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Roadkill Patterns on Workdays, Weekends and Long Weekends: Anticipating the Implications of a Four-Day Work Week

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Abstract: Understanding the spatial and temporal patterns of animal road mortality is important for planning protective measures and raising driver awareness. In our study of Lithuania, spanning from 2002 to 2022, we examined these patterns based on road types and categorized them by working days, weekends, and long weekends, predicting the potential impact of transitioning to a four-day working week. We found that road type explains 22–50% of the variability in roadkill numbers for moose, red deer, wild boar, and roe deer. The highest occurrences were on main roads, while regional roads had the fewest incidents. The overall number of roadkills, especially those involving ungulates, was highest on weekends, followed by workdays, with the least on long weekends. However, these variations lacked statistical significance, and their effect size was small. We also observed a trend of increased roadkill numbers on the day before, the first day, notably on All Saints Day, or the last day of long weekends. In this context, with the introduction of a four-day work week, we are only expecting the highest roadkill numbers to move from Friday to Thursday.

Keywords: roadkill temporal patterns; ungulate roadkills; *Alces alces*; *Capreolus capreolus*; long weekends; four-day work week

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1. Introduction

Temporal and spatiotemporal analyses of the roadkill were carried out in many counties around the globe [1–3], in European countries [4–7], including those close to Lithuania [8–11]. Roadkill recording by citizen scientists was used as a part of worldwide projects on roadkill data collection [12], and these projects were successful in several countries [13,14]. Some studies focused on the dominant species [15,16], others on the species complex [17–19]. In addition, activity patterns of these species were investigated [20–22].

However, while investigations of temporal variations in the roadkill are abound [23], there are no specific analyzes as for the influence of a four-day work week (4DWW) and long weekends. In most studies, temporal patterns in roadkill are presented as annual, seasonal, monthly, weekly, and diurnal changes [24,25]; both overall [4] and for individual species [26] in particular ungulates [17,24,27]. Comparison between time periods show that roadkill numbers are increasing due to shifts occurring in animal abundance and AADT, the annual average daily traffic [25].

Several countries, such as Spain, Japan, and New Zealand, are implementing or considering a 4DWW, with similar activity being planned in US and Canada [28]. Trials in the limited number of UK companies started in 2022: out of 61 companies, 18 made the 4DWW permanent, while 56 extended trial time [29]. After the COVID-19, a 4DWW was piloted by many companies worldwide [30].

One of the outcomes of the 4DWW is the 3-day weekend and Thursdays becoming the new Fridays [30]. Additional weekend day would give time for family and leisure [31]. Spending of the additional free time would have an environmental impact [32]. Some authors say that resource intensive spending of additional time will have no environmental benefits. However, as mentioned by research [33], discussions about climate change mostly ignore the topic of work time reducing. Regional differences of relation between work time, energy consumption and CO_2 production are very large, and most models are not significant [34]. Therefore, no unanimous conclusion on the consequences of the 4DWW on the environment has been reached so far.

Driving on weekends and holidays are known to have effects on the frequency of road crashes and driver injuries or deaths. As one of the reasons, risky behaviors when driving on public holidays was shown in the UK [35]. In Canada, predictors of crashes and injuries during public holidays were traffic violations, intoxicated driving, and ignoring of the seat belts [36].

Temporal variation of the crash risk was found, involving the time of the day, day of the week, and the month [37]. Higher numbers of crashes were observed on Fridays [38] and on weekends [39]. As for the long weekends, driving trips were more characteristic to city dwellers [40]. In general, workday traffic volumes up to 30% exceeded those on Saturdays and Sundays [41].

While crash factors on workdays and weekends did not differ significantly, many of these are driver-related, including more cases of intoxicated driving, fatigue after a working week, and careless driving [42]. For example, daylight saving time has an influence on sleep deprivation, therefore, Robb and Barnes considered this as one of the factors for accident rate increase in Fridays [43]. In Poland, retail restrictions on Sundays resulted in a decrease of the traffic on weekends, especially in 2020, the year of COVID-19 [44]. Authors conclude that people started planning weekends differently.

The influence of the long weekends, such as Easter or Christmas, is very significant, and results in a traffic volume increase in the holiday-preceding and holiday-following days [45,46]. Mobility might also be influenced by school holidays, socio-demographic changes, and weather [47]. Friday, by some investigators, is defined as the weekend, and the increase of crash numbers is shown for it [48]. The possibility to form a long weekend by including one work-off day between a normal weekend and related national holidays was mentioned by Cools [47].

Given the possibility of a 4DWW and already existing opportunities to obtain the long weekends by taking an extra day off and linking normal weekends to national holidays in Lithuania, the aim of this study was to compare roadkill numbers and rates on workdays, weekends, and the long weekends. Our working hypothesis was that the number of roadkills would be higher on long weekends, possibly due to changes in the distribution of traffic flows, driving habits and in the forms of leisure time. In addition to temporal analysis, we analyzed the influence of the road type (main, national, regional roads and roads in urbanized territories), representing different levels of AADT. We compared the number of animal roadkills in general, roadkills of the wild and domestic species, and roadkills of the four ungulates—moose (*Alces alces*), red deer (*Cervus elaphus*), wild boar (*Sus scrofa*) and roe deer (*Capreolus capreolus*).

Due to their size, these animal species cause the most dangerous accidents. In Lithuania, all four species are highly abundant and hunted [19]. The average shoulder height of adult female and male moose is 170–180 cm and body weight 270–380 kg, while that of red deer is 120–135 cm and 70–143 kg, and that of roe deer is 76–78 cm and 26–30 kg, respectively. Adult wild boar have an average shoulder height of 86–91 cm and an average body weight of 110–135 kg. As shown in our previous research [19], the number of ungulate roadkill in the country is estimated in the hundreds and roe deer in the thousands. The temporal pattern of ungulate roadkills was analyzed in our previous paper [17].

2. Materials and Methods

Data collection and analysis flow is presented as Unified Modelling Language (UML) Activity diagram [49]. The logical paths that the process follows under various conditions, parallel processing, data access (storage) and other logical paths were used to create the AVC data processing process (Figure 1). Further details are presented below in Sections 2.2–2.4.

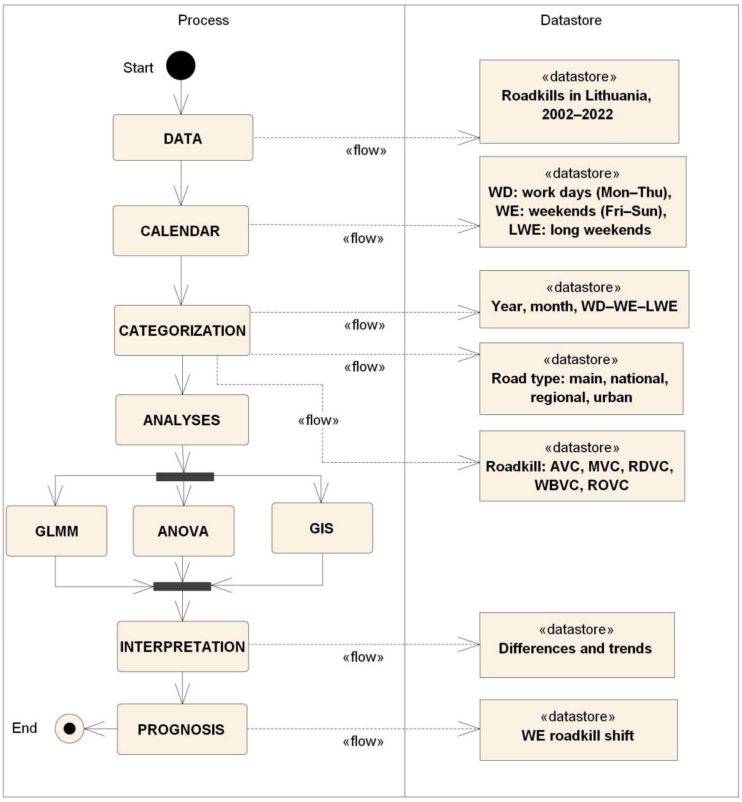

Figure 1. Unified Modelling Language (UML) Activity diagram. Abbreviations: AVC—animal-vehicle collisions, MVC—moose-vehicle collisions, RDVC—red deer-vehicle collisions, WBVC—wild boar-vehicle collisions, ROVC—roe deer-vehicle collisions.

2.1. Study Site

Our study site is Lithuania (Figure 2), small country of Northern Europe with continental climate. The main land use form is agricultural, 52.6%, followed by forests, 33.2% [50]. Human population is low, average density is decreasing, from 48.8 inhabitants per square km in 2009 to 42.8 inhabitants per square km in 2020 [51].

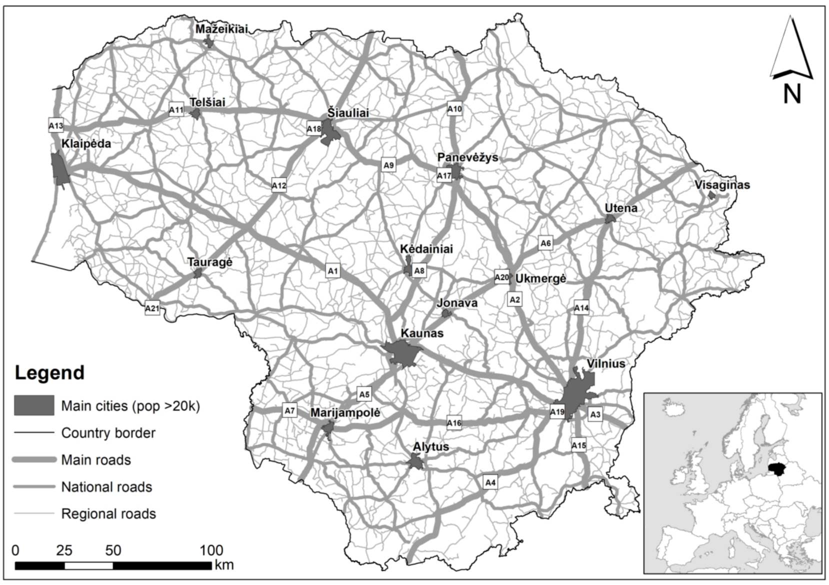

Figure 2. Study site with the road network and the main cities shown.

Road network in the country covers 1.61% of the area [50], and is divided into main, national, and regional roads. Data on the road network are presented in Table 1. Total length of the national road network is relatively stable, changing from 21,612.79 km in 2000 to 21,268.41 km in 2010 and 21,240.59 km in 2020. We also focused on the roads passing through urban areas (cities and suburbs), and streets, where AADT and road length data are not available. The speed limit is 110 km/h on main roads in winter. Limit is increased in summer to 130 km/h on motorways an 120 km/h on expressways. On all national roads and regional roads with an asphalt surface, the speed limit is 90 km/h. On gravel roads, the speed limit is 70 km/h. On urban roads and streets, the speed limit is 50 km/h (may be higher or lower if signs indicate).

Table 1. Characteristics of the road network in Lithuania [52–54]. AADT stands for annual average daily traffic, measured by vehicles per day. Data on the length of urban roads are not available, while AADT varies considerably, compared to other road types.

Road Type	2000		2010		2020	
	Length, km	AADT	Length, km	AADT	Length, km	AADT
Main	1860.66	4337	1738.47	7268	1750.71	9156
National	4927.6	1413	4939.35	1944	4927.82	2282
Regional	14,824.29	290	14,590.58	359	14,562.06	417

Despite the continuous growth of AADT, during the COVID-19 years there was a decrease of transport intensity on the main and national roads in 2020 (Table 1). In 2019, AADT on the main roads was 10,010 vehicles/day, and in 2022—10,260 vehicles/day. On the national rods, respective figures were 2381 and 2360 vehicles/day. A decrease of AADT on regional roads was not observed, in fact it has increased slightly, being 413 vehicles/day in 2019, 432 in 2021, and 439 vehicles/day in 2022. In Lithuania, the effects of the restrictions on human mobility during the COVID-19 period were already analyzed [55,56]. While there was a significant reduction in accidents on major roads during the period, the number of wildlife-vehicle collisions in urban areas increased.

2.2. Roadkill Data

Data on the roadkill were provided by the Lithuanian Police Traffic Surveillance Service and collected by the authors from the Nature Research Centre. Details of both methods are given in our previous publication [57]. Between 2002 and 2022, 50,681 animal–vehicle collisions were recorded, of which 44,667 involved wild animals, 2718 domestic animals and 3293 were undetermined road fatalities. The number of vehicle collisions with moose was 2708, red deer 743, wild boar 2178, and roe deer 29,256. The annual changes in these numbers are shown in Figure 3.

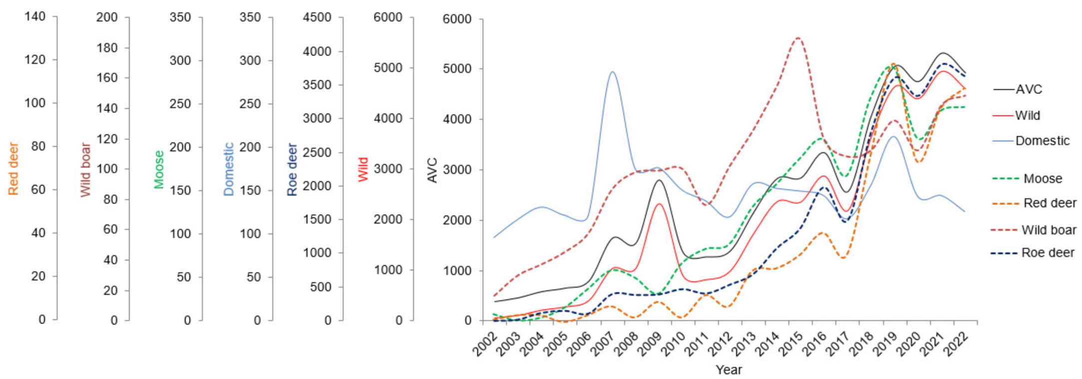

Figure 3. Roadkill numbers and trends in Lithuania, 2002–2022.

2.3. Time Intervals

We defined workdays—further WD—as Monday to Thursdays, weekends—further WE—as Friday to Sunday, and long weekends—further LWE—as any time when national holidays could be linked with weekends by taking an additional day out of work, officially or non-officially. A similar approach of forming a long weekend was used in the investigation of traffic variability in Belgium [58]. Abbreviations selected according to the Dictionary of Acronyms and Slang [59].

The list of religious and public holidays celebrated in Lithuania is shown in Table 2. Additionally to this, in 2006–2010, Lithuania used the practice of shifting weekend days and thus creating long weekends (Appendix A).

Table 2. Religious and national holidays in Lithuania, according to Calendar.today [60] and Labor Code of the Republic of Lithuania [61].

Religious and National Holidays	Date
New Year's Day	1 January
Day of the Restoration of the State of Lithuania	16 February
Lithuanian Independence Day	11 March
Christian Easter days	Sunday and Monday *
International Labor Day	1 May
Mother's Day	first Sunday in May
Father's Day	first Sunday in June
Dew and Midsummer Day	24 June
State Day	6 July
Žolinė **	15 August
All Saints' Day	1 November
All Souls' Day	2 November
Christmas Eve	24 December
Christmas Day	25 and 26 December

* according to Western tradition, ** Feast of the Assumption of the Blessed Virgin Mary.

Under used definition of weekends and long weekends, total number of workdays during 2002–2022 was 4162, that of weekends 2827 and that of long weekends 681 (Table 3). The other time scales used to address variation in roadkill were the year and month.

Table 3. Number of workdays (WD), weekends (WE) and long weekends (LWE) in 2002–2022.

Year	WD	WE	LWE	Year	WD	WE	LWE	Year	WD	WE	LWE
2002	196	135	34	2009	198	135	32	2016	200	137	29
2003	195	138	32	2010	205	125	35	2017	198	136	31
2004	197	133	36	2011	205	135	25	2018	195	135	35
2005	194	133	38	2012	197	139	30	2019	196	135	34
2006	201	129	35	2013	196	135	34	2020	202	141	23
2007	136	132	37	2014	196	135	34	2021	196	133	36
2008	201	129	36	2015	198	138	29	2022	200	139	26

2.4. Data Treatment

We analyzed proportions of wild and domestic animals, and proportions of four most abundant ungulate species—moose, red deer, wild boar, and roe deer—in the total roadkill. Yearly dynamics of roadkill numbers was approximated by linear regression based on the least squares method. To analyze the spatiotemporal characteristics of the roadkill, we ran the GLM (generalized linear model) on the dependent parameters (monthly average number of moose, red deer, wild boar, and roe deer roadkill per day per 1000 km) to find the cumulative influence of temporal factors—year, month, and day type (WD, WE or LWE), and spatial factor—the road type. To control data variability, number of WD, WE, or LWE in every month was applied as a continuous predictor.

Before running GLM, we tested the normality of the distribution of the dependent parameters via Kolmogorov–Smirnov's D. Part of the data do not conform to normal distribution, however, based on DataCamp Tutorial [62], we applied Gaussian family GLM as "generalization of ordinary linear regression that allows for response variables that have error distribution models other than a normal distribution like Gaussian distribution".

The significance of the model factors was evaluated using Hotelling's T^2 test. We used partial eta-squared ($\eta_p{}^2$) to express the amount of variance accounted for by independent variables. Tukey HSD with unequal N was applied for post hoc analysis. The confidence level was set as $p < 0.05$. Calculations were performed in Statistica for Windows, version 6.0 (StatSoft, Inc., Tulsa, OK, USA).

To better visualize WD, WE, or LWE differences, we mapped AVC and RDVC on the day before the LWE, first day of LWE, and last day of LWE during Easter and All Saints Day in 2020, 2021, and 2022.

3. Results

Number of the roadkills during 2002–2022 in Lithuania had an increasing trend (Figure S1). This trend was best approximated by linear regression explaining 87% of variation of both AVC and wild animal roadkill, 92% of moose, 75% of red deer, 68% of wild boar and 84% of roe deer annual roadkill. Roadkill of domestic animals was relatively stable, being about 150 registered cases per year (Table S1).

Spatiotemporal factors were found to have significant influence on the number of all ungulate roadkill: road type (Hotelling's $T^2 = 3.12$, $p < 0.0001$), year ($T^2 = 3.31$, $p < 0.0001$), month ($T^2 = 0.68$, $p < 0.0001$), and day type ($T^2 = 0.11$, $p < 0.025$), but not the number of WD, WE or LWE ($T^2 = 0.03$, $p = 0.30$). We have therefore analyzed the spatial and temporal components separately below.

3.1. Roadkill Numbers According Road Type

Effect of the road type alone was significant for the roadkill of all four analyzed species. Depending on the type of road, the differences were significant between the number of roadkilled moose ($F_{3,248} = 18.6$, $p < 0.0001$), red deer ($F = 10.8$, $p < 0.0001$), wild boar ($F = 23.4$, $p < 0.0001$), and roe deer ($F = 7.0$, $p < 0.0002$). These models were not strong, as they explain 17.4% of the moose, 10.5% of red deer, 21.1% of wild boar, and 6.7% or roe deer roadkill number variability.

Road type explained numbers of roadkilled moose per day ($F_{3,248} = 31.6$), red deer ($F = 14.4$), wild boar ($F = 35.9$), and roe deer ($F = 12.3$ all $p < 0.0001$) better than just roadkill numbers, explaining 26.8%, 13.8%, 29.4%, and 11.9% variability, respectively. Post hoc analysis of these differences is presented in Table 4: average numbers of roadkilled moose, red deer and wild boar per day were highest on the main and national roads, while those of roe deer were on national and urban rods.

Table 4. Effect of the road type (main, national, regional, or urban) on the roadkilled moose, red deer, wild boar, and roe deer average numbers per day and average number per day per 1000 km of the road, 2002–2022 data pooled. Superscript letters indicate the differences between the values in the columns, significant at $p < 0.05$.

Road Type	Average Roadkill Number per Day				Average Roadkill Numbers per Day per 1000 km			
	Moose	Red Deer	Wild Boar	Roe Deer	Moose	Red Deer	Wild Boar	Roe Deer
Main	0.144^{a}	0.034^{a}	0.091^{a}	0.740^{a}	0.082^{a}	0.019^{a}	0.052^{a}	0.420^{a}
National	0.124^{a}	0.042^{a}	0.118^{b}	1.576^{b}	0.025^{b}	0.009^{b}	0.024^{b}	0.319^{b}
Regional	0.033^{b}	0.011^{b}	0.048^{c}	0.652^{a}	0.002^{c}	0.001^{c}	0.003^{c}	0.045^{c}
Urban *	0.043^{b}	0.009^{b}	0.034^{c}	0.797^{a}				

* number per day per 1000 km is not available due to absence of data on the road length in urbanized territories.

However, the lengths of the different types of roads are not uniform. Therefore, we also compared average numbers of these species roadkilled per day per 1000 km of the road. Urban roads were excluded due to the lack of data on total length of passing roads and streets. Differences in ungulate roadkills were significant, and the explanatory power of the model was much better: 44.9% of variability explained for moose ($F_{2,186}$ = 77.5), 22.0% for red deer (F = 27.5), 49.7% for wild boar (F = 93.9), and 29.7% for roe deer (F = 40.8, all $p < 0.001$). Average roadkill numbers of these species per day per 1000 km of road are presented in Table 4.

An interpretation of Table 4 could be the following—one moose on the main roads was killed every seven days, on the national roads every eight days, on the regional roads every 30 days, and in the urban territories every 23 days on average.

Another interpretation of Table 4 says that the probability of hitting a moose, a deer, or a wild boar on a regional road is 10 times lower than on a national road and 20–40 times lower than on a main road. For roe deer, these probabilities are less different.

3.2. Temporal Variability of Total Roadkill Numbers

Given that the type of road explained limited part of the variability in roadkill, we continued the analysis of temporal factors. The model including year, month, and day type (WD, WE and LWE) was significant and explained 80.5% of variability of AVC roadkill numbers per day ($F_{34,627}$ = 81.3, $p < 0.0001$), with the strongest influence of the year (F = 12. 5, $p < 0.0001$), less by month (F = 30.6, $p < 0.0001$), and weakest, but still significant, of the day type (F = 5.6, $p < 0.005$). With the same explanatory power of 80.5%, the model works for wild animals roadkill ($F_{34,627}$ = 81.1, $p < 0.0001$), and is significant, but explains only 14% of domestic animal roadkill variability (F = 4.3, $p < 0.0001$).

However, the differences between the averages of roadkills in WD, WE, and LWE are so small as to be of limited practical significance: there are no significant differences, CI limits are overlapping (Table S1). Interpretation of Table S1: during 10 weekend days, on average, 5 more animal roadkill were registered than in workdays, and 6 more than on long weekends.

3.3. Temporal Variability of Ungulate Roadkill Numbers

Ungulate roadkill followed the same pattern as AVC, that is, the highest number of roadkills on weekends, exceeding that on work days and on long weekends (Table 5). On the species level, day type influence was strongest for roe deer and moose ($p < 0.02$), weaker for wild boar ($p > 0.05$), and not significant for red deer.

Table 5. Statistics of ungulate roadkill during work days (WD), weekends (WE), and long weekends (LWE). Based on a post hoc test, none of the differences between averages are significant.

Day Type	Moose/Day	Red Deer/Day	Wild Boar/Day	Roe Deer/Day
WD	0.081 ± 0.008	0.023 ± 0.003	0.061 ± 0.005	0.939 ± 0.111
WK	0.101 ± 0.011	0.027 ± 0.004	0.082 ± 0.006	0.989 ± 0.118
LWK	0.075 ± 0.010	0.021 ± 0.005	0.075 ± 0.008	0.895 ± 0.109

The model, including year, month, and day type (WD, WE and LWE) was significant and explained 83.6% of variability of roe deer roadkill numbers per day ($F_{34,627}$ = 100.1), 48.8% of variability of moose roadkill (F = 19.5), 40.2% of wild boar roadkill variability (F = 14.1) and 38.3% of red deer roadkill variability (F = 13.1), all being significant ($p < 0.0001$).

Effect size of the year and month are both considered large, ($\eta_p{}^2$ = 56.9% and ($\eta_p{}^2$ = 23.8%, respectively. Effect size of the day type is small, $\eta_p{}^2$ = 1.6%, though significant ($p < 0.02$). Based on the post hoc test, we did not find significant differences of the roadkill numbers per day between work days, weekends, and long weekends for any species and in any year.

Despite a steady increase in ungulate numbers during the study period [19], average ungulate roadkill numbers per day in WD, WE, and LWE on the main, national, regional and urban roads of Lithuania in 2002–2022 exhibited variability, except for a consistent long-term upward trend. This trend was particularly notable in roe deer, as highlighted in Figure 4.

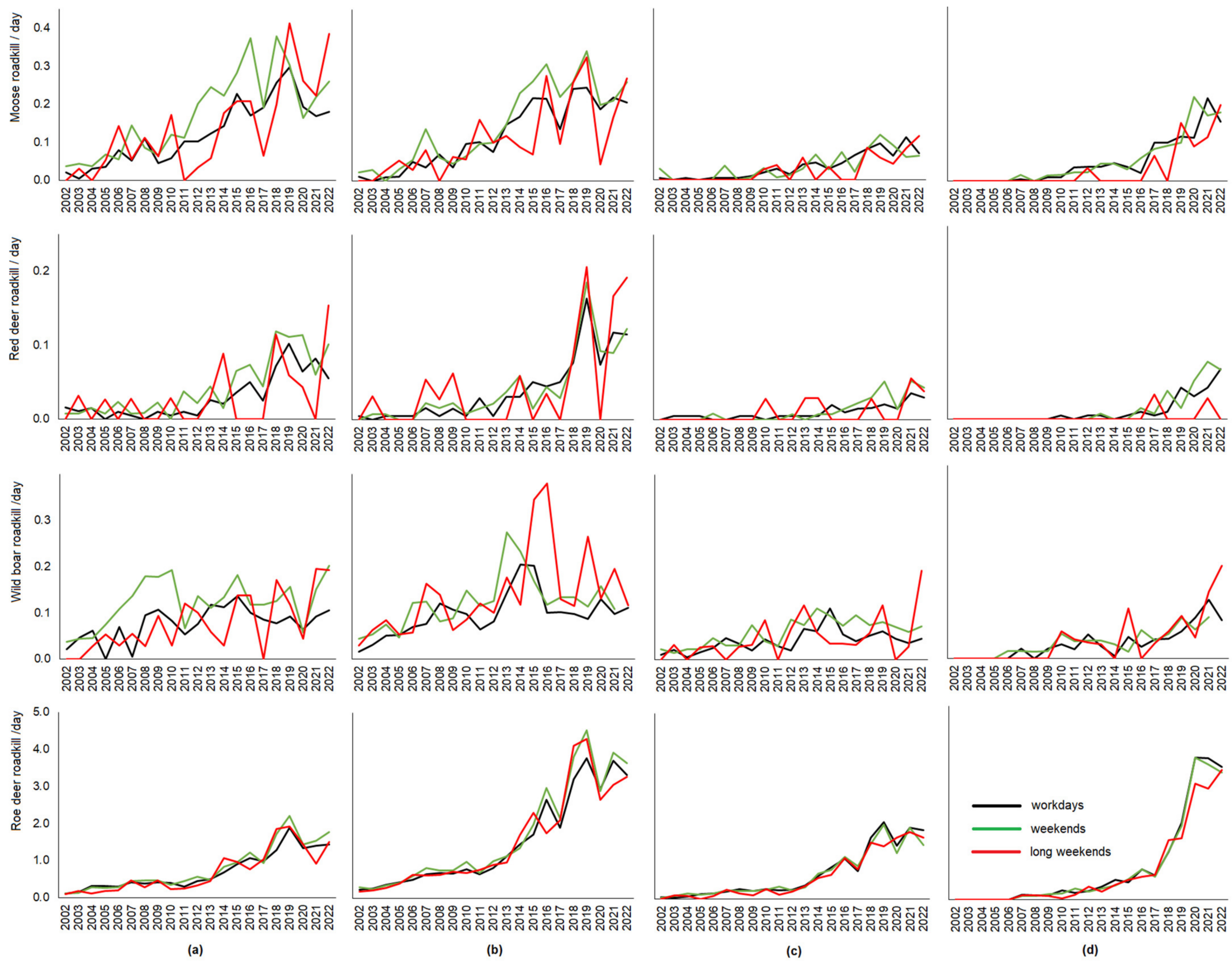

Figure 4. Dynamics of the moose, red deer, wild boar, and roe deer roadkills on main (**a**), national (**b**), regional (**c**) and urban (**d**) roads of Lithuania in 2002–2022.

Fluctuating patterns in roadkill incidents with a seesaw effect were typical for moose, red deer, and were most pronounced for wild boar. The number of roadkills of wild boar increased on national roads during LWE. The number of roe deer killed on roads has been the most stable and increasing on all types of roads, regardless of whether the day was a WD, WE, or LWE. Variations in roadkill mortality for all four ungulate species were least pronounced on regional roads. However, all these trends cannot be confirmed by the post hoc analysis.

3.4. Analysis of Three Long Weekend Roadkills by Day

Three religious festivals, namely Easter, All Saints' Day, and Christmas (this including Christmas Eve and Christmas days), experience a LWE in most years. We compared the number of roadkills in the day before these LWE, the first day, and the last day of LWE in 2016–2022 (Figure 5).

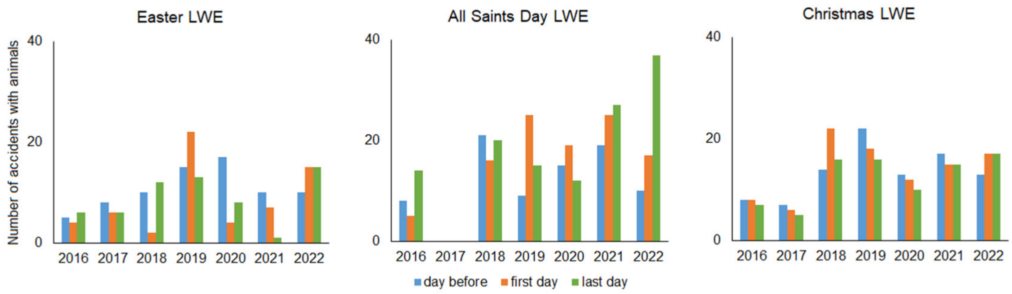

Figure 5. Animal roadkill numbers during three religious holidays in Lithuania, 2016–2022.

As far as the Easter holiday is concerned, the highest number of roadkills was recorded on the day before LWE or on the last day of LWE. During the All Saints' Day long weekends, in 2016–2018, accidents with animals peak on the day before LWE, then on the first day of LWE, and in 2021–2022 on the last day of LWE. Over the Christmas holidays, five out of seven years the highest accident rate was on the day before LWE (Figure 5).

Visualization of AVC, concerning two religious holidays in 2020–2022, is shown on Figure 6. Please note the absence of the roadkill in and near the biggest cities. This should not be attributed solely to COVID restrictions at Easter in 2020 and 2021, as the same picture is also the case on All Saints Day 2022 (Figure 6c).

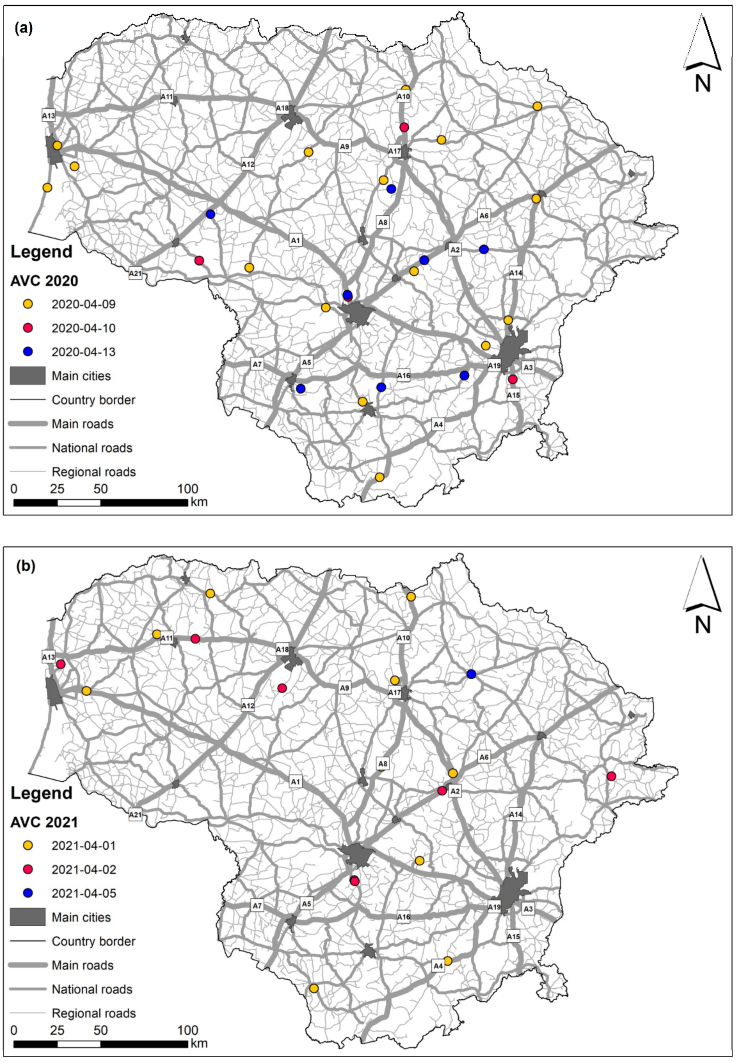

Figure 6. *Cont*.

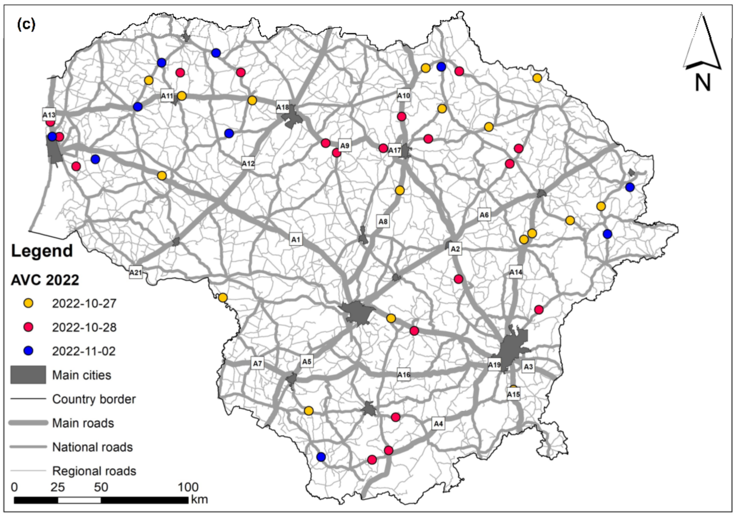

Figure 6. Example of distribution of animal–vehicle collisions on the day before LWE, first day of LWE, and the last day of LWE: (**a**)—Easter 2020, (**b**)—Easter 2021, (**c**)—All Saints Day 2022. Note: Easter LWE in 2020 and 2021 fall under COVID-19 restrictions of human mobility.

Most roe deer were roadkilled on Easter Eve or the first day of Easter, on the last day of the All Saints' Festival, and on the day before Christmas Eve (Figure S2). Figure S3 illustrates the spatial visualization of the roe deer roadkill in these LWE. Again, during the long weekends, roe deer were not roadkilled near the big cities.

However, both the number of AVC and the number of roe deer roadkills were not reliably different on the compared days. The number of other ungulates roadkilled during these LWE was small and, therefore, not visualized.

4. Discussion

In contrast to Belgium [14], in Lithuania and in other countries the number of roadkills is still increasing [63]. Road type is considered as one of the factors defining the number of roadkills [64]. However, absolute numbers are hiding details of the roadkill intensity per road length. We found, that despite absolute numbers of roadkills being highest on the national roads for moose, red deer, wild boar and roe deer, relative numbers of roadkills are not the same. The highest number of roadkills per day per km for all ungulate species is significantly higher on the main roads, followed by national roads, and then by regional ones (see Table 4), possibly due to higher speed limits. Road type alone explained 22–50% of variability of roadkill numbers for these ungulates. In Lithuania, another important factor is the steady increase in the number of ungulates during the study period [19].

Regarding the temporal variation of roadkills, our model shows that the year has the largest influence, followed by the month, and the type of day (weekdays, weekends, and long weekends) has the smallest influence. Although significant, the effect size of day type was small. The temporal model performs well with wildlife roadkills, but explains only 14% of domestic animal roadkill variability.

Temporal trends, such as an increase of roadkills in spring and autumn (related to ungulate rut season and seasonal migrations), and higher number of Friday roadkills, in Lithuania are similar in all European countries [5,6,8,9,17,24,25] and worldwide [1,3]. Knowledge of seasonal effects is useful in determining the maximum probabilities of roadkills [65], identification of roadkill hotspots, and planning of accident mitigation measures [66]. With mitigation measures being expensive, understanding of spatiotemporal effects can reduce mitigation costs [67,68].

The long weekend and the 4WDD roadkills have so far not received the attention they deserve in publications. Based on the increase of the traffic volumes [41,44,46], especially on Easter or Christmas [45], we expected an increase of roadkills during LWE, such as is being currently registered on Fridays in Lithuania [17,18]. Hypothesis was not confirmed:

the highest number of roadkills in general, as well as those of ungulates, was registered on weekends, while on the long weekends it was lowest. These differences, however, are small. The number of roadkilled animals per day did not differ significantly for any species and in any year (see Figure 4).

Other types of car crashes, however, are overrepresented on public holidays with fatigue, drunk driving, and unsafe speeding shown as main drivers of the accident increase [36]. Severity of crashes is driver behavior related [42]. In Lithuania, the total number of accidents is highest at weekends, especially on Fridays and Saturdays, but weekday statistics were only calculated in 2001–2004 [69] and were not related to AADT. We guess that Easter, being a family holiday, and All Saints Day with a long-standing tradition of visiting the graves of relatives on a specific date, should have different mobility patterns. However, we did not find significant changes in roadkill numbers during the long weekends. There is just a tendency of the highest roadkill occur on the day before, the first, or the last day (see Figure 5).

It seems that all changes of the human activity clock do have some influence on the roadkill, including daylight saving time [70] or the night driving [71]. We hypothesize, that the introduction of the 4WDD will lead a shift of the roadkill increases to Thursday, but might have other consequences of the activity regimes, especially in city dwellers [40]. We presume, that the 4WDD could also result in changes in the roadkill peak times. Currently in Lithuania, roadkill numbers peak at around sunrise and sunset [17], taking into account animal behavior patterns and travel times [72]. A midday peak might be expected on the leisure days, thus changing bimodal distribution of the roadkill time.

Thus, in addition to the completely uncertain environmental impacts [32], we can expect safety-related consequences of long weekends and the 4WDD, such as changes in the intensity of roadkills. These patterns might change human impact on the species level [4] therefore requiring additional mitigation measures [25]. From the current investigation point, we believe that informing drivers about the different temporal patterns on long weekend days would be an appropriate measure.

We understand that our study is best suited to countries in the mid-latitudes [4,6,8,10,14,17,22] and less suited to countries in the low-latitudes, which vary considerably in terms of the composition of their fauna, their climate, the composition of their habitats, and, perhaps, their driving habits. As shown by C. Grilo et al. [63], such countries are located in Asia [2,3], South America [73–75], and Africa [76,77], with the highest disparities in roadkill and traffic casualties in Australia [78,79].

5. Conclusions

This investigation revealed a substantial effect of road type on the number of ungulate roadkills per day per 1000 km of road. Notably, main roads exhibited the highest rates of moose, red deer, wild boar, and roe deer fatalities, while regional roads recorded the lowest. This underlines the need to prioritize protection measures on main roads, even though they are outnumbered by national roads in terms of absolute number of roadkills.

Analysis of the temporal distribution highlighted elevated roadkill occurrences during weekends (Friday to Sunday), followed by workdays, and then extended weekends. Although roadkill incidents during extended weekends exhibited a discernible day-before, first day or last day effect, these variations lacked statistical significance, and the observed effect size was small. Therefore, it is only expected that, with the change to a four-day work week, the peak day for traffic accidents with animals will change from Friday to Thursday.

In light of the heightened roadkill occurrences during weekends, we recommend that drivers exercise increased caution during these periods. They should be informed about the increased risk of collision with wild animals in the mass media, preferably on Fridays, and on Thursdays after the switch to 4DWW.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/d16020084/s1, Figure S1: General trends in the numbers of animal, wild animal, domestic animal, moose, red deer, wild boar and roe deer roadkills in Lithuania, 2002–2022, irrespectively of the road type; Figure S2. Roe deer roadkill numbers during three religious holidays in Lithuania, 2016–2022; Figure S3: Example of distribution of roe deer-vehicle collisions on the day before LWE, first day of LWE and the last day of LWE: (a)—Easter 2020, (b)—Easter 2021, (c)—All Saints day 2022; Table S1: Statistics of the total roadkill, wild animal roadkill, and domestic animal roadkill during work days (WD), weekends (WE), and long weekends (LWE).

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Appendix A

In 2006, weekend days were moved from Saturday 11 February, to Friday 17 February, from Saturday 1 July to Friday 7 July, and from Saturday 19 August to Monday 14 August [80]. In 2007, weekend days were moved from Saturday 22 December to Monday 24 December and from Saturday 29 December to Monday 31 December [81]. In 2008, weekend days were moved from Saturday 15 March to Monday 10 March, from Saturday 10 May to Friday 2 May, and from Saturday 28 June to Monday 23 June [82]. In 2010, weekend days were moved from Saturday, 20 February to Monday, 15 February, from Saturday, 20 March to Friday, 12 March, from Saturday, 19 June to Friday, 25 June and from Saturday, 10 July to Monday, 5 July [83].

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