

Reduction of labour input by a GPS-based livestock tracking system on alpine farms with young cattle



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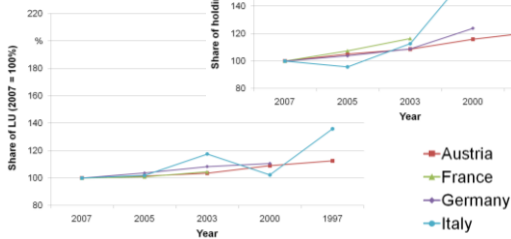


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Introduction – Development of alpine farming (I)

Structural change of alpine farming

(Less favoured mountainous areas, Eurostat, 2011)



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Introduction – Development of alpine farming (II)

Income development and labour input in alpine farming

(Gfeller, 2010; KTBL-Kalkulationsunterlagen 2010; Kümmel, 2005; Handler et. al, 1999)

- Lower income on alpine farms compared to valley farms
→ plus the gap grows continuously
- Higher labour input on alpine farms compared to valley farms (e.g. young cattle on alpine farm (A) 5-55 MPh/LU*season vs. young cattle in valley farm (D) 10-15 MPh/LU*year)
- Daily animal control needs between 11.5 and 57.8 % of the total labour input for young cattle on alpine farms
- Thereof, searching for cattle needs 11.4 % for young cattle on alpine farms
→ Searching for cattle needs do be done irregularly
→ Can not be planned and can last for a whole day in an extreme case



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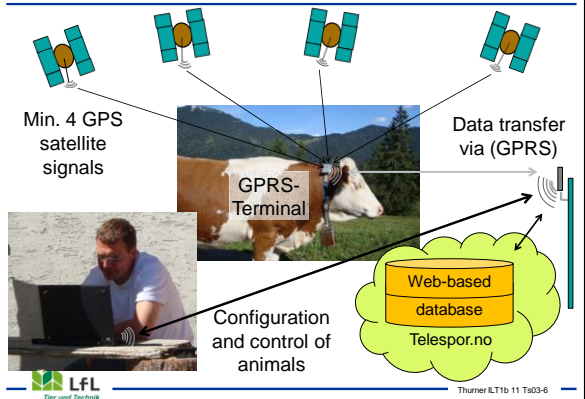
Aims of the study

- Test of the general applicability and function of a GPS-based livestock tracking system (LTS) on alpine farms
- Gather first experiences and data with the LTS of Telespor for the management of grazing cattle on alpine farms
- Evaluate the effects of a LTS on the labour input on alpine farms



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M&M - Function of the LTS of Telespor



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M&M – Visualisation Software Cow2KML

The screenshot shows the Cow2KML software interface. It features a map view with several data points plotted. A login window is open in the foreground, with fields for 'Platz' (Google Earth), 'Datenpfad' (Cow2KML), 'Passwort', 'Login', and 'Status'. The status field is set to 'Datenreihe ausgewählt (21.09.2010 09:52:48)'. The LfL logo and 'Tier und Technik' text are visible at the bottom.

M&M – Alpine farms

Kogalm: 1200 m above the Adriatic

- 8 ha open pasture
- 40 ha pasture partly covered with trees
- 2 farmers

Seekarlm: 1500 m above the Adriatic

- 72 ha open pasture
- 250 ha pasture partly covered with trees
- 4 farmers

The satellite map shows two alpine farms. Kogalm is marked with a red dot and a white circle. Seekarlm is marked with a red dot and a white circle. The map shows the terrain, roads, and pastures. The LfL logo and 'Tier und Technik' text are visible at the bottom.

M&M - Experimental setup

- 36 young cattle of two farmers
 - 4 groups (2 x heifers, 2 x calves)
 - 8 animals (at least one in each group) equipped with a GPRS-Terminal + collar + counter weight
- Configuration: 1 dataset per hour
 - Battery standing time approx. 1200 datasets
 - battery change after approx. 50 days
- Manual recording of working time:
 - 2009 without LTS
 - 2010 with LTS

The image shows a close-up of a GPRS-terminal collar with a counter weight attached to a cow's neck. The collar is blue and white, and the counter weight is a metal bell. The LfL logo and 'Tier und Technik' text are visible at the bottom.

Results - Static precision of GPS data

Accuracy in the static test (x+y coordinates) 15 – 20 m

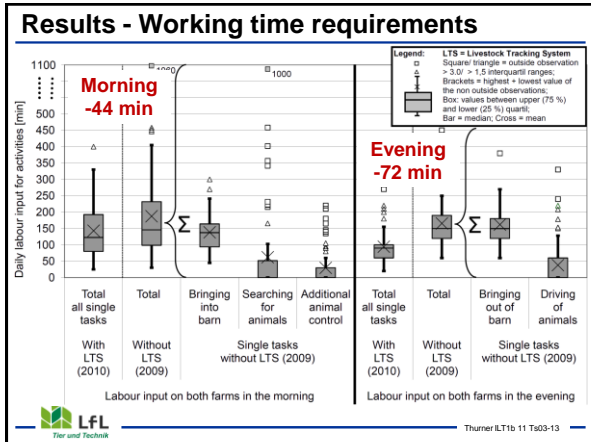
The box plot shows the static precision of GPS data for 10 different GPRS-terminals. The y-axis is 'Distance of signal to real position' in meters, ranging from 0 to 70. The x-axis shows terminals 1 to 10 with their respective number of measurements in brackets: (180), (52), (19), (69), (36), (34), (23), (49), (58), (56). The legend indicates: Square triangle = outside observation; Brackets = highest + lowest value of the non outside observations; Box: values between upper (75 %) and lower (25 %) quartile; Bar = median; Cross = mean. The LfL logo and 'Tier und Technik' text are visible at the bottom.

Results - Received position signals (I)

The box plot compares the share of received position data from possible position data for lateral and dorsal positions. The y-axis is 'Share of received position data from possible position data' from 0 to 100. The x-axis shows GPRS-Terminal numbers 51460 (lateral) and 53062 (dorsal). The legend indicates: Square triangle = outside observation > 3.0° = 1.5 interquartile ranges; Brackets = highest + lowest value of the non outside observations; Box: values between upper (75 %) and lower (25 %) quartile; Bar = median; Cross = mean. An inset image shows a cow with a GPRS-terminal collar. The LfL logo and 'Tier und Technik' text are visible at the bottom.

Results - Received position signals (II)

The box plot shows the share of received position data from possible position data for 10 different GPRS-terminals. The y-axis is 'Share of received position data from possible position data' from 0 to 100. The x-axis shows GPRS-Terminal numbers 2 to 10. Two terminals (2 and 6) are circled in red. The legend indicates: p-Wert > 0,05 = not significant = n.s.; p-Wert < 0,05 und > 0,01 = significant = *; p-Wert < 0,01 und > 0,001 = high significant = **; p-Wert < 0,001 = very high significant = ***. All pairs without extra indication show very high significant differences. The LfL logo and 'Tier und Technik' text are visible at the bottom.



- ### Shortcomings of the LTS from Telespor
1. Further technical development necessary
 - to enhance the number of received position signals.
 - to realize a higher data rate.
 - to reduce the energy consumption or to increase battery capacity in order to avoid battery changes during the season also with a higher data rate.
 - to enable bidirectional communication.
 2. Navigation system for the herdsman on a mobile phone necessary.
 3. User friendly software (for the web-based database, for the PC and for a mobile device) with different analysis functions and more options for configuration necessary.
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- ### Summary and Conclusions
1. Technique works reliable, accuracy is sufficient for location of cattle on alpine farms and 1 position data set per hour was sufficient for searching for animals and animal control → Herdsmen satisfied with LTS
 2. Grazed and not grazed parts of the pasture and temporal grazing behaviour could be identified → Feasibility for improvements of pasture management
 3. Large potential for reducing labour input especially for reducing labour peaks (irregular searching for animals could be avoided) → Depending on labour costs, system can work profitable
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