# Implication of community-based small scale irrigation in human and livestock health interaction: a case study in the Upper Awash River Basin areas

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# Outline

- Background and rationale
- Objective
- Materials and Methods
- Major findings - Discussion
- Conclusion and recommendations

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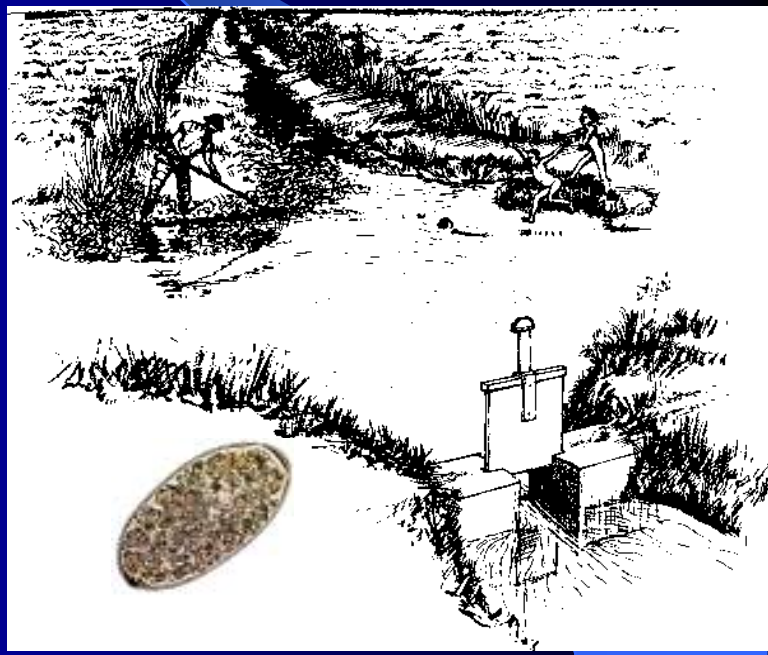
# Background and rationale

- Ethiopia
  - Agriculture is pillar of the economy
  - Considerable dependence on natural rain
  - Subsistence crop-livestock mixed farming in highlands and pastoralism in the lowlands
- Expansion of irrigation projects
  - Change in land use pattern
  - Intensification of labour
  - Enhance food security
  - Ensure sustainable agriculture
  - Increase risks of water-borne diseases

    Eg. fasciolosis, schistosomosis & malaria



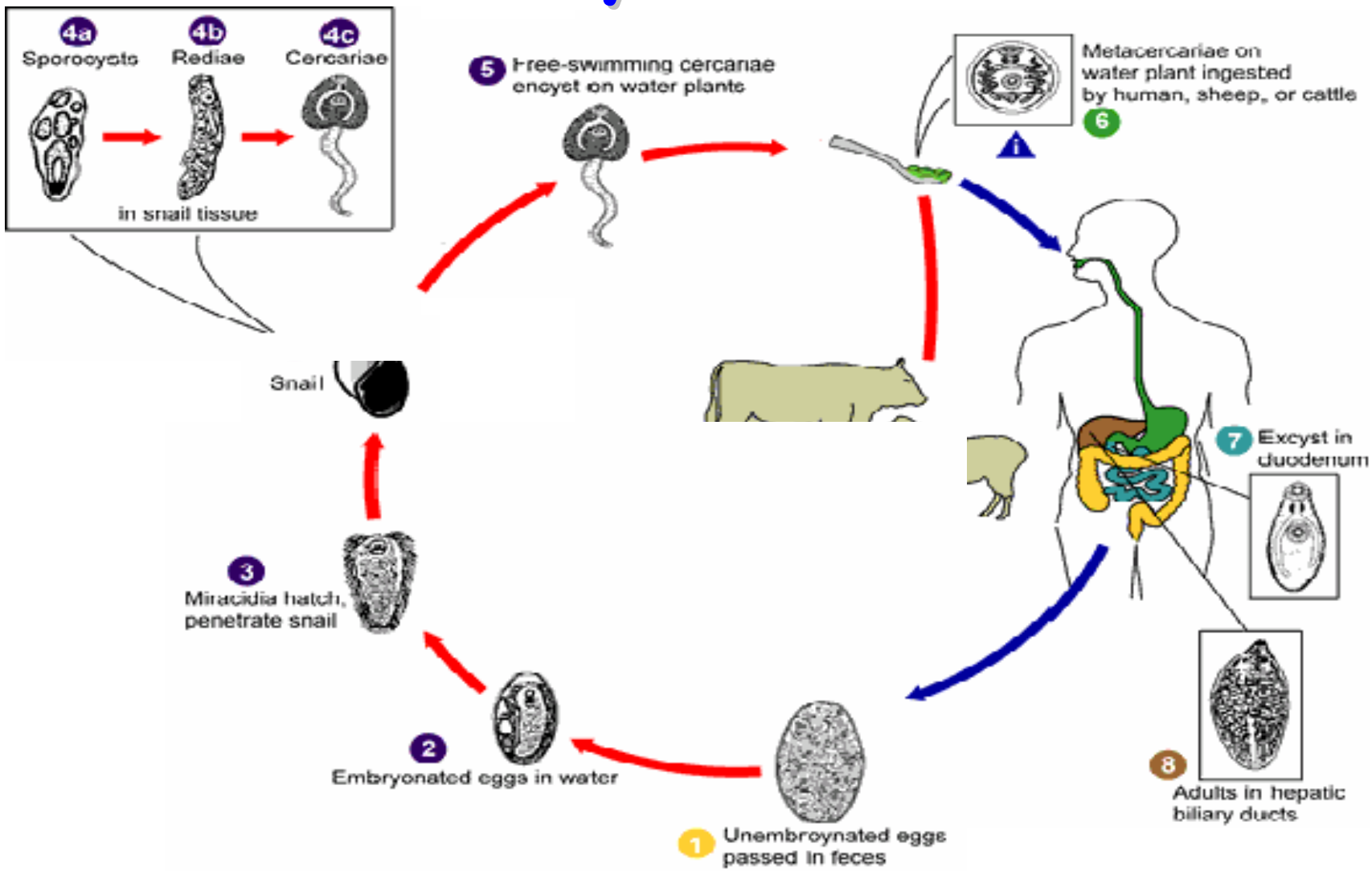
# Ruminant fasciolosis

*F. hepatica*

*F. gigantica*

The intermediate host

# Life cycle


4a
Sporocysts
4b
Rediae
4c
Cercariae
in snail tissue
5 Free-swimming cercariae encyst on water plants
Metacercariae on water plant ingested by human, sheep, or cattle
6
i
Snail
7 Excyst in duodenum
3 Miracidia hatch, penetrate snail
2 Embryonated eggs in water
1 Unembroynated eggs passed in feces
8 Adults in hepatic biliary ducts

# Background (cont'd...)

## Fasciolosis

- **Economic importance**
  - found in 5 continent (WHO, 1995)
  - loss US$ 200 mill. /annum (Ramajo *et. al.*, 2001)
  - 600 mill. animals infected (Ramajo *et. al.*, 2001)

- **Zoonotic Importance**
  - 1970-1990: about 2600 pos. from 42 countries (Slifko *et. al.*, 2000)
  - 2.4-17mill. global prevalence (Slifko *et. al.*, 2000) and 180mill. at risk (Ramajo *et. al.*, 2001)

# Background (cont'd…)

- **Common transmission route**
  - Ingestion of contaminated vegetation Eg. irrigated area
  - water containing floating metacercariae
- **The risk factor**
  - waste water effluent for irrigating vegetables
  - use of animal manure as fertilizer
- **Epidemiology of the disease influenced by**
  - grazing habits
  - rate of egg production as a function of pasture contamination

# Background (cont'd…)

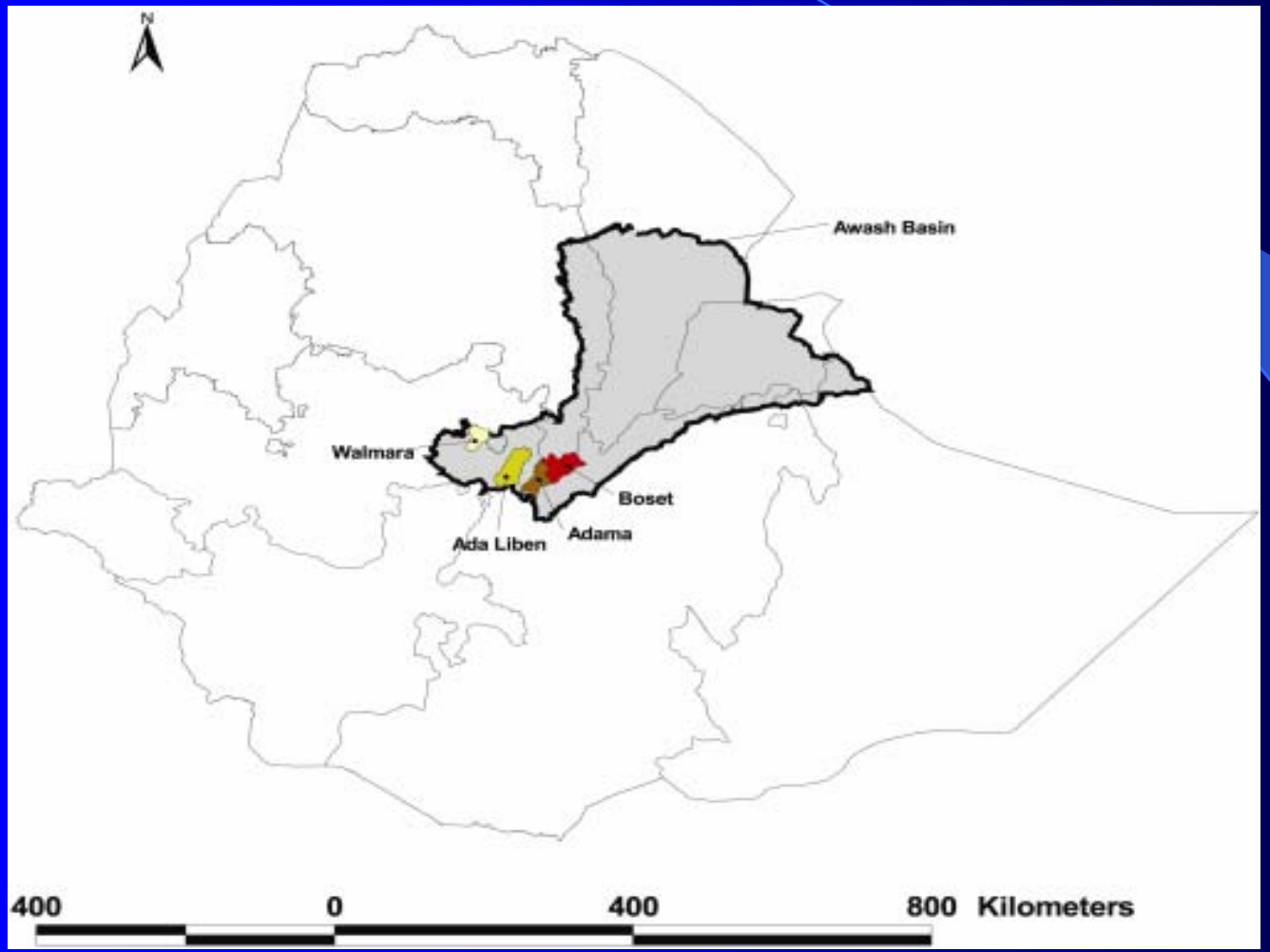
- **Control**
  - Control of snail population
  - Environmental sanitation and manipulation
  - Application of cost effective treatment
- **Situation in Ethiopia**
  - 23.62 mil. Sheep (CSA, 2004)
  - 75MT of mutton/annum (FAO, 2002)
  - Financial loss due to fasciolosis
    - 48.8 mill. Eth. birr/annum (Ngategize, *et. al.*, 1993)
      - 46.5% weight loss
      - 48.8% liver condemnation
      - 4.7% mortality

# Objective: -

- To assess the potential impact of community-based irrigation on the spread of fasciolosis in the upper Awash River Basin areas
- To evaluate the effect of a strategic treatment on some indicative parameters.

# Material and Methods

## Study areas




Map of Ethiopia showing the study sites in the Awash River Basin.

# Materials … (cont'd)

## Study animals

## Protocol

- Infection prevalence
- Effects of strategic anthelmintic treatment
- Statistical analysis

# Results and Discussion

Infection prevalence (November 2003 – October 2004) (n=1296).

| Category | Number examined | Number and percent positive |
|---|---|---|
| 1) Altitude | | |
| Highland | 529 | 333(62.9%)[a] |
| Mid-altitude | 302 | 154(51%)[b] |
| Lowland | 465 | 242(52%)[b] |
| | | |
| 2) Season | | |
| Dry | 690 | 370(53.6%)[a] |
| Wet | 606 | 359(59.2%)[b] |
| | | |
| 3) Grazing land | | |
| Irrigated | 732 | 445(60.8%)[a] |
| Non-Irrigated | 564 | 284(50.4%)[b] |
| | | |
| 4) Age | | |
| Young | 665 | 368(55.3%)[a] |
| Adult | 631 | 361(57.2%)[a] |
| | | |
| 5) Sex | | |
| Male | 306 | 183(59.8%)[a] |
| Female | 990 | 546(55.2%)[a] |

Different letter (a, b) along columns signify the presence of significant difference

# Results (cont'd...)

Prevalence by grazing land, season and altitude (November 2003 - October 2004 (n=1296)

| Grazing Land | Dry season (prevalence rate (%) | | | | Wet season (prevalence rate (%) | | | | Overall total |
|---|---|---|---|---|---|---|---|---|---|
| | Highland | Mid-Altitude | Lowland | Total | Highland | Mid-Altitude | Lowland | Total | |
| Irrigated grazing land | 64.5 [a] | 57.3 [a] | 58.3 [a] | 61.1 [a] | 64 [a] | 54.4 [a] | 61.5 [a] | 60.3 [a] | 60.8 [a] |
| Non-irrigated land | 57.3 [a] | 37.3 [b] | 32.1 [b] | 41.8 [b] | 63.5 [a] | 52.9 [a] | 55 [b] | 58.1 [a] | 50.4 [b] |
| Total | 62.3 | 47.9 | 46.9 | 53.6 | 63.7 | 53.8 | 58.4 | 59.2 | 56.3 |

Different letters (a,b) along columns signify the presence of significant difference ($p<0.05$).

# Results (cont'd...)

Feacal *Fasciola* egg output (Mean±S.E.) (n=729)

| Category | Number positive | Mean±S.E. |
|---|---|---|
| 1) Altitude | | |
| Highland | 333 | 270±1.06 [a] |
| Mid-altitude | 154 | 188±1.09 [b] |
| Lowland | 242 | 170±1.07 [b] |
| | | |
| 2) Season | | |
| Dry | 370 | 162±1.06 [a] |
| Wet | 359 | 260±1.06 [b] |
| | | |
| 3) Grazing land | | |
| Irrigated | 445 | 237±1.05 [a] |
| Non-Irrigated | 284 | 178±1.06 [b] |
| | | |
| 4) Age | | |
| Young | 368 | 251±1.06 [a] |
| Adult | 361 | 182±1.05 [b] |
| | | |
| 5) Sex | | |
| Male | 183 | 218.77±1.09 [a] |
| Female | 546 | 213.80±1.05 [a] |

Different letters (a,b) along columns signify the presence of significant difference (

# Results (cont'd ...)

Effects of strategic anthelmintic treatment (November 2003 – October 2004) (n=80)

| Treatment groups | No. exam. | Indicator parameters (Mean±S.E.) | | | |
|---|---|---|---|---|---|
| | | EPG | PCV (%) | Body wt. gain (kg) | BCS |
| Group I (once) | 23 | 0.35±1.55 [b] | 3.56±1.16 [b] | 0.90±0.73 [a] | 0.17±0.08 [a] |
| Group II (twice) | 28 | 0.03±1.32 [c] | 6.50±1.28 [b] | 4.10±0.76 [b] | 0.57±0.09 [b] |
| Group III (Untreated control) | 29 | 3.09±1.26 [a] | -2.03±0.91 [a] | 0.27±0.90 [a] | -0.02±0.05 [a] |
| Total | 80 | 0.32±18.20 | 2.56±0.76 | 2.30±0.49 | 0.24±0.05 |

Different letters (a, b and c) along columns signify the presence of significant

# Results (cont'd…)

Estimated economic benefits from strategic treat.*

| Groups | Body weight gain (BWG) (Kg) | Approximate unit price of BWG (Kg) | Gross value Birr | Net value Birr |
|---|---|---|---|---|
| **Group I** | **0.9** | **6.82** | **6.14** | **5.24** |
| **Group II** | **4.1** | **6.82** | **27.96** | **26.16** |
| **Group III** | **-0.27** | **6.82** | **-1.84** | **-1.84** |

*Price of TCBZ = birr 0.90/300mg (1 bolus)

# Conclusions

- As compared with mid-altitude and lowland areas, the highland grazing areas are more favorable for the propagation and activity of the snail intermediate hosts and progression of the life cycle of *Fasciola spp.* for most months of the year.

- There was no significant difference in the prevalence of fasciolosis between season and the grazing land types (irrigated and non-irrigated) in the highlands.

# Conclusions (cont'd…)

- ✓ Significant increase in fasciolosis prevalence associated with irrigation was observed
  - ✓ Mid-altitude = during dry season
  - ✓ lowland = during dry and wet seasons
  - ❖ Irrigation influences prevalence of fasciolosis in moisture deficient areas and seasons
- ✓ Economic benefits of different levels of strategic treatment showed that twice treatment conferred a net-profit of 26.16 birr/sheep and one-time treatment provide a net profit of 5.24 birr while no treatment showed a loss of 1.84 birr/sheep.
- ✓ Smallholder farmers have also appreciated the added non-monitory values.

# Recommendations

- Proper management of community based irrigation schemes is necessary in order to reduce the losses due to ovine fasciolosis

- Strategic anthelmintic treatments must be applied at appropriate times, and with the aim of reducing worm burden from infected animals and to reduce pasture contamination.

- Twice (Triclabendazole 10mg/kg BW) treatment was confirmed to be most economical and is recommended in the context of smallholder mixed crop-livestock system in the highlands of Ethiopia.

# Recommendations(cont'd…)

- Small holder farmers and development agents should be aware of the importance of strategic anthelmintic treatment (administered it at the right time) = improve the productivity.

- Need to institute a GIS based surveillance system
  - ✓Predict the occurrence of fasciolosis
  - ✓Monitor the success/failure of the control intervention put in place

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