Multispectral properties of moose dung piles

Identifying key features in pellet groups using UAV imagery

Frida Linder

Examensarbete/Självständigt arbete • 15 hp
Sveriges lantbruksuniversitet, SLU
Fakulteten för landskapsarkitektur, trädgårds- och växtproduktionsvetenskap/Institutionen för biosystem och teknologi
Alnarp 2025

Multispectral properties of moose dung piles: Identifying key features in pellet groups using UAV imagery

Multispektrala egenskaper hos älgspillning: Identifierar nyckelfunktioner i pelletsgrupper med hjälp av drönarbilder

Frida Linder

Handledare:	**Lukas Graf, Sveriges lantbruksuniversitet, Institutionen för sydsvensk skogsvetenskap**
Bitr. handledare:	Annika Felton, Sveriges lantbruksuniversitet, Institutionen för sydsvensk skogsvetenskap
Examinator:	Jonas Bohlin, Sveriges lantbruksuniversitet, Institutionen för skoglig resurshushållning

Omfattning:	15 hp
Nivå och fördjupning:	Grundnivå, G2E
Kurstitel:	Självständigt arbete i Biologi
Kurskod:	EX0855
Kursansvarig inst.:	Institutionen för Biosystem och Teknologi
Utgivningsort:	Alnarp
Utgivningsår:	2025

Nyckelord:	Moose, UAV, fecal pellet group, drone, QGIS, wildlife management

Sveriges lantbruksuniversitet
Fakulteten för Landskapsarkitektur, Trädgårds- och Växtproduktionsvetenskap
Institutionen för Biosystem och Teknologi

Sammanfattning

Att övervaka älgpopulationer är viktigt för viltövervakningen. Det finns olika sätt att göra detta på och en av dem är traditionell spillningsinventering. Detta är en tidskrävande metod som är känslig för partiskhet, vilket understryker behovet av en skalbar metod som är mer objektiv. Denna studie utforskar potentialen i att använda fjärranalysverktyg, specifikt drönarbilder, för att upptäcka älgspillning.

Fältdata samlades in i fyra unga tallbestånd i södra Sverige med hjälp av tre inventerare som spred ut sig opportunistiskt för att hitta spillning både från älg och rådjur. Spillningshögarna markerades och information om art och koordinater samlades in med hjälp av en högprecisions GNSS-enhet. Efter att markdata samlats in flögs en drönare (DJI Mavic 3M) över beståndet på 15 meters höjd. Drönarbilderna processades och det skapades polygoner runt de spillningshögar som gick att hitta i bilderna. En buffert skapades runt polygonerna för att kunna jämföra medelvärde och standardavvikelserna för spillningshögarna mot den omgivande vegetationen. Ett t-test visade att den omgivande vegetationen har en högre standardavvikelse i alla spektrala egenskapindex och ett högre medelvärde i alla spektrala egenskaper och vegetationsindex.

Resultaten från denna studie kan bidra till framtida forskning som vill bygga en modell som är tränad för att upptäcka spillningshögar, vilket minskar fältarbetet och ökar objektiviteten i inventeringen. Även om metoden för tillfället är begränsad till unga skogsbestånd samt är väderberoende, skulle en sådan modell kunna ge insikt i älgpopulationens utveckling över tid genom att allmänt tillgänglig fjärranalysteknik.

Nyckelord: älg, fjärranalys, spillningshög, drönare, QGIS, viltförvaltning

Abstract

Monitoring moose populations is important for wildlife management. There are multiple ways to do this and one of them is traditional fecal pellet surveys which are time-consuming and prone to observer bias, underscoring the need for more objective and scalable methods. This study explores the potential use of remote sensing tools, specifically drone imagery, to detect moose fecal pellet groups.

Field data were collected in four young pine stands in southern Sweden where three surveyors opportunistically spread out to find fecal pellet groups (moose, roe and red deer). The pellet groups were marked and information about species and coordinates were recorded using a high-precision GNSS device. After the ground data were collected, each stand was surveyed with a DJI Mavic 3M at an altitude of 15 meters.

The images from the drone were processed and the pellet groups found in the imagery were polygonized in QGIS. A buffer was created around the polygons to be able to compare the mean value and standard deviation of the fecal pellet groups to the surrounding vegetation. A t-test showed that that the surrounding vegetation has a higher standard deviation and a higher mean value in all spectral bands and vegetation indices

The results from this study can contribute to future research in building a model that is trained in detecting fecal pellet groups, thereby reducing field effort and increasing survey objectivity. While currently limited to young forest stands and by weather dependency, this type of model would be able to create insight in moose population trends over time using commonly available remote sensing technologies.

Keywords: moose, UAV, fecal pellet group, drone, QGIS, wildlife management

Table of contents

List of tables

List of figures

Abbreviations

UAV	Unmanned aerial vehicle
RGB	Red, green and blue
GNSS	Global Navigation Satellite System
ID	Identity
GPS	Global positioning system
NIR	Near Infrared
MS	Multi Spectral
NDVI	Normalized difference vegetation index
GNDVI	Green normalized vegetation index

1. Introduction

The moose (*Alces alces*) is Swedens biggest herbivore and is often referred to as "the king of the forest". Moose are not only an emblem for Swedish nature, but also play a significant part of the country's history, culture and ecosystem (Åkerberg, 2005). Historically, the interaction between humans and moose have affected the size and vitality of the moose population.

The moose hunt has a long and complicated history in Sweden. During the mid-20th century the forest management changed, generating more young forest plantations thus leading to an increase in moose population densities and moose related browsing damage (Fuller & Gill, 2001). To regulate this, strict hunting restrictions were established and today the moose hunt is heavily managed across Sweden (Lewander, 2022). During the last decade the moose population has decreased in Sweden, partly due to targeted hunting efforts in areas where the goal is to reduce damage, but also due to other factors that appear to negatively affect moose reproduction. One factor is climate change that has shown a negative impact on moose reproduction and a decline in calf mass and recruitment in Sweden (Holmes et al., 2021).

Today, forest companies argue that the moose population causes unacceptable damage to pine (*Pinus sylvestris*) plantations, leading to substantial economic losses (Lagrådsremiss, 2010). Some hunters however argue that moose populations have declined to unsustainable levels, threatening a deeply rooted cultural tradition in Sweden. The moose hunt has been a part of Swedish traditions for centuries and still is to this day. According to the Swedish Association for Hunting and Wildlife Management (Svenska Jägareförbundet) 250 000 out of 300 000 hunters participate in the annual moose hunt and is considered a social event (Svenska Jägareförbundet, 2022). Today's decrease in the moose population has led to hunters abstaining from participating in the moose hunt to give the population a chance to recover (Forssblad, 2023). As a result of this there have been accusations made against forest owning companies for threatening hunters that lease their hunting grounds that if they do not harvest their given quota they will lose their lease (DiGasper & Sandström, 2010). Meanwhile nature conservationists highlight the ecological importance of moose in maintaining natural forest dynamics (Edenius et al., 2002).

For those reasons it is important to reliably estimate the moose population size with a representative and reliable method. Today the population estimate is based on different factors such as moose observations and last season's harvesting statistics (Wennberg Digasper, 2006). Another tool used to assess population density is the dung pellet count, conducted voluntarily by hunters during April to May (Svenska jägareförbundet, 2025). In the droppings inventory all moose fecal pellet groups that have accumulated since last winter within the sample plots are counted. The sample plots are placed along the sides of tracts. The placement and number of tracts and sample plots are determined to obtain a sufficiently accurate estimate of pellet density (Bergström et al., 2019). This data is used to determine harvest quotas for the upcoming hunting season. This method is time consuming and can vary in results depending on sampling technique, intensity and also how many hunters volunteer in performing the inventory since the dedication of the hunters needs to be high to get a more accurate result.

Remote sensing technologies are getting more and more common in ecological research and wildlife monitoring (Lechner et al., 2020) due to their ability to supply data over large and inaccessible areas in a cost- and time-sufficient way that is also less invasive to the study area and minimizes wildlife disturbance (Ivošević et al., 2015). Unmanned aerial vehicles (UAV), have been used to count populations, monitor nesting sites and identify signs of presence (Corcoran et al., 2021).
UAVs are typically equipped with RGB (red, green, blue) cameras but can also be equipped with other various sensors, such as multispectral or thermal, that can capture detailed imagery on vegetation structure, animal presence or environmental conditions. Being able to collect data with fine spatial and temporal resolution is a primary advantage in ecological research (Müllerová et al., 2025). Data collection like this makes it possible to monitor species distributions, changes in habitat and evaluate ecological processes.
Hodgson et al. (2018) and Kellenberger et al. (2018) have shown that data collected by drones can later be used with automated detection models for object recognition.
This is something that hopefully can be used instead of the traditional moose dung pellet count in some habitat types to be able to create a more time-sufficient and objective data collection to support moose management.

1.1 Research objectives

The main objective of my bachelor thesis is to identify key features of moose dung pellet piles across different multispectral bands and vegetation indices derived from UAVs. The results from my research can later be used to develop a method for detecting moose fecal pellet groups in young pine plantations, where browsing pressure is typically high (Bjørneraas et al., 2011), using remote sensing tools. This kind of method would be a useful tool when it comes to estimating moose population trends over time.

2. Methods

2.1 Field data collection

The data used in this study were collected in March 2025 in four young pine stands located in southern Sweden, north of Kronobergs län (Fig 1). The nature in north Kronoberg is dominated by pine and spruce plantations surrounding arable land and water bodies. The stands are young and have not gone through the first thinning yet and have a mean height of 1.85 meters.

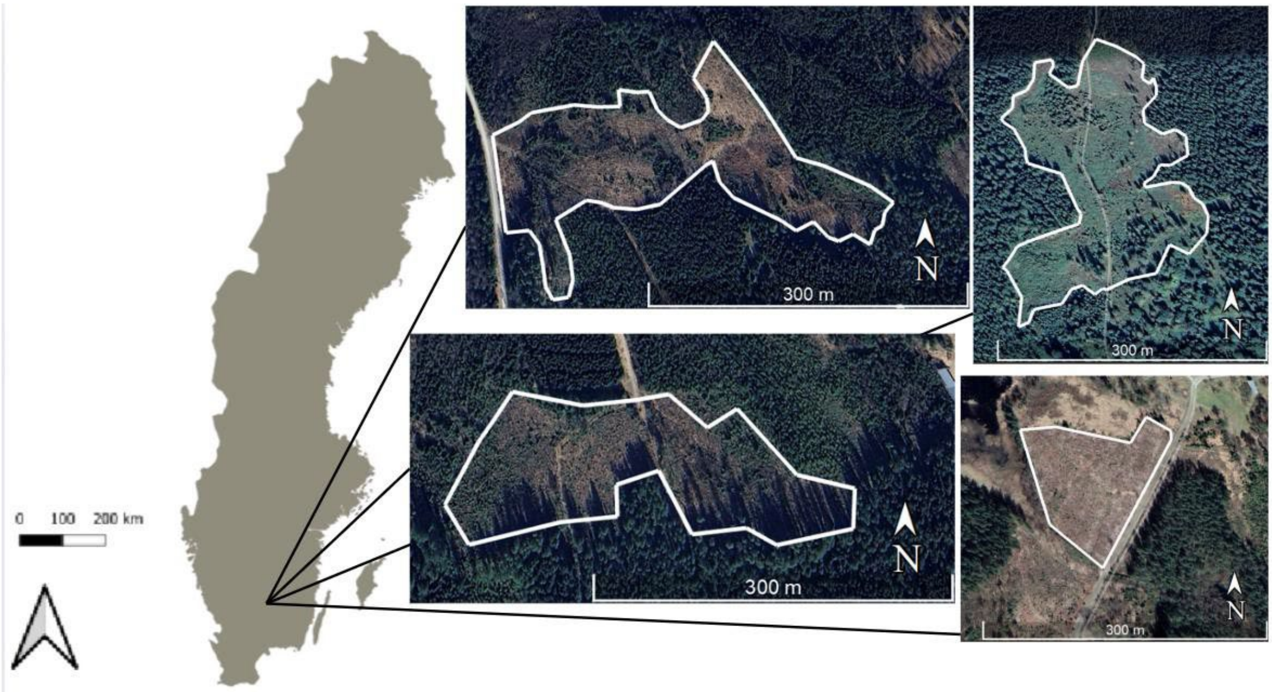


Figure 1. Location of the study sites (right) in Sweden (left). The grey shape indicates Sweden, the inset maps show the stands in southern Sweden. White lines indicate stand borders.

A ground survey was conducted to identify and mark moose dung pellet groups. However, dung piles from other species such as roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*) were identified as well. For a pile to be included it had to consist of at least 20 pellets (Fig 2). A high-precision global navigation satellite system (GNSS) receiver (Emlid Reach RS3) was used to record the geographic coordinates of each identified dung pile. Each dung pile was assigned an ID and categorized by attributes such as freshness (fresh/old), percentage cover from above (%) and species identification. The ground survey was conducted opportunistically, with three surveyors spreading out across the stand, trying to cover a majority of the area. Dung pellet piles were marked with flag tape (Fig 2).

Figure 2. Example of moose fecal pellet group next to a spruce marked with flagging tape. Photo: Frida Linder.

After completing the ground survey, each stand was surveyed using a DJI Mavic 3M drone equipped with a multispectral sensor (Fig 3). Flights were conducted with 50% frontal and sideways overlap between images. The drone was flown at an altitude of 15 meters above ground level. Two stands were surveyed again approximately a week later due to difficult weather conditions on the first flight. To standardize values between different images, reflectance panels (Figure 3) with known reflectance values were placed out in the stand to scale images to reflectance values. Further, they could also serve as ground control panels with known coordinates in the image.

Figure 3. Ground control panels and DJI Mavic drone. Photo: Frida Linder.

2.2 Image processing

I created orthomosaics, where drone images are stitched together, in software program DJI Terra version 4.2.13 of each stand with a 0.47cm spatial resolution (Figure 4). I imported the orthomosaics into QGIS where each dung pile previously recorded with GNSS was manually identified in the imagery. At first the coordinates did not match the images, so I adjusted them by matching the recorded GPS-positions with the ground control panels.
I polygonized the outlines of each identifiable dung pile in QGIS.

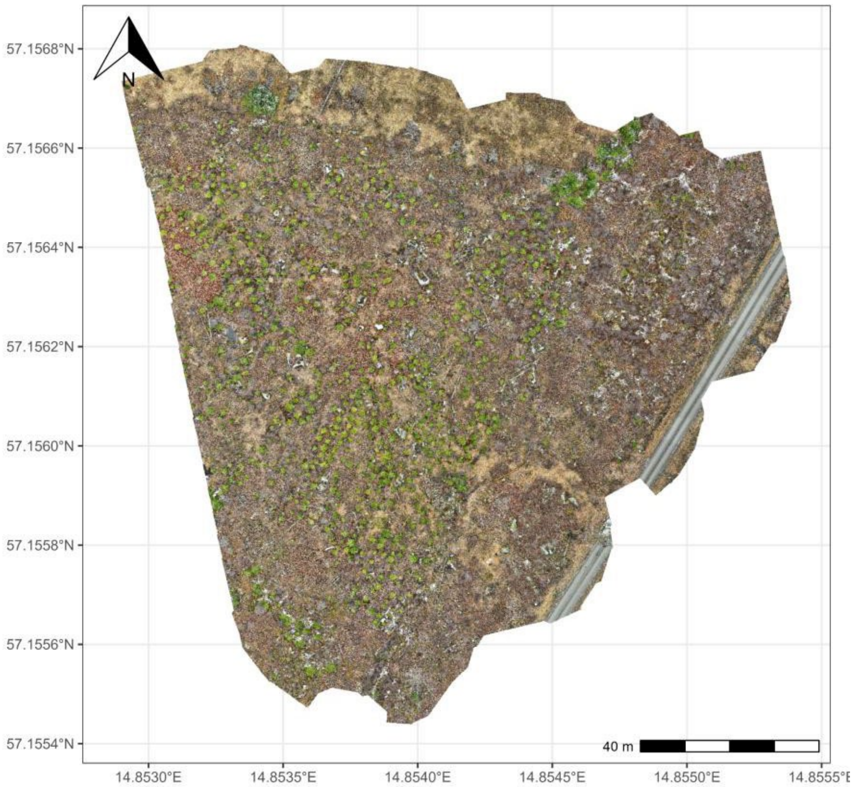


Figure 4. Exampl of a RGB - orthomosaic created in DJI Terra.

I used the statistics tool in QGIS to calculate the mean and standard deviation value of the red, green and blue bands (RGB), near infrared (NIR), multispectral (MS) red and green and also the red edge, which is the region of rapid change in reflectance of vegetation in the NIR. I further calculated two commonly used vegetation indices, the Normalized Difference Vegetation Index ($NDVI = \frac{NIR-Red}{NIR+Red}$ and the green Normalized Difference Vegetation Index ($GNDVI = \frac{NIR-Green}{NIR+Green}$). Next, I created a buffer of 25 cm around each dung pile and intersected it with each polygon (Fig 5) in order to do the same calculations as with the polygons to be able to compare the spectral properties of the moose dung piles to the surrounding pixels (corresponding the surrounding vegetation).

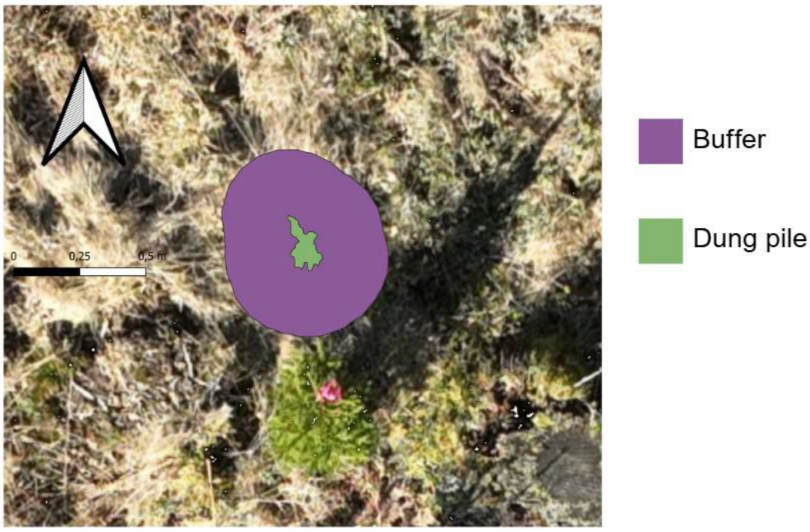


Figure 5. Example of how I separated the pixels belonging to the dung pile from the surrounding vegetation. The green polygon shows the dung pile, while the purple polygon shows the vegetation surrounding the dung pile.

2.3 Statistical Analysis

I created boxplots in Excel to compare the reflectance values of the dung pile polygons and their respective buffers. To assess whether dung piles differ from their surrounding vegetation in terms of mean value and standard deviation, I performed a T-test between the means and standard deviations of buffers and dung piles separately. I performed the difference in standard deviation in separate tests to see if the dung piles are homogeneous in their composition in contrast to the surrounding landscape.
I considered a p-value <0.05 as statistically significant.

3. Results

3.1 Field data collection

The field inventory resulted in a total of 367 identified dung piles across the four stands. These were categorized into species-specific groups (Fig 6).

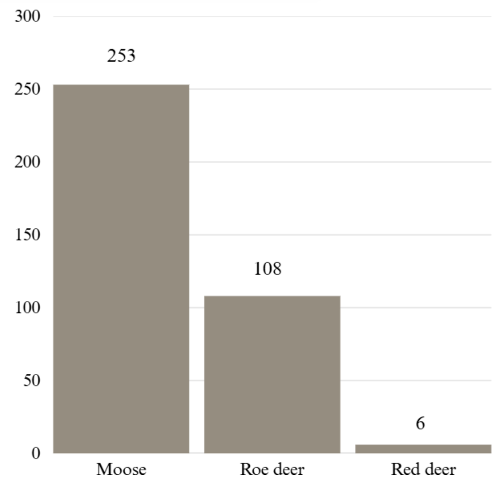


Figure 6. Number of dung piles divided to each species.

Moose were the most common species and their dung pellet piles were the most commonly found in the imagery. Almost half of the dung piles were found in the imagery and more than a quarter of the dung piles were not visible in the imagery as they were situated outside of the drones flight route (Fig 7).

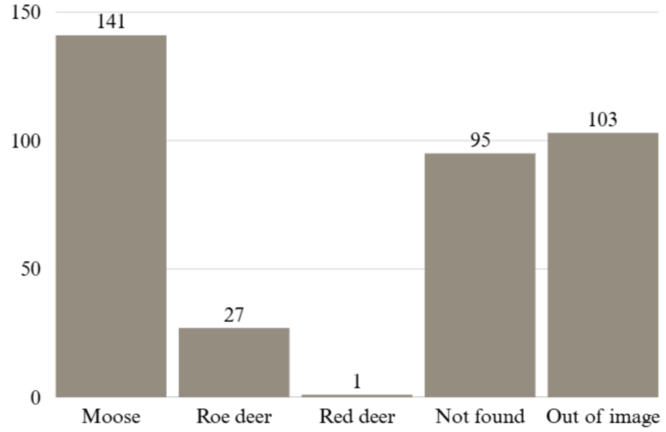
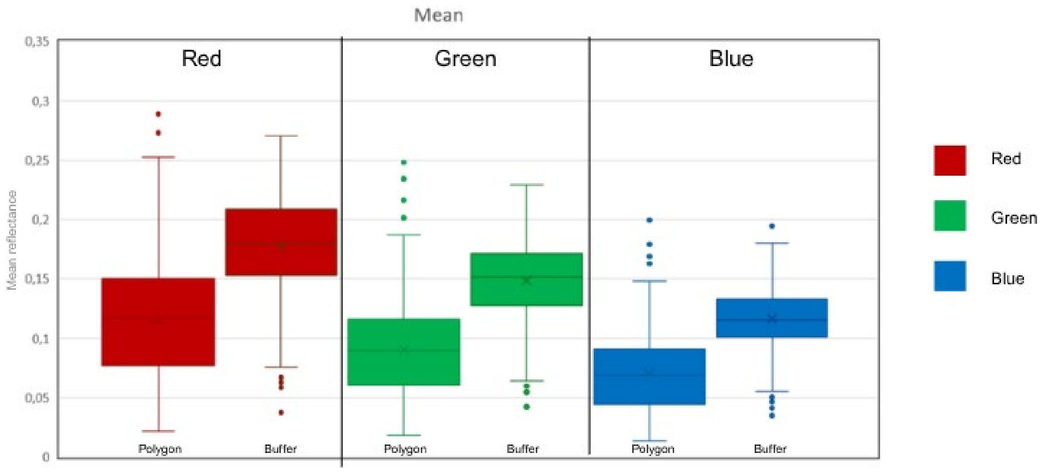


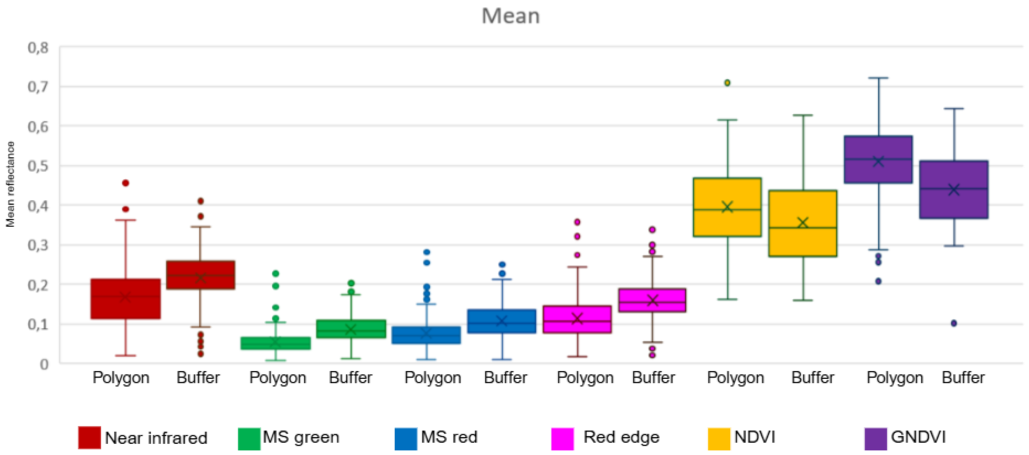
Figure 7. Number of dung piles found in the imagery divided by species and number of piles not found or not shown in the imagery.

3.2 Differences between dung piles and surrounding vegetation

The mean value of spectral bands and vegetation indices between the polygons and the buffer was different. Across nearly all variables, mean values are higher in the buffer compared to the polygons. However, for the vegetation indices the polygons mean value is slightly higher than in the buffer. The t-test showed that, across all bands and indices, reflectance values differed significantly between dung piles (polygons) and the surrounding vegetation (buffers) (see Table 1, Figure 8 and 9).



Figur 8. Box plots showing the mean value in polygons and buffer in RGB. The line across the box shows the median. The box shows the 25 and 75% quantile, whiskers show the 1.5 interquartile range (IQR), points show outliers.

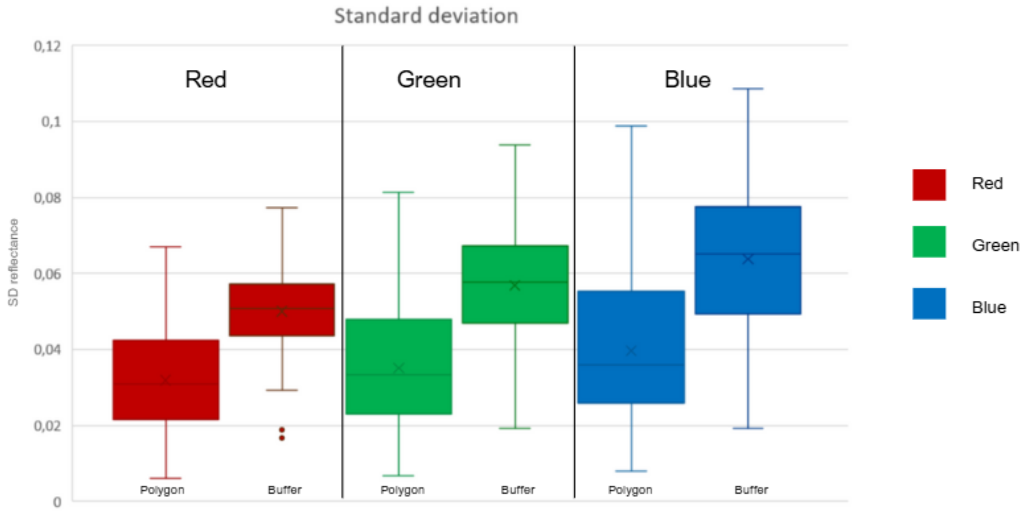


Figur 9. Showing the mean value between polygons and buffer. The line across the box shows the median. The box shows the 25 and 75% quantile, whiskers show the 1.5 interquartile range (IQR), points show outliers.

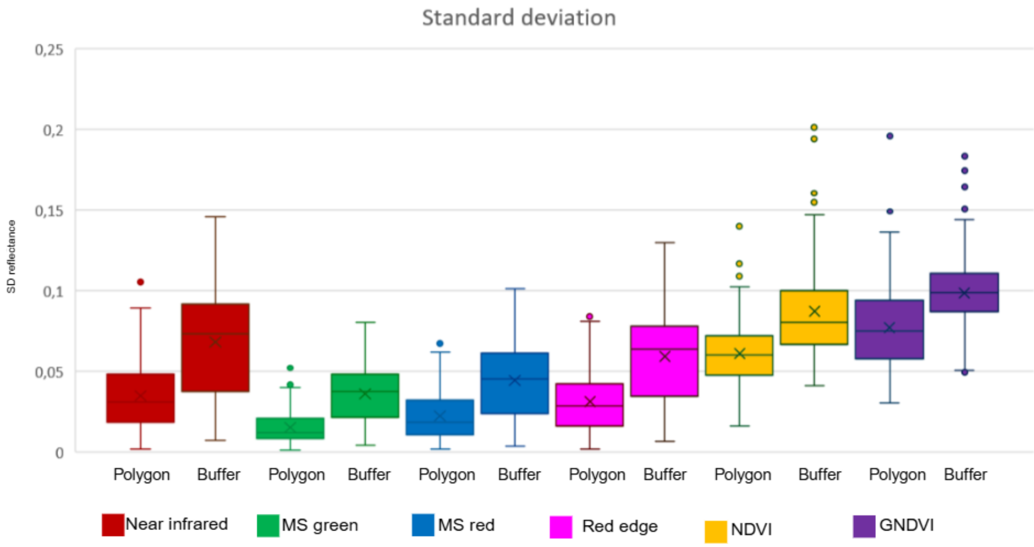
Table 1. Result from t-test done on every spectral band between polygons and buffers mean value.

Spectral band or indice	Degrees of freedom	T-value	P-value
Red	336	-11.767	<0.001
Green	336	-13.474	<0.001
Blue	336	-13.203	<0.001
NIR	336	-6.193	<0.001
MS green	336	-8.691	<0.001
MS red	336	-6.515	<0.001
Red edge	336	-7.54	<0.001
NDVI	336	3.593	<0.001
GNDVI	336	7.523	<0.001

In the standard deviation, the buffer value is higher in all bands and vegetation indices, showing high variability of the surrounding pixels in comparison to the dung pile (Fig10 & 11). The t-test showed that, across all bands and indices, reflectance values differed significantly between dung piles (polygons) and the surrounding vegetation (buffers) (Table 2).



Figur 10. Showing the standard deviation between polygon and buffer in RGB. The line across the box shows the median. The box shows the 25 and 75% quantile, whiskers show the 1.5 interquartile range (IQR), points show outliers.



Figur 11. Showing the standard deviation in polygon and buffer. The line across the box shows the median. The box shows the 25 and 75% quantile, whiskers show the 1.5 interquartile range (IQR), points show outliers.

Table 2. Result from t-test done on every spectral band between polygons and buffers standard deviation.

Spectral band or indice	Degrees of freedom	T-value	P-value
Red	336	-13.776	<0.001
Green	336	-13.714	<0.001
Blue	336	-12.264	<0.001
NIR	336	-11.979	<0.001
MS green	336	-13.764	<0.001
MS red	336	-10.609	<0.001
Red edge	336	-11.543	<0.001
NDVI	336	-9.865	<0.001
GNDVI	336	-8.044	<0.001

4. Discussion

4.1 Discussion of results

In my thesis, I used UAV-based high resolution imagery to help develop new methods in moose population monitoring. I identified key features of moose dung pellet piles in relation to their surrounding vegetation that shows that there is a significant difference between the two.

The boxplot and statistical analyses demonstrated that the buffer zones have higher mean values and higher standard deviation throughout all spectral bands.

A previous study used a UAV equipped with multispectral sensors to capture images of spruce canopies. The images were later used to compute the reflectance of single trees, derive vegetation indices and compared these indices between healthy trees and bark beetle infested trees. This study also showed possibilities in separating the spectral features (Bozzini et al., 2025)

My results show that, across almost all spectral bands and indices, the dung piles differ from the surrounding vegetation, highlighting that there is a significant difference that can be used for future development of automated detection models. However, based on the results found in my thesis, it might be enough to use UAVs equipped regular RGB cameras, as dung piles significantly differed across all the RGB bands, both in terms of means and variation.

Models trained on combinations of different spectral values could learn to recognize the spectral signature typical in moose dung piles and distinguish them from background vegetation.

A t-test confirmed that the difference between polygon and buffer values was highly statistically significant, supporting the potential for spectral signatures to serve as reliable indicators in automated detection.

Although, even if this method is limited to young forest regenerations it can actually be one of the habitat types that need an objective inventory method the most since moose might prefer young forests due to forage availability (Kuijper et al., 2009) and therefore, is the forest type most prone to browsing damage that can results in economic losses for forest owners and companies.

Only inventorying young forest regenerations are not quite reliable when it comes to population density estimates since they are likely to overestimate the results compared to other habitat types. Highlighting the necessity of combining data from the traditional dung pellet count and aerial surveys like this one. Or, if possible with future studies, be able to use UAV to survey more habitat types as well. Even though this method can't be used to provide moose population density on its own, it can still provide valuable information on trend data and if surveys are conducted regularly over multiple years, it can serve as an indicator of population fluctuations. Such data can be useful for local authorities and hunting organizations in their moose management. It could also be used by researchers to quickly survey their study area as they today also use the dung pellet count survey to assess wildlife relative habitat use.

4.2 Limitations

One key limitation with this method I have used, is that it is best suited for younger forest stands due to difficulties in flying the drone under canopies, in between trees, and also flying over the canopies, which is covering the dung piles. This is why information gathered about percentage cover from above was interesting. In those cases where dung piles were situated under a tree, and the coverage from above was >85%, the dung pile was not identifiable in the imagery.

It is important to note that environmental factors played a critical role for efficient data collection. Snow cover, shadows, and variations in light conditions reduced image clarity and, in some cases, the detectability of droppings. In the data used in this study such environmental factors impacted the drone-based inventory, leaving some data unusable. In one stand the sun created shadows from the trees which is not optimal for image quality. In another there was snow covering the ground which prohibits us from finding the dung piles. A new drone survey performed a week later, when weather conditions were more favorable, provided useful results. This highlights the importance of conducting surveys under optimal environmental conditions. Previous research show that remote sensing used in wildlife studies are dependent on environmental conditions, flight altitude and image resolution (Hodgson et al., 2018). An initial flight in the data collection for this study conducted at 30 meters height resulted in images of insufficient quality, making identifying the dung piles accurately not possible. However, subsequent flights conducted at 15 meters altitude resulted in images with good quality that allowed for clear identification of droppings.

4.3 Future studies

Future studies should consider seasonal variations, looking at different possibilities in building a model that works in difficult weather conditions, such as snow covered landscape. And also look further into the issue with shadow casting from trees.

In further development of this method it would be of importance to also develop a framework on how to use the UAV to get the most useful imagery results. For example, in the field data collection used in this thesis a lot of data was collected in the ground survey that were not captured in the aerial survey. This due to subsequent changes in the flight route where trees taller than 15 meters saved in the stands created problems during the survey. Also further exploring different flight altitudes could be interesting to see how high the UAV could collect useful imagery and therefore how fast a study area could be surveyed.
Flying at a lower altitude could be useful when developing this model further with other species where dung piles are smaller.

5. Conclusions

My study confirms that drone-collected imagery at an altitude of 15 meters in favorable weather conditions is sufficient to capture the details needed to be able to detect moose droppings and distinguish them from the surrounding vegetation. This confirms that there is a possibility to use this type of method and to further develop a model that can be used as a complement to the moose dung pellet count. That type of model would reduce observer bias in areas where conflicts about the moose's being or not being is discussed.

Referenser

Bergström, R., Månsson, J., Kindberg, J., Pehrson, Å., Ericsson, G. & Danell, K. (2019). *Inventering för adaptiv älgförvaltning i älgförvaltningsområden (ÄFÖ) - Spillningsinventering av älg*. m3_spillningsinventering_2019.pdf (Hämtad: 2025-05-09)

Bjørneraas, K., Solberg, E.J., Herfindal, I., Van Moorter, B., Rolandsen, C. M., Tremblay, J-P., et al. (2011). Moose Alces alces habitat use at multiple temporal scales in a human-altered landscape. *Wildlife Biology,* 17(1), 44-54. Moose Alces alces habitat use at multiple temporal scales in a human-altered landscape - Bj∅rneraas - 2011 - Wildlife Biology - Wiley Online Library

Bozzini, A., Huo, L., Brugnaro, S., Morgante, G., Persson, H. J., Finozzi, V., et al. (2025). Multispectral drone images for the early detection of bark beetle infestations: assessment over large forest areas in the Italian South-Eastern Alps. *Frontiers in Forest and Global Change,* 8(2025). https://www.frontiersin.org/journals/forests-and-global-change/articles/10.3389/ffgc.2025.1532954/full

Corcoran, E., Winsen, M., Sudholz, A. & Hamilton, G. (2021). Automated detection of wildlife using drones: Synthesis, opportunities and constraints. *Methods in Ecology and Evolution,* 12(6), 959-1143. Automated detection of wildlife using drones: Synthesis, opportunities and constraints

Edenius, L., Bergman, M., Ericsson, G. & Danell, K. (2002). The role of moose as a disturbance factor in managed boreal forests. *Silva Fennica* 36(1): 57–67. The role of moose as a disturbance factor in managed boreal forests | SLU:s publikationsdatabas (SLUpub)

Forssblad, M. (2023). Jägare vägrar skjuta: "De vill eliminera älgen". *SVT Nyheter.* 26 oktober. Jägare vägrar skjuta: "De vill eliminera älgen" | SVT Nyheter (Hämtad: 2025-03-05)

Fuller RJ, Gill RMA. 2001. Ecological impacts of increasing numbers of deer in British woodland. *Forestry* 74:193–99. (PDF) Ecological impacts of increasing numbers of deer in British woodland

Hodgson, J. C., Mott, R., Baylis, S. M., Pham, T. T., Wotherspoon, S., Kilpatrick, A. D., et al. (2018). Drones count wildlife more accurately and precisely than humans. *Methods in Ecology and Evolution*, 9(5), 1160-1167. (PDF) Drones count wildlife more accurately and precisely than humans

Holmes, S. M., Cromsigt, J. P. G. M., Danell, K., Ericsson, G., Singh. N. J. & Widemo, F. (2021). Declining recruitment and mass of Swedish moose calves linked to hot, dry springs and snowy winters. *Global ecology and Conservation*. 27:e01594. Declining recruitment and mass of Swedish moose calves linked to hot, dry springs and snowy winters - ScienceDirect

Ivošević, B., Han, Y-G., Cho, Y. & Kwon, O. (2015). The use of conservation drones in ecology and wildlife research. *Journal of Ecology and Environment.* 38(1). 113-118. The-use-of-conservation-drones-in-ecology-and-wildlife-research.pdf

Kellenberger, B., Marcos, D., & Tuia, D. (2018). Detecting mammals in UAV images: Best practices to exploit deep learning. *Remote Sensing of Environment*, 239, 111626. (PDF) Detecting Mammals in UAV Images: Best Practices to address a substantially Imbalanced Dataset with Deep Learning

Kuijper, D. P. J., Cromsigt, J. P. G. M., Churski, M., Adam, B., Jędrzejewska, B. & Jędrzejewski, W. (2009). Do ungulates preferentially feed in forest gaps in European temperate forest? *Forest Ecology and Management*. 258:1528-1535. Do ungulates preferentially feed in forest gaps in European temperate forest? - ScienceDirect

Lewander, M. (2022). *Sagan om den svenska älgen.* Sagan om den svenska älgen - Svenska Jägareförbundet Hämtad: 2025-05-12.

Müllerová, J., Kent, R., Brůna, J., Bucas, M., Estrany, J., Manfreda, S., et al. (2025). Understanding spatio-temporal complexity of vegetation using drones, what could we improve? *Journal of Environmental Management.* 373. Understanding spatio-temporal complexity of vegetation using drones, what could we improve? - ScienceDirect

Svenska Jägareförbundet (2025). *Snart dags för spillningsinventering - så kan du bidra.* Snart dags för spillningsinventering – så kan du bidra - Svenska Jägareförbundet (Hämtad: 2025-04-05)

Svenska Jägareförbundet, (2022). *Älgjakt och förvaltning*. Älgjakt och förvaltning - Svenska Jägareförbundet Hämtad: 2025-05-02

Utkast till lagrådsremiss – Älgförvaltningen. (2010). Microsoft Word - 100604 Lagrådsremiss älgförvaltning SLUTLIG.doc (Hämtad: 2025-03-07)

Wennberg DiGasper, S. (2006). Already adaptive? A quantitative study of the presence and adaptive management aspects in local moose management systems. I: *Paper to be presented at The Eleventh Biennial Global Conference of The International Association for the Study of Common Property (IASCP), Survival of the Commons: Mounting Challenges & New Realities*. Bli, Indonesia. June 19 – June 23, 2006. Microsoft Word - DiGasper_Sofia_Wennberg.doc

Wennberg DiGasper, S. & Sandström, C. (2010). Konflikt eller samarbete i älgskogen. *Future Forests Working Report*. wennberg-di-gasper-et-al-20230524.pdf

Åkerberg, S. (2005). The noblest game of our forest: A portrait of the moose and moose hunting in Sweden during the twentieth century. *The International Journal of Biodiversity Science and Management*. 1(2005). 167-179. 'The noblest game of our forests': A portrait of the moose and moose hunting in Sweden during the tw

Publicering och arkivering

Godkända självständiga arbeten (examensarbeten) vid SLU kan publiceras elektroniskt. Som student äger du upphovsrätten till ditt arbete och behöver i sådana fall godkänna publiceringen. I samband med att du godkänner publicering kommer SLU även att behandla dina personuppgifter (namn) för att göra arbetet sökbart på internet. Du kan närsomhelst återkalla ditt godkännande genom att kontakta biblioteket.

Även om du väljer att inte publicera arbetet eller återkallar ditt godkännande så kommer det arkiveras digitalt enligt arkivlagstiftningen.

Du hittar länkar till SLU:s publiceringsavtal och SLU:s behandling av personuppgifter och dina rättigheter på den här sidan:

- https://libanswers.slu.se/sv/faq/228316

☒ JA, jag, Frida Linder har läst och godkänner avtalet för publicering samt den personuppgiftsbehandling som sker i samband med detta

☐ NEJ, jag/vi ger inte min/vår tillåtelse till att publicera fulltexten av föreliggande arbete. Arbetet laddas dock upp för arkivering och metadata och sammanfattning blir synliga och sökbara.