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# Community conversations on community-based control of gastrointestinal parasites in small ruminants

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# Introduction

Sheep and goats make important contributions to smallholder farmers' livelihoods, particularly for women livestock keepers. Due to their lower production and management requirements and their higher productivity and marketability, small ruminants increase women's livestock ownership and income from livestock sales. However, these animals are susceptible to gastrointestinal (GI) parasites, among other diseases, which cause high morbidity and moderate mortality, and lead to economic losses for smallholder farmers. Parasitic nematodes (gut roundworms) and trematodes (liver fluke) of small ruminants and other livestock have major economic impacts in the highlands of Ethiopia. However, the clinical importance of GI parasites is less pronounced than for bacterial and viral infections.

Developing knowledge of community members about infection routes and seasonality of important GI parasites and their prevention and control is crucial to enable smallholder farmers to take effective prevention and control measures, thereby reducing production and economic losses associated with these diseases. Parasite problems are known to farmers, but they do not readily recognize or appreciate the economic losses due to parasites.

Successful GI parasite control demands community awareness and actions, which requires participatory learning processes to bring about knowledge and attitudinal change so that community members can take collective actions to prevent and control parasitic infections. Individual farmer efforts are inadequate to control GI parasite infections because animals are easily reinfected in communal grazing lands. Community conversation, which is a participatory learning process, can facilitate collaborative learning, analysis and solution-finding among community members and local service providers, leading to joint actions of community members and service providers to address key animal health challenges.

This community conversation module is designed to guide animal health workers in facilitating experiential and collaborative learning among community members about GI parasites and their control measures. It is part of a series of different participatory learning modules developed under the CGIAR Research Program on Livestock (Livestock CRP), which addresses smallholder livestock production and marketing challenges in Ethiopia. This participatory and inclusive group learning process will focus on GI nematodes and trematodes as these are the most important parasitic infections in sheep and goats in Ethiopia.

# Learning goal and objectives

The community conversations on GI parasites aim to create awareness and knowledge among men and women community members about the impacts of gastrointestinal parasites in small ruminant production, the causes, clinical signs and transmission pathways of these parasites, and prevention/control measures, so that community members can adopt appropriate prevention and control measures collectively and individually.

The module aims to contribute towards improvement of herd health and productivity by raising community members' awareness and increasing their motivation and capability to prevent and control GI parasitic infections in sheep and goats.

Specifically, the community conversations aim to:

- Explore knowledge, attitudes and practices of men and women community members about the causes, transmission pathways and prevention and control of gastrointestinal parasites.
- Explore gender differences (including intersectionality) in perceptions and knowledge about gastrointestinal parasites.
- Facilitate interactions, collaborative learning and joint actions among community members and animal health service providers.
- Develop context-specific community actions towards the prevention and control of gastrointestinal parasite infections.
- Bring in the voices of community members and integrate community actions into animal health management interventions of local service providers.

By the end of the community conversations, community members will be able to:

- Name major groups of GI parasites.
- Identify common GI parasite infections based on the clinical signs and the parasites' causes.
- Describe and discuss life cycles of common GI parasites.
- Take integrated measures collectively and individually to prevent and control common GI parasites.
- Access inputs and services for the control/prevention of GI parasites.
- Adopt strategic community sheep and goat deworming schedules/calendars.
- Influence others through sharing information and knowledge with households and other community members.

Learning content

- Major groups of GI parasites
- Economic importance of GI parasites
- Causes and transmission pathways of GI parasites
- Clinical signs of important GI parasites
- Prevention and control measures for common GI parasites

## Learning methods and materials

Community conversations are facilitated using a set of participatory and collaborative learning methods such as small group discussions, role plays, storytelling and provocative questioning. Such interactive and experiential learning methods stimulate contextualization, engagement, understanding, and retention of learning activities.

The delivery process involves a mix of experiential knowledge sharing among community members and introduction of new knowledge by animal health experts to supplement existing knowledge or address knowledge gaps using different learning methods. Men and women community members get motivated and learn better when they find the learning activity engaging, meaningful and relevant to their experiences and challenges. The use of a mix of active learning methods, such as interactive discussions, sharing of experiences by community members, storytelling, and reflections and discussions of how community members can apply the learning, increases understanding, sense-making, and motivation for knowledge application.

Starting from what men and women community members know and practice, and a discussion of their challenges, will create the need for learning and motivate them to internalize and apply the learning. Introducing new knowledge based on existing community members' knowledge and practices increases their understanding and the chance of knowledge application. The focus is not on conventional knowledge transfer, but on how the new knowledge builds on and is integrated with community members' knowledge and practices, and how it increases their learning capacity, motivation and capability to make practice improvements. In this approach of learning with and from community members, knowledge is contextualized, co-created and applied to solve identified problems. During the community conversations, community members will be encouraged to give examples and reflect on and share their experiences and stories. They will be encouraged to relate the learning with their experiences and challenges and see how they can apply it to improve the health of their animals.

To increase women's access to information and facilitate shared understanding and decision-making within the household, couples' participation will be encouraged in community conversations. In addition, the community conversation sessions will be delivered in community centres that are easily accessible to men and women community members (as well as couples).

Community conversations are best facilitated sequentially in half-day sessions with fortnightly or monthly intervals to allow community members time for knowledge application and reflection, and to cater for farm and household activities, particularly for women-headed households.

At the close of community conversation sessions, community members are encouraged to develop community actions to implement the new learning. Local service providers, such as livestock extension agents, will provide follow-up support to encourage community members to apply the community actions and make the desired changes.

# Session I. Gastrointestinal nematodes

This session aims to explore community members' understanding of GI parasites and economic losses due to common parasitic infections. In this session, community members will discuss clinical signs, causes, transmission pathways, and prevention and control of nematodes (roundworms) in sheep and goats, so that they will implement good animal husbandry and grazing land management practices that reduce risk of nematode infections.

## Learning objectives

By the end of the session, community members will be able to:

- Name common groups of GI parasites of sheep and goats
- Explain obvious and hidden losses due to parasitic infections
- Explain how nematodes cause diseases
- Identify exposure routes and seasonality of nematode infections
- Recognize the presence of nematode parasite infections in the flock
- Apply good animal husbandry practices to reduce nematode parasite infections
- Use appropriate grazing land management strategies to create safe pastures.

## Learning content

- Common GI parasites: causative agents and how they cause diseases
- Life cycle and transmission of nematode infections
- Agro-ecological conditions and seasonality of GI parasite infections
- Clinical signs of GI nematodes in live and slaughtered animals
- Grazing land management: co-grazing, rotation/resting
- Herd/flock management: controlling livestock density (stocking rate), assuring an adequate plan of nutrition
- Animal health management: worm control practices, anthelmintic usage/strategic deworming, community-based deworming calendars

## Methods and materials

- Small group discussions
- Pictures/posters/videos
- Animal disease leaflets
- Seasonal deworming calendars
- Samples of deworming drugs

**Duration:** 4 hours



## Learning activities<sup>1</sup>

**Activity 1.1. Explore knowledge, perceptions and practices of community members about clinical signs, causes, transmission pathways, prevention and control of gastrointestinal nematodes**

*Welcome, opening and introductions*

Greet and welcome community members as they arrive to establish friendly relationship. Place relevant posters to attract community members and set the context for the conversations.

What happens in the welcome and start can set the tone for the rest of the community conversation process.

*Introduce yourself and the rest of the facilitation team.*

**Introduce the learning activity.** In this activity, we will explore your knowledge, attitudes and practices about GI parasites and the effects of gastrointestinal parasites on the health, welfare and productivity of your sheep and goats. We will then discuss the clinical signs, causes, transmission routes, prevention and control of gastrointestinal nematodes.

The purpose of this learning activity is to first explore existing knowledge, attitudes and practices of men and women community members about GI nematodes and identify key knowledge and practice gaps, which will be addressed later by introducing new knowledge and communicating key action messages. The activity also aims to encourage learning from one another and make community members active problem-based learners. Starting from the experiences and knowledge of community members will make learning relevant, engaging and meaningful. It also increases the chance of knowledge application.

Start off in a mixed-sex group to set the context and motivation for learning. Then, use single-sex groups to encourage active participation of women and men and to explore gendered perceptions of community members about GI parasites in sheep and goats.

After the small group discussions, bring the groups together in plenary discussion and ask group note takers to share the group results. Observe how male and female group members react during the group result presentations.

Look for patterns in the group results. Identify and address key knowledge gaps through introduction of new knowledge.

In single-sex groups, encourage discussion on the following learning topics.

### *Clinical signs of gastrointestinal nematodes*

Handout pictures of sick/skinny sheep or goats and ask group members to 'buzz' in pairs or trios.

Then, encourage discussion using the following questions:

- What do the pictures show?
- What is happening to the animals in the pictures?

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<sup>1</sup>There is a clear structure to the sequence and flow of the learning activities. A logical progression of learning; in a more interactive, experiential and reflective/generative manner; is first to start off in a large, mixed-group to introduce the topic/activity and create common ground and motivation for learning using provocative/problem posing techniques. Second, break into single-sex group discussions to explore existing knowledge, attitudes and practices (KAP) of community members and question their gendered perceptions using active methods and rich documentation techniques. Third, bring groups in plenary and share group results, highlighting and clarifying key points. Fourth, analyse exploration results, identify key KAP gaps and develop content. Fifth, in a large or mixed group, introduce new knowledge, in a contextualized way, to address KAP gaps or supplement existing knowledge and practices. Check for understanding and reinforce knowledge through communication of key messages. Finally, review and reflect on the learning process, motivate community members for action, identify community actions, and agree on follow-up, monitoring and documentation strategies.

- Do these conditions also exist in your households?
- How do you know when your animals are sick?
- Which of the clinical signs you have mentioned can be due to worm infections?
- What are parasites? Can you give examples of parasites in sheep and goats?
- How do you think gastrointestinal parasites cause diseases in sheep and goats?
- How do you know if your sheep or goats are suffering from worms?
- Did you observe any indications of GI parasites during slaughtering of sheep or goats, or in sheep or goat droppings? If yes, how do you describe it and what could it be?

Encourage discussion and find out what men and women community members describe as parasites and what they perceive are the effects of parasites.

Ask community members to give examples or share their stories around losses due to parasites. Allow time for community members to think and respond.

Probe further and extend the discussion around: reduced productivity, reduced animal performance, decreased fertility, mortality, morbidity, and cost incurred on treatment.

Awareness and appreciation of community members about economic losses due to parasites is important to make them feel the need and have incentive for controlling parasitic infections.

Summarize the main learning points.

#### *Causes and transmission pathways of gastrointestinal nematodes*

Find out what community members think about how gastrointestinal parasites cause diseases and affect the health, welfare and productivity of their sheep and goats.

Ask group members:

- How do you think your sheep and goats can get parasitic diseases? Can you give examples or describe situations when your animals were/are affected by worm infections?
- How do you think gastrointestinal parasites cause diseases? Can you give examples or share your experiences?
- Do you think your sheep and goats currently get an adequate supply of nutrition? What does adequate nutrition mean to you?
- Do you allocate adequate feeds to different animals by age, sex and productive purpose? If yes, how is it done and why?

Summarize key learning points from the discussion.

Then, handout pictures of sheep and goats in poor welfare conditions and ask the following questions.

- What do you see in the pictures?
- What is happening to the animals?
- Does this situation exist in your households? If yes, why is this happening?
- Why do you think that weak animals or animals in poor welfare conditions are susceptible to diseases? What does this tell us?

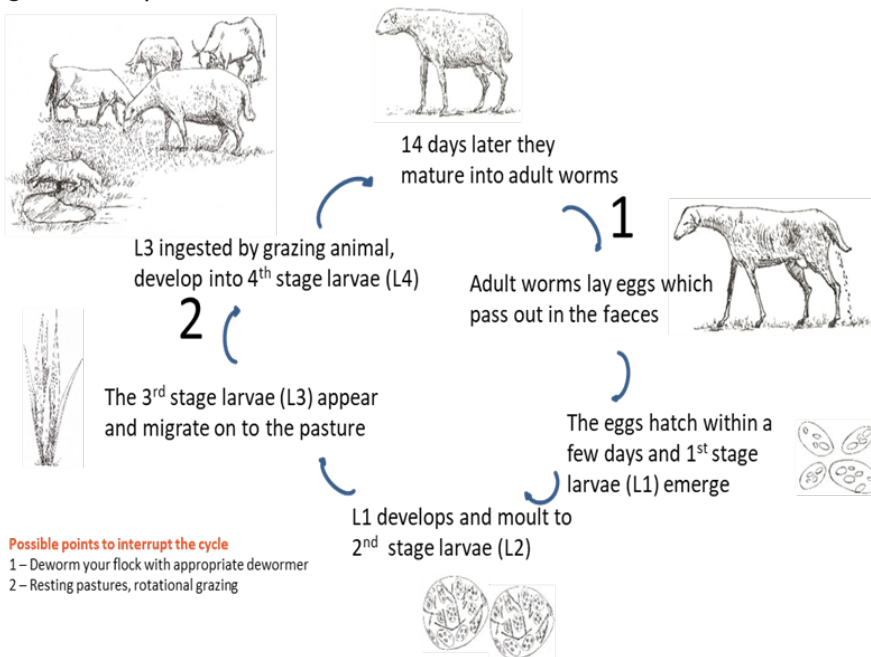
- In your community, who are seen as good animal caregivers? Why?
- How do you compare with these individuals?

Summarize key points of the discussion.

Then, handout the picture in Figure 1 that shows life cycle and transmission of nematode infections, and facilitate discussion using the following questions.

- What do you see in the picture?
- What story can you tell from this picture?
- How do you think your sheep and goats can get worm infections?
- Have you observed any indications of worms in sheep and goat droppings? If yes, what could it be, and what does this imply?
- Do you think grazing lands can be contaminated with faeces of worm-infected sheep and goats? If yes, how? What does this tell us?
- What is the seasonality of nematode infections in this community? Which months of the year are high-risk periods? What does this tell us?

Figure 1. Life cycle and transmission route of nematode infections.



Source: Alemu et al. 2019.

Summarize the main learning points.

## Prevention and control of GI nematodes

Encourage exploratory discussion about community members' animal husbandry and pasture management practices around grazing land management and explore the reasons.

Use pictures that show different grazing land management practices and facilitate discussion around the pictures using the following questions. You can also use role plays, panel discussions or storytelling. Whatever technique you plan to use, ask yourself why you want to use a particular method and design it well.

Discussion questions:

- Do you practice rotational grazing (resting of pastures)? If yes, why?
- Are there periods for which grazing animals are excluded from pastures? If yes, when and why?
- What alternative feeding strategies do you have during these periods?
- Do you leave manure on farm, open air or discard into the environment? Why? Do you think manure can cause worm infections? Why?
- Do you co-graze or alternate sheep or goats with cattle on pastures? If yes, why?

Summarize the main points the discussion and move on.

Find out anthelmintic use practices of community members, including antimicrobial resistance (AMR) risks.

Encourage discussion around use of deworming drugs: sources, quality, handling, dosage, administration, treatment duration and frequency, and AMR risks.

Discussion questions:

- When you plan to fatten your sheep or goats, do you use dewormers? If yes, why do you think dewormers help the animals gain weight?
- When do you deworm your sheep and goats? Why?
- Against what parasites do you deworm your sheep and goats?
- Do you follow a community-based deworming calendar? If yes, why?
- What are the benefits and challenges of implementing this deworming calendar?
- Where do you get dewormers?
- Do you think it is safe to buy dewormers from shops or the market without veterinary prescription?
- Do you encounter any dewormers which are not effective? If yes, what do you think is the reason?
- What are the consequences of inappropriate drug use?

In plenary, bring the small groups together and have them share their results.

Observe how members of the female and male groups react during the group result presentations.

Highlight the main points and ask community members: 'In your household, who is more knowledgeable about the causes, transmission routes and control of nematode infections and why?'

Extend the discussion covering women's challenges to access information and what community members can do to increase women's access to information, training or advisory services (e.g. convening household discussions to share information with women; inviting women to discussions during advisors' home or farm visits; taking up domestic work to free time for women to participate in community meetings or trainings; having couples participation in community meetings, etc.).

Note down reactions of men and women and talk about the need for collaborative learning and action at the household level.

Summarize activity 1.1 and identify key knowledge, attitude and practice gaps of community members and introduce new knowledge to address these knowledge gaps or supplement existing knowledge and practices.

## Activity 1.2. Introduce new knowledge<sup>2</sup>

Using understandable language and in a participatory way, introduce new knowledge to address knowledge and practices gaps or supplement existing knowledge. Make presentation on causative agents, routes of transmission, prevention and control measures for GI nematodes. Invite community members to give examples or share their experiences.

Extend the discussion about the seasonality and factors contributing to nematode infection distribution and intensity, and clinical signs in live and slaughtered animals, asking farmers to give examples or share their experience.

Summarize main learning points and communicate key messages to reinforce learning.

Key messages:

- Parasites compete with animals for food nutrients and when they are in large numbers in the animal, they cause disease.
- If animals are kept in poor conditions (housing, feeding, environmental stress), they become susceptible to parasite infections.
- Animals get infected from drinking contaminated water, through faecal-oral transmission and absorption of parasites through the skin.
- Lack of appetite, anaemia and bottle jaw are common clinical signs of GI nematodes.
- Misuse of anthelmintic drugs can cause drug resistance.
- Good animal husbandry and grazing land management practices reduce parasitic infections.

## Activity 1.3. Reflections and community actions

Ask a few community members to reflect on their learning experience and share key learning points.

Then, ask community members how they intend to apply the new knowledge.

Mention that it makes little sense to deworm animals and leave them on the same grazing land to become quickly reinfected by parasites, so community members must take collective actions to effectively control worm infections.

Then, ask community members to identify and commit to realistic actions that they can implement collectively and individually.

For example:

- Share information from the conversations with household members and neighbours.
- Observe closely the conditions of their animals.
- Hold household discussions on how to better care for animals.

Encourage responses from men and women and write down agreed community actions to control nematode parasite infections. Explain the benefits of implementing the community actions.

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<sup>2</sup>It is advisable to facilitate community conversations, as participatory training methods, in two half-day periods to allow time for facilitators to analyse findings of the exploratory discussion activity, identify key knowledge gaps, and plan for the new knowledge introduction activity to sufficiently address identified knowledge gaps. In the first half-day period, facilitators engage community members in exploratory discussions, sharing of group results in plenary discussions and clarification of key issues. Then, in the afternoon of the first day, facilitators reflect on their observations and identify key knowledge gaps. Based on this knowledge gap analysis, they plan for the second half-day period to introduce new knowledge to address knowledge gaps or supplement existing knowledge. This team analysis and planning time allows facilitators to better contextualize and sequence content and use different delivery methods that will make the learning more relevant, problem-based and meaningful.

Thank community members for their engagement and mention that you will follow-up on the community actions in a month's time.

Remind them that it is important that community members continue to participate in all the sessions to have a full grasp of knowledge about gastrointestinal parasites. As much as possible, they must complete all the sessions and should not send replacements in their absence.

Then ask a few community members and local service providers to reflect on their community conversation experience and how they will commit to the implementation of the community actions.

Encourage local partners to reflect on their observations and insights into the community conversations, how they will commit to support and monitor implementation of the community actions, and how they will integrate the approach in their extension work.

Note down reflections and commitments of local partners for monitoring after a few months.

Finally, invite community elders to close the conversations with blessings or prayers.

#### *Session notes*

Gastrointestinal parasites are worms living in a host organism and feeding at the expense of its host.

An intestinal parasite infection is a condition in which a parasite infects the gastrointestinal tract of an animal.

GI parasites affect mainly sheep and goats but also affect cattle. Most animals carry different GI parasites at the same time.

Gastrointestinal parasites of sheep and goats can be categorized into four groups:

- Nematodes (roundworms)
- Trematodes (leaf like worms, liver flukes)
- Cestodes (tape worms)
- Protozoa (coccidia)

GI parasites can be broadly categorized into two major groups: the Platyhelminthes or flat worms (trematodes and cestodes) and the nemathelminths or roundworms (nematodes).

Gastrointestinal nematodes (gut roundworms) and trematodes (liver fluke) cause reduced productivity in sheep and goats in Ethiopia.

Host categories:

- **Definitive (final host):** A host in which the parasite reaches sexual maturity and reproduces.
- **Intermediate host:** A host in which larval stages develop to become infective for the definitive host. In some GI parasite species, the larval stages multiply asexually in the intermediate host.
- **Paratenic host (transport host):** A host in which infective larval stages of a parasite do not develop further but remain alive and infective to a definitive host.

Parasites cause disease when they are present in large numbers or when the host animal has weak immunity due to other diseases or poor nutrition. The host becomes affected when the parasites attach to the lining of the gastrointestinal tract and ingest blood and create anaemia from blood loss or when the GI track becomes inflamed. Parasites also live in the lumen (open area) of the gastrointestinal tract and compete with the host for digested nutrients before the host absorbs them from the intestinal lumen.

Various risk factors in the host and environment play an important role in GI parasite infections. Environmental factors include agro-ecological conditions, animal husbandry practices such as housing system, deworming intervals and pasture management. These largely determine the type, incidence and severity of various parasitic diseases.

There is great variation in the prevalence and the geographic distribution of parasite infections in small ruminants in Ethiopia. Each parasite has a different life cycle.

Parasites generally spend part of their life cycles outside their definitive hosts (i.e. sheep or goats) either in the ground, on grass or within invertebrates such as snails, insects or earthworms. Temperature, rainfall and the type of soil determine the occurrence of a given parasite species. The vegetation and livestock density also matter. Knowledge of each parasite's epidemiology in different agro-climatic zones is essential for successful control strategies, and strategies vary from site to site.

Moisture and temperature are the most important factors which influence the survival, development, dissemination and availability of free-living stages of helminths. Moisture facilitates horizontal (larvae escaping from dung) and vertical (onto grass) migration of nematode larvae on the environment.

Gastrointestinal parasites increase with:

- Warm, wet weather
- Hosts with low resistance
- Increase in numbers of hosts
- Long grazing periods of the same animals on the pasture, so there are repeated cycles of ingestion and maturity and release of more eggs

Parasite infections affect small ruminant productivity with obvious and hidden losses.

Direct/obvious production losses:

- Death of infected animal
- Waste and condemnation of human food.

Indirect/hidden production losses:

- Poor feed conversion
- Poor growth
- Weakness and lowered resistance to other diseases
- Reduced milk and meat production
- Reduced reproduction performance
- Reduced work performance
- Condemned organs
- High cost of treatment or control measures such as drugs, labour and fences
- Inefficient use of land.

The aggregate hidden losses are probably more serious than obvious losses, but are often not noticed because:

- Such losses are widespread

- The process is not easily observable and chronic
- Most losses occur in young, growing animals and in those under physiological stress, when poor condition is regarded as normal

More significant are losses resulting from inferior weight gains, condemnation of organs and carcasses, and low milk yields.

### Life cycle and transmission of nematode infections

Sheep and goats get infected by ingesting roundworm larvae while grazing on contaminated pastures. Indoors infections can also happen through use of contaminated hay or feed.

The life cycle of a nematode (egg to mature adult) is 17 to 21 days. During development, a nematode moults at intervals, shedding its cuticles. In the complete life cycle, there are four moults, the successive larval stages being designated as L1, L2, L3, L4 and finally L5, which is the immature adult (Figure 1).

The cycle begins when the larvae in the infective L3 stage of development are ingested from the grass and travel to the abomasum of the host. Once in the abomasum, the larvae will follow one of two paths. They may proceed with further larval stages and the eventual development into adults, or they will go into hypobiosis. This is an inhibited or arrested development state that occurs when external environmental conditions are not conducive for the entire life cycle to be complete.

When the L3 stage larvae enter the abomasum, provided that environmental conditions are favourable, they will moult into the L4 stage of larval development and will then moult once more into adults. Once the moult into an adult form is complete, adults then begin to lay eggs in the abomasum. *Haemonchus* adults require about 14 days to begin laying eggs in the stomach after reaching adulthood.

Eggs in the faeces generally remain inactive for a few days in the environment, until the environment and temperature become favourable for the development of these eggs into larvae. The larvae hatch from the eggs and then emerge from the pellets and move through larval stages L1, L2 and L3 of development. Once the larvae reach the L3 stage, the infective stage, they emerge from the faecal pellet and climb up onto blades of grass where they wait to be ingested by a grazing animal, thus completing the life cycle. The L3 larvae can survive on pasture for extended periods of time, making pasture management a key component in the control of parasite infections.

Lambs or youngstock in their first grazing season tend to have no natural immunity to gastrointestinal nematode parasites. The level of larvae in L3 stage on pasture and the level of immunity in the lambs will determine the level of disease seen in the lambs. Over the grazing season, the loads in the lambs tend to increase, and they become the major contributors to egg contamination on pasture. Towards the end of the grazing season, a proportion of the new L4 gastrointestinal nematode infection will not progress to adults but will rather remain at the L4 stage and become hypobiotic or arrested.

Adult sheep and goats tend to have a level of immunity to the gastrointestinal nematode parasites but will still be infected and will contribute to pasture contamination. The phenomenon of periparturient eggs rise in ewes is due to a relaxation of immunity around the time of lambing. This allows for increased egg production by those parasites in the ewe, and thus the period becomes one of the most important sources of pasture contamination to newborn lambs.

### Agro-ecological conditions and seasonality of GI parasite infections

The survival outside the host, development to infective stages and transmission of the nematode infective larvae are mostly influenced by climatic conditions (moisture, temperature and rainfall). Broadly speaking, the free-living stages cannot survive for extended periods in high or low temperatures, and they cannot move onto the herbage without moisture.



Gastrointestinal nematodes can survive harsh conditions by hypobiosis or arrested development of larvae (usually stage L3 or early L4) within the host. In the absence of hypobiosis, nematodes survive in hosts during hot and dry season as adults.

Susceptibility of the host is determined by many factors: age, breed, physiological status (parturition, depression of immunity), level of immunity (previous exposure) and plan of nutrition.

## Clinical signs

*Haemonchus contortus* is a blood sucking parasite, and the development of clinical signs is related to the loss of blood and the animal is likely to become anaemic.

In acute infections, where large numbers of larvae are ingested over several days, anaemia can cause death before any effective erythropoiesis can commence.

In chronic infections, where the rate of infection has been slower, both anaemia and hypoalbuminaemia result from the loss of whole blood and the exhaustion of erythropoietic reserves. This causes oedema commonly seen as bottle jaw. Emaciation is also a result of *H. contortus* infection; oedema of the abomasum can cause an increase in pH, which leads to gastric dysfunction and further weight loss.

Some general symptoms typical of parasite infections are diarrhoea, weight loss or reduced weight gain, unthriftiness, loss of appetite, and reduced reproductive capacity and performance.

### Signs of GI parasites in live animals

- Weight loss/poor body condition: Animals do not get all the nutrients they need, poor growth rates
- Diarrhoea: detected by dirty tail and hind legs
- Rough hair coat: When nutrients are insufficient, the animals' hair loses its luster.
- Depression: Animals keep their head and ears down and are not willing to stand for long periods of time.
- Weakness: Animals are easier to catch or unstable when walking.
- Anaemia: Animal's mucous membranes of the eyes, mouth and perineum appear pale due to blood loss.
- Fever or, in the late stages of disease, cold extremities (e.g. ears and legs).
- Bottle jaw: Animals have fluctuant swelling under the jaw from the accumulation of fluid (submandibular oedema). Sometimes it can spread to front leg and belly (Brisket oedema).
- Poor production: low milk or meat production, poor hair coat or fleece growth
- Pass segments of tapeworm in their faeces

### Signs of GI nematode parasites in slaughtered animals

- Many visible adult worms and bleeding in the milk stomach
- Worms and fluid in the intestines
- Fluid in the body cavities
- Bumps on the intestines
- No fat on the carcass
- Pale carcass

In the case of *Haemonchus*, anaemia and oedema or swelling are key symptoms. Anaemia is most easily identified in small ruminants by the colour of the mucous membranes, particularly those in the lower eyelid. A normal animal will have healthy, red mucous membranes, while one heavily burdened with *Haemonchus* will exhibit light pink or white membranes. Oedema, accumulation of fluid, will be most obvious as a swelling in the lower jaw, a condition known as bottle jaw.

## Prevention and control

The main goal in attempting to control *Haemonchus* and other gastrointestinal parasites is to break the life cycle, which can be done in a variety of ways.

To implement integrated parasite management practice, it is essential to know when parasite loads will be highest, such as at lambing/kidding; where the young animals stay at those highest egg production times; and how pasture can be divided and rested in order to let egg and larvae die.

### Methods of managing GI parasites in the host

- Monitoring
- Anthelmintics
- Nutrition
- Medicinal plants
- Vaccination

### Methods of managing GI parasites in the environment

- Removal of faeces
- Alternate grazing and mixed-species grazing
- Rotational grazing
- Mowing and ploughing
- Burning
- Varying farming systems (e.g. extensive, intensive, crop residue, mixed system, zero grazing, cut and carry)
- Managing stocking density
- Control of intermediate hosts
- Use of nematophagous fungi

## Integrated parasite control

Integrated control methodologies comprise chemical, biological and environmental procedures used jointly or sequentially against a background of an extensive ecological understanding of the selected target pest, so as to maximize efficacy, and be fully acceptable from the health and environmental standpoints.

### Pasture management

- The larvae of most parasites move to the tops of plants when the intensity of light is low at sunrise, sunset and when the sky is overcast. Grazing should be avoided during these conditions.

- As the density of parasites is generally at a maximum in the rainy season and at a minimum in the dry season, it is preferable to limit grazing to the dry months to diminish the level of ingestion.
- Most worm larvae crawl up the plant only 5 cm from the ground. Preventing animals from grazing below that point decreases the number of worm larvae ingested.

#### Good animal management

- Animals should have good housing condition (clean, well ventilated and lighted) to better resist or tolerate gastrointestinal parasites.
- Always keep an optimum number of animals in the animal shed because overstocking in the shed causes a large number of animals to have parasites at a time.
- Water should be clean and free from faecal matter and watering areas should be situated in well drained places.
- Proper drainage in the animal shed reduces the chances of survival of the parasites.
- Always store manure in heap so that eggs, larvae, cyst or other stages of parasites are killed by the heat generated during composting.
- Feeders that cannot easily be contaminated with faeces should be used for grain, hay and minerals feeding.
- Ensure isolation and deworming of new animals arriving in herd to minimize parasitic burden and spread of infection.

#### Herd/flock management

- As susceptibility of animals against parasites varies with age, graze different age groups in different fields.
- Animals that are not susceptible to gastrointestinal parasites can clean a pasture for others. Sheep or goats can be co-grazed with bovines and/or equines, thus breaking the parasite's life cycle.
- During confinement, animals should be fed off the ground in feeders and watering containers should be kept free from faecal matter.
- Tropical legumes contain more condensed tannins and have anthelmintic properties. Providing alternative forages such as perennial legume and leafy perennials can lower parasitic load in animals.
- The stocking rate affects the amount of available forage and the numbers of gastrointestinal parasite larvae spread on the farm in manure. Always keep the optimum number of animals in the pasture and animal sheds to reduce chances of many animals getting infected with parasites at a time.
- During times of stress, provide feed supplementation to needy animals to reduce parasite infection in those animals and parasite contamination on pastures.

# Session 2. Gastrointestinal trematodes

In this session, community members will learn about the causes, clinical signs, transmission, prevention, and control of trematodes (liver flukes) in sheep and goats. They will learn about transmission routes and infection seasonality of trematodes, how trematodes cause disease, and the factors which can contribute to the distribution and intensity of GI trematodes. They will also learn how they can recognize the presence of liver fluke infection in the flock.

## Learning objectives

By the end of the session, community members will be able to:

- Identify routes of exposure and seasonality of trematodes infections
- Explain how trematodes cause disease
- Identify factors that contribute to the distribution and intensity of trematodes
- Identify liver fluke infections in sheep and goats
- Apply good animal management practices to reduce parasite infections
- Use appropriate grazing land management strategies to minimize the uptake of infective larvae and to create safe pastures.

## Learning content

- Common GI trematodes: causative agents and how they cause diseases
- Life cycle and transmission of trematode infections
- Agro-ecological conditions and seasonality of infections
- Clinical signs of trematode infections in sheep and goats
- Good animal management practices: sanitation, nutrition, strategic deworming
- Appropriate pasture management strategies: pasture resting/rotation, co-grazing, exclusion, cut and carry feeding
- Herd/flock management: density of livestock (stocking rate)

## Learning methods and materials

- Small group discussions
- Pictures showing life cycle of *Fasciola hepatica*
- Community-based deworming calendars
- Samples of deworming drugs

**Duration:** 4 hours

## Learning activities

### Activity 2.1. Exploring knowledge, perceptions and practices of community members about clinical signs, causes, transmission pathways, prevention and control of gastrointestinal trematodes

Recap the previous session.

Ask community members:

- What have we discussed in the previous session?
- What were your key learning points from the previous session?
- How have you shared information from the community conversation?
- What has changed in your household due to the community conversations?
- What did not change, and why?

Write down reflections and trends of change stories on a flip chart and reinforce learning by recapping key learning points and messages.

Plan to follow-up on exemplary change stories with home visits and interviews with household members and neighbours.

**Introduce the learning activity.** In the previous community conversation session, we have discussed about GI nematodes (roundworms). In this session, we will discuss the clinical signs, causes, transmission routes, prevention and control of GI trematodes (liver flukes), and how the parasites cause diseases in sheep and goats.

First, we will work in small groups of men and women to explore your knowledge, attitudes and practices regarding control of gastrointestinal trematodes and identify key knowledge gaps, which will be addressed later by introducing new knowledge and communicating key messages.

### Clinical signs of gastrointestinal trematodes

In single-sex groups, facilitate discussion using pictures and probing questions.

Distribute pictures of sick sheep or goats with recognizable clinical signs of trematodes infection. Ask group members to look at the pictures and 'buzz' in pairs.

Then, facilitate discussion using the following questions:

- What do the pictures show?
- What is happening to the animal in the picture?
- Does this problem also exist in your household?
- Can you share a story about this situation in your household?
- How do you know if your sheep or goats suffer from liver fluke?
- What have you observed in the liver of slaughtered sheep or goats?

Probe further by asking questions based on the responses of group members. Encourage participation of all the group members.

Paraphrase and summarize the main discussion points. You will later address key knowledge gaps of community members during the introduction of new knowledge.

## Causes and transmission pathways of gastrointestinal trematodes

In small groups, find out what community members think about how liver flukes cause diseases and affect the health, welfare and productivity of sheep and goats.

Ask group members:

- How often do you clean sheep and goat houses?
- How do you water your animals? Do you use waterers or drive your animals to rivers?
- Do you think watering places can transmit parasitic infections?
- How do you feed your animals?
- How do you allocate feeds to different animals?
- Do you think overcrowding of animals can cause parasitic infections? If yes, how?
- How do you graze animals during the rainy season?

Paraphrase and summarize key discussion points.

Then, handout the following picture (Figure 2) that shows the life cycle and transmission of liver fluke infections, and facilitate discussion using the following questions.

- What do you see in the picture?
- What story can you talk about from this picture?
- How do you think liver flukes infect sheep and goats?
- Which animal species (age, sex, physiological status) are most susceptible to liver fluke infections? Why?
- Do you think grazing lands can be contaminated with faeces of trematode-infected sheep and goats? If yes, how? What does this tell us?
- What is the seasonality of trematode infections in this community? What times of the year are high-risk periods? What does this tell us?

Summarize the discussion and identify key knowledge gaps.

## Prevention and control measures for GI trematodes

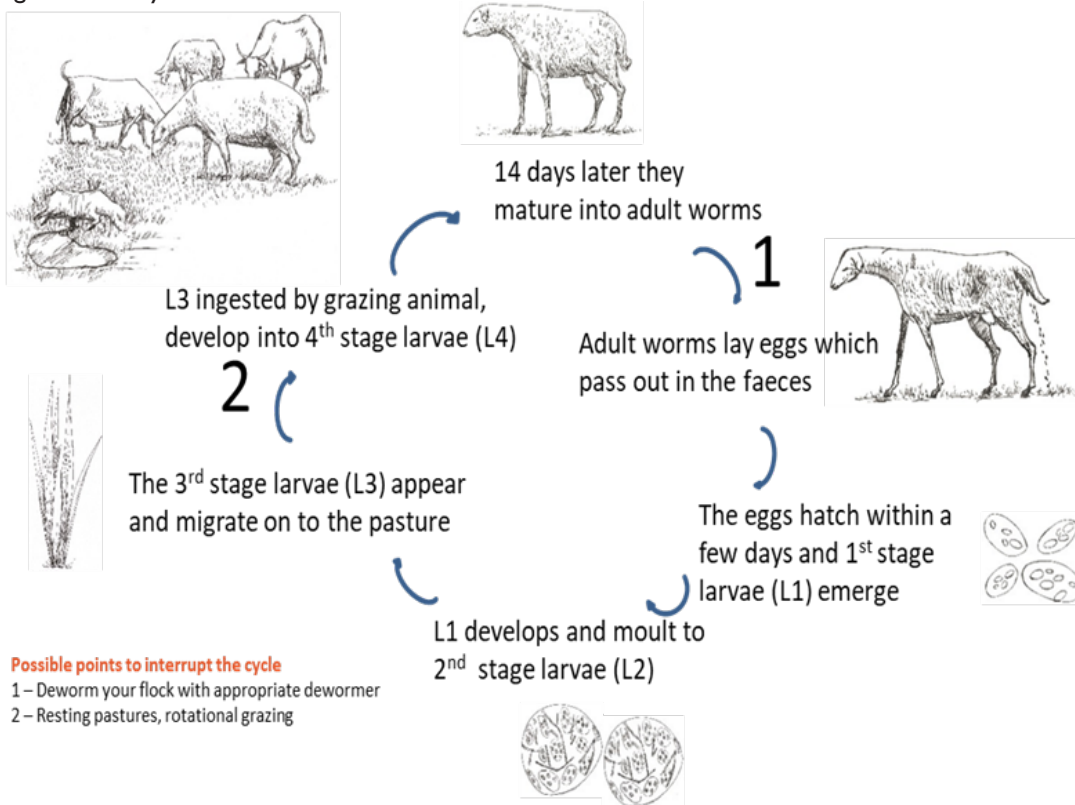
So far, we have seen the causes, clinical signs, and transmission of GI trematodes. Now we will discuss prevention and control measures for GI trematodes, so that you will take actions collectively and individually to improve the health, welfare and productivity of your sheep and goats.

In small groups, encourage discussion and explore the knowledge, attitudes and practices of community members about good animal husbandry and pasture management practices.

Encourage discussion around current grazing land management practices and find out reasons.

Use pictures that illustrate different grazing land management practices and facilitate discussion around the pictures using the following questions.

Figure 2. Life cycle and transmission of liver fluke infections.



Source: Alemu et al. 2019.

Discussion questions:

- Do you have pasture resting or rotation periods? If yes, when, how long and why?
- Do you co-graze or alternate sheep or goats with cattle or other animals on pasture? If yes, why and which species?
- Are there periods in which grazing sheep or goats are excluded from pastures? If yes, when and why?
- What alternative feeding options do you have during this period?
- Do you practice cut and carry feeding during the wet season? If yes, why?
- Are houses for your animals regularly cleaned and well ventilated?
- Do you leave manure on farm, open air or discard it into the environment? Why?
- Do you isolate sick or new animals? Why?
- Do you let your animals drink in rivers during wet seasons?
- Do you use feeders and waterers for your animals? Why?
- Do you buy anthelmintic drugs from shops or market? Why?
- Do you think individual efforts to control liver fluke infections can be effective? Why?

Summarize the main points of the discussion.

Then, find out anthelmintic use practices of community members.

Encourage discussion around use of deworming drugs: sources, quality, handling, dosage, administration, treatment duration and frequency, and antimicrobial resistance risks.

Discussion questions:

- Why and when do you deworm your sheep or goats?
- Against what GI parasites do you deworm your sheep and goats?
- Do you follow a community-based deworming calendar? If yes, when is that and why?
- What are the benefits and challenges of implementing this deworming calendar?
- Where do you get dewormers?
- Do you think it is safe to buy dewormers from shops or the market without veterinarian prescription?
- Have you encountered any dewormers which are not effective? If yes, what do you think is the reason?
- Do you use any traditional treatments for GI parasites infection? If yes, please explain the treatments and how you use them.
- What do you think are the consequences of inappropriate use of drugs?

Summarize Activity 2.1 and identify key knowledge, attitude and practice gaps of community members. Then introduce new knowledge to address the knowledge gaps or supplement existing knowledge and practices.

## Activity 2.2. Introduce new knowledge

In an interactive way, present the critical importance of good animal husbandry practices to keep animals healthy and in good condition and reduce the use of anthelmintic and AMR risks. In your presentation, ask community members to give examples of good animal husbandry practices, such as sanitation, nutrition and deworming.

Extend your presentation on integrated good animal husbandry and pasture management practices and how this helps reduce the risk of liver fluke infections.

Recap/highlight the main learning points and messages.

Key messages:

- Reduce animal exposure to parasites by cleaning the environment. Keep barns clean, dry, and avoid overcrowding.
- Balanced nutrition is important to keep animals healthy and help them develop appropriate resistance.
- Breeding does are more susceptible to worms between two weeks before and up to eight weeks after kidding, as their immunity is lowered due to the physiological processes they experience during this time.
- Since the susceptibility of animals varies with age; during rainy season, youngstock should graze in advance of older stock.
- Rotate pastures to avoid high parasite burdens.
- Use cut and carry feeding system which can significantly limit worm infestation.
- Avoid livestock overpopulation (overstocking) which increases parasite concentration and forces animals to graze closer to faecal material on the ground and may result in consumption of a higher number of infective larvae.



- Regularly deworm animals in the community using a broad spectrum anthelmintic to reduce the buildup of worm burdens and limit pasture contamination.

### Activity 2.3. Reflections and community actions

Ask a few community members to reflect on their learning experience and identify key learning points or take-home messages.

Mention that individual efforts are inadequate to control liver fluke infections if community members use common grazing lands, as there will be reinfections.

Then, ask community members what they can do individually and collectively to prevent and control liver fluke infections.

Ask them:

- What would happen if you do not take any action to control liver fluke infections?
- What can you do to prevent and control liver fluke infections in your community?

Write community action points on a flip chart.

Then, ask local service providers to reflect on their experience and how they will continue monitoring and supporting community members. Also encourage reflections and commitments to integrate the approach in the extension system.

Thank community members for their time and active participation. Express that you have learned much from their experiences and stories.

Close the conversation session smoothly with elderly blessings or prayers.

## Session notes

### Common GI trematodes: causative agents

In Ethiopia, farm animals are kept on pasture throughout the year and climatic conditions are favourable for the development and survival of infective stages of gastrointestinal parasites.

*Fasciola* spp, *Paramphistomum* spp and *Schistosoma* spp are the main trematodes infecting goats and sheep.

Fasciolosis is a parasitic disease which is caused by the trematode parasite *Fasciola hepatica*, the common liver fluke, as well as by *Fasciola gigantica*.

Several species of snails serve as intermediate hosts.

### Life cycle and transmission of trematode infections

Livestock become infected by grazing on contaminated pastures or through contaminated hay. Trematodes have indirect life cycles and intermediate hosts play an important role in their epidemiology.

Figure 2 shows the life cycle of a liver fluke. The eggs, which are laid by the adult worm in the bile ducts of the livers of infected animals, are passed into the environment through the faeces. When deposited in a wet environment, a miracidium (larva) develops, escapes from the egg and actively swims to seek the right snail species. Upon penetration into the snail intermediate host, the miracidium passes through various stages. The developed larvae (cercariae) leave the snail, attach to the grass and encyst to become metacercariae, the infective stage. Grazing animals eat the encysted

cercariae along with the grass for initial infection. Hay or fresh grass cut and carried can transfer metacercariae to confined animals. The metacercariae are ingested by grazing animals with infected herbage or water. The duration of the life cycle is 2.5 to 3 months depending on the parasite species.

### Agro-ecological conditions and seasonality of infections

The distribution and intensity of infections of helminth parasites vary from area to area depending on climate, ecology and systems of animal production. Transmission of GI parasites generally follows a seasonal pattern because it is dependent of climatic variations.

Factors determining the availability, development and survival of intermediate hosts in the environment will influence the level and severity of trematode infections.

Faeces and manure can act as reservoirs of the infection. The concentration of animals at watering points during the dry season is a favourable factor for the transmission of *F. gigantica* leading to outbreaks of fasciolosis.

### Clinical signs

The symptoms of the disease vary depending on the stage of development of the parasite within the definitive host and the duration of the infection. In sheep, liver flukes cause an acute disease, which results in sudden death, or a chronic disease (in more resistant breeds) whose symptoms are diarrhoea, anaemia, jaundice and oedema (bottle jaw). In chronic cases, animals lose weight progressively and may ultimately die from the infections.

In sheep, fascioliasis can be acute, subacute or chronic.

- Acute: sudden death or dullness, anaemia, dyspnoea, ascites and abdominal pain
- Subacute: rapid weight loss, anaemia, submandibular oedema, and ascites in some cases.
- Chronic: progressive weight loss, anaemia, submandibular oedema, diarrhoea and ascites.

The disease is caused by the migration of large numbers of immature flukes through the liver, or from the presence of adult flukes in the bile ducts, or both.

### Prevention and control

- Improve drainage and fence-off wet areas with poor drainage, where possible.
- Dose animals with an appropriate flukicide before introducing to pastures.
- Animals grazing on communal pastures should be treated at regular intervals following a seasonal calendar.
- Deworm all newly introduced animals before allowing them to mix with the remaining flock.
- Plan rotational grazing to avoid high risk pastures (presence of snails) and ensure adequate drainage to eliminate the snails.
- If possible, delay grazing on flooded pastures until the area has been dry for at least eight weeks. Grass from these pastures can be used as hay if dried properly.

Provide water troughs as an alternative to muddy watering holes.

# Session 3. Review, reflection and follow-up

This round-up session brings wider community members, not only those who participated in previous conversation sessions, and local service providers in reflective discussions and knowledge sharing. It aims to consolidate, reinforce and share key learning points and messages from the previous conversation sessions and address emerging knowledge gaps. It also aims to monitor community members' learning recall, retention and application, and document change stories due to the conversations.

Community members will be guided through reflective questions to capture and document their experiences and stories about the benefits of the community conversation sessions and the changes they have made individually or as a group due to the conversations.

The session also aims to document how local partners have integrated the approach into the regular extension approach and supported continued learning and social influencing of community groups based on community action plans.

Specifically, the session aims to:

- Recap key learning points and messages from the previous sessions.
- Integrate and reinforce knowledge on gastrointestinal parasites, how they affect health, welfare and productivity of animals, and on appropriate control measures.
- Address new learning needs and questions.
- Monitor knowledge application and capture change stories and lessons.
- Influence and motivate wider community members through experience sharing, telling change stories and testimonies of fellow community members.
- Monitor follow-up activities and implementation support by local service providers on community action plans.
- Plan for sustaining changes and integrating community conversations into the extension system through the work of communities of practice.

## Learning activities

Open the session in culturally appropriate way.

Introduce the purpose of the session.

Invite community members to reflect on their experiences, what they have learned, what they have changed and how they have benefited.

Reflection questions:

- What is your overall impression of community conversation?
- What makes it different from other community engagement methods?
- What were your key learning points and home-take messages from previous discussions?

- What community actions were agreed on at the end of each session?
- How have you shared information with your household members and neighbours?
- What is your experience of holding household conversations to share information among household members?
- What have you implemented from the community actions agreed during the previous sessions?
- What would you advise your neighbours about gastrointestinal parasite control in small ruminants?

Hold a panel discussion with a few men and women community members who have promising change stories. From the recap of previous sessions and monitoring of community action plans, you should be able to identify a few households that have made good progress in sharing information with other community members and taking actions to prevent and control gastrointestinal parasite infections in sheep and goats. Based on the objectives, content and learning activities of previous sessions, prepare discussion questions for the panellists. The aim is to encourage reflective discussions using the panel as a contextualizing technique and facilitate learning by tapping on the experiences of community members.

Panel discussion questions:

- What is a gastrointestinal parasite?
- How do gastrointestinal parasites cause disease in animals?
- Why should farmers be concerned about gastrointestinal parasites?
- What are the local terms for nematode and trematode parasites?
- What are the routes of transmission for these parasites?
- What are the most reasonable prevention and control measures for gastrointestinal parasite infections?
- Do you think individual efforts by farmers are adequate to control gastrointestinal parasite transmission?
- What is the advantage of community actions in preventing and controlling gastrointestinal parasite infections?

After each round of questions, paraphrase and summarize the main points and reinforce the discussion by highlighting key messages and addressing any knowledge gap. Invite community members to ask questions. Mention that integrated good animal and grazing land management strategies are a primary tool for preventing and controlling gastrointestinal parasite infections. Discuss the importance of community-based grazing land management and deworming calendars.

Wind up the panel discussion by highlighting the main points and communicating key messages to reinforce learning.

In plenary, ask community members how they would like to continue learning and sharing about gastrointestinal parasite control measures.

Then, ask how partnerships of community members and local service providers can be strengthened. Encourage reflections from local partners on how they plan to integrate community conversations into extension as inclusive, community-based extension methods to better engage with community members, understand their animal management issues, and feedback community issues into local planning and interventions.

Mention that you have learned much from community members and thank them for their active participation and knowledge sharing in the course of the conversations. Express your hope that they will continue learning and sharing information and knowledge with other community members and that local partners integrate community conversations into the extension system and support community members in their learning and change process.

Close the session smoothly in culturally appropriate way.

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