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# Comparison of local and crossbred cattle populations for resistance to high altitude disease in Ethiopia

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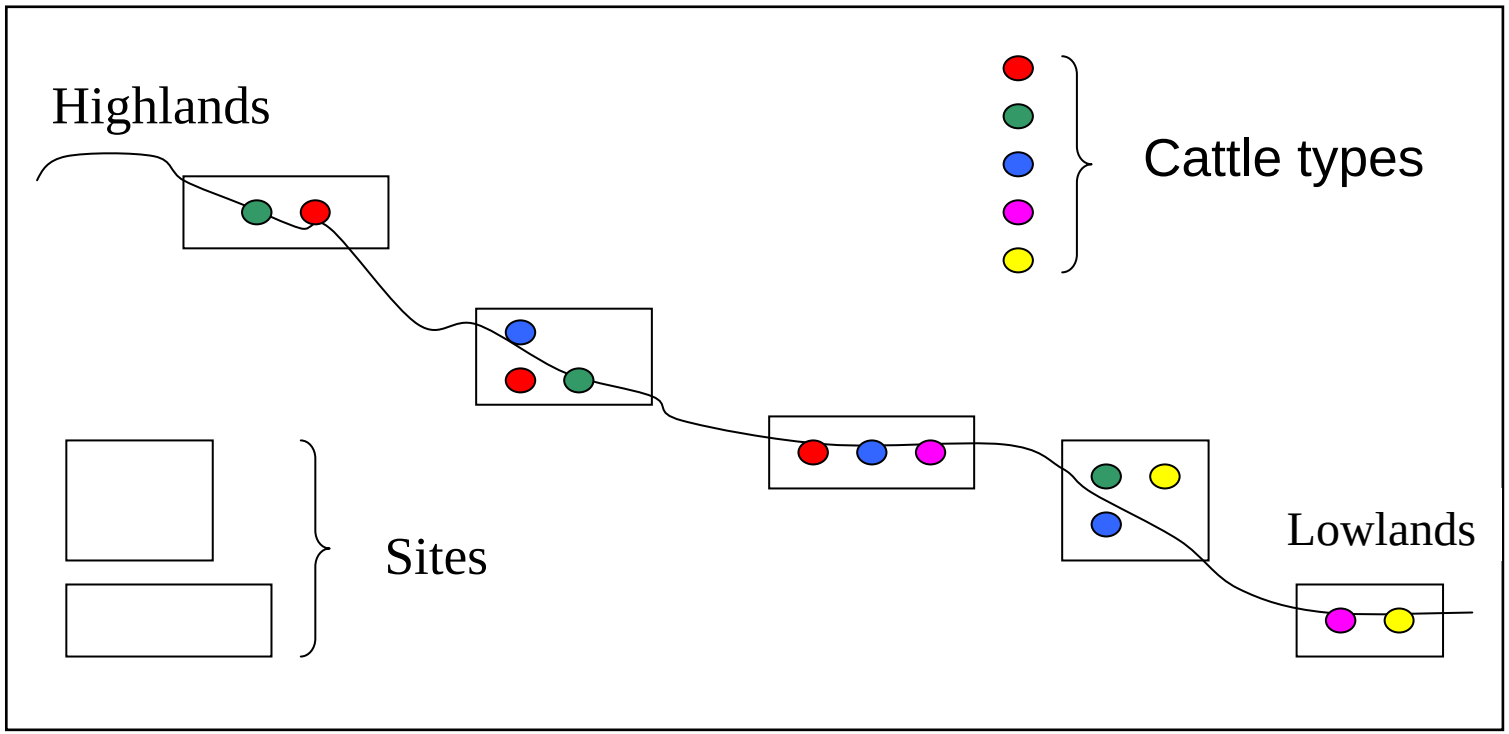
# Background

- Characterisation of local cattle populations along the ranges of the Simien mountains of Ethiopia

- Cattle are kept up to altitudes of 4000 m

# Microevolution at work

- **Genetic differentiation and metabolic adaptation to altitude of cattle populations along the slopes of the Semien Mountains in Northern Ethiopia**



# Examination of potential methods to predict pulmonary arterial pressure score in yearling beef cattle[1]

J. K. Ahola,* R. M. Enns,†[2] and T. Holt‡

- JAS, 2006
- High altitude disease („brisket disease“) was first described in cattle (Glover and Newsome, 1914)
- HAD is one of the primary causes of calf mortality on beef cattle ranches above 2,100 m in the Rocky Mountains


231

# Pulmonary arterial pressure

- via right heart catheterization
- Very good indicator of proneness to HAD
- Highly heritable (~ 0.4)
- Important part of bull selection in the Rockies

- Little correlation with blood tests (Hemoglobin, Hematocrit) or Oxygen saturation

# Tim Holt and PAP testing


Tested 130,000 cattle


02.04.2005

# PAP Measurement Evaluation

- Altitudes >6400 ft (1950 m)
- 30-39 mmHg
  - Low risk
- 40-49 mmHg
  - Moderate risk
- 50+ mmHg
  - High risk

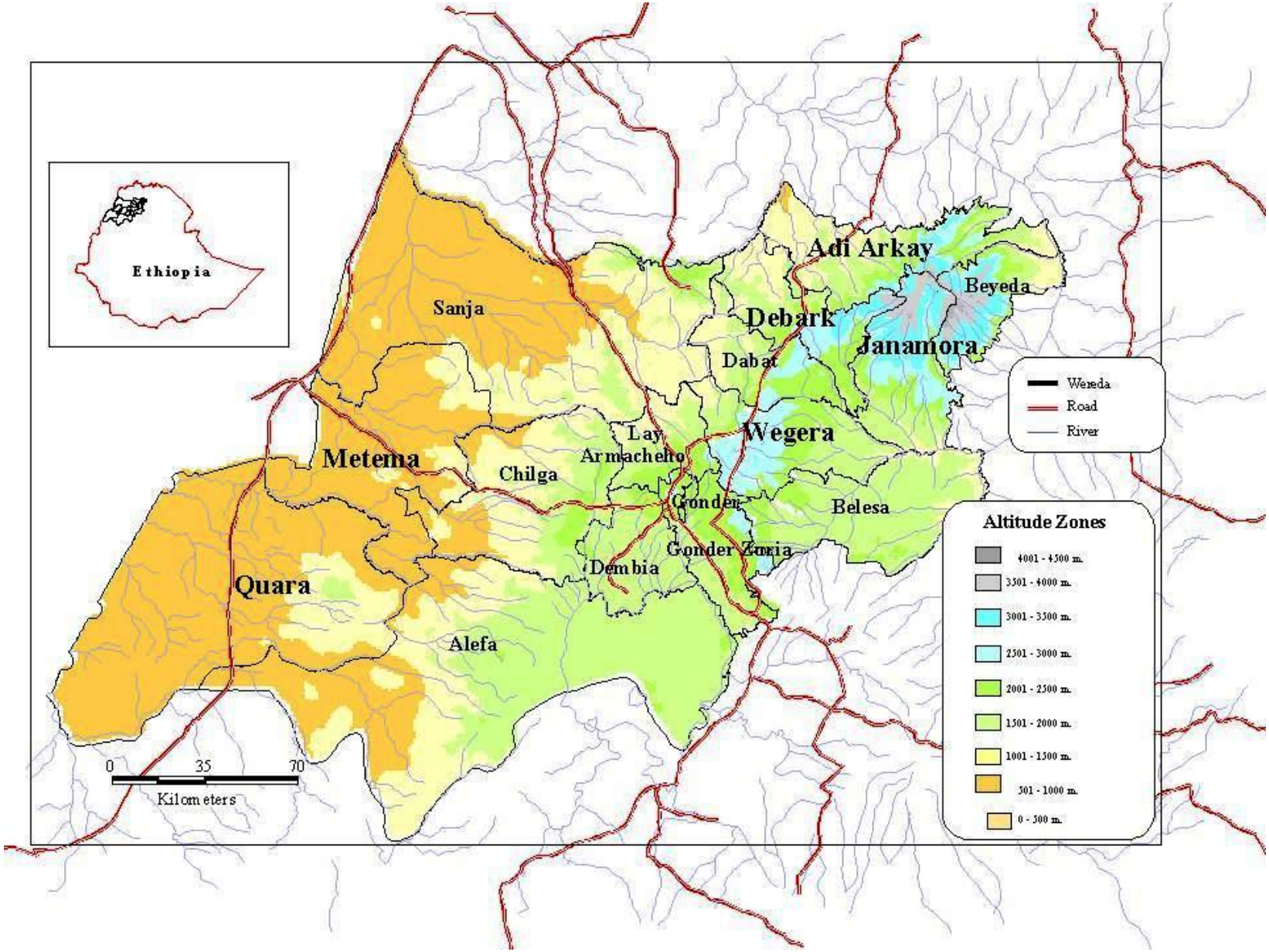
# Examination of potential methods to predict pulmonary arterial pressure score in yearling beef cattle[1]

J. K. Ahola,* R. M. Enns,†[2] and T. Holt‡

- Site of measurements at 2200 m
- Experiment 1 (39 animals)
  - PAP: 45.5 ± 11.6 mmHG
- Experiment 2 (84 animals)
  - PAP: 42.5 ± 8.1 mmHG

# Tim Holt in Ethiopia

- Jan/Feb 2007, 10 days
- Tested 218 cattle at 1730-3500 m
- Local breeds, Holstein and Jersey crosses


Ethiopia
Adi Arkay
Beyeda
Sanja
Debark
Janamora
Dabat
Wereda
Road
River
Lay
Armachelho
Wegera
Metema
Chilga
Gonder
Belesa
Gonder Zuria
Dembia
Quara
Alefa
0
35
70
Kilometers
Altitude Zones
4001 - 4500 m.
3501 - 4000 m.
3001 - 3500 m.
2501 - 3000 m.
2001 - 2500 m.
1501 - 2000 m.
1001 - 1500 m.
501 - 1000 m.
0 - 500 m.

# Results

- Number of animals tested

| **Breed/ Type** | **Location** | | |
|---|---|---|---|
| | Andassa (1730m) | Debark/Dabat (2700m) | Arginjona (3500m) |
| Local | 55 | 39 | 32 |
| Local X HF | 6 | 64 | |
| Local X Jer | | 20 | |
| **Total** | 61 | 123 | 32 |

# Results

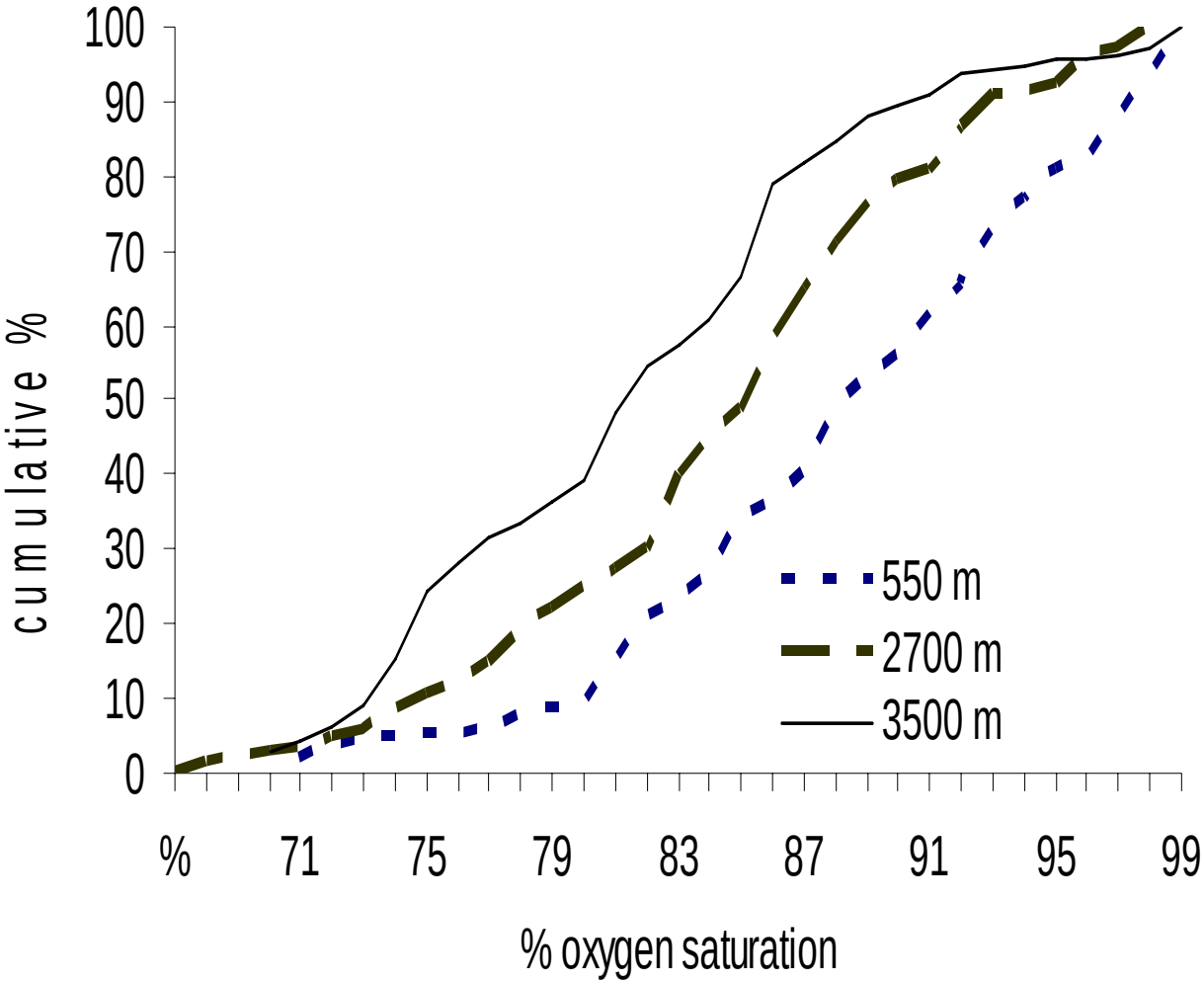
- PAP values

| **Breed/Type** | **Location** | | |
|---|---|---|---|
| | Andassa (1730m) | Debark/Dabat (2700m) | Arginjona (3500m) |
| Local | 32.5 (27-42) | 34.4 (28-42) | 32.5 (21-46) |
| Local X HF | 34.5 (31-39) | 33.4 (28-47) | |
| Local X Jer | | 35.5 (30-41) | |

# PAP values < 30

- Tim Holt was amazed to find animals with PAP values < 28
  - Only ~ 10 of the 130,000 in the Rockies
  - 5 of the 32 in Arginjona (3500m)

# Cumulative oxygen saturation distribution of cattle residing at 550 m, 2700 m, and 3500 m of altitude



# Metabolic blood parameters

- Red blood cell count
- Hemoglobin
- Hematocit

$\Rightarrow$ Significantly higher in Simien cattle than in other genotypes

# Conclusions

- Indigenous cattle of the Simien Plateau of Ethiopia are adapted genetically to high altitude
- The good adaptation is most likely due to natural selection.
- Crossbred animals are adapted up to the altitude (2700 m) we have observed them.

# Next steps

- histology of jugular vein, heart, pulmonary artery, and lungs
- Bring some crossbreds up to 3500 m