

TEMPORAL TRENDS OF HUMAN ACTIVITY IN THE LANDSCAPE AND IN THE CROSSING STRUCTURES ACROSS MAIN ROADS IN AUSTRIA

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Abstract

In recent decades, the pressure on the environment and biodiversity has increased dramatically, mainly due to human activities. In order to improve the connectivity between habitats and also to safeguard both nature conservation and human well-being, elements of grey and green infrastructure have recently been increasingly implemented. Understanding how different human activities change over time is an essential information for conservation and landscape planning. To reveal temporal trends in human activity, annual photo-trapping data were used at sites in the cultural landscape and at crossing structures across main roads in Austria. Data collected throughout the year 2022 were categorized into eight categories of human activity involving pedestrians, pedestrians with dogs, cyclists, equestrians, motorcyclists, cars, farm and forest machinery, and others. Cars were the most represented category (48 %), followed by pedestrians (21 %) and farm and forestry machinery (13 %). Overall, the highest level of human activity during the year was recorded in the spring months. The daily pattern was dominated by human activity before and after noon. The individual categories varied according to the distribution of records over the days of the week, but in general most records were taken on Tuesdays and at the weekends. To understand human behaviour in detail, a focus on a specific category of human activity, is essential.

Keywords: human landscape utilization, monitoring, temporal patterns, underpasses, overpasses, recreation

Introduction

Human activities can be defined as sources of pressure on the environment (EEA 2020). The first human influence on nature and landscape in Europe can be linked to its arrival around 45,000 years ago (Riffkin 2011). Currently, it is estimated that 80% of Europe's surface is altered by human activities such as construction of buildings, roads, industrial infrastructure or agricultural management (EEA 2024). The anthropogenic impact can be described in terms of land use, but recently the increasing impact of outdoor activities must also be taken into account. Although outdoor recreation brings many benefits to human health and well-being (Carpenter and Harper 2015, Zwart and Ewert 2022), negative impacts on wildlife and ecosystems have also been observed (Bötsch et al. 2017, Coppes et al. 2018, Naidoo and Burton 2020, Lewis et al. 2021). In our study, we indicate the aggregate results of temporal human activity over the period of one year in Austria for eight categories of human activities. We suggest that this temporal information can be considered for specific interventions and is suitable for better integration of nature conservation and sustainable management of the landscape.

Materials and methods

Monitoring was carried out using automatic photo traps at 57 selected sites in Austria, which included the federal states of Burgenland as well as Upper and Lower Austria. The selected sites included locations in the landscape on ecological corridors, 5 underpasses and 10 overpasses (green bridges). Information signs about the ongoing monitoring were installed at selected sites. The obtained data were evaluated for the period of the whole year 2022, i.e. from 1.1.2022 to 31.12.2022. The collected data (n = 32,822) were evaluated according to time, abundance and divided into eight categories of human outdoor activities involving e.g. pedestrians, pedestrians with dogs, cyclists, equestrians (horse riders), motorcyclists, cars, farm and forest machinery, and category others (includes excavators, trucks and other unspecified categories).

Results

A total of 35,093 records of human activities in the landscape were identified in the landscapes under consideration (Table 1). Activities characterised by the use of cars were the most numerous category of human activity (48.28 %), followed by those involving pedestrians (21.2 %), farm and forestry machinery (12.62 %), cyclists (8.04 %) and pedestrians with dogs (6.23 %). On the contrary, the least represented categories included motorcyclists (1.73 %), equestrians (0.96 %) and category “others”.

Tab. 1: Categories of human activity in the landscape

Categories	N	%
Cars	16943	48.28
Cyclists	2823	8.04
Equestrians	338	0.96
Farm and forest machinery	4428	12.62
Motorcyclists	606	1.73
Others	330	0.94
Pedestrians	7439	21.20
Pedestrians with dogs	2186	6.23

The highest activity of humans was recorded in the spring months i.e. March, April, May (Fig. 1). Cars, pedestrians with dogs and other activities had the highest frequency in the spring months. Conversely, equestrians, farm and forest machinery and pedestrians were registered with the highest frequency in both spring and autumn. The cyclists and motorcyclists categories had the highest frequency in summer.

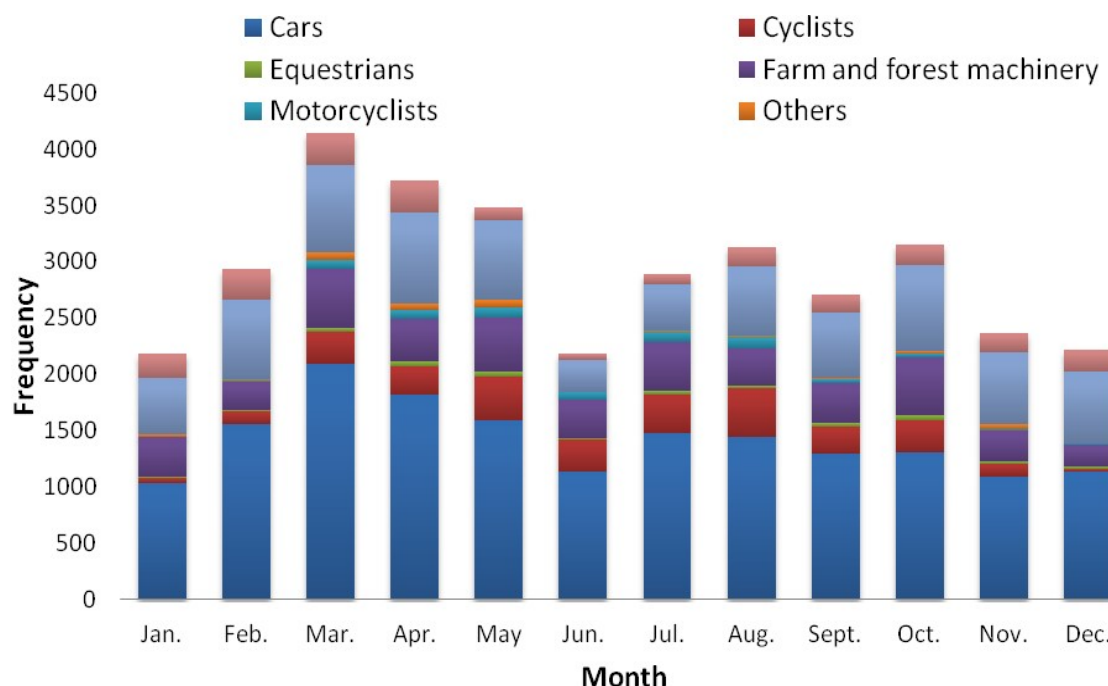


Fig. 1: Annual trends by individual human activity category

Human activities were observed mainly during daylight hours, with the highest values before and after noon (Fig. 2). The highest values of human activity frequency achieved before and after noon were registered for cars, farm and forest machinery and category others. In the afternoon, the highest frequency of activity was found in for categories involving cyclists, equestrians, motorcyclists, pedestrians and pedestrians with dogs.

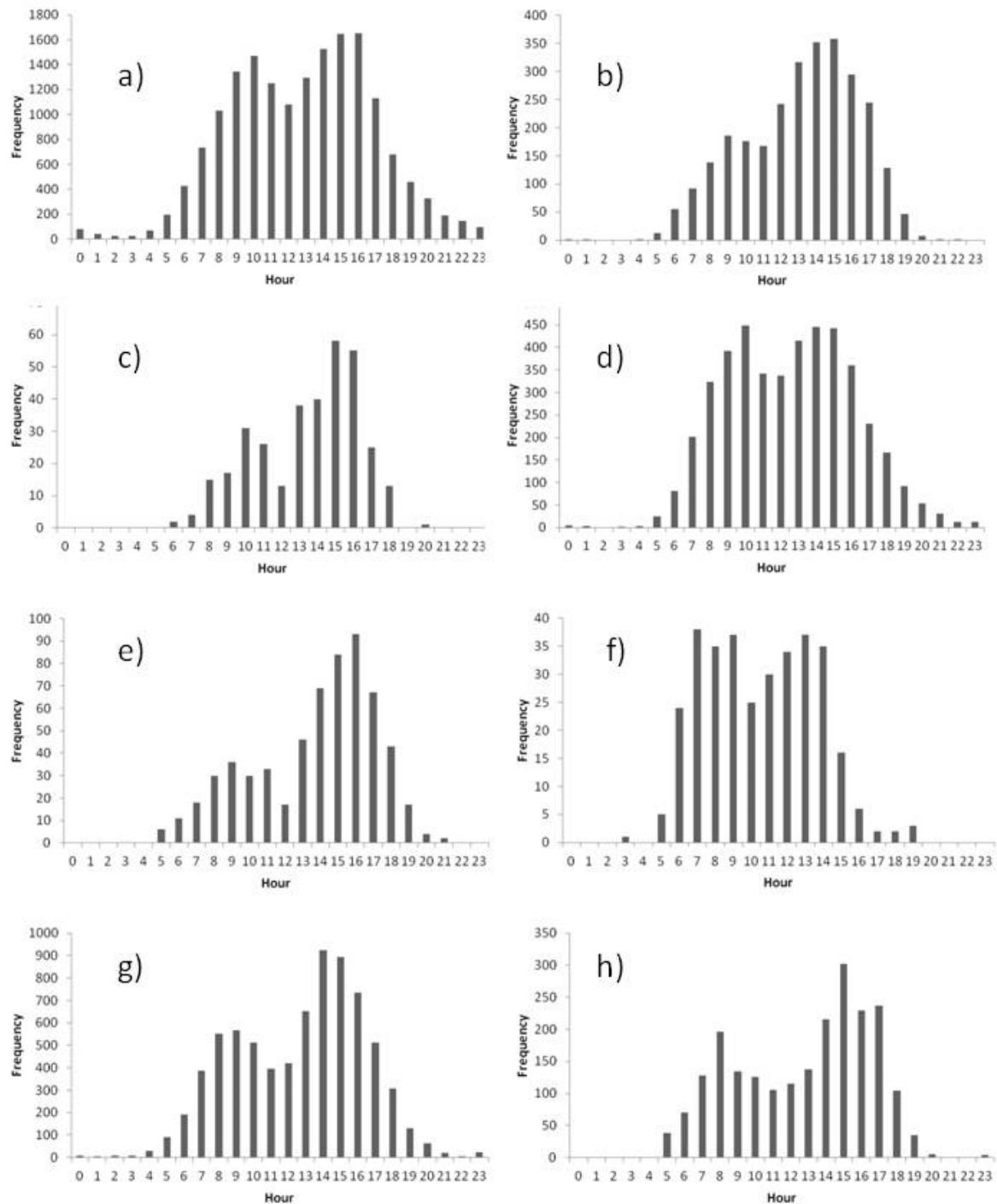


Fig. 2: Daily time trends by human activity category: a) cars, b) cyclists, c) equestrians, d) farm and forest machinery, e) motorcyclists, f) others, g) pedestrians, h) pedestrians with dogs

Overall, most records of human activity were registered on Tuesdays and on the weekends, however, activity varied by category (Fig. 3). Activities characterised by car use and category “others” were most represented on Mondays and Tuesdays, cyclists and motorcyclists were most frequent on Thursdays and Sundays, equestrians were most represented on Saturdays and Sundays, farm and forest machinery dominated on Tuesdays, pedestrians and pedestrians with dogs were most represented on the weekends, with the highest values on Sundays.

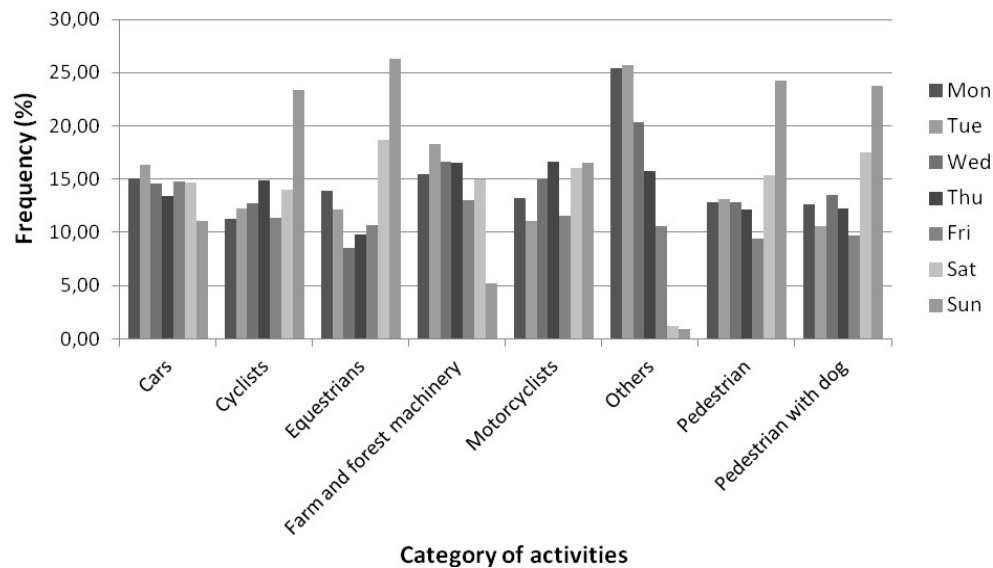


Fig. 3: Relative frequency of human activity during the week

Discussion

The data obtained for each category of human activity provide insight into the temporal use of the landscape by humans. Our results of the temporal distribution support general trends of human activity observed in other studies (Reilly et al. 2017, Lewis et al. 2021). The specific categories of human activities had specific time distributions due to differences in work and free-time (recreational) use. However, it is necessary to take into account that different categories of activities may be influenced by specific conditions, which may vary according to local, regional, national and international contexts. Human activities influence wildlife behaviour patterns, which has been described in many studies (Bötsch et al. 2017, Coppes et al. 2017, 2018, Gaynor et al. 2018). We assume that the results obtained according to the different categories of human activity may be useful for a better understanding of the interaction between humans and wildlife. These insights can also be beneficial for future more detailed studies, landscape planning incl. related human activities, local development policy, recreation and nature protection.

Conclusion)

Our study shows (i) the general representation of human activities in the landscape, as well as (ii) daily (iii) weekly and (iv) annual time trends for each category of human activity over a one-year period at representative locations in the Austrian cultural landscape.

Human activities have a critical impact on the environment and its wildlife, so we suggest that these outcomes are relevant for landscape planning and nature conservation.

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Souhrn

Lidská aktivita v krajině významně ovlivňuje životní prostředí, což souvisí s řadou negativních dopadů (fragmentace krajiny, změny chování volně žijící zvěře, aj.). Zjištění časové distribuce výskytu člověka v krajině je základní informací pro pochopení bližších souvislostí a negativních dopadů. V studii prezentujeme časové trendy osmi kategorií lidských aktivit zaznamenané v krajině a na migračních objektech přes liniovou infrastrukturu, které byly zaznamenány během ročního monitoringu v Rakousku. Nejvíce zastoupenou kategorií byly osobní automobily (48 %), dále chodci (21 %) a zemědělské a lesní stroje (13 %). Celkově byla nejvyšší lidská aktivita během roku zaznamenána v jarních měsících. V denní časové struktuře převažovala lidská aktivita před a po poledni. Jednotlivé kategorie se lišily podle dnů v týdnu, ale obecně bylo nejvíce záznamů pořízeno v úterý a o víkendy. Získané výstupy mohou být přínosné pro budoucí podrobnější studie, pochopení vlivu člověka na volně žijící živočichy, plánování v krajině, místní rozvojovou politiku, rekreaci a ochranu přírody.

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