Interface of Animal Genetic Resources, Biodiversity and Climate Change

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University of Edinburgh, United Kingdom
Outline

• The Need for Livestock Biodiversity
  » What role will Biodiversity play in helping the world’s poorest people?

• The Need for National and International Frameworks
  » What must government do?

• The Need for Research and Development
  » What are the new opportunities?
1. The Need for Livestock Biodiversity
Drivers for Change

- Livestock are a focal point for
  - Lifting people out of poverty into sustainable livelihoods
Drivers for Change

• Livestock are a focal point for
  » Lifting people out of poverty into sustainable livelihoods
  » More than products, transport, power etc
    • consumption smoothing
    • saving
    • insurance
    • social integration
    • management of climatic uncertainty
Drivers for Change

• Livestock are a focal point for
  » Lifting people out of poverty into sustainable livelihoods
  » Satisfying global demands for livestock products
  » Promoting international trade

• Production must
  » Respond to new patterns of demand
  » Reduce impact on environment

• Broad conclusion: need for sustainable intensification!!!
Policy Drivers for Livestock

• Livestock are a focal point for
  » Lifting people out of poverty into sustainable livelihoods
  » Satisfying global demands for livestock products
  » Promoting international trade
• Production must
  » Respond to new patterns of demand
  » Reduce impact on environment
• Broad conclusion: need for sustainable intensification!
Breed Erosion

• Change creates new market pressures on breeds
  » changing economics of inputs and outputs
  » changing market demands
  » breeds survive if ‘fit for purpose’ else ...

• Current markets favour breeds of high inputs with high outputs
  » these breeds survive

• Other breeds decline and become vulnerable

• Vulnerable breeds are lost
  » conflict, disease, flood, drought
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# How Severe is Breed Erosion?

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<tr>
<th>Risk Status</th>
<th>Actual %</th>
<th>State Of The World Report</th>
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<td>At Risk</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Not at Risk</td>
<td>35</td>
<td></td>
</tr>
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- More than 1 in 3 breeds of ‘unknown’ status!
- Likely status of ‘unknown’
  - 40% ‘at risk’!
### How Severe Is Breed Erosion?

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<td>10</td>
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- > 1 in 3 breeds are predicted to be ‘at risk’
- ~ 1 in 10 ‘extinct’
- ~ 1 in 2 ‘secure’
Is This A Problem?

- No ... not with certainty and stability
Is This A Problem?

- But we have no longer have certainty and stability!
- We have rapidly changing demands and markets
  » an uncertainty, but a ‘familiar’ one
Is This A Problem?

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Uncertainty!
Is This A Problem?

- But we have no longer have certainty and stability!
- We have rapidly changing demands and markets
  - an uncertainty, but a ‘familiar’ one
- Now there is a scientific consensus:
  - climate change is happening
  - we should expect a rapid global warming
  - humans have contributed and continue to do so
    - Intergovernmental Panel on Climate Change 2007
Is This A Problem?

• But we have no longer have certainty and stability!
• Scientific consensus on:
  » there is climate change
  » we should expect a rapid global warming
  » humans have contributed and continue to do so
  • Intergovernmental Panel on Climate Change 2007

Change not stability!
How Much Change?

- Degree of climate change is open to debate
- Not all climate model parameters are known accurately
How Much Change?

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Uncertainty!
Some Predictions

Length of Growing Season

- expectations for Africa
- widespread reduction predicted

Thanks to CGIAR for map.
Some Predictions

Length of Growing Season
- expectations for Africa
- widespread reduction predicted

BUT
- model assumes global cohesive response

Thanks to CGIAR for map.
Some Predictions

Length of Growing Season
- this model assumes less cohesion

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Some Predictions

Length of Growing Season
- this model assumes less cohesion

Uncertainty!

Thanks to CGIAR for map.

13 & 14 February 2008
Bioversity: Climate Change and Biodiversity for Food and Agriculture
What Will Be Required of Livestock?

- Other implications of climate change
  - production systems will change to meet the trends
    - e.g. crops for bio-fuels
  - changes in market values
  - cause of conflict for resources
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  - production systems will change to meet the trends
  - e.g. crops for bio-fuels
  - changes in market values
  - causes of conflict for resources

Uncertainty!
Meeting the Needs of our Children

• What will be required of our livestock?

• Need full range of genetic diversity to secure the needs of tomorrow
  » a coherent risk management strategy
  » risk is not theoretical!
Breed Variation is Vital

- In livestock diversity lies both within and between breeds
- Commonly held that 50% of variation is between breeds
- For fitness and adaptation, scientific evidence is > 50%
- Within breed variation is
  - important but limited
  - cannot be selected fast enough
- Breed variation
  - major source for fitness & adaptation
  - can be deployed quickly
    - paradoxically same reason that underlies much of breed loss!
Breed Variation & Climate Change

• Climate change increases chance of catastrophic events
• Recovery from catastrophes depends critically on adaptation
  » Simple example ... ½ herd lost due to drought

<table>
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<tr>
<th>Reproductive rate</th>
<th>1.05</th>
<th>1.10</th>
<th>1.20</th>
<th>1.5</th>
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<tr>
<td>Recovery time</td>
<td>15</td>
<td>8</td>
<td>4</td>
<td>2</td>
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• Breed performance in extreme often more important than average performance
Breed Variation & Climate Change

- Range of options for using livestock genetic resources to manage uncertainty
  - not only purebreeding and crossbreeding
  - e.g. multiple breed strategies
    - maintaining mix of breeds
    - breeds of high productivity to capitalise on good times
    - breeds of high adaptation to buffer bad times

- Livestock diversity adds resilience to agricultural production systems
Breed Variation is Vital

• Commonly held at 50% of variation is between breeds
• For fitness and adaptation, scientific evidence is >90%
• Within breed variation is
  » limited
  » cannot be selected fast enough
• Breed variation
  » major source
  » can be deployed quickly
  • paradoxically same reason that underlies much of breed loss!
Summary

- Time of rapid change
- Uncertain future
  - needs, markets, production environments, production systems
- Breed variation hold important variation
- Breed variation is being *selectively* lost
  - towards a single ‘basket’ suited only for current needs
- Need for breed conservation strategy *now* that is
  - comprehensive
  - global
- Breed variation mitigates climate change, adds resilience
2. The Need for Frameworks
International Frameworks

- Agrobiodiversity should be made a basic component of climate change adaptation strategies
- No co-ordination of international agreements
  
  Dr Belgis Osman-Elasha
  
  » UN Framework Convention on Climate Change
  » Convention on Biological Diversity
  » International Treaty on Plant Genetic Resources
International Frameworks

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Dr Osman-Elasha

» UN Framework Convention on Climate Change
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» Interlaken Declaration & Global Plan of Action for Animal Genetic Resources

September 2007
International Frameworks

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September 2007

- Needs to be implemented!
National Framework

At community level
- Social issues dominate over environmental
- What is government doing?

Dr Trevor Hill
National Framework

At community level

- Social issues dominate over environmental
- What is government doing?

Dr Trevor Hill

- Need for
  - development direction to be understood
  - enabling policies in place
  - cohesive policies
  - support services
Development of Breeding Guidelines

DECIDE Activities and Services

1. Setting Livestock Development Objectives

2. Establishing Livestock Development Strategy

3. Deciding upon AnGR

4. Defining the Breeding Goal

5. Effective Crossbreeding

6. Effective Straightbreeding

- Making Investment Decisions
- Establishing Recording Schemes
- Forming Breeding Associations
- Developing Technical Support

Glossary
Here are the traditional ‘breeding activities’
Development of Breeding Guidelines

- Major part of Guidelines involve Governments
  - Setting Livestock Development Objectives
  - Establishing Livestock Development Strategy
  - Deciding upon AnGR
- It is here that Biodiversity, Climate Change Adaptation & Mitigation needs to be addressed nationally!
Summary

• Need to integrate global plan of action with other international frameworks
• Need to implement Global Plan of Action
• Need to encourage coherent national development objectives and livestock development strategies
3. Research and Development Needs
Research and Development Needs

- Wide area!
- Focus on just one aspect, genomics
Research and Development Needs

• Technology is developing very, very rapidly
  » 10 years ago biodiversity study with 30 loci was ‘state of the art’
  » today 50,000 loci genome wide is cheaper, quicker, less error prone
  » can look within genomes for patterns of diversity

• FAO’s MoDAD provided guidelines for genetic diversity studies
  » gave such studies scientific credibility
    • highly successful initiative
  » require revision to guide application of new technology
Research and Development Needs

- Disease is a continual challenge
- Climate change is expected to create additional challenges
  - e.g. Bluetongue
- New technology offers new approach to using variation to increase resistance
  - selection within breeds
  - identified QTL introgressed between breeds
  - reduced requirement for pedigree, long-term phenotyping
  - need to have proof of principle studies
  - John Williams will give more details
4. Conclusions
Conclusions

- Livestock provide a route for sustainable livelihoods
- Livestock diversity has an essential role in mitigating climate change, and adding resilience
- Need integration of international frameworks, including Interlaken Declaration and Global Plan of Action
- Need implementation of Global Plan of Action
- Need governments to develop coherent livestock strategies
- Need to take advantage of new scientific opportunities arising from the technological revolution in genomics