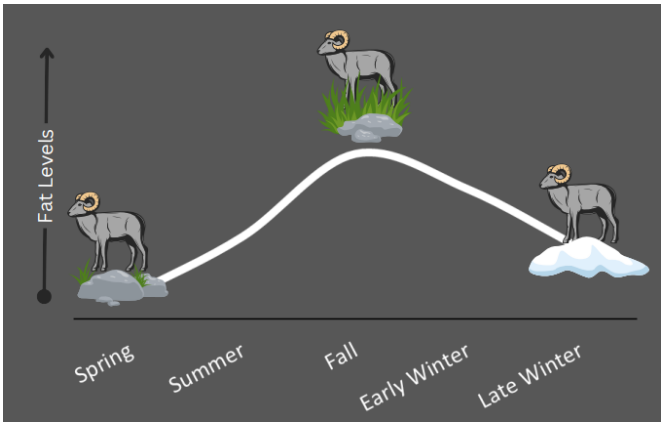

Population Monitoring and Seasonal Nutrition in a Southern Interior BC Stone's Sheep Population – summary of field research.

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How to Monitor and Enhance Stone's Sheep Populations Through Seasonal Nutrition Management

Phase 1: Track Population Trends and Recruitment

- **Perform regular aerial surveys:** Count herd populations across targeted mountain blocks (e.g., the Finlay-Russel, Tatlatui, and Swannell Ranges) to detect current trend and compositions and to identify historical declines.
- **Calculate lamb-to-ewe ratios:** Measure lamb counts during summer and late winter to monitor recruitment rates and evaluate long-term population stability.
- **Identify mortality drivers:** Investigate mortality sites to determine if population shifts stem from severe weather events, disease, starvation, or predator-prey dynamics involving wolves, grizzlies, or wolverines.

Phase 2: Monitor Body Condition and Seasonal Nutrition

- **Deploy GPS tracking collars:** Capture adult ewes to map precise range utilization, movement behavior, and seasonal distribution patterns. Higher fix rates (i.e., 1-2hr locations) can help with fine scale habitat use and selection analyses, important for a sheep. and may improve interpretations and support outcomes and conclusions.
- **Measure rump fat via ultrasound and body condition scores:** Evaluate body condition scores of collared sheep twice per year to allow for habitat linked seasonal fat dynamics:
  - *Early-Winter Intercept:* Reflects the abundance and quality of food gathered on the summer-fall range. If you can only do one, this one is the most important. Dates: December-Jan when conditions allow – the sooner the better. If sheep start the winter skinny, you know the problem was prior to winter. Whereas most sheep, regardless of winter range, are somewhat skinny in late winter.
  - *Late-Winter Intercept:* Quantifies winter energy expenditure and fat depletion rates. Dates: March
  - *Behavioural impacts:* If recaptures are conducted, as with most captures of sheep, understand behavioural changes may occur. Previously captured animals show a heightened sense of helicopter awareness and fleeing or hiding behaviour.

Body condition

Score	Sketch
1	
2	
3	
4	
5	No sketch

- **Map vegetation greenness via satellite imagery:** Use the Delta Enhanced Vegetation Index (\(\Delta \)EVI) to track forage quality, operating under the principle that higher greenness equals higher nutritional value.

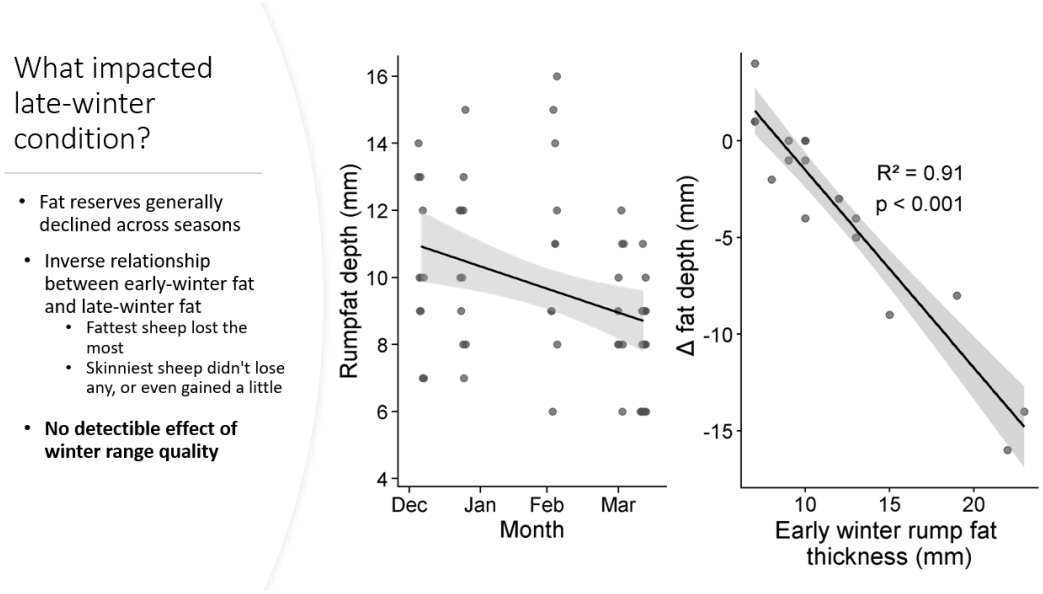
Phase 3: Analyze Key Nutrition and Fat Dynamics

- **Link summer forage to winter survival:** Recognize that a higher summer-fall \(\Delta \)EVI use directly correlates t increased early-winter rump fat.

- **Account for the winter fat depletion paradox:** Factor in that fat loss over winter is inversely related to early-winter body condition; the fattest sheep lose the most depth, whereas the skinniest sheep maintain or slightly increase fat. “You need to be fat to lose fat”
- **Acknowledge winter range limitations:** Note that winter range forage quality has no statistically detectable effect on late-winter fat stabilization or decline.

Phase 4: Execute Targeted Range Enhancements

- **Prioritize summer-fall range restoration:** If over winter condition is limiting, from a nutritional perspective, habitat enhancement resources should focus on summer and fall ranges to optimize pre-winter fat accumulation rather than attempting to enhance winter ranges, wherein the benefit may be buried under deep snows or ice. Sheep entering winter with sufficient fat reserves may need little to no forage to survive over-winter.
- **Apply prescribed range burns:** Conduct controlled burns on summer-fall habitats to stimulate high-quality forage growth. This is highly beneficial for sheep migrating to zones prone to deep snowpacks and heavy icing.



Key takeaway:

- Summer-fall range quality (\(\Delta \)EVI) is the primary driver of winter fat reserves, making summer-fall habitat enhancement likely the most effective intervention to improve individual nutritional fitness and, where nutrition may be limiting, improve population stability.
- Over winter fat reserves are influenced by summer-fall forage.
- Fat loss over winter strongly correlated to condition they entered winter in (Summer/Fall range burns could be more beneficial in areas prone to icing and deep snow packs).
- This research did not identify a significant effect of fat on survival or pregnancy, however there were limitations with a relatively low number of deaths of collared sheep; a relatively short study period; and in general sheep during this work could be considered ‘Fat’ sheep, with rump fat depth never dropping below 6mm!?
- Pregnancy appeared to be significantly corelated to lamb at-heel status. Ewes with a lamb at-heel in winter, had significantly reduced pregnancy rates compared to ewes without a lamb at-heel.

The management strategy and approach may be slightly different depending on:

- The **specific geographic region** or wildlife management unit you are targeting.
- The **primary predator species** present in your local study area.
- Any **existing data** you have regarding localized winter snowpack depth or icing frequency.