



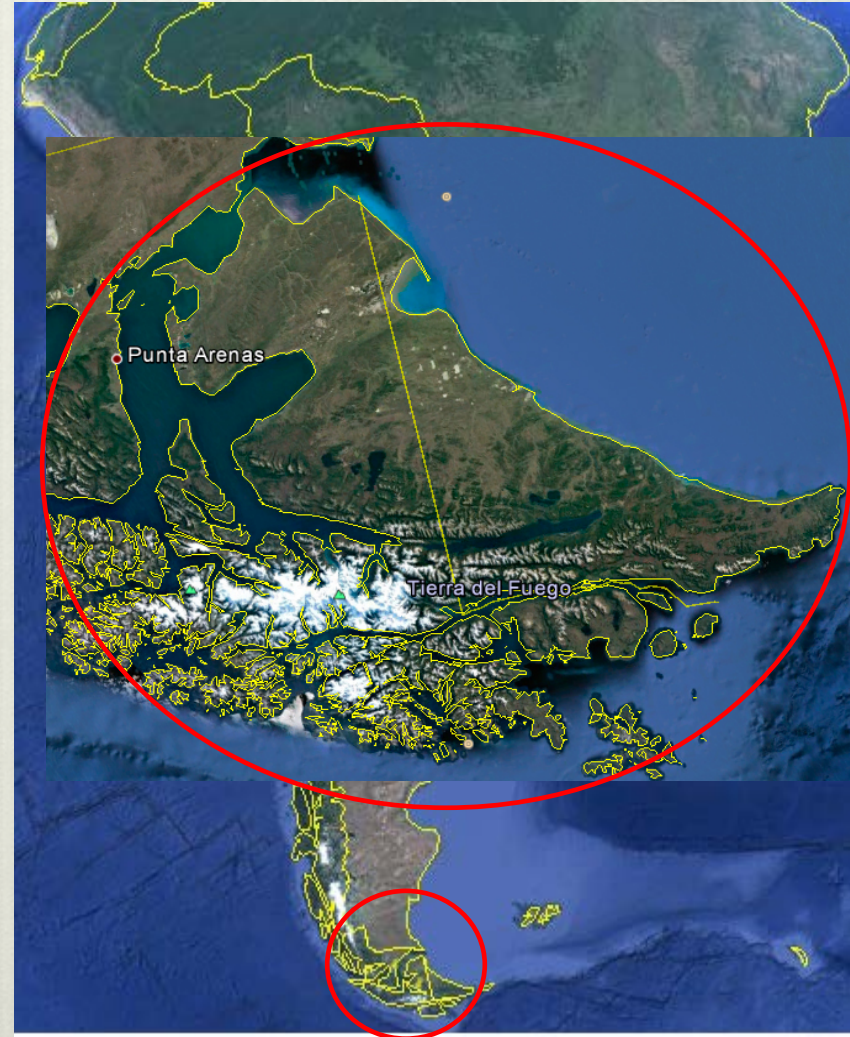
Satellite imagery to support sheep management in Tierra del Fuego, Chile

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Magallanes region - Chile

- ❖ Total area: 13×10^6 ha
- Agricultural area: 5×10^6 ha
- ❖ Mean size of farm is 5,000 ha.
- ❖ Agriculture is based on extensive sheep production from natural pastures.
- ❖ Population density (Agric.Area)
0.03 inhabitants/ha
0.38 sheep/ha



Introduction

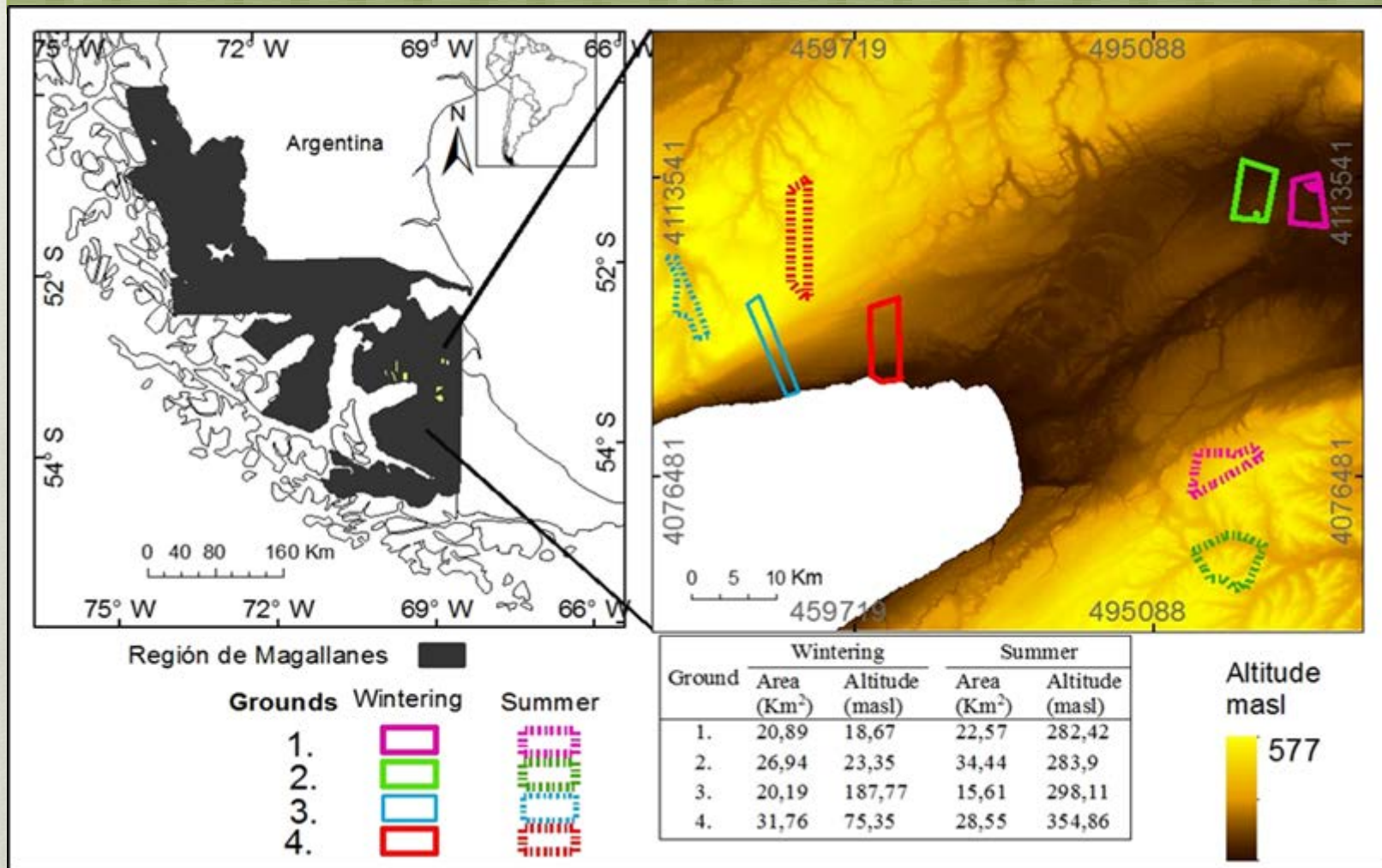
- ❖ Sheep systems are based on traditional seasonal grazing patterns-summer and winter grazing pastures for each ranch.
- ❖ Snow cover, low temperatures and forage quality limit pasture utilization of summer grazing pastures.
- ❖ Moving stock between grounds takes 2-4 days and is based on traditional farming practices.



Aim

- ❖ The aim of this study was to investigate the potential for satellite imagery to be applied as a scientific criteria for selection of the best period to move sheep from summer to winter ranches in central Tierra del Fuego, Chile.

Study area



Wintering ranches (solid line) and summering ranches (dotted line).

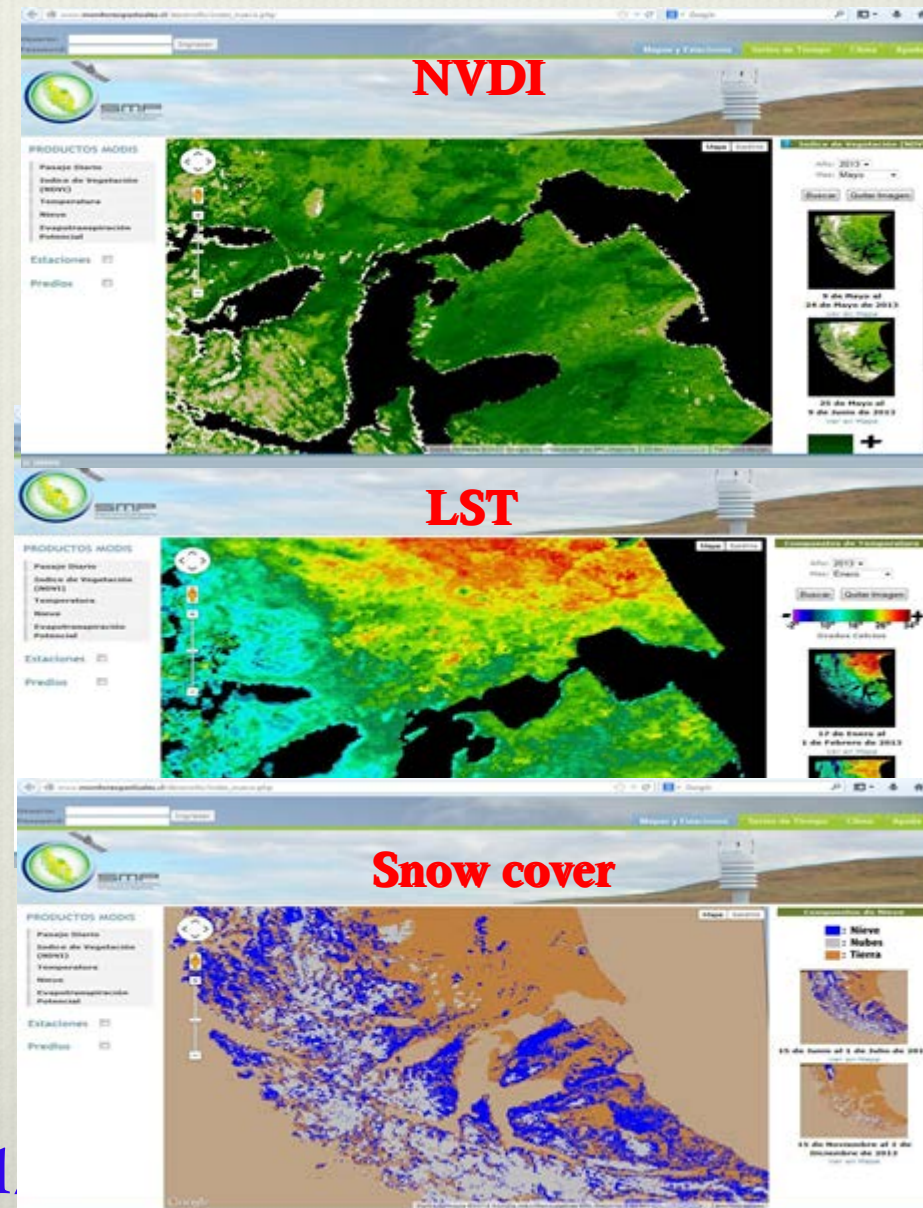
Methodology

- ❖ Four ranches in Tierra del Fuego were selected. The average areas for summer and winter ranches were 2,495 & 2,529 ha respectively.
- ❖ The analysis consisted of 12 year (2000-2011) series of Normalized Difference Vegetation Index (NDVI), snow cover, and Land Surface Temperature (LST) data
- ❖ The mean altitude was determined by using a Digital Elevation Model.
- ❖ To analyze snow cover, LST and NDVI during each year, 46 periods were selected from satellite images.



Methodology

- ❖ The MODIS products (Moderate Resolution Imaging Spectroradiometer) were:
 - ❖ MOD13Q1 (NDVI with a pixel of 250m)
 - ❖ MOD11A2 (LST with a pixel of 1000m)
 - ❖ MOD10A2 (snow cover with a pixel of 500m).



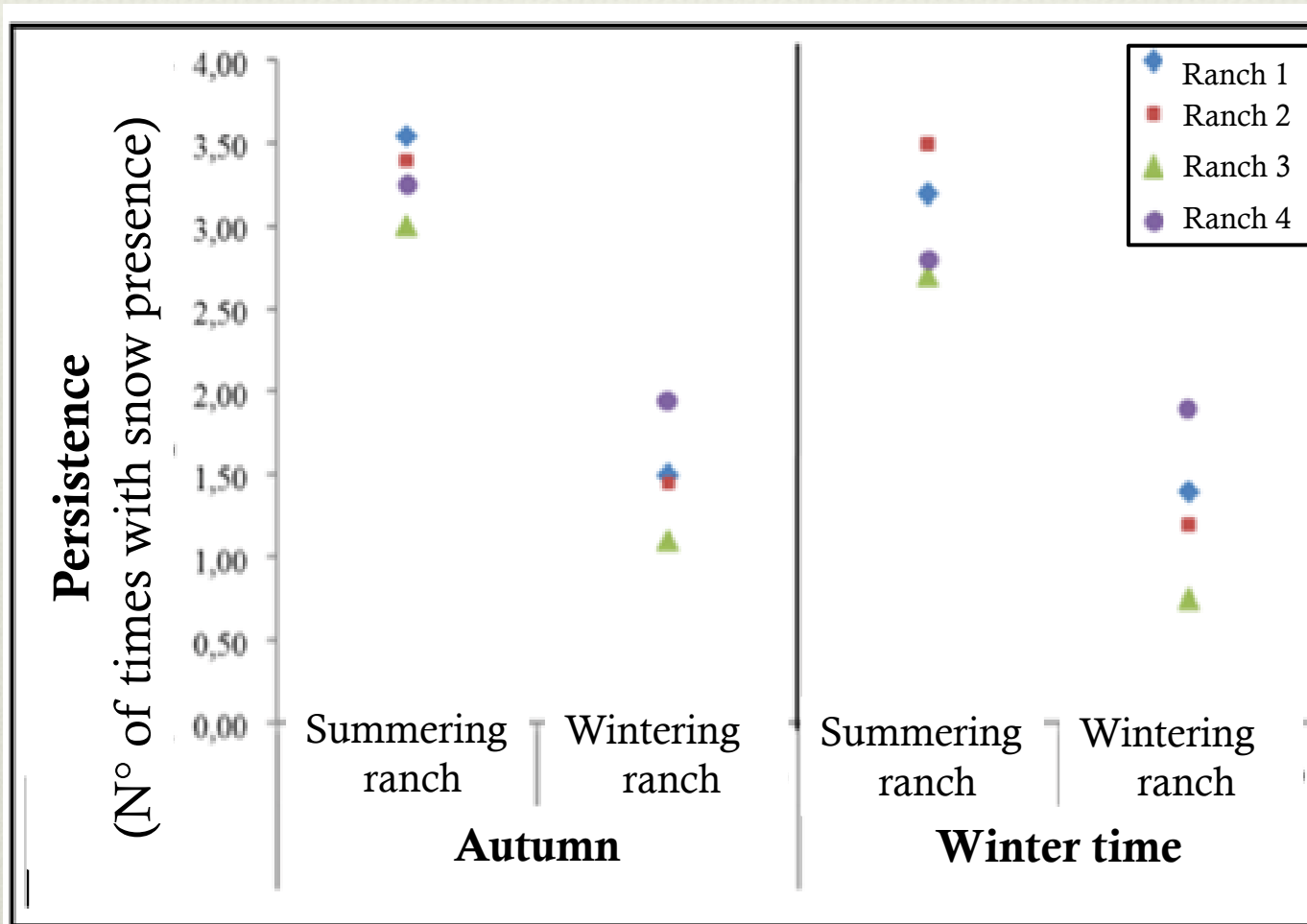
Methodology

- ❖ The experimental design was a randomized block experiment, where each ranch is a block and the treatments were the summering and wintering ranches.
- ❖ To determine the differences in snow persistence between wintering and summering ranches, ANOVA analyzes was performed (significance: $p < 0.05$).
- ❖ Critical thresholds for snow cover, LST and NDVI, were determined from bibliographical reviews and their respective original levels.

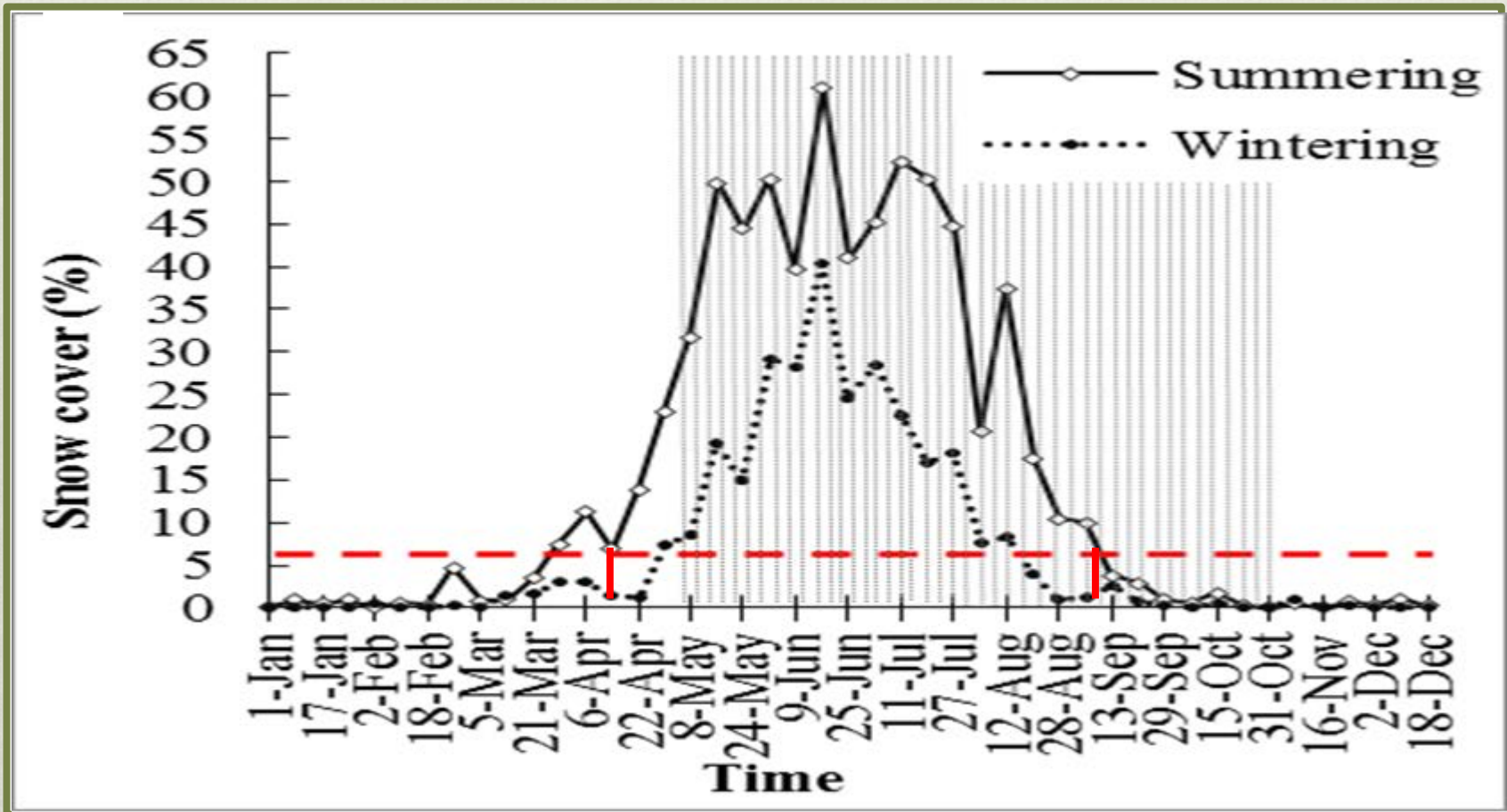


RESULTS

Snow persistence



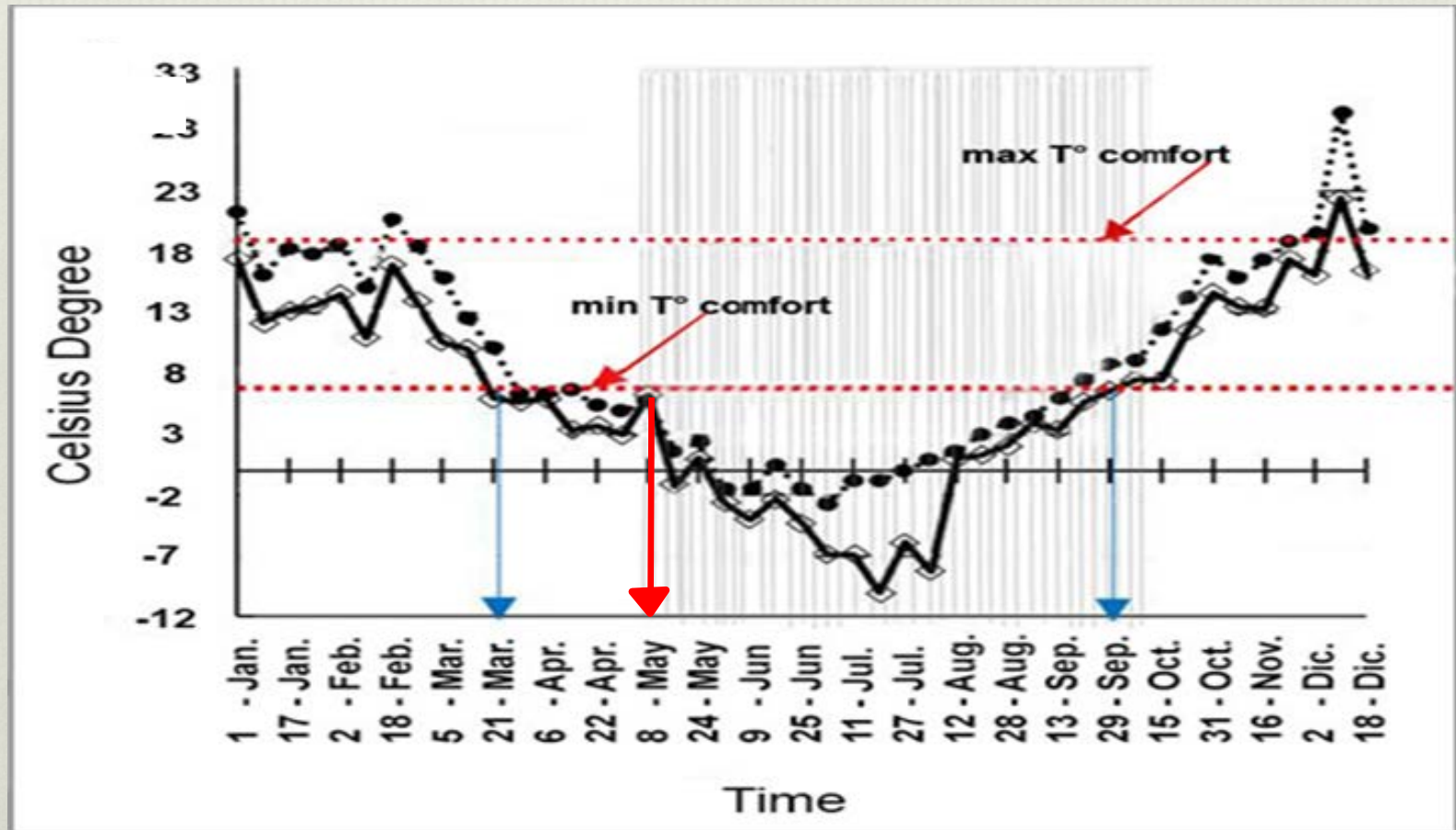
Snow cover



Average duration of snow cover (%) per ranch type (dashed red line is the critical threshold for snow cover)

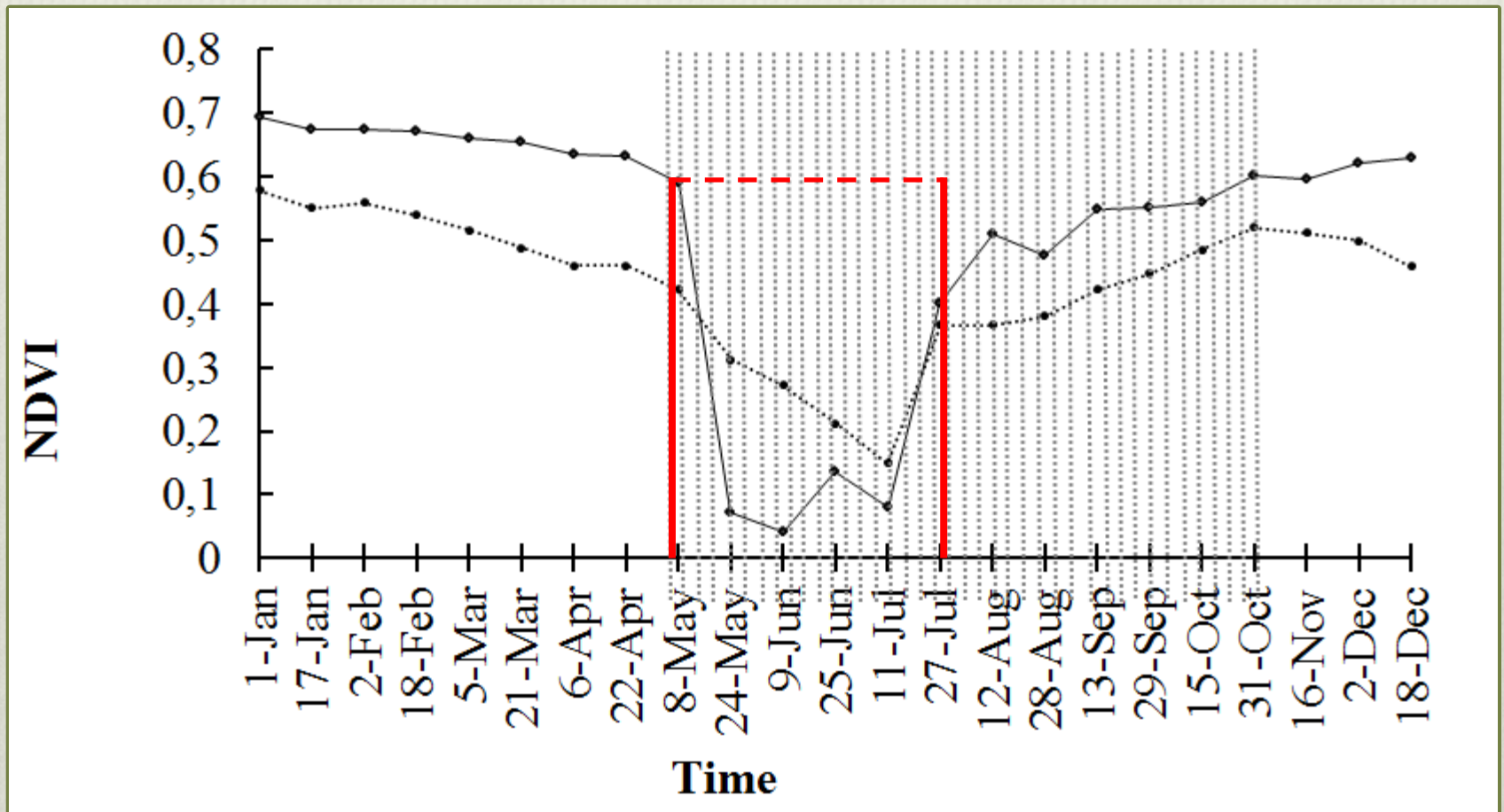
Land Surface Temperature

Pre-stress temperature minimum of sheep is 7.2°C (Saravia & Cruz 2003).



LST ($^{\circ}\text{C}$) for four ranches

NDVI



NDVI average for four ranches.

Conclusions

- ❖ Sheep flocks should be moved between wintering and summering ranches in certain specific periods.
 - Snow cover is consistently higher in summering ranches during autumn and winter, specifically between April 6 and September 13.
 - The LST critical period occurred between March 21 and September 29.
 - ❖ - The NDVI critical period occurred between May 8 to July 27.

Conclusions

- ❖ These findings suggest that the critical period for overwintering should be between March 21 to September 29, and the period from May 8 until September 13 should be avoided.
- ❖ These methodology can be incorporated into sheep management planning, and can help trigger public support measures when the climatic conditions are extreme.

