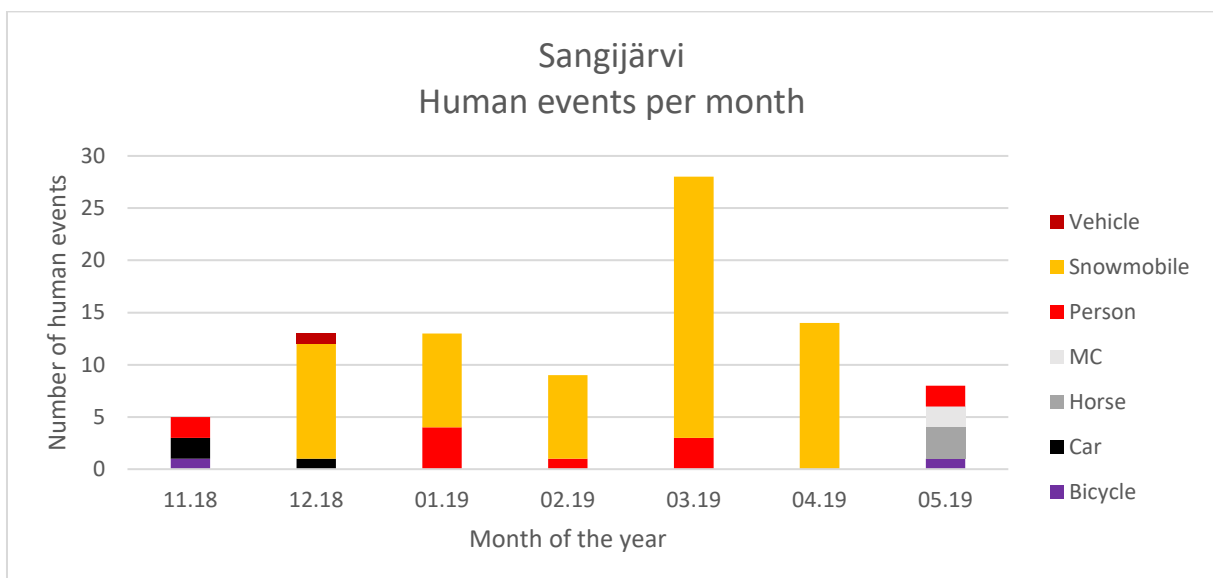


Figure 30: Human events per month in Sangijärvi

6) Kåaträskvägen

6a) Diurnal patterns

The animal activity at Kåaträskvägen was showing differing patterns. Moose were active in the night-time, with one moose event at 03 o'clock, in the morning from 08 to 10 and in the late afternoon/early evening, from 17 to 21 o'clock. Reindeer were active in the morning hours and in the evening, but also in the mid of the day, at 13 und 15 o'clock. Due to the bad quality of the photo, one unidentifiable ungulate species was recorded at 02 o'clock.

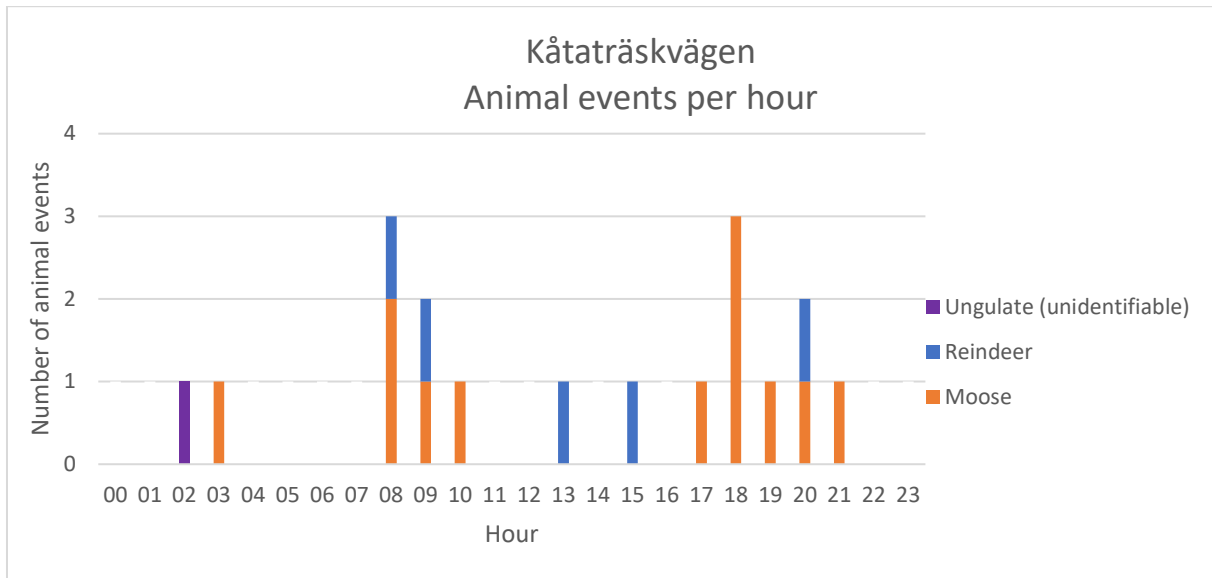


Figure 31: Animal events per hour in Kåaträskvägen

Human activity at Kåaträskvägen showed a very clear preference for the period from the morning hours to early evening (from 09 to 19 o'clock). The biggest share of human activity was snowmobile use (200 of 317 events), followed by cars (69 events) and pedestrians (27 events).

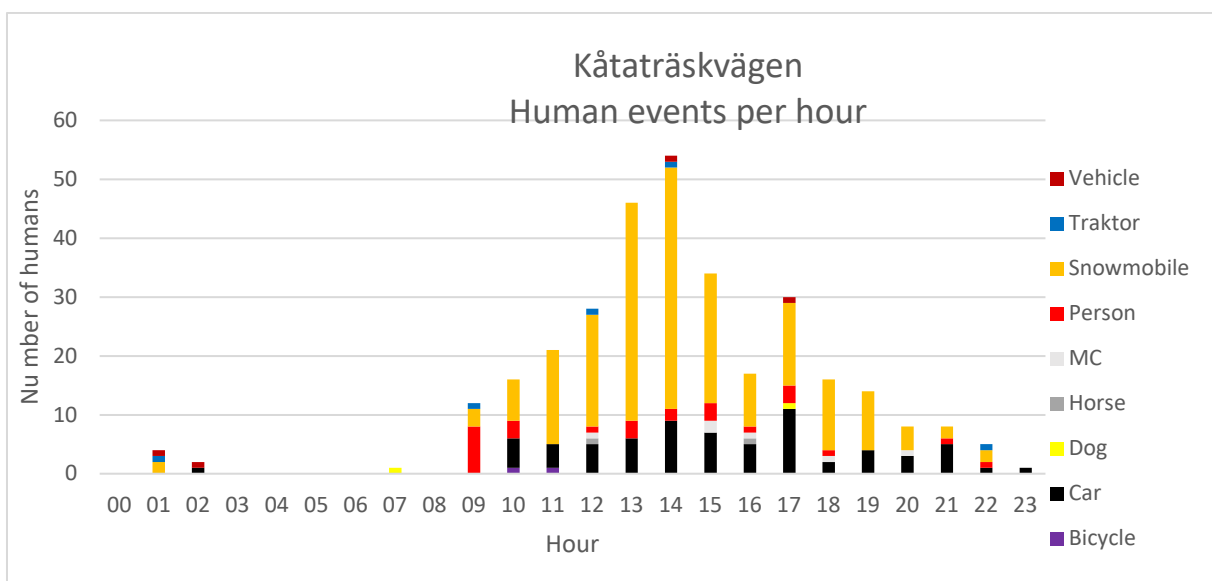


Figure 32: Human events per hour in Kåaträskvägen

6b) Patterns over the week

Animal's activity at Kåaträskvägen was showing a day to day changing pattern. Moose activity was higher on Mondays (two events), Tuesday (three events), Thursdays (three events), Saturdays (two events) and lower at Wednesdays, Fridays and Sundays. Reindeer on the other hand were always only recorded with one event. Moose were detected on every day, except for Sunday and reindeer were not recorded on Wednesday and Sunday.

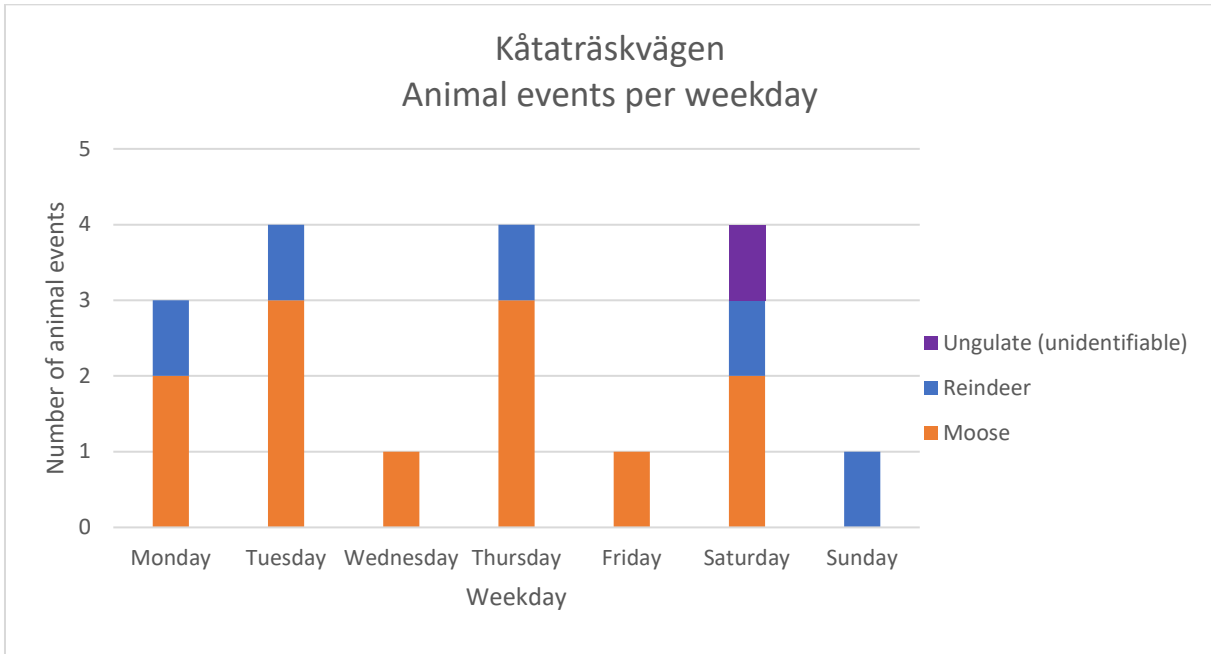


Figure 33: Animal events per weekday in Kåaträskvägen

The human activity at Kåaträskvägen was clearly focused at the weekends. The activity on days of the weekend was up to twice as high as on weekdays. Snowmobiles use made up a big share on every day.

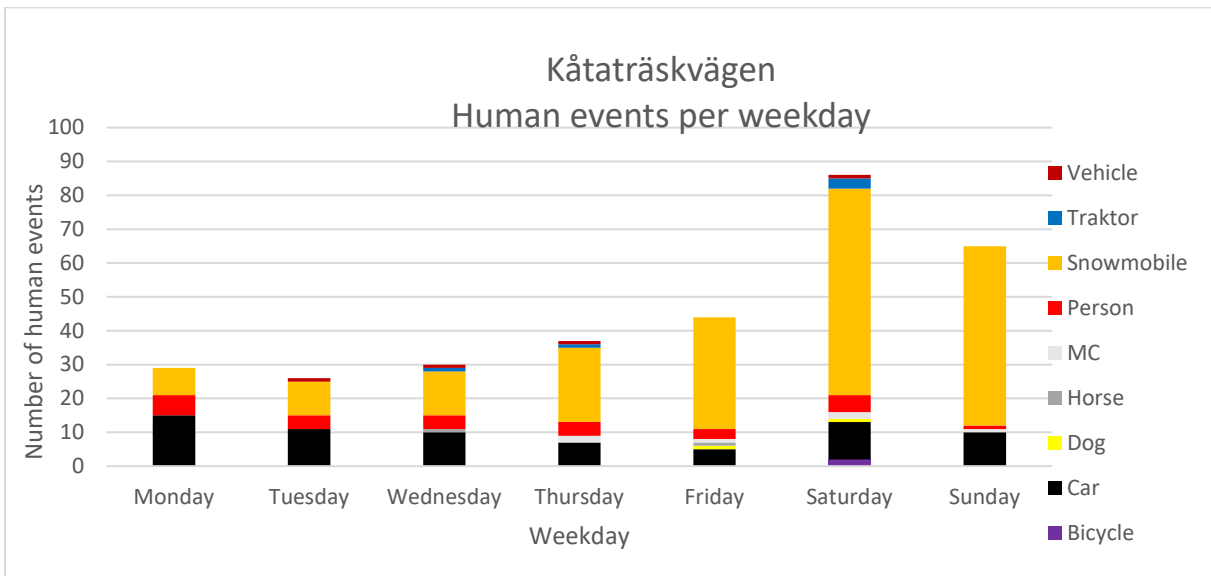


Figure 34: Human events per weekday in Kåaträskvägen

6c) Patterns over the winter

The animal's activity at Kåaträskvägen showed a clear peak but also months with a low amount of animal events. Moose were recorded in every month with positive records, with a very clear peak in February with seven records, compared to two records in January and May and one record in March. Reindeer were only photographed in January, February and May.

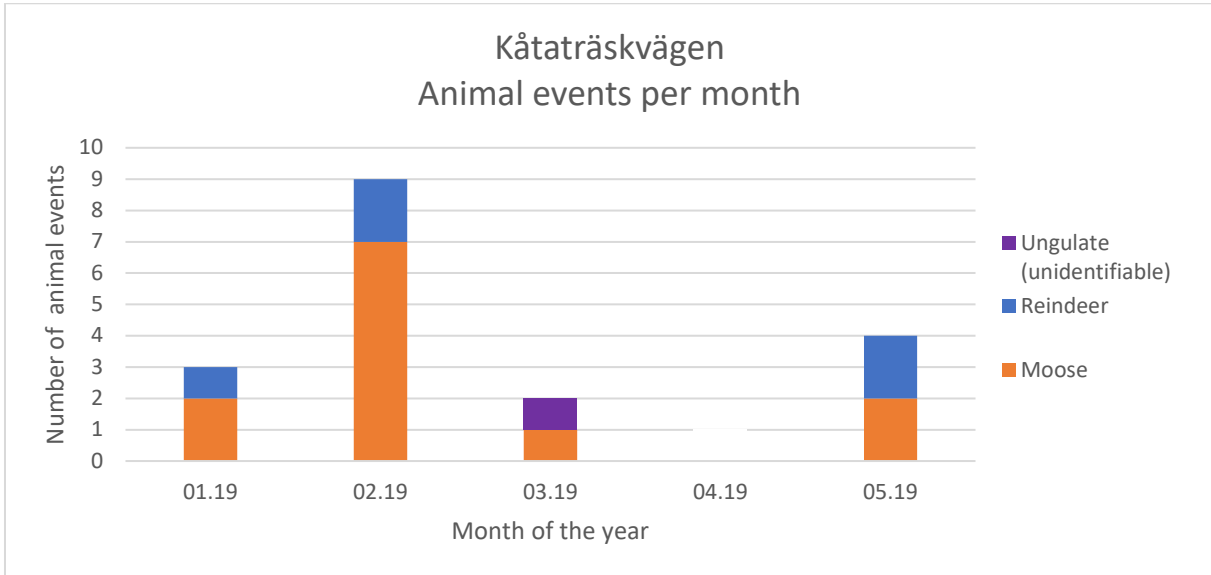


Figure 35: Animal events per month in Kåaträskvägen

Differences in human use at Kåaträskvägen were obviously bound to the type of activity. The peak in the monthly activity, due to a very high amount of snowmobile use (92 events) was in March. In all other month's except for May snowmobiles made up a big share of the human activity. In the months with lower snowmobile activity, the amount of car events was increasing, whereas in February and March no cars were used at all.

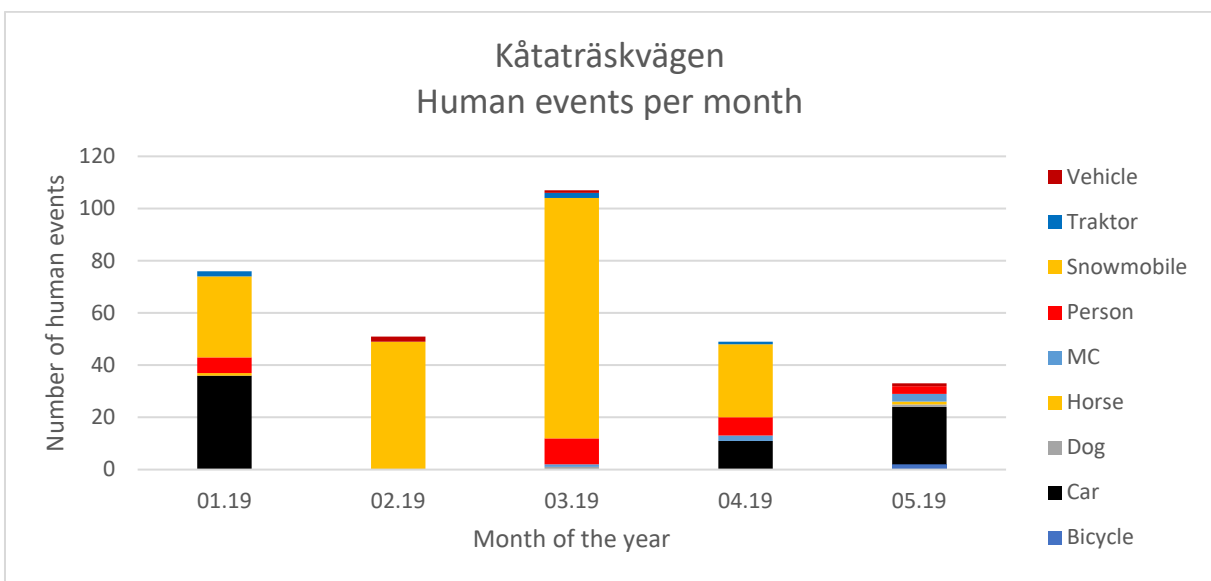


Figure 36: Animal events per month in Kåaträskvägen

7) Borås

7a) Diurnal patterns

The animal's activity in Borås was bound to the periods of dusk, dawn and night-time. Roe deer were active round the clock, with 12 o'clock as an exception. The peaks of roe deer activity were from 21 to 03 o'clock. In contrast to the roe deer, wild boar were only active in the night time, with one event at 00, 01, 21 and two events at 23 o'clock. The activity of the moose was round the clock, with one event each at 03, 04, 13, 18, 20 and 21 o'clock.

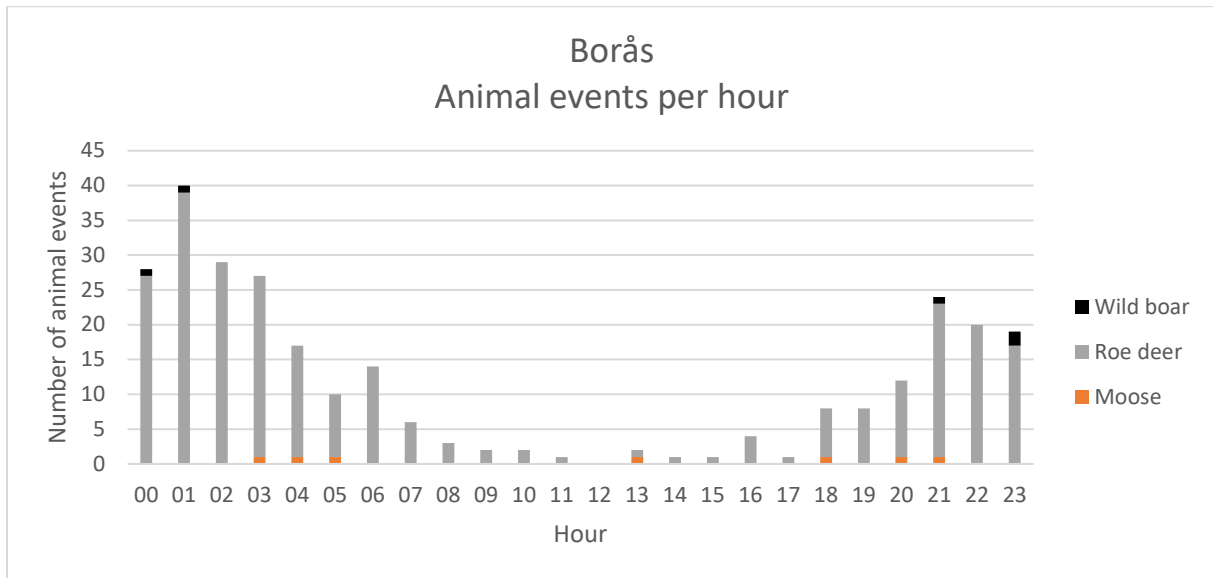


Figure 37: Animal events per hour in Borås

With one exception at 01 o'clock, human activity was bound to the daytime and early evening. Most of the human activities were pedestrians (10 of 15 events).

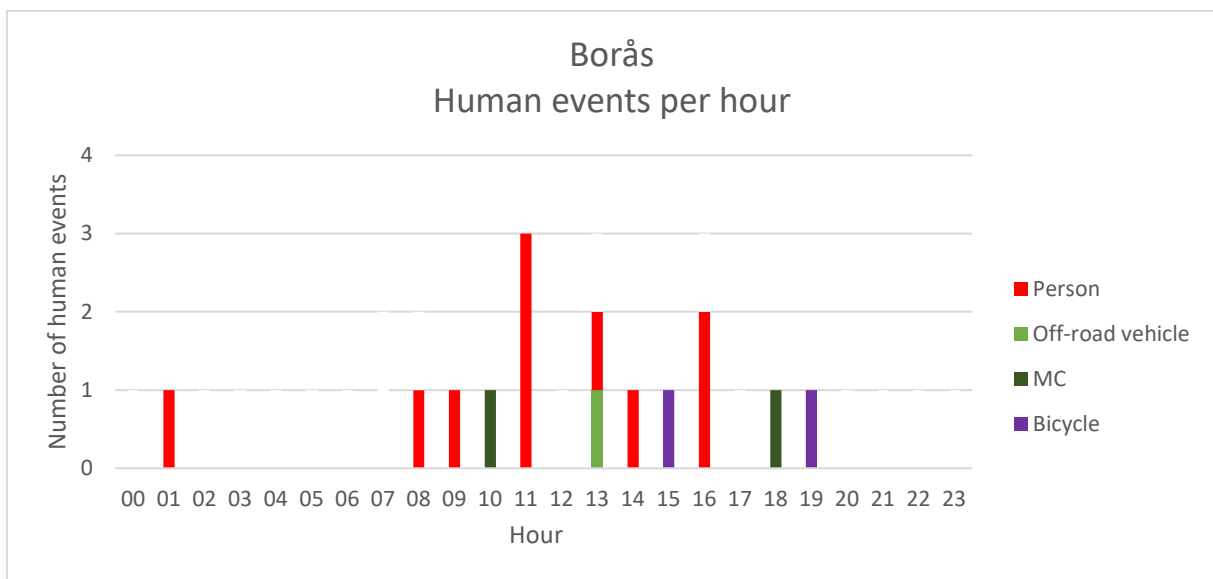


Figure 38: Human events per hour in Borås

7b) Patterns over the week

Animal activity in Borås did not seem to be dependent on the weekday. Every day, except for Sunday has a more or less similar amount of animal events. The peak was on Sundays with 51 crossing events, whereas the lowest number of use was recorded on Thursday (34 events).

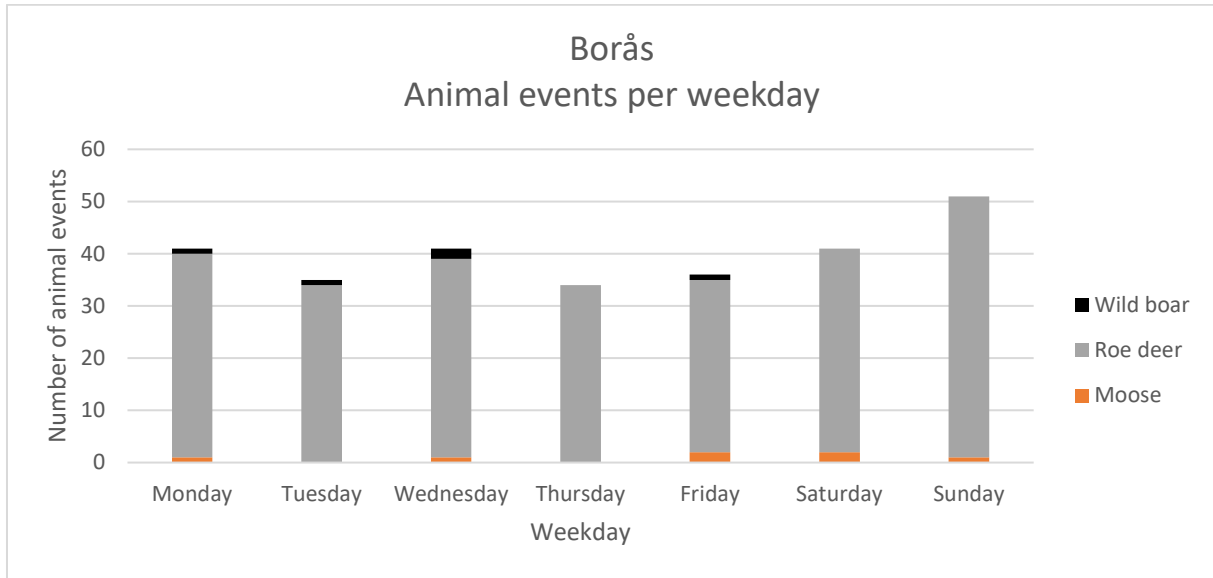


Figure 39: Animal events per weekday in Borås

Human activity in Borås was showing no preference for a special weekday, with exception for the avoidance of Wednesday. Pedestrians were always making up the highest or a least a big amount of human usage.

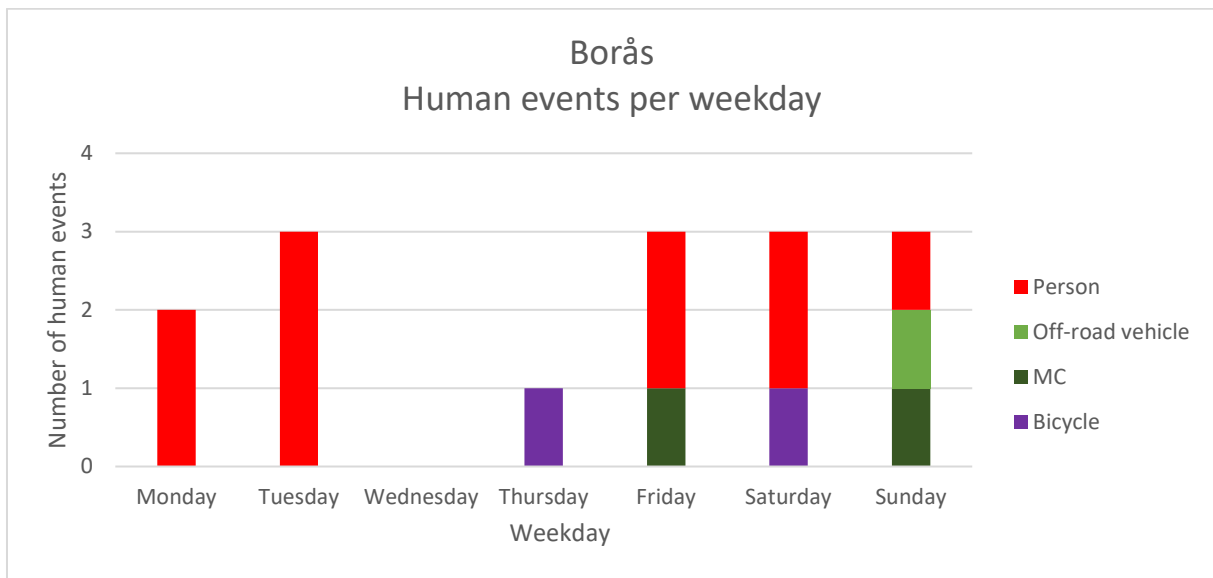


Figure 40: Animal events per weekday in Borås

7c) Patterns over the winter

The animals usage at Borås was showing a clear monthly pattern. Moose were only photographed from April on, wild boar only in March and May. Roe deer's events which made

up the lions share, showed a clear peak in May (81 events) and June (83, but also an increased number of events in April (43 events) and July (39 events).

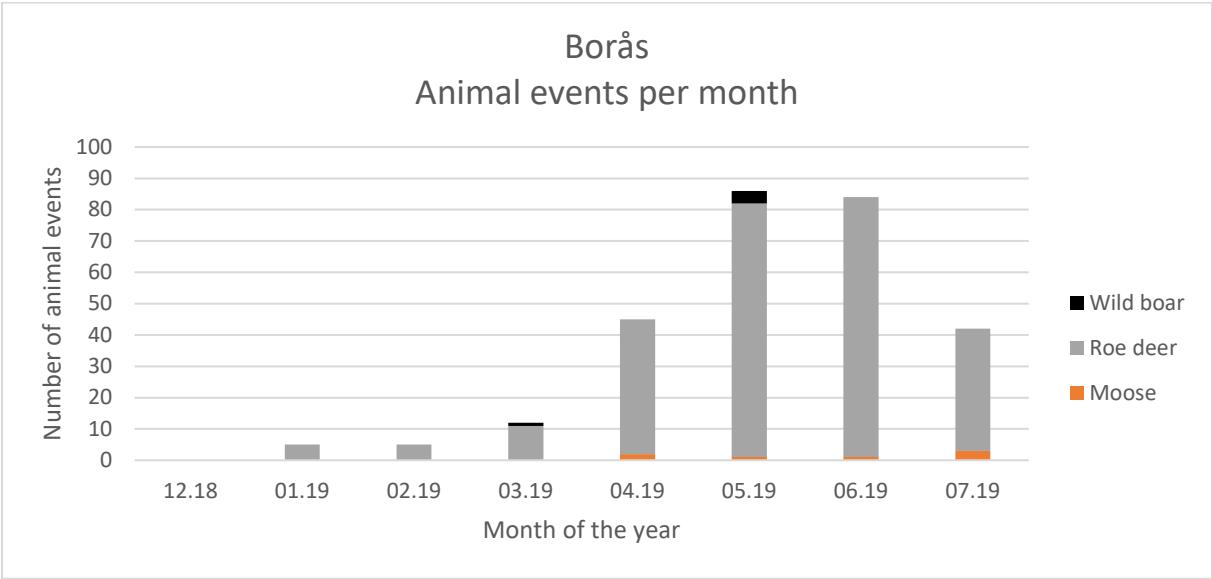


Figure 41: Animal events per month in Borås

Not only the animals, but also the human activity in Borås was showing peaks in the monthly activity patterns. No human activity was recorded in February, whereas five events in July resulted in a monthly peak.

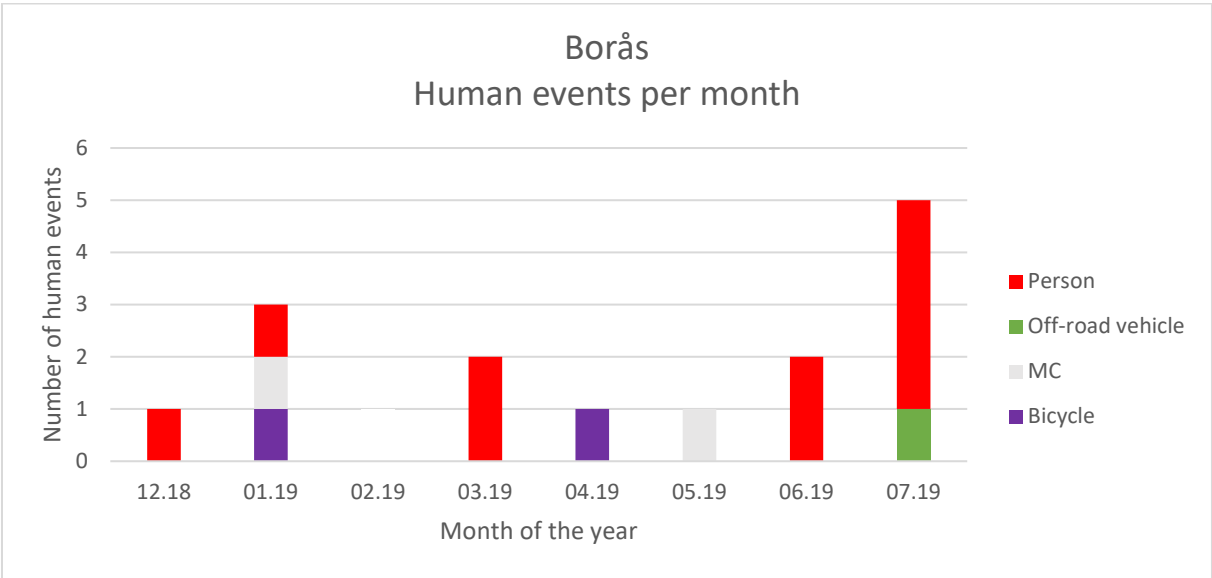


Figure 42: Human events per month in Borås

Appendix 2B Crossing rates and timespans

The interaction of the animals' temporal patterns and the human use periods were showing indifferent results. In general for both species, moose and reindeer the number of events in the period of low human use was not significantly different from the number of crossing events in the period of high human use. Moose were recorded less often in the period of low human use, than in the period of high human use, but these values were not significantly different ($p = 0.3713$). However, moose showed a significantly lower number of events on Fridays with high human use ($p = 0.0198$) and trends towards a lower usage on Saturdays ($p = 0.0895$) and Sundays ($p = 0.0895$) in the period of high human usage.

Reindeer showed a significantly ($p = 0.0206$) lower crossing rates in the period of low human usage on Sundays. In general, although non-significant, the number of reindeer events was lower in the period of low human use, than in the period of high human use. This correlation was non-significant ($p = 0.3713$).

The crossing rates for each of the structures were quite different. The highest rate of ungulate use was shown at Borås. The human use rate at the same time, was the lowest at Borås. In Norrbotten, Sattaoja was the structure with both, the highest use rate with and without reindeer included. The lowest use with reindeer included was at Kåaträskvägen, whereas the lowest use without reindeer was shown at Harrioja. The lowest rate of human use in Norrbotten was at Mertainen.

Table 1: Crossing rates (events/day) at the structures

Site	Start of the period	End of the period	Number of days	Usage rate ungulate event/day with reindeer	Usage rate ungulate event/day without reindeer	Usage rate human event/day
Harrioja	13.11.2018	11.05.2019	179	0.212290503	0.061452514	0.519553073
Mertainen	15.11.2018	19.07.2019	246	0.304878049	0.085365854	0.223577236
Sattaoja	14.11.2018	14.07.2019	242	0.615702479	0.417355372	0.512396694
Sangijärvi	13.11.2018	11.05.2019	179	0.374301676	0.145251397	0.502793296
Kåaträskvägen	14.11.2018	11.05.2019	178	0.207865169	0.073033708	2.842696629
Borås	28.12.2018	30.07.2019	214	No Reindeers	1.303738318	0.070093458

Moose

The rate of moose using the structures and the surrounding is quite different, both within one structure when comparing different months and when comparing different structures.

The highest number of usage rates of moose was in December at Sattaoja, with one moose

per day. However, Sattaoja is not showing these high rates in every month, in March only 0,16 moose, so approximately one moose every six days, were using the structure.

Most of the other structures in Norrbotten are showing extremely lower crossing rates comparable to Sattaoja, some structures like Harrioja and Mertainen show generally low rates of moose usage. It is obvious, that moose are only temporary users of the structures and their surroundings, because no structure is showing similar rates of usage over the whole period.

Table 2: Usage rate of the moose at each structure per day

Site	November	December	January	February	March	April	May	June	July
Harrioja	0	0.12903 226	0.06451 613	0	0	0	0.1	No data	No data
Mertainen	0	0	0.03225 806	0.60714 286	0	0.06666 667	0.07692 308	No data	No data
Sattaoja	0.5	1.12903 226	0.77419 355	0.32142 857	0.16129 032	0.26666 667	0.6	No data	No data
Sangijärvi	0	0.03225 806	0.06451 613	0.25	0.03225 806	0	0	No data	No data
Kåatträskvägen	0	0	0.07407 407	0.25	0.03225 806	0	0.2	No data	No data
Borås	0	0	0	0	0	0.06666 667	0.03225 806	0.03333 333	0.1

The temporal distances of the moose and reindeer events are showing big differences when comparing the structures. Structures with low rates of moose use (e.g. Mertainen and Harrioja) are also showing higher values in the mean and maximum temporal differences. However, the site with the highest usage rates of moose, Sattaoja is also showing comparable values to Sangijärvi where the usage rate is quite low.

Table 3: Time distances of moose events with foregoing human events

Site	Mean	Variance	Min	Max
Harrioja	269:01	2114:23	53:11	579:33
Mertainen	213:00	1367:53	05:10	472:23

Sattaoja	45:30	117:01	02:00	216:37
Sangijärvi	55:38	180:19	00:27	171:22
Kåträsksvägen	19:50	08:28	03:12	47:43
Boras	31:22	44:29	03:28	108:04

The mean time distances of moose events to foregoing moose events are except for Sangijärvi all lower than the time distances of moose events to foregoing human use events. The mean time distance at Sangijärvi from moose events to foregoing moose events is double as long as the moose event time distance to foregoing human events.

Table 4: Time distances of moose events with foregoing moose events

Site	Mean	Variance	Min	Max
Harrioja	07:55	03:15	00:12	20:17
Mertainen	19:55	126:25	00:01	219:16
Sangijärvi	107:57	953:36	00:13	505:10
Sattaoja	21:54	64:22	00:01	211:38
Kåträsksvägen	17:59	18:56	00:16	46:09
Boras	10:04	08:46	00:00	91:32

The following table is showing the results of the timing differences from human to moose events and from moose to moose events from all Norrbotten structures combined. The data is showing, that the mean crossing interval from human events to moose events was significantly higher than from moose to moose event.

Table 5: Timing differences in between moose and human usages

	Foregoing human event	Foregoing moose event	Foregoing moose event - after > 10 minutes	P-value
Mean (HH:MM)	78:35	29:05	33:48	
F-test		4.2969E-08	1.772E-06	
T-test with uneven variances				0.01775509
T-test with uneven variances - Periods shorter than 10 minutes excluded				0.03349421

Since a few of the moose events were shorter than 10 minutes, which is grounded on the separation of multiple moose into different events due to unsimilar behaviour, we excluded them in a second run. These moose may have been coming to the structure together and were therefore not independent. But even with this excluded time periods the time period remains significantly shorter ($p = 0.03349421$) than the time period to foregoing moose events.

Reindeer

The overall pattern of reindeer usage is also showing indifferences in the use per day per month. Some passages show very high values for the daily crossing rate in some months, whereas low values in the other months. The highest rate per day was in November at Sangijärvi, however several are structures showing months without reindeer usages. The pattern when comparing the structures is not consistent, reindeer used Sangijärvi in November, December, April and May, but not in January and February. The pattern in Kåaträskvägen is the complete opposite, reindeer were only photographed in January, February and May, but not in November, December, March and April.

Table 6: Usage rate of the reindeer at each structure per day

Site	Novemb er	Decemb er	January	Februar y	March	April	May	Jun e	Jul y
Harrioja	0.47058 824	0.29032 258	0.03225 806	0.07142 857	0.12903 226	0.03333 333	0.2	No dat a	No da ta
Mertainen	0	0.12903 226	0.03225 806	0.85714 286	0.25806 452	0.46666 667	0.23076 923	No dat a	No da ta
Sangijärvi	0.91666 667	0.58064 516	0 0	0 0	0 0	0.06666 667	0.3	No dat a	No da ta
Sattooja	0.5625	0.35483 871	0.06451 613	0.03571 429	0.25806 452	0.4	0.5	No dat a	No da ta
Kåatträskv ägen	0	0	0.03703 704	0.07142 857	0 0	0 0	0.2	No dat a	No da ta
Borås	0	0	0	0	0	0	0	0	0

The timing distances of reindeer are showing differences between the sites. The mean timing between a human event and reindeer usage is very low at Kåatträskvägen and thirteen times higher at Mertainen. The time distances at Harrioja, Sangijärvi and Sattooja are very similar.

Table 7: Time distances of reindeer events with foregoing human events

Site	Mean	Variance	Min	Max
Harrioja	55:50	245:44	00:11	291:03
Mertainen	141:19	2619:47	02:27	759:45
Sattooja	49:35	175:06	00:28	237:41
Sangijärvi	46:22	87:11	00:49	163:56
Kåatträskvägen	11:57	03:27	00:35	24:43
Boras	No data	No data	No data	No data

The time distances from reindeer event to reindeer event are more comparable to each other than the reindeer events with foregoing human events. Kåaträskvägen the site with the lowest time distance in between human events and following reindeer events had no reindeer event following on another.

Table 8: Time distances of reindeer events with foregoing reindeer events

Site	Mean	Variance	Min	Max
Mertainen	18:39	146:36	00:04	364:30
Harrioja	27:20	131:38	00:24	225:28
Sattaaaja	29:09	124:56	00:01	212:34
Sangijärvi	44:51	368:12	00:18	521:59
Kätaträskvägen	No data	No data	No data	No data
Boras	No data	No data	No data	No data

The following table is showing the timing differences from human to reindeer and reindeer to reindeer usage events. The mean time spans from reindeer events after human events are double as long as reindeer to reindeer events. However, these values are not significantly different when testing the variances with a T-test for unequal variances.

Table 9: Timing differences in between reindeer and human usages

	Foregoing human event	Foregoing reindeer event	Foregoing reindeer event - after > 10 minutes	P-value
Mean (HH:MM)	62:21	28:55	32:03	
Result of the F-test		1.3326E-07	1.9533E-06	
T-test with uneven variances				0.07016786
T-test with uneven variances - Periods shorter than 10 minutes excluded				0.10405381

Roe deer

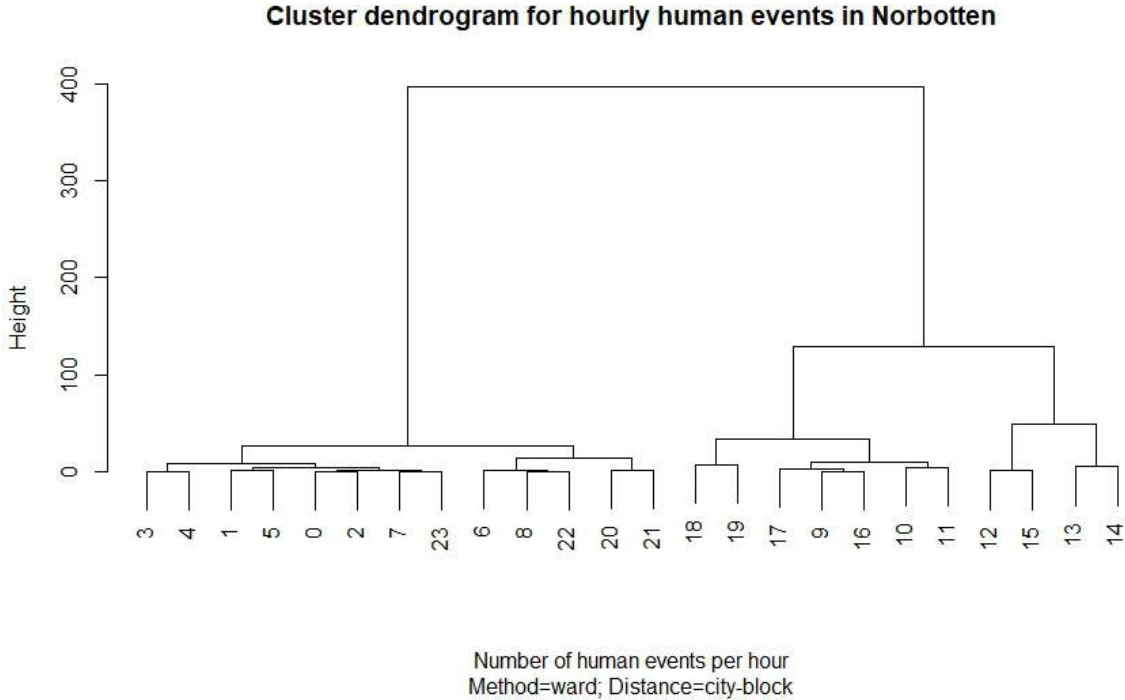
Roe deer crossing events at Norrbotten were generally low, whereas the most abundant ungulate events at Borås. Sattaolja has the highest roe deer crossing rate in Norrbotten with 0.2 animals per day in May, the second highest roe deer usage rate is also in May in Harrioja. In the wintertime the usage rate in Borås is quite low but steadily increasing up to a peak in June with 2.7 roe deer per day in June.

Table 10: Usage rate of the roe deer at each structure per day

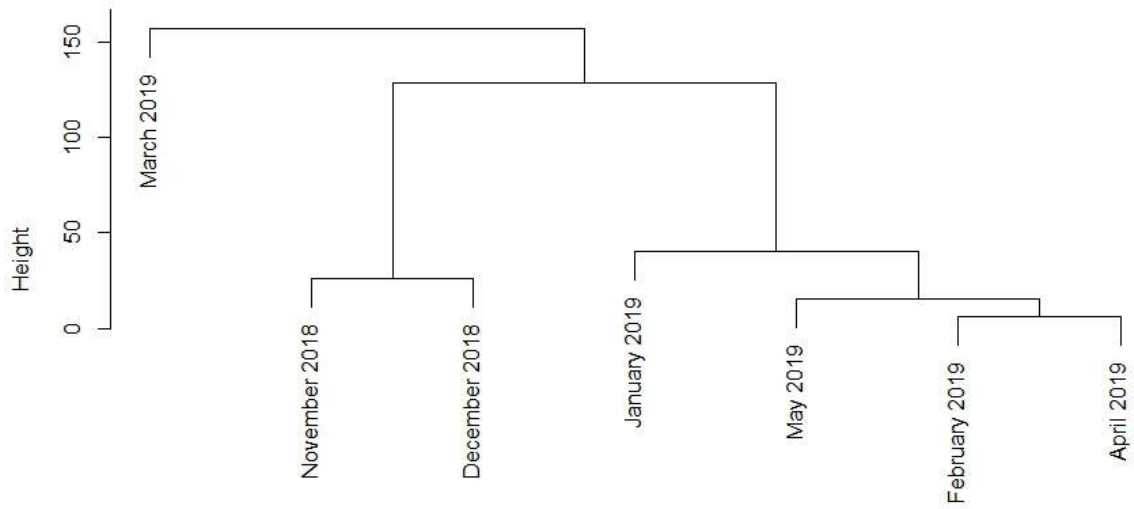
Site	Novem ber	Decem ber	January	Februar y	March	April	May	June	Jul y
Harrioja	0	0	0	0	0	0.03333 333	0.2	0	0
Mertainen	0	0	0	0	0	0	0	0	0
Sattaolja	0	0	0	0	0	0	0.6	0	0
Sangijärvi	0	0	0.03225 806	0	0	0.13333 333	0	0	0
Kåatträskv ägen	0	0	0	0	0	0	0	0	0
Borås	0	0	0.16129 032	0.17857 143	0.35483 871	1.43333 333	2.61290 323	2.76666 667	1. 3

Appendix 2C Dendrograms

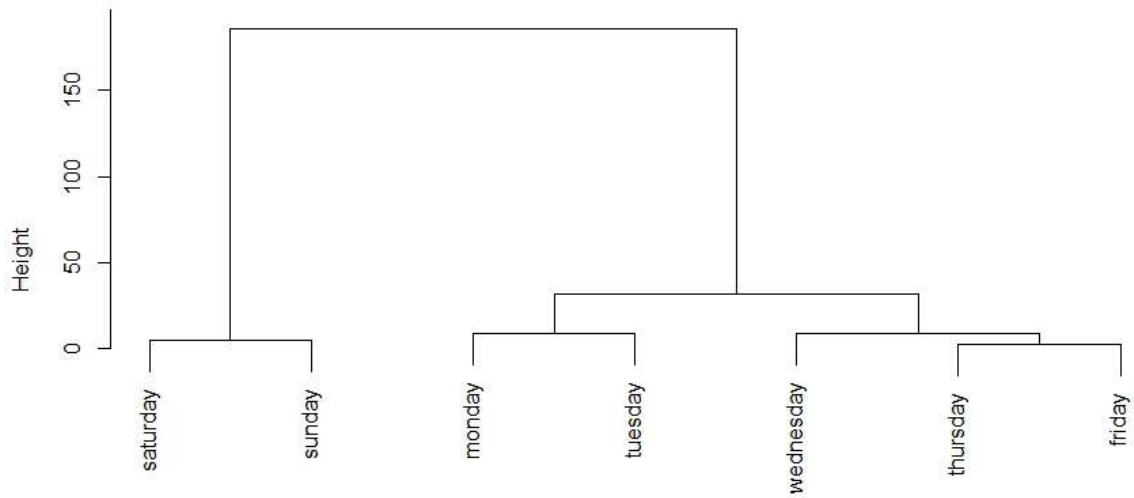
These were only used as a help to explore temporal patterns.



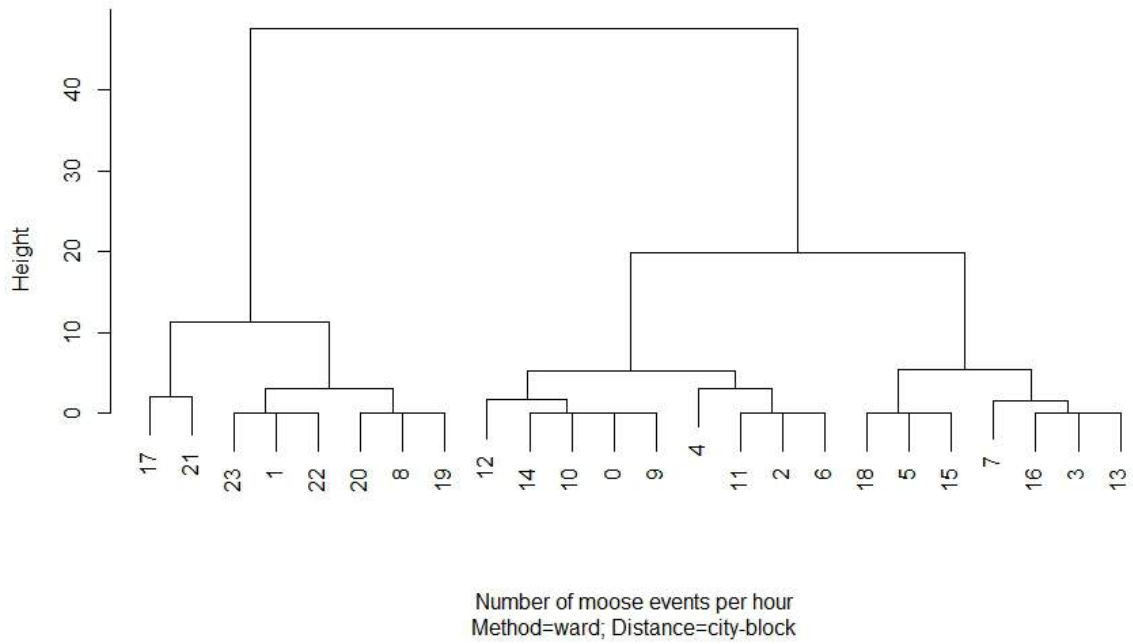
Cluster dendrogram for monthly human events in Norbotten



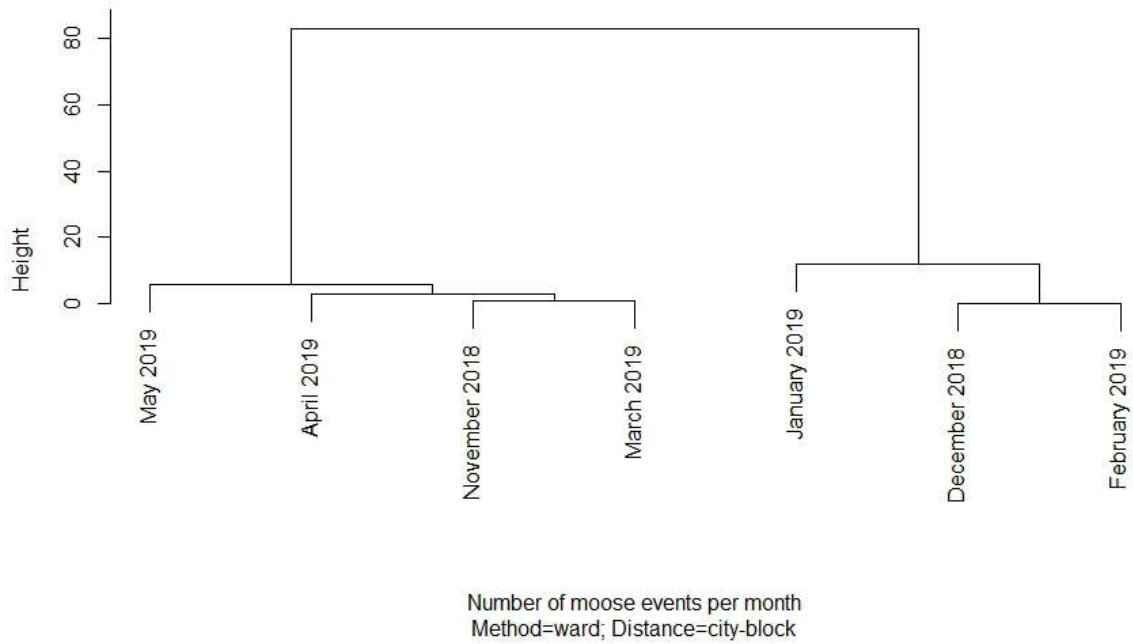
Cluster dendrogram for weekday human events in Norbotten



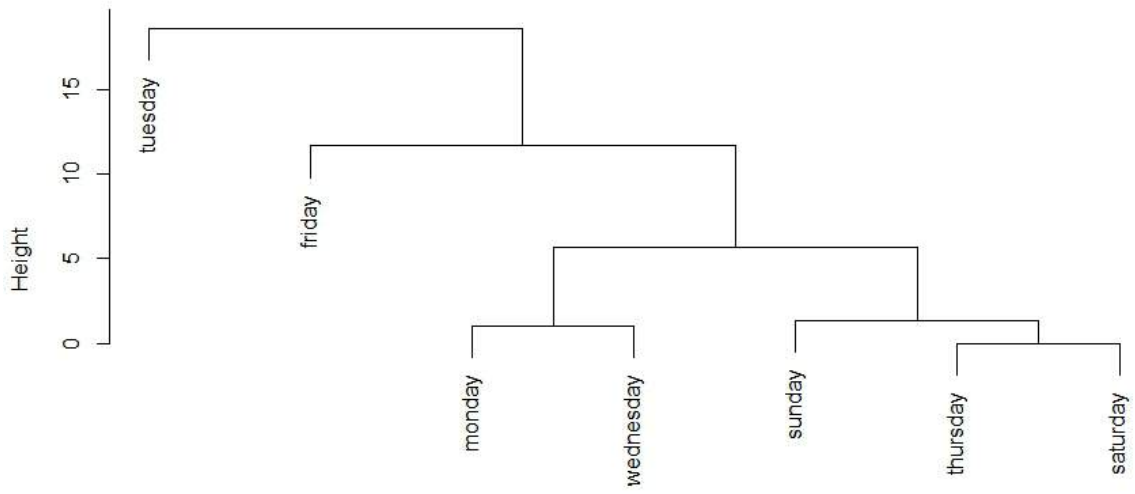
Cluster dendrogram for hourly moose events in Norbotten



Cluster dendrogram for monthly moose events in Norbotten

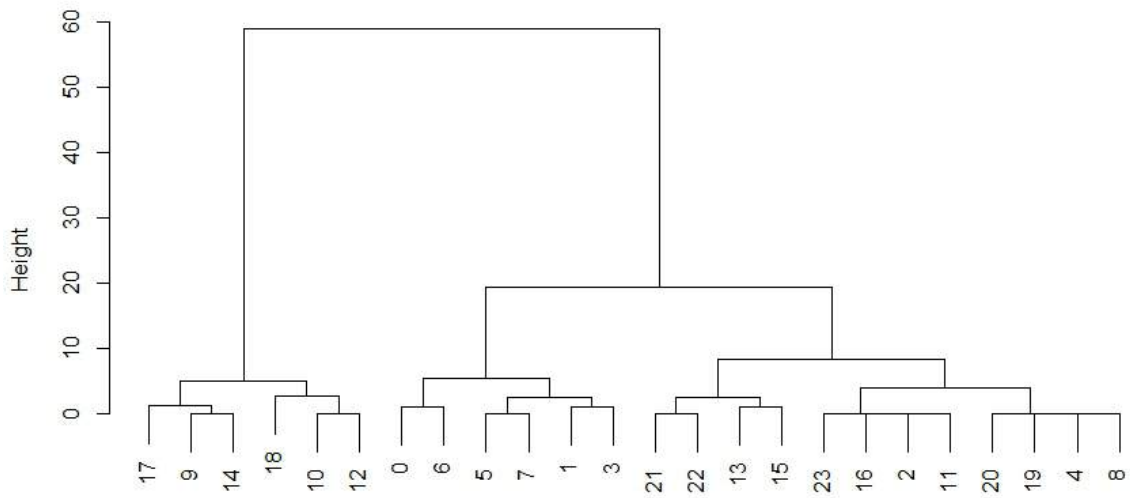


Cluster dendrogram for weekday moose events in Norbotten



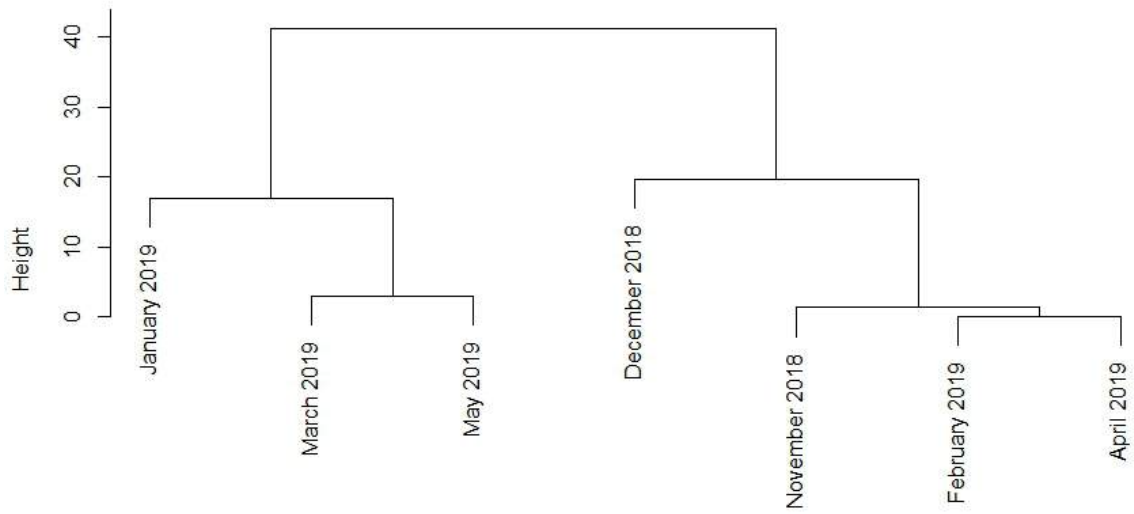
Number of moose events per weekday
Method=ward; Distance=city-block

Cluster dendrogram for hourly reindeer events in Norbotten

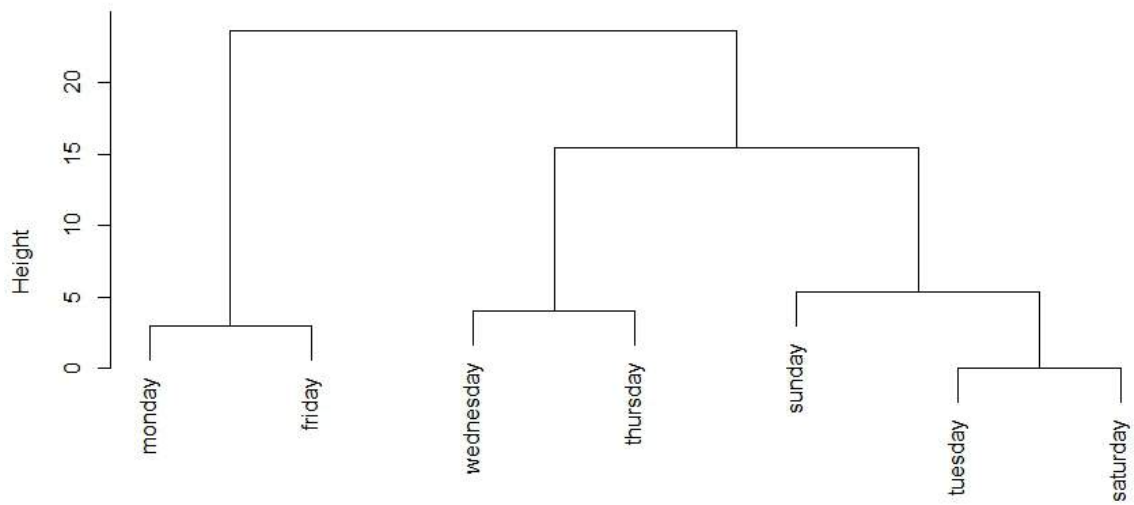


Number of reindeer events per hour
Method=ward; Distance=city-block

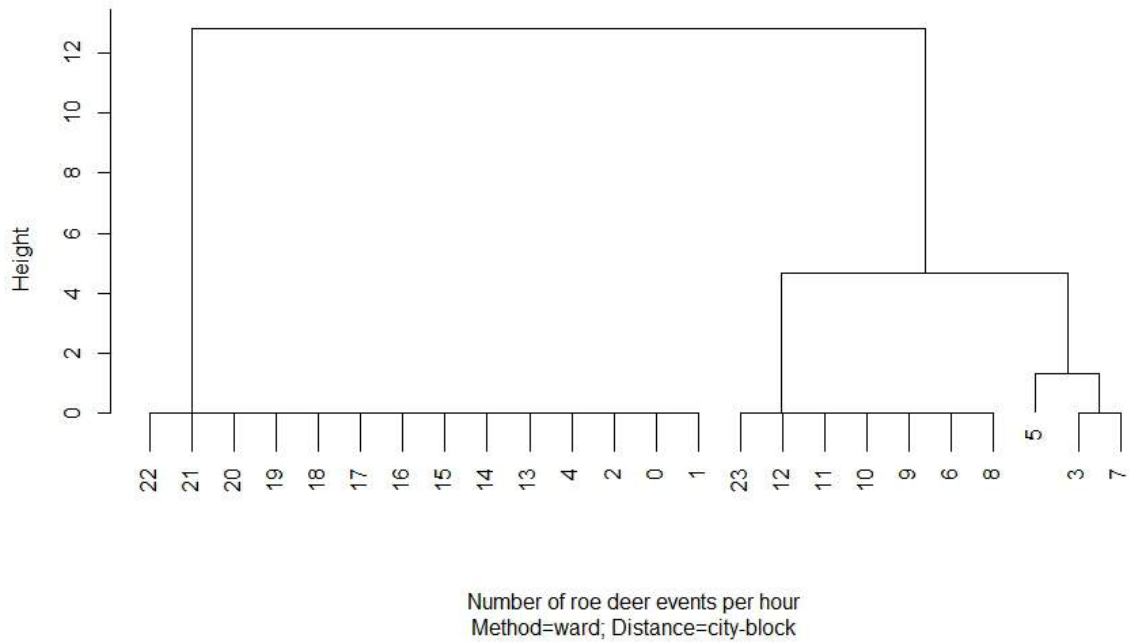
Cluster dendrogram for monthly reindeer events in Norbotten



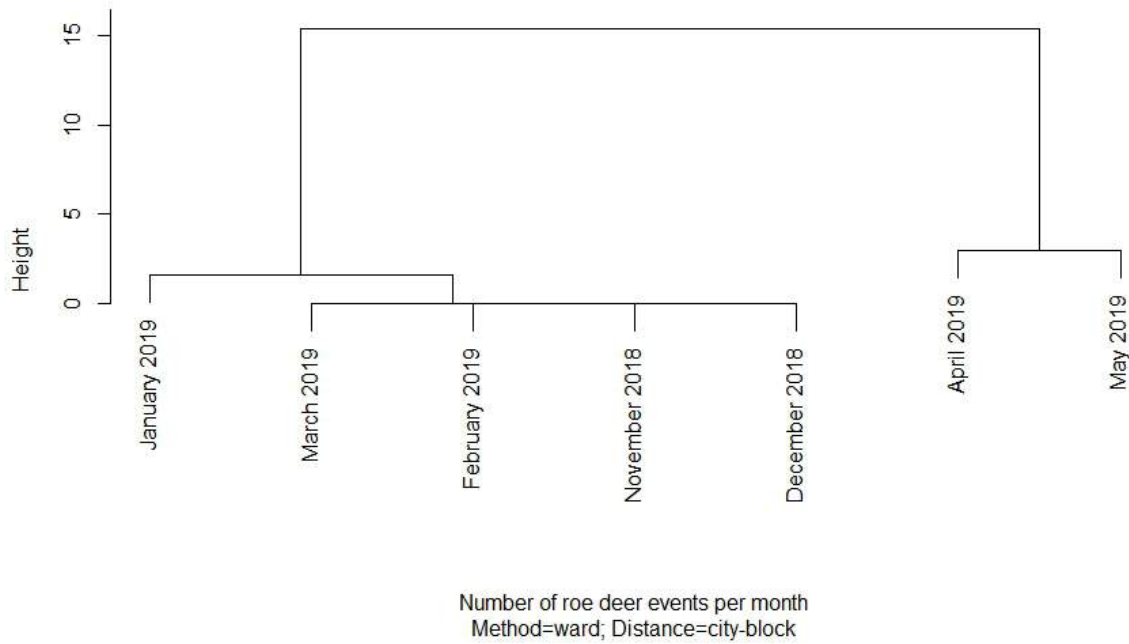
Cluster dendrogram for weekday reindeer events in Norbotten



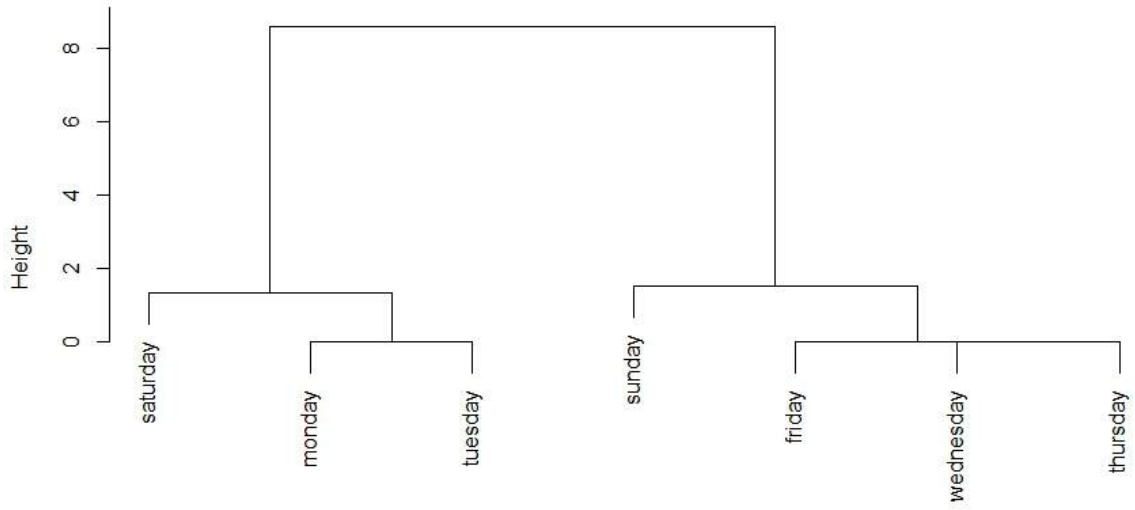
Cluster dendrogram for hourly roe deer events in Norbotten



Cluster dendrogram for monthly roe deer events in Norbotten

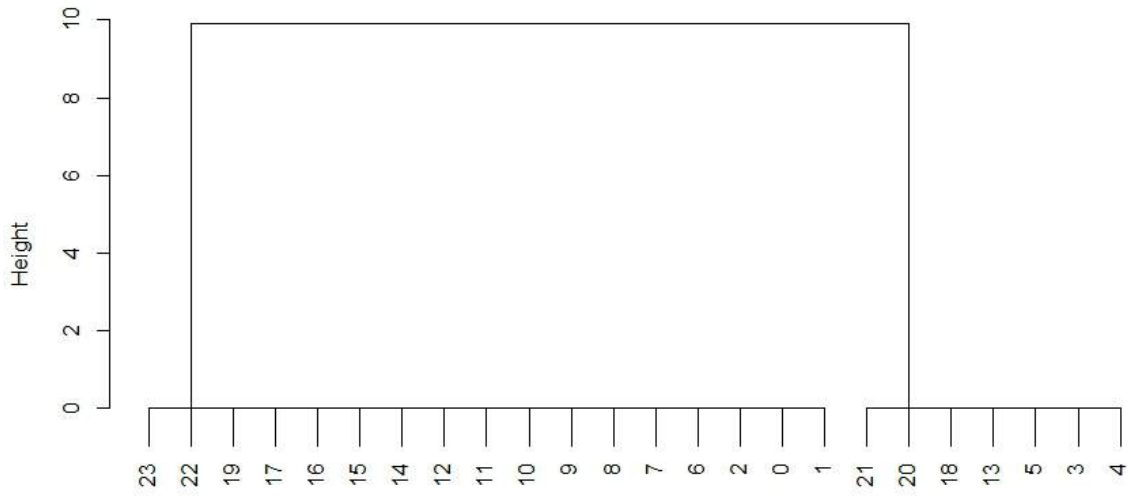


Cluster dendrogram for weekday roe deer events in Norbotten



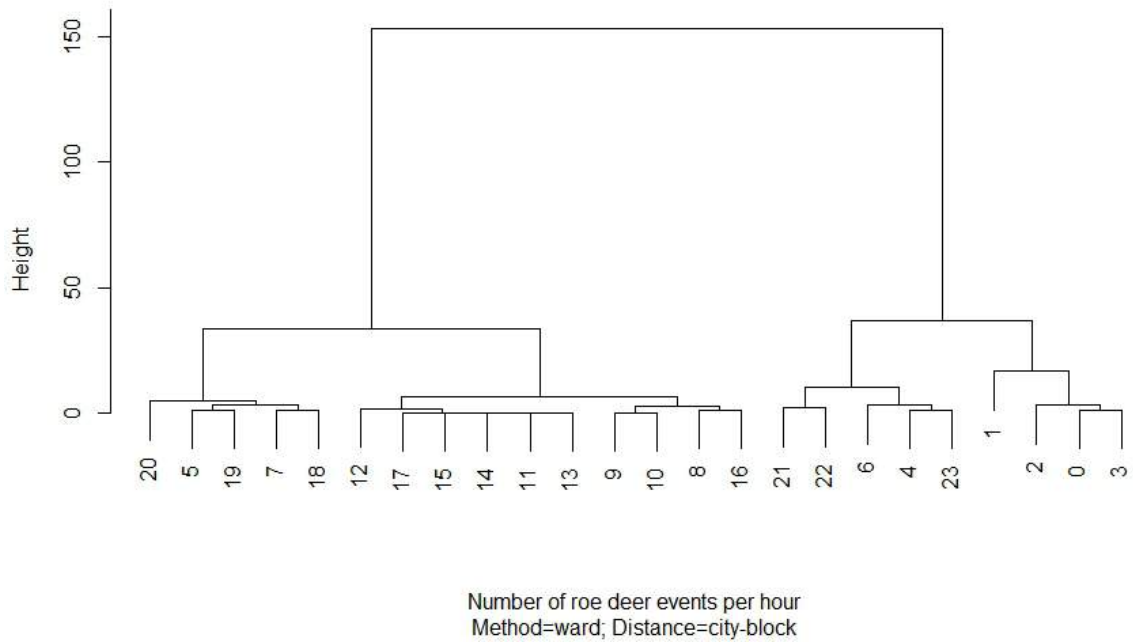
Number of roe deer events per weekday
Method=ward; Distance=city-block

Cluster dendrogram for hourly moose events in boros

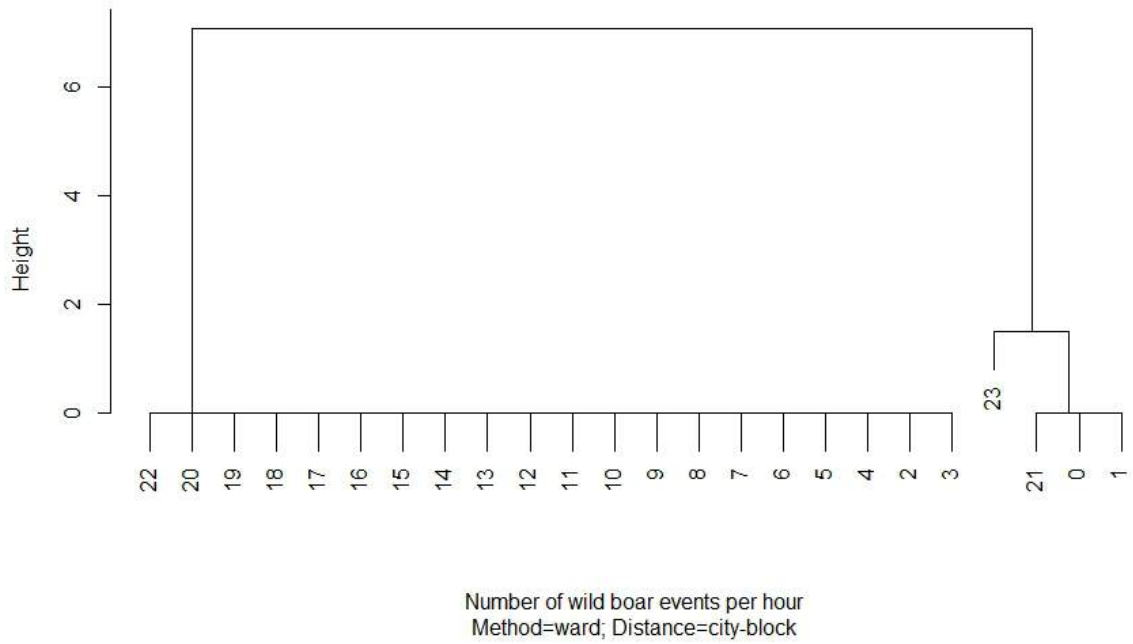


Number of moose events per hour
Method=ward; Distance=city-block

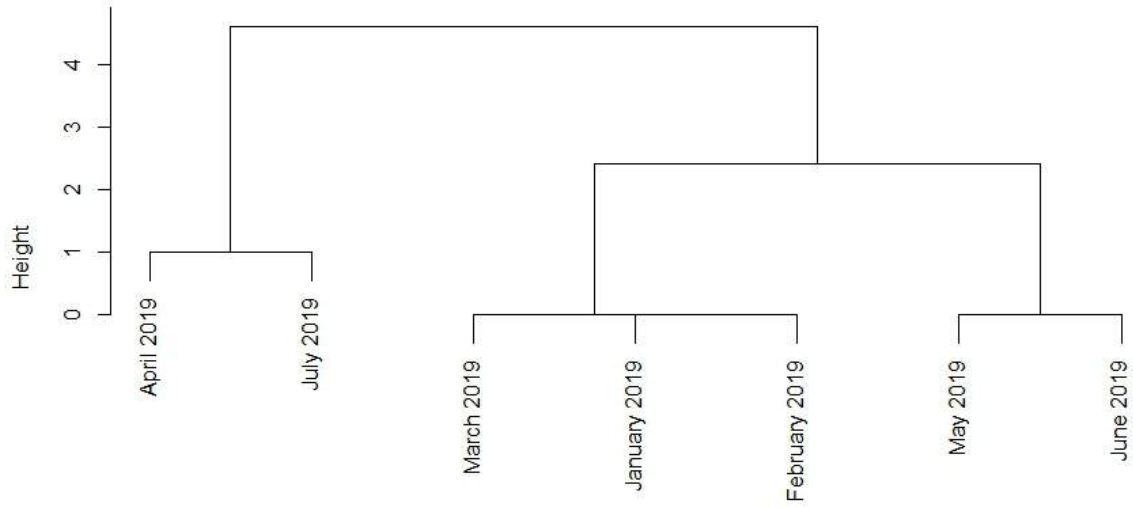
Cluster dendrogram for hourly roe deer events in boros



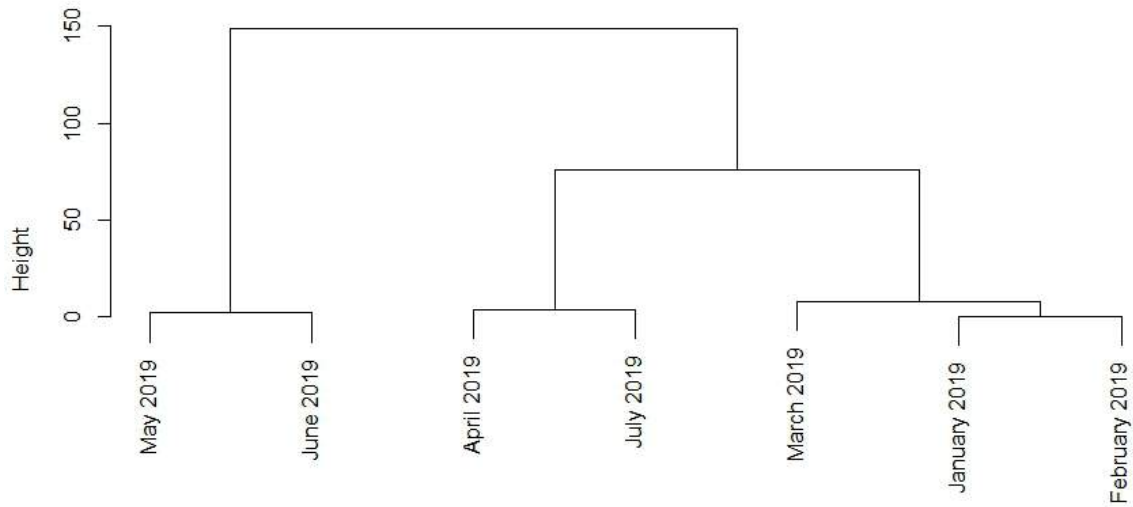
Cluster dendrogram for hourly wild boar events in boros



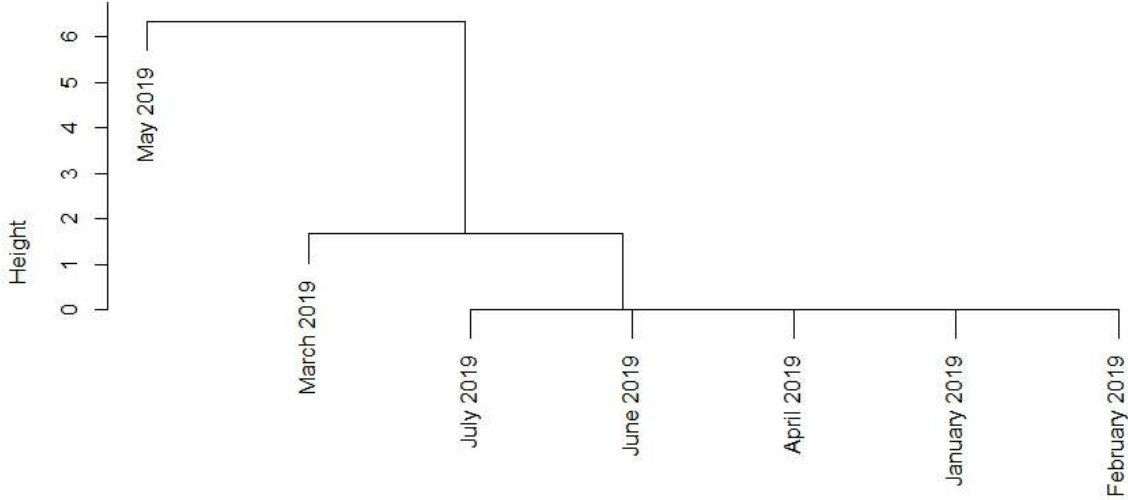
Cluster dendrogram for monthly moose events in boros



Cluster dendrogram for monthly roe deer events in boros

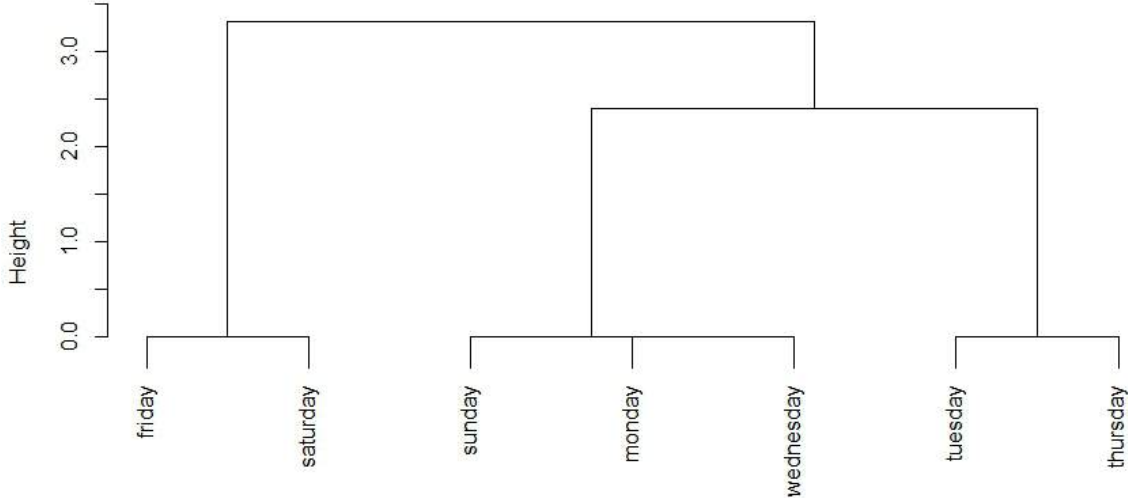


Cluster dendrogram for monthly wild boar events in boros



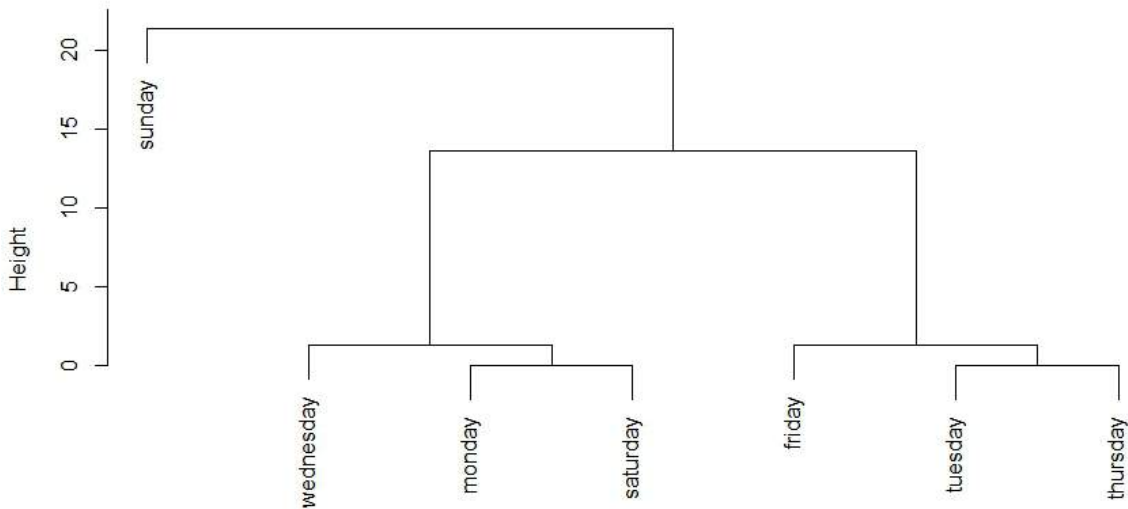
Number of wild boar events per month
Method=ward; Distance=city-block

Cluster dendrogram for weekday moose events in boros



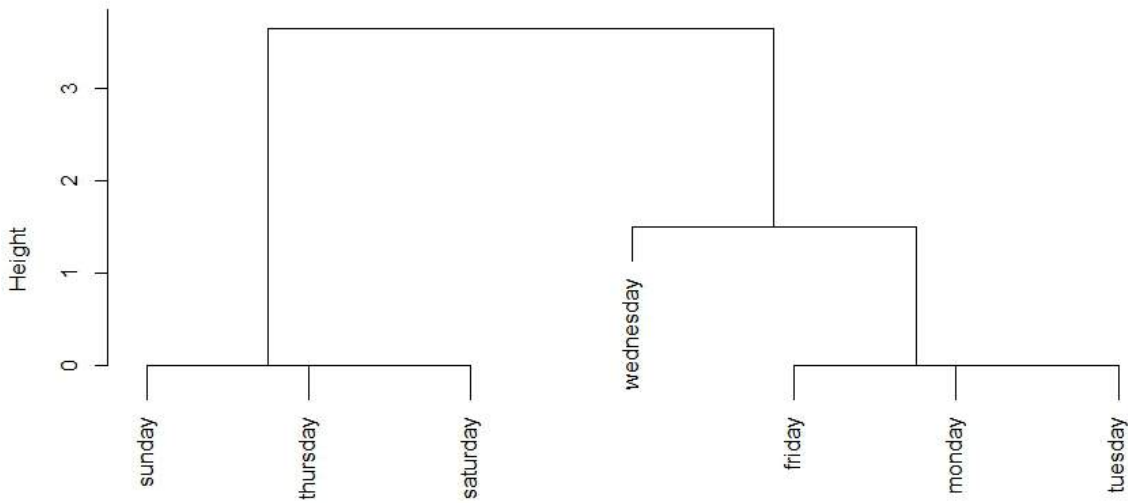
Number of moose events per weekday
Method=ward; Distance=city-block

Cluster dendrogram for weekday roe deer events in boros



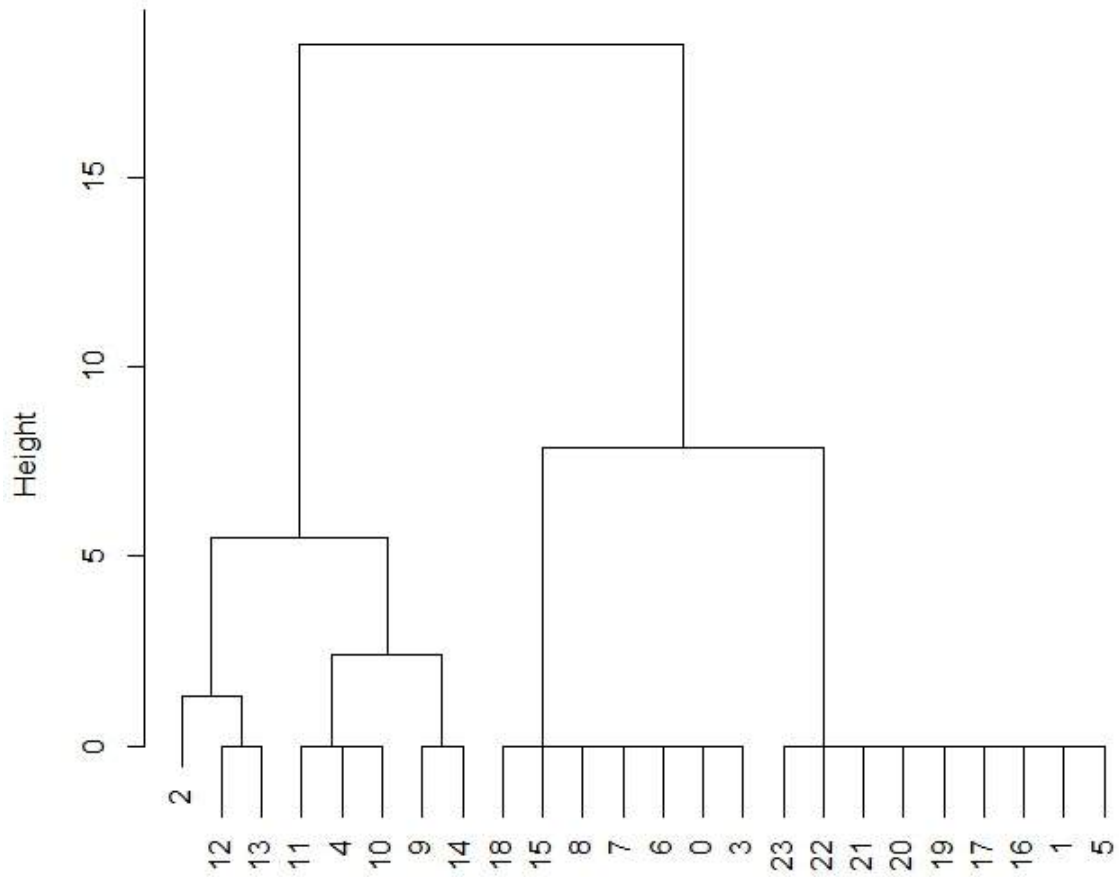
Number of roe deer events per weekday
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Cluster dendrogram for weekday wild boar events in boros



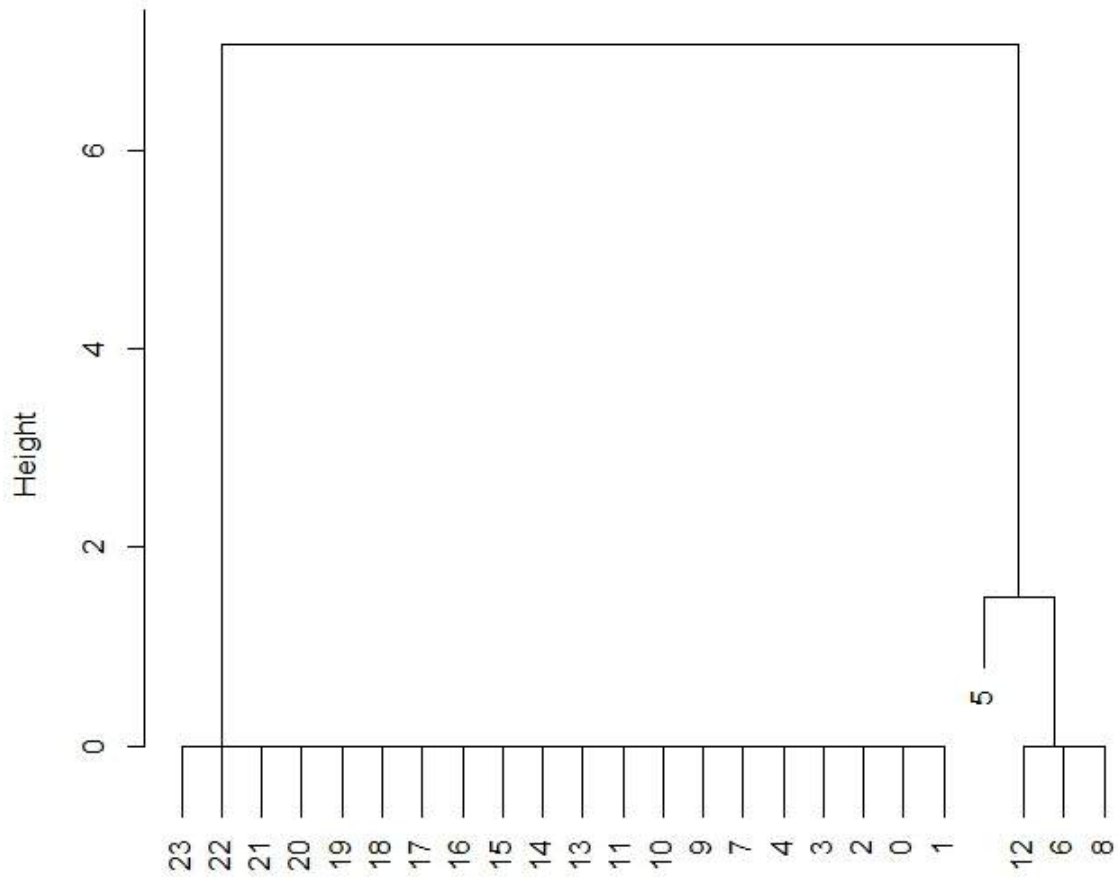
Number of wild boar events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly reindeer use at Sangisjärvi



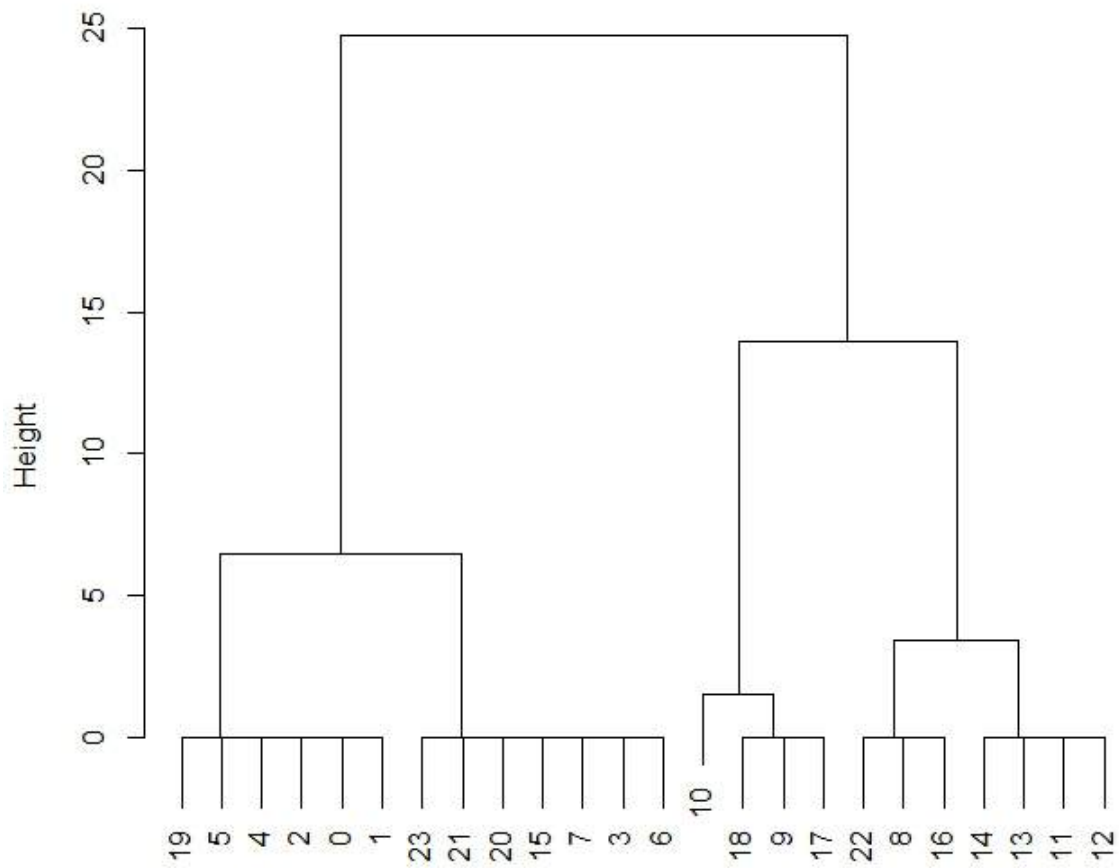
Cluster on the basis of the reindeer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly roe deer use at Sangisjärvi



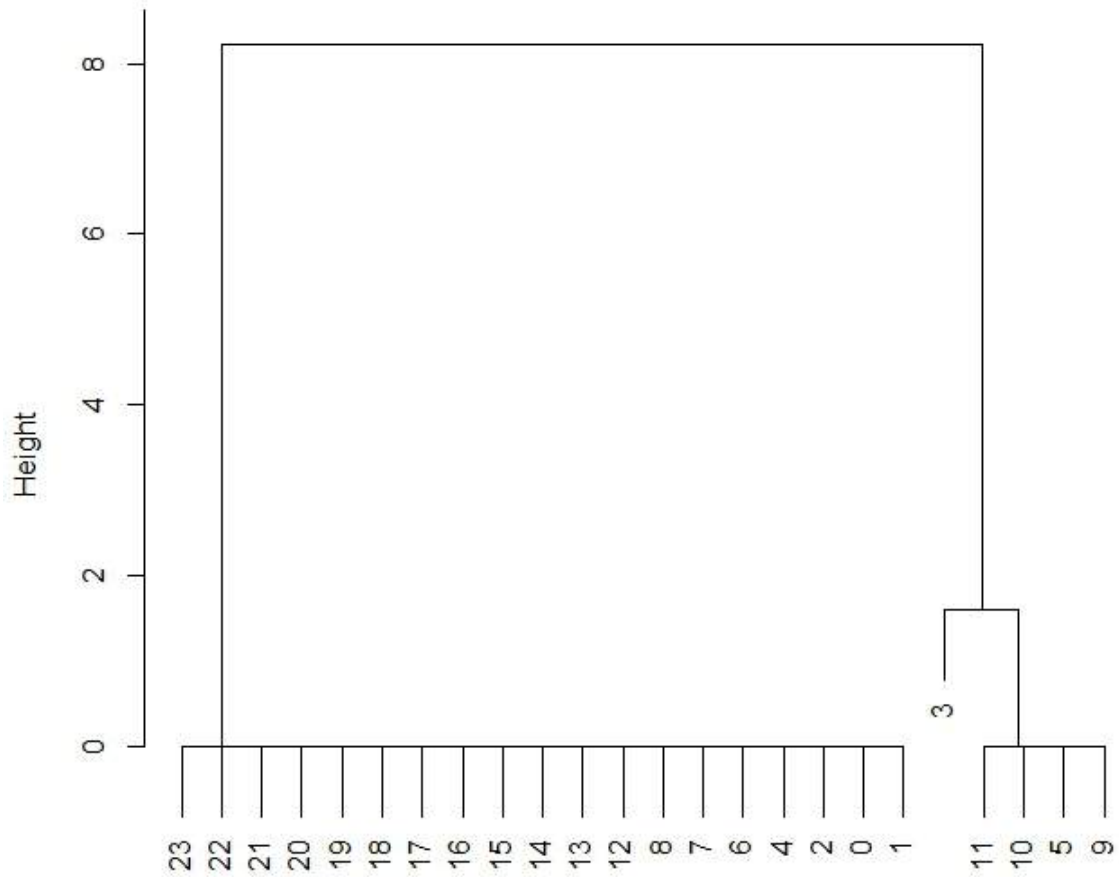
Cluster on the basis of the roe deer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly reindeer use at Sattaoja



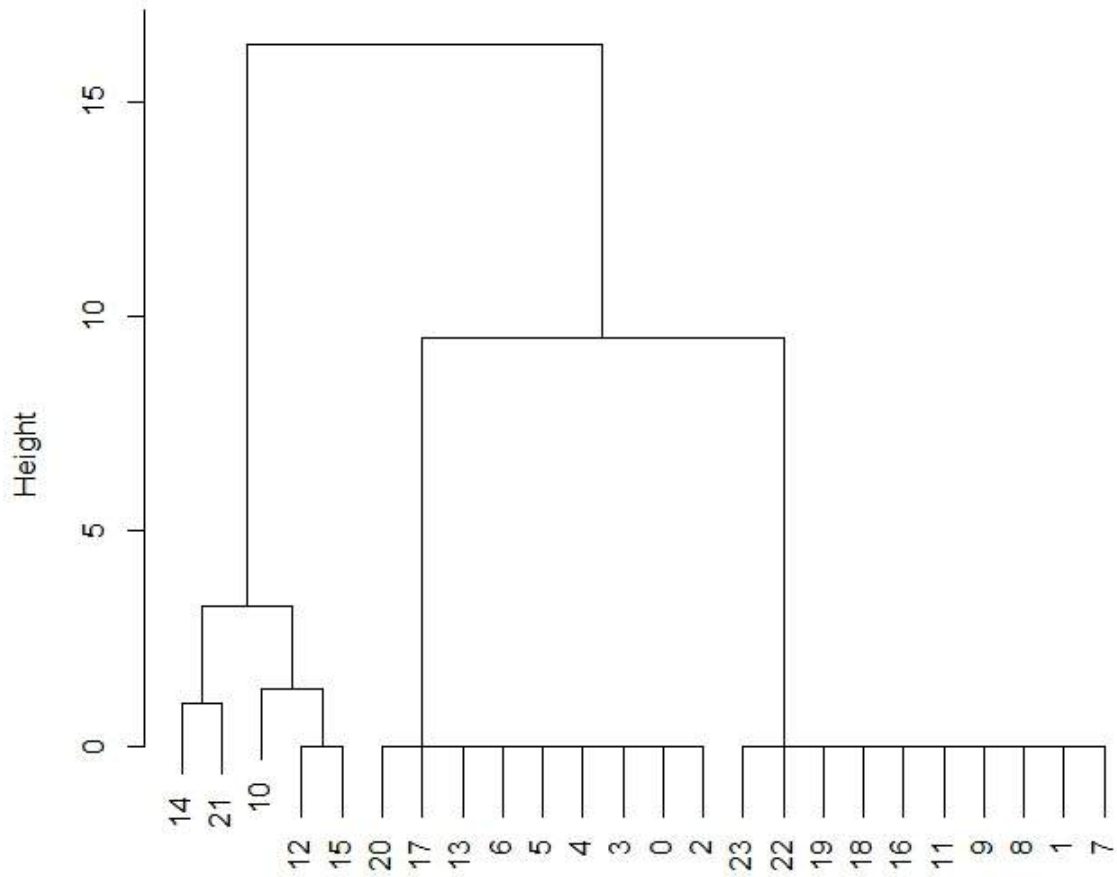
Cluster on the basis of the reindeer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly roe deer use at Sattaoja

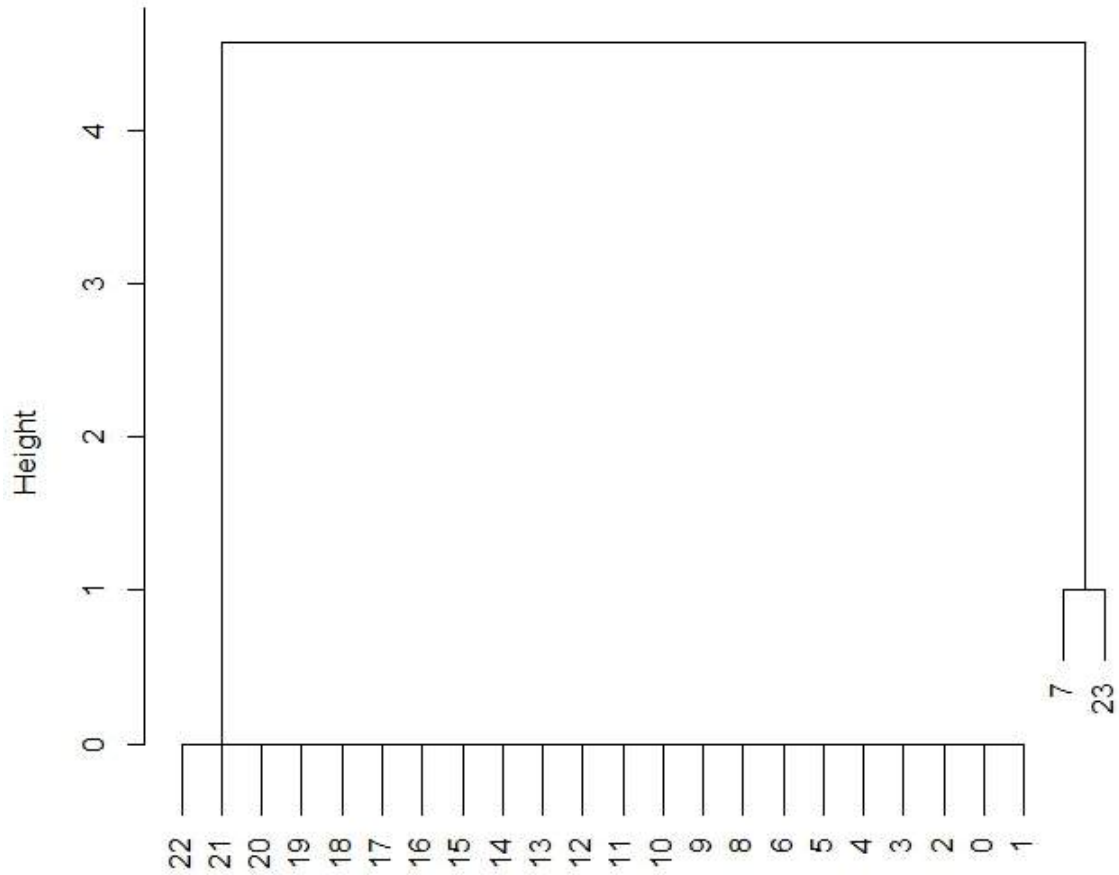


Cluster on the basis of the reindeer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram hourly reindeer use at Harrioja

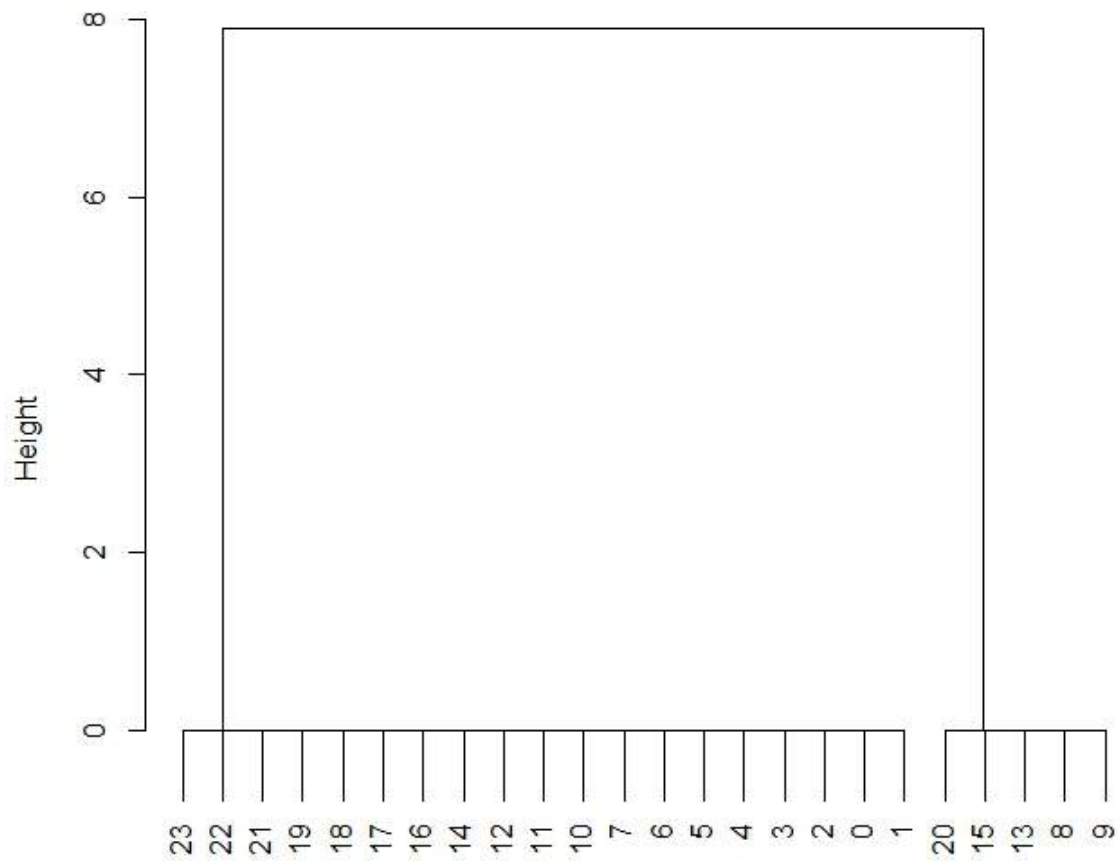


Cluster Dendrogram of the hourly roe deer use at Harrioja



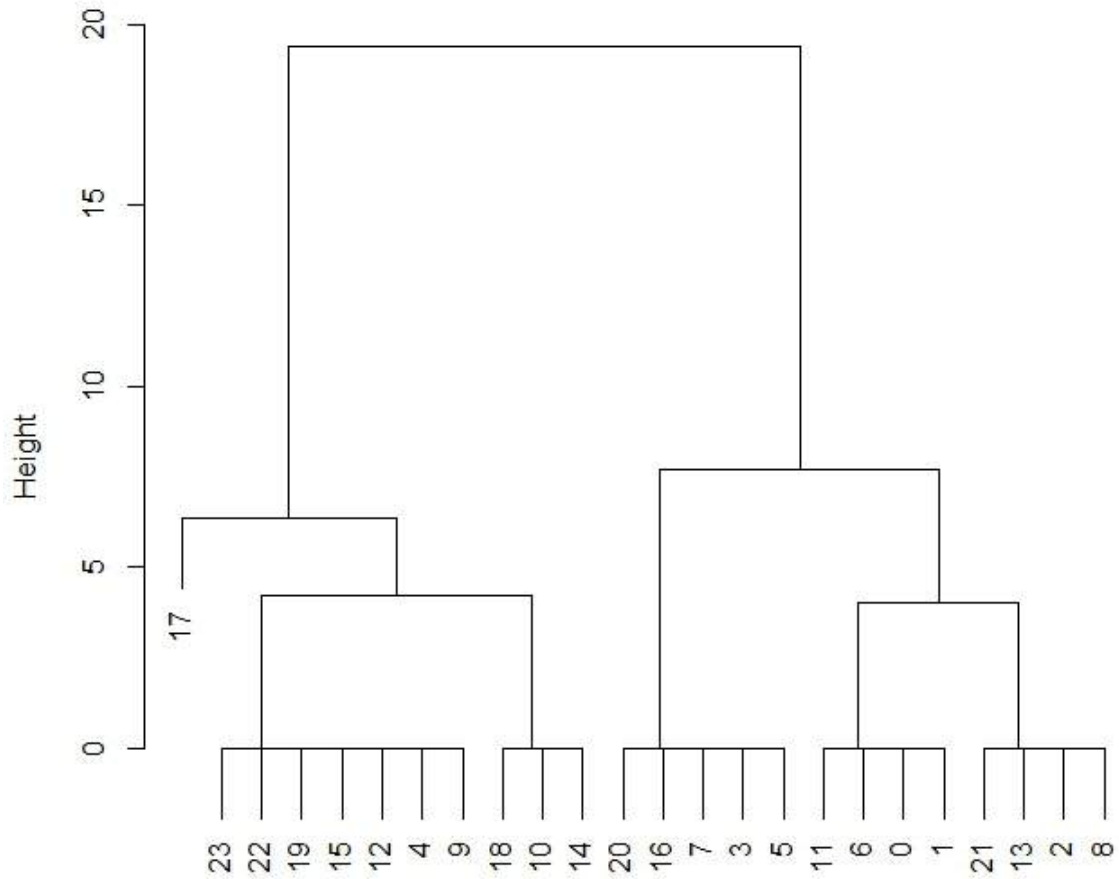
Cluster on the basis of the roe deer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly reindeer use at Kotaträskvägen



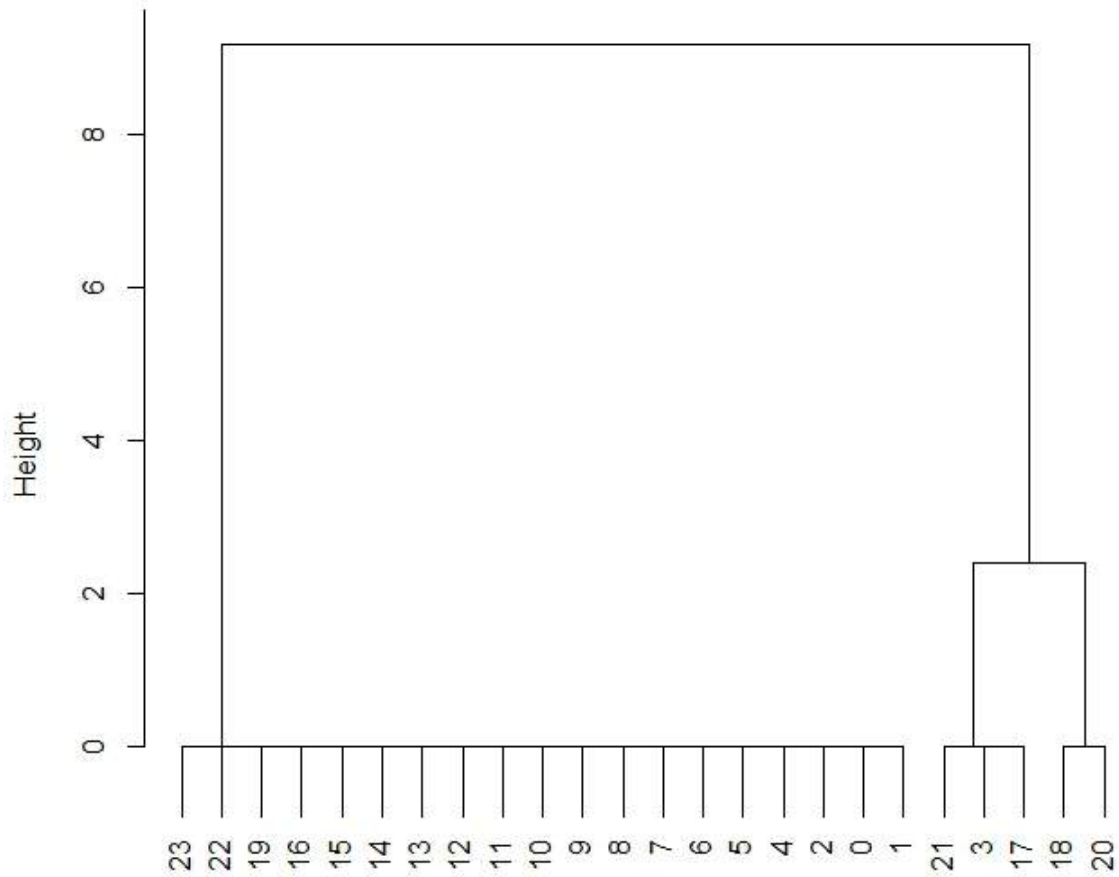
Cluster on the basis of the reindeer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly reindeer use at Mertainen



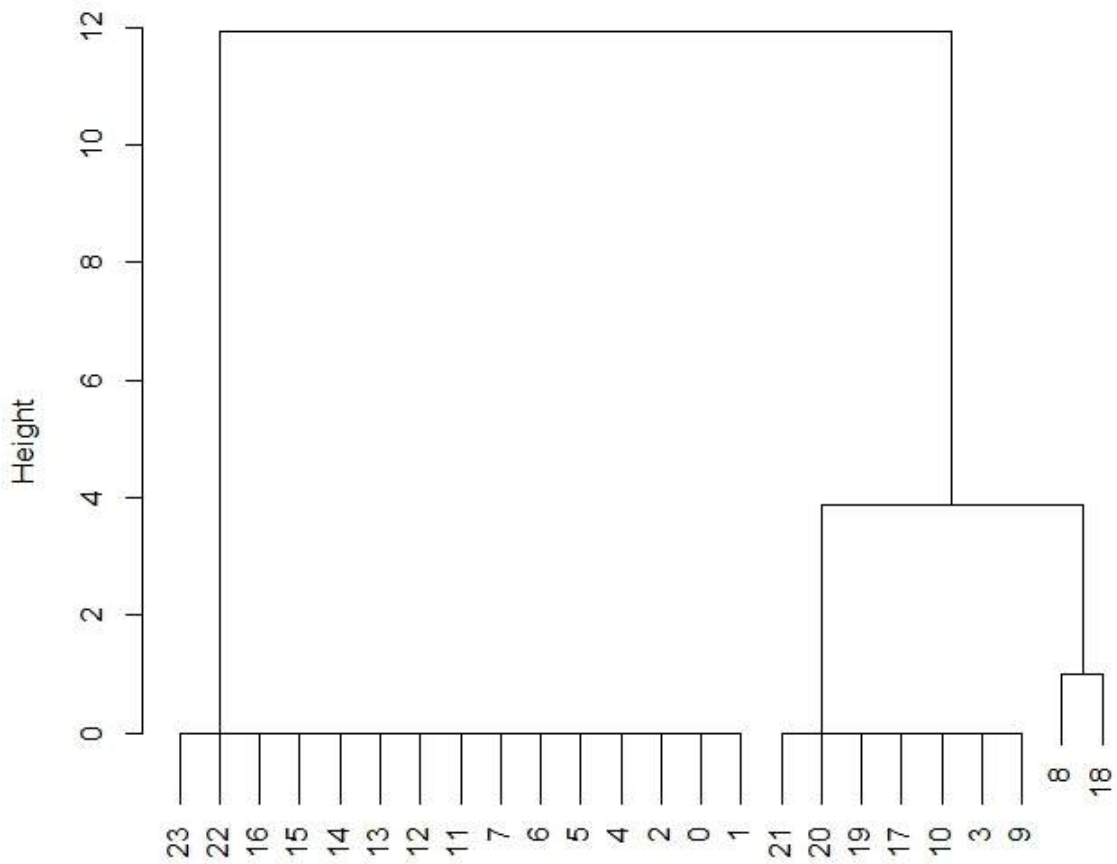
Cluster on the basis of the reindeer events per hour
Method=ward; Distance=city-block

Cluster Dendrogram hourly moose use at Harrioja



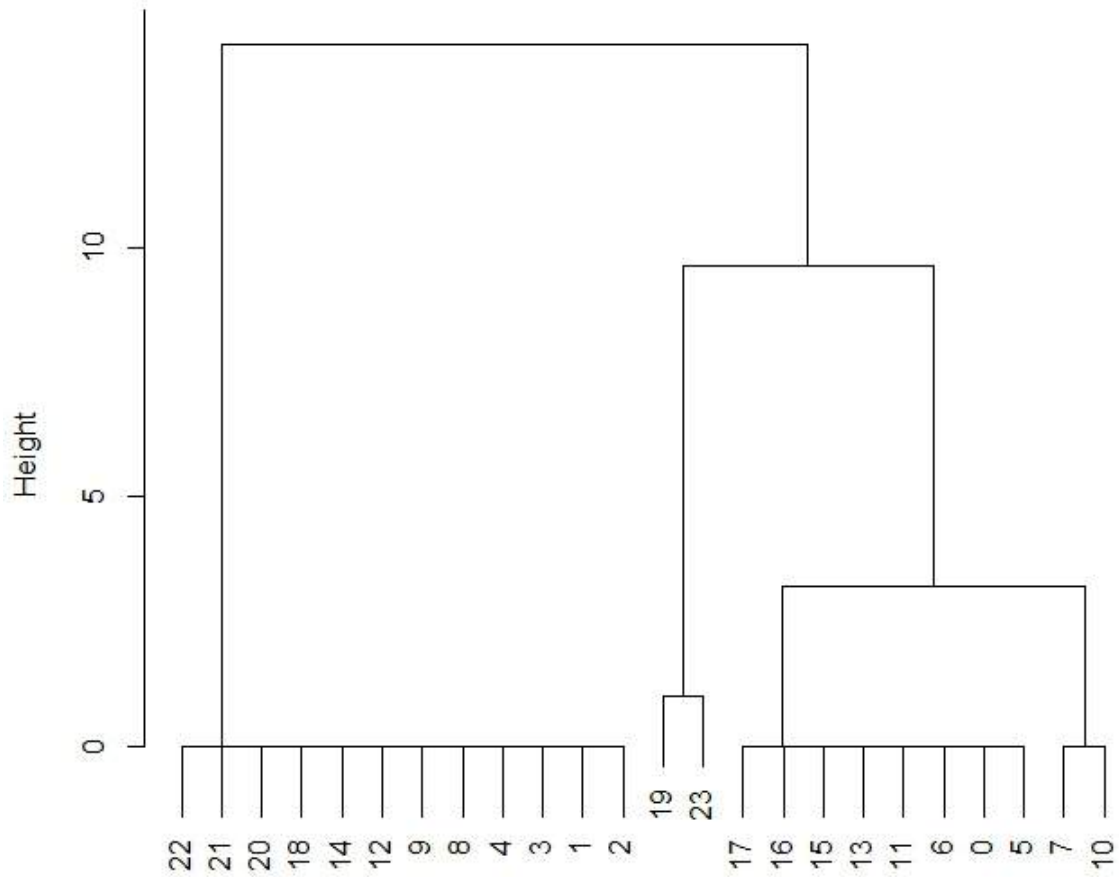
Cluster on the basis of the moose events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly moose use at Kotaträskvägen



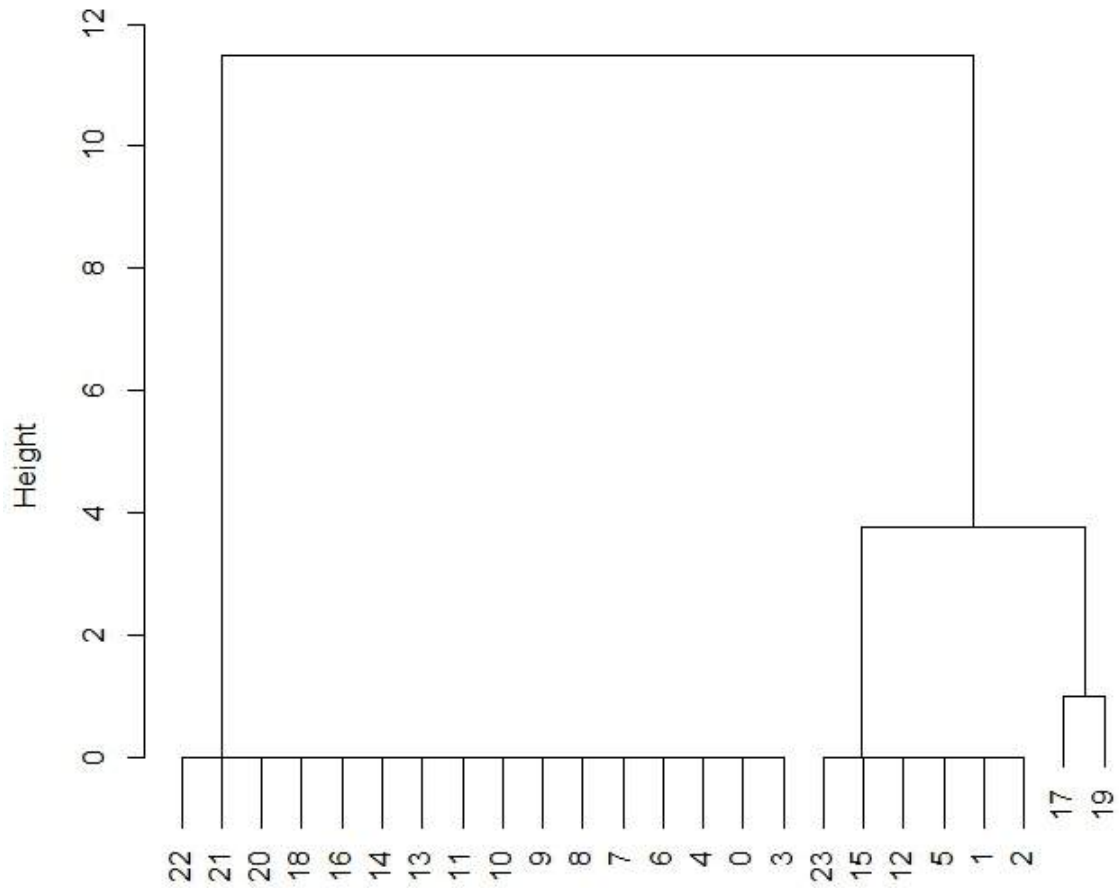
Cluster on the basis of the moose events per hour
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Cluster Dendrogram of the hourly moose use at Mertainen



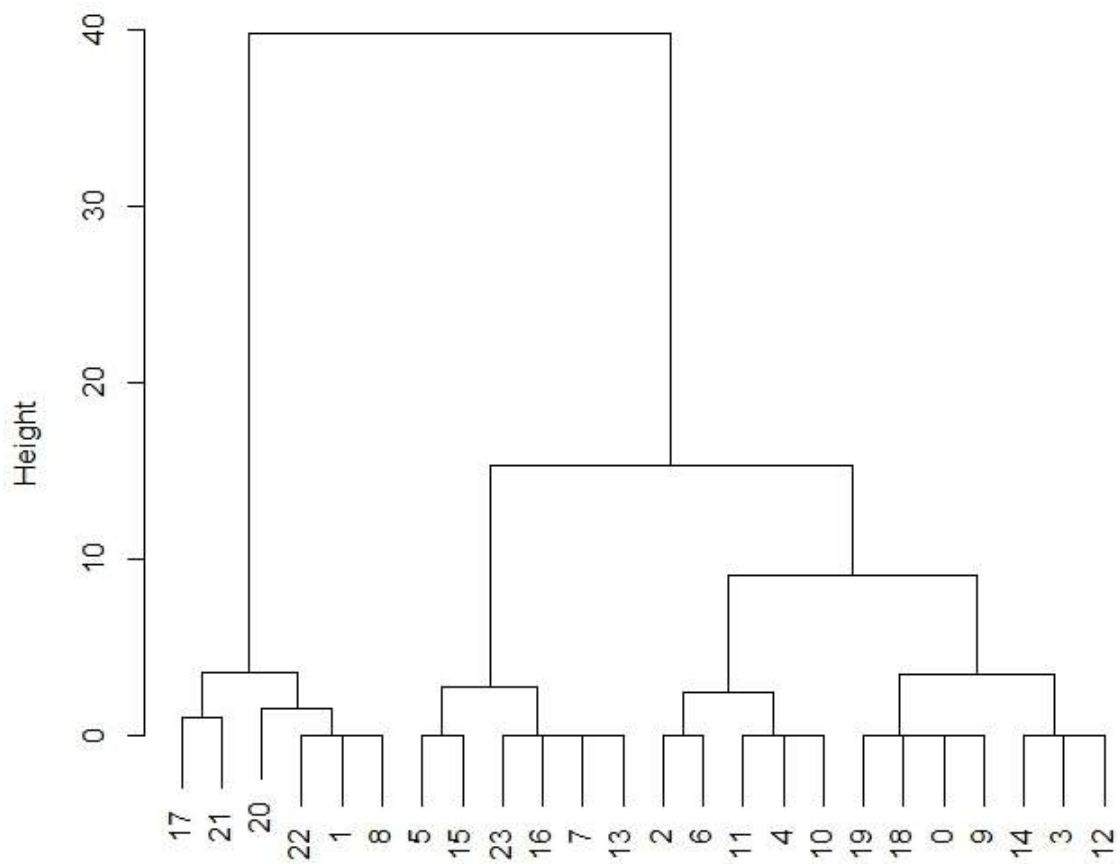
Cluster on the basis of the moose events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly moose use at Sangisjärvi



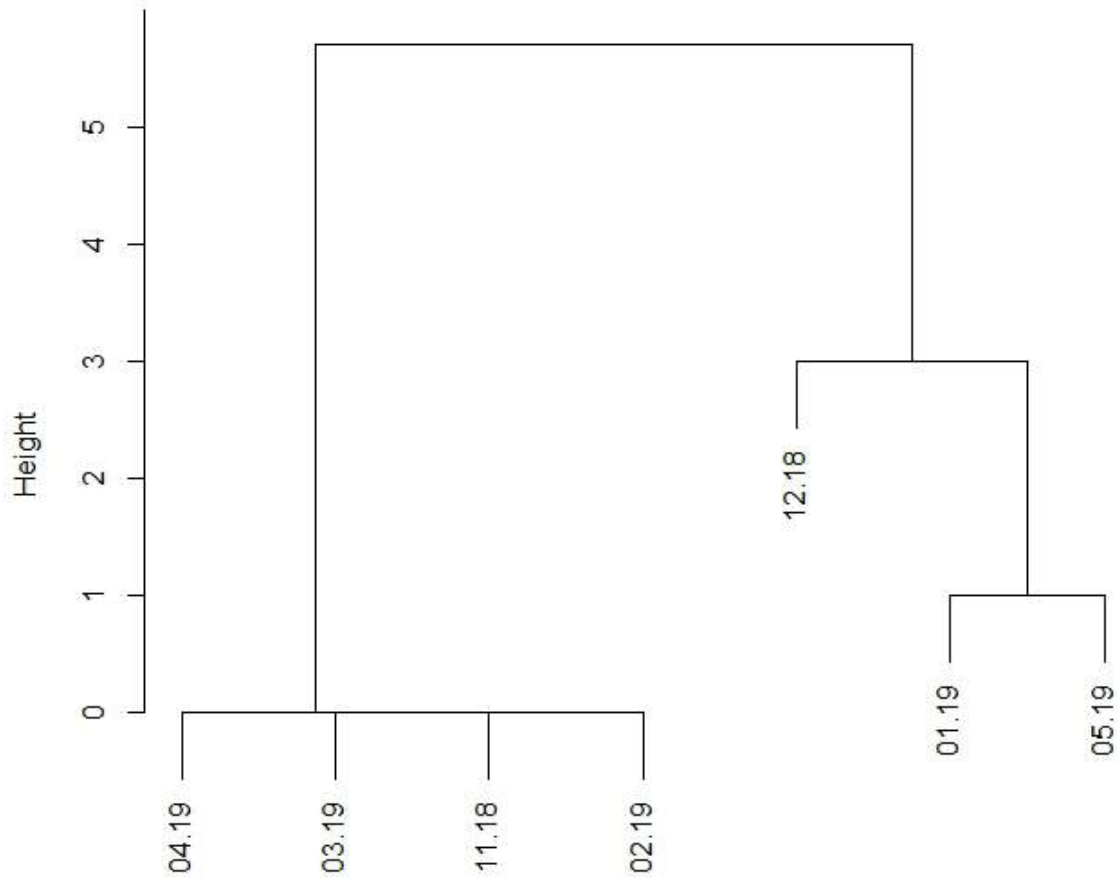
Cluster on the basis of the moose events per hour
Method=ward; Distance=city-block

Cluster Dendrogram of the hourly moose use at Sattaoja



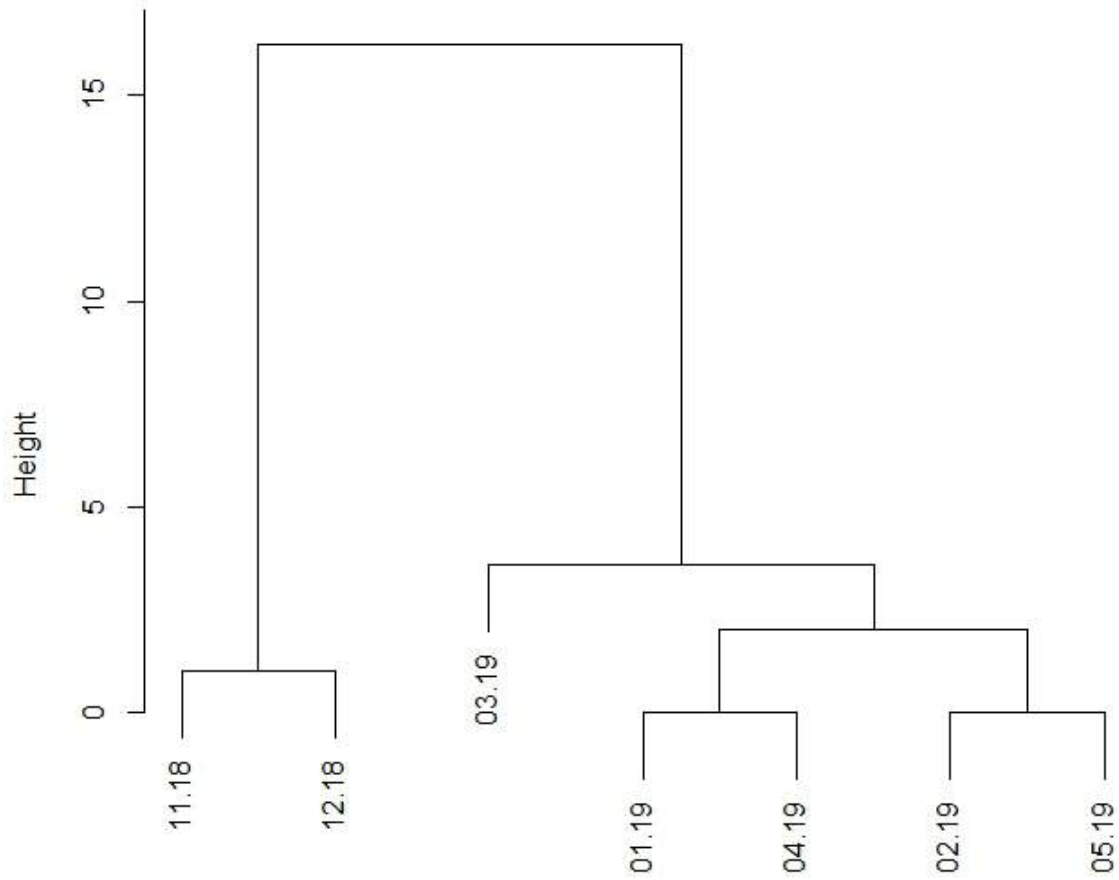
Cluster on the basis of the moose events per hour
Method=ward; Distance=city-block

Cluster Dendrogram monthly moose use at Harrioja



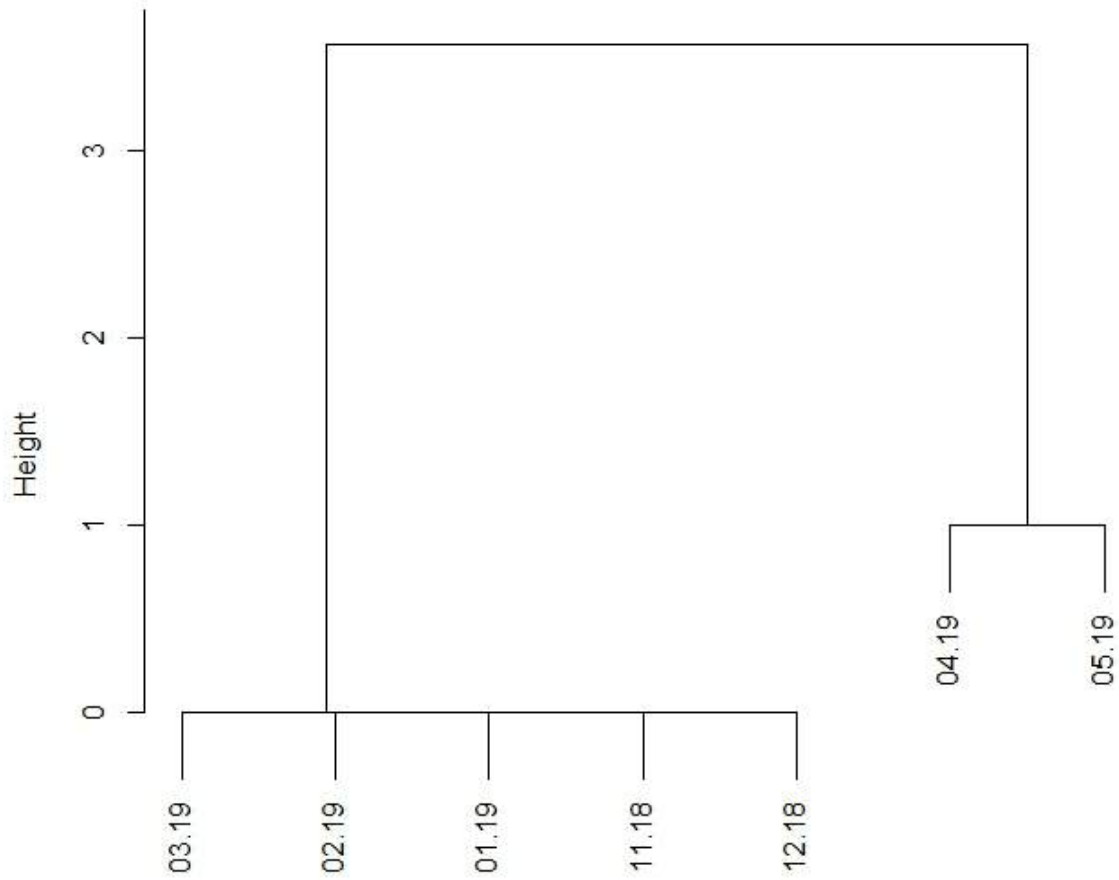
Cluster on the basis of the moose events per month
Method=ward; Distance=city-block

Cluster Dendrogram monthly reindeer use at Harrioja



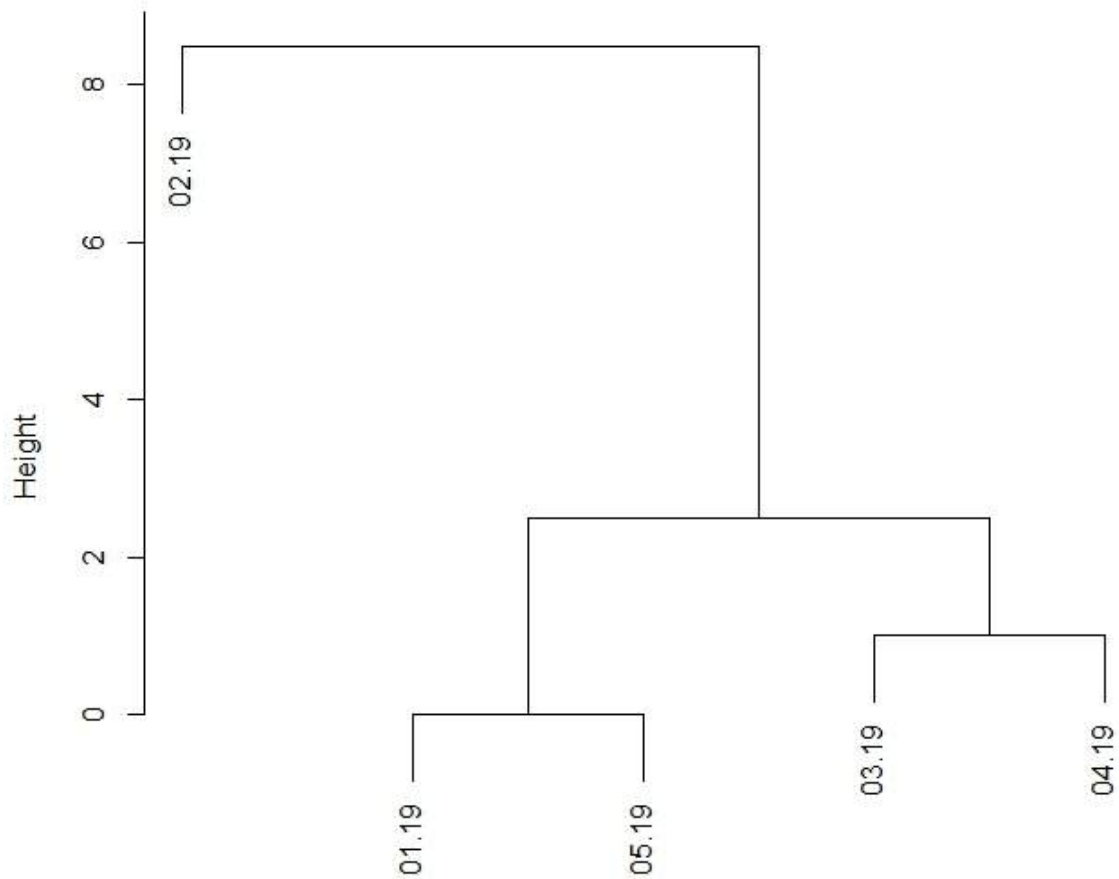
Cluster on the basis of the reindeer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly roe deer use at Harrioja



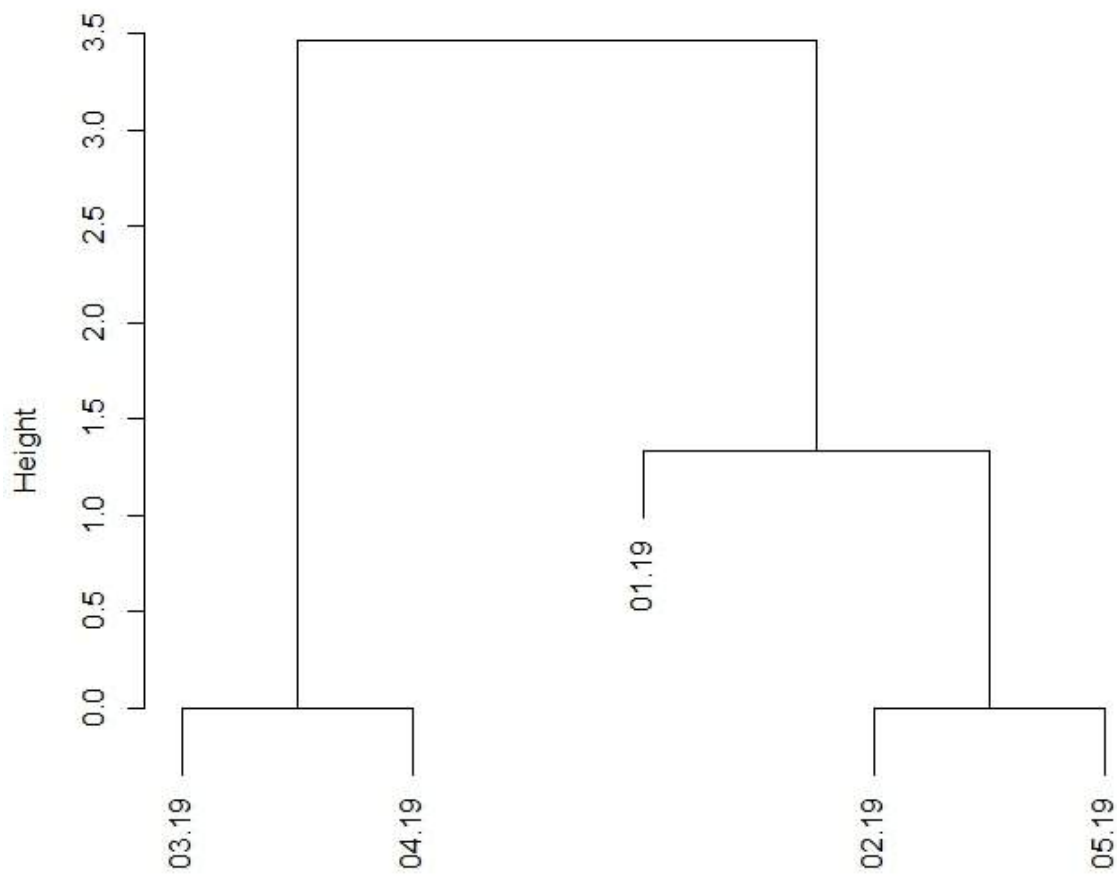
Cluster on the basis of the roe deer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly moose use at Kotaträskvägen



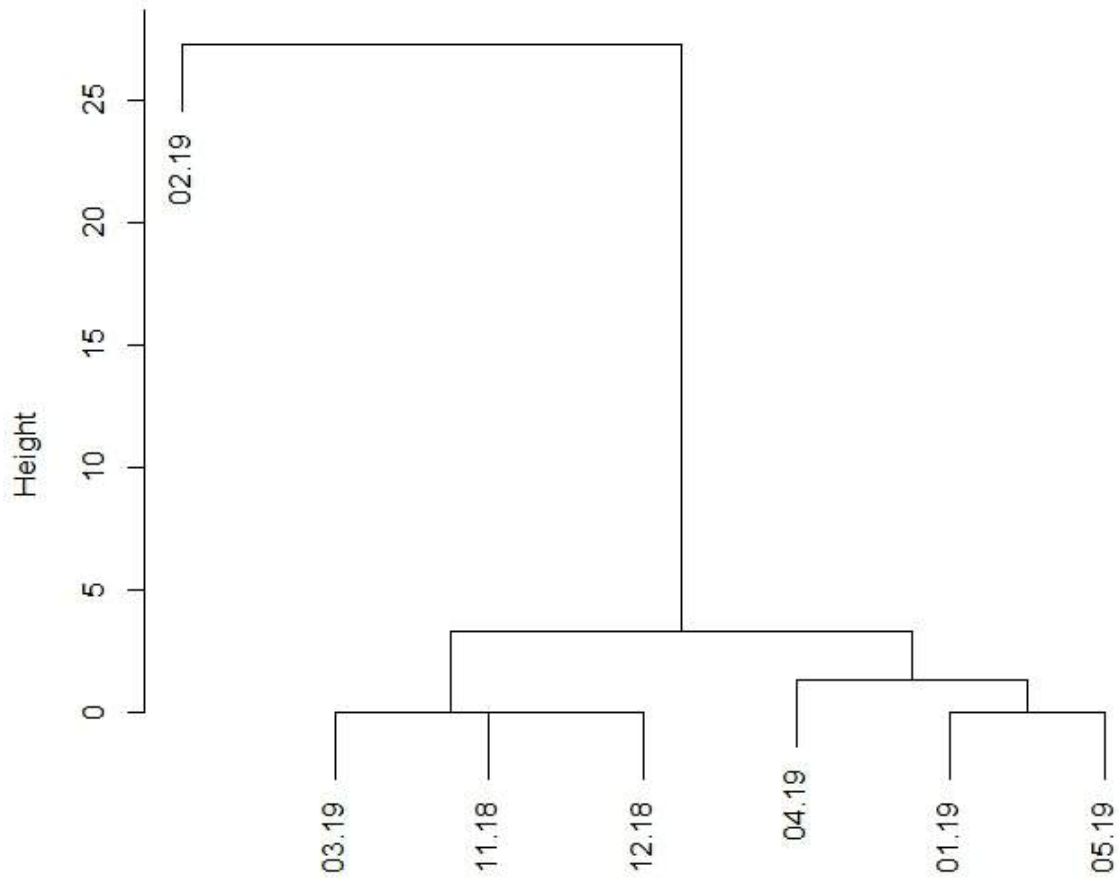
Cluster on the basis of the moose events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly reindeer use at Kotaträskvägen



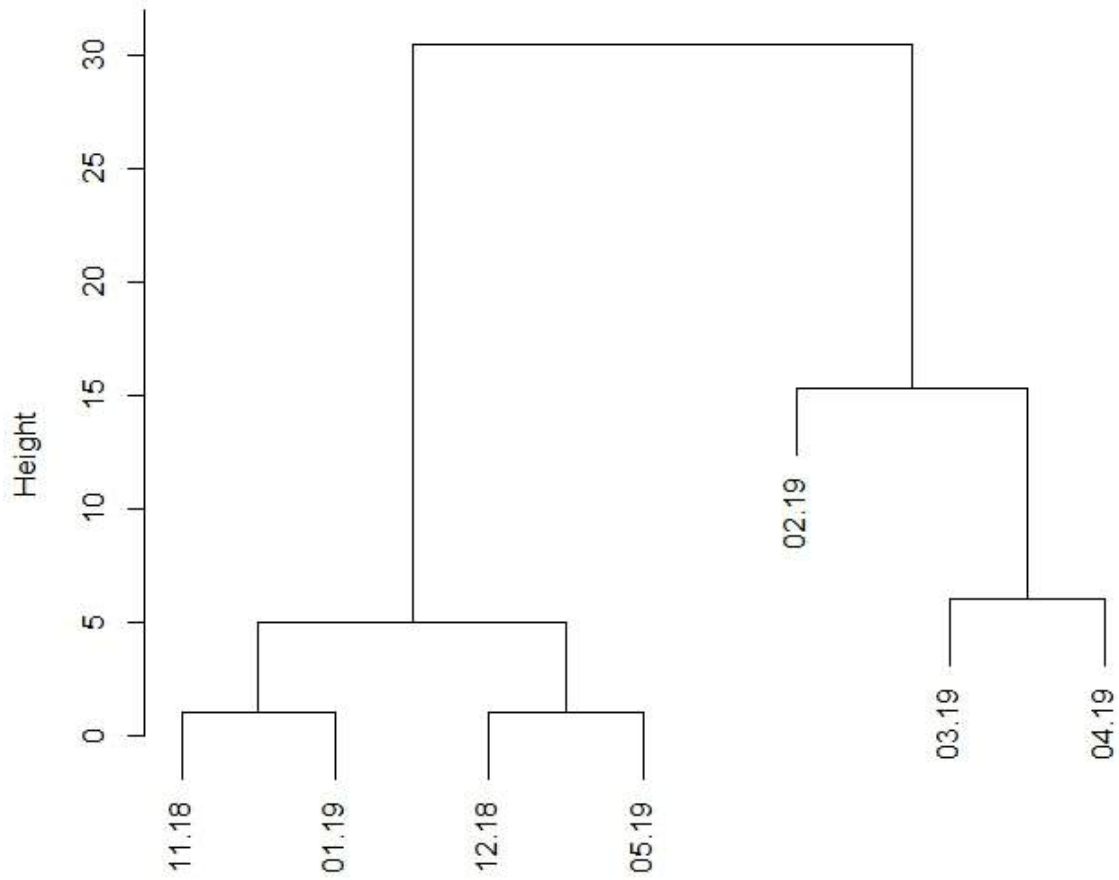
Cluster on the basis of the reindeer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly moose use at Mertainen



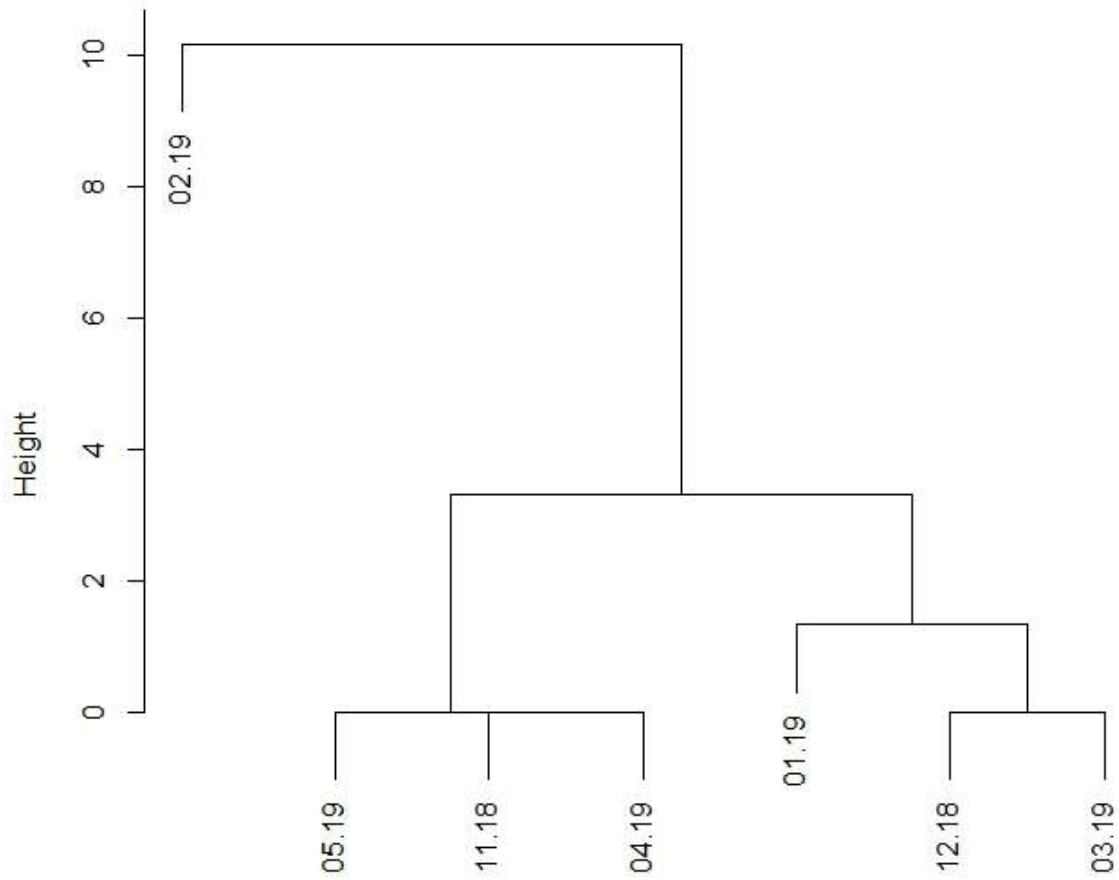
Cluster on the basis of the moose events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly reindeer use at Mertainen



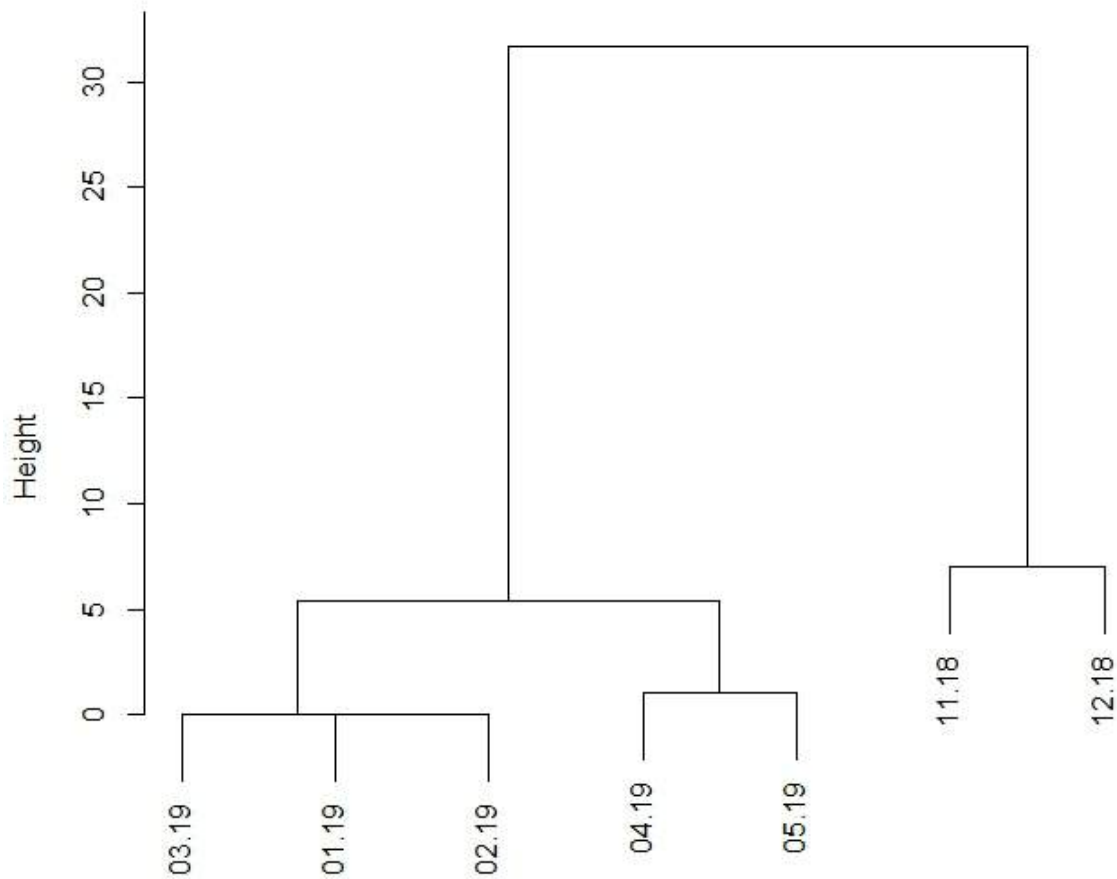
Cluster on the basis of the reindeer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly moose use at Sangisjärvi



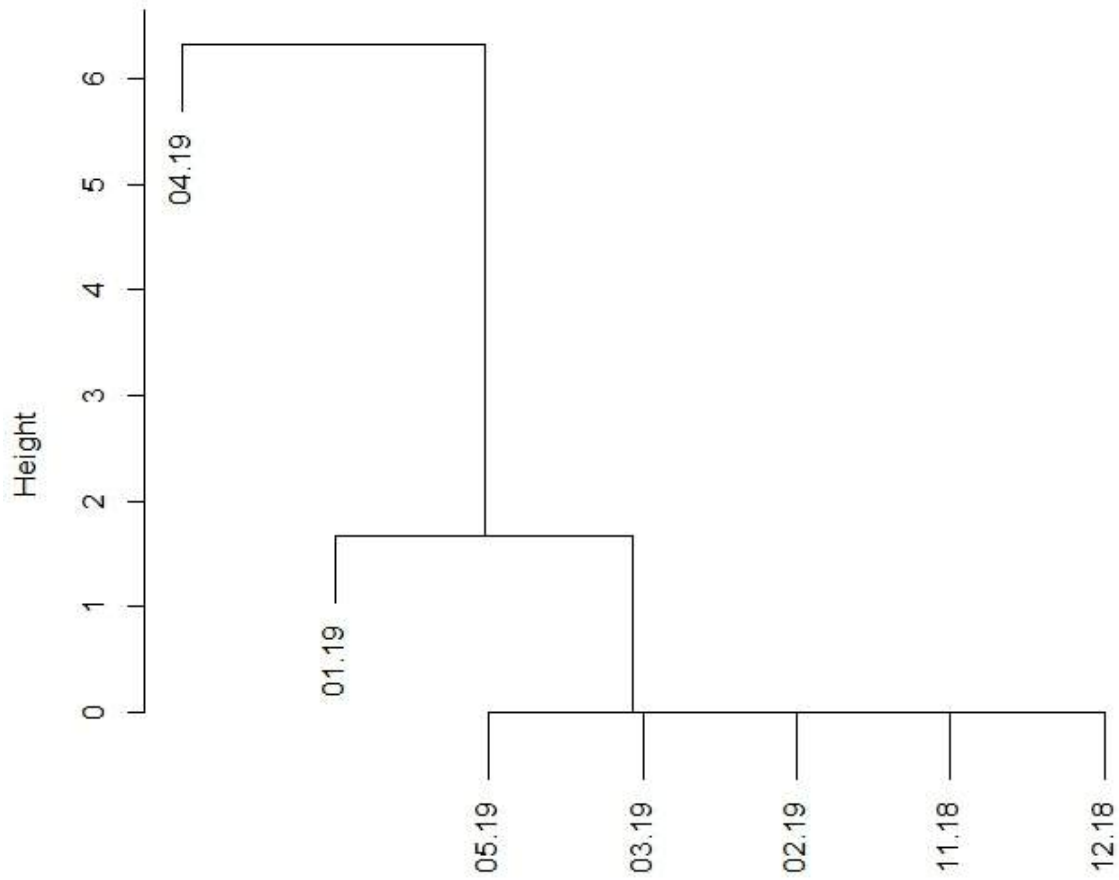
Cluster on the basis of the moose events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly reindeer use at Sangisjärvi



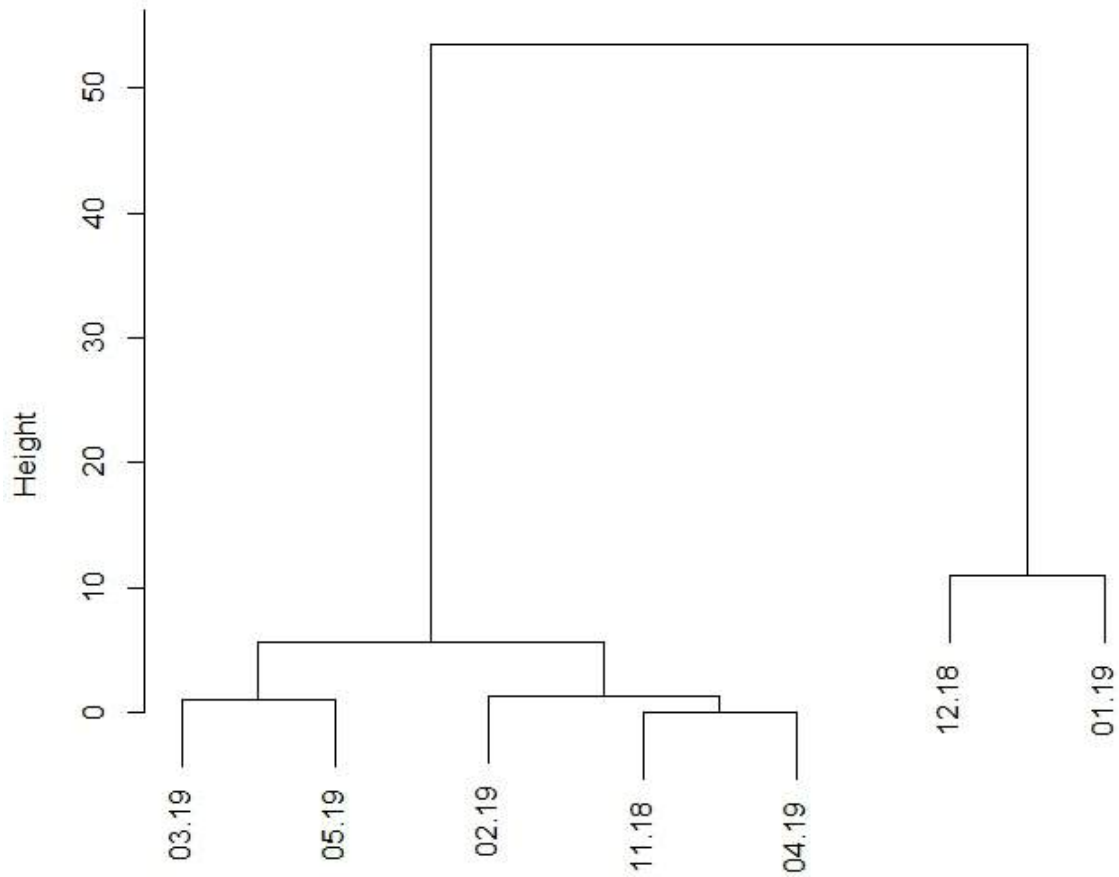
Cluster on the basis of the reindeer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly roe deer use at Sangisjärvi



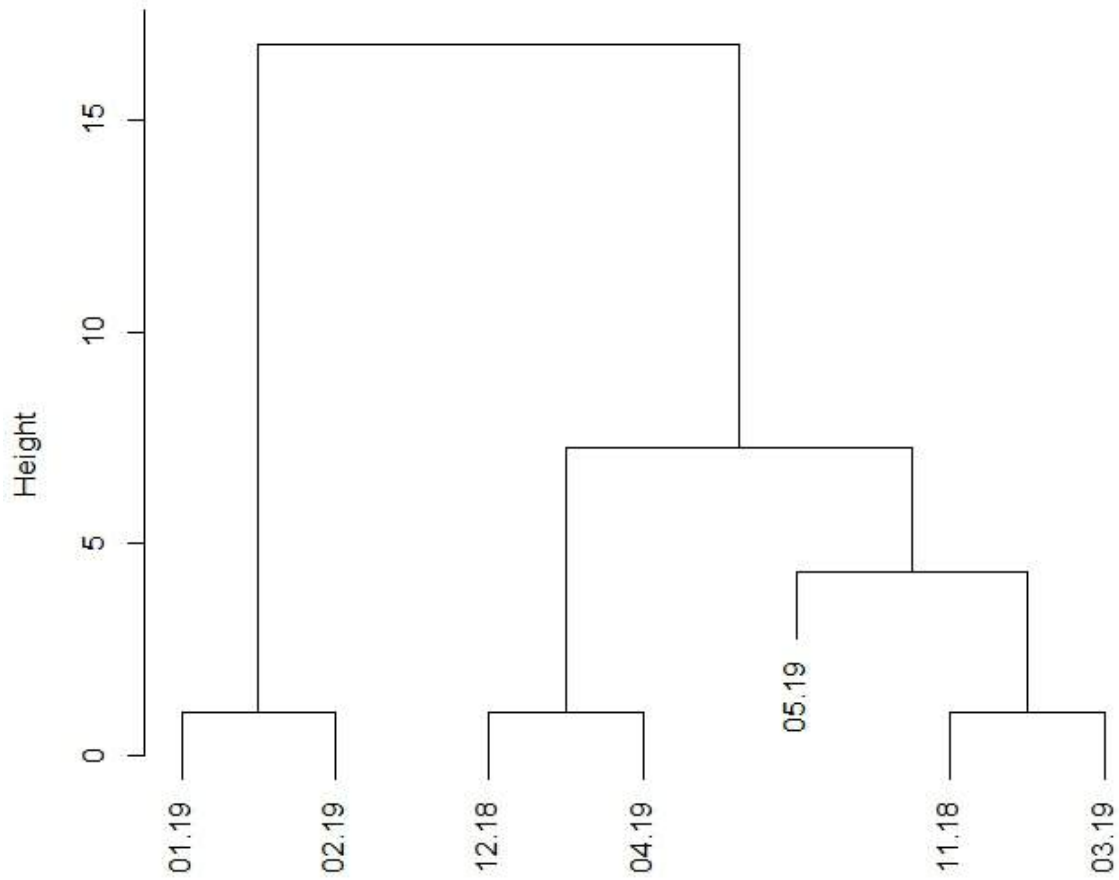
Cluster on the basis of the roe deer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly moose use at Sattaoja



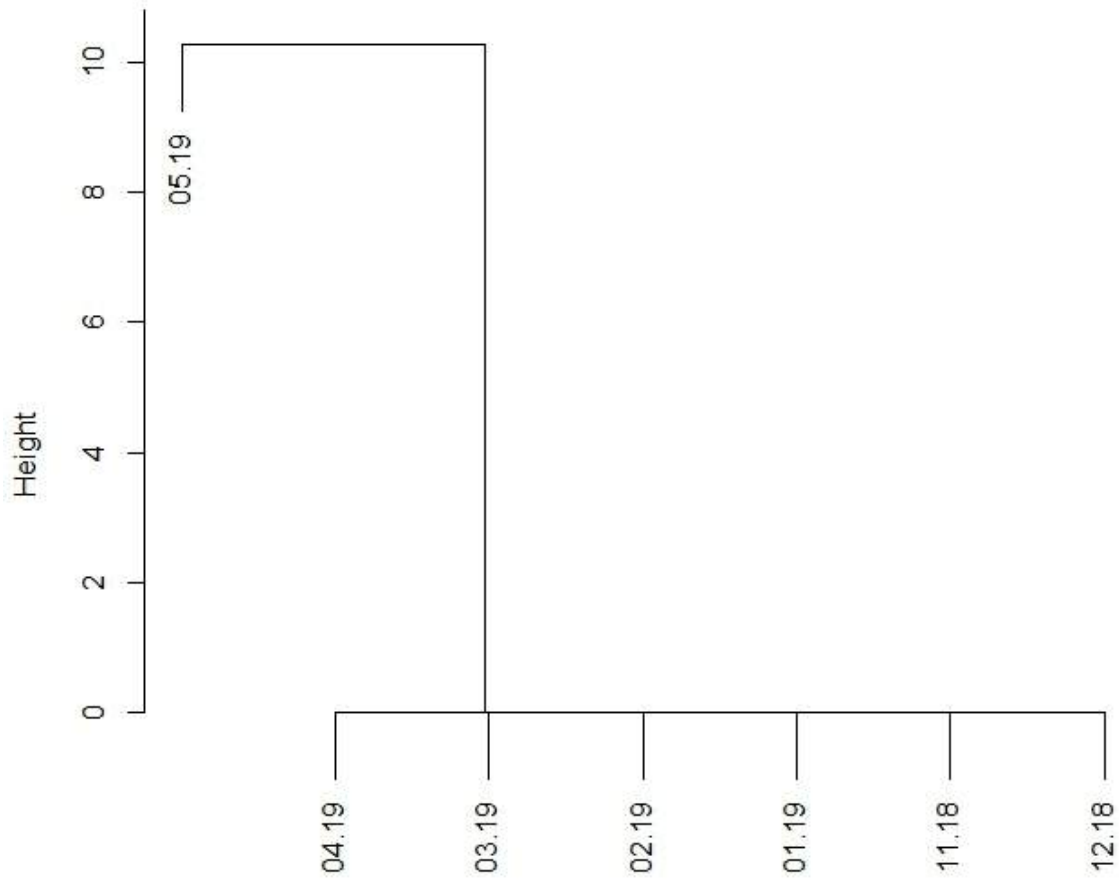
Cluster on the basis of the moose events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly reindeer use at Sattaoja



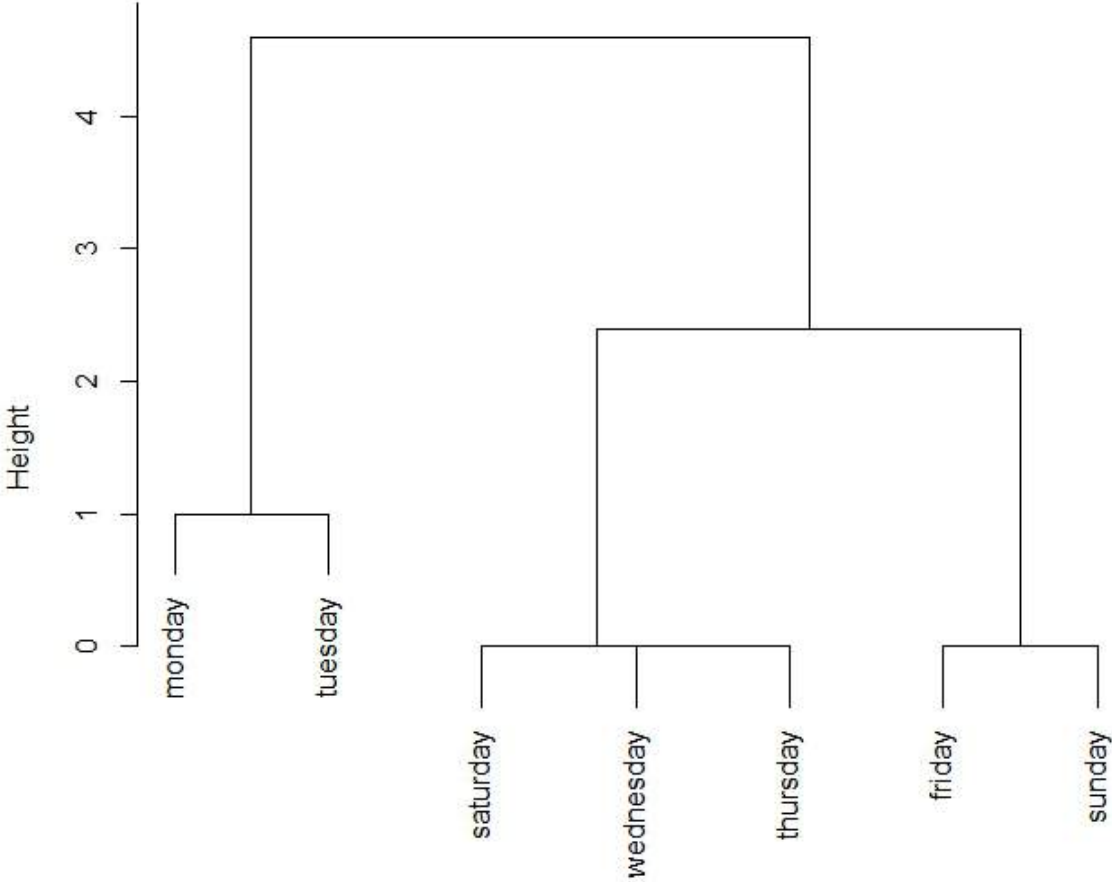
Cluster on the basis of the reindeer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the monthly roe deer use at Sattaoja



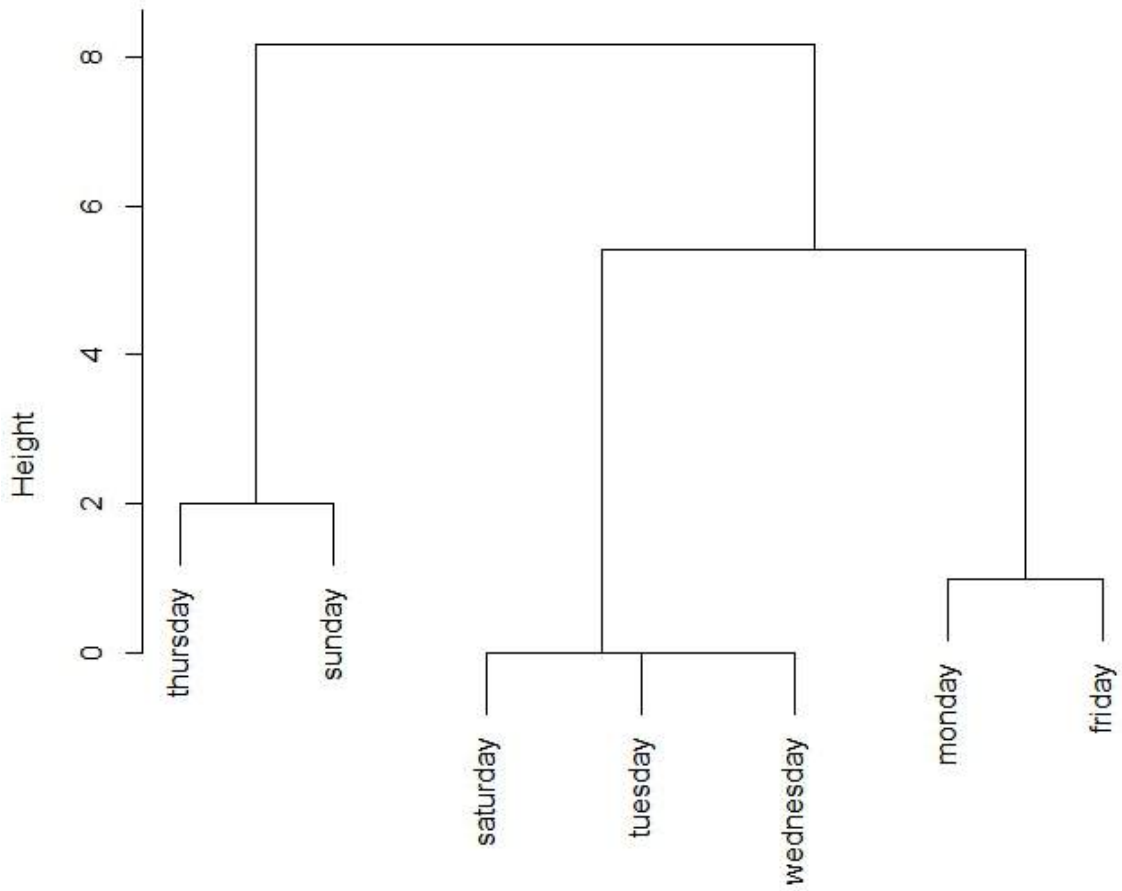
Cluster on the basis of the roe deer events per month
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly moose use at Harrioja



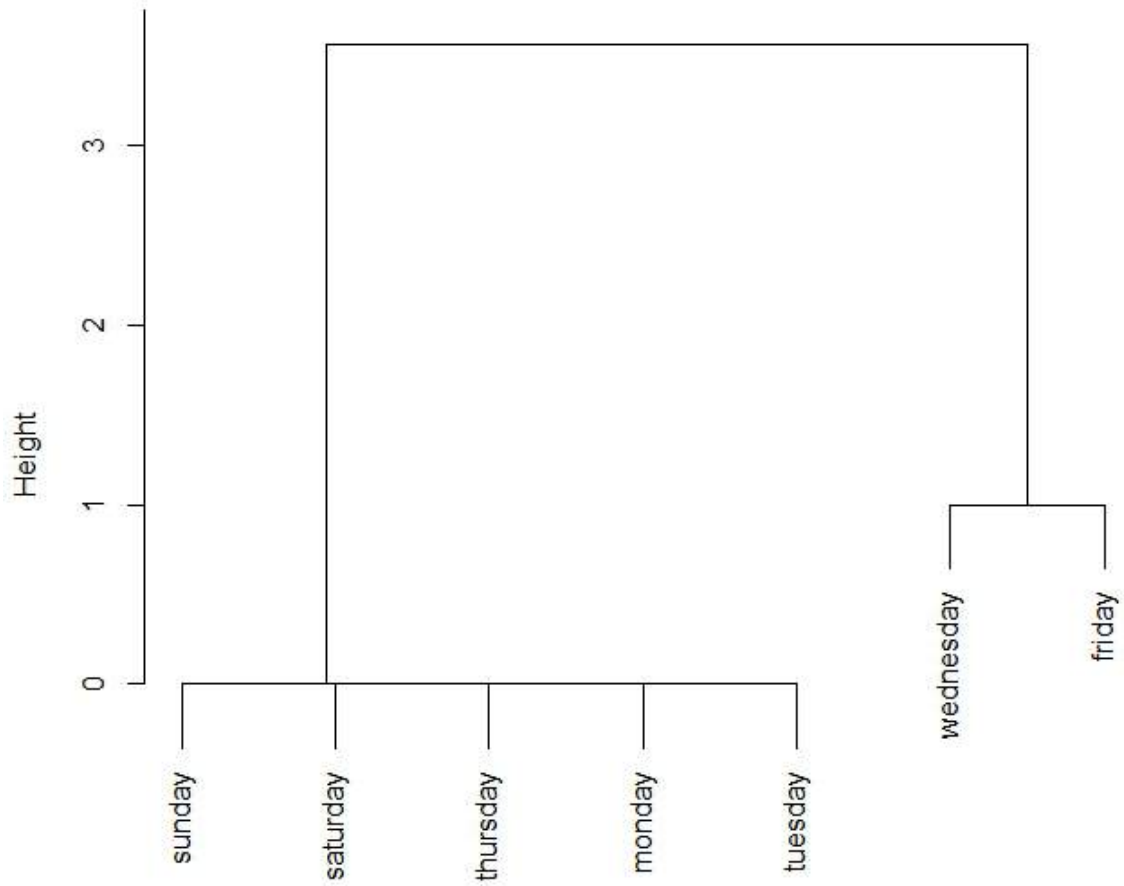
Cluster on the basis of the moose events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly reindeer use at Harrioja



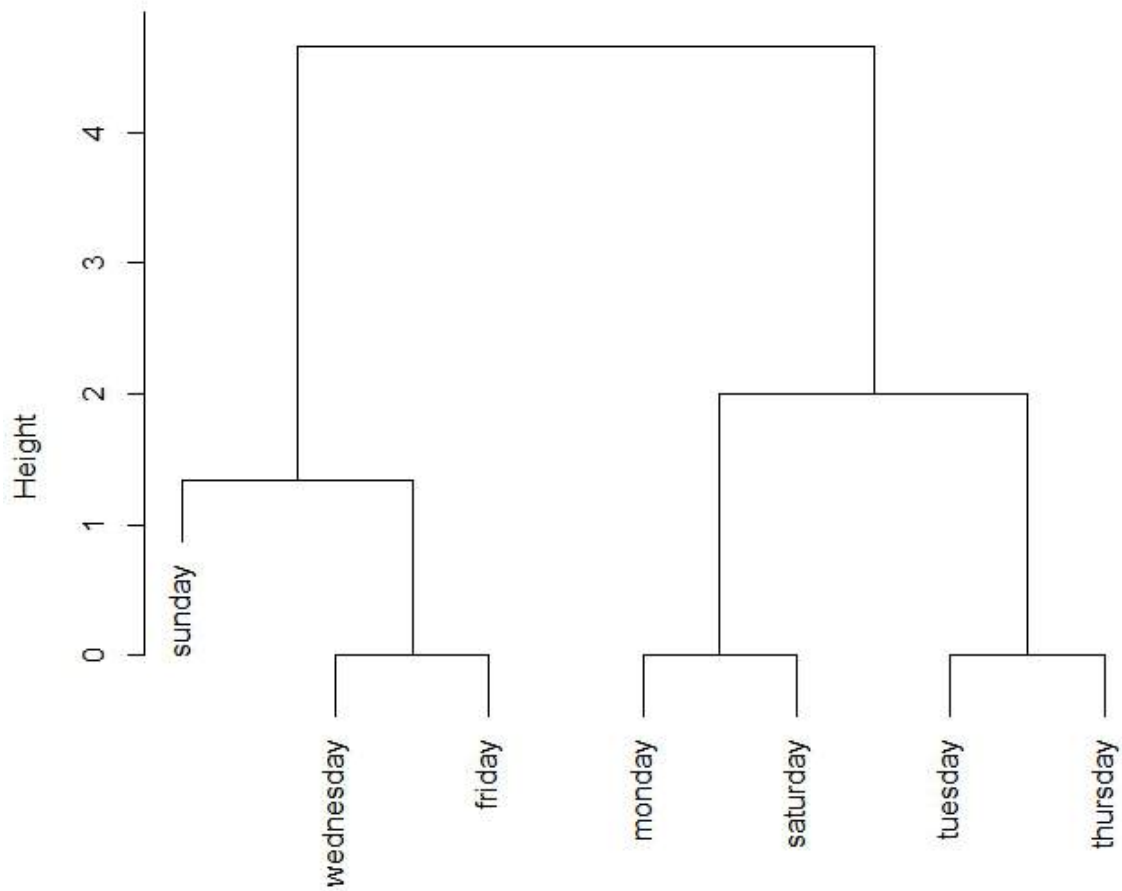
Cluster on the basis of the reindeer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly roe deer use at Harrioja



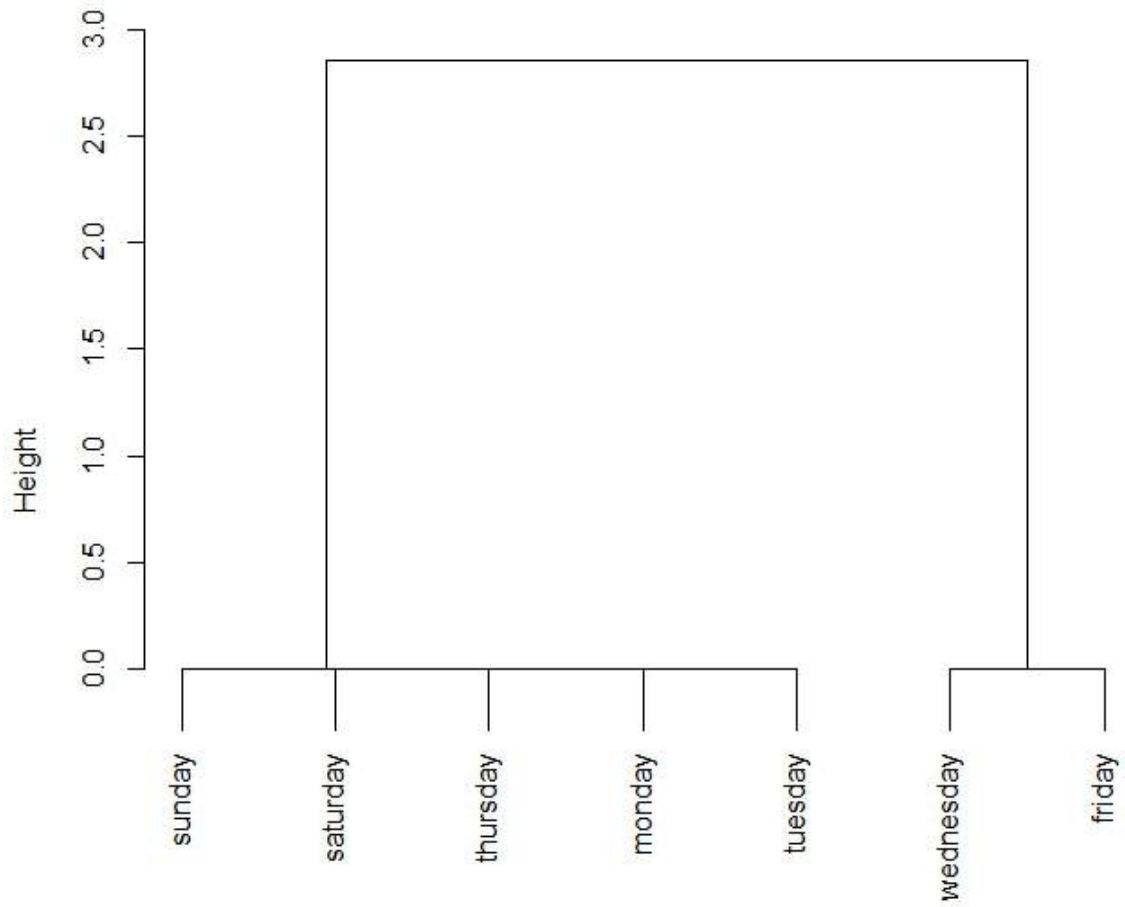
Cluster on the basis of the roe deer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly moose use at Kotaträskvägen



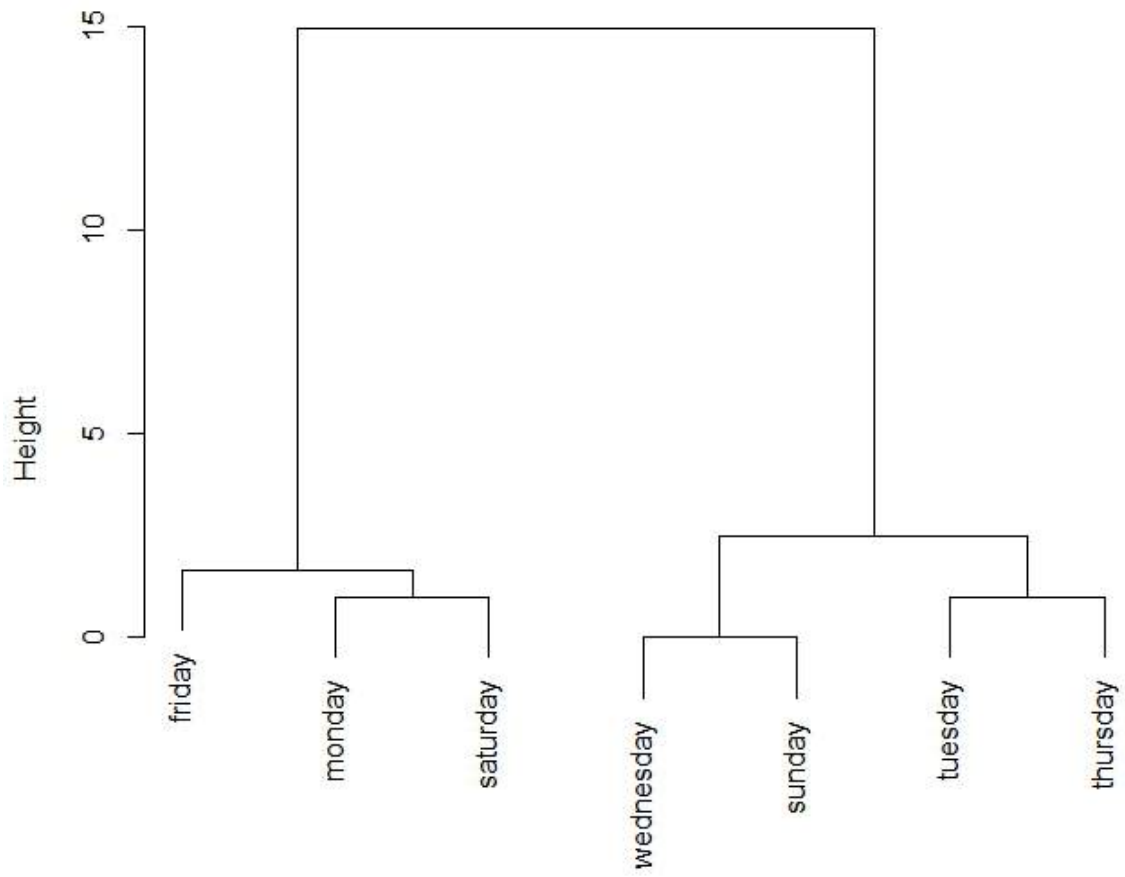
Cluster on the basis of the moose events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly reindeer use at Kotaträskvägen



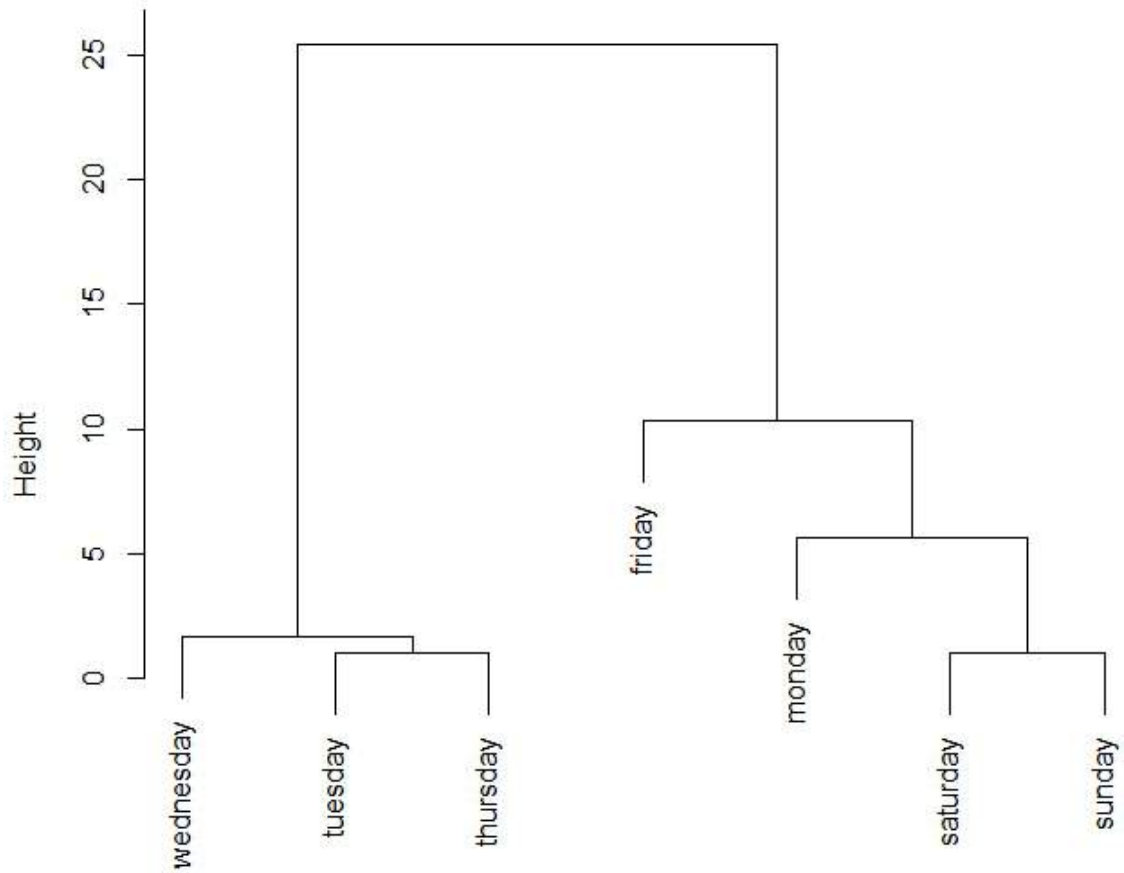
Cluster on the basis of the reindeer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly moose use at Mertainen



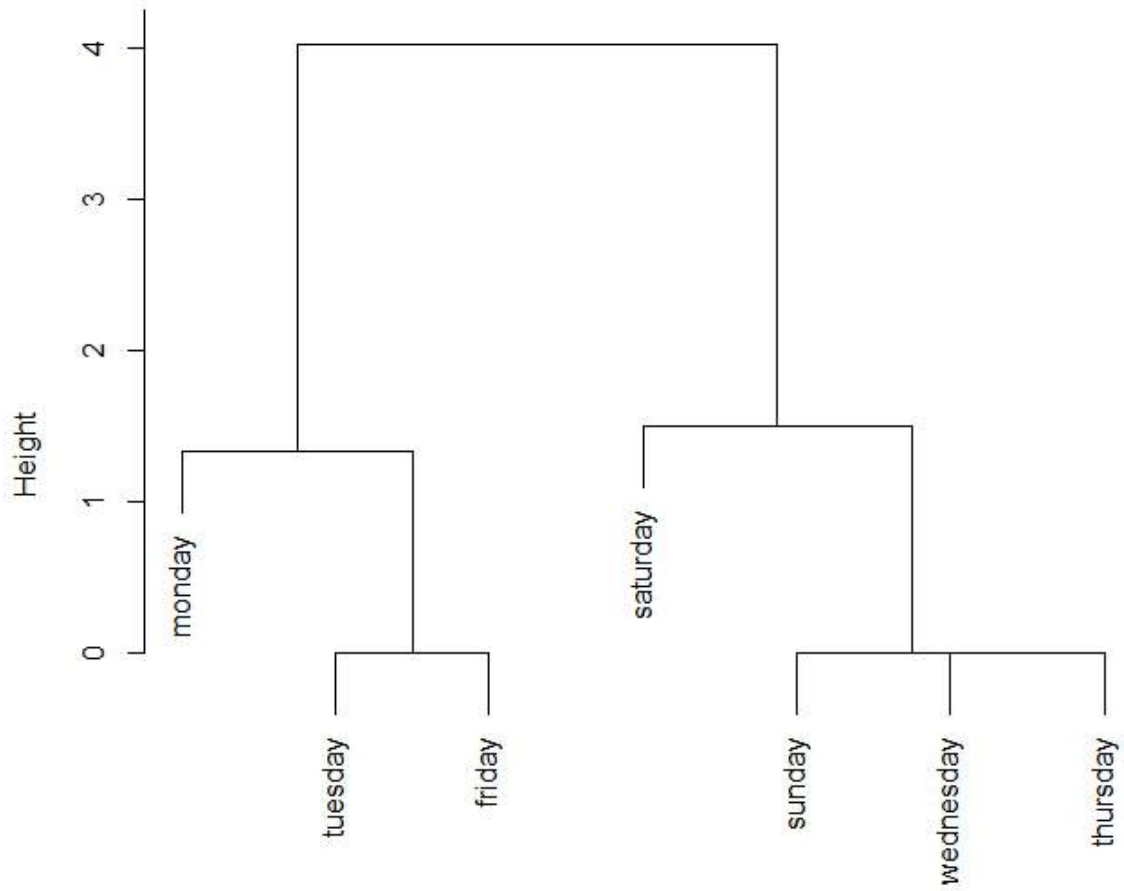
Cluster on the basis of the moose events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly reindeer use at Mertainen



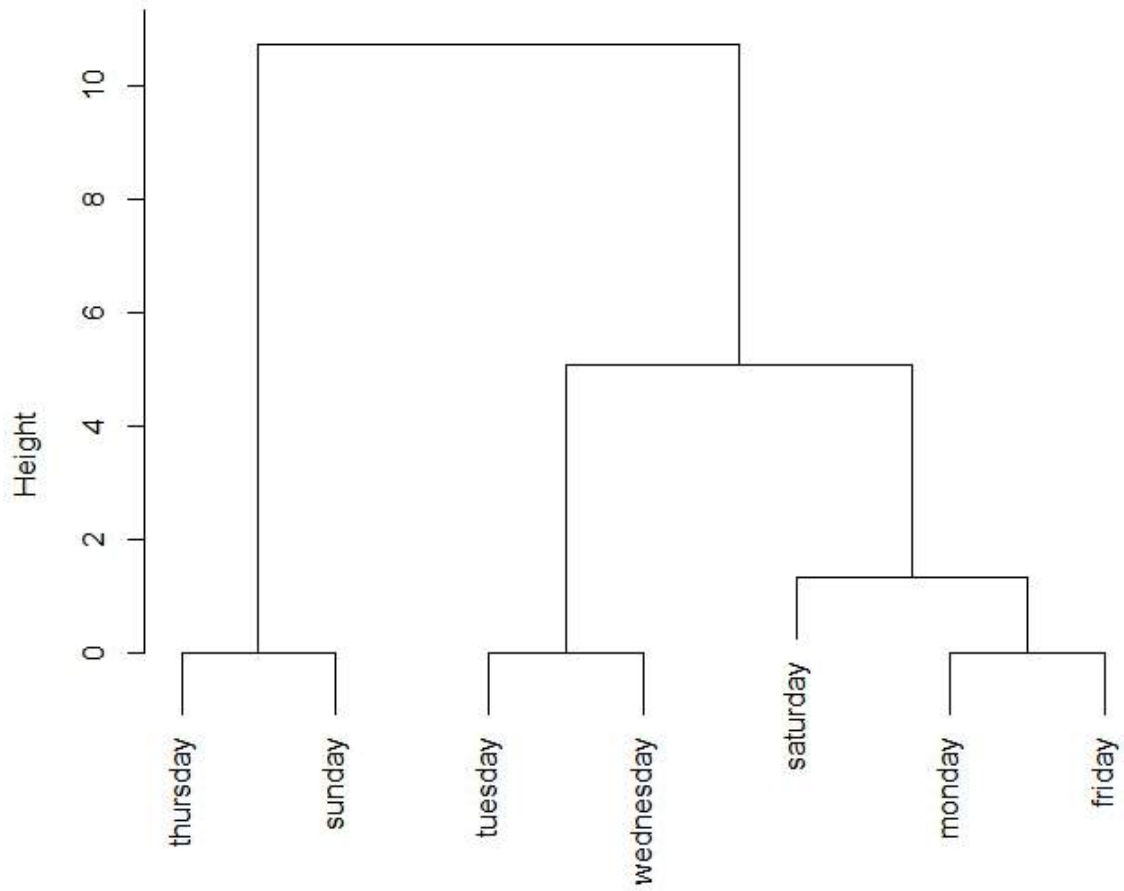
Cluster on the basis of the reindeer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly moose use at Sangisjärvi



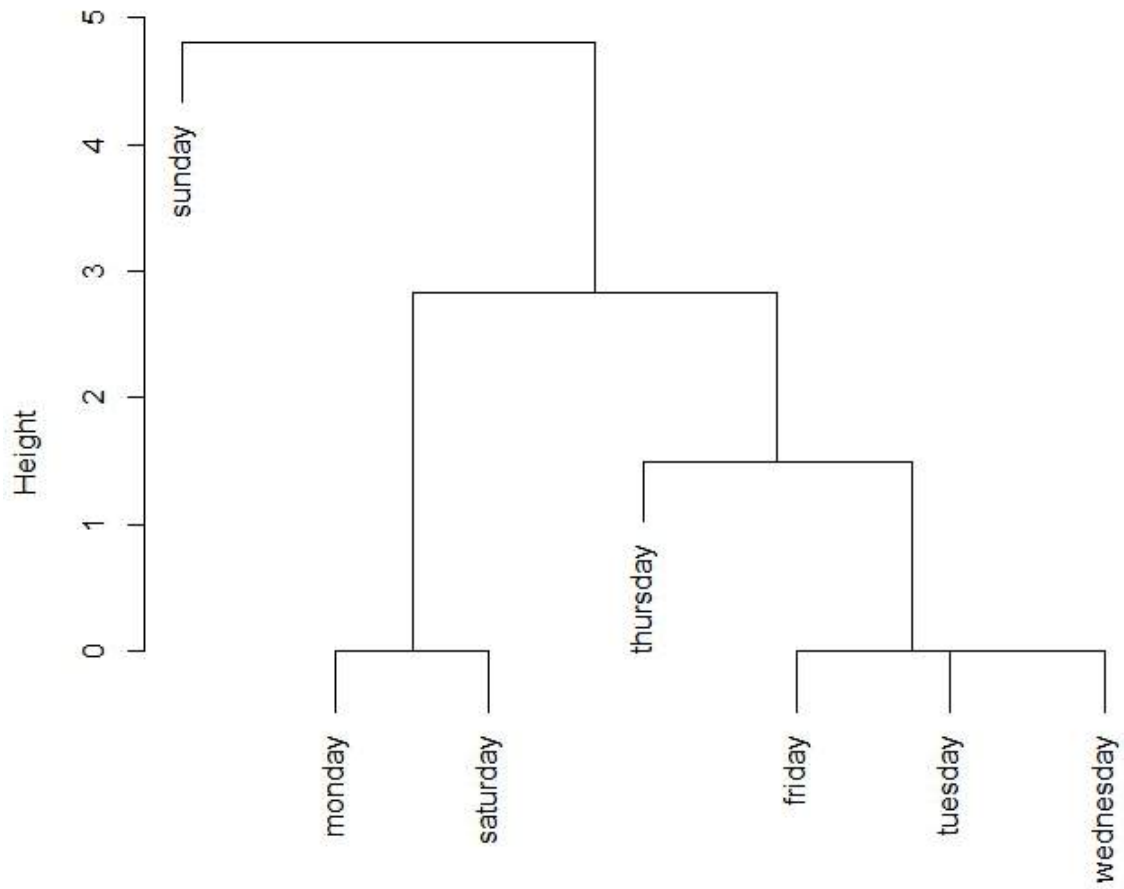
Cluster on the basis of the moose events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly reindeer use at Sangisjärvi



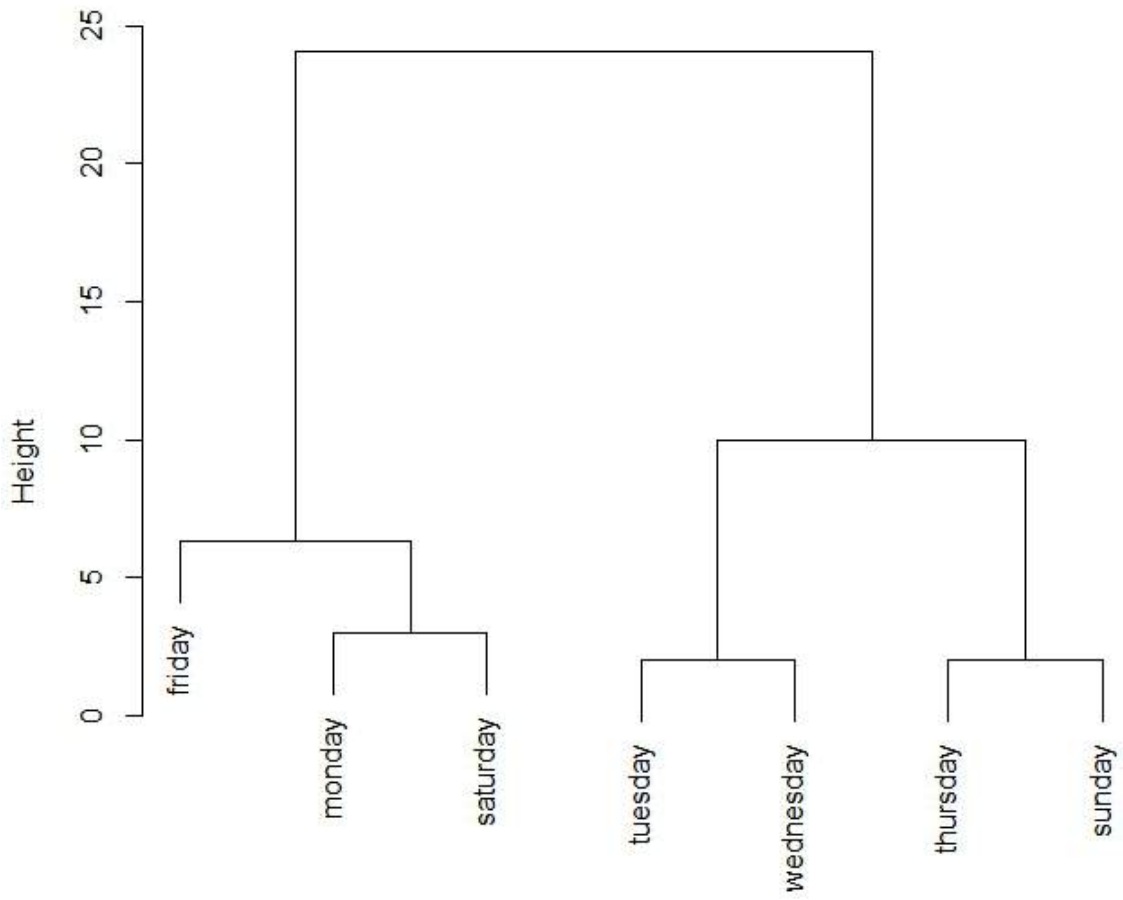
Cluster on the basis of the reindeer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly roe deer use at Sangisjärvi



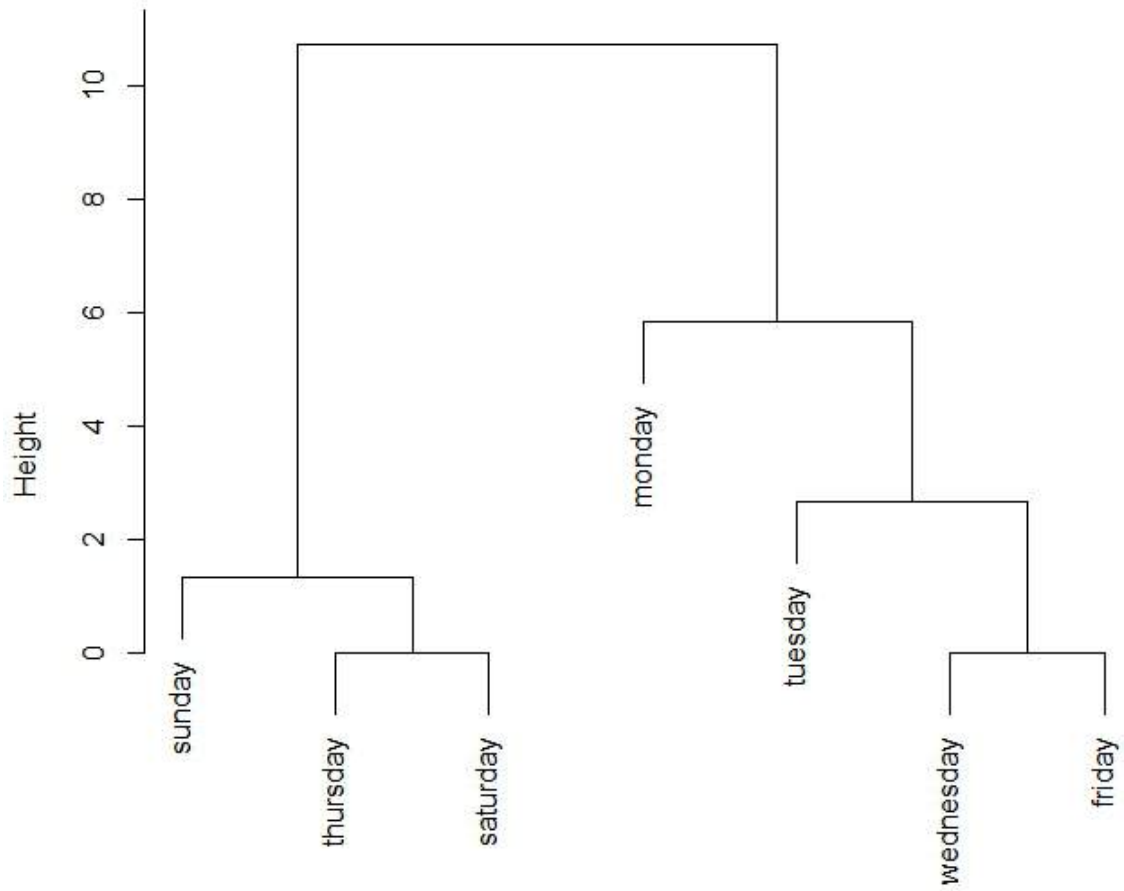
Cluster on the basis of the roe deer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly moose use at Sattaoja



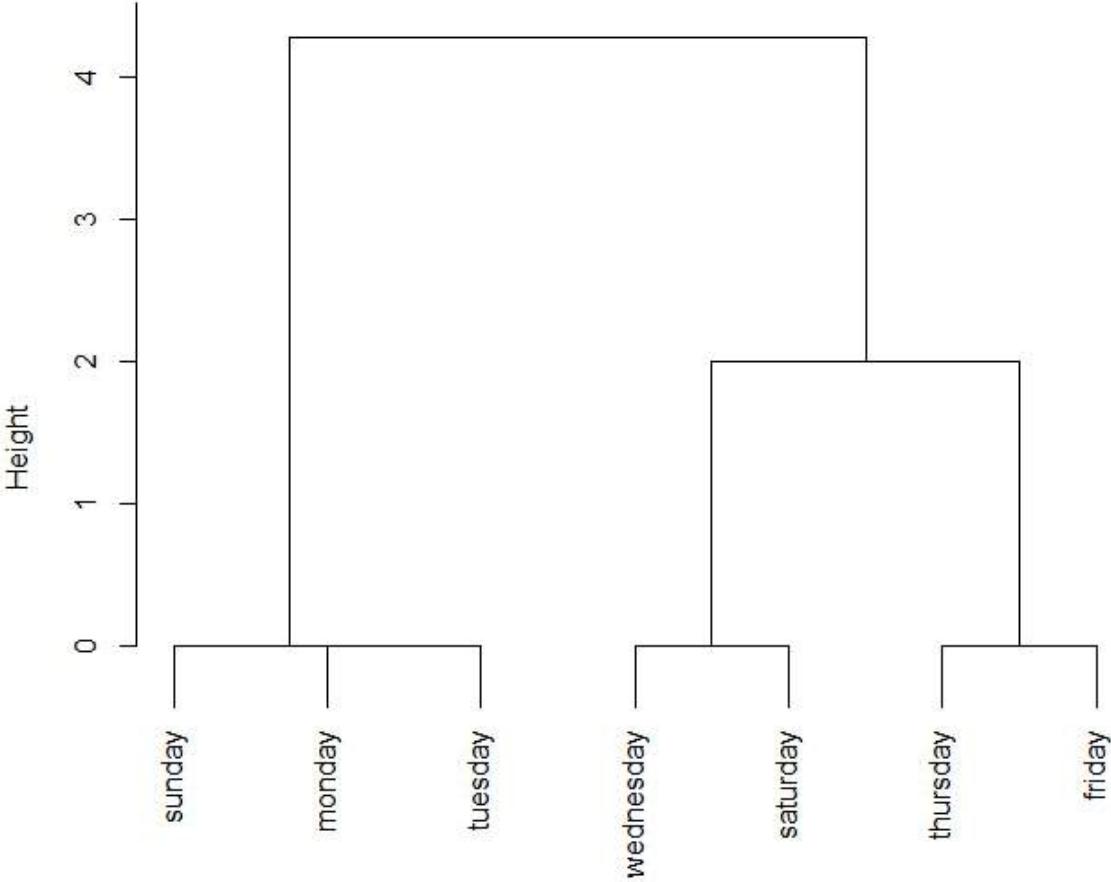
Cluster on the basis of the moose events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly reindeer use at Sattaolja



Cluster on the basis of the reindeer events per weekday
Method=ward; Distance=city-block

Cluster Dendrogram of the weekly roe deer use at Sattaoja



Cluster on the basis of the roe deer events per weekday
Method=ward; Distance=city-block