



# Increasing efficiency in rangeland-based livestock value chains by co-designed digital technologies and machine-learning approaches

Brigitte Kaufmann on behalf of the whole InfoRange team

Status Seminar 2025: Sustainable Land Management in Sub-Sahara Africa | 03/06/25

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Innovation Inspired



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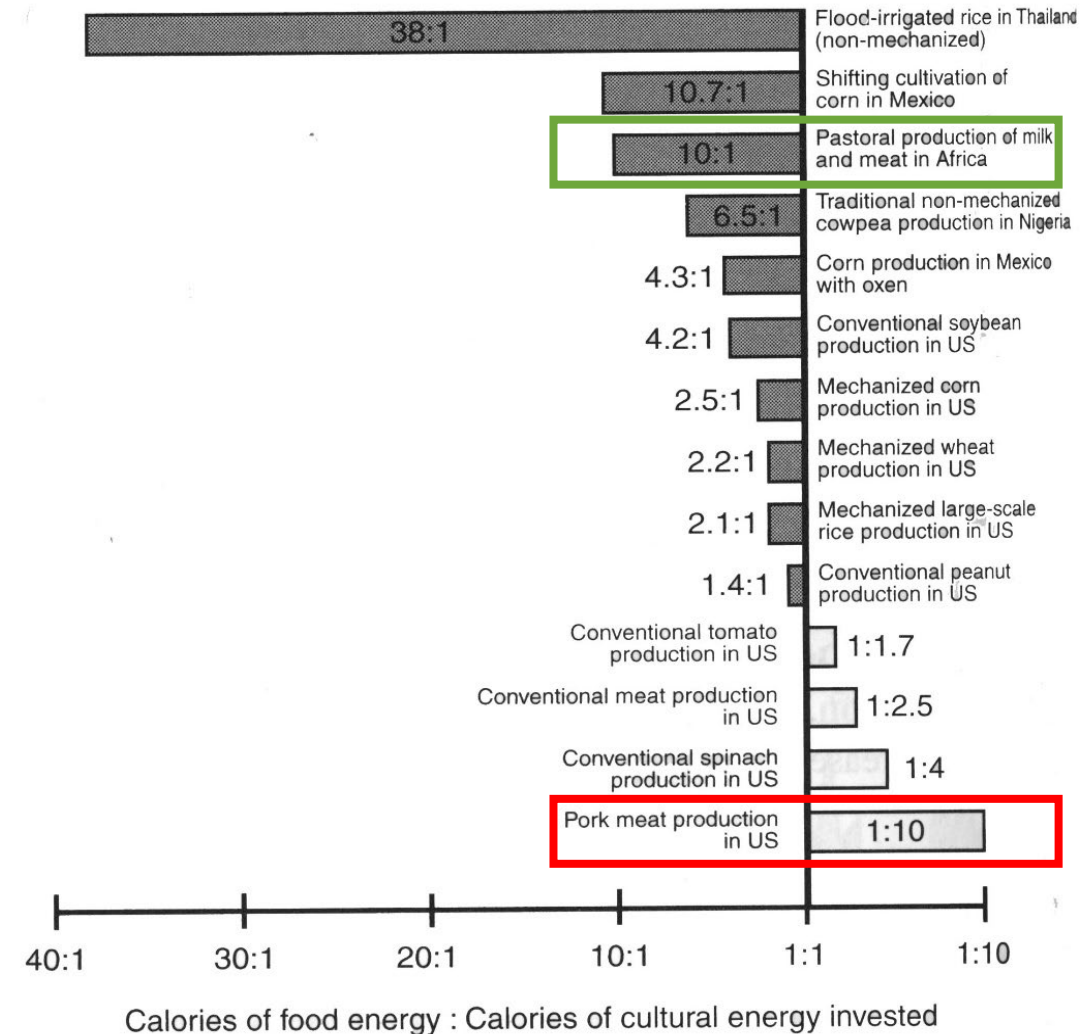
# Conceptual background of InfoRange

## Rangeland-based livestock production

- makes use of mobility to harness variable resources
- uses adapted breeds with a comparable low production potential but high productive adaptability
- requires minimal external inputs

→ High support energy efficiency

- Improvement measures that follow an intensification strategy largely failed in pastoral livestock production



Gliessmann 2007

# Conceptual background of InfoRange

Mobile livestock production is a knowledge and information intensive system,

e.g. accurate and timely information

- is necessary for grazing decisions
- is essential to reduce losses.

Internet coverage has increased in remote rangelands

ICT tools become an option to improve information access and sharing



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# Aims of InfoRange

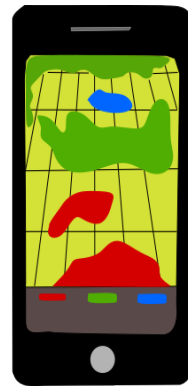
## InfoRange uses a transdisciplinary approach to:

Render digital and ICT services more relevant for rangeland users' immediate management decisions

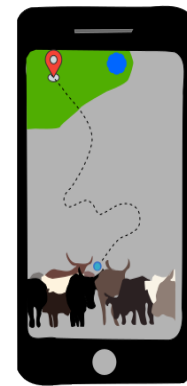
- Co-develop a smartphone application for pastoralist livestock keepers
  - Rangeland app
  - Veterinary app

→ Improves access to information from other sources:

- Different stakeholder groups
- Telemetry and observatory data



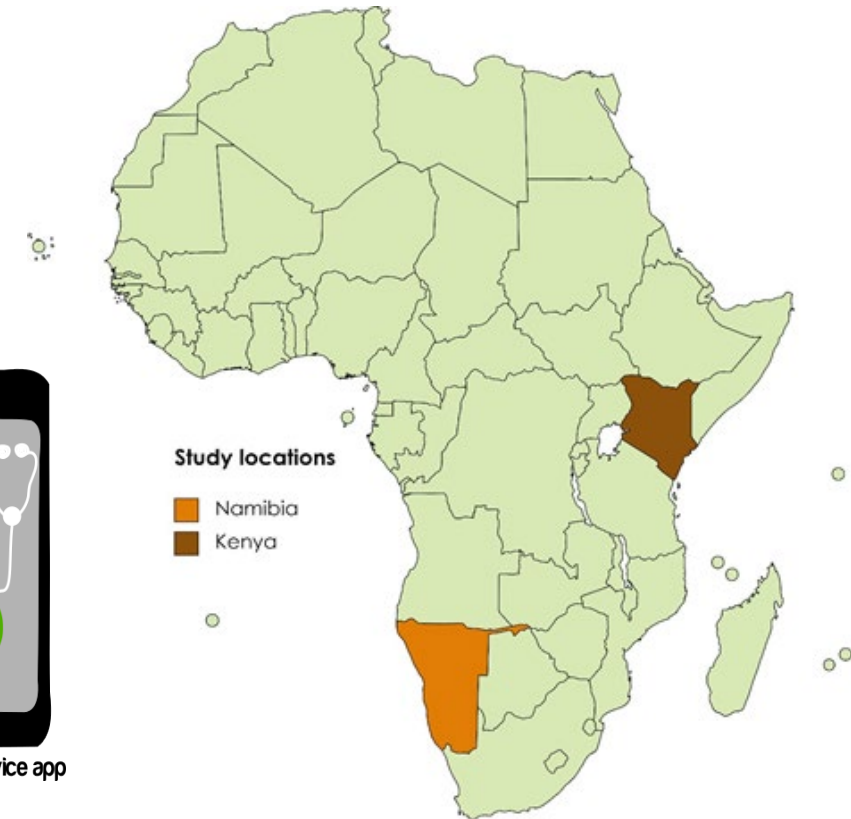
Rangeland resource app



Rangeland use app



Veterinary service app



# Key characteristics of InfoRange

1. Transdisciplinary approach
2. Interdisciplinary collaboration
3. App co-design



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# 1 Transdisciplinary collaboration

InfoRange Community Committees as a space where

- researchers and technical developers can share updates
- communities give their feedback on processes and outcomes, offer advice, or raise concerns

9 committees in Kenya and 4 in Namibia

- Fixed schedule for Committee meetings
- WhatsApp groups providing a platform for continuous communication



Net mapping in Muduva Nyangana, Namibia

© B.Thanies

# 2 Interdisciplinary collaboration



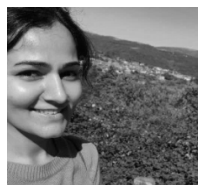
H. Akala



A. Erastus



M. Wako



Z. Alizadeh



R. Halakhe



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Dr. Raphael Lotira



Prof. Oliver Wasonga



Prof. Hilma Amwele



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Kenyan-German-Namibian collaboration



Ms. Mareike Voigts



D. Sentamu



E. Mbaeva



S. Tjiraso



H. Hosseini



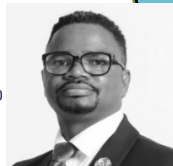
S. Schmidt



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Dr. Joshua Onono



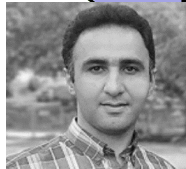
Prof. Colin Stanley



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AGRARTECHNIK WITZENHAUSEN



Prof. Abozar Nasirahmadi



Prof. Brigitte Kaufmann



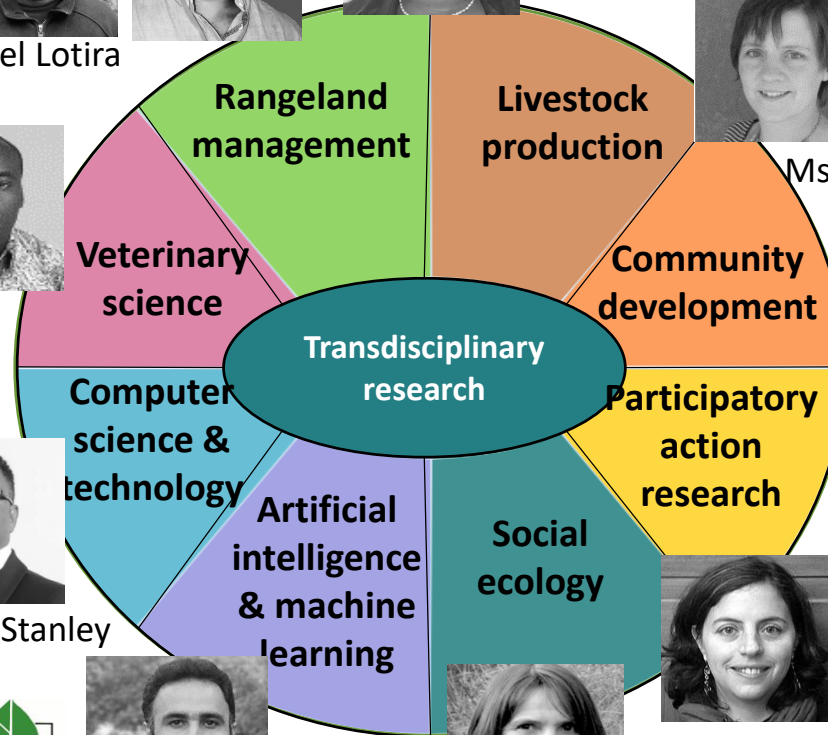
Dr. María Restrepo



Dr. Lilli Scheiterle



where science meets people



# 2. Example for Interdisciplinary Collaboration

## Rangeland governance, use, classification and monitoring

Kenya: Sololo subcounty

*Badana nyencha* (Dense thicket with lions)

Soil type and color: Light grey soils

Common grasses: *Digitaria sp.*

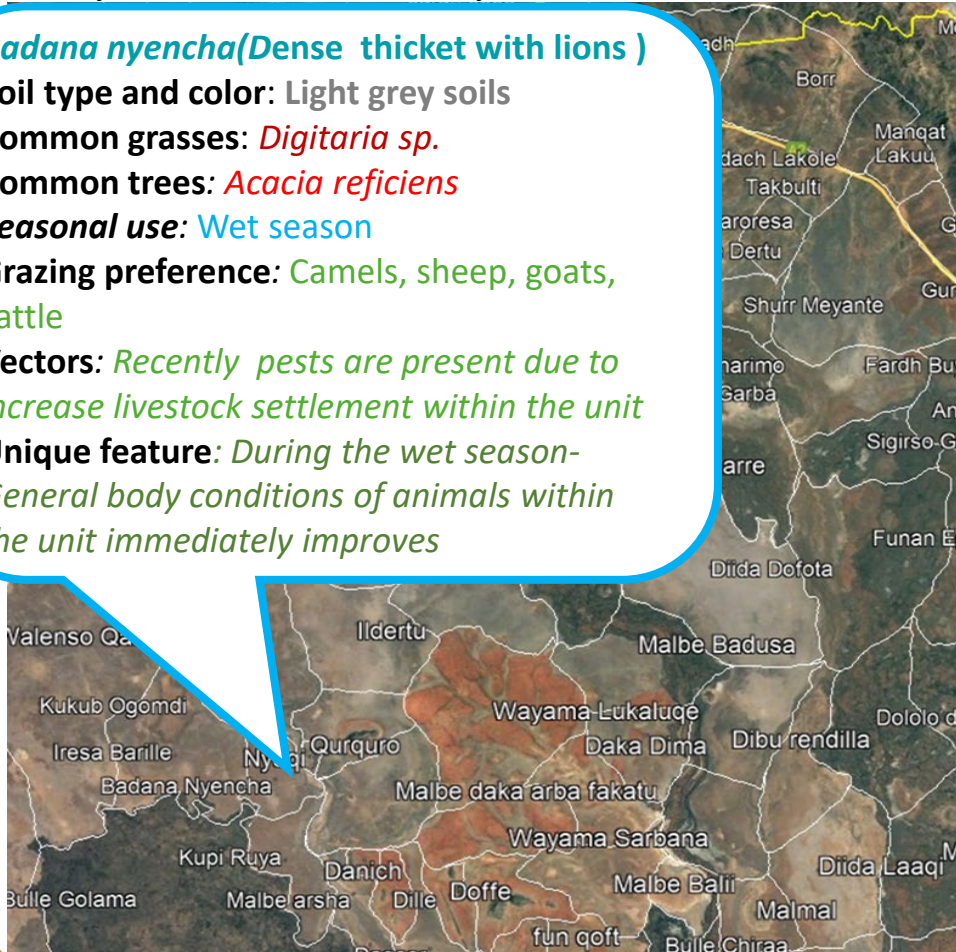
Common trees: *Acacia reficiens*

Seasonal use: Wet season

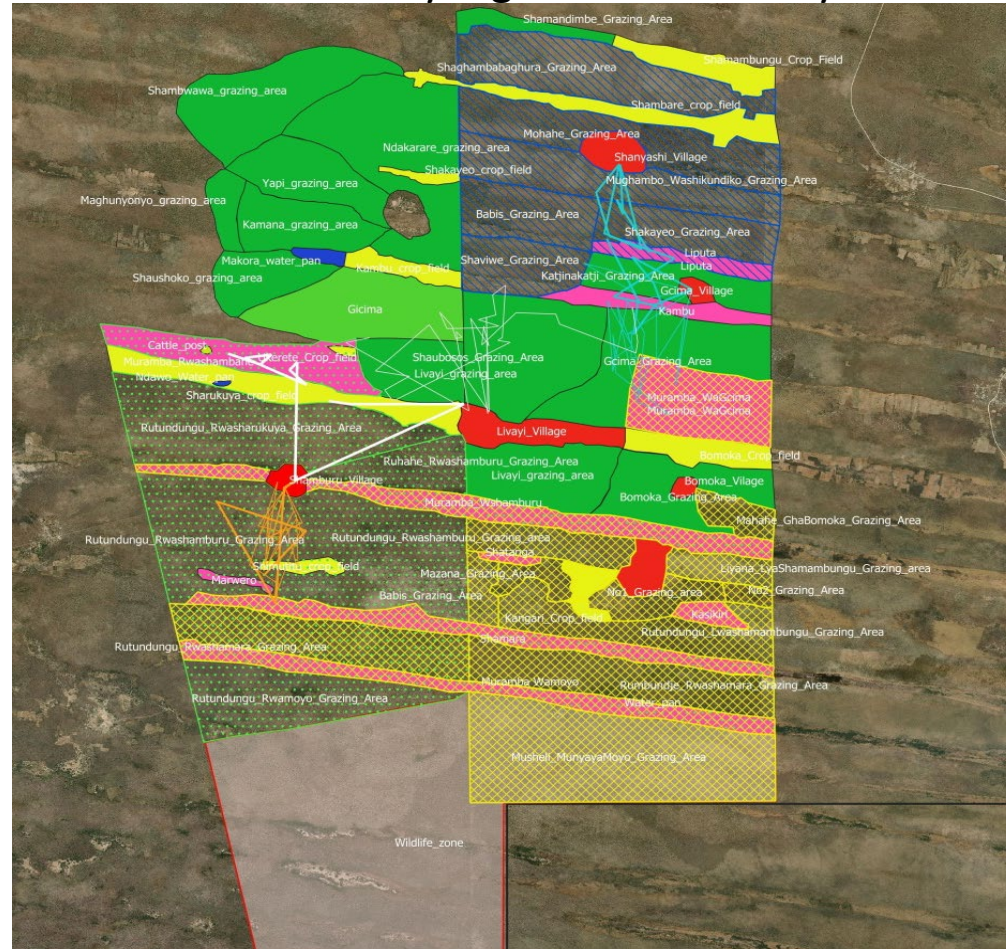
Grazing preference: Camels, sheep, goats, cattle

Vectors: Recently pests are present due to increase livestock settlement within the unit

Unique feature: During the wet season - General body conditions of animals within the unit immediately improves

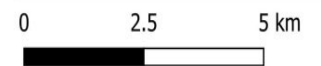


Namibia: Muduva Nyangana conservancy



**Legend**

- Shanyashi Grazing Area
- Shamambu Village Grazing Area
- Shamburu Village Grazing Area
- Other Grazing Areas
- Villages
- Crop Fields
- Shared Grazing Area
- Wildlife\_zone
- Water Pan
- National Boundary
- Livayi Cow 1
- Livayi cow 2
- Shamburu cow 1
- Shamburu Cow 2
- Shanyashi cow 1
- Shanyashi cow 2



## 2. Example for Interdisciplinary Collaboration

### Rangeland governance, use, classification and monitoring

Social-ecology



Malit Wako

Rangeland governance and decision making

Rangeland management



Haron Akala

Rangeland monitoring incl. pastoralists' criteria and thresholds

Machine learning



Zakieh Alizadeh

Automatic classification of rangeland vegetation using ground-based images

Machine learning



Sebastian Schmidt

Vegetation classification based on identified grazing patterns and classified satellite data

Rangeland management



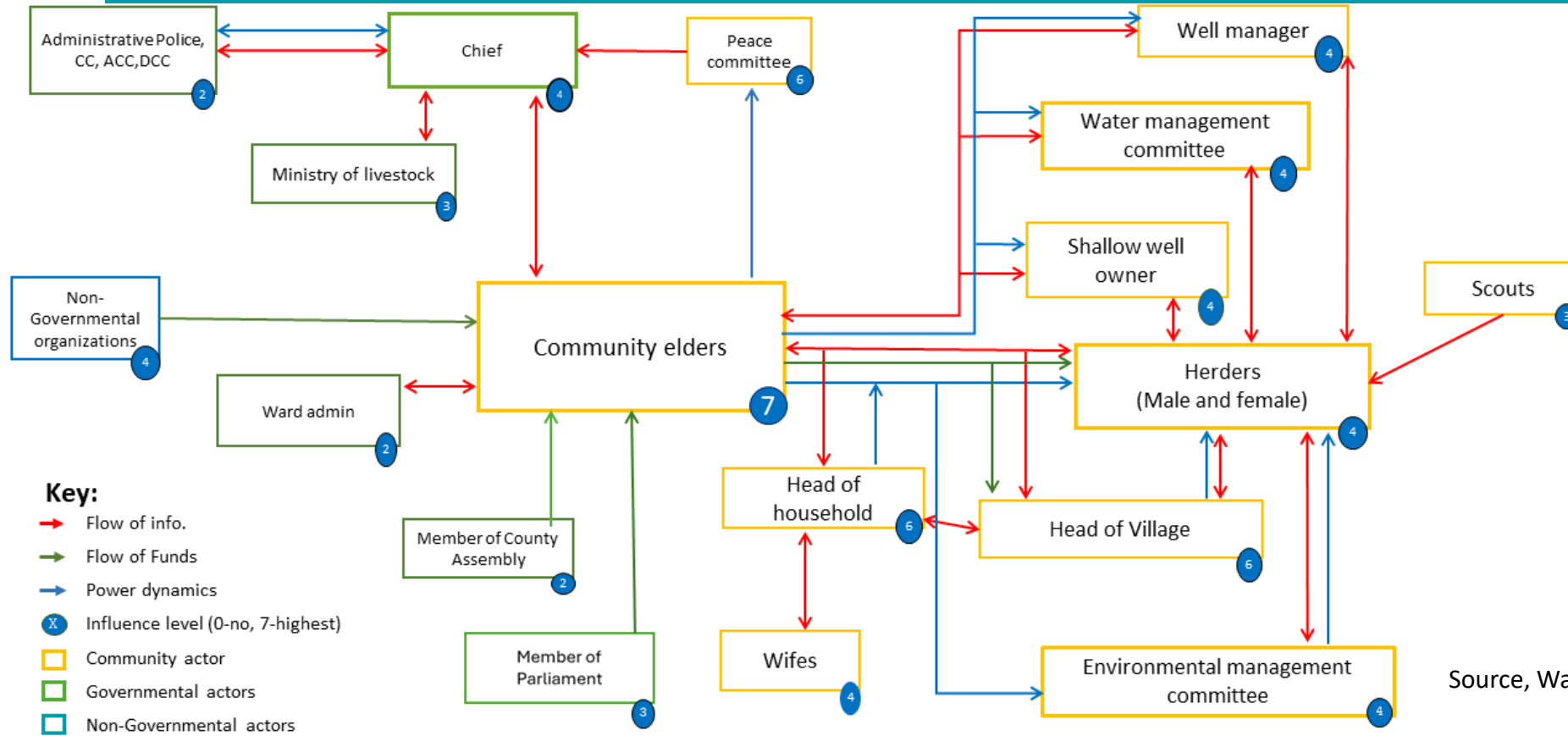
Andreas Erastus

Rangeland governance and use pattern



# 2. Example for Interdisciplinary Collaboration

## Rangeland governance



Source, Wako M. et al. 2024



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Wako et al.: Beneath the Surface of Rangeland Governance: Examining Values, Norms, and Practices in Northern Kenya’s Pastoralist Communities’. Governance of Land and Natural Resources

Erastus et al.: Understanding the Governance Structures of Rangeland Management: Insights from Namibia’s Agropastoralist Communities.

Governance of Land and Natural Resources

# 2. Example for Interdisciplinary Collaboration

## Rangeland monitoring

### Pastoralists' criteria for grazing units importance

High amount of pasture	111
Large area	63
Suitable types of trees	49
Open area	45
Pods and flowers	37
Close to water point	35
Suitable for fora	34
Dry season grazing	34
Water in wet season	34
Variety of grass	30



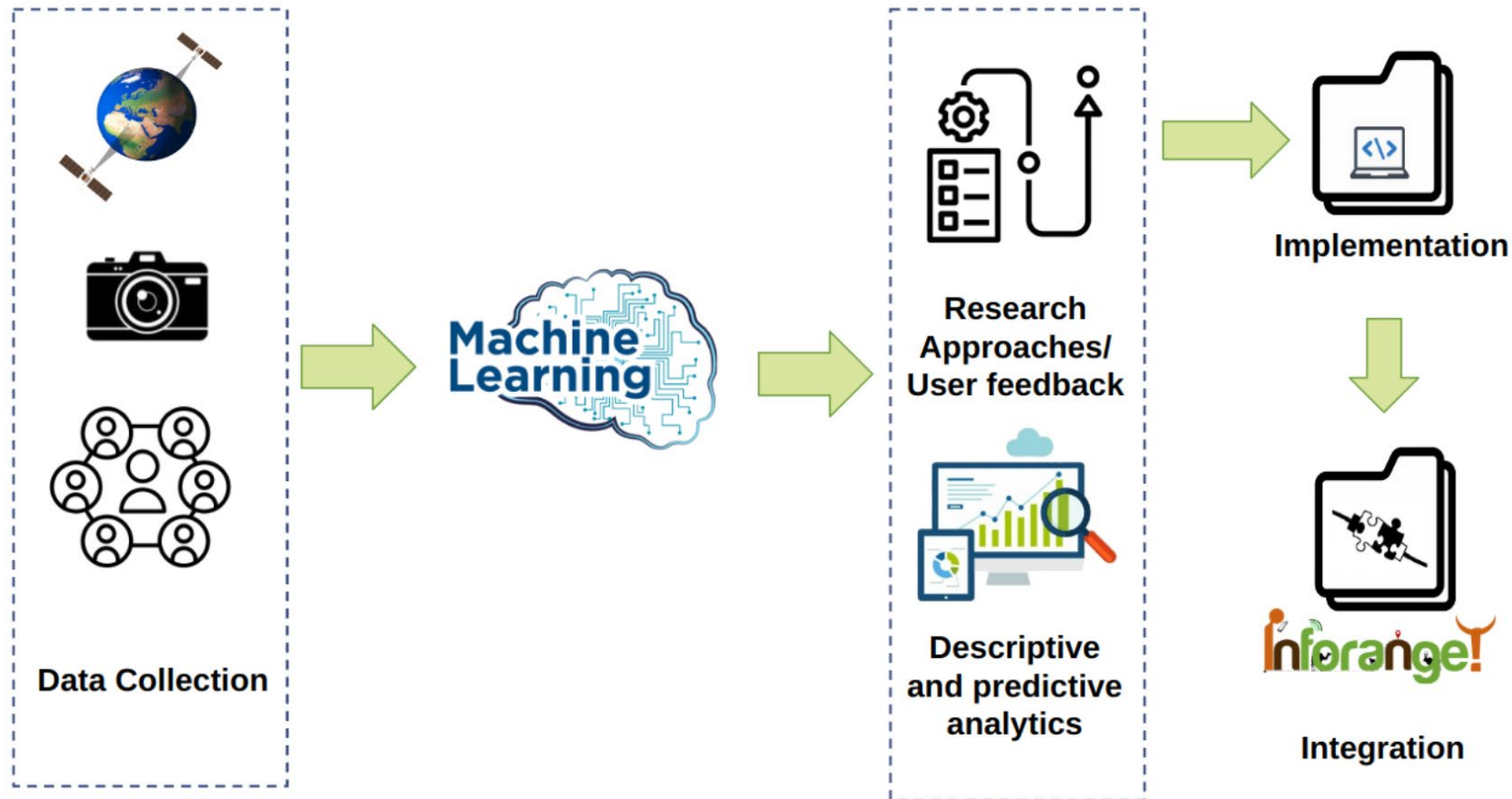
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@ Saroi Lesaigor

# 2. Example for Interdisciplinary Collaboration

## Rangeland classification



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Alizadeh & Nasirahmadi: Automation of Rangeland vegetation scoring using machine learning techniques.

ICT and Machine Learning

Schmidt et al.: Application of artificial intelligence and satellite imagery to support pastoralists for Rangeland management.

ICT and Machine Learning

# 3 App Co-design

## Assessment of information needs

### Information needs related to routine activities of pastoral women in northern Kenya:

- Feed management at household level and fodder collection
- Providing adequate water
- Care for pregnant small ruminants and young ones
- Monitor animal health
- Milking and milk sale



# 3 App Co-design

## Assessment of information needs - Volunteer information facilitators (VIF)

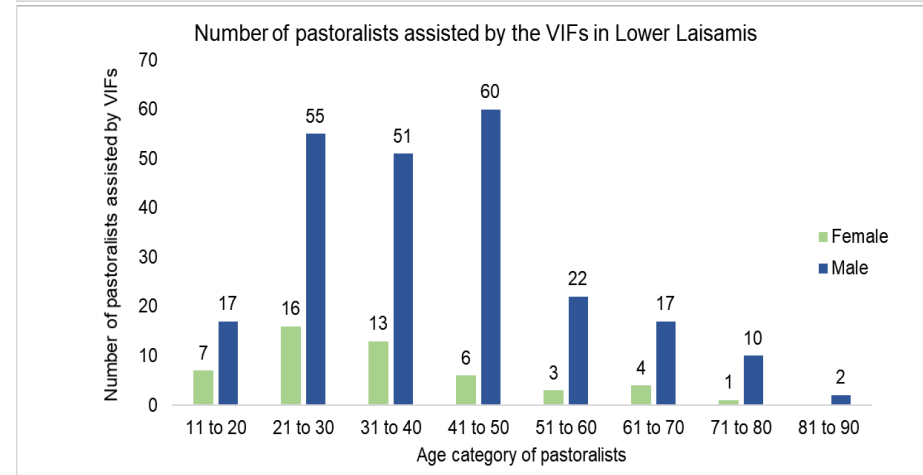
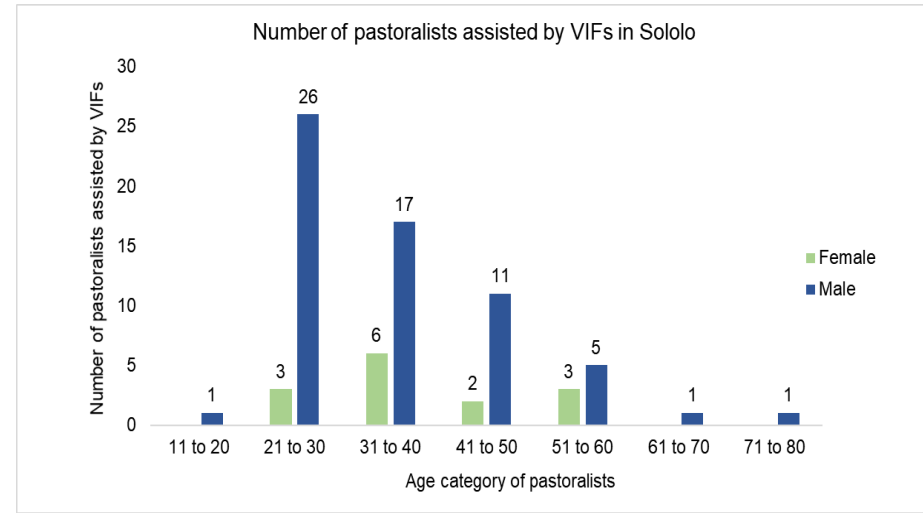
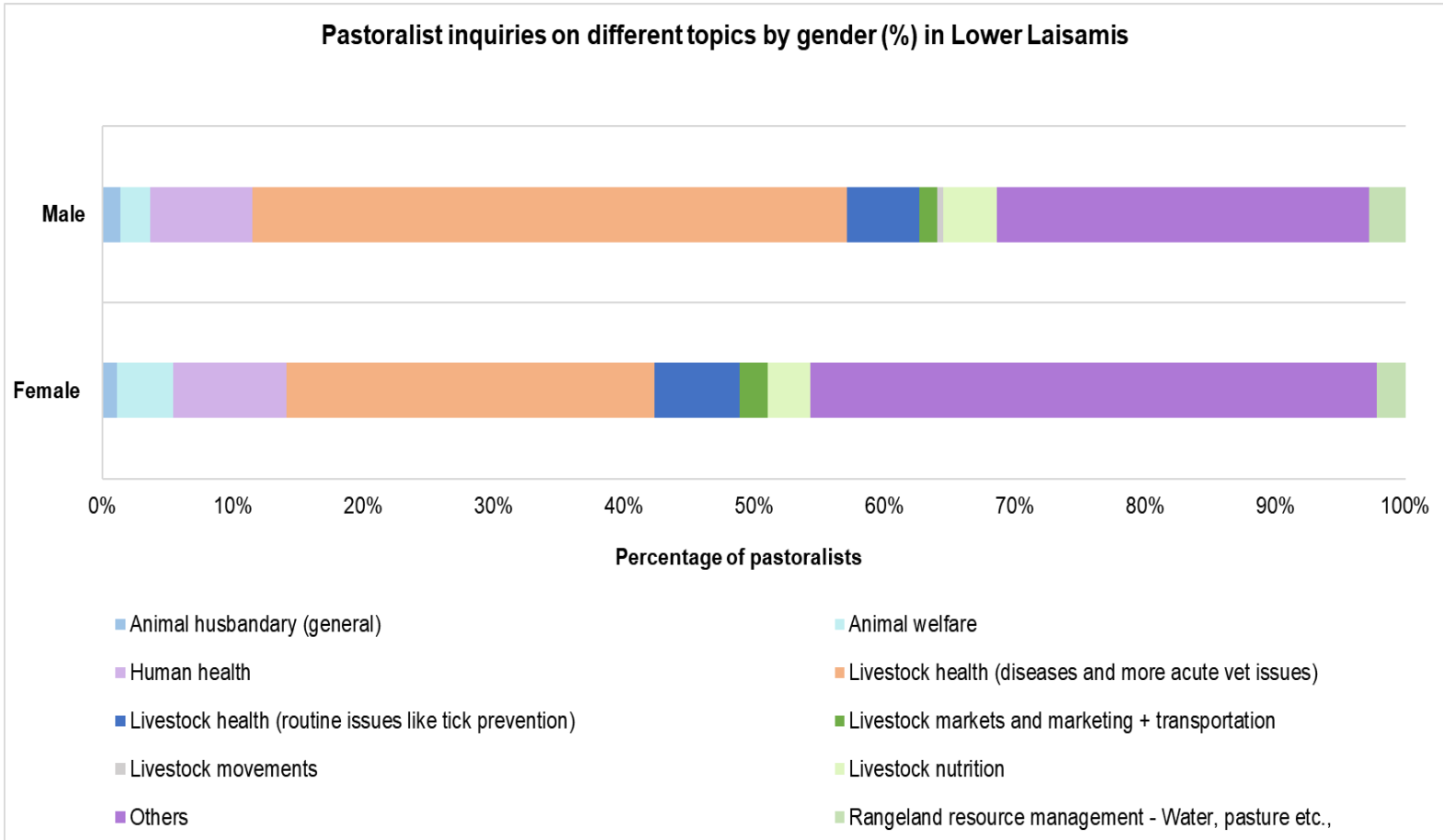
- 4 VIFs in Kenya and Namibia each
- Provide access to internet to community members
- Available on set days in known location
- Support community with technology training
- Collect data on information requests of pastoral communities



# 3 App Co-design

## Assessment of information needs - Voluntary information facilitators (VIF)

Pastoralist inquiries on different topics by gender (%) in Lower Laisamis



# 3 App Co-design

## Co-design of Rangeland app

### Co-design teams

- *Lchekuti Lolkiliku* – herders of information
- *Aburtu finn borri* – scouts for a better future
- Characteristics of members:
  - Trustworthiness & responsibility
  - Knowledge & experience
  - Leadership & representation
  - Commitment to others
  - Effective communication

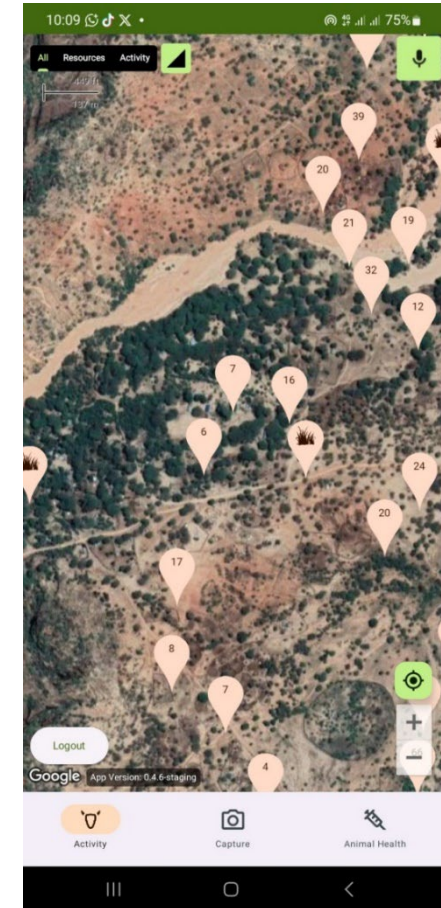
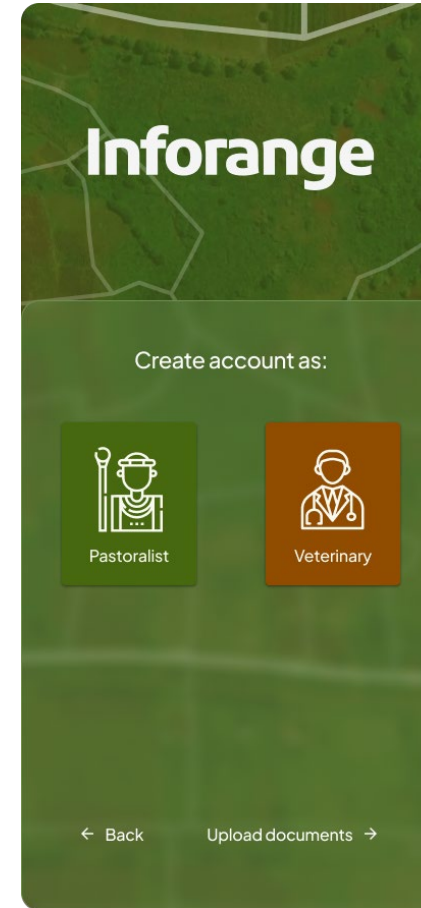


# 3 App Co-design

## Co-design of Rangeland app – High fidelity prototype

Main features of InfoRange Rangeland app

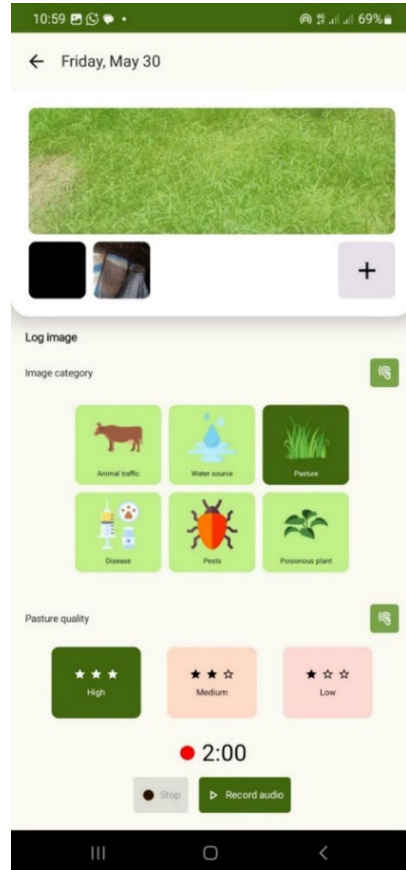
- Basic layer: Satellite maps with landmarks relevant to pastoral land users and grazing unit borders
- Rainfall layer: Regular update of remotely sensed spatial rainfall distribution data (TAMSAT)
- Vegetation layer: vegetation classification agreed upon by users
- User generated information
  - Photos and voice messages on vegetation, poisonous plants, water availability, predators, ectoparasites.....



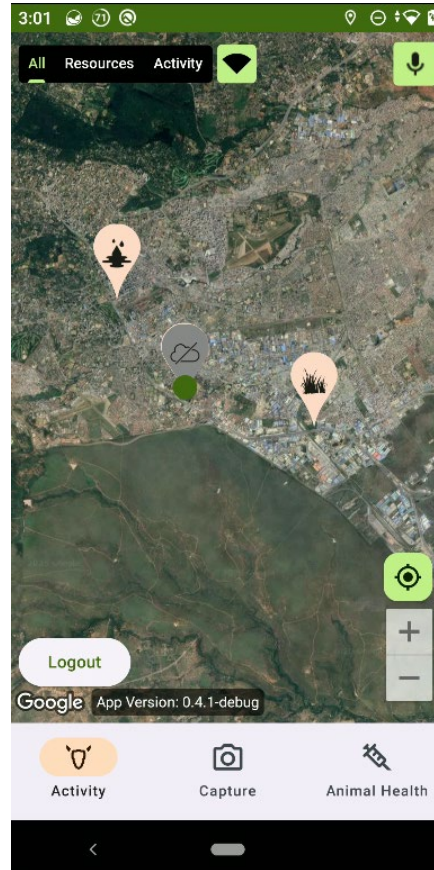
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# 3 App Co-design

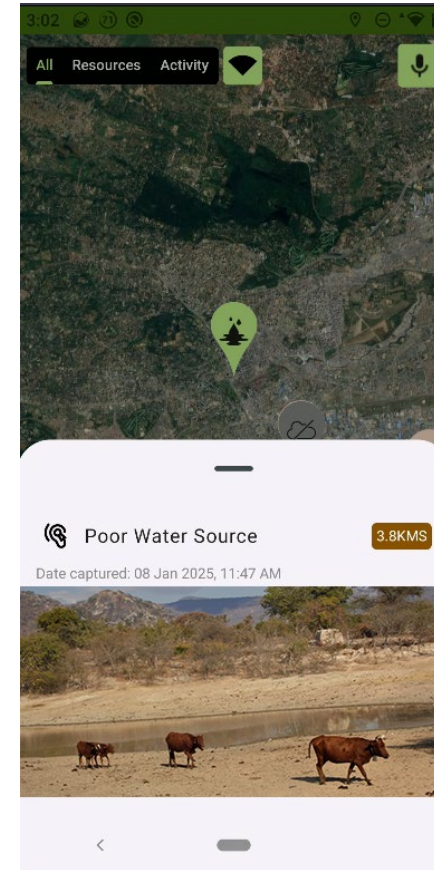
## Co-design of Rangeland app – High fidelity prototype



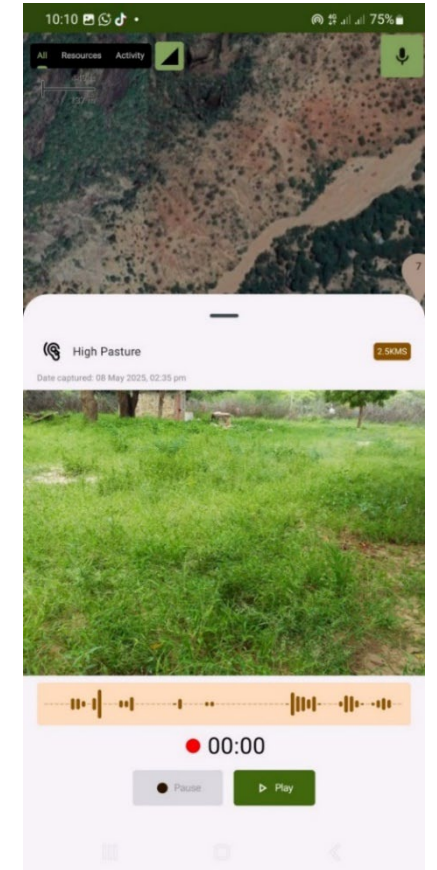
Choice of info



Pins after posting



Viewing pin



Viewing pin



# 3 App Co-design

## Co-design of Veterinary app

### Actor groups involved in the app co-design

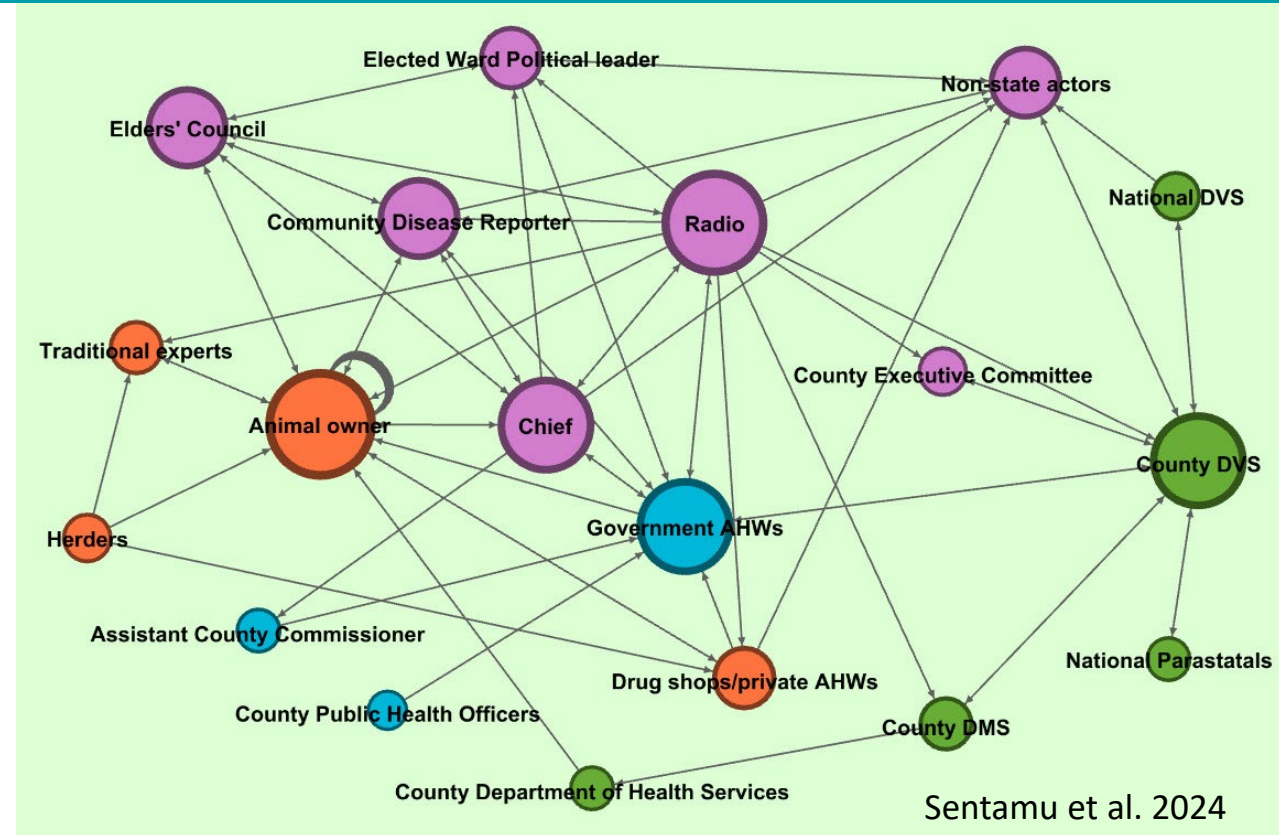
- Livestock owners and herders
- Community disease reporters
- Governmental animal health workers
- Agrovets and other private vets



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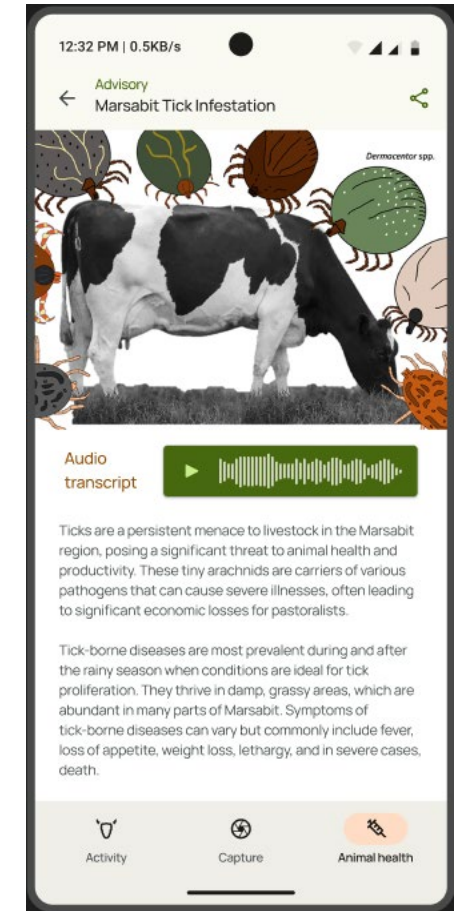
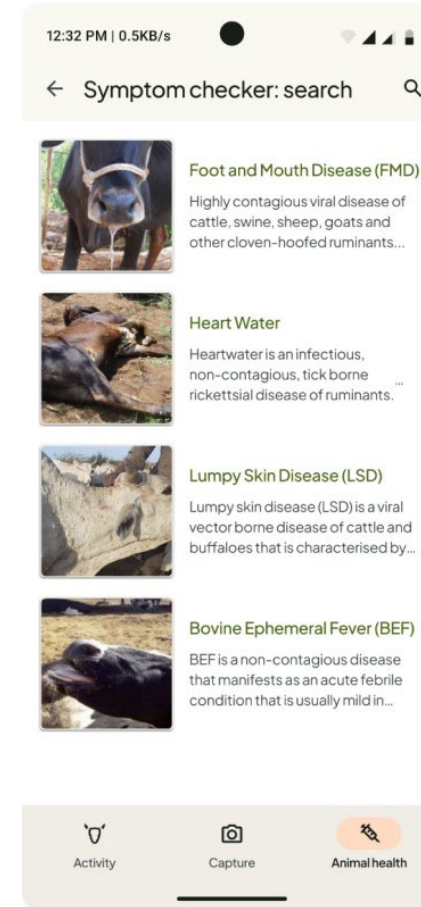
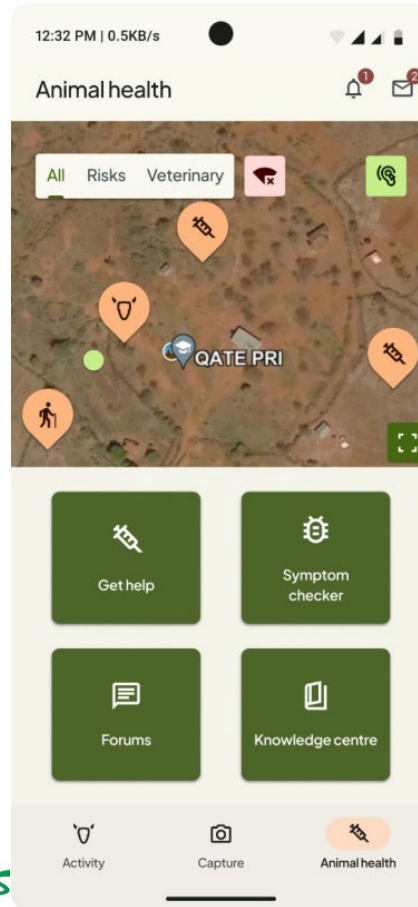


Stakeholders involved in livestock reporting and response

# 3 App Co-design

## Integrating indigenous veterinary knowledge in App knowledge center

- AI Model to formalising indigenous and scientific knowledge
- Enables a shared understanding
- Supports adaptive and intuitive user interfaces



**THANK YOU FOR YOUR ATTENTION**



# ACKNOWLEDGEMENTS

We are very thankful to the pastoral communities in Kenya and Namibia for their collaboration in the project.

Equally we thank the Voluntary Information Facilitators, the translators and field assistants in both countries for their engagement.

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Federal Ministry  
of Research, Technology  
and Space

# FONA

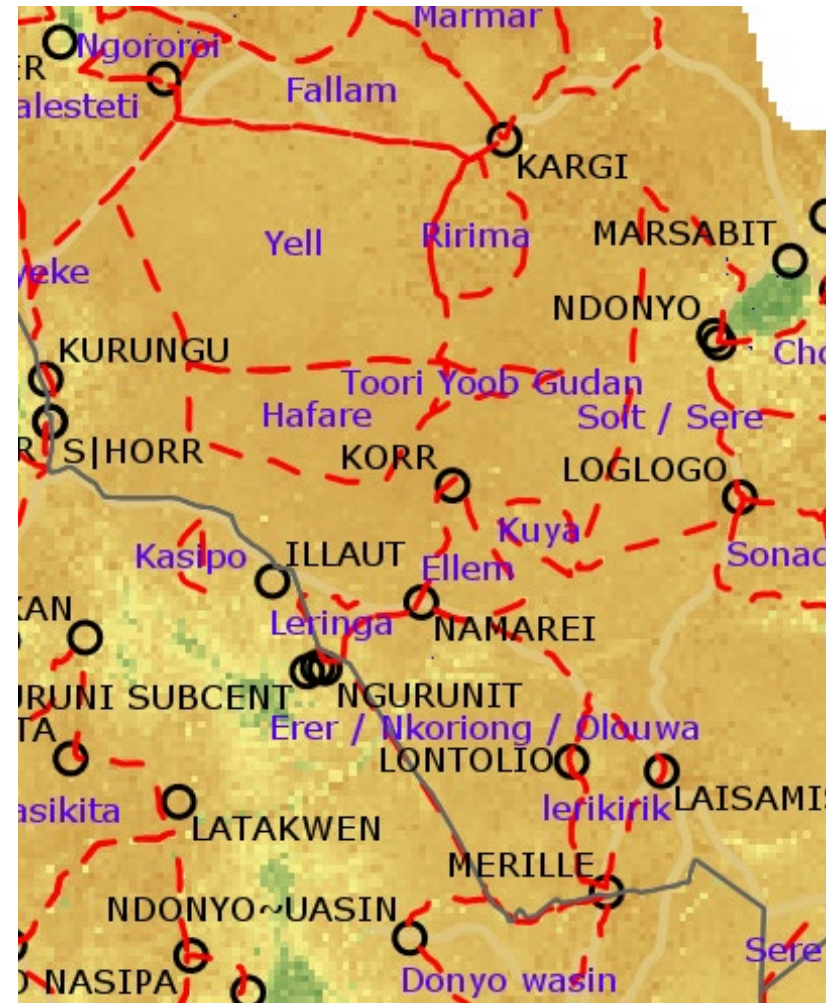
Research for Sustainability

# Limitations of already available apps: pastoral production



- Aims at providing up-to-date information on fodder availability
- Limited involvement of users
- Rangeland resource monitoring based on NDVI

Screen view in Afriscout from one project location in Kenya

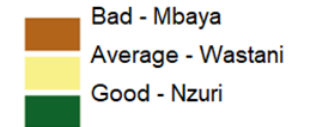


## Laisamis

Grazing Conditions

October 20, 2023

Legend / Ufunguo



# Limitations of already available apps: veterinary service provision



- County wide disease surveillance systems
- Information flows from community disease reporters to directorate of veterinary services in Nairobi
- Focus on disease outbreaks
- No communication between pastoralists and veterinary service

