

Introduction of corralones, (semi-roofed shelters) and veterinary pharmacies in order to protect livestock (Llama camelids) and reduce mortality due to extreme events in the Bolivian Altiplano (High Andean Plateau)

Source	FAO Bolivia, Strategic Objective 5 – Resilience, in FAO
Keywords	Livestock, shelters, mortality, Llama
Country of first practice	Bolivia (Plurinational State of)
ID and publishing year	8931 and 2017
Sustainable Development Goals	Climate action and life on the land

Summary

In the highlands of Bolivia, recurrent cold waves and related extreme events severely increase the risk of Llama camelids mortality.

The introduction of shelters to protect camelids from frost, combined with the increased access to treatments following the establishment of veterinary pharmacies, significantly reduced the mortality rate of camelids.

This practice describes in detail how shelters can be built to protect livestock in the highland.

Description

1. Corralones (semi-roofed shelters)

1.1 Location

The corralones are necessarily needed during winter and summer, therefore, they should preferentially be located close to the areas where the llamas spend most time, which might be different according to the season.

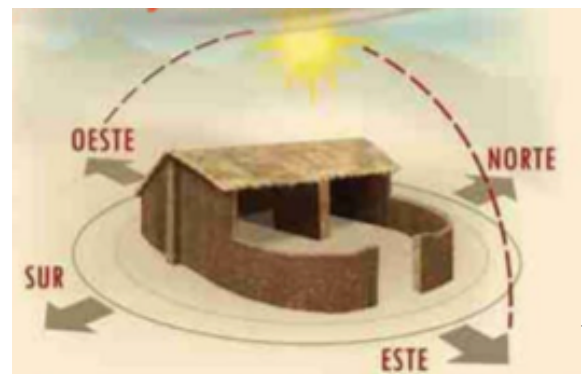
When possible, two corralones would be ideal.

1.2 Orientation considerations

1.2.1 Sun

The entrance of the corralón should face the sunrise (east) in order to warm up and disinfect the shelter.

Figure 1. Orientation in relation to the sun



© FAO/TECA

1.2.2 Wind direction

The back of the corralón should face the direction from where the strongest and most frequent winds blow.

1.2.3 Topography

When built on a slope, the corralón entrance should be oriented facing down the slope,



Climate Change Adaptation and Disaster Risk Reduction

and a water-diversion canal should be digged in the upper side, at the back of the corralón.

Figure 2. Orientation in relation to the wind



© FAO/TECA

1.3 Dimensions and volumes

1.3.1 Size of the herd

The dimension of the corralón is directly correlated to the size of the herd, with a ratio of 1.5 m² per adult llama. It is advisable to also consider the amount of pregnant female and baby llamas.

1.3.2 Size of the shelter

A shelter of 9 m x 5 m. is enough to fit 30 adult llamas, covering a surface of 45 m².

1.3.3 Roof design

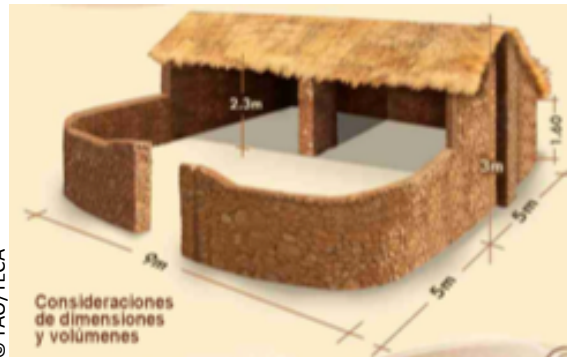
The roof of the shelter could be of one or two gabled roofs. When designing the roof, considerations on the maximum high of llamas (1.70 cm) should be taken, being recommended to have a maximum high of 3 m.

Figure 3. Orientation in relation to the topography



© FAO/TECA

Figure 4. Corralón dimensions



© FAO/TECA

1.3.4 Size of the patio

As a general rule, the area of the patio is the same as the area of the shelter but may vary according to the availability of space.

1.3.5 Shape of the patio

The shape can be circular, rectangular or squared. Although it is recommended for the patio to have a rounded shape, in order to facilitate cleaning as well as to facilitate the movement of the llamas and a safe management.

1.4 Materials

1.4.1 Floor

It is recommended to have soil as a floor.

1.4.2 Walls

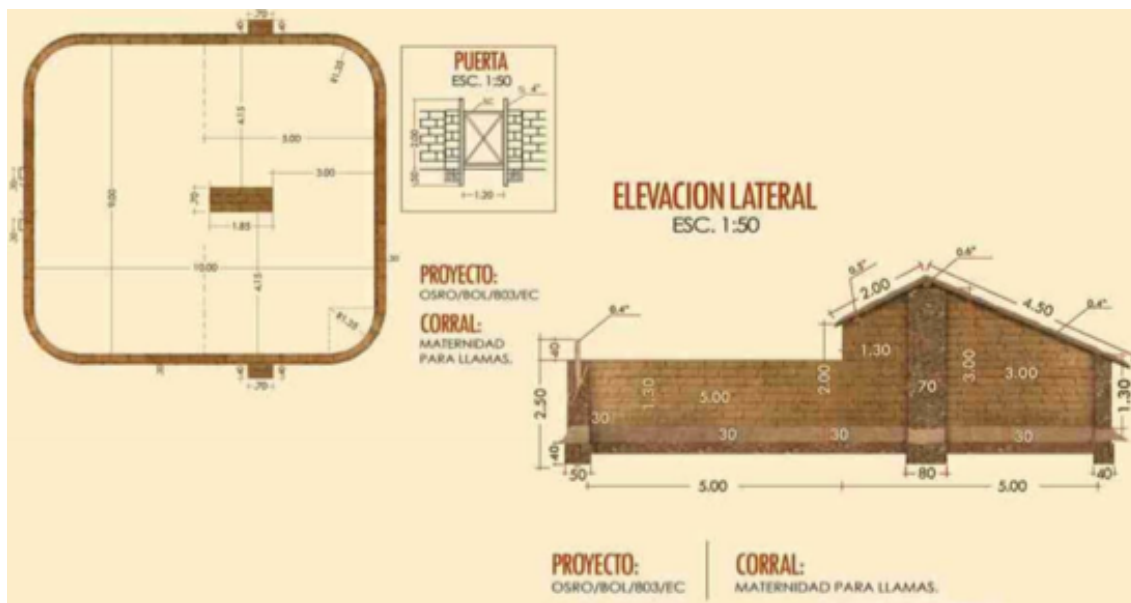
It is recommended to use local materials, such as rocks, adobe, etc.

1.4.3 Roof

The roof may vary in thickness, and may be composed by one material or by the



Figure 5. Construction design



© FAO/TECA

combination of different materials, such as straws, roof tiles, bamboos, mud, plastic membranes, weaved wires, etc.

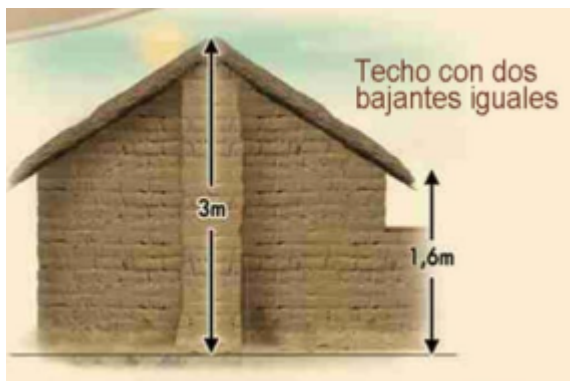
Figure 6. Ceiling design



© FAO/TECA



© FAO/TECA



© FAO/TECA

The cost (in Boliviano) for the construction of the roof are: (check the Table below).

1.5 Complementary Infrastructure

1.5.1 Water-diversion canal

In laden terrains a construction of a water-diversion canal in the upper side of the corralón is needed to deviate rain water.

1.5.2 Draining canal

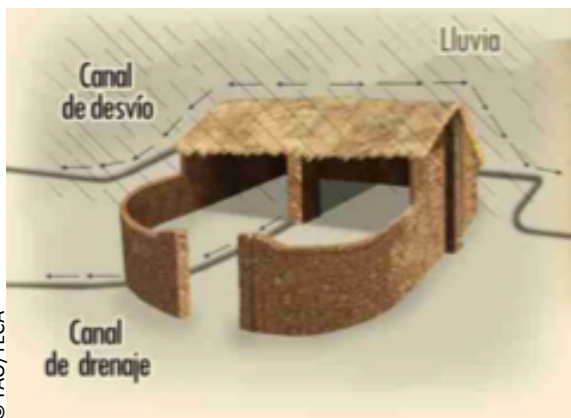
To drain out the urine and any rain water that filters into the corralón, in order to maintain it dry.



Figure 7. Patio design



Figure 8. Water diversion and draining canal



- Shelter and canals should be cleared regularly.

Figure 9. Dung deposit



1.5.3 Dung deposit

In order to maintain the corralón clean, while facilitating the production of manure.

1.6 Maintenance

- In-depth cleaning of the corralones should be done twice a year.
- The roof should be checked every year prior to the commencement of the rain season.

2. Veterinary Pharmacies

In addition to shelters, veterinary pharmacies located at the municipalities were introduced in order provide livestock with the necessary treatments to cope with prolonged frost and snow periods.



Table 1. Cost for the construction of the roof

Material	Units	Quantity	Price per Unit (Bs)	Total (Bs)
Wooden logs 2"x 2m	piece	8	5	40
Wooden logs 3"x 2m	piece	11	7	77
Wooden logs 4"x 4.5m	piece	11	25	275
Wooden logs 5"x 5m	piece	2	30	60
Wooden logs 6"x 5m	piece	2	30	60
Chajallo	moorage	10	25	250
Nails 4"	kg	2	15	30
Nails 6"	kg	2	15	30
Nails 1.5"	kg	2	15	30
Wire	kg	4	16	64
Galvanised wire	kg	2	17	34
Rope (plastic)	m	30	2.5	75
Geomembrane	m2	70	10	700
Sub-total with Geomembrane				1725
Sub-total without Geomembrane				1025

Other required material (usually this material does not imply and additional cost, due to its availability in the location. Labor is provided by the owner of the corralon)				
Stones	cube	8	80	640
Adobe	piece	1200	0.6	720
Straw		25	25	625
Man labor	wage	30	60	1800

Source: FAO 2017

Farmers in this way were provided with easy access to veterinary pharmacies, supplied (dewormers and multivitamins) by the municipalities before and after (possible) extreme weather events and low temperature seasons, in order to guarantee the access to the dewormers and multivitamins, being those the most requested medications.

2.1 Deworming and Multivitamins

During crisis periods, camelids usually experience a high level of stress, both

nutritional and physiological, compromising the balance of their vital functions, their pastoral ethological behaviour, their immunological levels and reproductive disorders among others.

This situation is worsened by the parasitic state of the animals. Depending on their state of gravity, a process of cleaning and disinfection of the parasitic population can be applied. This is in order to ensure that the benefits of a subsequent vitamin, mineral, energetic and protein dosage



are for the camelids, rather than by the parasites.

It is advisable to consider a complete deworming of endo and ecto parasites through oral dosage of a product based on levamisole agents or similar. Additionally advisable is the application of a subcutaneous parenteral injection of a product based on the enzyme principles of ivermectin, preferably accompanied by a fat-soluble vitamin complex containing vitamins A, B, C, D and K.

3. Benefits

The farmers found that their livelihood practices are now safer in the face of extreme events. The practice contributed to avoid livestock losses and increased livestock production. The veterinary pharmacies have allowed farmers to apply vitamins during frost periods, helping the animals to cope with the extreme weather periods.

Increased access to treatment through the veterinary pharmacies helped reduce the mortality rate. However, it is not possible to disentangle the benefits of veterinary pharmacies from the benefits of corralónes.

In addition, the functioning of the veterinary pharmacies allowed the increase of vaccination and deworming campaigns provided by the “Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria” (SENASAG).

3.1 Economic

Cost-Benefit Analyses (CBA) were conducted based on quantitative data collected during the 2016 winter period. The net benefits obtained from raising camelids with corralónes and veterinary pharmacies were compared to the net benefits of raising camelids without corralónes and veterinary pharmacies.

The costs and benefits were calculated based on the average herd size in the monitored farms (i.e. 85 llamas).

The CBA calculates the cumulative net benefits obtained by an average farm over a period of 11 years (10 percent discount rate is applied to express the future value of costs and benefits in present terms), as well as the benefit-cost ratio (BCR), which is the ratio between total discounted benefits and total discounted costs over the appraisal period. Figure 10 provides an overview of the outcome of the CBA. In particular, it shows that:

- the good practice brings 17 percent higher net benefits as compared to the usual practice;
- and the BCR of the good practice (2.98) is higher than the BCR of the local practice (2.4), meaning that the good practice brings greater benefits relative to costs, as compared to the usual practice.

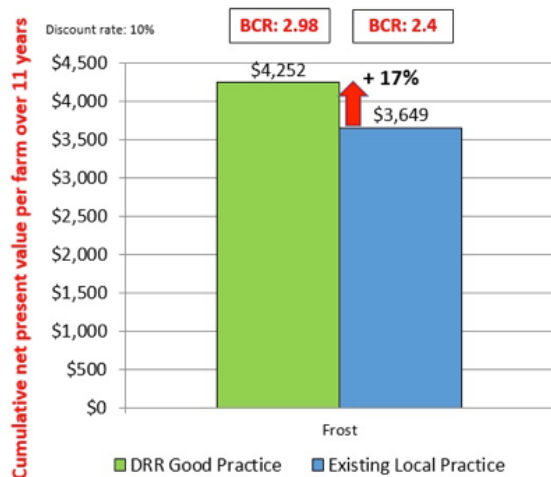
The assessment was conducted in farms that were affected by frost during the monitoring period. Benefits considered include the value of sold camelid meat and wool, and the live weight value of camelids sold. The introduction of shelters to protect camelids from frost, combined with the increased access to treatments following the establishment of veterinary pharmacies, significantly reduced the mortality rate of camelids. On the other hand, the increase in benefits was partially outweighed by the capital costs of building shelters, as well as the costs of travelling to the veterinary pharmacies located in the municipalities.

3.2 Environmental

Further analysis is required in order to assess potential environmental co-benefits of this good practice.



Figure 10. Cumulative Net Benefits and Benefit Cost Ratio of DRR Good Practice and Existing Local Practice



Source: FAO 2017

4. Difficulties and/or limitations

- Farmers cannot afford to build new corralónes unless they receive additional support from the municipality.
- High costs of travelling to the municipality, in order to attend the veterinary pharmacies, located in the municipalities.

5. Validation of the practice

5.1 Geographical area of practice validation

Bolivian eco-region of the Altiplano (High Andean Plateau).

5.2 Context of implementation

In the highlands of Bolivia, recurrent cold waves and related extreme events severely increase the mortality rate of camelids, which represent a main source of livelihood for the local population.

5.2.1 Climatic (period/season) – Hazard Context

The Bolivian eco-region of the Altiplano has significant daily variations in temperature, ranging from 15°C to 20 °C degrees and up to 27°C in summer days, where at night temperature drops to

around 0°C. Extreme weather and climate events in the Altiplano, include frost and snow during the dry season (April to November) and heavy rains and hailstorms during wet season (December to March).

5.2.2 Social context - Target group

Livestock farmers (Llama camelids), affected by cold waves in the Bolivian eco-region of the Altiplano (High Andean Plateau).

6. Minimum requirements for the successful implementation of the practice

6.1 Necessary conditions for a successful implementation

- Llamas, in particular female and baby llamas, should rest inside the corralón during the night, to avoid energy loss while sleeping and to reduce the incidence of pneumonia.
- The engagement of the municipalities is vital for the correct functioning of the veterinary pharmacies, as they are responsible for the supplies.
- It is important to have a permanent technical support and ongoing training for technicians and farmers to prevent side effects in animals by extreme climate events.
- Campaigns should be accompanied by basic training on the use of the materials and veterinary inputs as well as on the correct application of anti-parasites, so the practice can be replicated year after year by camelid breeders.

6.2 Constrains (limiting factors) for the implementation of the technology

- Due to the investment cost to build new corralónes, additional support from the municipality is needed for the further implementation of the practice.



- The relatively high costs of travelling to the municipality. Farmers advised that veterinary pharmacies should be established within each community.

7. Further reading

- FAO Bolivia. 2009. Guía para la Construcción de un Cobertizo para Llamas.
- FAO Bolivia. 2012. Pericias Contribuyentes a Mitigar los Efectos de las Olas Frías y Tormentas de Nieve en Favor de la Ganadería Alto Andina.

8. Agro-ecological zones

- Tropics, warm

9. Objectives fulfilled by the project

- Resource use efficiency