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# **Drivers of illegal garden waste dumping in Trondheim Municipality**

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# Abstract

Invasive alien plant species pose a significant threat to ecosystems globally, including those in Norway. One major pathway for their spread is from residential gardens, particularly through illegal dumping of garden waste. Despite its importance, research on the drivers of this behavior remains scarce, especially in Norway.

This thesis aims at filling this gap by investigating the reasons leading to garden waste being dumped in green areas rather than delivered to approved waste facilities. This is done by analyzing data from a questionnaire conducted by Trondheim Municipality in 2023, on garden waste disposal behaviors and perceptions. The questionnaire reached 3728 recipients, of which 345 (9.3%) responded. The data was analyzed using a modified version of the Theory of Planned Behavior, employing chi-square tests and logistic regression. Additionally, an interview was conducted with representatives working within management of waste and invasive alien species in Trondheim, to gain insight into their perspectives and the challenges they face in preventing garden waste dumping.

The findings revealed that knowledge about the negative consequences of garden waste dumping decreased the likelihood of such behavior, both directly and indirectly through attitudes. Attitudes were found to promote the use of appropriate waste disposal methods, with seeing the point of proper garden waste disposal and being content with the existing solutions being especially significant. The influence of neighbors dumping garden waste significantly increased the likelihood of individuals doing the same. Perceived behavioral control variables showed a weak association with garden waste dumping and using the municipal garden waste center. Surprisingly, for the municipal garden waste collection campaign, an increase in barriers led to increased use of the campaign, likely due to those with few barriers not using the campaign.

The interview revealed that the main challenges of preventing garden waste dumping were related to uncertainty about which measures and disposal solutions would prove effective, difficulties with information dispersal, and practical obstacles in extending proper waste disposal solutions. The results indicate that increasing the knowledge among inhabitants, along with changing attitudes and targeting social norms, could be the most effective measures against garden waste dumping.

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# 1. Introduction

The growth of the human population and increasing transport of goods and people across the world, has the last couple of centuries facilitated a massive movement of species outside of their natural habitats (Clements et al., 2022). These species are in literature often referred to by the terms alien, non-native or introduced and have the potential of becoming invasive, causing major changes in local ecosystems and landscapes (Kumar Rai & Singh, 2020). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has identified invasive alien species to be one of five major direct drivers of change in nature (Brondizio et al., 2019), having major impacts globally on ecosystem services (Pejchar & Mooney, 2009), economy (Diagne et al., 2021), human health (Kumar Rai & Singh, 2020) and cultural relationships (Pfeiffer & Voek, 2008).

In Norway, around 50% of alien species are vascular plants, making it the largest taxonomic group (Artsdatabanken, 2023). According to Hulme et al. (2008) alien species can spread along one or more of six pathways: through deliberate release, escape from confinement, as a contaminant of a commodity, a stowaway on a transport vector, via an anthropogenic corridor or unaided from other invaded regions. The dominant pathway for plants is the escape from confinement pathway, accounting for 73% of alien plant introductions in Norway (Sandvik et al., 2022). Most of these species are identified to have escaped from horticulture, and mainly from domestic gardens (Hu & Gill, 2015; Rusterholz et al., 2012). Due to the steady growth of the horticulture industry and an increase in live-plant import, horticulture is expected to be the major pathway for spreading alien plants in the future (Kleunen et al., 2018). In 2021, the Norwegian Institute for Nature Research stated that efforts to prevent the escape of garden plants should be top priority in fighting alien plants in Norway (Skrindo et al., 2021).

Plant propagules can move across garden boundaries by natural processes, but are often aided by humans through illegal dumping of garden waste (Hu & Gill, 2015; Rusterholz et al., 2012). Garden waste can be defined as all biodegradable waste originating in or around a garden, such as grass, weeds, leaves, garden plants, branches or twigs (LOOP, n.d.). Illegal garden waste dumping has proven to be a common practice in many urban areas (Gaggini et al., 2017), especially in green areas such as forests, parks and other vegetated spaces. Rusterholz et al.

(2012) documented the effect of these dumping sites on spreading non-native plant species in Switzerland, and found that 37 non-native species were present close to illegal dumping sites, in contrast to only three in control sites. Furthermore, these dumps can also have other negative consequences, like functioning as stepping-stones for other invasive species, such as arthropods (Ødegaard & Tømmerås, 2000), or be the beginning of a larger dumping problem which also includes other types of waste (Trondheim kommune, 2022, 2023).

Research on illegal garden waste dumping in Norway is scarce. However, Trondheim Municipality conducted projects during the summers of 2022 and 2023 to investigate the extent and drivers of the issue. The results supported those of Rusterholz et al. (2012), that illegal garden waste dumping in several cases seemed to be the source of new populations of invasive alien species (Trondheim kommune, 2022, 2023). Both summers, questionnaires were sent out to better understand inhabitant's garden waste disposal behavior and the drivers behind them. These questionnaires have previously only been analyzed using descriptive statistics. Therefore, for this thesis, the questionnaire dataset from 2023 is analyzed using chi-square tests and logistic regression. The analysis is driven by the Theory of Planned Behavior (TPB). The questionnaire data is complemented by an interview exploring the perceptions of representatives working within the management of garden waste and invasive alien species in Trondheim. By analyzing the situation in Trondheim and building further on the data collected by Trondheim Municipality, we can better understand the mechanisms behind garden waste dumping in cities, which can help decision-makers in identifying future management strategies. Therefore, the following research question is investigated in this thesis:

*Why is garden waste being dumped in green areas rather than delivered to approved waste facilities in Trondheim Municipality?*

Furthermore, the following sub-questions are explored:

*RQ1: What are the factors influencing garden waste disposal behavior?*

*RQ2: What do the actors involved in the management of garden waste and alien species in Trondheim perceive to be the greatest challenges in avoiding illegal garden waste dumping?*

The thesis is structured as follows; The background chapter starts by presenting the Theory of Planned Behavior, the theoretical framework guiding the data analysis. The theory section



culminates in a presentation of the research hypotheses that will be investigated in the statistical analysis. This will be followed by a review of existing research relevant to the research questions. The last section in the background chapter provides information about garden waste management in Trondheim, and the project in Trondheim Municipality on garden waste dumping. The background chapter is followed by the methods chapter, which describes the methodological approach, including the sampling and data collection, and analysis for both the questionnaire and interview. Moreover, ethical considerations and an assessment of the limitations of the method are presented. The results chapter presents the findings of the chi-square tests and logistic regression, followed by the main results from the interview. Finally, the discussion and conclusion chapters will conclude the thesis. They consider the implications of the findings, discuss the way forward in terms of research and possible measures to be implemented, and provide final answers to the research questions.

## 2. Background

### 2.1 Theoretical framework and research hypotheses

As the research questions are greatly related to human behavior, it is natural to view the research through the lens of theories on human motivation and action. Numerous theories originating from different fields of study attempt to explain human behavior in different settings. In the case of pro-environmental behavior one of the most commonly used theories is the Theory of Planned Behavior (TPB). It has been used in research studying sustainable food consumption (Vermeir & Verbeke, 2008), use of public transportation (Heath & Gifford, 2002), water saving (Lam, 2006) and others, as well as for studying behaviors concerning recycling and waste management (Akhter et al., 2024; Ojedokun et al., 2022; Tonglet et al., 2004).

TPB originated in the Theory of Reasoned Action (TRA), which was developed by Fishbein and Ajzen in 1975 (Sheppard et al., 1988). TRA is based on the assumption that people consider the implications of their choices, and thereby act rationally (Tonglet et al., 2004). The theory provides a model for predicting human intention, which is seen as an immediate determinant of behavior, based on the individual's attitudes and subjective norms. Attitude refers to whether the behavior is seen as positive or negative by the individual, and subjective norm refers to "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). TRA was criticized for not being able to deal with behaviors that are influenced by factors outside of people's conscious control (Ajzen, 1991). Therefore, an additional component, perceived behavioral control, was later added, introducing the Theory of Planned Behavior. Perceived behavioral control refers to "the perceived ease or difficulty of performing the behavior", in other words an individual's confidence in their ability to perform the behavior (Ajzen, 1991). Perceived behavioral control is part of forming intention along with attitudes and subjective norms, but is also a direct determinant of behavior together with intention (Ajzen, 1991). This improved the model's ability to predict behavior in cases where external factors are at play.

No studies were found investigating illegal waste dumping in light of TPB when reading literature for this thesis. However, there are studies using TPB to investigate other types of waste behavior, in particular recycling, waste minimization and littering (Ojedokun et al., 2022; Tonglet et al., 2004). Nevertheless, these studies do not have consistent results considering the

relative importance of attitudes, subjective norms and perceived behavioral control in the context of waste behavior. The findings seem to vary depending on the behavior investigated, the type of waste and the specific context. For example, Tonglet et al. (2004) found attitudes to be the major determinant of recycling behaviors, while Ramayah et al. (2012), also looking at recycling behaviors, found subjective norms to be the most significant factor. Other studies again, have not found subjective norms to be significant at all (Akhter et al., 2024). There is, in other words, no consistency in findings that could give a picture of what is to be expected in the case of illegal garden waste dumping.

For this study, an abbreviated version of TPB is applied as a framework for analyzing the data. The adapted model bypasses intentions and looks directly at the connection between the key explanatory components and behavior. This simpler version of the model is applied due to the lack of data on intentions in the dataset and for the practical applicability of the study for those working within waste management. Furthermore, studies within both pro-environmental behaviors in general (Casaló & Escario, 2018; Liu et al., 2020) and recycling (Ramayah et al., 2012; Tonglet et al., 2004) have found a direct connection between attitudes and behavior, indicating intentions do not necessarily need to work as an intermediary. As for subjective norms, Ramayah et al. (2012) found a direct connection with behavior also here. In addition, the mapping conducted by Trondheim Municipality showed that garden waste dumping sites, similar to what has been found for illegal dumping sites in general, are often located in secluded places such as in forests and on slopes (Trondheim kommune, 2022, 2023). This can also suggest that subjective norms have a direct impact on behavior, as people try to hide the dumping from others.

In addition to removing intentions, it was decided to add knowledge of the impacts of garden waste dumping to the model. After all, with no knowledge of the problems associated with garden waste dumping there is no reason to act differently. Studies within several topics have found that knowledge can have an impact on attitudes, either by seeing it as a component of attitudes (Kaiser et al., 1999) or as a determinant of attitudes (Liu et al., 2020; Ramayah et al., 2012). While some studies have found that knowledge only has an impact on behavior indirectly through attitudes (Liu et al., 2020), others have found that knowledge can directly impact behavior without attitudes as an intermediary (Brosdahl & Carpenter, 2010; Levine & Strube,

2012). Observations and discussions I had while working with garden waste dumping in Trondheim Municipality, also gave reason to believe that a lack of knowledge could be an important driver of garden waste dumping. It is therefore included in the model. The adapted model is shown in Figure 1.

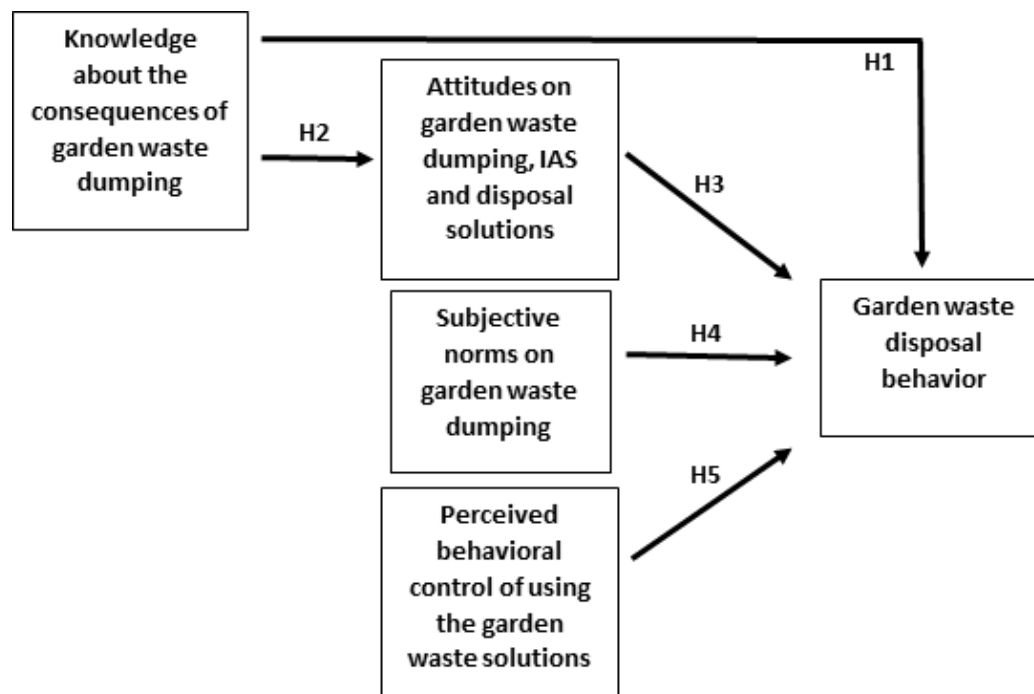


Figure 1: Research model and the hypotheses explored. IAS: invasive alien species.

Based on the explanation above, the following hypotheses will be investigated as part of the statistical analysis in this thesis:

**H1:** *There is a relationship between knowledge about the consequences of garden waste dumping, and garden waste disposal behavior.*

As the knowledge about consequences increases, garden waste dumping is expected to decrease, and the use of proper garden waste disposal methods increase.

**H2:** *There is a relationship between knowledge about the consequences of garden waste dumping, and attitudes.*

Increased knowledge about garden waste dumping is expected to lead to more positive attitudes towards proper garden waste disposal and negative attitudes towards alien species.

*H3: There is a relationship between attitudes, and garden waste disposal behavior.*

Positive attitudes towards proper garden waste disposal and negative attitudes towards alien species are expected to decrease the likelihood of garden waste dumping and increase the likelihood of using proper garden waste disposal methods.

*H4: There is a relationship between subjective norms, and garden waste disposal behavior.*

Subjective norms that support garden waste dumping are expected to increase the likelihood of garden waste dumping and decrease the likelihood of using proper garden waste disposal methods.

*H5: There is a relationship between the perceived behavioral control of using the garden waste disposal solutions, and garden waste disposal behavior.*

Low perceived behavioral control of using the garden waste disposal solutions is expected to increase the likelihood of garden waste dumping and decrease the likelihood of using proper garden waste disposal solutions.

## 2.2 Literature review

Illegal dumping of waste, also referred to as indiscriminate dumping and fly-tipping in literature, is an environmental issue faced by authorities globally. The drivers behind this practice are scarcely researched, especially in Norway and in the context of garden waste. Additionally, drivers can be complex and differ greatly between countries and communities based on factors such as waste type, the local waste management system, social control, socioeconomic factors, personal knowledge and attitudes among others.

Several studies have investigated the characteristics of those who illegally dump garden waste. However, the results are inconclusive, which could be a result of the studies addressing different waste types and different countries. In some cases, low education level has shown to increase the likelihood of illegal dumping (Kodua & Anaman, 2020; Wright et al., 2018). Other studies have

found the opposite, that a higher level of education can increase the rate of waste dumping (Sedova, 2016), or that there is no connection whatsoever (Lee et al., 2021). Similarly, while a study by Matsumoto & Takeuchi (2011) from Japan found a higher frequency of dumping in communities with high unemployment rate, a study by Hohl et al. (2023) from the United States found that high rates of unemployment decreased the odds of illegal dumping. When it comes to income, Sedova (2016) argued that higher income leads to higher waste production and therefore increased dumping. Hohl et al. (2021) found greater poverty in areas where illegal dumping was *not* reported, supporting the results of Sedova. In contrast, a study by Liu et al. (2017) from England found that areas with higher income have a decreased chance of waste dumping due to inhabitants being able to afford more expensive waste management services, being better educated and having lower likelihood of violating the law. Lee et al. (2021) found no connection between the level of income and dumping activity.

In many countries, a fee must be paid to dispose of waste. While the influence of level of income on waste dumping is contested, most studies agree that higher costs of legal waste disposal will lead to an increase in illegal waste dumping. Kim et al. (2008) found in their study from Korea that “a 1% increase in the unit price of a trash bag led to a 3% increase in the number of reports of illegal dumping”. Similar trends were found in other studies (Ichinose & Yamamoto, 2011; Matsumoto & Takeuchi, 2011; Purdy et al., 2022; Sedova, 2016). Furthermore, a study from Cameroon found that illegal dumping was often chosen when there is a dumping site close to the family home and the costs of transportation is lower (Sotamenou et al., 2019). Moreover, they find that easy access of legal waste disposal alternatives lowers the likelihood of illegal dumping. Yang et al. (2019) also stress the importance of convenience as a factor in Shanghai, and Comerford et al. (2018) found that lack of transportation to the waste disposal facilities and lack of storage until official collection are barriers that could lead to illegal dumping. Several studies therefore underline the importance of more waste treatment facilities (Ichinose & Yamamoto, 2011; Liu et al., 2017), and investments in better waste collection infrastructure (Sotamenou et al., 2019) as means to reduce illegal dumping.

Due to the importance of convenience, illegal dumping sites are also often found in areas that are easily accessible to people. Jakiel et al. (2019) investigated illegal dumping sites in the Ojców National Park in Poland and found that the majority were located within 300 meters from

buildings. Most were also located on a slope, as it makes dumping easier. Additionally, they found, in agreement with other studies, that dumping sites usually are close to roads (Hohl et al., 2023; Tasaki et al., 2007). Yet, high traffic volume decreases the risk of illegal waste dumping, meaning that areas with a high density of road intersections and proximity to traffic junctions have fewer dumping sites (Du et al., 2023; Yang et al., 2019). Generally, the opportunity to hide the illegal waste disposal is a central factor for the location of illegal dumping sites (Jakiel et al., 2019). Locations with a high people flow or where people gather, such as public facilities and parks, are therefore usually avoided (Du et al., 2023). This is also the reason why dumping sites are commonly found in areas with a high number of trees (Du et al., 2023; Hohl et al., 2023). In fact, Jakiel et al. (2019) found that almost three-quarters of dumping sites were located in forests. Other factors decreasing visibility, such as streetlight outages also increase the chance of waste dumping (Hohl et al., 2023).

Illegal dumping behaviors can be influenced by local norms and community perceptions (Hohl et al., 2023). Several studies emphasize the potential impact of informal social control for controlling illegal waste dumping. When the community has a common understanding of illegal dumping, they can have a form of voluntary community surveillance that can aid government supervision (Du et al., 2023; Hohl et al., 2023; Matsumoto & Takeuchi, 2011). Crofts et al. (2010) underline the importance of education for achieving this. Furthermore, they state the significance of thinking of waste dumping as a crime, as it would also encourage formal enforcement and crime prevention approaches. A lack of formal enforcement will, according to Hohl et al. (2023), enable illegal dumping through sending a signal that waste can be dumped without there being any consequences. Deterrence through a relatively high number of inspections (D'Amato et al., 2018) and sufficiently high penalties (Liu et al., 2017) is therefore necessary.

Public awareness and knowledge surrounding the consequences of illegal waste dumping is, according to Hasan (2004), a necessity for successful waste management. Purdy et al. (2022) found through both a survey and focus group interviews in England that ignorance and lack of awareness is often a cause of illegal waste dumping. At times, people do not realize that what they are doing can be considered illegal dumping (Comerford et al., 2018). A few studies have investigated the impact of perceptions and awareness on public support for management of

invasive alien species, and the drivers and motivations behind garden waste dumping. A study by Novoa et al. (2017) found that people, after receiving information about invasive alien species, were more willing to support management. Similar results were found by Junge et al. (2019) in Switzerland, who saw a higher willingness to pay for countermeasures among those with a higher awareness of invasive alien species. Sipek & Sajna (2020) conducted a questionnaire study in Slovenia in order to investigate the public knowledge and opinions on invasive alien species in connection to garden waste disposal. They found that respondents had a relatively good knowledge of invasive alien species. More than 10 % of those owning a garden discarded their garden waste in forests, but the likelihood of doing so was lower among those with a higher awareness of the consequences for invasive alien species.

While these studies can give valuable insight into some of the mechanisms behind illegal waste dumping, there is a lack of studies from Norway and only scarce research on the drivers of garden waste dumping specifically. This makes it difficult to determine whether the results presented in this review are transferrable to this context. This thesis therefore aims at providing a deeper understanding of which factors are significant in the case of garden waste dumping in Norway.

## 2.3 Garden waste management in Trondheim Municipality

The overall waste management strategy in Trondheim is outlined in the waste plan for Trondheim Municipality for 2018-2030. The plan states that the spread of invasive alien species should be prevented by increasing the efforts against garden waste dumping on public ground, and through increased garden waste collection from households (Trondheim kommune, 2019). In Trondheim Municipality, household waste, including garden waste, is handled by Trondheim Renholdsverk AS (TRV). TRV is part of TRV Gruppen AS, which is owned by Trondheim Municipality (TRV Gruppen AS, n.d.). In 2023, 4058 tons of garden waste was collected by TRV from private households in Trondheim (Statistisk sentralbyrå, 2024b).

TRV provide different solutions for gardeners wishing to dispose of their garden waste. The best-known solution is the garden waste collection center located at Heggstadmoen outside of Trondheim, next to the city's household waste recycling center (Trondheim Renholdsverk, n.d.-



b). The center is financed through municipal waste management fees, and there is therefore no additional cost for inhabitants to dispose of their garden waste there. It is open year-round, though with more limited opening hours during the winter season. The garden waste collection center also has designated containers to dispose of invasive alien species. The collected garden waste is grinded and treated at a compost facility and used to create new soil.

In addition to the garden waste collection center, TRV arrange “hageavfallsaksjonen”, which can be translated to the garden waste collection campaign, two times per year, usually one time in the spring and one time in the fall. The campaign involves garden waste being collected directly from the households and delivered to the garden waste collection center (Trondheim Renholdsverk, n.d.-b). To participate, inhabitants buy specific garden waste bags provided by TRV, which can be found in stores and gas stations throughout the entire city. The income from the bags helps finance the collection. Before the collection date, the bags are filled and placed at the curbsides for easy collection. In addition, they also pick up Christmas trees in January.

While these are the solutions provided specifically for garden waste, inhabitants can also utilize other solutions, such as a waste taxi provided by TRV. Through the TRV waste taxi, inhabitants can order pick-up of waste, including garden waste, at their home for a cost (Trondheim Renholdsverk, n.d.-a). There are also several private actors providing similar pick-up services, as well as rental of containers. Furthermore, smaller amounts of garden waste and especially invasive alien plants can be thrown in the residual waste. Many inhabitants also have private compost, or storage of garden waste, in their own garden. Home composting is encouraged by TRV and a one-time subsidy is provided to households who acquire approved equipment for a hot compost (Trondheim Renholdsverk, n.d.-c).

Information about the different solutions is available to inhabitants on the TRV webpage, and information campaigns are conducted regularly to inform about proper garden waste disposal. Still, garden waste dumping is a significant issue in Trondheim (Trondheim kommune, 2023). To better understand the issue and what measures to implement, the units of Municipal Engineering and Climate and Environment in the Municipality initiated a project in 2022, that was continued in 2023. The aim of the project was to investigate the extent of garden waste dumping in neighborhoods, and to explore the drivers behind the practice. For two summers students have been employed in summer internships, one of them myself, to do extensive mapping of illegal

garden waste dumping sites in the Municipality, as well as sending out questionnaires to selected areas to explore garden waste disposal behaviors. Based on the mapping, information letters were later sent out to neighborhoods with a large concentration of dumps, to inform about the approved solutions for garden waste disposal and the issues with garden waste dumping. Additionally, some of the larger dumps in prioritized areas have been removed by the Municipality.

Over the course of the two summers, 546 dumping sites were found in the parts of the Municipality that were mapped (Trondheim kommune, 2022, 2023). Mapping was in 2022 conducted in certain areas of Trondheim city, while the mapping in 2023 focused on Klæbu and Tanem, two urban areas outside of the city center. Invasive alien species were found growing close to, or thrown on, some of these waste dumps. The invasive plant species identified were Japanese knotweed, Garden lupin, Giant hogweed, Rugosa rose and Himalayan balsam. In addition, other types of waste, such as flowerpots and wooden planks, were found on some of the dumps. Pests, including invasive slugs, have also been found to accumulate around the dumping sites. Furthermore, the mapping in 2023 investigated the effect of the measures implemented after the 2022 mapping, by revisiting dumping sites that had been cleaned and sites in areas that had received information letters. The measures seemed to have had limited effect, as most dumping sites had new organic material on them.

Both years, a questionnaire was sent out to selected locations within the areas that were mapped. The two questionnaires were examined using basic statistical methods, with both featuring numerous identical questions for the purpose of comparing results. The comparison is presented in the 2023 report (Trondheim kommune, 2023). Overall, the results found that there were many similarities between Trondheim and Klæbu/Tanem. While the garden waste collection campaign and the TRV waste taxi were found to be less used in Klæbu and Tanem, other solutions such as composting/storing the waste in the garden, throwing it in the residual waste or renting a container were used more. Additionally, poor information and costs of alternative solutions, such as the waste taxi, were bigger barriers for delivering garden waste to approved facilities for inhabitants living in Klæbu/Tanem compared to Trondheim. The questionnaire data has, however, not been analyzed using inferential statistics, and therefore this thesis will analyze the data from the 2023 questionnaire using chi-square tests and logistic regression.

## 3. Methods

In order to investigate the mechanisms behind garden waste dumping in Trondheim Municipality, the following chapter will present the research process and methodology. First, the research design will be presented. This will be followed by a description of the sampling, data collection and analysis of first the questionnaire and then the interview. In the last sections ethical considerations and an assessment of the methods and data material will be presented.

### 3.1 Research strategy

The research questions were investigated through a mixed methods approach, with an explanatory sequential design. The explanatory sequential design, as presented by Creswell & Plano Clark (2011), involves first collecting and analyzing quantitative data, before collecting and analyzing qualitative data. Data was first collected through a self-completion questionnaire sent out to inhabitants in Klæbu and Tanem in Trondheim. This was followed by an interview with representatives from the Municipality and TRV, building on the results from the questionnaire. This design allowed for exploring the perceptions of inhabitants in a part of the Municipality, and thereafter triangulating these with the perceptions of those operating and developing solutions for garden waste collection. Additionally, it contributed to increasing the completeness of the research through also investigating the challenges the Municipality and TRV have in developing good solutions for garden waste disposal and getting inhabitants to dispose of their garden waste properly. Based on the data retrieved from the questionnaire, it was later decided to analyze the findings in light of the Theory of Planned Behavior. In addition, the data has been examined in relation to relevant literature.

### 3.2 Questionnaire survey

The questionnaire data was collected by Trondheim Municipality in 2023, as part of their summer project investigating garden waste dumping. This questionnaire was developed based on the one distributed in 2022. The purpose of the questionnaire was to provide the Municipality with knowledge about inhabitant's barriers for using the existing solutions for garden waste disposal, and thereby give an understanding of what measures need to be implemented to increase the use them. As I had an internship in the Municipality at the time, I was part of

developing the questionnaire and it was later decided that it would also be used for this thesis. However, when developing the questionnaire, the opportunities to adapt it to this thesis were somewhat limited, as comparison with the 2022-version was desirable. The methodology for the questionnaire is also described in the report “Kartlegging av villfyllinger med hageavfall 2023” (Trondheim kommune, 2023).

The format of an online self-completion questionnaire was chosen due to the possibility of easily distributing it to a large number of people, and thereby collecting significant amounts of data in a short time (Clark et al., 2021). This would allow for receiving the opinions of a larger group of inhabitants than with for example interviews. Additionally, self-completion questionnaires avoid the issue of interviewer effects, meaning the possibility that answers are influenced and biased due to characteristics of the interviewer (Clark et al., 2021). The online format of the questionnaire made it possible to distribute it through the Municipality’s SMS system, enabling participation even for inhabitants who were on vacation at the time.

### 3.2.1 Sampling and data collection

The questionnaire was sent to inhabitants living in Klæbu and Tanem, two urban areas located in the southeastern part of Trondheim Municipality, with a population of respectively 3516 and 1302 inhabitants in 2023 (Statistisk sentralbyrå, 2024a). The area constituted its own municipality, Klæbu Municipality, until January 1<sup>st</sup> 2020 when it was merged with Trondheim. TRV has been responsible for the renovation in the area since 2018 (Trondheim kommune, 2023). As areas closer to Trondheim city center, which have been part of the renovation system for a long time, were investigated the year before, it was decided that it would be interesting to see if there were any differences in Klæbu and Tanem. In addition, mapping of garden waste dumping in the area revealed that garden waste dumping was a significant issue (Trondheim kommune, 2023). Comparing the results with those of the questionnaire sent the year before could give a deeper understanding of the mechanisms influencing garden waste disposal methods.

The sampling was guided by the directions provided by the Municipality for the project. The main criteria were that the sample needed to be adults living in former Klæbu Municipality. As we were interested in exploring garden waste disposal behaviors and opinions, it was a prerequisite that the questionnaire would reach garden owners. It was therefore sent to residential

areas. The questionnaire was distributed as an URL through the Municipality's SMS system on July 28<sup>th</sup>, 2023. It was closed on August 7<sup>th</sup>, 2023. The message was sent to all registered homeowners within the selected area, outlined as polygons in the SMS system. The system did not support drawing a random sample within the polygons, and creating many small polygons would be too time consuming. Therefore, it was decided to send it to all central areas in Klæbu and Tanem. Figure 2 outlines the areas that received the message. As the recipients of the message could decide whether or not they wanted to participate, the study applied volunteer sampling (Agresti, 2018). The message reached 3728 recipients, of which 909 were registered in Tanem and 2819 in Klæbu.



*Figure 2: Areas that received the questionnaire. Klæbu to the right and Tanem to the left. Figure retrieved from Trondheim kommune (2023).*

### 3.2.2 Questionnaire design

The questionnaire was created using Google Forms and consisted of 18 questions. To facilitate comparison, most of the questions were the same as in the questionnaire sent to areas of Trondheim city in 2022. Additionally, some new questions were added based on discussions with employees in the Municipality and their observations and thoughts. For example, the question about influence from neighbors was added after observations that some neighborhoods have large dumping sites that seemed to be used by a lot of people, which raised the hypothesis

of the effect of social norms. However, it was attempted to keep the questionnaire relatively short in order to reduce the likelihood of non-completion due to “respondent fatigue”, meaning that respondents decide not to finish the questionnaire or answer inaccurately because they become tired of answering (Clark et al., 2021). The addition of new questions was therefore limited.

As the questionnaire was originally only meant to be used by the Municipality, not all the questions are used in this thesis. The questions that were most relevant for TPB and therefore used in the analysis are described below. Not included in this thesis were questions regarding respondents’ knowledge of the existing solutions for waste disposal, willingness to pay, suggestions for dumping sites, and ideas for how the garden waste disposal solutions could be improved. The complete questionnaire can be found in Appendix I.

### 3.2.3 Measures

Most of the questions in the questionnaire fit into one of the components of TPB and were sorted accordingly. The relationship between the variables in the explanatory components of the theory, and the behaviors, were thereafter explored. However, when designing the questionnaire, some questions were asked with certain behaviors in mind, and the analysis was therefore adapted based on this. The variables belonging to each component of the theory, and the specific relationships explored, are described below. All the questions used are summarized in Table 1, each with a specific abbreviation used when presenting and discussing the results.

#### *Garden waste disposal behavior:*

Three variables were used to study garden waste disposal behaviors. The first concerns dumping behavior, in the questionnaire termed as “throwing garden waste in a green area”. The two other variables are the use or non-use of two solutions for appropriate garden waste disposal – the garden waste center at Heggstadmoen and the garden waste collection campaign (Hageavfallsaksjonen). These were selected as they represent the main solutions offered by TRV for garden waste disposal. Including a question related to garden waste dumping, provided the opportunity to discover the perceptions and barriers behind this behavior, which is crucial to understanding how to prevent it.

### *Knowledge:*

Only one variable in the questionnaire was relevant for the knowledge component, and it investigated the respondents' knowledge of the negative implications of garden waste dumping. This variable was examined in relation to each of the three behavior variables (H1). In addition, knowledge was examined in relation to attitudes (H2) which is explained below.

### *Attitudes:*

Four variables were considered to fit under the attitude component of the theory. The first two variables investigated attitudes towards garden waste disposal, by exploring if respondents saw the point in appropriate garden waste disposal, and if they perceived garden waste dumping to be less negative than other waste dumping. The third investigated attitudes towards alien species, by asking how concerned they were about the spread of alien species in Norway. The fourth investigated attitudes towards the existing garden waste disposal solutions by asking respondents what they think about them on a scale from very poor to very good.

First, the relationships between knowledge and the three first attitude variables were explored (H2). The fourth variable was omitted as it was not perceived relevant to the knowledge variable. Secondly, all four attitude variables were examined in relation to each of the three variables for behavior (H3).

### *Subjective norms:*

For subjective norms, there was only one relevant variable, investigating to what degree respondents feel influenced by neighbors dumping their garden waste. The variable was examined in relation to all three behavior variables (H4).

### *Perceived behavioral control:*

There was a total of seven perceived behavioral control variables, investigating various barriers the respondents could have towards using the appropriate garden waste disposal solutions. These included not having access to a car, costs for renting a car/trailer, poor information, not having time, the distance to the garden waste center, the limited time period for the garden waste collection campaign and costs for using alternative services (such as the waste taxi).

When investigating the relationship between these and each of the three variables for behavior, only the barriers relevant to each specific behavior were included (H5). This meant that for the garden waste center at Heggstadmoen the first five variables were used, while for the garden waste collection campaign the variables poor information, not having time and the limited duration of the campaign were used. Garden waste dumping was examined with all the variables.

*Table 1: The questions used in the analysis, including which component of TPB they belong to, abbreviations used in the results and discussion, and the response options.*

<b>Components</b>	<b>Abbreviation</b>	<b>Questions</b>	<b>Response options</b>
Behavior		<i>“Which solutions do you utilize for garden waste disposal?”</i>	
	B1 Dump	Throw it in a green area nearby	Yes/no
	B2 Heggstadmoen	The garden waste center at Heggstadmoen	Yes/no
	B3 Campaign	The garden waste collection campaign (Hageavfallsaksjonen)	Yes/no
Knowledge	K1 Implications	Did you know that garden waste dumped in nature is a significant contributor to the spread of invasive species and pests?	Yes/no
Attitudes	A1 Point	Is the following a barrier for you to deliver your garden waste: I don't see the point of delivering it to an approved facility.	Yes/no
	A2 Less negative	How much do you agree with the following statement: disposing of garden waste in nature is less negative than disposing of other waste in nature?	Likert (1-5)
	A3 Concern	How concerned are you about the spread of invasive species in Norwegian nature?	Likert (1-5)
	A4 Solutions	What do you think of the current system for garden waste in Trondheim?	Likert (1-5)
Subjective norms	SN1 Neighbors	How much do you agree with the following statement: The fact that neighbors dispose of garden waste in green areas/nature makes me more inclined to do the same.	Likert (1-5)
Perceived behavioral control		<i>“Are the following barriers relevant to you regarding getting your garden waste delivered to an approved facility?”</i>	
	PBC1 Car	Do not have access to a car	Yes/no
	PBC2 Rental	Costs for rental of a car/trailer	Yes/no
	PBC3 Info	Poor information	Yes/no
	PBC4 Time	Do not have time	Yes/no
	PBC5 Distance	Distance to the garden waste center at Heggstadmoen	Yes/no
	PBC6 Limited time	The limited duration of the garden waste collection campaign (Hageavfallsaksjonen)	Yes/no
	PBC7 Alt. costs	Costs for alternative services (e.g. waste taxi)	Yes/no



### 3.2.4 Analysis of the questionnaire

The questionnaire was analyzed using the statistical software R version 4.3.3. Respondents who said they did not have access to a garden were excluded from the analysis. The analyses were guided by the modified version of the Theory of Planned Behavior, as presented in section 2.1.

Because most of the questionnaire consisted of nominal and ordinal categorical variables, it was decided to use Pearson's chi-square test of independence to determine association between variables (Clark et al., 2021). An association was considered significant at an alpha value of  $p < 0.05$ . To investigate the strength of an association, Cramer's V was calculated. Cramer's V is the best suited measure for strength when variables with more than two categories are involved (Clark et al., 2021). The Cramer's V was interpreted based on the values presented in Table 2. In addition, the contingency tables for the significant associations were studied, in order to look for tendencies and connections.

*Table 2: Interpretation of Cramer's V. Table extracted from Lee (2016).*

Estimated values	Interpretation of association
0.00–0.10	Negligible
0.10–0.20	Weak
0.20–0.40	Moderate
0.40–0.60	Relatively strong
0.60–0.80	Strong
0.80–1.00	Very strong

To complement the chi-square tests the same relationships were investigated using logistic regression. The logistic regression allowed for investigating all the explanatory variables in conjunction with each other and for controlling for the variation of other variables. It can also help to avoid spurious associations, meaning associations that occur due a third variable influencing the two others (Agresti, 2018). One logistic regression model was constructed for each of the three variables for behavior. Each of the models applied all the variables belonging to knowledge, attitudes, subjective norms and perceived behavioral control as independent variables. However, instead of applying all the perceived behavioral control variables independently, the sum of the variables was used to lower the number of independent variables

in the models. As for the chi-square tests, only the barriers relevant to each solution were included in the sum, meaning that the maximum sum was seven for garden waste dumping, five for using Heggstadmoen and three for using the garden waste collection campaign. Also, only the direct relationship between knowledge and behavior was investigated, meaning that the relationship between knowledge and attitudes, H2, was not investigated by logistic regression. For the questions using a Likert scale, 1 was used as the reference level, while 0 was used for the yes/no (1/0) questions. To provide a measure of goodness-of-fit for the logistic regression models, the McFadden pseudo  $R^2$  was calculated. The McFadden  $R^2$  gives a value between 0 and 1, and indicates the proportion of the variation in the outcome variable that is explained by the independent variables in the model (Field, 2018). A value between 0.2 - 0.4 was by McFadden considered a very good fit of the model (Lee, 2013).

### 3.3 Semi-structured interview

Following the questionnaire survey, a semi-structured group interview was conducted with people working with garden waste management and the consequences of garden waste dumping. Interviewing is one of the most widely used methods in qualitative research and allows for discussion around the study topic and exploring participants' views and perceptions (Clark et al., 2021). With the semi-structured interview an interview guide with predetermined questions is used, but there is also room for follow-up questions and for interviewees to shape the interview more than in structured interviews (Clark et al., 2021). The goal was that participants in the group could discuss and build on each other's arguments.

#### 3.3.1 Sampling and data collection

Sampling of participants for the interview was done on two levels. First, it was decided to interview people working within garden waste management and management of invasive alien species. These people have, through their knowledge of the Municipality and feedback from inhabitants, an overall overview of the issue and today's situation. Additionally, they have a systems perspective that could shed light on connections and patterns in the case of garden waste dumping. On the second level of sampling participants were selected. Due to my internship in the Municipality the year before, I started by building on my network and reached out to people who fit the criteria. From there, I applied snowball sampling asking if they had recommendations

for other people that fit the criteria or units that should be included (Clark et al., 2021). It was suggested to include representatives from the different units in the Municipality working on the issue, including the units of Municipal Engineering (Kommunalteknikk), Climate and Environment (Klima- og miljøenheten) and Trondheim City Operations (Trondheim Bydrift), as well as someone from TRV. Because of group size and balance in perspectives, it was decided to include one person from each unit. As no one could participate from Trondheim City Operations the sample ended up consisting of three informants.

The interview was conducted in late January 2024 and lasted approximately 45 minutes. It was set in the buildings of Trondheim Municipality in the city center of Trondheim in a familiar setting for the participants. Due to TRV being located outside of the city center and the inconvenience of travel time, the representative from TRV participated digitally through the digital meeting systems of the Municipality. The use of video call allows for flexibility (Clark et al., 2021) and worked well as the representative could easily be heard and seen by the participants present in the room and vice versa. The interview was recorded after permission from the participants, to get better records of the views and to facilitate the analysis (Clark et al., 2021). The app Nettskjema-Diktafon was used to record the interview. The interview was later transcribed through the Nettskjema system, in combination with manual transcription to fix errors.

### 3.3.2 Designing an interview guide

The interview guide was designed to function as a framework for the group interview. It was developed based on the research questions and the hypotheses, as well as the questionnaire from 2023. In total it consisted of seven main questions, with several of these also having sub-questions, or follow-up questions, that could be asked for further details. The interview was split into four parts; an introduction, introductory questions, main questions and a concluding part. The interview guide can be found in Appendix II.

The introduction part of the interview provided the participants with information about the thesis, the interview, and their role and rights as participants, and allowed them to sign the consent form. To get the interview participants to start talking and feeling comfortable, the introduction was followed by two introductory questions where the participants could explain how they work with garden waste dumping, and what they believed to be the main problems connected to

garden waste dumping. The main part of the interview explored the participants' perceptions on three main topics; the reasons for garden waste dumping, what can be done to prevent garden waste dumping, and the challenges they face in developing good solutions for garden waste collection. In the concluding part of the interview, participants were asked if there was anything else they wanted to add, and were thanked for their contribution.

### 3.3.3 Analysis of the interview

The interview data was analyzed and coded in two rounds based on the research questions. The first round of coding was based on the Theory of Planned Behavior and the key components of the modified version of the theory – knowledge, attitude, subjective norms and perceived behavioral control. In addition, other factors influencing behavior, that were not part of TPB, were coded.

The second round of coding focused on RQ2, exploring what the participants perceived to be the greatest challenges in preventing garden waste dumping. It aimed at identifying the main discussion points surrounding the challenges the Municipality and TRV face in implementing measures against garden waste dumping and in developing new solutions. The coding helped identifying themes and categories. These were color coded in the transcription, and then moved into a table to gather the data and look for connections. After coding, relevant quotes from the interview were translated to English.

## 3.4 Ethical considerations

Ethical concerns is an essential part of the research process (Clark et al., 2021) and was considered in collection and analysis of both the quantitative and qualitative data. When designing the questionnaire, it was decided to design it in a way that would allow participants to stay completely anonymous, in the hope of receiving more honest answers and to protect the privacy of participants (Clark et al., 2021). In order to allow participants to make an informed decision about participating, they were presented with an information box at the beginning of the questionnaire. The information box included information about the project, what the questionnaire would be about, how the data would be used and that no identifiable data would be collected. They were informed that by participating they consented to these terms. The

questionnaire was created in Google Forms, as the Municipality mainly use the Google systems and therefore have a data processor agreement with Google.

Before conducting the interview, participants were provided with an information letter and a consent form by email. The information letter was based on the template provided by the Norwegian Agency for Shared Services in Education and Research (SIKT), and included information about the project, the interview, privacy and the rights they possess as participants. The consent form stated that they had read the information, and they had to tick off boxes agreeing to participate and to the interview being recorded. Before starting the interview, the information was briefly reiterated, and the participants signed the consent form. The Nettskjema system was used for recording and transcription as it provided safe storage of the data. When using the app Nettskjema-Diktafon, the recording was not stored directly at my phone, but in the Nettskjema system where university login was required to get access. To protect the privacy of participants and ensure their anonymity, their names have been replaced with P1, P2 and P3 in the transcription and when referring to them in this thesis.

### 3.5 Assessment of method and data material

The questionnaire was designed for the use of Trondheim Municipality, not specifically for this thesis, and was therefore mostly based on the questionnaire from the previous year. Therefore, when used in this thesis, conceptualization of the study had to come after data collection and not the other way around, meaning that the theory and literature used to analyze the data were chosen after data collection. This could potentially cause biases. This also meant that the instructions and standardized measures for studies using TPB, proposed by Ajzen (1991), were not used in the development of the questionnaire. The questionnaire therefore lacked, or had very few questions, on some of the key components of the theory, such as behavioral intention and subjective norms. Furthermore, it reduces the comparability of the findings with previous studies and may weaken the validity of how well the questions measure the key components of the theory.

The application of volunteer sampling for the questionnaire presents a weakness for the study due to the inherent selection bias of this type of sampling (Agresti, 2018). It is unlikely that the sample is representative of the population as participants themselves have volunteered to answer

and have their own motivations for doing so. Additionally, the response rate, at 9,3%, can be considered quite low and the external validity of the findings can therefore be questioned (Clark et al., 2021). The fact that the questionnaire was sent out during the summer when many were on vacation, combined with a quite short response window, could also have had a negative impact on the response rate.

There are also some challenges connected to the questionnaire being anonymous. Firstly, it can be recommended to follow up on people who do not reply at first, in order to increase the response rate (Clark et al., 2021). However, the lack of contact information and registration of who had answered and not, made this impossible. Secondly, there was no way of knowing if more people from the same household had answered. Two people could both be owners of the house and therefore both receive and answer the questionnaire. There is also no way of knowing if someone completed the questionnaire several times, though in this case there is no clear incentive or benefit that could be derived from doing so. To ensure anonymity, the number of background questions asked also had to be limited. It would have been beneficial to include more background questions exploring demographic factors to better assess the representability of the sample. However, since Klæbu and Tanem have a relatively small population, including too many questions could potentially compromise anonymity.

For the analysis of the questionnaire, there was an issue connected to many of the questions having ordinal variables. While the chi-square test can be used for this type of variable, it will treat them as nominal variables and the ordinal information will therefore be lost (Agresti, 2018). The chi-square test can also not tell anything about the causality of the association between the variables (Clark et al., 2021). This was part of the reason why it was decided to do the chi-square tests in combination with logistic regression, as the logistic regression is more suitable for ordinal variables, and also test for a causal link between the independent variables and the dependent variable.

Additionally, inferential statistics assumes probability sampling in order to estimate generalizability to the population (Clark et al., 2021). As the study applied a form of non-probability sampling, this gives some uncertainty to the results. Furthermore, an assumption for the chi-square test is that the expected frequency of each cell in the contingency table should exceed 5 (Agresti, 2018). This assumption is not fulfilled for all the tests in this thesis. However,

when the contingency table is larger than 2x2, a rule of thumb used by many is that the assumption is fulfilled as long as no more than 20% of the cells are less than 5, and all expected counts are greater than 1 (Field, 2018). Following this rule, all the tests in this thesis fulfill the assumption.

As for the interview, biases could have emerged from my previous internship in the Municipality, giving me predetermined ideas about what I would find, affecting both data collection and analysis. In addition, as I knew two of the interview participants, there could be a chance of some response bias due to underlying expectations about what I wanted to discover. On the other hand, my knowledge of the study participants could contribute to building rapport, meaning a positive and trusting relationship with the interview participants (Clark et al., 2021). There is also little evidence that the hybrid format, with one person participating by video call, would negatively impact the ability to build rapport (Clark et al., 2021), especially since the participants had knowledge of each other and are used to having meetings with this format. As the interview was conducted in Norwegian, findings and quotes had to be translated to English for this thesis, which could include some risk of mistranslations.

## 4. Results

The following chapter presents the results obtained from analyzing the collected data. The first part discusses the questionnaire results, where the research hypotheses were tested. It starts with a description of the sample, followed by the findings from the chi-square tests of independence and then the results from the logistic regression models. The second part of the chapter presents the findings from the interviews, focusing on the participants' perspectives on the factors influencing garden waste disposal behavior, and thereafter the challenges they face in avoiding illegal garden waste dumping.

### 4.1 Questionnaire

#### 4.1.1 Sample characteristics

The questionnaire received a total of 345 responses. Among these, 15 respondents indicated that they did not have access to a garden and were consequently excluded from the analysis. The demographic composition of the remaining 330 can be seen in Table 3.

*Table 3: The demographic composition of the sample.*

	<b>n</b>	<b>%</b>
<b>Location</b>		
Klæbu	243	73.6
Tanem	87	26.4
Total	330	100
<b>Age</b>		
< 18	1	0.3
18 – 30	19	5.8
30 – 50	128	38.8
50 – 70	139	42.1
<70	43	13.0
Total	330	100

The distribution of respondents showed that 74% resided in Klæbu, while the remaining 26% lived in Tanem. This distribution closely reflects the population distribution of the two areas. The most common age groups, comprising over 80% of the respondents, were individuals aged 30 - 70 years old.



#### 4.1.2 Chi-square analysis

*Hypothesis 1: There is a relationship between knowledge about the consequences of garden waste dumping, and garden waste disposal behavior*

For the first hypothesis, the associations between knowledge of the implications of garden waste dumping (*K1 Implications*), and the three behaviors garden waste dumping (*B1 Dumping*), using the garden waste center (*B2 Heggstadmoen*) and using the garden waste collection campaign (*B3 Campaign*) were explored. The results are shown in Table 4.

*Table 4: Association between knowledge of the implications of garden waste dumping and garden waste dumping behavior, analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .*

B1 Dumping						
K1 Implications	Yes n (%)	No n (%)	X <sup>2</sup>	df	p-value	Cramer's V
Yes	24 (42.1)	219 (80.2)	33.35	1	<0.001***	0.33
No	33 (57.9)	54 (19.8)				
B2 Heggstadmoen						
Yes	196 (77.5)	47 (61.0)	7.39	1	0.01**	0.16
No	57 (22.5)	30 (39.0)				
B3 Campaign						
Yes	30 (63.8)	213 (75.3)	2.16	1	0.14	0.09
No	17 (36.2)	70 (24.7)				

The chi-square tests found an association between knowledge (*K1 Implications*) and garden waste dumping (*B1 Dumping*), that was significant at  $p < 0.001$  and with a Cramer's V of 0.33, suggesting moderate strength. Among the respondents who did not dump garden waste, approximately 80.2% had knowledge of the implications of garden waste dumping, compared to 42% among respondents who admitted to dumping garden waste.

Additionally, an association that was significant at  $p < 0.01$  was found with using the garden waste center (*B2 Heggstadmoen*). With a Cramer's V of 0.16 this association was considered relatively weak. Among those utilizing the garden waste center, 77.5% knew of the implications of garden waste dumping, compared to 61% among those who did not use it.

No significant association was identified between knowledge and using the garden waste collection campaign (*B3 Campaign*).

*Hypothesis 2: There is a relationship between knowledge about the consequences of garden waste dumping, and attitudes*

For hypothesis 2, the relationships between having knowledge of the implications of garden waste dumping (*K1 Implications*), and the three relevant attitude variables were explored. The relevant attitude variables were seeing the point in proper garden waste disposal (*A1 Point*), seeing garden waste dumping as less negative than other dumping (*A2 Less Negative*) and being concerned about alien species spreading (*A3 Concern*). The results are presented in Table 5.

*Table 5: Association between knowledge of the implications of garden waste dumping and attitudes, analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .*

	K1 Implications		X <sup>2</sup>	df	p-value	Cramer's V
	Yes n (%)	No n (%)				
A1 Point			0.04	1	0.85	0.02
Yes	27 (11.1)	11 (12.6)				
No	216 (88.9)	76 (87.4)				
A2 Less negative			46.66	4	<0.001***	0.38
1 (Strongly disagree)	38 (15.6)	1 (1.1)				
2	29 (11.9)	5 (5.7)				
3	77 (31.7)	12 (13.8)				
4	58 (23.9)	28 (32.2)				
5 (Strongly agree)	41 (16.9)	41 (47.1)				
A3 Concern			25.88	4	<0.001***	0.28
1 (Strongly disagree)	14 (5.8)	13 (14.9)				
2	15 (6.2)	11 (12.6)				
3	70 (28.8)	33 (37.9)				
4	77 (31.7)	25 (28.7)				
5 (Strongly agree)	67 (27.6)	5 (5.7)				

An association significant at  $p < 0.001$  was found between knowledge and seeing garden waste dumping as less negative than other waste dumping. The Cramer's V of 0.38 revealed that the strength of the association was considered moderate, but on the stronger side of the range. Of those answering "No" to having knowledge of the implications of garden waste dumping, about 80% selected that they agree or strongly agree to garden waste dumping being less negative than other waste dumping (score 4 or 5 for *A2 Less negative*), compared to about 41% in the "yes" group.

An association significant at  $p < 0.001$  was also discovered between knowledge and concern about alien species spreading in Norwegian nature (*A3 Concern*). The association had a moderate

strength with a Cramer's V of 0.28. Among the respondents who knew of the implications of garden waste dumping (*K1 Implications*), 59.3% agreed or strongly agreed to being concerned, compared to 34.4% among those who did not know of the implications.

Seeing the point in proper garden waste disposal (*A1 Point*) did not exhibit any association with knowledge of the implications of garden waste dumping (*K1 Implications*).

*Hypothesis 3: There is a relationship between attitudes, and garden waste disposal behavior*

For hypothesis 3, all four attitude variables were first tested for association with garden waste dumping (*B1 Dumping*), as displayed in Table 6.

Table 6: Association between attitudes and dumping of garden waste in green areas, analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

	B1 Dumping		X <sup>2</sup>	df	p-value	Cramer's V
	Yes n (%)	No n (%)				
A1 Point			0.18	1	0.67	0.04
Yes	8 (14.0)	30 (11.0)				
No	49 (86.0)	243 (89.0)				
A2 Less negative			21.88	4	<0.001***	0.26
1 (Strongly disagree)	4 (7.0)	35 (12.8)				
2	4 (7.0)	30 (11.0)				
3	10 (17.5)	79 (28.9)				
4	11 (19.3)	75 (27.5)				
5 (Strongly agree)	28 (49.1)	54 (19.8)				
A3 Concern			14.69	4	0.01**	0.21
1 (Not concerned at all)	7 (12.3)	20 (7.3)				
2	9 (15.8)	17 (6.2)				
3	21 (36.8)	82 (30.0)				
4	16 (28.1)	86 (31.5)				
5 (Very concerned)	4 (7.0)	68 (24.9)				
A4 Solutions			20.85	4	<0.001***	0.25
1 (Very poor)	4 (7.0)	9 (3.3)				
2	10 (17.5)	19 (7.0)				
3	26 (45.6)	78 (28.6)				
4	11 (19.3)	88 (32.2)				
5 (Very good)	6 (10.5)	79 (28.9)				

The findings show that seeing garden waste dumping as less negative than other waste dumping (*A2 Less negative*), was associated with dumping garden waste at  $p < 0.001$ . The Cramer's V of 0.26 indicated a moderate association. Among those who dumped their garden waste, 68.4%

agreed or strongly agreed to garden waste dumping being less negative than other waste dumping, compared to 47.3% among those who claimed to not dump their garden waste.

Furthermore, being concerned about alien species spreading (*A3 Concern*) was associated with garden waste dumping at  $p < 0.01$ . The Cramer's V was 0.21, meaning a strength at the lower range of moderate. While 35.1% of those reporting to dump their garden waste stated to agree or strongly agree to being concerned, 56.4% of those who did not dump felt the same.

A highly significant ( $p < 0.001$ ) association was also found between the level of content with the existing garden waste disposal solutions (*A4 Solutions*) and garden waste dumping. The association had a moderate strength with a Cramer's V of 0.25. 29.8% of those who dumped their garden waste thought that the existing solutions were good or very good, compared to 61.1% for those who did not dump.

No significant association was found between seeing the point in proper garden waste disposal (*A1 Point*) and garden waste dumping.

Next, the associations between the attitude variables and using the garden waste center at Heggstadmoen (*B2 Heggstadmoen*) were explored. The results can be seen in Table 7. Significant associations were identified for all four variables.

The association between seeing the point in proper garden waste disposal (*A1 Point*) and using the garden waste center (*B2 Heggstadmoen*) was significant at  $p < 0.001$ . It had a Cramer's V of 0.23 indicating moderate strength. Among those who used the garden waste center, 92.5% saw the point in proper garden waste disposal, while 75.3% who did not use it saw the point.

Seeing garden waste dumping as less negative than other waste dumping (*A2 Less negative*) was associated with using the garden waste center at Heggstadmoen (*B2 Heggstadmoen*) at  $p < 0.01$ . The Cramer's V showed a strength of 0.21, meaning at the lower side of moderate. For those who claimed to use the garden waste center 46.7% agreed or strongly agreed to seeing garden waste dumping as less negative than other dumping, compared to 65.0% for those who did not use the garden waste center.

Being concerned about alien species spreading in Norwegian nature (*A3 Concern*) was associated with the behavior of using the garden waste center (*B2 Heggstadmoen*) at  $p < 0.05$ .

The association was at the higher range of weak, with a Cramer's V of 0.19. Among the respondents who stated to use the garden waste center, 56.9% agreed or strongly agreed to being concerned, while 39% answered the same for those who did not use the garden waste center.

Lastly, an association was found between the level of content with the existing solutions (*A4 Solutions*) and using the garden waste center (*B2 Heggstadmoen*). With a Cramer's V of 0.33 it was of moderate strength. Among those who used the garden waste center, 64.0% thought the existing solutions for garden waste disposal were good or very good, compared to 28.6% for those who did not use the garden waste center.

Table 7: Association between attitudes and using the garden waste center at Heggstadmoen, analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

B2 Heggstadmoen						
	Yes n (%)	No n (%)	X <sup>2</sup>	df	p-value	Cramer's V
A1 Point			15.43	1	<0.001***	0.23
Yes	19 (7.5)	19 (24.7)				
No	234 (92.5)	58 (75.3)				
A2 Less negative			13.89	4	0.01**	0.21
1 (Strongly disagree)	33 (13.0)	6 (7.8)				
2	29 (11.5)	5 (6.5)				
3	73 (28.9)	16 (20.8)				
4	67 (26.5)	19 (24.7)				
5 (Strongly agree)	51 (20.2)	31 (40.3)				
A3 Concern			11.74	4	0.02*	0.19
1 (Not concerned at all)	16 (6.3)	11 (14.3)				
2	16 (6.3)	10 (13.0)				
3	77 (30.4)	26 (33.8)				
4	84 (33.2)	18 (23.4)				
5 (Very concerned)	60 (23.7)	12 (15.6)				
A4 Solutions			36.48	4	<0.001***	0.33
1 (Very poor)	7 (2.8)	6 (7.8)				
2	14 (5.5)	15 (19.5)				
3	70 (27.7)	34 (44.2)				
4	84 (33.2)	15 (19.5)				
5 (Very good)	78 (30.8)	7 (9.1)				

Chi-square tests were also conducted between the attitude variables and the garden waste collection campaign (*B3 Campaign*), but no statistically significant associations were found for any of the variables.

*Hypothesis 4: There is a relationship between subjective norms, and garden waste disposal behavior*

The results for the chi-square tests for hypothesis 4 are found in Table 8. Tests were conducted between the variable for subjective norms, *SNI Neighbors*, and the three variables for garden waste disposal behavior.

Being more inclined to dumping garden waste if neighbors did so (*SNI Neighbors*), was associated with garden waste dumping (*B1 Dumping*) at  $p < 0.001$ . The strength of the association, with a Cramer's V of 0.45, was relatively strong. Of those who admitted to dumping garden waste, 43.9% answered that they strongly agreed to being more inclined to dump if their neighbors did the same, compared to only 6.6% among those who did not dump.

No significant associations were identified with using the garden waste center (*B2 Heggstadmoen*) or the garden waste collection campaign (*B3 Campaign*).

Table 8: Association between subjective norms and behavior, analyzed by chi-square tests.

B1 Dumping						
SNI Neighbors	Yes n (%)	No n (%)	X <sup>2</sup>	Df	p-value	Cramer's V
1 (Strongly disagree)	10 (17.5)	148 (54.2)	65.83	4	<0.001***	0.45
2	5 (8.8)	42 (15.4)				
3	9 (15.8)	38 (13.9)				
4	8 (14.0)	27 (9.9)				
5 (Strongly agree)	25 (43.9)	18 (6.6)				
B2 Heggstadmoen						
1 (Strongly disagree)	128 (50.6)	30 (39.0)	8.06	4	0.09	0.16
2	33 (13.0)	14 (18.2)				
3	34 (13.4)	13 (16.9)				
4	30 (11.9)	5 (6.5)				
5 (Strongly agree)	28 (11.1)	15 (19.5)				
B3 Campaign						
1 (Strongly disagree)	21 (44.7)	137 (48.4)	1.38	4	0.85	0.07
2	6 (12.8)	41 (14.5)				
3	6 (12.8)	41(14.5)				
4	7 (14.9)	28 (9.9)				
5 (Strongly agree)	7 (14.9)	36 (12.7)				

*Hypothesis 5: There is a relationship between the perceived behavioral control of using the garden waste disposal solutions, and garden waste disposal behavior*

Chi-square tests were conducted between the relevant perceived behavioral control variables and each of the garden waste disposal behaviors. The results for the chi-square tests with garden waste dumping (*B1 Dump*) are presented in Table 9. Three variables had a statistically significant association with garden waste dumping at  $p < 0.01$ , although all of them had a Cramer's V of less than 0.2, meaning the associations were relatively weak. These variables were seeing poor information as a barrier (*PBC3 Info*), seeing not having time as a barrier (*PBC4 Time*) and seeing the distance to Heggstadmoen as a barrier (*PBC5 Distance*) for handing in the garden waste. Among those who dumped, 36.8% saw poor information as a barrier compared to 19.8% among those who did not dump. Not having time was a barrier for 33.3% of those dumping their garden waste and for 15.8% of those not dumping. 47.4% of those dumping perceived the distance to Heggstadmoen as a barrier, in contrast to 27.1% of those not dumping.

*Table 9: Association between perceived behavioral control and dumping of garden waste in green areas, analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .*

	B1 Dump		X <sup>2</sup>	df	p-value	Cramer's V
	Yes n (%)	No n (%)				
PBC1 Car			0.96	1	0.33	0.07
Yes	10 (17.5)	32 (11.7)				
No	47 (82.5)	241 (88.3)				
PBC2 Rental			0.13	1	0.72	0.03
Yes	12 (21.1)	49 (17.9)				
No	45 (78.9)	224 (82.1)				
PBC3 Info			6.88	1	0.01**	0.15
Yes	21 (36.8)	54 (19.8)				
No	36 (63.2)	219 (80.2)				
PBC4 Time			8.44	1	0.004**	0.17
Yes	19 (33.3)	43 (15.8)				
No	38 (66.7)	230 (84.2)				
PBC5 Distance			8.19	1	0.004**	0.17
Yes	27 (47.4)	74 (27.1)				
No	30 (52.6)	199 (72.9)				
PBC6 Limited time			0.00	1	1	0.00
Yes	15 (26.3)	72 (26.4)				
No	42 (73.7)	201 (73.6)				
PBC7 Alt. costs			2.44	1	0.12	0.10
Yes	24 (42.1)	83 (30.4)				
No	33 (57.9)	190 (69.6)				

Table 10 presents the results of the chi-square tests with using the garden waste center at Heggstadmoen (*B2 Heggstadmoen*). The tests showed that seeing the costs for renting a car/trailer as a barrier (*PBC2 Rental*) was associated with using the garden waste center at  $p < 0.05$ . With a Cramer's V of 0.14 the association was weak. Of those using the garden waste center, 15.4% saw the costs for renting a car/trailer as a barrier, compared to 28.6% for those who did not use the garden waste center.

Additionally, seeing poor information as a barrier was associated with using the garden waste center at  $p < 0.001$ . The Cramer's V of 0.20 indicated a strength that is right at the boundary between weak and moderate. Of those using the garden waste center 18.2% saw poor information as a barrier, compared to 37.7% of those who did not use it.

*Table 10: Association between perceived behavioral control and using the garden waste center at Heggstadmoen, analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .*

B2 Heggstadmoen						
	Yes n (%)	No n (%)	X <sup>2</sup>	df	p-value	Cramer's V
PBC1 Car			2.09	1	0.15	0.09
Yes	28 (11.1)	14 (18.2)				
No	225 (88.9)	63 (81.8)				
PBC2 Rental			5.94	1	0.02*	0.14
Yes	39 (15.4)	22 (28.6)				
No	214 (84.6)	55 (71.4)				
PBC3 Info			11.67	1	0.001***	0.20
Yes	46 (18.2)	29 (37.7)				
No	207 (81.8)	48 (62.3)				
PBC4 Time			0.12	1	0.73	0.03
Yes	46 (18.2)	16 (20.8)				
No	207 (81.8)	61 (79.2)				
PBC5 Distance			1.94	1	0.16	0.08
Yes	72 (28.5)	29 (37.7)				
No	181 (71.5)	48 (62.3)				



For using the garden waste collection campaign (*B3 Campaign*), only seeing the limited duration of the campaign as a barrier (*PBC6 Limited time*), showed a significant association at  $p < 0.01$ . The findings are presented in Table 11. The Cramer's V of 0.15 indicated a weak association. Among the group who used the campaign, 42.6% saw the limited duration of the campaign as a barrier for using it, compared to 23.7% for those who did not use the campaign.

*Table 11: Association between perceived behavioral control and using the garden waste collection campaign (Hageavfallsaksjonen), analyzed by chi-square tests. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .*

B3 Campaign						
	Yes n (%)	No n (%)	X <sup>2</sup>	df	p-value	Cramer's V
PBC3 Info			1.43	1	0.23	0.08
Yes	7 (14.9)	68 (24.0)				
No	40 (85.1)	215 (76.0)				
PBC4 Time			1.16	1	0.28	0.07
Yes	12 (25.5)	50 (17.7)				
No	35 (74.5)	233 (82.3)				
PBC6 Limited time			6.46	1	0.01**	0.15
Yes	20 (42.6)	67 (23.7)				
No	27 (57.4)	216 (76.3)				

### 4.1.3 Logistic regression

Three logistic regression models were constructed, one for each of the garden waste disposal behaviors. For each of them, the variables for knowledge, attitudes and subjective norms were added as explanatory variables, as well as the sum of the relevant perceived behavioral control variables for each behavior.

Table 12: Association between the different independent variables and dumping of garden waste in green areas, analyzed by logistic regression.

B1 Dumping				
Variables	Coefficient	OR	95% Confidence Int.	p-value
K1 Implications	-1.17	0.31	0.14, 0.68	**
A1 Point	-0.07	0.94	0.30, 2.65	
A2 Less negative				
2	-0.16	0.85	0.14, 5.31	
3	-0.50	0.61	0.13, 3.21	
4	-1.22	0.30	0.06, 1.65	
5	-0.12	0.89	0.19, 4.60	
A3 Concern				
2	0.59	1.80	0.42, 8.12	
3	0.29	1.34	0.39, 5.15	
4	0.24	1.27	0.35, 5.02	
5	-0.60	0.55	0.10, 2.72	
A4 Solutions				
2	0.23	1.25	0.18, 9.85	
3	-0.06	0.94	0.16, 6.51	
4	-0.85	0.43	0.06, 3.33	
5	-1.31	0.27	0.03, 2.37	
SN1 Neighbors				
2	0.28	1.32	0.36, 4.41	
3	0.80	2.23	0.71, 6.92	
4	0.82	2.27	0.71, 7.10	
5	2.55	12.75	4.73, 36.81	***
PBC Sum	-0.08	0.92	0.73, 1.15	
N = 330      McFadden R <sup>2</sup> = 0.28      * p < 0.05, ** p < 0.01, *** p < 0.001				

The results from the first logistic regression model, with garden waste dumping (*B1 Dumping*) as the response variable, are presented in Table 12. The regression found two variables to be significant; knowledge of the implications of garden waste dumping (*K1 Implications*) and strongly agreeing to being influenced by neighbors dumping (option 5 for *SN1 Neighbors*). They were significant at  $p < 0.01$  and  $p < 0.001$  respectively. Those who knew of the implications of garden waste dumping had 69% lower odds of dumping their garden waste compared to those

who did not know of the implications. Furthermore, those who strongly agreed to being more inclined to dump their garden waste if their neighbors did so (option 5 to *SN1 Neighbors*), had 12.75 times higher probability of dumping their garden waste than those who strongly disagreed. The McFadden pseudo  $R^2$  of 0.28 indicated the model being a good fit.

Table 13: Association between the different independent variables and using the garden waste center at Heggstadmoen, analyzed by logistic regression.

B2 Heggstadmoen				
Variables	Coefficient	OR	95% Confidence Int.	p-value
K1 Implications	0.37	1.45	0.70, 2.96	
A1 Point	-1.34	0.26	0.11, 0.59	**
A2 Less negative				
2	-0.33	0.72	0.17, 3.17	
3	-0.25	0.78	0.21, 2.64	
4	0.01	1.01	0.27, 3.43	
5	-0.98	0.37	0.10, 1.23	
A3 Concern				
2	-0.14	0.87	0.25, 3.11	
3	-0.11	0.90	0.31, 2.54	
4	0.16	1.17	0.39, 3.48	
5	-0.06	0.94	0.28, 3.11	
A4 Solutions				
2	-0.33	0.72	0.16, 3.03	
3	0.49	1.63	0.43, 6.05	
4	1.41	4.09	0.96, 17.06	
5	2.38	10.76	2.25, 53.25	**
SN1 Neighbors				
2	-0.39	0.68	0.29, 1.64	
3	0.16	1.17	0.47, 3.01	
4	0.96	2.61	0.86, 9.31	
5	0.06	1.06	0.43, 2.72	
PBC Sum	0.06	1.07	0.83, 1.39	
N = 330      McFadden $R^2$ = 0.18      * p < 0.05, ** p < 0.01, *** p < 0.001				

The results from the second logistic regression model, with using the garden waste center at Heggstadmoen (*B2 Heggstadmoen*) as response variable, are shown in Table 13. Again, only two variables were significant; seeing the point in proper garden waste disposal (*A1 Point*) and seeing the existing solutions as very good (option 5 for *A4 Solutions*). Both were significant at  $p < 0.01$ . Those who did not see the point in delivering their garden waste to approved waste facilities had 74% lower odds of using Heggstadmoen compared to those who answered that they saw the point. For those who thought the existing garden waste solutions were very good (option 5 to *A4*

*Solutions*), the probability of using the garden waste center was 10.76 higher than for those who thought the solutions were very poor. The McFadden pseudo  $R^2$  was calculated to be 0.18.

Table 14: Association between the different independent variables and using the garden waste collection campaign (*Hageavfallsaksjonen*), analyzed by logistic regression.

B3 Campaign				
Variables	Coefficient	OR	95% Confidence Int.	p-value
K1 Implications	0.42	1.52	0.75, 3.08	
A1 Point	-1.35	0.26	0.11, 0.59	**
A2 Less negative				
2	-0.40	0.67	0.15, 3.01	
3	-0.36	0.70	0.18, 2.40	
4	-0.04	0.96	0.25, 3.34	
5	-1.11	0.33	0.09, 1.11	
A3 Concern				
2	-0.34	0.71	0.19, 2.61	
3	-0.24	0.79	0.26, 2.27	
4	0.11	1.11	0.36, 3.38	
5	-0.12	0.89	0.26, 2.99	
A4 Solutions				
2	-0.07	0.93	0.21, 4.03	
3	0.86	2.37	0.60, 9.22	
4	1.97	7.18	1.62, 32.09	**
5	3.01	20.35	4.06, 107.59	***
SN1 Neighbors				
2	-0.36	0.70	0.29, 1.70	
3	0.18	1.20	0.48, 3.11	
4	0.98	2.68	0.87, 9.60	
5	0.07	1.07	0.43, 2.78	
PBC Sum	0.45	1.57	1.07, 2.35	*
N = 330      McFadden $R^2 = 0.19$ * $p < 0.05$ , ** $p < 0.01$ , *** $p < 0.001$				

The last logistic regression model, using the garden waste collection campaign (*B3 Campaign*) as response variable, revealed four significant variables. The results are presented in Table 14. The first variable, *A1 Point*, was significant at  $p < 0.01$ . Those who did not see the point in delivering their garden waste to approved waste facilities had 74% lower odds of using the campaign compared to those who answered that they saw the point.

The next significant variables, with a significance level of respectively  $<0.01$  and  $<0.001$ , were the response options 4 and 5 for *A4 Solutions*, meaning those who thought the existing garden

waste disposal solution were good or very good. Those who answered these options had respectively 7.18 and 20.35 higher probability of using the campaign compared to those who thought the solutions were very poor (response option 1).

Lastly, the sum of the relevant perceived behavioral control variables, *PCB Sum*, was significant at  $p < 0.05$ . For each additional perceived behavioral control variable added to the sum, the odds of an individual using the campaign increased by 57%.

## 4.2 Interview

The interview was conducted with three participants, one from TRV (P1) and two from Trondheim Municipality (P2 and P3). Various topics related to both sub-research questions were discussed. The main points covered are presented here, organized according to the research questions. Under RQ1, arguments are sorted based on the Theory of Planned Behavior, while under RQ2, the difficulties in preventing garden waste dumping, including challenges in developing new solutions, are addressed.

### 4.2.1 RQ1: Factors influencing garden waste disposal behavior

#### *Knowledge*

The impact of knowledge on garden waste dumping behavior was mentioned several times during the interview. The statements can be split into two perspectives. The first perspective concerned knowledge regarding invasive plants species and the role of garden waste dumping in their dispersion, a point that was brought up by all participants throughout the interview. If people are not aware of the negative consequences of dumping garden waste, they will also not see a problem with doing so. As one participant said:

*"I think it's partly due to a lack of knowledge. The fact that one doesn't know about invasive species, consequences of spreading them, for example." (P3)*

Another expressed something similar:

*"And I also think many are not aware of alien species. They don't know... They don't know what they have themselves and they don't know what it is." (P2)*

The second perspective revolved around recognizing garden waste as a potential resource that could be utilized if disposed of correctly. This perspective was particularly emphasized by the representative from TRV, but with supporting remarks from the other participants.

*“It is difficult for many to understand that this is a resource we would like to have.” (P1)*

### *Attitudes*

Both attitudes towards garden waste itself and solutions for garden waste disposal were discussed during the interview. When talking about the attitudes toward garden waste and garden waste dumping, one participant said:

*“you don’t think it’s something dangerous. It’s natural sort of.”*

Additionally, it was outlined how garden waste seem to have a different status than other types of waste, and while the attitudes towards other waste types have changed over the last few decades, garden waste has not followed. This could be a reason it is more frequently dumped than other waste types.

*“So the attitude towards everything else has changed dramatically. And I would say that garden waste hasn’t followed, but I perceive, since we still have so many illegal dumps as we do, and we don’t have that for other types of waste then... there may be some attitudes there that... yeah. There’s been focus on all sorts of other waste and not garden waste.” (P1).*

When it comes to attitudes towards garden waste disposal, one participant said:

*“We want it to be convenient, we want to do it when it suits us.” (P2)*

Therefore, illegal dumping may often be chosen as a disposal method, as utilizing the garden waste center or the garden waste collection campaign require more planning and must be done at certain times.

### *Subjective norms*

All participants had an impression that local norms in a neighborhood and influence from neighbors were central factors contributing to illegal garden waste dumping. Mostly, the perception was that if one person starts dumping, or if it is common practice in the neighborhood, it is easier for others to follow.

*“That’s perhaps the biggest problem, when one person just starts dumping. (...) It becomes like... here the whole neighborhood dumps all their garden waste. Then it’s difficult to do something about it.” (P1)*

Furthermore, it was underlined that while one person only dumps their grass cuttings, and do not see an issue with that, they may not realize that their behavior also impacts others to dump their garden waste, which may include alien species or other types of waste.

*“The fact that you create a huge pile of grass, it might encourage others to throw invasive species, or other waste.” (P3)*

However, one participant also mentioned that norms could have a positive effect and be an effective tool in avoiding garden waste dumping, given that there are some engaged people in the neighborhood:

*“Because that’s perhaps what we’ve seen works best, it’s where there are some neighborhoods where some people are very engaged, or they have a board that’s very engaged. So they speak up when people try (...). And then it works.” (P3)*

#### *Perceived behavioral control*

Regarding perceived behavioral control, one obstacle outlined in the interview was that garden waste is often bulky and voluminous. This can cause practical challenges for transporting it to the garden waste center at Heggstadmoen, as having access to a car, and often also a trailer, is necessary. Additionally, people might not want to get the inside their car dirty.

*“you need a tow bar on the car, and... And access to a trailer. (...) Not everyone may want to have it in their car, either.” (P2)*

Especially if there is a convenient dumping site close by or the amount of garden waste is small, the planning and effort required to use the existing solutions may seem too much in a busy everyday life.

*“those who are doing something in the garden (...) and have a relatively large garden, they transport it in a trailer instead. Maybe they don’t have the slope nearby, or... Whereas for those who (...) don’t have such a large garden, and have a slope, it’s very easy to just...[dump]. Because it disappears eventually.” (P1)*

For the garden waste collection campaign (Hageavfallsaksjonen), the participants believed that the planning required could be a barrier, even though the waste is picked up from the residents' homes.

*"You have to plan if you're going to participate in Hageavfallsaksjonen [the garden waste collection campaign], you have to buy the bags, and then you have to put them out when it's time to pick them up" (P2)*

Furthermore, the fact that the collection is only two times a year at specific and set times could be a potential barrier for using it.

*"We also understand that if people had been able to have it collected when it suited them, they would have used it more than if they had to transport it themselves." (P1)*

#### *Other factors*

While most of the factors mentioned can be categorized within the components of TPB, there were also a couple of factors identified that did not align with any specific component of the framework. Firstly, there is the significance of past behavior. As articulated by one participant:

*"This is how it's always been done." (P2)*

This is also related to the other factor mentioned, habits. The act of garden waste dumping is not always a result of a conscious choice, but rather a habitual behavior that occurs automatically, and that is not necessarily reflected upon. One of the participants had the following reflection:

*"You just do it sort of. It doesn't have to be very planned." (P2)*

#### 4.2.2 RQ2: Challenges with preventing illegal garden waste dumping

##### *Uncertainty about which measures or solutions to implement*

When the participants were asked which measures they believed were needed to avoid illegal garden waste dumping, the immediate response was *"If we had only known..."* (P3). While they expressed a willingness to implement measures or develop solutions to avoid garden waste dumping, they also expressed an uncertainty regarding what measures are effective and needed.



*"we're trying different things, but it's kind of difficult to measure if it works or not. (...) So it depends, what kind of impact it has and what works. We would have liked to know more about that." (P3)*

Both the mapping of garden waste dumping sites and the following measures implemented were brought up as attempts of understanding better what is needed; however, these did not provide much clarity to which measures to implement.

*"We actually had hope that the mapping would give us something on that. It was one of the things that was a bit of a focus the first year. It was about whether there's some sort of system to where in the city there are illegal dumps. But there isn't. It's not like there's more [in one part of the city], or at least we haven't found out until now." (P2)*

The measures implemented after the mapping did also not show the desired effect:

*"And then we see that those [dumping sites] that have been cleaned up, they've been dumped on again." P(3)*

#### *Reaching out with information*

Even though information, according to the participants, is easily available on the TRV webpages and information campaigns are run regularly, reaching out with information to those who need it was perceived as difficult.

*"Information distribution is never easy. To reach everyone, so... I don't know. We probably can never inform enough about why they should take it there, and... Or use the garden waste campaign instead of dumping it in the slope as they've always done." (P1)*

When discussing the garden waste collection campaign (Hageavfallsaksjonen) and the results from the questionnaire to Klæbu and Tanem, a lack of knowledge about the campaign was brought up as a potential reason for why it is only used by a minority of respondents.

*"But then there are probably also some people who don't know about it. Half of them know about it, but that means half of them don't know about it." (P2)*

Furthermore, reaching out with information to the people who actually dump has been a challenge. One participant highlighted difficulties they had when sending out information letters

to areas with many dumping sites, as those who dumped seemed to not always be the closest neighbors of the dumping site.

*"And in the areas that were cleaned, we've noticed that those who may have dumped there have been quite a bit farther away than we initially thought. So they haven't received any letters or information. They lived even further out, so they've driven quite a distance with a wheelbarrow or trailer." (P3)*

#### *Possible new solutions*

Through the two questionnaires, inhabitants provided several suggestions for new solutions for garden waste disposal. Several of these were discussed during the interview. When the interview participants were asked what the challenges and hindrances are for developing these solutions, a lack of resources was brought up as one of the main reasons.

*"It's resources which might be the biggest hindrance in terms of achieving that." (P1)*

One of the solutions suggested was to expand the garden waste collection campaign (Hageavfallsaksjonen) to more than two times a year. While the participant from TRV considered it possible to do, resources were again brought up as a challenge:

*"There are some financial challenges with that as well. Because it requires both manpower and equipment to get it done. For the spring campaign, we operate in the evenings, and we do that in the fall as well. So... essentially, we're utilizing both the manpower and vehicles that we already have. So... Yeah, no, it's feasible enough. The question is just how far the service should extend?" (P1)*

Another possibility that was discussed is the possibility of having a second recycling center, including a garden waste center, closer to the city. However, one of the difficulties brought up was to find a suited area.

*"Space is a scarce resource as well. So I think that's also a barrier, really." (P2)*

A third potential solution, also suggested in the questionnaires, was to have containers for garden waste at recycling points around the city. One of the participants had the following to say about such a solution:

*"There has been talk about containers at recycling points, for example, but the challenge with that, and it's a big challenge, is that there's a lot of improper sorting. So it remains to be seen if it would serve a purpose, in a way. (...) Because you can't just have a small opening, you sort of need a container." (P2)*

While it was emphasized that many of the possible solutions that had been discussed and evaluated would be possible to move forward with, it was concluded that it all comes down to an evaluation of whether the costs are worth the benefits.

*"Everything is possible. It's just a matter of resources, in that sense. (...) Then it's perhaps a bit of a cost-benefit analysis." (P1)*

## 5. Discussion

The following chapter will discuss how the findings fit with the research questions and hypotheses of the thesis. Furthermore, these results will be seen in connection with the findings from other literature using the Theory of Planned Behavior, as well as the general literature on waste dumping. Based on this, the research model will be evaluated, and some suggestions for future research on the topic will be provided. Lastly, based on the findings and literature, some possible measures and solutions to prevent garden waste dumping will be discussed.

### 5.1 Interpretation of the findings

When comparing the results from the chi-square tests and the logistic regression, it becomes clear that while some results are consistent across methods, others show disparities. These disparities provide insight into the complexity of garden waste disposal behaviors and show that the results can be impacted by the statistical methodology chosen. Understanding the association between variables is not always straightforward and which variables are significant varies based on the specific behavior explored.

For hypothesis 1, investigating the relationship between knowledge (*K1 Implications*) and behavior, the findings for the behavior of dumping garden waste (*B1 Dumping*), are consistent across the methods. The results are highly significant and therefore support the hypothesis. As expected, increased knowledge about the implications of garden waste dumping seems to reduce the likelihood of garden waste dumping. This was also repeatedly brought up during the interview, which further supports the relationship. However, for the two other behaviors investigated, the relationship is not quite as clear. For the behavior of using the garden waste center at Heggstadmoen (*B2 Heggstadmoen*), the chi-square test showed an association with knowledge. The contingency table suggested that those who use the garden waste center had somewhat higher knowledge of the implications of garden waste dumping, which is what was expected. However, Cramer's V showed that the association was weak, and the regression did not find a significant association altogether, suggesting that knowledge does not have a strong impact when seen in conjunction with other variables. Neither the chi-square test nor the regression showed a significant association between knowledge and the behavior of using the

garden waste collection campaign (*B3 Campaign*), and the hypothesis can therefore not be supported for this behavior.

The second hypothesis, exploring the association between knowledge and attitudes, was only analyzed using chi-square tests. The majority of respondents saw the point of handing in their garden waste regardless of their knowledge of the implications of garden waste dumping, and a significant association with knowledge was therefore not found. The two other variables explored, however, support the hypothesis that there is relationship between knowledge and attitudes. It is apparent that those who know of the implications of garden waste dumping to a smaller degree perceive it to be less negative than other types of waste dumping, and they are also more concerned about alien species spreading in Norwegian nature. These findings fit with the expectation.

When exploring the link between attitudes and behavior, which constitutes hypothesis 3, the findings vary. Logistic regression revealed no significant association between attitudes and the behavior of dumping garden waste. However, chi-square tests indicated moderate associations with three attitude variables. Those who perceived garden waste dumping as less negative than other waste dumping (*A2 Less Negative*) were more likely to dump their garden waste.

Individuals who were concerned about alien species spreading in Norwegian nature (*A3 Concern*) and who thought that the existing solutions for garden waste disposal (*A4 Solutions*) were good, tended not to dump their garden waste. This aligned with the expected patterns. Similarly, regarding the behavior of using Heggstadmoen, all attitude variables demonstrated significance in chi-square tests and followed the anticipated patterns. In the logistic regression model only the attitude variable related to seeing the point of proper garden waste disposal (*A1 Point*), and thinking that the existing solutions for garden waste disposal are very good (option 5 for *A4 Solutions*) significantly increased the odds of using Heggstadmoen. Conversely, the behavior of using the garden waste collection campaign exhibited different patterns. While chi-square tests found no significant associations, the logistic regression model identified that attitudes related to seeing the point of proper garden waste disposal (*A1 Point*) and perceiving the existing disposal solutions as good or very good (options 4 and 5 for *A4 Solutions*) were significant. Overall, the interview participants had the impression that attitudes were an important predictor of behavior, although the specific statistical connections were not discussed.

For hypothesis 4, exploring the relationship between subjective norms and behavior, the findings are consistent across the chi-square tests and the logistic regressions. They find an association, that is considered highly significant and relatively strong, between being more inclined to dump garden waste if the neighbor does so (*SNI Neighbors*), and garden waste dumping (*B1 Dumping*). As expected, the logistic regression confirms that those who strongly agree to be more inclined to dump garden waste if neighbors do so, have much larger odds of dumping garden waste themselves. This was also the impression the interview participants shared. In contrast, the question on subjective norms did not show any association with the two behaviors for proper garden waste disposal, and the hypothesis is therefore not supported for these two.

When testing the relationship between perceived behavioral control and behavior, hypothesis 5, the number of relevant variables for each behavior was summarized and used in the regression model. The variables can therefore not be compared one-to-one across methods as done so far. For garden waste dumping (*B1 Dumping*), the sum of barriers was not significant. Still, the chi-square tests found a weak association with the barriers of poor information (*PBC3 Info*), not having time (*PBC4 Time*), and distance to Heggstadmoen (*PBC5 Distance*), suggesting that these, as expected, more often are seen as barriers by those who dump their garden waste than those who do not. Interestingly, while seeing the distance to Heggstadmoen as a barrier was associated with garden waste dumping, the same was not the case for the use of Heggstadmoen. This might indicate that other factors were of greater importance for whether Heggstadmoen was used or not. The logistic regression did not show the sum of barriers to be significant, but the chi-square tests found that poor information (*PBC3 Info*) and the costs for renting a car/trailer (*PBC2 Rental*) had an association with using Heggstadmoen and seemed to be greater barriers for those who do not use Heggstadmoen than for those who do. For the garden waste collection campaign, the sum of barriers was significant in the logistic regression, and the chi-square tests showed an association with the limited duration of the collection campaign (*PBC6 Limited time*). However, contrary to expectations, the odds of using the campaign increased as the number of barriers increased. The contingency table also suggested that the limited duration of the campaign presents a greater barrier for those who already use the campaign than those who do not. This could be explained by many of those having a low number of barriers not using the garden waste collection campaign, and the barriers are therefore not relevant to them.

As discussed, there are some apparent discrepancies in the results between chi-square tests and logistic regression. These imply that some variables that have a significant association when seen alone, are not as significant when the variation of the other variables is controlled for. Or vice versa, as with the associations between attitudes and the garden waste collection campaign, where the variables were not a strong predictor when seen alone, but became more apparent when seen together with other variables. In addition, the discrepancies can come from the chi-square tests being able to detect associations in both directions between the variables, while the logistic regression assumes a causal link. Furthermore, some of the associations found by the chi-square tests could be spurious associations, which regressions can help avoid.

## 5.2 Comparison with previous findings

The results showing a significant association between knowledge and garden waste dumping, are in line with the findings by Sipek & Sajna (2020) from Slovenia. While other studies have found that the association between knowledge and behavior is uncertain (Laroche et al., 2002), these have investigated other types of pro-environmental behaviors, and the findings may therefore not be comparable. Furthermore, if people do not have knowledge of the possible negative implications they may also not see anything wrong with dumping their garden waste, or, like what Comerford et al. (2018) found, they might not even realize that it is illegal. The findings from this thesis therefore further support Sipek & Sajna's claim that in the case of garden waste dumping specifically, knowledge about the consequences plays a significant role.

The association between knowledge, attitudes, and behavior involves nuanced findings. Unlike what, for instance, Liu et al. (2020) found, knowledge seemed to have a direct impact on both attitudes and garden waste dumping behavior, suggesting that attitudes are not required as a mediating factor. This could be due to sufficient knowledge being a strong motivator itself for not dumping garden waste, without necessarily relying on attitudinal change. Another possibility is that the associations between attitude variables and garden waste dumping found by chi-square tests are spurious, as knowledge influences both attitudes and knowledge directly. Further analyses would however be necessary to uncover this.

Continuing with the impact of attitudes on behavior, previous studies have shown varying results, which is also the case for the findings in this thesis. The comparability with previous

studies is also questionable, as they have investigated other behaviors and mostly with different variables for attitudes. The original TPB, however, does not include a direct relationship between attitudes and behavior, but builds on intentions working as a mediating component (Ajzen, 1991). There are many studies that have used the theory as a framework and have results supporting this relationship (Akhter et al., 2024; Heath & Gifford, 2002; Ojedokun et al., 2022). Intentions being a mediating factor could be a reason for some of the weak or non-significant attitude - behavior connections found in this study, but since intentions were excluded, such a connection would not have been discovered. Including intentions would therefore have given a more nuanced understanding of this relationship.

The findings showing that subjective norms are significant for garden waste dumping are in alignment with the previous studies emphasizing the role of local norms and perceptions (Hohl et al., 2023). Furthermore, the impact of a common community understanding of illegal garden waste dumping, whether this perception is that garden waste dumping is accepted or not, was supported by the statements in the interview. While there was only one question on subjective norms investigated in the questionnaire, the results indicate that the informal social control aspect could be central to garden waste dumping.

The variables included in perceived behavioral control also vary widely between different studies and contexts, and the comparability is therefore uncertain. However, the significance of distance to the garden waste center and not having time suggests that the findings are in alignment with previous literature showing the importance of convenience and easy access to legal disposal alternatives to prevent illegal dumping (Sotamenou et al., 2019; Yang et al., 2019). Furthermore, the significance of the costs of renting a car/trailer for using Heggstadmoen supports the findings of Comerford et al. (2018) that a lack of transportation to the waste disposal facilities can be a barrier leading to illegal waste dumping. This could also be related to what studies have found about higher costs of legal waste disposal leading to an increase in illegal waste dumping (Kim et al., 2008). While there are no costs to using the garden waste center itself, the costs of renting a car or trailer, which in most cases would be necessary to use it, could have the same effect.



### 5.3 Other factors influencing garden waste disposal behavior

The Theory of Planned Behavior has the potential to shed light on many factors influencing garden waste disposal behaviors, especially at the individual level. However, there are also factors that the original theory and the version of it used in this thesis, does not cover. For example, past behavior and habits were brought up in the interview. Additionally, the literature presented in the background chapter presents socioeconomic factors and a lack of formal enforcement as influential factors for illegal waste dumping. Ajzen (1991) argues that the effect of other variables is mainly indirect and mediated through the components of TPB, but this is contested and many studies therefore apply extended versions of the theory to include other factors.

Recognizing the impact of the factors not included in this thesis is essential for understanding the limitations of the model in answering the research questions. Habits and past behavior are some of the factors most commonly added to extended versions of the theory (Yuriev et al., 2020), as done by for instance Akhter et al. (2024). They studied food waste behavior and found habits and routines to have a significant influence on intentions to not waste food. Similar results were found by (Knussen & Yule, 2008) investigating household waste recycling. If these factors have a significant explanatory impact on garden waste dumping as well, as hypothesized by the interview participants, not addressing these factors is a significant weakness of the model.

Literature also emphasizes the impact socioeconomic factors can have on garden waste dumping, which is also not covered in this thesis. There is reason to believe that garden waste dumping does not necessarily follow the same patterns as other waste dumping. For example, it seems more likely that garden waste dumping follows the trend found by Sedova (2016), showing that higher income leads to increased waste dumping, rather than the findings by Liu et al. (2017) showing the opposite. Those who have gardens mostly live in houses, and typically have a higher income, lower unemployment, and higher education levels than those who do not. On the other hand, those with the highest incomes might also be able to afford to spend more money on garden waste disposal and utilize services such as the waste taxi or renting a container. Sipek & Sajna (2020) also found indications, though not significant, that those with higher education levels had a higher likelihood of being familiar with the term invasive alien species, which could also decrease the odds of dumping.

Furthermore, as both the questionnaire data and interview revealed, garden waste seems to have a different status than other waste types and garden waste dumping is by many perceived as less negative than other waste dumping. One can also suspect that this is connected to a lack of formal enforcement. While the mapping conducted by Trondheim Municipality showed that garden waste is often dumped in hidden places, such as in forests or on slopes, many dumping sites were also located in visible places, like right next to roads or walkways (Trondheim kommune, 2022, 2023). Also, based on my personal impressions from the mapping, garden waste dumping often happens during the daytime, indicating less of an effort to hide it. This suggests that people see it as unlikely that they would be subject to any sort of consequences or penalties if observed by anyone.

#### 5.4 What can be done to prevent garden waste dumping in the future?

In order to prevent garden waste dumping in the future and develop effective management strategies, more information is needed to understand the extent of the issue and its drivers in Norway. It could therefore be beneficial to quantify the effect of garden waste dumping on spreading invasive alien species in Norway, to make it easier for decision-makers to judge how much resources should be invested in preventing it. Furthermore, additional factors like the ones described above should be further explored to get a better understanding of the drivers.

Inhabitants' willingness to pay, which was also reported in the questionnaire, could also be analyzed to estimate the perceived benefits derived from the user perspective. Even deeper perspectives could be gained by also interviewing inhabitants, to further understand their drivers and barriers for using the existing solutions.

While the significance of easy access and convenience of waste disposal solutions is outlined in the literature, there are some practical challenges with developing such solutions, as discussed in the interview. Still, testing such solutions in a trial project could be a good way of exploring the impact on garden waste dumping in a smaller area with limited use of resources. However, the mapping in Trondheim did not find that there were fewer dumping sites in parts of the city located closer to Heggstadmoen (Trondheim kommune, 2022), which could suggest that easy access is not the main influencing factor in this case. While some associations with perceived behavioral control variables were found in this thesis, most of them were considered weak and other factors seem to be more influential.

One of the factors that showed to be most influential on garden waste dumping was social norms, and finding a way to influence these could be an effective measure. Enhancing the informal social control in neighborhoods could be a way of doing this, through for example educating and engaging the population. Several studies also suggest encouraging the public to report illegal dumping, some have even created digital systems for doing so, as this will strengthen social supervision (Du et al., 2021). Acknowledging garden waste dumping as a crime and enhancing formal enforcement could also have significant effects. However, this would require substantial resource use and could be seen as disproportionate by inhabitants.

Also, knowledge was found to have a significant association with garden waste dumping, suggesting that measures involving spreading information about the negative effects of garden waste dumping could be impactful. However, interview participants found reaching out with information to be challenging, despite information seemingly being easily accessible to inhabitants. Based on the findings of this thesis, showing that knowledge decreases the odds of garden waste dumping, it seems likely that many of those receiving information do not read it. This could also be the reason why many dumping sites still seemed to be active and have new material on them even after receiving information letters (Trondheim kommune, 2023). It could therefore be necessary to test other methods for spreading information, such as social media campaigns, TV campaigns, newspapers, or poster campaigns among others. Implementing information on the issue in schools could also have an impact over time.

In addition to investigating drivers and testing measures on a local level, cooperation between municipalities and actors within waste management could be beneficial. Other actors can have perspectives and experiences on garden waste management that could be transferrable also to other cities and urban areas. Using these experiences could save time and resources and make testing of measures and solutions more targeted. Cooperating on regional and national levels could therefore be highly advantageous.

## 6. Conclusion

Using a mixed methods approach, this thesis has provided a unique insight into the drivers of garden waste dumping in Trondheim, a topic that has scarcely been researched in Norway or internationally. The findings have been analyzed using the Theory of Planned Behavior as a framework. The results showed that knowledge reduced the likelihood of garden waste dumping, both directly and to some degree through attitudes. Attitudes showed associations with garden waste dumping, but even more so with using the garden waste center and the garden waste collection campaign. Especially seeing the point of proper garden waste disposal, and satisfaction with the existing solutions were important predictors. Subjective norms, in the form of influence from neighbors, showed to be an important predictor influencing garden waste dumping, but was not associated with the two other behaviors. Of the perceived behavioral control variables, poor information, lack of time and distance to Heggstadmoen had a weak association with garden waste dumping, and costs for renting a car/trailer and poor information were associated with using the garden waste center. These barriers decreased the likelihood of using these solutions for garden waste disposal. For the garden waste collection campaign, an increase in the sum of barriers, and seeing the limited duration of the campaign as a barrier, increased the likelihood of using the campaign. This is likely due to many not using it and therefore not seeing the barriers as relevant.

Preventing garden waste dumping comes with challenges in terms of uncertainty about the effectiveness of measures, difficulties with spreading information and practical challenges in developing new solutions. Restricted resources were outlined as an overarching issue. Further research on the impacts of garden waste dumping, and drivers other than the ones included in TPB, could help guide future management and is needed to fully answer the research question of this thesis. Additionally, the findings support that enhancing social control, improving information distribution, and making legal garden waste disposal convenient are measures that could be effective in preventing garden waste dumping. Finally, it is emphasized that cooperation and experience sharing with other actors working within garden waste management can be beneficial.

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# Appendix I

## Hageavfall i Klæbu og Tanem

Villfyllinger med hageavfall, det vil si hageavfall som er kastet i grøntområder og naturen, kan bidra til spredning av fremmede arter og skadedyr. I Trondheim kommune ønsker vi å bekjempe slike villfyllinger. Vi gjennomfører derfor en spørreundersøkelse for å se på vaner og meninger knyttet til dagens hageavfallsløsninger.

Dataene vil brukes av Trondheim kommune til å kartlegge trender og behov i forbindelse med håndtering av hageavfall i kommunen, og til å identifisere hvor villfyllinger finnes. Noe av dataene vil også kunne brukes i en masteroppgave ved NMBU som omhandler villfyllinger med hageavfall. Ved å delta samtykker du til dette.

Undersøkelsen tar ca. 5 minutter å gjennomføre. Den er anonym. Svar kan ikke knyttes til enkeltpersoner. Vi ber om at det ikke oppgis personidentifiserende informasjon i svarene.

### 1. Hvor bor du? \*

*Markér bare én oval.*

Tanem

Klæbu

Annet

### 2. Hvor gammel er du? \*

*Markér bare én oval.*

<18

18-30

30-50

50-70

>70

### 3. Har du tilgang på hage? \*

*Markér bare én oval.*

Ja

Nei

4. Kjenner du til de følgende løsningene for håndtering av hageavfall? \*

Markér bare én oval per rad

	Ja	Nei
<b>Hageavfallsmottaket på Heggstamoen</b>	<input type="radio"/>	<input type="radio"/>
<b>Trondheim Renholdsverks hageavfallsaksjoner (henting av hageavfallssekker)</b>	<input type="radio"/>	<input type="radio"/>
<b>Avfallstaxi</b>	<input type="radio"/>	<input type="radio"/>

5. Benytter du de følgende løsningene for levering/håndtering av hageavfall (trykk nei hvis ikke relevant)? \*

Markér bare én oval per rad

	Ja	Nei
<b>Hageavfallsmottaket på Heggstamoen</b>	<input type="radio"/>	<input type="radio"/>
<b>Trondheim Renholdsverks hageavfallsaksjoner (henting av hageavfallssekker)</b>	<input type="radio"/>	<input type="radio"/>
<b>Avfallstaxi</b>	<input type="radio"/>	<input type="radio"/>
<b>Felles innsamling/container i nabolaget</b>	<input type="radio"/>	<input type="radio"/>
<b>Kompostering/oppbevaring i egen hage</b>	<input type="radio"/>	<input type="radio"/>
<b>Kaster det i restavfallet</b>	<input type="radio"/>	<input type="radio"/>
<b>Legger det i et grøntområde i nærheten</b>	<input type="radio"/>	<input type="radio"/>

6. Hvordan syns du dagens ordning for hageavfall i Trondheim er? \*

Markér bare én oval.

Veldig dårlig

1

2

3

4

5

Veldig bra

7. Er de følgende barrierene relevante for deg med tanke på å få hageavfallet ditt levert til godkjent mottak? \*

Markér bare én oval per rad

	Ja	Nei
Har ikke tilgang på bil	<input type="radio"/>	<input type="radio"/>
Kostnader for leie av bil/henger	<input type="radio"/>	<input type="radio"/>
Dårlig informasjon	<input type="radio"/>	<input type="radio"/>
Har ikke tid	<input type="radio"/>	<input type="radio"/>
Avstand til hageavfallsmottaket på Heggstamoen	<input type="radio"/>	<input type="radio"/>
Kostnader knyttet til alternative tjenester (feks avfallstaxi)	<input type="radio"/>	<input type="radio"/>
Hageavfallsaksjonens begrensede periode (mai og oktober)	<input type="radio"/>	<input type="radio"/>
Ser ikke poenget med å levere inn til mottak	<input type="radio"/>	<input type="radio"/>

8. Har du selv på noe tidspunkt kastet hageavfallet ditt i et grøntområde/naturen? \*

*Markér bare én oval.*

Ja

Nei

9. Ville du vært villig til å betale for en tjeneste der hageavfall ble hentet **jevnlig**? \*

*Markér bare én oval.*

Ja

Nei

10. Ville du vært villig til å betale for en tjeneste der du kunne bestilt henting av hageavfall hjemme hos deg **ved behov**? \*

*Markér bare én oval.*

Ja

Nei

11. Hvor mye ville du eventuelt vært villig til å betale i året for å få hageavfall hentet hjemme hos deg?

\_\_\_\_\_

12. Hvor sannsynlig er det at du ville endret dine leveringsvaner dersom det var godkjente mottak for hageavfall nærmere der du bor? \*

Markér bare én oval.

Svært usannsynlig

1

2

3

4

5

Svært sannsynlig

13. Var du klar over at hageavfall som kastes i naturen et viktig bidrag til spredning av fremmede arter og skadedyr? \*

Markér bare én oval.

Ja

Nei

14. Hvor bekymret er du for spredningen av fremmede arter i norsk natur? \*

Markér bare én oval.

Svært lite bekymret

1

2

3

4

5

Svært bekymret

15. Hvor enig er du i følgende påstand: å kaste hageavfall i naturen er mindre negativt enn å kaste annet avfall i naturen \*

Markér bare én oval.

Helt uenig

1

2

3

4

5

Helt enig

16. Hvor enig er du i følgende påstand: det at naboer kaster hageavfall i grøntområder/naturen gjør meg mer tilbøyelig til å gjøre det samme \*

Markér bare én oval.

Helt uenig

\_\_\_\_\_

1

\_\_\_\_\_

2

\_\_\_\_\_

3

\_\_\_\_\_

4

\_\_\_\_\_

5

\_\_\_\_\_

Helt enig

\_\_\_\_\_

17. Har du forslag til hvordan dagens løsning for håndtering av hageavfall i Trondheim kan forbedres?

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18. Kjenner du til noen steder der hageavfall kastes i naturen? I så fall beskriv plassering så nøyaktig som mulig:

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# Appendix II

## Intervjuguide

### Introduksjon

- Litt om masteroppgaven min og rollen til intervjuet
- Gjenta informasjon fra informasjonsskriv og skrive under på samtykkeskjema
- Har dere noen spørsmål før vi begynner?

### Introduksjonsspørsmål

- Hvor jobber dere og på hvilken måte jobber dere med problematikken rundt villfyllinger med hageavfall?
- Hva er problemet med villfyllinger med hageavfall?

### Hoveddel

- Hva opplever dere er årsakene til at hageavfall blir dumpet i naturen i stedet for levert inn til godkjent mottak?
  - Ut fra spørreundersøkelsene ser man at innbyggerne stort sett er godt fornøyd med hageavfallsløsningene. Hvorfor tror dere da at så mange ikke benytter seg av disse?
  - Hageavfallsmottaket er godt kjent blant innbyggerne og også den løsningen som brukes mest viser spørreundersøkelsene – hvorfor benyttes det ikke av flere?
  - Over halvparten kjente til hageavfallsaksjonen, men likevel er det bare et mindretall som sier de benytter seg av den – hva kan være årsaken til dette?
  - Hvordan opplever dere at problemet med villfyllinger med hageavfall har utviklet seg over tid (har det blitt større/mindre)?
- Hva tror dere skal til for at innbyggerne slutter å kaste hageavfall i naturen/grøntområder?
  - Hvordan tenker dere å få til dette?
- Hvilke utfordringer møter dere i utformingen av gode løsninger for innsamling av hageavfall?
  - I spørreundersøkelsen kom det fram at mange ønsker seg mer tilgjengelige innleveringsmuligheter – oftere henting eller mottak nærmere der de bor. Hva er utfordringene med å skulle innføre slike løsninger?
  - Hvilken status har hageavfall i sammenlikning med annet avfall?
  - Hva er realistisk å få til?

### Avslutning

- Avslutningsvis: er det noe annet dere har tenkt på nå underveis/noe dere tenker vi ikke har snakket om, eller noe dere ønsker å legge til før vi avslutter?





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