Biodiversity and Species Distribution in the Heart of British Columbia

Introduction

Natural forests provide vital resources for conservation and biodiversity. Many native species rely on these forests as a habitat, meaning their management is essential, especially when the land is utilised for products like timber[1]. British Columbia is rich in boreal woodland, comprising of diverse forests and a unique mountain topography that directly influences the climate and vegetation[2]. As a result, forestry is a primary economic contributor to the province, supporting many of its communities with over 7,000 logging businesses that extract and export billions of dollars worth of timber products per year[3]. However, these forest operations can have harmful impacts on the local wildlife, namely through habitat loss and fragmentation[4]. The concept of sustainable forest management has therefore evolved over the past 20 years, driven by constant research to monitor the current state of the forest and develop effective frameworks for it's management[2]. These regulations aim to ensure that minimal ecological and environmental impacts arise from logging practices being carried out across the province.

During our expedition, we worked in collaboration with the John Prince Research Forest (JPRF), an organisation committed to sustainable logging through resource conservation and management. The animal research conducted there is a vital contribution to the knowledge of the forest and its fauna; as well as updating logging techniques to protect the ecosystems, all whilst continuing to provide local people with renewable income[5]. Our research aimed to investigate the behaviour and distribution of wildlife in BC, specifically in JPRF as it is an active logging site. This opportunity gave us a first-hand understanding of the practices taking place and provided us with the chance to obtain primary data to assess how they impact the wildlife.

Aims and Hypotheses

Our expedition aimed to investigate the regional fauna and microfauna in the John Prince Research Forest, British Columbia. Each of us focused on a personal research project with unique aims and objectives, all demonstrating a shared interest in the local wildlife and the different factors affecting it. Kiera focused on examining the effects of deforestation on species diversity and richness, whereas Jack explored the potential bias of using lures in camera trap research. They both identified suitable camera trap locations using a pre-existing LiDAR map, which standardised deforestation occurrence through tree height. Kiera hypothesised that logging would negatively impact the local wildlife, causing lower species diversity and richness due to habitat loss and fragmentation. Therefore, it was anticipated that 'high-high' and 'low-high' areas would have higher species richness and diversity. On the other hand, Jack predicted that the lure would not attract individuals from other forest areas, suggesting that it simply draws animals toward the camera that were already present in the area.

Henry sought to determine the effect of otter latrine sites on carnivore presence, while Josh aimed his focus on the visitation and usage of otter latrines by the North American river otter. We aimed to survey the lakes for long enough to produce an ecological snapshot of the British Columbian summer, having the cameras capture data for 30 days. Henry predicted that latrine locations would become a hotspot for carnivores and have much higher detections of carnivore presence when compared to control locations. Cameras were setup at two differing lakes, one with mercury contamination and one without. It was also considered that carnivore presence as a whole would be lower at the locations on the contaminated lake.

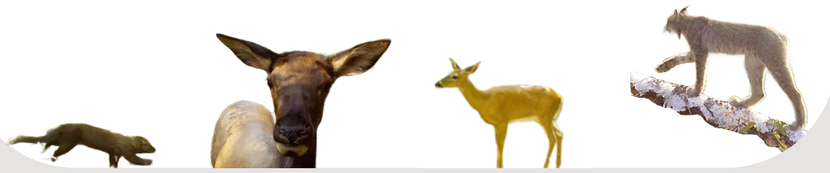
Josh predicted that otter visitation would decrease with higher levels of mercury, producing lower scat (poo) counts and presence on camera traps. We were successful in achieving our aims for the expedition, with some elements of our plan being updated on arrival, facilitated by advice from the JPRF researchers. All team members will use the data gathered to write our 3rd year dissertations. This gives us an opportunity to process and analyse raw data, perform calculations, create visual plots, find relevant references and ultimately write a scientific report.

Methodology

To investigate the effect of logging on diversity, we collected data from areas where deforestation had and hadn't occurred and compared the two. A LiDAR map was used with 4 categories of forest type based on the height of the trees, which standardised a measure of deforestation in the area. The categories ranged from high-high, where logging had occurred very long ago or never, to low-low, where the area had been cleared in recent years. 20 cameras were set up in total, 5 in each of the four forest categories. These were left up for 1 month, gathering video footage triggered by a motion detector. For this study, we gathered 1,650 videos in total. RStudio programming will then be used to calculate species diversity indexes and draw conclusions regarding the effects of deforestation on wildlife.

Cameras were also used in similar locations to explore the effectiveness of lures on camera trapping studies. The effect on detection rate and animal density was measured. 4 cameras were placed in a square grid with 100 metre transects measured between them. A habitat boundary was established 50 metres across the grid, ensuring the habitat that borders the gridded area was dense forest or recently logged (depending upon which habitat type was being measured). Two cameras in each habitat were provided with catnip lure, and 5 replicates of this grid were placed totalling 20 cameras. Trap cams were placed at shoulder height in order to capture a large area for medium-sized mammals that were expected to be attracted to the lure. The area around the cameras was also cleared from vegetation that may set off motion capture.

To study the usage of the otter latrine sites, 28 remote camera traps were placed along the shoreline of both Tezzeron Lake (16) and Pinchi Lake (12), and river otter scat was sampled across a 36 day period. Cameras were not only placed at the latrine sites but additional sites, approximately 50 metres down the shoreline, that served as control locations. Furthermore, at both latrine and control locations, high angle and low angle cameras were placed to capture the whole spectrum of animal sizes. Vegetation around the cameras was not cleared so the latrine locations would not be altered. Scat was counted and sampled from a total of 14 latrine sites; 8 at Tezzeron and 6 at Pinchi, using sterile ziplock bags to remove and store all scat found at each latrine. The 7 latrines with cameras were revisited to change SD cards, and further scat counts were conducted at two time intervals: two and five weeks after the first visit to the latrines. Additionally, GPS coordinates of each latrine site were recorded for cartographic analysis using QGIS software, in order to assess the changes in latrine usage visitation rates.



Map of the John Prince Research Forest

Effects of Deforestation

Satellite imagery from 1984, showing the surrounding area.

Imagery from 2020, illustrating the vast scale and effects of industrial logging on the landscape.

Figures

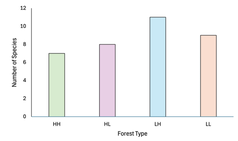


Figure 1. Species richness in four identified forest types. Forest types are categorised by High 3-10m - High 10+m (H-H), High 3-10m – Low 10+ (HL), Low 3-10m – High 10+m (LH), and Low 3-10m – Low 10+m (LL). "High" and "Low" describe the frequency of each tree height, identified using a LiDAR scanning drone.

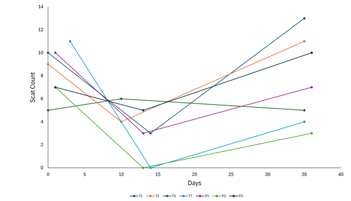
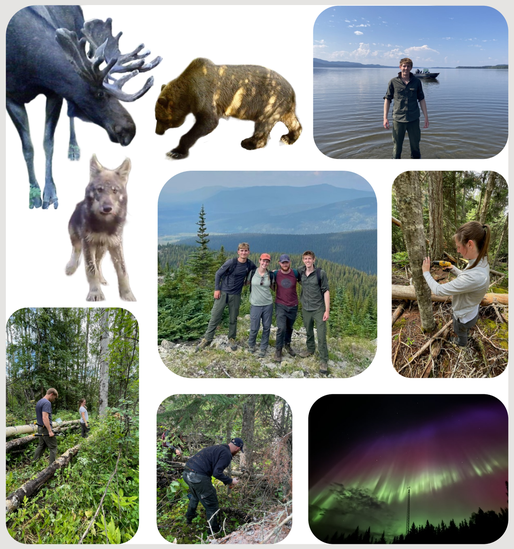


Figure 2. Number of scat found at each latrine (Tezzeron 1,2,3,7 & Pinchi 1,2,3) relative to the number of days since first visit.

About JPRF

The John Prince Research Forest in Canada unites First Nations' knowledge with western science for natural resource conservation, where researchers from indigenous communities and academic institutions collaborate. JPRF also serves as a learning hub for local and international students like ourselves, offering experiential programs that deepen knowledge of local ecosystems and their stewardship[6].



Links

Video footage highlights

References

Key Findings and Next Steps

Kiera's raw data found that there was a mean average of 8.75 species across each of the four forest types: with 7 in high-high, 8 in high-low, 11 in low-high and 9 in low-low. The results that were gathered so far somewhat match her hypothesis, with the low-high area having the highest richness (see *figure 1*). However, the LL area had the second highest species richness, with the HH area having the lowest, which completely contradicted her predictions. Further calculations will be required to find the overall diversity in each forest type, how individual species differed in habitat selection, and the average time spent in each place. These are necessary in order to confidently draw conclusions from the data. She is in the process of completing this data analysis using RStudio, a statistical analysis and graphics programme.

An initial review of Jack's data suggests his hypothesis was accurate; in the tall forested areas, there were considerably more instances of large predators and herbivores such as bears and moose, as well as mesopredators like pine marten, interacting with the lures. The same was true for the control cameras, which showed fewer animals than the lured sites, but more than the logged sites. Overall, the presence of the lure in the logged sites, while it had a small number of interactions, did not seem to draw animals from the forested areas. Future steps involve quantitating the results and using data software to visualise any hidden trends, while also investigating any specific interactions with the lures.

From a preliminary analysis of the otter latrine scat counts, we observed that Tezzeron Lake averaged a scat count of 6.6, 0.9 higher than Pinchi Lake, which had an average count of 5.7. Whilst there is a difference in usage between Tezzeron Lake and Pinchi Lake, this variation isn't significant, so it's unlikely that mercury contamination had an effect. The rate at which the number of scats at each site increased was equal between both lakes. Furthermore, we noticed that Tezzeron latrine 3, one of the lowest use latrines, was the only site to increase in visitation rates after all the scat was removed on day 1 (see *figure 2*). We believe this is due to kokanee salmon spawning at the time, as latrine T3 was located at the creek where they migrate, clearly showing how changing biotic factors affect river otter latrine visitation rates. Moving on from this, we will compare the scat count data to the camera footage to evaluate the effectiveness and reliability of scat sampling as a measure for latrine usage.

Otter latrine camera footage suggests there is a clear increase in carnivores presence at latrine locations compared to that of the control. The presence of certain species, such as wolves, river otters and lynx, were only detected at latrines. Larger carnivorous species like grizzly or black bears were found in all areas but still maintained a higher presence count at the latrine locations. Next steps involve further quantification of my results and the of use R-studio for more in-depth statistical analysis, revealing any statistically significant trends in the dataset. Further considerations will be taken to determine influencing factors that could cause outlying results.

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