DISSERTATIONES GEOGRAPHICAE UNIVERSITATIS TARTUENSIS
40

DISSERTATIONES GEOGRAPHICAE UNIVERSITATIS TARTUENSIS
40

SIIRI SILM

The seasonality of social phenomena in Estonia: the location of the population, alcohol consumption and births

TARTU UNIVERSITY
PRESS

Department of Geography, Institute of Ecology and Earth Sciences,
Faculty of Science and Technology, University of Tartu, Estonia

Dissertation was accepted for the commencement of the degree of *Doctor philosophiae* in human geography at the University of Tartu on 19 October 2009 by the Scientific Council of the Institute of Ecology and Earth Sciences University of Tartu.

Supervisor: Prof. Rein Ahas, University of Tartu, Estonia

Opponent: Prof. Dieter Müller, Umeå University, Sweden

Commencement: Scientific Council room in university main building, Ülikooli 18, on 21 December 2009 at 14.15.

Publication of this thesis is granted by the Institute of Ecology and Earth Sciences, University of Tartu and by the Doctoral School of Earth Sciences and Ecology created under the auspices of European Union Social Fund.

ISSN 1406–1295
ISBN 978–9949–19–279–3 (trükis)
ISBN 978–9949–19–280–9 (PDF)

Tartu Ülikooli Kirjastus
www.tyk.ee
Tellimus nr 441

CONTENTS

LIST OF PUBLICATIONS

This thesis is based on the following publications.

I **Silm, S**. and Ahas, R. (2005) Seasonality of alcohol-related phenomena in Estonia. *International Journal of Biometeorology* 49: 215–223.

II Ahas, R., Aasa, A., **Silm, S**. and Roosaare, J. (2005) Seasonal Indicators and Seasons of Estonian Landscapes. *Landscape Research* 30(2): 173–191.

III Ahas, R., Aasa, A., Roose, A., Mark, Ü. and **Silm, S**. (2008) Evaluating passive mobile positioning data for tourism surveys: An Estonian case study. *Tourism Management* 29: 469–486.

IV Ahas, R., **Silm, S**., Järv, O., Saluveer, E. and Tiru, M. (forthcoming) The modeling of locations of meaningful places for mobile telephone users using mobile positioning data. *Journal of Urban Technology* 17(1). (Accepted for publication).

V **Silm, S.** and Ahas, R (forthcoming) Seasonal variability of population in Estonian municipalities. *Enironment and Planning A*. (In review).

Author's contribution

I The author participated in 70% of the data collection, analysis and interpretation of the results, and has participated in 50% of the composition of the theoretical part.

II The author participated in 30% of the data collection, in 30% of the analysis and in 30% of the writing of the article.

III The author participated in 20% of the development of the methodology and also in 30% of the testing of the methodology and in 20% of the writing of the article.

IV The author participated in 20% of the development of the anchor points model and in the writing of its description; the author completed 80% of the analysis of the anchor points used during the project and compared it to the data taken from the Population Register; the author participated in 50% of the writing of the article.

V The author participated in 75% of the composition of the theoretical part, the processing and analysis of the data and in writing the article.

ABSTRACT

This thesis examines seasonality in Estonian society, with the aim of learning about patterns of seasonal behaviour. This thesis argues that seasonality in Estonian society can be observed through many phenomena, and that the patterns of seasonal behaviour are directly or indirectly caused by natural seasonality. Estonia, which is located in the temperate zone, is a good example for the investigation of such phenomena and the causal relations between them. This thesis examines the seasonality of just a few phenomena: the location of the population, alcohol consumption and births.

The thesis consists of an overview and five publications, three of which deal with different seasonal phenomena in society – the location of the population, alcohol consumption, births – and factors that influence it. Another two publications give an overview of exploring the spatiotemporal seasonality of people's behaviour by using the passive mobile positioning method. In addition to mobile positioning, traditional sources of data have been used to research the seasonality of social phenomena, for example data from the Population Register and other statistical data obtained from different institutions. In addition, a survey of students at the University of Tartu was conducted, as well as interviews with specialists. The data reflect various periods of the phenomena, and range from 2 years to almost one century.

The seasonality studies began a few centuries ago with phenological studies about the timing of natural events. Seasonality in society has been researched for over half a century; the seasonality of society is much more complex. One is about the interaction between people and nature, while the other is about human culture. As a result, the reasons for the seasonality of the social phenomena examined in this thesis emanated from 4 types of factors: 1) natural seasonal phenomena, 2) the biological clock or the processes that take place within people that are influenced by the seasonality of natural phenomena, 3) social phenomena that are directly influenced by the seasonality of natural phenomena, and 4) social phenomena that are indirectly influenced by the seasonality of natural phenomena.

Due to its position at temperate latitude, Estonia is a very good example of a country where people and society as a whole are influenced by the changing of the seasons. Due to natural conditions, we can distinguish four seasons of the year, two of which are the main seasons (summer and winter), and two of which are intermediate seasons (spring and autumn). On the basis of the social phenomena we have investigated, we can also observe similar opposite dynamics between summer and winter in social phenomena. The number of residents increases in the summer months (June-August) in rural municipalities, especially on the coast and islands, and decreases in urban municipalities. In synchrony with the rise and fall in air temperatures, the high season of beer consumption is in summer (June-August), and the low season is in winter (January-February); the relative importance of which is 5.4 percentage points lower than in the summer months. The higher consumption of alcohol is also

reflected in statistics of traffic accidents involving drunken drivers. As regards births, the opposing seasons are not summer and winter, but spring and autumn. There are fewer births in October, and more in March; the difference can be up to 15%. In the seasonality of births we can see a changing rhythm of seasonality in the middle of the 20th century, as at the beginning of the century the peak in births was in autumn and the trough was in spring-summer, whereas in the second half of the century the situation was reversed, with the peak in spring and the trough at the end of year. This change probably matches the shift from an agrarian society to an industrial society and an urban lifestyle in Estonia.

The seasonal causes of the social phenomena in Estonia studied by the author can be divided into three main groups of the four mentioned above, as the biological clock or the processes that take place within people have not been studied directly. Among the phenomena researched, the impact of natural factors is clearly prominent, as alcohol production, consumption and its consequences, as traffic accidents demonstrate a close correlation with fluctuations in air temperature. The human activities that are directly related to seasonal natural phenomena are studied here, using the example of seasonal migrations. There is a close correlation between the fluctuation of population numbers in recreational areas (coastal regions, summer house areas etc.) and season. Those outdoor activities in the summer season also influence alcohol consumption. Most of the studied seasonal phenomena in society are influenced by traditions and regulations such as holidays and calendar events.

1. INTRODUCTION

The changing of the seasons causes major changes in nature. Seasonality affects the physical environment and the organic world. Organisms have adapted themselves to make the most of favourable times of year and to survive periods that are less favourable to them. The way the seasons change varies in different geographical zones; the greatest changes occur in the areas closest to the poles, while the least change is seen in the equatorial zone. Just as the change in seasons affects the natural environment, it also affects human society.

Seasonal variation in the outside world has caused human society to adapt and adopt: at favourable times of year we have always done things that help us get through the less favourable times, such as replenishing our food stocks and building shelters. The seasonality of human behaviour can be seen in many activities. In some areas of life, taking seasonality into account is something we do instinctively, and little attention is paid to it; in other areas it is a conscious thing for which we have special procedures and customs. It is generally believed that human and social development strives to achieve independence from the natural world, and at the beginning of the 21st century that has largely been accomplished. However, seasonality is programmed into society and human culture. It is often not even recognised: for example, southern farmers are unlikely to make a connection between their harvest and the seasons in the northern countries for which their produce is destined; and consumers in the north are unlikely to think about the time of year in which the tropical fruit they buy ripened. Nor is attention often devoted to the role of the seasonal factor in movement between the starting points and destinations of tourism.

In temperate climates, the direct association between everyday behaviour and the changing of the seasons is frequently underestimated, despite the fact that it is a key factor in human behaviour (Foster and Roenneberg 2008). In the examples of both tourism and agriculture, the geographical dimension is one of the most important. The seasons and harvest periods in our planet's two hemispheres are opposites: one exports while the other imports. This is a crucial aspect in understanding mobility in the modern world.

How the changing of the seasons precisely affects people and their behaviour remains largely unknown. Philosophical debates have taken place for centuries as to whether human beings are biological or social phenomena or a combination of both. As the social sciences and humanities have developed, we have found that in order to understand human behaviour we must treat people as primarily social in nature. We are not guided by rationality alone: our bodies often overrule our minds, and the biological side of our nature is often forgotten. In connection with seasonality, it has also been found that it is very important to take into account the way the biological body functions. People are subject to a number of cycles that are programmed into the body, which we cannot ignore and which affect our behaviour. One of these is the seasonal cycle that manifests itself in various patterns of behaviour, but for which no causal links have yet been proved (Roenneberg and Aschoff 1990; Lam and Miron

1991). Over the last decade, mostly thanks to progress in genetics, people have once again begun to appreciate the importance of the biological body in understanding human behaviour and culture. Analysis of ethnic, linguistic and cultural drift has shown that the mind and body need to be studied as one: human culture can neither be fully described nor fully understood by examining them separately.

This thesis examines the seasonality of the selected phenomena in Estonian society. It aims to identify the extent to which human behaviour is dependent upon the changes in the seasons and the factors that influence that behaviour. The author of this thesis argues that seasonality in Estonian society can be observed through many phenomena and indicators. Patterns of seasonal behaviour are caused by many factors and the complex interaction between them. This thesis attempts to answer the question of whether the seasonal patterns that emerge in our behaviour are the result of the direct influence of the natural world or whether they are indirectly connected. Factors influencing seasonality are divided into four groups of causes: 1) natural seasonal phenomena (temperature, rainfall, wind, etc); 2) the biological clock or the processes that take place within people, which are influenced by a variety of seasonal natural phenomena; 3) social phenomena that are directly influenced by the seasonality of natural phenomena, such as agriculture, tourism, outdoor sports and hobbies, recreation; 4) social phenomena that are indirectly influenced by the seasonality of natural phenomena, such as traditions, calendar celebrations, the alternation of work and leisure time, holidays, etc.

In order to provide an overview of the factors influencing the nature and seasonality of the phenomena of human society, the results of three studies carried out between 2005 and 2009 are summarised. The author was part of the research team of the Chair of Human Geography of the University of Tartu that studied certain aspects of seasonality in Estonian society. Three social indicators were selected for the analyses, with the following argumentation: 1) the indicator had to have been academically investigated elsewhere in the world from the point of view of seasonality; 2) the phenomenon had to be indicative, i.e. describe deeply-rooted social processes; 3) data had to be available about Estonia. On that basis, the following indicators were selected: a) alcohol consumption – the seasonality of this phenomenon has been noted and investigated in many countries (Lemmens and Knibbe 1993; Uitenbroeck 1996; Cho et al. 2001), and the phenomenon is very closely connected with human culture; b) the seasonality of births – this topic has been extensively investigated, but has not been fully explained (Foster and Roenneberg 2008; Lam and Miron 1991; Udry and Morris 1967) – this apparently reflects the influence of the external environment, internal processes and social factors; c) the location of the population, which have been investigated from various points of view (Baum and Lundtrop 2001; Hanson and Bell 2007; Ragatz 1970) – these reflect the contemporary lifestyle and increasing social mobility.

- The publication I studies the seasonal variation of alcohol consumption and its consequences, and analyses the social and environmental factors that may cause its seasonal rhythm.

- The publication II studies seasonality and the seasons of Estonian landscapes based on natural parameters such as air temperature, radiation regime, climatic seasons and snow cover, and social parameters of births, alcohol consumption and state budget allocations.

- The publication V studies the seasonal variability of population in municipalities and attempts to determine the causes of seasonal changes in places of residence.

The remaining two publications (III and IV) present an overview of the passive mobile positioning method used in publication V of the thesis.

- The publication III gives an overview of passive mobile positioning data and the ways such data can be used in studies of the temporal and spatial behaviour of people in connection with tourism. The article also presents several significant aspects of the gathering of passive mobile positioning data and the issues of precision and privacy.

- The publication IV describes the model used to identify the locations of regularly visited places called anchor points (home and work-time anchor points), based on passive mobile positioning data, and sets out the comparison of the home anchor points identified by the model with residential data from the Population Register.

2. THEORETICAL BACKGROUND

2.1. Seasonality

The natural reason for the rotation of seasons on Earth is the inclination of the Earth's axis at an angle of 23.5 degrees. This influences the distribution of the solar radiation that reaches the Earth varies throughout the year. From April to September the northern hemisphere receives more solar radiation, and from October to March the southern hemisphere receives more, and accordingly there is a summer half-year in the northern hemisphere from April to September and in the southern hemisphere from October to March. This in turn affects most of climatic factors, such as temperature, solar radiation, precipitation and wind. A number of biochemical and physiological processes in organisms are synchronised to seasonal variations in environmental conditions, as are different types of behaviour. As with other organisms, seasonal variation in both the biotic and abiotic environment also affects humans and human society.

In this thesis the term "seasonality" is applied in its broader sense to all seasonal phenomena, and in its narrower sense it is used as a term to refer to seasonal phenomena of an abiotic nature (the physical environment). Since 1853, when the term was coined by the Belgian scientist Morran (Schults 1981), phenology has traditionally studied the seasonality of organisms. The terms phenology and seasonality are both suitable to describe the seasonal rhythm of human activities, although seasonality is more commonly used.

The rotation of the seasons is defined astronomically and climatologically. Astronomically, the changing of seasons takes place at the moment the central point of the Earth's axis passes through the conceptual line marking the respective season: spring begins around 21 March, summer around 21 June, autumn around 23 September and winter around 22 December. Climatic seasons are characterised by seasonal changes in the weather and in the natural environment. Unlike the astronomical seasons, which begin at precise times on predetermined dates, climatic seasons arrive at different times each year depending on the weather. The defining of climatic seasons is based on the principle that one season must be clearly (qualitatively) distinguished from another and be more or less uniform in itself. The effect the climate has on the seasonal development of organic life during a particular climatic season must be uniform.

Seasonal phenomena are characterized by rhythm, i.e. they repeat each year. The indicators that characterise seasonal rhythm are cycle and amplitude. These are repeated from one year to the next in a very similar manner, but may vary in details such as timing and amplitude. Period is the time required for a rhythm to complete one full cycle, or the time from peak to peak.

2.2. Seasonality in the abiotic environment

The factor of the abiotic environment that exhibits the greatest seasonal variation is weather, which affects the variability of other factors in the abiotic and biotic environment. The most important climatic phenomenon is the seasonal change in solar radiation, which causes changes in the regime of temperature and precipitation. Nevertheless, seasonality is also manifested in other components of the abiotic environment, such as changes in humidity and wind conditions.

The seasonality of weather and of nature in general is best studied in terms of climatic zones, since indicators within the same zone exhibit the same seasonal variations; they differ compared to other zones. Seasonality can be observed at almost all latitudes. The greatest seasonal variations are found close to the poles, where there are only two seasons – polar day and polar night – depending on whether the sun never sets or never rises. In temperate climates there are four seasons, two main seasons – summer and winter – and two intermediate seasons – spring and autumn. The main factor influencing the change in the seasons is air temperature.

The effect of the changing of the seasons is smaller in tropical zones, where light and temperature are more evenly distributed throughout the year. The factors that determine the seasons in the tropics are humidity and changes in air masses: the two seasons here are the wet season and the dry season. This often affects life in such areas just as significantly as changes in air temperature at higher latitudes. At the equator there is little or no seasonal variation caused by weather; air temperature and humidity are virtually the same year-round.

In areas at the same latitude, the seasons are influenced by the maritime or continental nature of the climate. In maritime climates the intermediate seasons are longer due to the inertia of warmth, while in continental climates the seasons change rapidly. That is why in Estonia, which has a maritime climate, spring lasts 78 days, while in the continental climate of Jakutsk in central Siberia it lasts just 24 days.

The abiotic and biotic environments are both directly affected by the climatic seasons, i.e. changes in weather conditions. Climatic seasons can be distinguished from one another based on a wide variety of criteria. The key factor in the temperate zone is air temperature. Phenomena are most greatly influenced by their distance from the equator (0° of latitude): as one moves north or south, frozen water generates ice and snow cover, which is one of the most important factors influencing landscape, climate and organisms. The greater the distance, the greater the effect on seasonal phenomena. Distribution of rainfall is also important, particularly in terms of snow cover and duration, which determine the length of winter.

In Estonia the climatic seasons are determined using the following eight categories (Raik 1963; Jaagus and Ahas 2000; Jaagus 2001). 1. Late winter is the period of snow melting in spring. The start date of the snow melting period is defined as the day after which the occurrence of non-melting days does not

exceed the number of melting days. 2. Early spring begins after the final disappearance of snow cover. This is the period in which the average daily air temperature rises above 0ºC. 3. Spring begins after the permanent increase in daily mean air temperature exceeds 5ºC and plant cover begins to emerge. 4. Summer begins when the average daily air temperature has consistently risen above 13ºC. 5. Autumn begins when the average daily air temperature consistently falls below 13ºC. 6. Late autumn begins when the period of the plant growing season ends and the average daily air temperature consistently falls below 5ºC. 7. Early winter begins with the first formation of snow cover. During this period the average daily air temperature usually falls below 0ºC. 8. Winter begins after the formation of permanent snow cover. The continuous period with cold weather (below 0ºC) before the formation of snow cover is included in the winter season.

2.3. Phenology: seasonality in the biotic environment

The seasonal factors of the abiotic environment also affect the biotic environment. The seasonal changes that manifest themselves in the biotic environment influence every level of life, from *aspergillus* all the way up to higher-level organisms: plants, birds and mammals, including humans.

In the seasonal environment, organisms have adapted to make the most of favourable times of year and to prevent or at least mitigate the effects of periods that are less favourable for survival. Plants have adapted to grow and blossom at the most favourable time; when conditions do not favour them, they shed their leaves. Animals use the most favourable time of year to grow, develop and reproduce, while many diminish the effects of unfavourable periods through hibernation or migration.

Seasonal variation manifests itself in the energy-consuming physiological and behavioural processes of all of the planet's inhabitants. Adaptation has seen processes that require great amounts of energy coincide with conditions of a sufficiency of resources and other favourable environmental conditions, which promote survival and successful reproduction. The main limiting factors that emerge seasonally are a lack of food and low air temperatures.

The phenological development of plants has been studied throughout the world for centuries. Research has revealed that plants react very differently to the changing of the seasons. The factors that normally trigger the development are temperature, daylight (including photoperiodism) and precipitations. Different plants react to different changes in environmental factors in their own way (Schnelle 1955). Some are influenced by soil temperature and the conditions on the surface (how cold it gets), while others are affected by air temperature. However, models that reflect phenological development are quite complex (Schwartz 2003): as the seasons change there is a risk that plants will begin accidentially to develop with the arrival of the first warm weather (i.e. in autumn). As a result, many plants not only require warmth for development, but

also the period of cold that precedes it. In this way, plants protect themselves against premature or wrong timing.

Animals have made a variety of behavioural adaptations in order to survive winter. These include hibernation and migration. They may also change their social behaviour, gathering together in large numbers for the winter in order to conserve warmth and humidity (Madison 1984). Feeding behaviour also change seasonally: birds, for example, may form huge flocks in winter or change from a nightly pattern of activity in summer to a daily pattern in winter in order to conserve the energy they use in gathering food (Horton 1984). In autumn animals may build up a store of food to ensure that they have enough to see them through to spring (Bartness 1995). Many animals also construct large heat-retaining insulated nests for the winter (Dark and Zucker 1983). However, the most important seasonal adaptation that animals make is to interrupt reproduction in the winter period in order to conserve energy.

In addition to seasonal changes in behaviour and reproductive function, there are a number of physiological and morphological adaptations that help individuals survive the energy shortage they experience in winter. These are, for example, changes in basal metabolic rate, non-shivering thermogenesis, body mass, pelage development, gut efficiency and endocrine function (Moffatt et al. 1993). Gonadotropin and prolactin concentration decline, sex steroid hormone production wanes, and reproductive activities stop prior to winter. All of these changes are exhibited in smaller mammals in autumn.

Seasonal variation can also be seen in the immunity function (Nelson et al. 2002). Individuals 'optimise' this function such that they will overcome minor illnesses if the energy loss is greater than the benefit. Existing energy is distributed between competing functions, of which the most important is survival. If energy supplies are great (at a time of migration, gestation, territorial defence or suckling), the immunity function is reduced; but in winter, with limited stocks of energy, what energy they have is used for thermoregulation and maximum immune function rather than for growth, reproduction and other non-essential processes.

In order to be able to successfully cope with seasonal variations in environmental conditions, organisms must be prepared for the arrival of the seasons. For example, reproducing too late in autumn leaves newborns unprotected against the winter; hibernating too early removes the opportunity for continued reproduction and reduces nutritional reserves accumulated to survive the winter and for reproduction the following spring. Adaptation in a seasonal environment depends on timing: the optimal time must be found to migrate, to reproduce, to stop reproducing and to migrate again. All of these activities require a level of preparedness: reproduction requires resources and territory; hibernation requires a build-up of fat; migration requires old feathers to be replaced with new ones (Bradshaw and Holzapfel 2007).

The individuals that live on Earth have developed a variety of mechanisms that inform them of seasonal changes. Some species have an annual clock, while others have a circadian clock, which is used to determine the length of the day

(the photoperiod) and in turn determines the seasonally required reaction (Gwinner 1986; Bartness et al. 1993). In the polar and temperate zones the most important factor in recognising the changing of the seasons is photoperiod (Bradshaw and Holzapfel 2007), because it provides the most reliable signal of the arrival of different climatic conditions. Temperature, rainfall, food and other environmental conditions are also significant, but their roll only increases when a relevant event is approaching. Specific reactions to photoperiod are based on our evolutionary choice of optimal seasonal period. The photoperiod sends out a signal which sets in motion an irreversible series of physiological and developmental processes culminating in reproduction, hibernation or migration.

The biological clock helps birds and animals in the timing of seasonal activities if for some reason photoperiodism does not help. For example, the biological clock helps birds maintain their sense of time during their spring and autumn migratory periods, when they travel rapidly through a large number of zones in which the days have different lengths (Gwinner 1996). With animals, the biological clock is, for example, important as part of the reproductive cycle at higher latitudes, where the most favourable time of year for reproduction is very short, the summers are subject to permanent sunlight, and organisms may hibernate in relatively stable conditions for more than six months of the year.

2.4. Seasonality in human society

The seasonality of social phenomena has been studied for more than half a century. Unlike studies of the seasonality of natural phenomena, for which a good methodology has been developed, there is no clear framework for the investigation of seasonality of the social phenomena. Research into the seasonality of social phenomena is fragmented – seasonally varying phenomena are studied independently in a number of specific fields in which seasonality is primarily treated as a characteristic of a phenomenon rather than as an independent subject of study.

The study of the seasonality of phenomena in human society can be divided into four main fields.

1. Humans as biological individuals – these studies examine the seasonality of people's internal physiological processes (Ingram and Dauncey 1993; Johnston 1993; Stroud 1993), nutrition (de Garine 1993; Johnston 1993), illnesses (Nelson et al. 2002; Foster and Roenneberg 2008), moods (Murray et al. 2001), births (Ahas et al. 2005; Foster and Roenneberg 2008) and deaths (Foster and Roenneberg 2008).
2. Human behaviour – there is, for example, a seasonal characteristic to alcohol consumption (Lemmens and Knibbe 1993; Uitenbroeck 1996; Cho et al. 2001; Silm and Ahas 2005), crimes (Landau and Feidman 1993; Farrel and Pease 1994) and car accidents (Radun and Radun 2006).
3. People’s locations – seasonality is a highly characteristic feature of tourism (Baum and Lundtrop 2001; Ahas et al. 2007), visits to second homes (Ragatz

1970; Stynes et al. 1997; Tress 2007) and seasonal work (Perloff et al. 1998; Hanson and Bell 2007).
4. The economy – the seasonality of cash flow, prices, the stock exchange and investment activity have been examined (Bernstein 1998; Bouman and Jacobsen 2002).

All of these areas are very closely connected and exert a reciprocal influence on one another's seasonality.

In the case of social phenomena, no single seasonal rhythm can be highlighted that applies to all of them. The cycle, amplitude and other indicators of seasonal variation vary according to the phenomenon and depending on the factors influencing seasonality.

While there is a clear seasonal reason for natural phenomena – annual variation in climatic conditions – the seasonality of the phenomena exhibited within human society is much more complex. The seasonality of social phenomena is described as the interaction between humans and the environment. Such interaction is best characterised on the basis of the type of social organisation: tribal, agrarian, industrial or information society. The relationship between human beings and the natural world has changed significantly over time, and this must be taken into account in studies of the seasonality of social phenomena.

It was predominantly environmental factors that determined the way people lived and where they lived in tribal society, survival depended on hunting and gathering, and groups of people moved from one place to another without a fixed 'home location'. Seasonal variation in places of residence was primarily determined by limiting environmental factors: in order to survive, people needed to choose the most suitable place to live according to the seasons. The decisive role played by the environment diminished with the rise of farming and animal husbandry in agrarian society, which enabled people to survive without constantly migrating from one place to another, by growing and storing food stocks for periods of unfavourable environmental conditions. Human activity in agrarian societies is connected with the natural environment to a great extent, but is not directly determined by it. In the industrial and information society, people's survival no longer depends on environmental conditions, or only depends on them to a minor extent, due to developments in technology. Most important are social factors and the natural factors influence human behaviour through certain choices that arise from ethnic, cultural, social and economic factors. In industrial society there is often a contrary rhythm to natural seasonality, for example social factors producing a reverse summer holiday rhythm. The information society has a more complex rhythm of natural relationships and seasonality, which is characterised by project-based work and the opportunity to choose activities and places (Ahas et al. 2005).

Differences in seasonal rhythm appear in the case of the same type of social organisation in rural and urban areas. The more urban the lifestyle, the more limited the influence of seasonality on way of life. The influence of seasonality

is most clearly evident in the primary sector, which is comparable to an agrarian society, where everyday activities directly depend on natural conditions and where people live to a large extent on this basis. In an urban environment, seasonality tends to be influenced by social factors, which are associated with special days, holidays and free time.

Seasonal changes in human society depend on a wide range of circumstances. The factors that influence decisions can be divided into two groups: structural, i.e. external factors (natural and social environment) and actors' internal factors. Natural structural factors are phenomena and processes from the natural environment surrounding us, such as changes in climate. Social structural factors are the rules and practices governing society, such as the timing of holidays, traditions and so on. The internal factors of an actor are 'free will', which is regarded as a person's choice to do some activity for a certain period in the year, and this is also influenced by the processes taking place within them and probably by the 'biological clock' as a programmed reaction to factors from the external environment. Genetic research has led to renewed importance being placed on the biological clock over the last decade as a factor determining everyday and seasonal behaviour (Bradshaw and Holzapfel 2007; Hofman 2004). Nevertheless, the investigation of the connections between social behaviour and the 'biological clock' is only in the early stages, and much remains to be discovered. In the following chapter the factors influencing the seasonality of human society are divided into four groups according to their connections to natural seasonal phenomena.

The way in which structural and actors' internal factors express themselves as seasonal changes in human society is in turn influenced by a number of contextual factors, such as infrastructure, economic conditions, etc. As far as context is concerned, it is also very important to take social attitudes and fashions into account.

Compared to those in the natural environment, little research has been carried out into the causes of the seasonality of phenomena in human society. This is evidently due to the complexity of such phenomena. Attempts have been made to categorise the causes of seasonality in tourism and economics (Bar-On 1975; Butler 2001; Granger 2001). In tourism there are two main group of factors causing seasonality, one is called natural and the other institutional (Bar-On 1975; Butler 2001). Natural factors are regular temporal variations in natural phenomena that are associated with climate and true seasons: temperature, rainfall, daylight, etc. Institutional seasonality is caused by people's activities and behaviour and is the result of decisions we make, such as social norms and practices based on ethnic, cultural, religious, social and economic factors (Butler 2001). Social pressure or fashions, sporting seasons and inertia or tradition are also given as causes for the seasonality of tourism (Butler 2001). One of the causes of seasonality in the economy (Granger 2001), as in tourism, is the weather. However, the phenomena regarded as institutional factors in relation to tourism are divided by economists into two categories: 1) the calendar, which determines the timing of certain public holidays (Christmas,

Easter) and the number of working days in a given month; and 2) timing decisions, which include school holidays, university semesters and specific economic phenomena such as the payment of company dividends and choice of the end of a tax year or accounting period. Economic factors also include the category 'expectations', which includes the fact that people choose their vacation destinations on the expectation of weather conditions rather than on the actual situation, for example companies expecting a sales peak during the Christmas period.

Generalising, the causes of all of the seasonal phenomena in human society can be divided into four groups.

1. **Natural seasonal phenomena**. These are comparable to the Bar-On natural factors and to Granger weather. Natural seasonal phenomena directly or indirectly form the basis for all of the factors that belong to the remaining groups.
2. **The biological clock or the processes that take place within people** that are influenced by the seasonality of natural phenomena and affect human behaviour. Direct connections include seasonal variations in sunlight and the production of melatonin and serotonin within the body and the illnesses and changes in mood that causes seasonal affective disorder (SAD) (Oren and Rosenthal 1992).
3. **Social phenomena that are directly influenced by the seasonality of natural phenomena**, such as agriculture, tourism and outdoor sports and recreation.
4. **Social phenomena that are indirectly influenced by the seasonality of natural phenomena**, such as traditions (the calendar, holidays, work and rest time, school holidays etc.), regulations and people's choices.

Very little research has been carried out into the significance of the influence on people of factors that lead to seasonality. A study conducted in Edmonton Park in Canada revealed that the leading factors influencing seasonal visitation were work commitments, followed by precipitation, temperature, long weekends, school commitments and sunlight/cloud (Hinch et al. 2001). The seasonality of alcohol consumption, meanwhile, shows that the type of alcohol consumed is influenced not only by the time of year (and in particular the air temperature) but also by holidays (Silm and Ahas 2005). As such, no one can say that natural seasonal phenomena are more important than social seasonal phenomena or vice versa. The importance of the reasons for this seasonality varies depending on the phenomena. At the same time, there is rarely only one cause for the seasonality of the majority of seasonally varying social phenomena, but rather a combination of natural seasonal phenomena, the processes that take place within us and a variety of seasonal social phenomena whose original cause is, directly or indirectly, natural seasonal phenomena.

The following sub-chapters examine three seasonal social phenomena – dates of births, the location of the population and alcohol consumption – and identify the factors that influence their seasonality.

2.4.1. The seasonality of births

The seasonal variation in births is clearly visible in most human populations. This area has been studied quite thoroughly in various demographical, biological, phenological and epidemiological investigations conducted in different regions (Udry and Morris 1967; Roenneberg and Aschoff 1990; Lam et al. 1994; Ahas et al. 2005). The results of this research indicate that the seasonal rhythm of births has a definite geographical aspect. For example, the seasonal rhythm of births in Northern Europe, where the maximum number of births occurs in spring, and in the United States, where the maximum number of births occurs in summer and early autumn, is different. At the same time, the birth seasons in the Mediterranean countries, the Near East and Central America are quite similar (Lam and Miron 1994). In the birth curves of the populations of the Northern and Southern hemispheres, a contrary pattern has been detected, which indirectly refers to the impact of the external environment arising from the seasons (Cowgill 1966).

The seasonal rhythm of births in populations also changes over the course of time. The most extensive changes in the seasonality of births have been observed since the 1960s (Roenneberg and Aschoff 1990). One reason for this is that great social and economic changes have taken place in society (Lam and Miron 1994; Ahas et al. 2005).

The search for the reasons for the seasonality of births has been one of the central topics of study of demographers and biologists since the mid 20th century. No direct correlation has been detected between the frequency of intercourse and the seasonality of births (Udry and Morris 1967). The seasonality of births is most often related to the impact of weather conditions (Cowgill 1966; Roenneberg and Aschoff 1990; Rojansky et al. 1992; Centola and Eberley 1999), while the connections generally still remain weak, so that one could say that there are no proved connections (Lam and Miron 1996).

It has been hypothesised that the external environment (air temperature, photoperiod etc.) has an impact on the birth rate (conceptions) through hormonal composition, the quality of sperm or sexuality (Centola and Eberley 1999; Rojansky et al. 1992; Rojansky et al. 2000). The key factor in seasonal variance might be melatonin, which may be involved in both spermatogenesis and folliculogenesis (Partonen 1999). The fertility of men may depend seasonally on the quality of sperm, which varies greatly (Jorgens et al. 2001). The concentration of sperm and its spermatozoon content is generally lower in summer than it is in autumn and winter (Spira 1984; Gyllenborg et al. 1999). Fewer connections have been discovered between conception by women and environmental factors (Rojansky et al. 1992). However, a definite trend

consisting in an increase in the probability of conception in the first half of June and December has been discovered (Smits 1998).

Biological and physical mechanisms probably constitute another important set of factors influencing the seasonality of the birth rate. The mechanisms of the biological clock timing of life activity and procreation certainly fall into this category as well (Follett and Follett 1981; Gwinner 1986; Roenneberg and Aschoff 1990). In the biological sense, a modern person no longer has any direct need (food, weather conditions) to time births seasonally, but certain physiological, endocrinological and immunological variables still indicate systematic seasonal variances (Roenneberg and Aschoff 1990). It is possible that the reasons for this might lie in the continued functioning of the genetically-coded biological clock.

Socio-economic and demographic factors could constitute a third set of factors conditioning the seasonal rhythm of births (Lam and Miron 1991). The most outstanding of these are aspects related to the type of production used by the society (agrarian, industrial or information society), as well as economic conditions and causes, aspects related to traditions and holidays (the Christmas and Midsummer Day effect), phenomena related to getting married and planning a family, and phenomena related to social and political events (wars, political regimes, revolutions).

2.4.2. The seasonality of population numbers

Seasonal variations in places of residence and seasonal migration have characterised human society throughout its history. It was predominantly environmental factors that determined the way people lived and where they lived in tribal society. Vestiges of these different settlements can still be seen in the landscape today. For example, movement between summer and winter grazing lands produced mountain passes, and these grazing lands have become vast fields; spawning grounds and fishing areas have evolved into coastal landscapes. The land also reveals traces of a period in which people were hunters and gatherers and changed both their way of life and the place they lived according to the seasons (Donahue and Lovis 2006; Jones et al. 2008; Riley 2008; Carre et al. 2009).

Although people today are less dependent on nature, seasonal migration can still be observed in modern post-industrial society. The transition from seasons of warmth to seasons of coldness instigates a mass movement of people on the local, regional and global levels. The majority of contemporary seasonal migration is not the result of limiting factors, i.e. survival needs, but the opportunity to choose a better place to live or work. At times of the year when the climate is favourable, people spend more time in the natural environment; at other times they remain in towns and cities or relocate to warmer climates.

Seasonal changes in place of residence have been studied in a number of countries, but from a slightly different perspective. In the United States,

seasonal changes in place of residence are mainly connected with the seasonal movement of retired people from colder regions to the Sun Belt states (Krout 1983; Gober and Mings 1984; Hogan 1987; Smith and House 2007). In the Nordic countries, seasonal migration is primarily associated with the use of second homes (Müller et al. 2004; Hiltunen 2007; Tress 2007). Research has also been carried out into seasonal variations in the location of the population as a whole in Australia, examining a wide range of aspects (Bell 2004; Charles-Edwards et al. 2008). In most cases such migration is connected with tourism and holidays (Charles-Edwards et al. 2008), but labour migration is also seasonal in nature, particularly in the recreational economy and agriculture (Jolliffe and Farnsworth 2003; Hanson and Bell 2007).

The temporal rhythm of seasonal migration depends on factors related to both the starting point and destination of the migration, as well as the aim of the migration: whether it is connected with seasonal work, studies or holidays. In the case of migration related to seasonal work, for example in agricultural regions the peak of population numbers occurs during the harvesting period (Perloff et al. 1998; Hanson and Bell 2007). At the same time, in the case of tourism-related migration, the peak in numbers takes place during the high season (Ashworth and Thomas 1999). In the case of holiday-related migration, three types of regions emerge in connection with seasonal rhythm: the summer peak; the winter peak; and the combined summer and winter peak. Cold climates and coastal regions have more residents during the summer than in winter (Stynes et al. 1997; Happel and Hogan 2002; Tress 2007). Areas with warm climates have more residents during the winter (Smith and House 2007). Mountainous regions, especially ski resorts, often have both summer and winter seasons (Bell and Ward 2000).

Since the seasonality of the location of the population arises from temporary migration, i.e. movement from one place to another, it is important to evaluate the starting points and destinations of changes in place of residence. In the case of seasonal labour migration, the movement is often from developing countries to developed countries (North America, Europe, Australia etc.); and in Europe the migration is from the newer, Eastern European member states westwards (Hess 2004). The seasonal movement of Mexican labourers to North America (Martin 2002) is a classic example of this. Based on the fields in which the use of seasonal labour is most common, the destinations of seasonal migration are agricultural and tourism regions.

At the national level, the starting point for seasonal migration related to consumption is often areas with colder climates (Gober and Mings 1984; Smith and House 2006); at the domestic level it is towns and cities (Ragatz 1970; Hiltunen 2007). In the case of both, the impetus is living conditions: in the case of the former the unfavourable climate; and in the case of the latter the poorer living conditions in towns and cities – the artificial environment, smaller apartments and so on. The destinations of seasonal migration in the case of consumption-related migration are mostly those which offer recreational value: coastal areas and lake districts (Stynes et al. 1997; Keen and Hall 2004;

Selwood and Tonts 2004; Hiltunen 2007; Tress 2007); mountainous areas (Jansson and Müller 2003 cit Hall and Müller 2004); areas with attractive landscapes (Coppock 1977; Wolfe 1977); areas boasting historical or unique atmospheres or climatic conditions (Krout 1983; Gober and Mings 1984; Hogan 1987; Smith and House 2007), areas offering sports opportunities, etc. Also popular as destinations of seasonal migration are resorts specially developed for tourism that offer a variety of services and events and are home to other holiday-makers. In addition to recreational factors associated with landscapes, another destination of seasonal migration connected with consumption is the second home districts close to larger towns and cities (Ragatz 1970; Clout 1971; Hall and Müller 2004). In this case the determining factor is the temporal distance from the town or city, i.e. from the person's permanent place of residence. Second home districts situated near towns and cities are mainly occupied on weekends.

In the case of seasonal migration, it transpires that the seasonality of social phenomena may also be connected to a specific social group that can be characterised using demographic, social and economic indicators. One important indicator in seasonal migration is age. Australian research (Bell and Ward 2000) has shown that temporary migration is greatest among those aged between 20 and 30, followed by those over the age of 65. In the 25–55 age group such activity is markedly higher among men than women. In the case of seasonal migration related to holidays, the availability of free time is a significant factor. Those able to change their place of residence according to the seasons are the elderly (Gober and Mings 1984; Stynes et al. 1997; Smith and House 2007) and those who are not tied down to one particular place and job. In the case of seasonal migration related to consumption, another important factor is a certain level of income that enables people to change their place of residence according to the seasons and to make the most of a second home or a better climate.

One of the identified causes of seasonality in changes in place of residence is the influence of the weather. The main reason for temporary relocation is migration to an area with a warmer climate, as can be seen in the movement of the population of the United States in the winter period from the northern states to the southern Sun Belt states. Here the majority of those making the move are older people (Krout 1983; Hogan 1987; Smith and House 2006). The weather is also important in terms of the use of second homes within one country, since outdoor activities, going to the beach and enjoying the sun play an important role here (Kaltenborn 1998; Tress 2007). The periods in which people can play sports and actively enjoy their hobbies, which are also affected by the seasonality of natural factors, have a significant influence on the residents of particular regions. This is most clearly visible in regard to skiing, particularly in mountainous areas. The periods in which people can play sports and enjoy their hobbies also affect the use of second homes in areas that are not in the mountains or near ski centres. Key activities around such homes include fishing, hunting and picking berries and mushrooms (Kaltenborn 1998), opportunities

for which depend on the seasonality of natural factors. The social phenomenon which bears the greatest influence on seasonal relocation is school holidays, particularly the long summer break (Tress 2007).

2.4.3. The seasonality of alcohol consumption

Alcohol as a seasonal phenomenon has been studied as a parameter reflecting the seasonality of social life. The phenomenon of alcohol is that it does not belong to the list of goods necessary to life, but it has penetrated very deeply into people's lives. The seasonality of alcohol consumption has been studied by several authors as an important indicator reflecting stress and recreation in society (Silm and Ahas 2005).

Many studies in European and North American countries regarding the seasonality of alcohol consumption show that there is a sharp peak in alcohol consumption in December, which is mostly caused by Christmas and New Year's Eve celebrations (Lemmens and Knibbe 1993; Uitenbroeck 1996). According to studies performed in the Netherlands, alcohol consumption rose 70% during the final 2 weeks of the year. In the case of wine, the increase was more than double; in the case of vodka it was 70%, and for beer only 40% in comparison to an ordinary week (Lemmens and Knibbe 1993).

In addition to an increase in alcohol consumption during December, there is also an increase during the summer months. On the basis of data from the state of Iowa in the USA, the number of alcohol users who consumed 5 centilitres or more of pure alcohol in alcoholic beverages per day rose by 36% in summer in comparison to the previous winter and dropped to 28% by the following winter (Fitzgerald and Mulford 1984 cit Cho et al. 2001). In Scotland, apart from December, the consumption of alcohol by men is highest at the end of August, and by women in the middle of October (Uitenbroeck 1996). In contrast, among Dutch people it has been found that if one disregards the sudden rise in alcohol consumption during the last 2 weeks of December, the highest average level of alcohol consumption is in spring and the lowest in autumn, when men's consumption represented 69–80% and women's 64–95% of their total spring consumption (Lemmens and Knibbe 1993).

Many scientists agree that alcohol consumption is one of the most difficult seasonal phenomena to explain (Fitzgerald and Mulford 1984; Lemmens and Knibbe 1993; Uitenbroeck 1996; Cho et al. 2001). Alcohol consumption can be motivated socially (holidays), physiologically (as a deterrent to cold or due to thirst) or emotionally. Emotional, physiological and indirectly also social motivations for alcohol consumption are frequently influenced by environmental factors.

3. DATA AND METHODS

The investigation of the seasonality of social phenomena is often complicated by a lack of sufficiently precise data sources. Statistical databases often only record indicators at annual intervals, while studies of seasonality require data to a degree of accuracy of at least monthly intervals.

Two main types of data sources are most commonly used in studies of seasonality: statistical databases/registers and surveys. Both have their disadvantages in such studies – databases and registers often only record data annually, while with surveys the limiting factor is people's ability to remember.

This thesis uses different types of data, both traditional (registry data and surveys) and more modern (a mobile positioning database). For clarity, they are divided thematically, which is also suitable in terms of the publications.

3.1. Place of residence

In this thesis the seasonal variation in the location of the population is evaluated on the basis of places of residence (Publication V). In order to determine places of residence, a new method of mobile positioning, or more precisely passive mobile positioning, was used instead of the usual method of registers and surveys. In order to verify outputs based on passive mobile positioning data, the distribution of place of residences was compared to the data from the Estonian Population Register (Publication IV).

3.1.1. Passive mobile positioning

In publications III, IV and V, the author has used the passive mobile positioning database of Estonia's largest mobile communications operator, EMT. Passive mobile positioning is data that is automatically stored in the memory or log files (billing memory; hand-over between network cells etc.) of mobile operators. The specific nature of passive mobile positioning and the way it differs from other mobile positioning methods is explained in greater detail in publication III. The data in the database were collected by Positium LBS, a mobile positioning company (www.positium.ee). EMT's market share in the field of mobile communications services in Estonia is 44%, as estimated by the mobile phone use survey carried out by TNS EMOR 2008, which means that slightly fewer than half of all mobile phone users in Estonia are included in the study. Approximately 95% of the population of Estonia use mobile phones (TNS EMOR, Mobile telephone use survey, 2008).

The database used in the study establishes the locations of (anonymous) call activities (calls and text mesaages initiated by the respondent) made on mobile phones via the EMT network with mobile antenna service area accuracy. The database determines the time of each call and the mobile antenna through which

it was transmitted. Every person (EMT network consumer) making a call activity is assigned a random identifying tag that ensures their anonymity and cannot be associated with a specific individual or telephone number.

The collection, storage and processing of the data obtained using the passive mobile positioning method conformed to all European Union requirements in terms of the protection of personal data (EC 2002), and separate approval was also sought from the Estonian Data Protection Inspectorate in May 2009. The issue of privacy and the fear of being 'spied on' are dealt with in greater detail in publication III.

The passive mobile positioning database has been recording data since 1 November 2006. An average of approximately 63 million call activities per month was recorded in the database through passive mobile positioning.

EMT's mobile communications network covers 99.9% of Estonia. Mobile antennas are unevenly distributed throughout the country, generally reflecting the location of the population and transport infrastructure. The accuracy of passive mobile positioning is therefore greater in more densely populated areas or in areas with denser networks of roads, and less accurate in more sparsely populated areas. The location and density of mobile antennas is shown in publication III (Figure 3).

3.1.2. Anchor points model

The anchor points method – which identifies the places people visit regularly – was used to determine people's places of residence each month. The model for determining these anchor points was developed by Positium LBS in cooperation with the Department of Geography of the University of Tartu. A detailed description of the model can be found in publication IV.

The model enables the places in which people have regularly made call activities to be identified separately for each month, and on this basis to distinguish home, work-time and secondary anchor points. The anchor points are those from which call activities are made. To determine the anchor points, the model sorts the locations of the call activities first by the number of days on which they were made and then, in the event of the number of days being the same, by the number of call activities. The two most frequently visited (called) anchor points are labelled 'everyday anchor points', while the remainder are labelled 'secondary anchor points'. The everyday anchor points are home anchor points and work-time anchor points (including schools and other regular daytime activities). The timing of call activities and the specialised filter based on standard deviation are used to distinguish between them. The accuracy of the locations of the anchor points is the network cell.

The anchor points model was developed in the course of a comprehensive analysis of questionnaires issued to 271 randomly selected clients and the breakdown of their call activities over the previous 24 months. 89% of home anchor points match the actual places of residence of the individuals. At the

national level, and compared to the data of the Population Register, the model quite accurately described the geography of the population (Publication IV, Figure 9). Publication IV presents a detailed comparison of the anchor points identified using the model with the data from the Population Register.

3.1.3. Factor analysis

The analysis of the seasonality of people's place of residence was carried out on the basis of municipalities and using factor analysis. In order to conduct the factor analysis, a matrix was produced on the basis of the home anchor points of the anonymous IDs that comprised the number of months of the study period and the number of municipalities with home anchor points. Exploratory factor analysis was then carried out in the Statistica 7 programme on this basis, using the principal components method. The first factor was seasonal rhythm, which describes 55% of total variation. The second factor describes 16% of variation, and the remaining factors less than 10%. Factor scores describe the seasonal variation and factor loadings the municipalities' correlation with the seasonality factor.

3.2. Alcohol consumption

The data related to alcohol consumption that is presented here is used in publications I and II. The seasonality of alcohol consumption is evaluated through the pre-consumption and post-consumption phenomena that preceded and followed the actual consumption of alcohol (Publication I, Figure 1). Consumption indicators are evaluated by alcohol type - beer, wine and vodka.

A variety of statistical data was used to evaluate alcohol consumption. The pre-consumption phenomena of alcohol evaluated were production volumes of beer, wine and vodka, excise entry and sales data drawn from the producers and the Statistical Office of Estonia for the years 1996–2002. The post-consumption phenomena analysed were alcohol-related traffic accidents (gathered by the Road Administration) and crimes (by the police), people registered in a house of detention (by Tartu House of Detention) and an alcohol treatment clinic (by Tartu Alcohol Treatment Clinic).

In addition, a survey was carried out among the students of University of Tartu, to determine their self-assessed beer, wine and vodka consumption over different months on a scale of 1–5 (1 = did not consume any alcohol to 5 = consumed a great deal of alcohol). For a representative sample, students from all of the 11 departments of Tartu University were represented in the survey: 1) first year, 2) second to fourth years, and 3) master's students and doctoral students. From the total list of students in each group, a randomly selected sample comprising two or three male and two or three female students from

each group was taken. Responses were received from a total 87 students (39 male and 48 female).

Specialist employees of the alcohol industry who deal with alcohol sales, production or other alcohol-related areas were interviewed. All of the areas analysed through alcohol consumption indicators on the basis of quantitative data were included in the interviews.

3.3. Dates of births

We used the Population Register database of the Ministry of Internal Affairs of Estonia, presented in publication II, for the analysis of births. This database includes all data on the dates of births of permanent residents and citizens residing in Estonia as of 1 January 2001. Of the data recorded in the Population Register, the author has used in the research only those parts of personal identity codes that described the gender and the birth (date/month/year). The database contains a total of 1,387,939 persons. In comparison, it could be pointed out that according to the data obtained from the official census conducted in 2000, the number of permanent residents of Estonia was 1,370,052 (Statistical Office of Estonia 2000). The data used in this research differ from those used in other similar research, because they encompass all births, regardless of what the person did in the future.

3.4. Meteorological Data

In the analysis of the social phenomena examined in the thesis (Publication I, II and V), climatic data derived from the database of the Estonian Meteorological and Hydrological Institute (EMHI) were used to evaluate the influence of natural phenomena. The primary phenomenon analysed in all of the publications describing seasonal social phenomena was air temperature.

4. MAIN RESULTS FROM THE STUDIES

In the case of all of the aspects of the studied social phenomena – the location of the population, alcohol consumption and births – there is statistical evidence of a seasonal rhythm in time series. Here I present the most prominent evidence from our studies in this area.

4.1. Seasonal variability of population numbers

The annual variation in the number of residents in Estonian municipalities clearly shows a contrast between summer and winter periods (Figure 1). Some municipalities have more residents in summer (June, July and August), and fewer from October to April; others exhibit the opposite rhythm, with fewer residents in summer than at other times of year. In areas where the population rises in summer, the number of residents in this period lasts for the three main summer months, rising sharply in June and falling again in September. The same tendency can be seen in areas where the population decreases in summer, in reverse, with the number of residents falling sharply in June and rising again in September. The number of residents in the winter period remains relatively stable from October to April. The seasonal rhythm of changes in population numbers was similar for both years studied, 2007 and 2008 (Figure 1). The number of people relocating may be as high as 67,000 or 5% of the total population of Estonia.

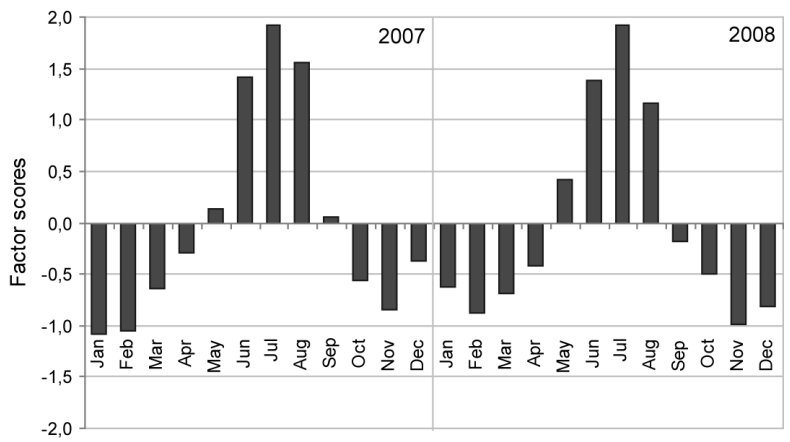

Figure 1. The seasonal pattern of the location of the population is described by factor 1, obtained as a result of factor analysis.

The seasonal rhythm of population numbers depends on geographical location. Municipalities in which the number of residents increases in summer are mainly located in coastal areas (on the shores of the Baltic Sea and Lake Peipus) and on

the islands (all of the municipalities on Hiiumaa and the majority of those on Saaremaa) (Figure 2). The opposite rhythm – with the number of residents falling in summer – can be seen in urban areas (the negative correlation (factor loadings) with the seasonality factor being more than 0.5). The drop in the number of residents in the summer months is most obvious in Estonia's largest city, Tallinn, where the negative correlation with the seasonality factor is more than 0.9. The number of residents of Tallinn fell in the summer months of 2007 by slightly more than 9000 people (14%) compared to February, and in 2008 the same figure was 9600 (15%).

In cities, the absolute number of seasonal migrants is highest but their proportion of the total population is small. In relative terms, the amplitude of variation in population numbers is highest in rural municipalities. In such areas, the average number of residents is approximately 30% higher in July than in February. In some rural municipalities seasonal migration can lead to an enormous rise in the population, for example in Alajõe municipality on the northern shores of Lake Peipus, where the number of residents increases by 400% (from 50 to 250) in summer.

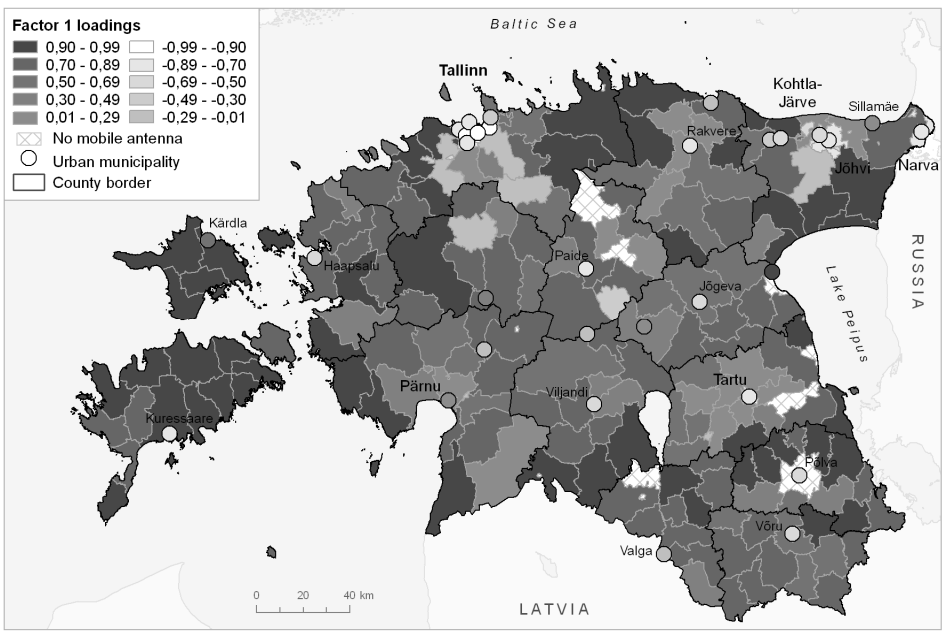

Figure 2. Municipalities' correlation with the seasonality factor.

4.2. Seasonal variability of alcohol consumption

The contrasting rhythm of summer and winter periods is evident in alcohol related phenomena. The most significant correlations with seasonality are found in the area of beer consumption. The standard deviation of beer consumption varies monthly from 2.26 (sales) to 2.36 (excise), whereas for wine and vodka it remains below 1.66 for all factors. Consumption of beer is higher in summer than in other seasons according to all analysed indicators (production, sales and excise) ($P<0.01$) (Publication I, Table 2). On average, the three summer months account for 34% of the annual total. Peaks in production come in May and June; peaks in excise in June and August; and peaks in sales in June (Figure 3). The lowest period of beer consumption is winter: this season is statistically different from the others in terms of sales and excise, but there is no statistical difference between winter and autumn in terms of production. The January and February percentages average 11.3% of the annual total for all indicators, and the average for these months is therefore approximately 5.4 percentage points lower than during the summer months.

The results of a survey among students from the University of Tartu also indicated higher consumption of beer during the summer months, when the number of students who consume 'quite a lot' or 'a lot' of beer increases markedly from June to August (Publication I, Figure 4). The lowest month was February. In the summer months the number of students who drink beer varies from 18–22%, while in other months this figure is below 14%. The number of students who do not drink beer decreases in summer, because many who do not drink it in winter do so in summer when it is hotter.

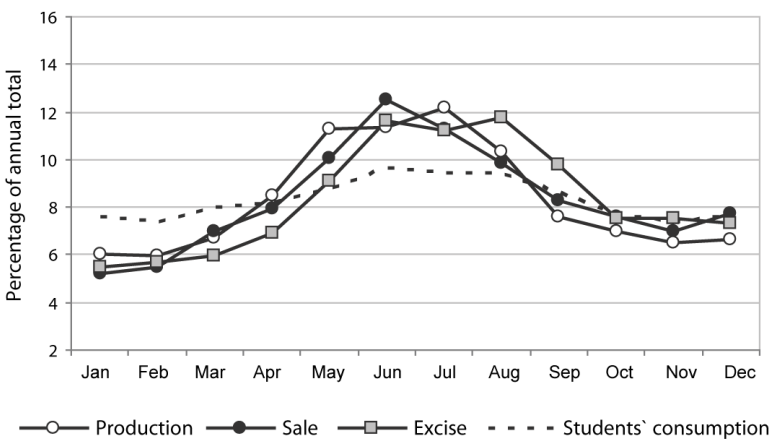

Figure 3. Average monthly beer production, sales and excise, and self-assessed beer consumption of students.

In the case of particular types of alcohol, the peak period in seasonal rhythm is in December. The rhythm of the Christmas period differs enormously from that of the rest of the year and is one of the statistical influences on the seasonality of social phenomena. Based on the results of a student survey, a peak in wine consumption is only seen in December. At the same time, sales of vodka in December differ to a statistically significant extent ($P<0.01$) from sales in other months (Publication I).

As a consequence of alcohol consumption, there is similar seasonal rhythm in traffic accidents caused by drunk drivers. A peak period can be observed from May to September (Figure 4). At a statistically significant level, the number of traffic accidents caused by drunk drivers is higher during the summer months – June to August – than during others ($P<0.01$). Of the traffic accidents caused by drunk drivers, 56.6% occur from May to September. The smallest number of traffic accidents caused by drunk drivers is in winter, with the least in February. In January and February the number of traffic accidents caused by drunk drivers is significantly lower than during other months.

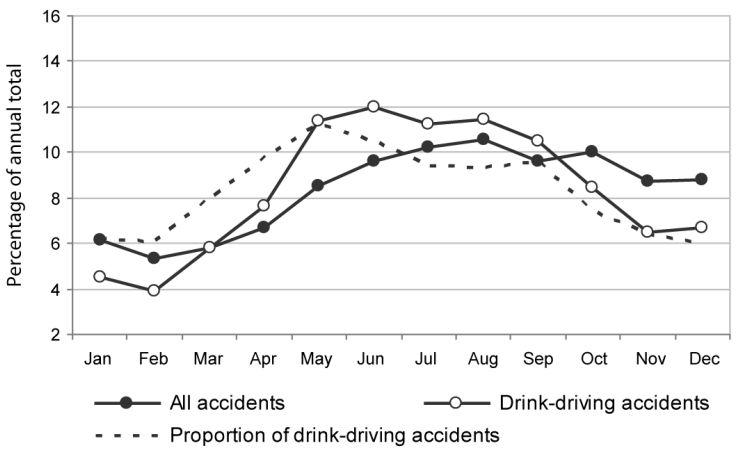

Figure 4. Monthly average of all traffic accidents and drinking and driving accidents compared to average proportion of drinking and driving accidents.

4.3. Seasonal variability of births

The births are unevenly distributed over the year; they have rather clear seasonal rhythm (Figure 5). The dates of births in the Estonian population peak in spring, with the lowest period occurring at the end of the year. The smallest number of birthdays occurs from 11 October to 31 October (on average 3453 per day), while the largest number occurs from 8 March to 28 March (on average 4084 per day) – the difference being 15%. The timing of calculated conception dates, which is averaged at 9 months (38 weeks) before birth, match the summer (maximum number of conceptions) and winter (minimum number of conceptions) seasons.

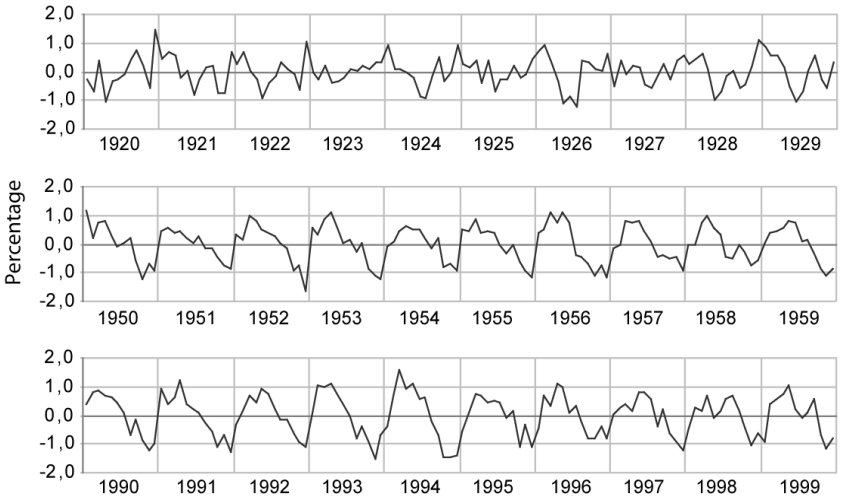

Figure 5. Averaged monthly deviation from the average annual birth rate.

The seasonal pattern of births studied over the last century has changed, with the turning point in Estonia being the mid-20th century (Figure 6). In the earlier period (1901–1943), the number of births increased during the second half of the year, peaking at the end of the year, while the smallest number of births occurred in spring and summer. In the modern era (1944–1999), the dynamics of births are opposite, with the peak arriving in spring, and the smallest number occurring in the second half of the year (Figure 6). This is most probably related with the transition from an agrarian society to an industrial one and the introduction of an urban lifestyle.

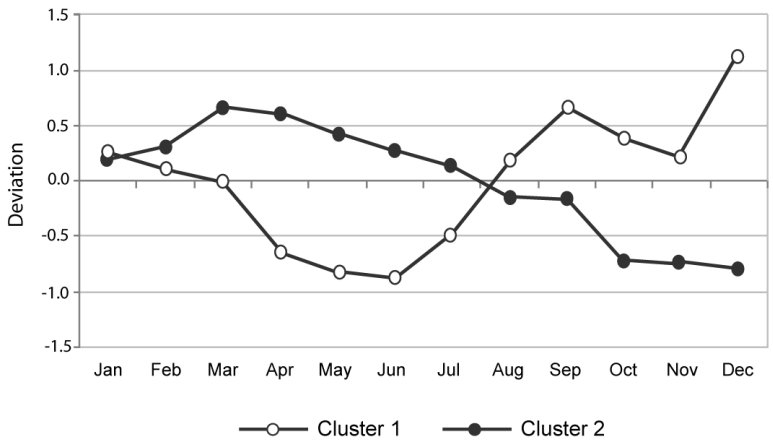

Figure 6. Two clusters depicting monthly deviation in the number of births. Cluster 1 depicts the years 1901–1943; cluster 2 depicts the years 1944–1999.

5. DISCUSSION

The results of the analysis carried out as part of this thesis into the seasonality of certain social phenomena revealed that seasonal differences in behaviour can be observed in Estonian society. The location of the population, alcohol consumption and births, all has a seasonal rhythm of one degree or another. Below we shall examine the results of the research based on the reasons for the seasonality of social phenomena specified in the theoretical framework.

5.1. Natural seasonal phenomena

All of the social phenomena studied, the one that is most directly influenced by natural factors is alcohol consumption. The best parameter for determining the influence of weather on alcohol consumption is air temperature (Figure 7). According to interviewed people employed in the alcohol industry, air temperature is the main reason behind the greater consumption of beer and wine in summer; people drink to quench their thirst. The average monthly air temperature correlates at a statistically significant level with beer-related phenomena and with the number of traffic accidents caused by drunk drivers. Vodka consumption has a weak relationship with negative air temperatures.

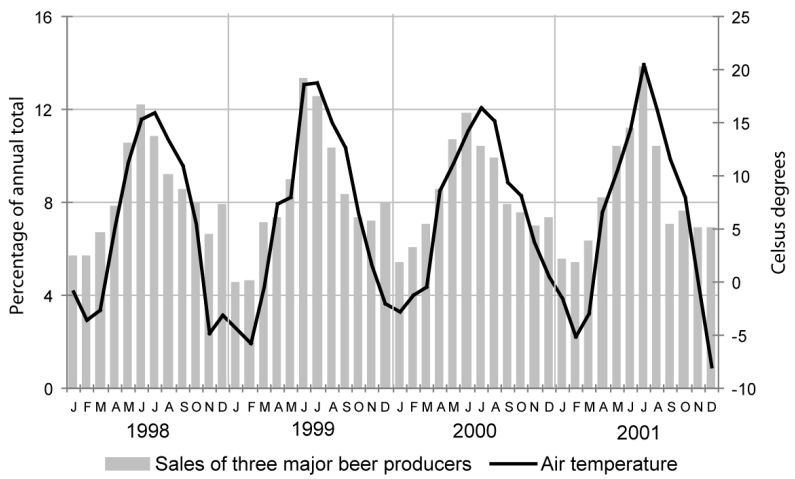

Figure 7. Monthly average air temperature at Türi observation station and sales of three major beer producers.

In the case of beer sales and production, the correlation with air temperature is strong; the coefficients are 0.79 and 0.84 respectively, but with excise the coefficient is slightly lower (r=0.63). The relationship between air temperature

and the number of traffic accidents caused by drunk drivers is also strong (r=0.71). Alcohol consumption in the summer period is also influenced by rainfall; during cool and rainy summers the media report that beer consumption decreases considerably, and the income of those employed in the alcohol industry decreases accordingly. At the same time, 87% of the students in our survey (Publication I) said that air temperature had 'little' or 'no' influence on their alcohol onsumption; only 8% considered air temperature an influential factor.

There is no correlation between air temperature and births, although the pattern of conception is quite similar to air temperature changes throughout the year. A more detailed analysis of conception indicated that deviations in air temperature do not produce deviations in the number of babies conceived. Nevertheless, the fact that a month with a significantly higher or lower air temperature does not lead to a higher or lower rate of conception on average does not necessarily mean that there is no relation between air temperature and conception.

It is most probable that the weather has some influence on temporary relocation and people's use of second homes. Clearly, at times of poor weather fewer people visit their second homes than at times when the weather is good. However, no direct connection between natural factors, including the weather, and temporary relocation could be identified in the study submitted as part of this thesis.

5.2. Biological clock: processes that take place within people

Humans, like all organisms that inhabit the Earth, are influenced by the seasonal variation in environmental conditions, as a result of which a number of internal biochemical and physiological processes also vary according to the seasons, and as a result so do the behaviour and activities of the said organisms.

The effect of the processes that take place within people on the seasonality of social phenomena is very difficult to determine. This is an issue that chronobiologists and more recently geneticists have been studying for many years. In the case of the social phenomena analysed as part of this thesis, the effect of people's internal processes cannot be directly proven, although there are nevertheless some factors that may influence the analysed phenomena.

One aspect that indisputably influences people's behaviour is emotions. For example, according to our student survey the consumption of alcohol increases during the spring break. One reason for this may be the passing of the long, dark northern winter: people are cheered at the arrival of spring and want to celebrate it. During these celebrations people frequently drink a great deal of beer and wine. Drinking in the autumn, in contrast, is frequently caused by a depressive state of mind resulting from changes in the psyche (Sher 2002).

People's emotional state is influenced by the seasons through radiation and the length of the photoperiod, which cause both 'vernal happiness' and 'winter depression'. The trigger for the emotional state that induces drinking is environmental change, which is quite easily discernable.

Seasonal variation in births may be caused by processes taking place within people, for example variation in factors affecting the balance of hormones that influence sexuality, which, through conception, affects the seasonal rhythm of births. The extent of the role biology plays in the variation in births and the role social factors (family planning) play is not entirely clear.

Seasonal variation in people's emotional state and their level of activity also influences the seasonal variation in the location of the population. This influence is, however, very indirect and therefore difficult to pinpoint.

People are often unaware of the factors influencing their behaviour or of which factor plays the most important role. This is particularly true of factors related to processes that take place within people (biological clock): they are unaware of their influence on their behaviour. Also, indirect indicators do not enable us to identify such behaviour and its causes. Nevertheless, scientists studying seasonal patterns of behaviour in the animal kingdom have identified and proven seasonal tendencies in higher species as mammals (chapter 2.3). Based on research in animals, the author of this thesis feels emboldened to posit that seasonal processes also occur in the human body, either manifestly or covertly. They are clearly not completely disguised or concealed by our 'social I': certain phenomena are occasionally recognisable. Seasonal depression (SAD) is common in many areas subject to dark autumns, while in spring people are more open and active. In order to uncover these processes programmed into us, we need to utilise new research methods and indicators. For example, there could be opportunities here for the implementation of experience that has been gathered in environmental psychology or the conducting of experimental research.

5.3. Social phenomena directly influenced by the seasonality of natural phenomena

The influence of social phenomena such as gardening, tourism, outdoor sports and hobbies and recreation, which are directly affected by the seasonality of natural phenomena, is most obvious among the phenomena studied in the seasonal variation in the location of the population. Seasonal relocation, which in Estonia is most commonly associated with visits to summer or second homes, is clearly influenced by gardening and often also particular hobbies, such as fishing and berry or mushroom picking.

Activities that are directly dependent on natural conditions also influence alcohol consumption. Such activities are generally those that take place outdoors, generally in the summer months, such as vacations and barbecues.

5.4. Social phenomena indirectly influenced by the seasonality of natural phenomena

Social phenomena indirectly influenced by the seasonality of natural phenomena, such as traditions – the calendar, holidays, vacations, etc. – have a significant influence on annual variations in most of social phenomena as the location of the population, alcohol consumption and births.

The effect of indirect social factors has been most clearly demonstrated in the case of alcohol consumption. 35% of students surveyed believe that national holidays and celebrations have an impact on alcohol consumption. In the opinion of both these students and specialists in alcohol-related phenomena who were interviewed, alcohol consumption is mainly influenced by year-end celebrations (Christmas and New Year's Eve), Midsummer Day and the spring holidays. 57% of respondents considered New Year's Eve and 50% Midsummer Day to have a 'significant' or 'highly significant' impact on alcohol consumption. The impact of New Year's Eve can mainly be seen in the increase in wine- and vodka-related phenomena in December. The impact of Midsummer's Day can mostly be seen in consumption of beer, and to a lesser extent wine and vodka, because of the higher air temperatures in summer. Moreover, the number of traffic accidents caused by drunk drivers increases during the Midsummer holiday period. A specific role is also played by the spring holidays (30 April and 1 May), when alcohol consumption increases markedly.

The alternation in work and rest time influences people's places of residence. This can be seen in the increase in the number of residents of rural areas and the decrease in the number of city dwellers in the summer months (July to August), which is the typical holiday period in Estonia.

5.5. Society and environment

The seasonality observed in social behaviour is not a fixed phenomenon: it is influenced by a large number of internal and external factors. The social factors that have the greatest effect on seasonal rhythm are unquestionably social organisation and connection with nature. Communities that are directly connected with the natural world, such as farming and fishing communities or simply those who live in the countryside are directly and significantly influenced by seasonality. Seasonality can be observed in many factors in rural areas, where people live in accordance with the rhythm of nature. Conversely, industrial society and the urban environment enable people to live independently of the rhythm of nature, and seasonal factors are therefore less noticeable. Nevertheless, city dwellers are often connected to seasonality through their recreational activities. Our analysis has shown that one of the most influential indications of seasonality – seasonal migration – is based on the urban environment. Its cause is clearly also a certain opposing reaction: people

removed from the natural environment want to get back to it, at least during their free time. How people time the visits they make to their second homes, why they time them in that way and how they spend that time are subjects that require a great deal more study. In Scandinavia it can be seen that a second home is part of people's lifestyles, and this is closely connected to traditions and circles of acquaintances (Hall and Müller 2004). However, in Eastern Europe second homes are often associated with gardening and seen as important in providing families with food (Leetmaa et al. 2009). Estonia lies somewhere between, or overlapping, these two factors, with people from different backgrounds using the free time available to them in different ways.

Rather general analysis of the seasonality of births in Estonia highlighted an intriguing connection with seasonality (Publication II): the results showed a connection between the seasonality of births and social organisation. In the transition from an agrarian society (i.e. a rural lifestyle) to an industrial society (i.e. an urban lifestyle), the seasonal rhythm of births underwent a marked change (see chapter 4.3). Since much that is related to the seasonality of births cannot be directly explained by family planning (Roenneberg and Aschoff 1990; Lam and Miron 1994), a more detailed treatment and investigation of the subject would offer an opportunity to discover more complex connections in the field of seasonal human behaviour. It may also represent one way of revealing new aspects in the contrast between culture and body. Studying the connections between people's biological and social 'rites' would also provide new geographical knowledge. Recreation, tourism, hobbies and where people choose to partake in them are all closely connected with seasonality and environmental factors. Such studies are likely to develop alongside gene research, a field in which some exciting connections have been identified (Deen at al. 2001; Hofman 2004) – presumably the first of many. Geographers are able to apply these studies in their own research into social phenomena and spatial behaviour.

5.6. About methods

The methods employed in this thesis are one step towards more effective studies of the temporal and spatial aspects of seasonality. Traditional methods making use of databases and surveys provide answers to the question of whether our behaviour is seasonal. They also enable us to identify the causes of seasonality. The mobile positioning methods developed as part of the thesis and used for it represent a new and interesting tool in studies of everyday behaviour. Whereas ordinary statistical data is collected at intervals of up to several years, and registry data is only updated when a new event occurs, mobile positioning data is more accurate in both temporal and spatial terms. It is of potential use in pinpointing behavioural differences between seasons and within social groups, and from there in studying connections between seasonality and the human environment in general. The seasonal relocation refered in this thesis is one example in this field. The model for the calculation of personal anchor points

(Publication IV) that is used for the thesis has advantages and disadvantages. For example, one problem is the insufficient number of calls made by mobile phones, which does not enable places of residence and work places to be calculated with the degree of accuracy we would prefer. Another problem is the excessive size of mobile network cells in regional areas, which is why it is not possible to distinguish with any accuracy the places of work and residence of a large number of people living in the countryside. Of course, many rural residents work on their farms, so there is little difference, but the model still needs to be perfected here. The fact that the data is too quantitative, that there are large numbers of location points and that very little other information is available about people is also a problem. This, however, stems from the issue of privacy: the tracking of mobile data is a sensitive topic, and some people fear being 'spied on'. Although the data we use is anonymous and complies with all European Union regulations, there remains plenty of room for debate. This thesis does not examine that debate in great detail.

6. CONCLUSIONS

The changing of the seasons is a complex of factors that have a significant impact on the natural world and human society and whose origins are primarily physical. The seasonality is often considered to be self-explanatory, and it is for this reason that the role of seasonality is underestimated in studies and in the organisation of everyday life. This thesis was designed to identify the extent to which the behaviour of human society is influenced by the changing of the seasons and the factors that affect it. While most work based on natural seasonality and phenology is guided by an environmentally deterministic approach, this thesis analysed social phenomena from a viewpoint that does not consider the causes of seasonality to be directly dependent on natural phenomena alone, but also on processes that take place within persons and social phenomena that are either directly or indirectly influenced by natural phenomena.

Based on the empirical research carried out as part of the thesis – the location of the population, alcohol consumption and births – it can be claimed that a number of social phenomena have a seasonal rhythm in Estonia. Like natural conditions, the seasonal rhythm of social phenomena is characterised by a distinction between two contrasting seasons – summer and winter. Of the phenomena studied, summer and winter are most clearly distinguished by the indicators for the location of the population and alcohol consumption.

The analysis of seasonal relocation revealed that the number of residents increases in rural areas – mainly those in coastal areas (on the shores of the Baltic Sea and Lake Peipus) and on the islands (all of the municipalities on Hiiumaa and the majority of those on Saaremaa) – during the summer period, particularly in the months June, July and August. At the same time, the number of people residing in urban areas, especially Tallinn, decreases. During the non-summer period (from October to April), the number of residents of both rural and urban areas is relatively stable. This number increases by an average of 30% and by as much as 400% (in Alajõe municipality, for instance) in areas subject to extensive seasonal variation. The total number of people who change their place of residence seasonally is approximately 67,000 or 5% of the Estonian population.

Some alcohol consumption indicators also show clear seasonal variation and regularity. Our research revealed that consumption of beer is seasonal and can be tracked against changes in air temperature. An average of 34% of all of the beer consumed in a year is consumed in the three main summer months. The lowest period of beer consumption occurs in winter, with an average of 5.4 percent points less beer being consumed in January and February than in summer months. A survey we conducted among university students showed that the increase in consumption of beer in the summer months is connected with an increase in the number of beer drinkers, not an increase in the amount of beer drunk, with many who do not drink beer in winter doing so in summer, when

the weather is warmer. Greater alcohol consumption in the summer months is also reflected in drink-driving accidents statistics.

Our research has also demonstrated that there is a notable seasonal variation in terms of births, but here the contrasting seasons are not summer and winter, but spring and autumn. The fewest number of birthdays fall in October, and the greatest number in March, with a difference of up to 15% between the two. However, the seasonal rhythm of births did not remain constant throughout the century under study: a shift can be seen from the middle of the 20th century onwards. This can be connected with Estonia's transition from an agrarian society in which rural lifestyles were dominant to an industrial society in which urban lifestyles have taken precedence.

While there is an obvious reason for the seasonality of natural phenomena – the annual variation in climatic conditions – the seasonality of the phenomena that occur in human society is much more complex. Here seasonality is influenced by both the natural environment and the organisation and rules of society. The causes of seasonal variation in social phenomena are divided into four groups: seasonal variation in natural phenomena (1), the biological clock or the processes that take place within people, which are influenced by natural phenomena (2) and social phenomena that are either directly (3) or indirectly (4) influenced by the seasonal variation in natural phenomena.

Studies of natural phenomena have indicated that air temperature regime has the most direct effect on social phenomena. The best example from our research is the connection between air temperature and alcohol consumption. The amount of beer consumed increases in the summer period, when people drink to quench their thirst. The average monthly air temperature correlates to a statistically significant degree with phenomena related to beer consumption (production, sales and excise) and car accidents caused by drunk drivers.

The most important social phenomena that are directly influenced by the seasonality of natural phenomena are seasonal activities such as gardening, outdoor sports, tourism and recreation. Among the phenomena studied, the effects of these activities can be most clearly seen in the location of the population. With second homes or summer houses, which are the main reason for seasonal relocation in Estonia, the key activities are also those taking place outdoors: gardening, sports and seasonal activities such as berry and mushroom picking. Outdoor and recreational activities also influence alcohol consumption.

In addition to activities directly influenced by natural conditions, people's behaviour and decisions are also influenced by traditions that were originally necessitated by the seasonality of the natural environment, but which today, as a result of choices, have become social factors. These include the calendar, holidays and vacation periods. The influence of indirect social phenomena is noticeable in the location of the population, alcohol consumption and births. The location of the population is most closely affected by work and holiday time. People tend to visit their second homes or summer houses during vacation periods, which is why it is mainly during such periods, in the summer months, that the number of residents of rural areas increases at the expense of the

number of residents of urban areas. The different annual rhythm of work and holiday time can be seen in the change in the dynamics of the seasonality of births during the 20th century. In the agrarian society (i.e. rural lifestyle) of the first half of the century, the main work periods were the summer months: people rested in winter, and births were normally planned for autumn and winter, when there was less work to do. But in the industrial society (i.e. urban lifestyle) of the second half of the century, the winter period has become the active time for work, with holidays being taken in summer and families preferring to have children in spring, a time of good weather and vacations. The consumption of alcohol is influenced by indirect social phenomena, but primarily by particular days, first and foremost among them being Christmas and New Year's Eve, Midsummer's Day and the spring holidays. New Year's Eve primarily affects the consumption of wine and vodka, while Midsummer sees an increase in the consumption of beer. Midsummer also sees a rise in the number of alcohol-related traffic accidents.

The seasonality of social phenomena is also influenced by the processes that take place within us called as biological clock: for example, alcohol consumption is influenced by the annual variation in emotion (e.g. winter depression, improved mood in spring). However, the effect of these processes is not directly proven in this thesis.

In order to more comprehensively study the social dimensions of seasonality, both passive and experimental research methods need to be introduced in research into the connections between people and their environment. Moreover, the study of the geographical aspects of seasonality offers extensive possibilities to learn more about the structural and internal aspects of seasonal behaviour. One possibility is to apply more precice spatio-temporal datasets that could help to discover details of everyday mobility and activity spaces. There are also possibilities for the study of internal processes and the biological clock in connection with genetic research. This thesis highlights only one of these options.

SUMMARY IN ESTONIAN

Ühiskonnanähtuste sesoonsus Eestis: rahvastiku paiknemine, alkoholi tarbimine ja sünnid

Aastaaegade vaheldumine on Eesti loodust ja elukorraldust oluliselt mõjutav tegur. Talv, suvi ja üleminekuaastaajad on oluliseks osaks meie looduses ja kultuuris. Aastaaegade vaheldumine on nii loomulik, et üldjuhul arvestatakse sellega vaikimisi. Ühiskonnanähtuste sesoonsuse tundmine on oluline mitmest aspektist. Esiteks on sesoonsuse temaatika süstemaatiline kaasamine vajalik ühiskonnaelu planeerimisel ja korraldamisel. Teiseks aitab sesoonse käitumise tundmine mõista indiviidi ja ühiskonna seost väliskeskkonnaga. Oluliseks väljakutseks on võimalus seletada läbi ajaloo teadlastele huvi pakkunud teemat: inimese keha ja vaimu vastandumist. Kolmandaks on sesoonsus oluline indikaator ühiskonna ja looduse seose kirjeldamisel. Looduslähedased ja jätkusuutlikud ühiskonnad elavad looduse rütmidega arvestades, looduse rütmide eiramiseks peab aga palju energiat kulutama.

Käesolev doktoritöö käsitleb ühiskonnanähtuste sesoonsust Eestis. Eesmärgiks oli välja selgitada kui palju sõltub inimeste käitumine aastaaegade vaheldumisest ning missugused tegurid seda mõjutavad. Autor leiab, et sesoonsus on meie ühiskonnas märgatav paljudes eluvaldkondades ning see on väga oluline tegur, mis on mõjutatud nii looduslikest kui sotsiaalsetest teguritest.

Doktoritöö koosneb ülevaatlikust osast ning viiest publikatsioonist, millest kolm (I, II ja V) käsitlevad valitud ühiskonnanähtuste (alkoholi tarbimine, sünnid ja rahvastiku paiknemine) sesoonsust ja seda mõjutavaid tegureid ning kaks ülejäänut annavad ülevaate artiklis V kasutatud passiivse mobiilpositsioneerimise andmetest (III) ning nende põhjal loodud ankurpunktide mudelist (IV), mille kaudu on analüüsitud inimeste ajalis-ruumilise käitumise sesoonsust.

Ühiskonnanähtuste sesoonsuse analüüsimiseks on kasutatud erinevat tüüpi andmeid, nii traditsioonilisi kui ka suhteliselt uudset mobiilpositsioneerimist. Passiivse mobiilpositsioneerimise andmete põhjal on leitud 2007. ja 2008. aasta kohta ankurpunktide (regulaarselt külastatavate kohtade) meetodil inimeste elukohad, millest lähtuvalt on analüüsitud rahvastiku paiknemise sesoonset varieerumist. Traditsioonilistest meetoditest on alkoholi tarbimise analüüsimisel kasutatud statistilisi andmeid, mis pärinevad erinevatest ametkondadest: Eesti Statistikaamet, Maanteeamet, Politseiamet, Tartu arestimaja, Tartu A-polikliinik ning erinevatelt alkoholi tootmise ja müügiga tegelevatelt ettevõtetelt. Andmed kajastavad perioodi 1990–2002. Lisaks on viidud 2003. aastal läbi küsitlus Tartu ülikooli üliõpilaste hulgas ning intervjueeritud alkoholi tootmise, müügi ja teiste alkoholi tarbimisega seotud valdkondade spetsialiste. Sündide analüüsimiseks on kasutatud Rahvastikuregistri andmeid, mis kajastavad kõigi 1. jaanuar 2001 seisuga alaliselt Eestis elanud inimeste sugu ning sünnikuupäeva, kokku 1 387 939 inimest.

Sesoonsuse uurimine sai alguse looduses esinevate nähtuste aastasisese varieerumise kirjeldamisest, kuid juba peaaegu pool sajandit on tegeletud ka

ühiskonnanähtuste sesoonsuse uurimisega. See on aga suhteliselt fragmenteerunud, sesoonselt varieeruvaid nähtusi on uuritud eraldiseisvana mitmes spetsiifilises valdkonnas käsitledes sesoonsust peamiselt kui nähtust iseloomustavat tunnust, mitte aga kui iseseisvat uurimisobjekti. Ühiskonnanähtuste sesoonsuse uurimise võib jaotada 4 suuremasse valdkonda: 1) inimene kui bioloogiline olend, mille alla liigituvad uuringud, mis käsitlevad inimese siseste bioloogiliste protsesside, toitumise, haiguste, meeleolu ning sündide ja surmade sesoonsust; 2) inimeste käitumine, kus sesoonsus on iseloomulik näiteks alkoholi tarbimise, liiklusõnnetuste ja kuritegude puhul; 3) inimeste paiknemine, kus avaldub sesoonsus turismi, teise kodu külastamise ja hooajalise töö puhul; 4) majandus, kus on tegeletud rahavoogude, hindade, börsi ja investeerimise aktiivsuse sesoonsusega.

Looduskeskkonna nähtuste uurimiseks on olemas selge metodoloogia, seda uuritakse lähtuvalt kliimatingimuste sesoonsest varieerumisest. Ühiskonnanähtuste puhul ei ole aga ühte selget sesoonsuse põhjust, ühiskonnanähtuste sesoonsus on palju komplekssem. Ühiskonnanähtuste sesoonsuse käsitlemisel on lähtutud inimese ja looduse vastasmõjust. Vastavalt sellele on käsitletud ühiskonnanähtuste sesoonsuse põhjuseid lähtuvalt 4 tüüpi teguritest: 1) looduslikud sesoonsed nähtused (temperatuur, sademed, tuul jms); 2) bioloogiline kell ehk inimese sisesed protsessid, mis on mõjutatud looduslikest teguritest, näiteks melatoniini ja serotoniini tootmine ning sellest mõjutatud emotsionaalsus; 3) sotsiaalsed tegurid, mis on otseselt mõjutatud looduslikest teguritest näiteks põllumajandus, turism, väljas harrastatavad spordialad ja hobid, rekreatsioon; 4) sotsiaalsed tegurid, mis on kaudselt mõjutatud looduslikest teguritest, näiteks traditsioonid, rahvakalendri tähtpäevad, töö- ja puhkeaja vaheldumine, koolivaheajad jms.

Asendi tõttu parasvöötmes on Eesti hea näide riigist, kus inimesed ja ühiskond on mõjutatud aastaaegade vaheldumisest. Selgelt eristuvad neli aastaaega, kaks vastandlikku põhiaastaaega (suvi ja talv) ning kaks üleminekuaastaaega (kevad ja sügis). Uuritud nähtuste põhjal võib öelda, et ka ühiskonnanähtuste sesoonsuses esineb vastupidine dünaamika suvel ja talvel. Elanike arv suureneb suvekuudel (juuni-august) maalistes omavalitsustes, eriti rannikualadel ja saartel ning väheneb linnalistes omavalitsustes. Oktoobrist aprillini on elanike arv nii maalistes kui linnalistes omavalitsustes suhteliselt stabiilne. Sarnaselt õhutemperatuuri käiguga muutub ka alkoholi tarbimine, eelkõige õlle tarbimine. Õlle tarbimise kõrgperiood on suvel, kui tarbitakse 34% kogu aasta kogusest, ning madalperiood talvel (jaanuaris ja veebruaris), mille osatähtsus on 5,4 protsendipunkti madalam kui suvekuudel. Suvekuude suurem alkoholi tarbimine kajastub ka alkoholi joobes põhjustatud liiklusõnnetuste statistikas. Sündide puhul ei ole vastandlikeks aastaaegadeks mitte suvi ja talv, vaid kevad ja sügis. Sünnikuupäevasid on kõige rohkem märtsis ja vähem oktoobris, erinevus on kuni 15%. Sündide sesoonne rütm ei ole aga kogu uuritud sajandi jooksul olnud ühesugune, erinevus tuleb esile 20-nda sajandi keskpaigas. Seda võib seostada üleminekuga agraarühiskonnast, kus valitses maaline elustiil, industriaalühiskonda, kus muutus valdavaks linnaline elustiil. 20-nda sajandi

esimese poole agraarühiskonnas oli sündide maksimum sügisel, suurenedes aasta lõpu poole, miinimum aga kevad-suvel. Sajandi teise poole industriaalühiskonnas oli sündide dünaamika aga muutunud vastupidiseks, sündide maksimum oli kevadel ja miinimum aasta lõpul.

Uuritud ühiskonnanähtuste sesoonsuse põhjused on jaotatud eelnevalt nimetatud nelja sesoonsuse põhjuste gruppi. Looduslikest teguritest mõjutab sesoonsust kõige rohkem õhutemperatuur. Kuu keskmine õhutemperatuur korreleerub statistiliselt olulisel määral õlle tarbimisega seotud nähtustega (tootmine, müük, aktsiisi laekumine) ning liiklusõnnetustega, mis on põhjustatud joobes juhtide poolt. Sündide puhul on viljastumiste muster temperatuuri käiguga suhteliselt sarnane, kuid statistiliselt olulist seost nende vahel ei ole tõestatud. Sotsiaalsed nähtused, mida mõjutab otseselt looduslike nähtuste sesoonsus, avaldavad mõju rahvastiku paiknemisele. Sesoonsed tegevused nagu aiapidamine, sport ja harrastused mõjutavad teise kodu või suvekodu külastamist. Samuti on väliüritustest ja rekreatsioonilistest tegevustest mõjutatud alkoholi tarbimine. Oluliseks ühiskonnanähtuste sesoonsuse põhjuseks on ka kaudsed sotsiaalsed tegurid. Rahvastiku paiknemisele avaldab nendest kõige rohkem mõju töö- ja puhkeaja vaheldumine, teise koju minnakse peamiselt puhkuste perioodil. Töö- ja puhkeaja mõju sesoonsusele tuleb esile ka sündide sesoonsuse dünaamika muutuses 20-nda sajandi jooksul. 20-da sajandi esimese poole agraarühiskonnas (maaline elustiil), kui peamiseks tööperioodiks olid suvekuud ja puhati talvel, eelistati lapsi sünnitada sügisel ja talvel, kui oli vähem tööd. 20-nda sajandi teise poole industriaalühiskonnas (linnaline elustiil) on muutunud aktiivseks töö tegemise ajaks aga talveperiood ja puhatakse suvel ning lapsi eelistatakse saada kevadel, kui on ilus ilm ja algab puhkuste aeg. Alkoholi tarbimist mõjutavad kaudsetest sotsiaalsetest teguritest kõige enam tähtpäevad, peamiselt jõulud ja aastavahetus, jaanipäev ning maipühad. Ilmselt mõjutab ühiskonnanähtuste sesoonsust ka bioloogiline kell ehk inimese sisesed protsessid, näiteks alkoholi tarbimist emotsionaalsuse aastasisene varieerumine (talvine väsimus ja tärkav õnnetunne kevadel), aga seda mõju pole käesolevas uuringus otseselt tõestatud.

ACKNOWLEDGEMENTS

I am grateful to my supervisor Rein Ahas for his contributions during my studies. Many thanks also to the Mobility Study Group of Chair of Human Geography and Regional Planning in Tartu University: Anto Aasa, Erki Saluveer, Margus Tiru, Olle Järv, Mari-Liis Lamp and my colleague Kadri Leetmaa. The work was partly funded by Grant of Estonian Science Foundation No. ETF7562 and Estonian Information Technology Foundation (EITSA). I am also very grateful to my family and friends, who have supported and believed in me.

REFERENCES

Ahas, R., Aasa, A., Mark, Ü., Pae, T. and Kull, A. (2007) Seasonal tourism spaces in Estonia: Case study with mobile positioning data. *Tourism Management* 28: 898–910.

Ahas, R., Aasa, A., Silm, A. and Roosaare, J. (2005). Seasonal Indicators and Seasons of Estonian Landscapes. *Landscape Research* 3(2): 173–191.

Ashworth, J. and Thomas, B. (1999) Patterns of seasonality in employment in tourism int he UK. *Applied Economics Letters* 6: 735–739.

Bar-On, R.V. (1975) *Seasonality in Tourism*, London: Economist Intelligence Unit.

Bartness, T.J. (1995) Short day-induced depletion of lipid stores in fat pad- and gender-specific in Siberian hamster. *Physiol. Behav.* 58: 539–550.

Bartness, T.J., Powers, J.B., Hastings, M.H., Bittman, E.L. and Goldman, B.D. (1993) The timed infusion paradigm for melatonin delivery: What has it taught us about the melatonin signal, its reception, and photoperiodic control of seasonal responses? *J. Pineal Res.* 15: 161–190.

Baum, T. and Lundtrop, S. (2001) *Seasonality in Tourism*, Amsterdam-London-New York-Oxford-Paris-Shannon-Tokyo: Pergamon.

Bell, M. (2004) *Measuring Temporary Mobility: Dimensions And Issues*, Queensland Centre for Population Research, School of Geography, Planning and Architecture, The University of Queensland. (Discussion Paper).

Bell, M. and Ward, G. (2000) Comparing Temporary Mobility with Permanent Migration. *Tourism Geographies* 2(1): 97–107.

Bernstein, J. (1998) *Seasonality Systems, Strategies and Signals*, John Willy & Sons.

Bouman, S. and Jacobsen, B. (2002) The Halloween indicator, Sell in May and go away: Another puzzle. *American Economic Review* 92(5): 1618–1635.

Bradshaw, W.E. and Holzapfel, C.M. (2007) Evolution of Animal Photoperiodism. *Annual Review of Ecology, Evolution, and Systematics* 38: 1–25.

Butler, R.W. (2001) Seasonality in Tourism: Issues and Implications. In: Baum, T. and Lundtrop, S. (Eds.) *Seasonality in tourism*, Amsterdam-London-New York-Oxford-Paris-Shannon-Tokyo: Pergamon, pp. 5–21.

Carre, M., Klaric, L., Lavallee, D., Julien, M., Bentaleb, I., Fontugne, M. and Kawka, O. (2009) Insights into early Holocene hunter-gatherer mobility on the Peruvian Southern Coast from mollusk gathering seasonality. *Journal of Archaeologiacal Science* 36: 1173–1178.

Centola, G. and Eberley, S. (1999) Seasonal variations and age-related changes in human sperm count, motility, motion parameters, morphology, and white blood cell concentration. *Fertility and Sterility* 72: 803–808.

Charles-Edwards, E., Bell, M. and Brown, D. (2008) Where people move and when: temporary population mobility in Australia. *People and Place* 16(1): 21–30.

Cho, Y. I., Johnson, T.P., and Fendrich, M. (2001) Monthly Variations in Self-Reports of Alcohol Consumption. *Journal of Studies on Alcohol* 62(2): 268–272.

Clout, H.D. (1971) Homes in the Auvergne. *Geographical Review* 61(4): 530–553.

Coppock, J.T. (1977) Second homes in perspective. In: Coppock, J.T (Ed.) *Second Homes: Curse or Blessing?*, Oxford: Pergamon, pp. 1–16.

Cowgill, U.M. (1966) Season of Birth in Man. Contemporary Situation with Special Reference to Europe and the Southern Hemisphere. *Ecology* 47(4): 614–623.

Dark, J. and Zucker, I. (1983) Short photoperiods reduce winter energy requirements of the meadow vole, Microtus pennsylvanicus. *Physiol. Behav.* 31: 699–702.

Deen, S., Albrecht, U., van der Horst, G.T.J., Illnerova, H., Roenneberg, T., Wehr, T.A. and Schwartz, W.J. (2001) Assembling a Clock for All Seasons: Are There M and E Oscillators in the Genes? *Journal of biological rhythms* 16(2) 105–116.

de Garine, I. (1993) Culture, seasons and stress in two traditional African cultures (Massa and Mussey). In: Ulijaszek, S.J. and Strickland, S.S. (Eds.) *Seasonality and human ecology*, Cambridge University Press, pp. 184–201.

Donahue, R.E. and Lovis, W.A. (2006) Regional settlement systems in Mesolithic northern England: Scalar issues in mobility and territoriality. *Journal of Anthropological Archaeology* 25: 248–258.

EC. (2002) Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications). *Official Journal of the European Communities* L201 37–47 31 July, European Commission, Brussels.

Farrel, G. and Pease, K. (1994) Crime seasonality – domestic disputes and residential burglary in Merseyside 1988–90. *British Journal of Criminology* 34(4): 487–498.

Fitzgerald, J.L. and Mulford, H.A. (1984) Seasonal changes in alcohol consumption and related problems in Iowa, 1979–1980. *Journal of Studies On Alcohol* 45: 363–368.

Follett, B.K. and Follett, D.E. (1981) *Biological clocks in seasonal reproductive cycles,* Bristol: Scientechnica.

Foster, R.G. and Roenneberg, T. (2008) Human Responses to the Geophysical Daily, Annual and Lunar Cycles. *Current Biology* 18: R784–R794.

Gober, P. and Mings, R.C. (1984) A geography of nonpermanent residence in the U.S. *Professional Geographer* 36(2): 164–173.

Granger, C.W.J. (2001) Seasonality: Causation, Interpretation, and Implications. In: Granger, C.V.J., Ghysels, E., Swanson, N.R. and Watson, M.V. (Eds.) *Essays in Econometrics: Volume 1, Spectral Analysis, Seasonality, Nonlinearity, Methodology, and Forecasting: Collected Papers of Clive W. J. Granger*, Cambridge University Press, pp. 121–146.

Gwinner, E. (1986). *Circannual clocks,* Berlin: Springer-Verlag.

Gwinner, E. (1996) Circannual clocks in avian reproduction and migration. *Ibis* 138: 47–63.

Gyllenborg, J., Skakkebaek, N.E. and Nielsen, N.C. (1999) Secular and seasonal changes in semen quality among young Danish men: a statistical analysis of semen samples from 1927 donor candidates during 1977–1995. *Int. I. Androl.* 22(1): 28–36.

Hall, C.M. and Müller, D.K. (2004) Introduction: Second Homes, Curse or Blessing? Revisited. In: Müller, D.K. and Hall, C.M. (Eds.) *Tourism, Mobility and Second homes. Between Elite Landscape and Common Ground*, Clevedon-Buffalo-Toronto: Channel view publications, pp. 3–14.

Hanson, J. and Bell, M. (2007) Harvest trails in Australia: Patterns of seasonal migration in the fruit and vegetable industry. *Journal of Rural Studies* 23: 101–117.

Happel, S.K. and Hogan, T.D. (2002) Counting snowbirds: The importance of and the problems with estimating seasonal populations. *Population Research and Policy Review* 21: 227–240.

Hess, S. (2004) The employment of seasonal farm workers from Central and Eastern European countries in German agriculture. *Berichte Uber Landwirtschaft* 82(4): 602.

Hiltunen, M.J. (2007) Environmental Impacts of Rural Second Home Tourism – Case Lake District in Finland. *Scandinavian Journal of Hospitality and Tourism* 7(3): 243–265.

Hinch, T.D., Hickey, G. and Jackson, E.L. (2001). Seasonal Visitation at Fort Edmonton Park: An Empirical Analysis Using a Leisure Constraints Framework. In: Baum, T. and Lundtrop, S. (Eds.) *Seasonality in tourism*, Amsterdam-London-New York-Oxford-Paris-Shannon-Tokyo: Pergamon, pp. 173–186.

Hofman, M.A. (2004) The brain`s calendar: neural mechanisms of seasonal timing. *Biological Review* 79: 61–77.

Hogan, T.D. (1987) Determinants of the seasonal migration of the elderly to sunbelt states. *Research of Aging* 9: 115–133.

Horton, T.H. (1984) Growth and reproductive development of male Microtus montanus is affected by the prenatal photoperiod. *Biol. Reprod*. 31: 499–504.

Ingram, D.L. and Dauncey, M.J. (1993) Physiological responses to variations in daylength. In: Ulijaszek, S.J. and Strickland, S.S. (Eds.) *Seasonality and human ecology*, Cambridge University Press, pp. 54–64.

Jaagus, J. (2001) Kliimakalender. In: Ahas, R. (Ed.) *Eesti looduse kalender*, Tartu: TÜ Geograafia Instituut pp. 9–25.

Jaagus, J. and Ahas, R. (2000) Space-time variations of climatic seasons and their correlation with the phenological development of nature in Estonia. *Climate Research* 15(3): 207–219.

Jansson, B. and Müller, D.K. (2003) *Fritidsboende i Kvarken. Umeå*, Kvarkenrådet.

Johnston, F.E. (1993) Seasonality and human biology. In: Ulijaszek, S.J. and Strickland, S.S. (Eds.) *Seasonality and human ecology*, Cambridge University Press, pp. 5–16.

Jolliffe, L. and Farnsworth, R. (2003) Seasonality in tourism employment: human resource challenges. *International Journal of Contemporary Hospitality Management* 15(6): 312–316.

Jones, T.L., Kennett, D.J., Kennett, J.P. and Codding, B.F. (2008) Seasonal stability in Late Holocene shellfish harvesting on the central California coast. *Journal of Archaeologiacal Science* 35: 2286–2294.

Jorgens, N., Andersen, A.G. and Eustache, F. (2001) Regional differences in semen quality in Europe. *Hum. Reprod.* 16(5): 1012–1019.

Kaltenborn, B.P. (1998) The alternate home - motives of recreation home use. *Norsk Geografisk Tidsskrift - Norweigian Journal of Geography* 52: 121–134.

Keen, D. and Hall, C.M. (2004). Second Homes in New Zealand. In: Hall, C.M. and Müller, D.K. (Eds.) *Tourism, Mobility and Second homes. Between Elite Landscape and Common Ground*, Clevedon-Buffalo-Toronto: Channel view publications, pp. 174–195.

Krout, J.A. (1983) Seasonal migration of the elderly. *The Gerontologist* 23: 295–299.

Lam, D. and Miron, J. (1991) Seasonality of Birth in Human Populations. *Social Biology* 38(1–2): 51–78.

Lam, D.A. and Miron, A. (1996) The Effects of Temperature on Human Fertility. *Demography* 33(3): 291–305.

Lam, D.A. and Miron, J.A. (1994) Global Patterns of Seasonal-Variation in Human-Fertility. *Annals of the New York Academy of Sciences* 709: 9–28.

Lam, D.A., Miron, J.A. and Riley, A. (1994) Modeling Seasonality in Fecundability, Conceptions, and Births. *Demography* 31(2): 321–346.

Landau, S.F. and Feidman, D. (1993) The seasonality of violent crime - the case of robbery and homicide in Israel. *Journal of research in crime and delinquency* 30(2): 163–191.

Leetmaa, K., Tammaru, T. and Anniste. K. (2009) From priorities- to market-led suburbanisation in a post-communist metropolis. *Tijdschrift voor Economische en Sociale Geografie* 100(4).

Lemmens, P.H.H.M. and Knibbe, R.A. (1993) Seasonal Variation in Survey and Sales Estimates of Alcohol Consumption. *Journal Studies on Alcohol* 54: 157–163.
Madison, D.M. (1984) Group nesting and its ecological and evolutionary significance in overwintering microtine rodents. *Bull. Carnegie Museum Nat. Hist.* 10: 267–274.
Martin, P. (2002) Mexican workers and US Agriculture: the revolving door. *International Migration Review* 36(4): 1124–1142.
Moffatt, C.A., DeVries, A.C. and Nelson, R.J. (1993) Winter adaptation of male deer mice (Peromyscus maniculatus) and prairie voles (Microtus ochrogaster) that vary in reproductive responsiveness to photoperiod. *J.Biol. Rhythms* 8: 221–232.
Murray, G., Allen, N.B. and Trinder, J. (2001) A longitudinal investigation of seasonal variation in mood. *Chronobiology International* 18(5): 875–891.
Müller, D.K., Hall, C.M. and Keen, D. (2004) Second Home Tourism Impact, Planning and Management. In: Hall, C.M. and Müller, D.M. (Eds.) *Tourism, Mobility and Second homes. Between Elite Landscape and Common Ground*, Clevedon-Buffalo-Toronto: Channel view publications, pp. 15–32.
Nelson, R.J., Demas, G.E., Klein, S.L. and Kriegsfeld, L.J. (2002) *Seasonal patterns of stress, immune function, and disease*, Cambridge university press.
Oren, D.A. and Rosenthal, N.E. (1992) Seasonal affective disorders. In: Paykel, E.S. (Ed.) *Handbook of Affective Disorders*, Edinburgh: Churchill Livingstone, pp. 551–567.
Partonen, T. (1999) Melatonin-dependent infertility. *Med Hypotheses* 52(3): 269–670.
Perloff, J., Lynch, L. and Gabbard, S. (1998) Migration of seasonal agriculture workers. *American Journal of Agricultural Economics* 80(1): 154–164.
Radun, I. and Radun, J.E. (2006) Seasonal variation of falling asleep while driving: An examination of fatal road accidents. *Chronobiology International* 23(5): 1053–1064.
Ragatz, R.L. (1970) Vacation hmes in the northeastern United States: seasonality in population distribution. *Annals of the Association of American Geographers* 60(3): 447–455.
Raik, A. (1963). *Klimaatilised aastaajad Eestis*, Tartu: Tartu riiklik Ülikool, pp. 33–44.
Riley, T. (2008) Diet and seasonality in the Lower Pecos: evaluating coprolite data sets with cluster analysis. *Journal of Archaeologiacal Science* 35: 2726–2741.
Roenneberg, T. and Aschoff, J. (1990) Annual Rhythm of Human Reproduction. *Journal of Biological Rhythms* 5(3): 195–239.
Rojansky, N., Benshushan, A, Meirsdorf, S, Lewin, A., Laufer, N. and Safran, A. (2000) Seasonal variability in fertilization and embryo quality rates in women undergoing IVF. *Fertil Steril.* 74(3): 476–481.
Rojansky, N., Brezinski, A. and Schenker, J.G. (1992) Seasonality in human reproduction: an update. *Hum. Reprod.* 7: 735–745.
Schults, G.E. (1981) *Obshthaja Fenologija*, Leningrad: "Nauka" Leningradskoje Otdelenije.
Schnelle, F. (1955) *Pflanzen-Phänologie*, Leipzig: Akademische Verlagsgesellschaft Geest & Portig KG.
Schwartz, M.D. (2003). *Phenology: An Integrative Environmental Science. Tasks For Vegetation Science*, Dordrecht-Boston-London: Kluwer Academic Publishers.
Selwood, J. and Tonts, M. (2004) Recreational Second Homes in the South West of Western Australia. In: Hall, C.M. and Müller, D.K. (Eds.) *Tourism, Mobility and Second homes. Between Elite Landscape and Common Ground*, Clevedon-Buffalo-Toronto: Channel view publications, pp. 149–161.
Sher, L. (2002) Relationship between seasonality and alcohol use: a genetic hypothesis. *Medical hypothesis* 59(1): 85–88.

Silm, S. and Ahas, R. (2005) Seasonality of Alcohol Related Phenomena in Estonia. *International Journal of Biometeorology* 49: 215–223.
Smith, S.K. and House, M. (2006) Snowbirds, Sumbirds, and Stayers: Seasonal Migration of Elderly Adults in Florida. *Journal of Gerontology* 61B(5): S232–S239.
Smith, S.K. and House, M. (2007) Temporary migration: a case study of Florida. *Popul. Res. Policy. Rev.* 26: 437–454.
Smits, L.J. (1998) Seasonal variation in human fecundability. *Hum. Reprod.* 13(12): 3520–3524.
Spira, A. (1984) Seasonal variations in sperm characteristics. *Arch. Androl*. 12: 23–28.
Stroud, M.A. (1993) Environmental temperature and physiological function. In: Ulijaszek, S.J. and Strickland, S.S. (Eds.) *Seasonality and human ecology*, Cambridge University Press.
Stynes, D.J., Zheng, J. and Stewart, S.I. (1997) *Seasonal Homes and Natural Resources: Patterns of Use and Impact in Michigan*, North Central Forest Experiment Station, Forest Service - U.S. Department of Agriculture, pp. 39.
Tress, G. (2007) Seasonality of second-home use in Denmark. In: Palang, H., Sooväli, H. and Printsmann, A. (Eds.) *Seasonal Landscapes*, Berlin: Springer-Verlag, pp. 151–179.
Udry, J.R. and Morris, N.M. (1967) Seasonality of Coitus and Seasonality of Birth. *Demography* 4(2): 673–679.
Uitenbroeck, D.G. (1996) Seasonal Variation in Alcohol Use. *Journal of studies on alcohol* 57(1): 47–52.
Wolfe, R.I. (1977) Summer cottages in Ontario: Purpose-built for an inessential purpose. In: Coppock, J.T. (Ed.) *Second Homes: Curse or Blessing?*, Oxford: Pergamon, pp. 17–34.

PUBLICATIONS

CURRICULUM VITAE

Name	Siiri Silm
Date and place of birth	30.05.1980, Kõue
Nationality	Estonian
Address	Department of Geography, University of Tartu, Vanemuise 46, 51014, Tartu, Estonia
Telephone	office +372 737 5077 mobile +372 52 11 646
Fax	+ 372 737 5825
E-mail	siiri.silm@ut.ee

Education

2005–2009	University of Tartu, PhD studies in human geography
2003–2005	University of Tartu, MSc studies in human geography
1998–2003	University of Tartu, BSc studies in human geography
1991–1998	Kose Secondary School
1986–1991	Harmi Basic School

Work experience

2009–	Researcher, University of Tartu, Department of Geography
2005–2009	Technician, University of Tartu, Department of Geography
2004	Group member, Tallinn SAPA, "Analysis and drafting building regulation for city centre"
2004	Group member, State Env. Investment Centre (KIK), "Toolkit and management system for sustainable planning and evaluation of built environment (II step)"
2003–2004	Group member, Tallinn SAPA, "Social impact assessment and analysis on Tallinn City Centre"
2003	Group member, State Env. Investment Centre (KIK), "Toolkit and management system for sustainable planning and evaluation of built environment (I step)"
2002	"Toila developmnet plan" writer, Toila rural municipality government
2001–2003	Digitizer, Metsaekspert

CURRICULUM VITAE

Nimi	Siiri Silm
Sünniaeg ja -koht	30.05.1980, Kõue
Rahvus	eestlane
Aadress	Geograafia osakond, Tartu Ülikool, Vanemuise 46, 51014, Tartu, Eesti
Telefon	büroo +372 737 5077 mobiil +372 52 11 646
Fax	+ 372 737 5825
E-post	siiri.silm@ut.ee

Haridus

2005–2009	Tartu Ülikool, Geograafia osakond, doktoriõpe
2003–2005	Tartu Ülikool, Geograafia instituut, magistriõpe (MSc)
1998–2003	Tartu Ülikool, Geograafia instituut, bakalaureuseõpe (BSc)
1991–1998	Kose Keskkool
1986–1991	Harmi Põhikool

Töökogemus

2009–	Teadur, Tartu Ülikool, Geograafia osakond
2005–2009	Tehnik, Tartu Ülikool, Geograafia osakond
2004	Töörühma liige, Tallinn SAPA, "Kesklinna planeeringu analüüs, ehitusmääruse koostamine ja monitooringumehhanismi väljatöötamine"
2004	Töörühma liige, KIK, "Ehitiste ja nende projektide keskkonnasõbralikkuse hindamise mõõdiku rakendamine (II etapp)"
2003–2004	Töörühma liige, Tallinn SAPA, "Kesklinna sotsiaalsete gruppide liikumise uuring ja analüüs"
2003	Töörühma liige, KIK, "Ehitiste ja nende projektide keskkonnasõbralikkuse hindamise mõõdiku rakendamine (I etapp)"
2002	"Toila valla arengukava" koostaja, Toila vallavalitsus
2001–2003	Digitaliseerija, OÜ Metsaekspert

Publications / Publikatsioonid

Silm, S. and Ahas, R (forthcoming) Seasonal variability of population in Estonian municipalities. *Environment and Planning A* (submitted).

Ahas, R., **Silm, S.**, Järv, O., Saluveer, E., Aasa, A. and Tiru, M. (forthcoming) The modelling of locations of meaningful places for mobile telephone users using mobile positioning data. *Journal of Urban Technology* 17(1) (in press).

Ahas, R. Aasa, A., **Silm, S.** and Tiru, M. (forthcoming) Daily rhythms of suburban commuters' movements in the Tallinn metropolitan area: case study with mobile positioning data. *Transportation Research C* (in press).

Tammaru, T., Leetmaa, K., **Silm, S.** and Ahas, R. (2009) New residential areas in the Tallinn Metropolitan Area. *European Planning Studies* 17(3): 423–439.

Ahas, R**.** Aasa, A., Roose, A., Mark, Ü. and **Silm, S.** (2008) Evaluating passive mobile positioning data for tourism surveys: An Estonian case study. *Tourism Management* 29(3): 469–486.

Ahas, R., Saluveer, E., Tiru, M. and **Silm, S.** (2008) Mobile Positioning Based Tourism Monitoring System: Positium Barometer. In: O'Connor, P., Höpken, W. and Gretzel, U. (Eds.) *Springer Computer Science: Information and Communication Technologies in Tourism*, Springer-Verlag, pp. 475–485.

Ahas, R., Roosaare, J., Uusküla, A. and **Silm, S.** (2008) Seasonal variability of human reproduction in Estonia. *Publicationes Instituti Geographici Universitatis Tartuensis* 107: 19–41.

Ahas, R., **Silm, S**, Saluveer, E. and Järv, O. (2008) Modelling Home and Work Locations of Population Using Passive Mobile Positioning Data. In: Gartner, G. and Rehr, K. (Eds.) *From Sensor Fusion to Contexts Models*, Berlin: Springer-Verlag, pp. 301–315.

Ahas, R., **Silm, S**., Saluveer, E., Järv, O., Tiru, M. and Aasa, A. (2008). Locating commuting patterns using mobile positioning data: Differences in modelled home and work locations. *Publicationes Instituti Geographici Universitatis Tartuensis* 107: 9–18.

Ahas, R.**,** Aasa, A., **Silm, S.**, Aunap, R., Kalle, H. and Mark, Ü. (2007). Mobile positioning in space-time behaviour studies: Social Positioning Method experiments in Estonia. *Cartography and Geographic Information Science* 34(4): 259–273.

Ahas, R., Aasa, A., **Silm, S.** and Tiru, M. (2007). Mobile positioning data in tourism studies and monitoring: case study in Tartu, Estonia. In: Sigala, M., Mich, L. and Murphy, J. (Eds.) *Springer Computer Science: Information and Communication Technologies in Tourism*, Springer, pp. 119–128.

Ahas, R., Aasa, A., **Silm, S**. and Järv, O. (2006) Activity Spaces of Residents of New Suburban Settlements in the Tallinn Metropolitan area. In: Pae, K., Ahas, R. and Mark, Ü. (Eds.) *Joint Space. Open Source on Mobile Positioning and Urban Studies*, Tallinn: Positium, pp. 71–80.

Ahas, R., **Silm, S**., Aasa, A., Tammaru, T., Järv, O., Nuga, M. and Kivi, K. (2006) Valglinnastumine Tallinna linnaregioonis. In: Roose, A. (Ed.) *Keskkonnasäästlik planeerimine ja ehitus 2*. *Publicationes Instituti Geographici Universitas Tartuensis* 100: 12–21.

Silm, S. and Rossi, P. (2006). Location-Aware Participatory Tools: Bicycle Route Voting in Tartu. In: Pae, K., Ahas, R. and Mark, Ü. (Eds.) *Joint Space. Open Source on Mobile Positioning and Urban Studies*, Tallinn: Positium, pp. 149–153.

Ahas, R.**,** Aasa A., **Silm, S.** and Roosaare, J. (2005). Seasonality of natural and social factors in Estonia. *Landscape Research* 30(2): 173–191.

Ahas, R., Roosaare and **Silm, S**. (2005) Seasonal Variability of Human Reproduction in Estonia. *17th International Congress of Biometerology. Annalen der Meteorologie* 41(1): 377–380.

Silm, S. and Ahas, R. (2005) Seasonality of Alcohol Related Phenomena in Estonia. *Int. J. Biometeorology* 49(4): 215–223.

Silm, S. and Ahas, R. (2005). Ajalis-ruumilised protsessid Tallinna kesklinnas. In: Kangur, M. and Anniste, K. (Eds.) *Eesti Geograafia Seltsi Publikatsioonid* VII. EGEA-Tartu.

Silm, S., Ahas, R., Kalle, H. and Mark, Ü. (2005) Linnaruumi funktsioonide kaardistamine Tallinna kesklinna näitel. In: Roose, A. (Eds.) *Keskkonnasäästlik ehitus ja planeerimine. Publicationes Instituti Geographici Universitatis Tartuensis* 99: 44–61.

Ahas, R., Poom, A. and **Silm, S.** (2004) Keskkonnasäästlikult ehitada ei tähenda ainult "öko-mäkerdamist". *Eesti Loodus* 3.

Ahas, R., Roosaare, J., Uusküla, A. and **Silm, S**. (2004) Eestlaste sündide aastaajalisusest. *Akadeemia* 16(12): 2563–2588.

Poom, A., Ahas, R. and **Silm, S.** (2004) Ehitusmõõdik – ehitiste keskkonnasõbralikkuse hindamise vahend. In: Roose, A., Kuusemets, V. and Liivak, E. (Eds.) *Keskkonna- ja elutsükli hinnangud ehituses*. Tartu Ülikool.

Silm, S. and Ahas, R. (2004). Alkoholiga seotud nähtuste sesoonsus Eestis. Geograafilisi uurimusi aastatuhande vahetusel. *Publicationes Instituti Geographici Universitatis Tartuensis* 89: 137–151.

DISSERTATIONES GEOGRAPHICAE UNIVERSITATIS TARTUENSIS

1. Вийви Руссак. Солнечная радиация в Тыравере. Тарту, 1991.
2. Urmas Peterson. Studies on Reflectance Factor Dynamics of Forest Communities in Estonia. Tartu, 1993.
3. Ülo Suursaar. Soome lahe avaosa ja Eesti rannikumere vee kvaliteedi analüüs. Tartu, 1993.
4. Kiira Aaviksoo. Application of Markov Models in Investigation of Vegetation and Land Use Dynamics in Estonian Mire Landscapes. Tartu, 1993.
5. Kjell Weppling. On the assessment of feasible liming strategies for acid sulphate waters in Finland. Tartu, 1997.
6. Hannes Palang. Landscape changes in Estonia: the past and the future. Tartu, 1998.
7. Eiki Berg. Estonia's northeastern periphery in politics: socio-economic and ethnic dimensions. Tartu, 1999.
8. Valdo Kuusemets. Nitrogen and phosphorus transformation in riparian buffer zones of agricultural landscapes in Estonia. Tartu, 1999.
9. Kalev Sepp. The methodology and applications of agricultural landscape monitoring in Estonia. Tartu, 1999.
10. Rein Ahas. Spatial and temporal variability of phenological phases in Estonia. Tartu, 1999.
11. Эрки Таммиксаар. Географические аспекты творчества Карла Бэра в 1830–1840 гг. Тарту, 2000.
12. Garri Raagmaa. Regional identity and public leaders in regional economic development. Tartu, 2000.
13. Tiit Tammaru. Linnastumine ja linnade kasv Eestis nõukogude aastatel. Tartu, 2001.
14. Tõnu Mauring. Wastewater treatment weltlands in Estonia: efficiency and landscape analysis. Tartu, 2001.
15. Ain Kull. Impact of weather and climatic fluctuations on nutrient flows in rural catchments. Tartu, 2001.
16. Robert Szava-Kovats. Assessment of stream sediment contamination by median sum of weighted residuals regression. Tartu, 2001.
17. Heno Sarv. Indigenous Europeans east of Moscow. Population and Migration Patterns of the Largest Finno-Ugrian Peoples in Russia from the 18th to the 20th Centuries. Tartu, 2002.
18. Mart Külvik. Ecological networks in Estonia — concepts and applications. Tartu, 2002.
19. Arvo Järvet. Influence of hydrological factors and human impact on the ecological state of shallow Lake Võrtsjärv in Estonia. Tartu, 2004.
20. Katrin Pajuste. Deposition and transformation of air pollutants in coniferous forests. Tartu, 2004.

21. Helen Sooväli. *Saaremaa waltz*. Landscape imagery of Saaremaa Island in the 20th century. Tartu, 2004.
22. Antti Roose. Optimisation of environmental monitoring network by integrated modelling strategy with geographic information system — an Estonian case. Tartu, 2005.
23. Anto Aasa. Changes in phenological time series in Estonia and Central and Eastern Europe 1951–1998. Relationships with air temperature and atmospheric circulation. Tartu, 2005.
24. Anneli Palo. Relationships between landscape factors and vegetation site types: case study from Saare county, Estonia. Tartu, 2005.
25. Mait Sepp. Influence of atmospheric circulation on environmental variables in Estonia. Tartu, 2005.
26. Helen Alumäe. Landscape preferences of local people: considerations for landscape planning in rural areas of Estonia. Tartu, 2006.
27. Aarne Luud. Evaluation of moose habitats and forest reclamation in Estonian oil shale mining areas. Tartu, 2006.
28. Taavi Pae. Formation of cultural traits in Estonia resulting from historical administrative division. Tartu, 2006.
29. Anneli Kährik. Socio-spatial residential segregation in post-socialist cities: the case of Tallinn, Estonia. Tartu, 2006.
30. Dago Antov. Road user perception towards road safety in Estonia. Tartu, 2006.
31. Üllas Ehrlich. Ecological economics as a tool for resource based nature conservation management in Estonia. Tartu, 2007.
32. Evelyn Uuemaa. Indicatory value of landscape metrics for river water quality and landscape pattern. Tartu, 2007.
33. Raivo Aunap. The applicability of gis data in detecting and representing changes in landscape: three case studies in Estonia. Tartu, 2007.
34. Kai Treier. Trends of air pollutants in precipitation at Estonian monitoring stations. Tartu, 2008.
35. Kadri Leetmaa. Residential suburbanisation in the Tallinn metropolitan area. Tartu, 2008.
36. Mare Remm. Geographic aspects of enterobiasis in Estonia. Tartu, 2009.
37. Alar Teemusk. Temperature and water regime, and runoff water quality of planted roofs. Tartu, 2009.
38. Kai Kimmel. Ecosystem services of Estonian wetlands. Tartu, 2009.
39. Merje Lesta. Evaluation of regulation functions of rural landscapes for the optimal siting of treatment wetlands and mitigation of greenhouse gas emissions. Tartu, 2009.