Will African local breeds withstand the challenges of the 21rst century?

Irene Hoffmann

Beate Scherf, Paul Boettcher, Badi Besbes, Roswitha Baumung (AGAG)

Carolyn Opio, Tim Robinson (AGAL)

FAO

ALive Sixth General Assembly, Nairobi, 7 April 2011

Content

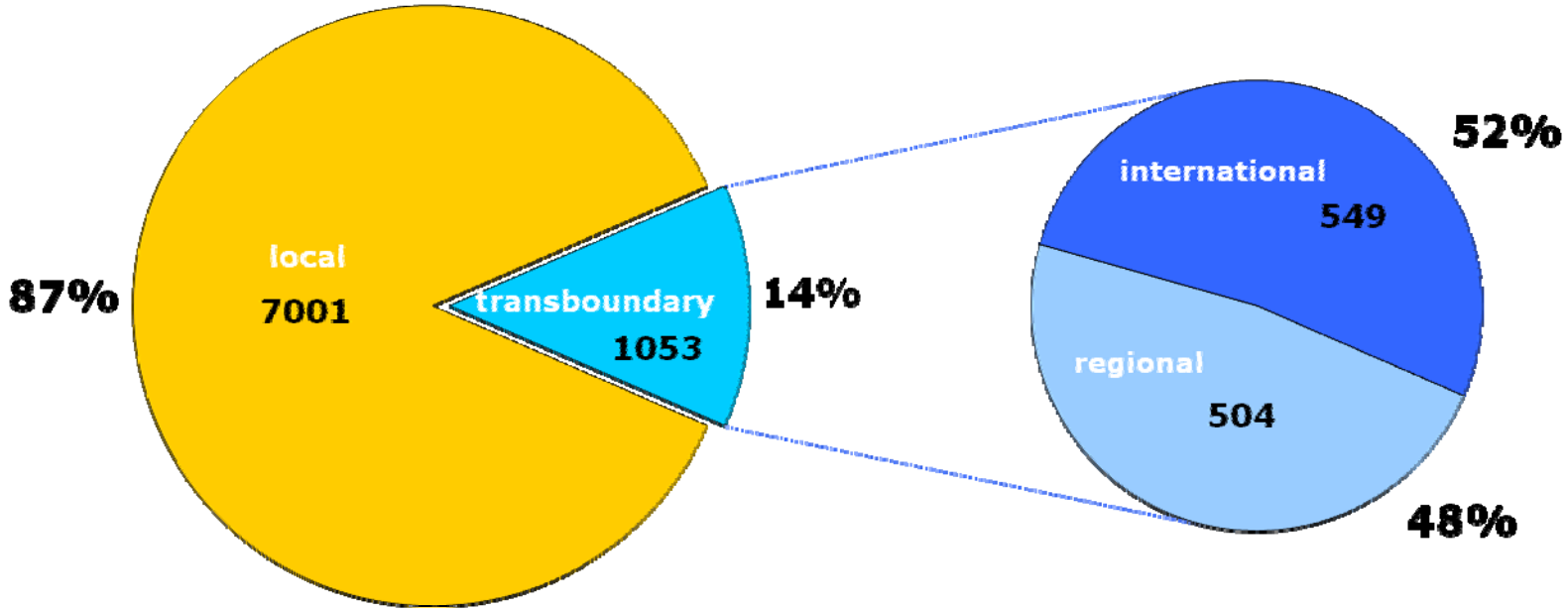
- Status and trends for breed diversity
- What are the challenges?
  - Sustainable production intensification
  - Resources constraints and climate change
- Opportunities
- R & D needs
- Conclusions

Status and trends of breed diversity

Updated Status of AnGR

Breed diversity – the global picture

8054 breeds reported

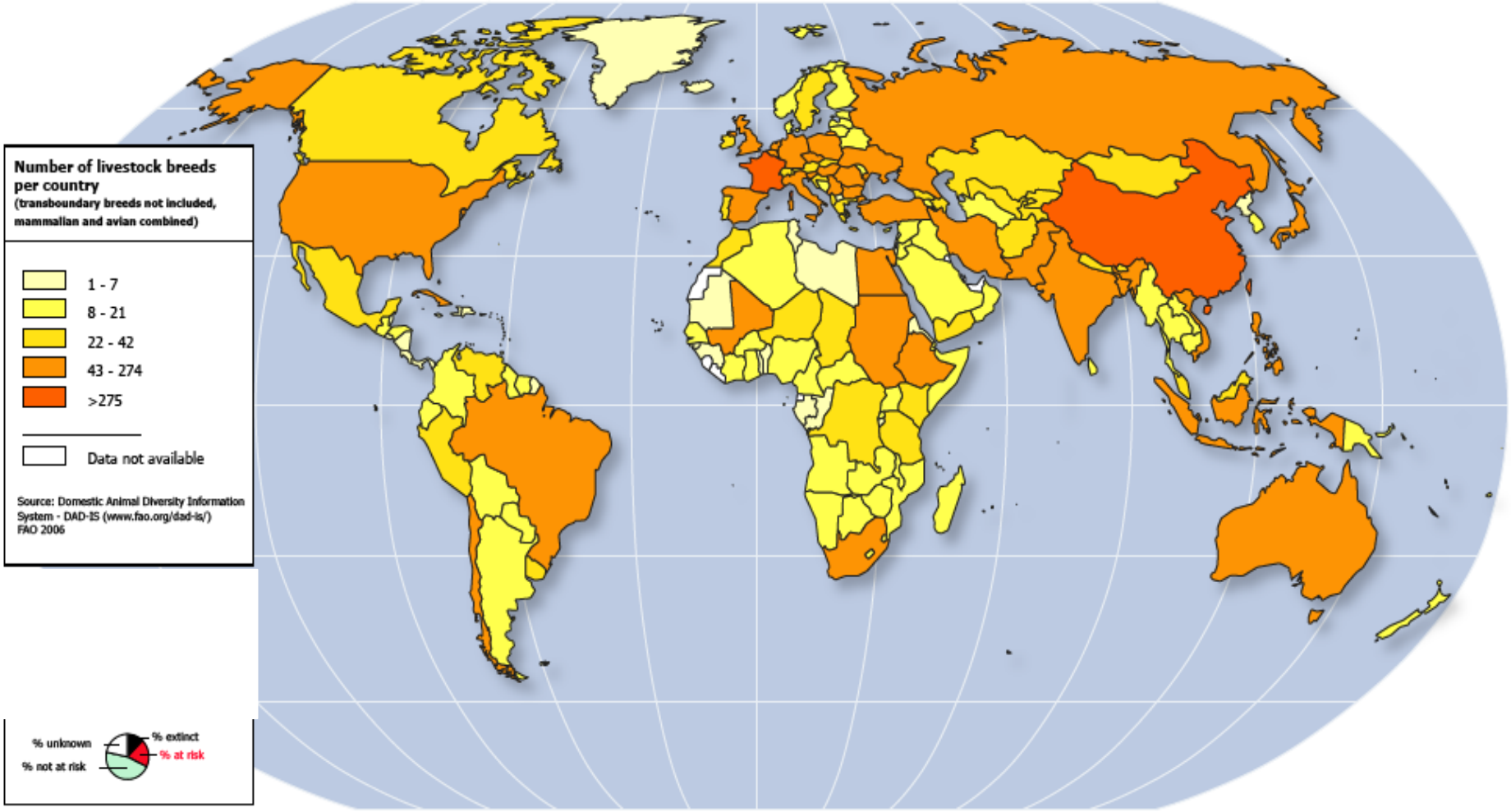


FAO, 2010

Local breeds

- In grassland-based pastoral and small-scale mixed crop-livestock systems
- Hill/mountain areas, agriculture based economies
- Low to medium external inputs
- Deliver a wide range of products and services
- Low production
- Not well characterized, adaptedness not understood
- Few structured breeding programmes
- Few conservation programmes
- Some breeds very localized

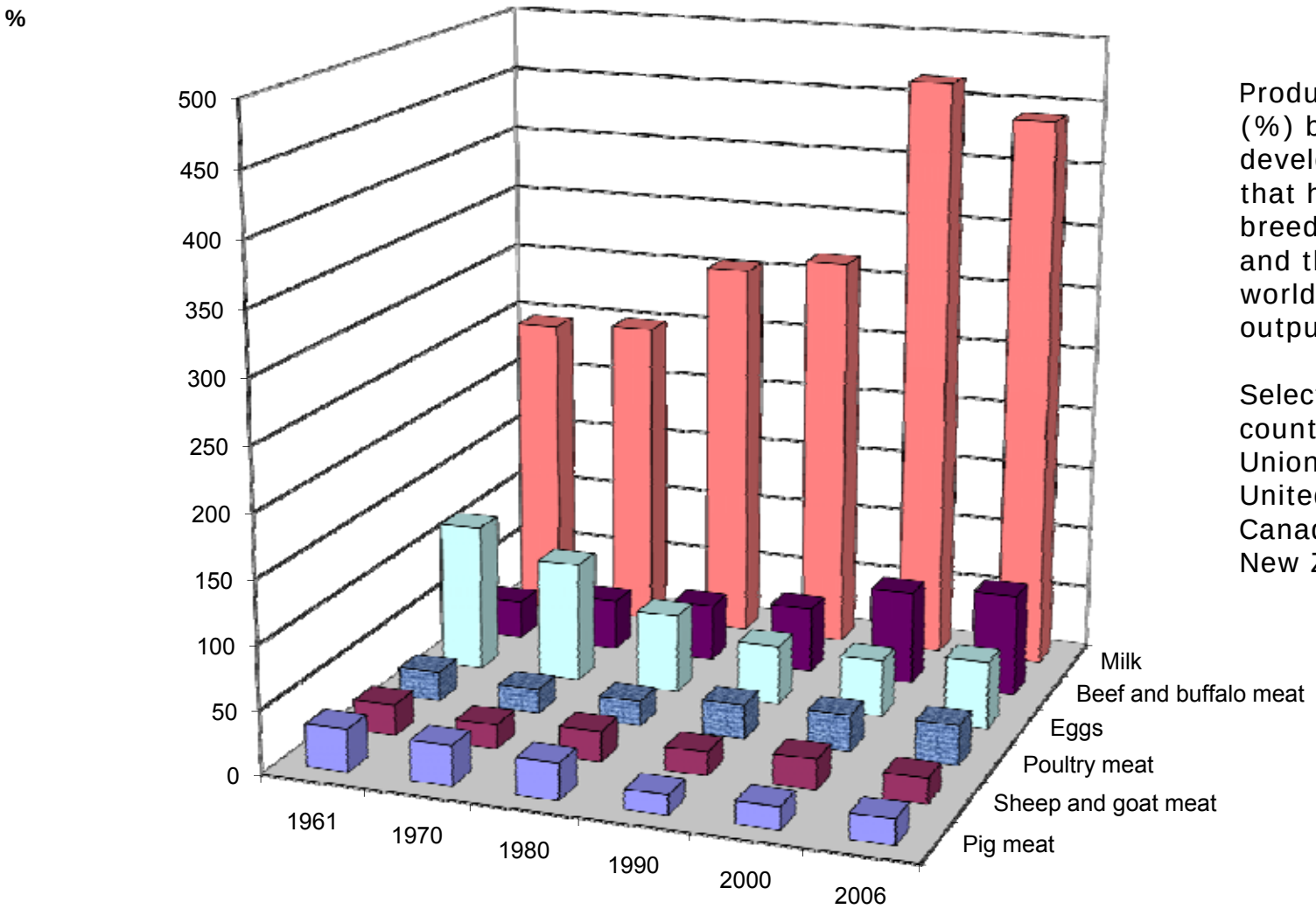
Local breeds by country



International transboundary breeds

- International transboundary breeds have spread globally for use in large-scale high external input systems
- Provide one special product for the market
- Well characterized (e.g. QTL)
- Efficient (global) high-tech structured breeding programmes
- Genebanks
  (for AI or conservation)

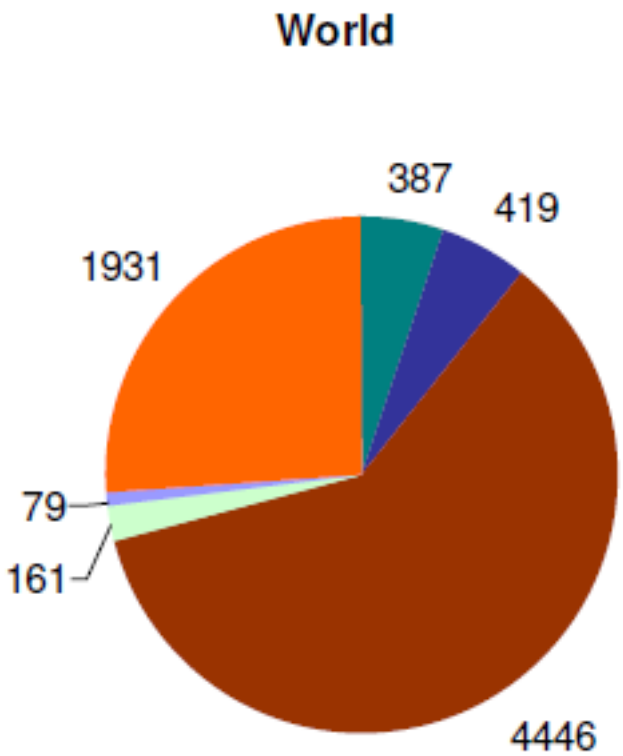
Production differential thru breeding & mgt.

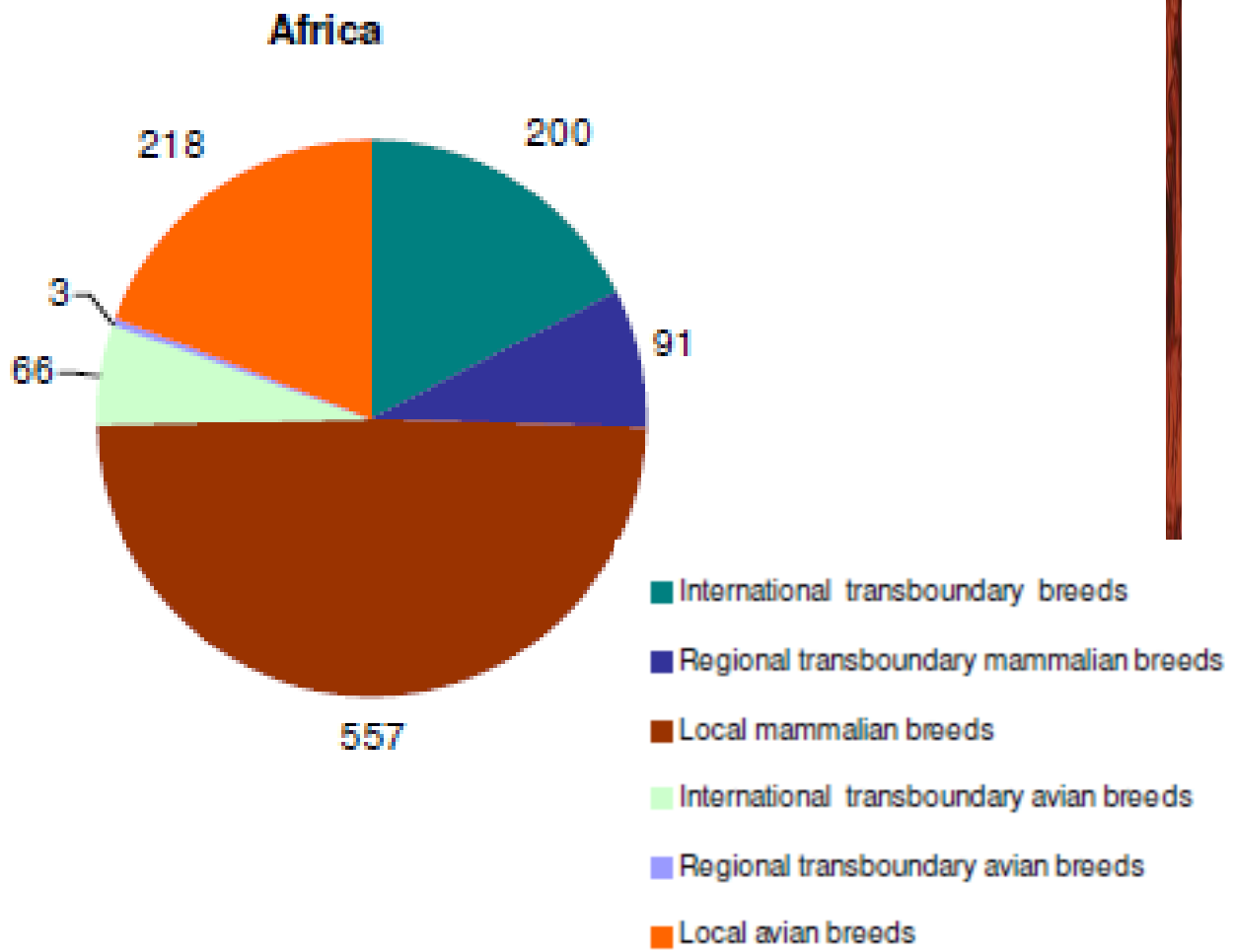


Production differential (%) between selected developed countries that have commercial breeding programmes and the rest of the world (production output/head)

Selected developed countries: European Union countries, United States, Canada, Australia, New Zealand

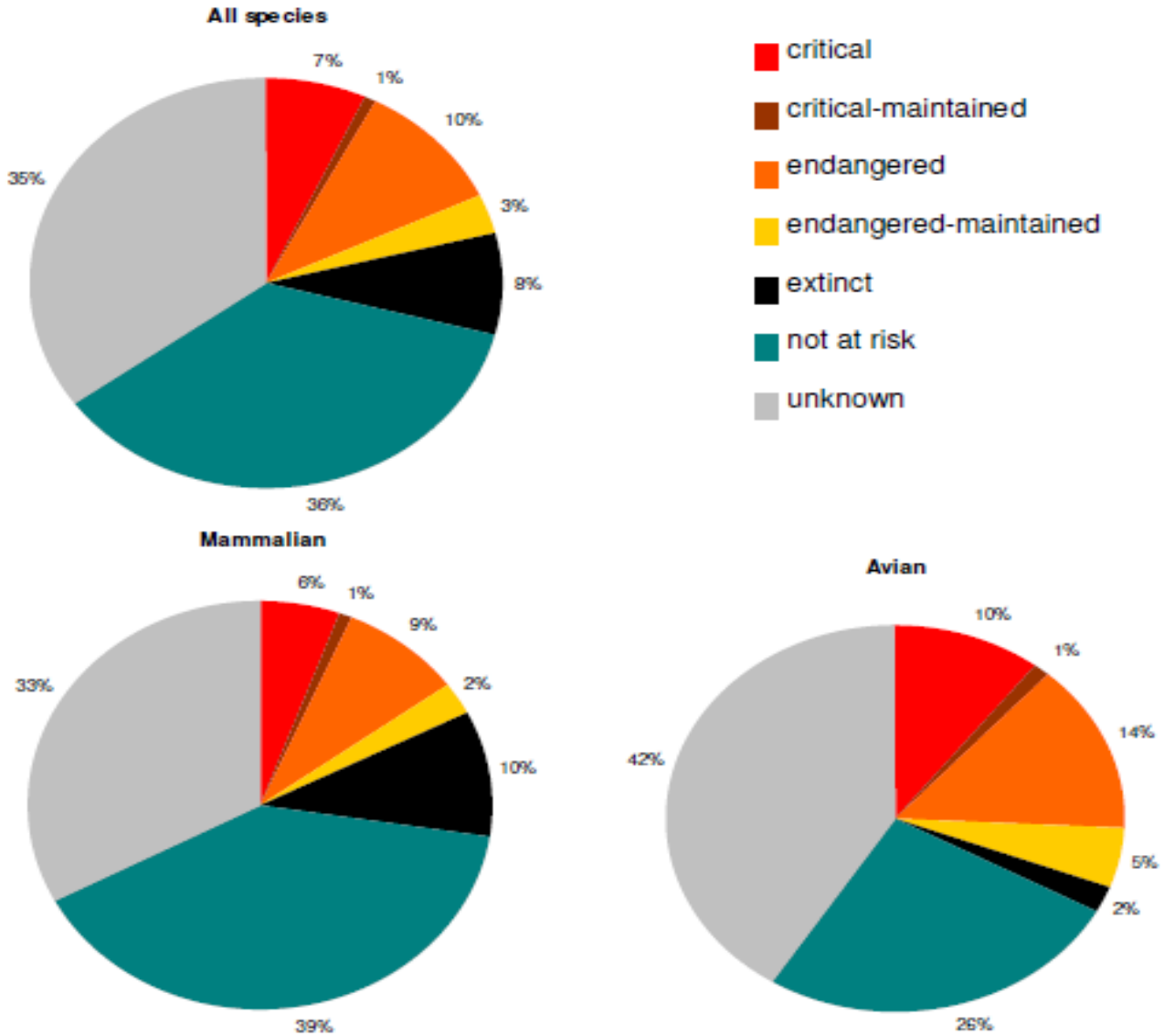
Local and transboundary breeds: Africa and global





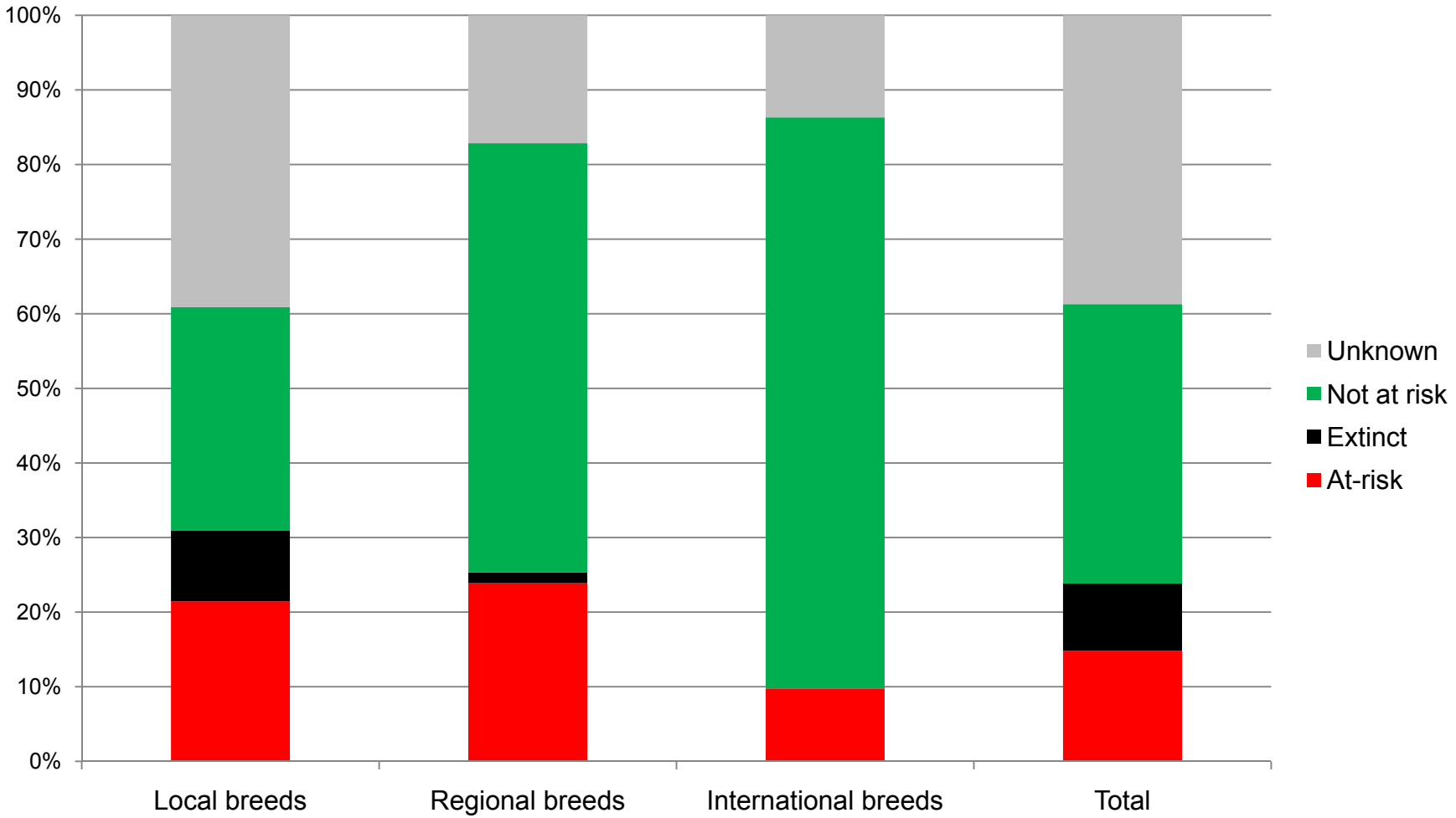
FAO, 2010

Proportion of the world's breeds by risk status category



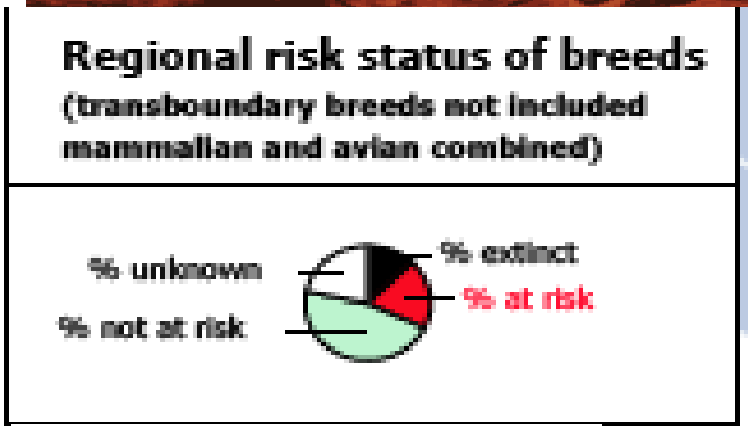
FAO, 2010

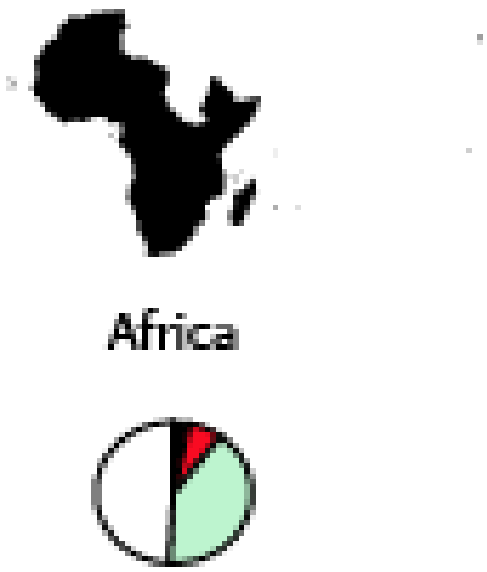
Risk status of local & transboundary breeds

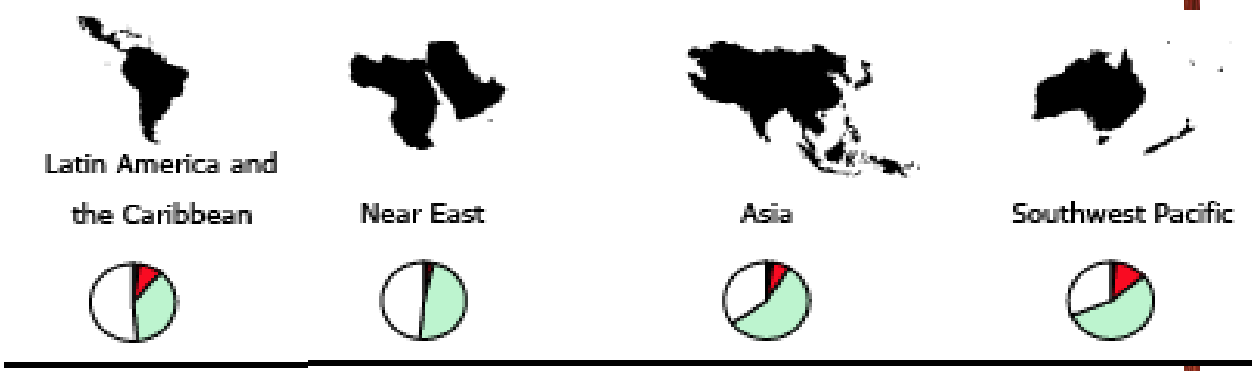


(DAD-IS 2010)

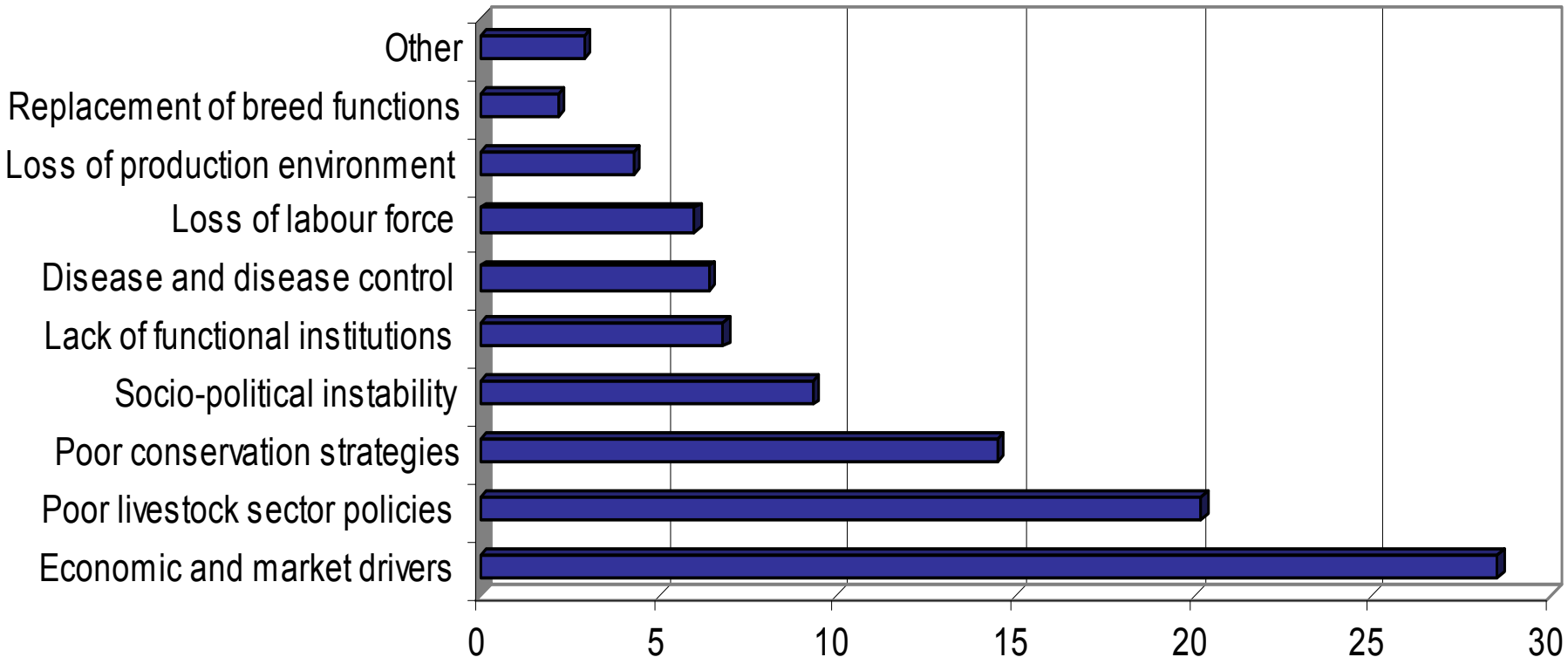
Local breeds - regional risk status





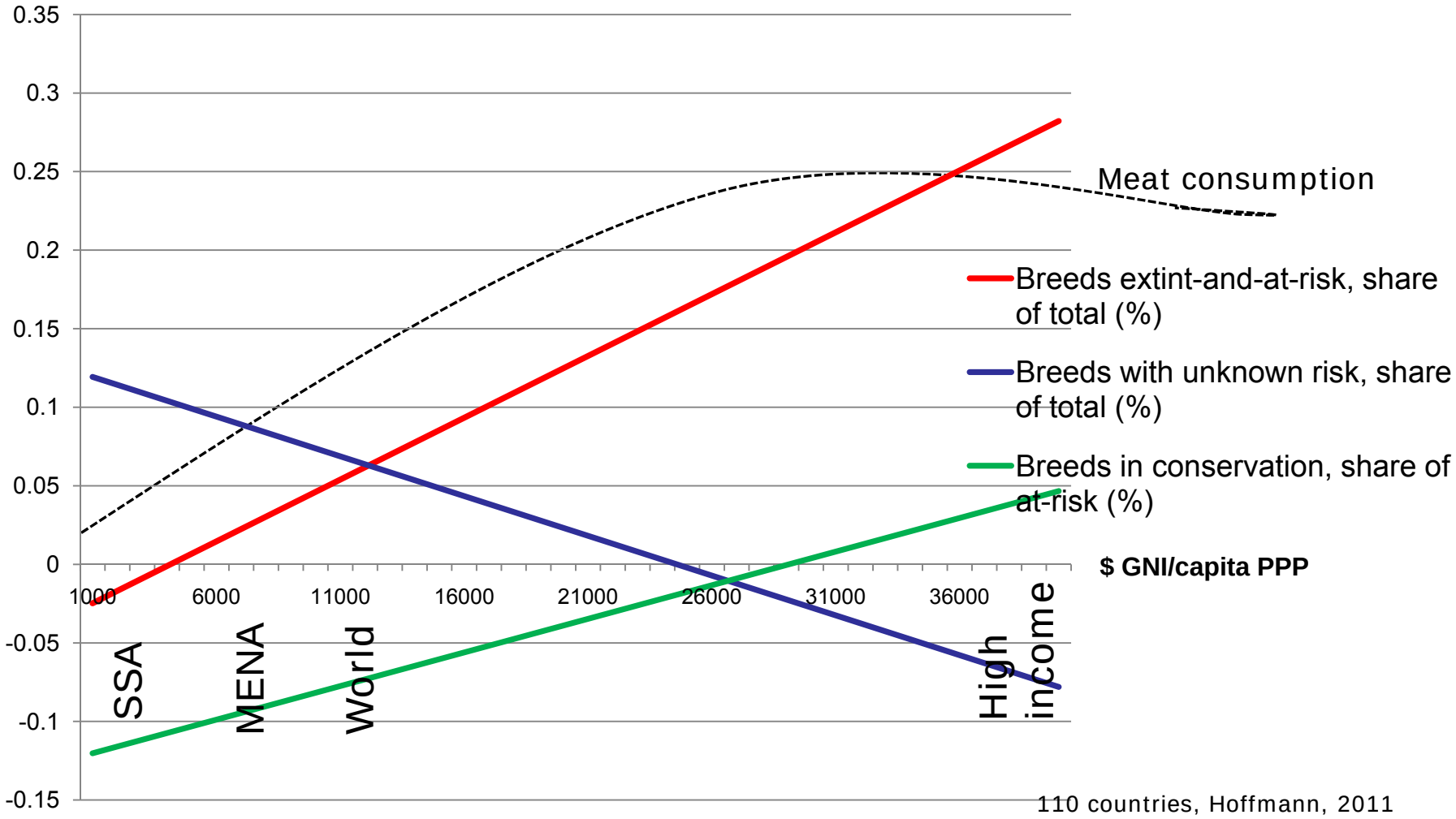


Main threats to breed diversity



FAO, 2009

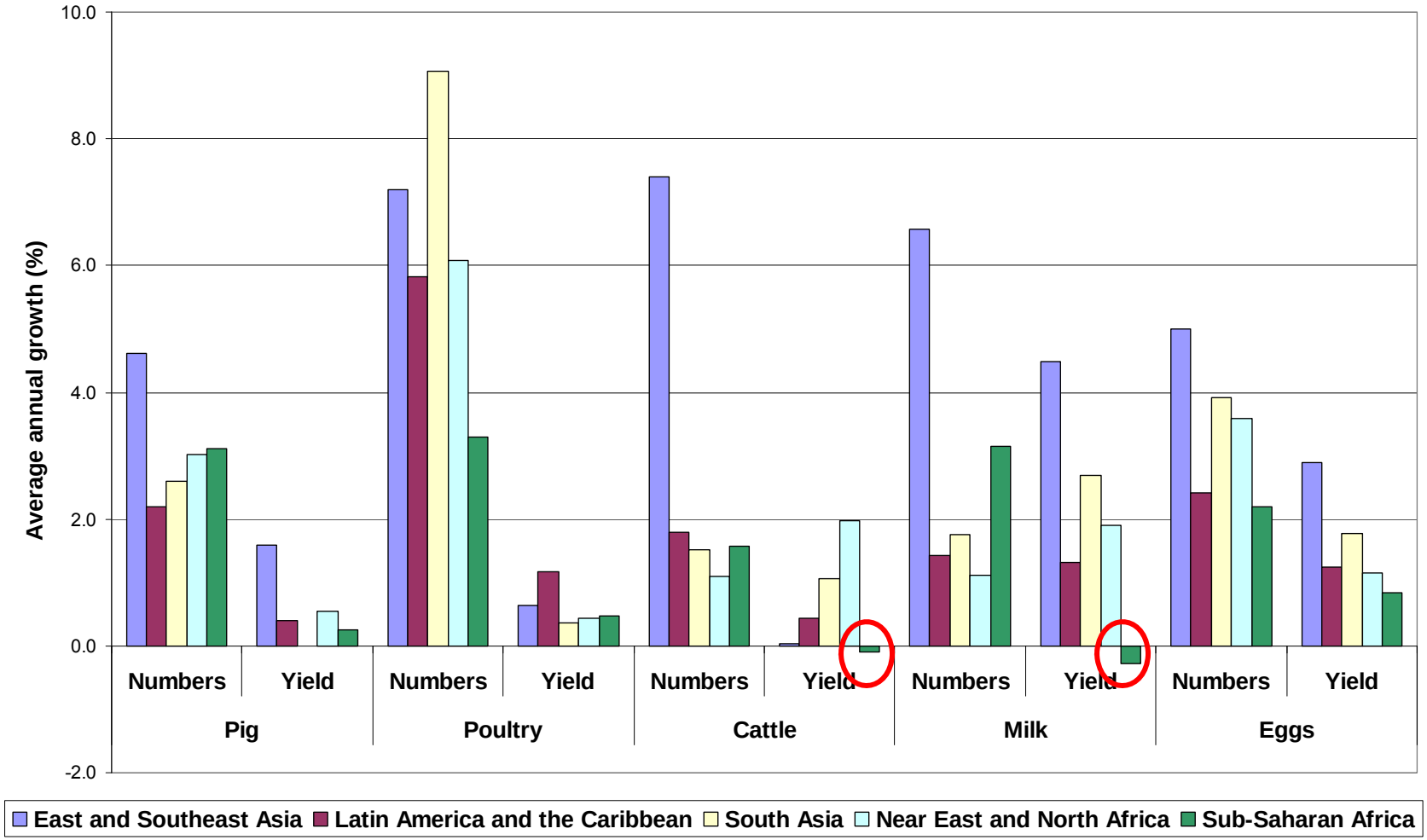
Breed shares and purchasing power



110 countries, Hoffmann, 2011

Food: Meat, milk, eggs - trends

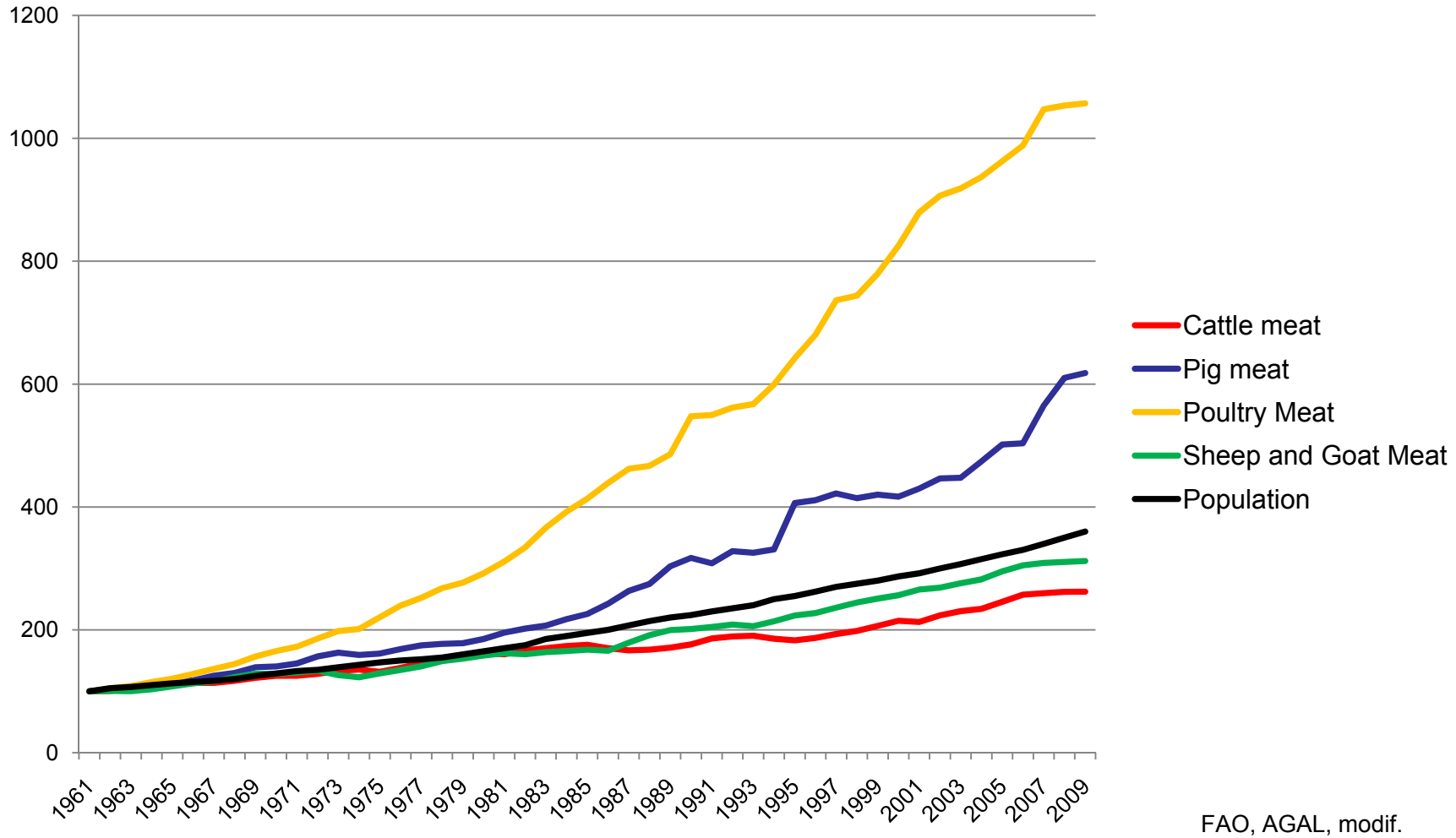
Growth in production: animal numbers and yields



(1980-2007)

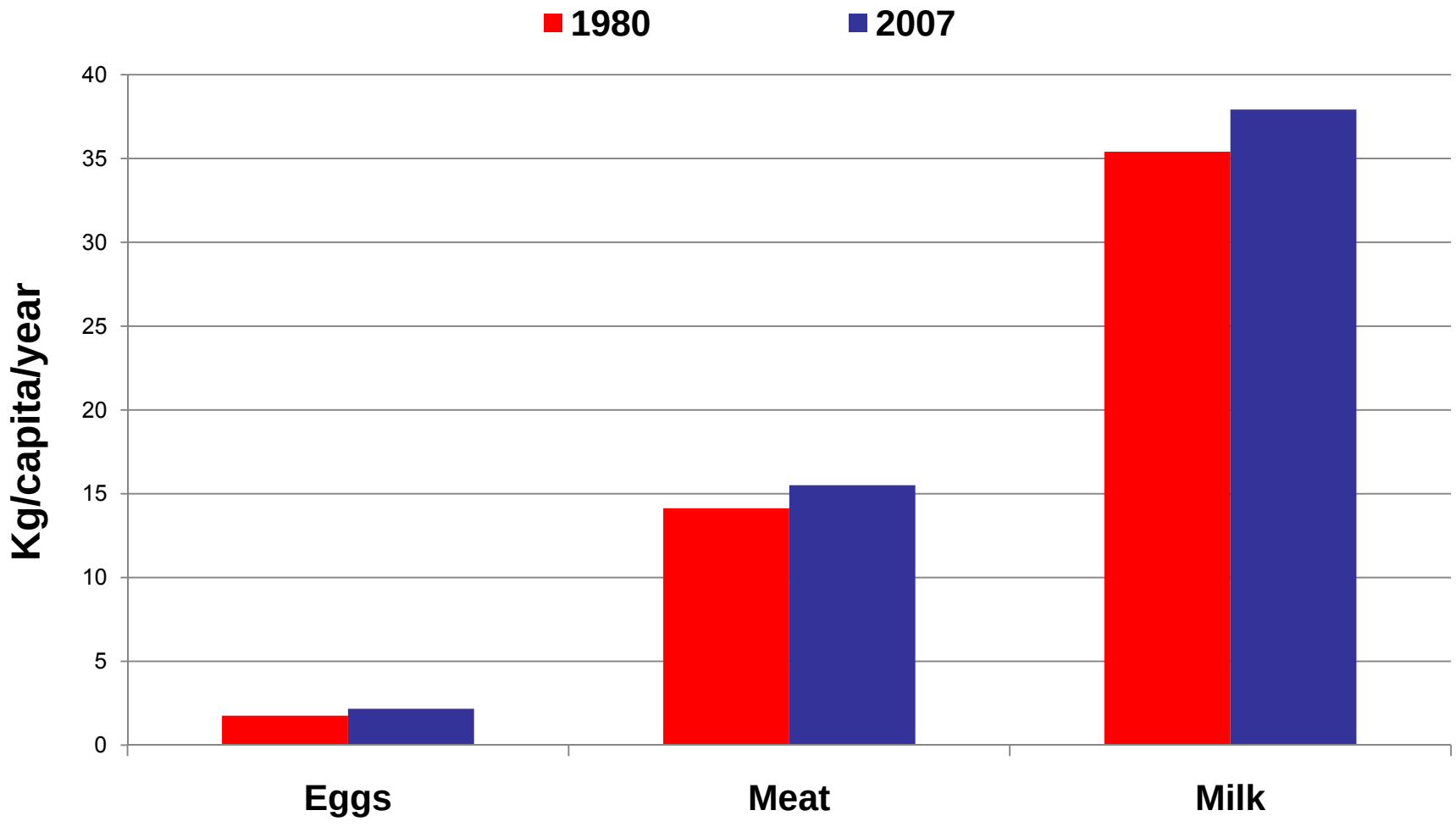
FAO, SOFA 2009

Meat production and population trends Africa (1961-2009)



FAO, AGAL, modif.

Consumption trends in Africa

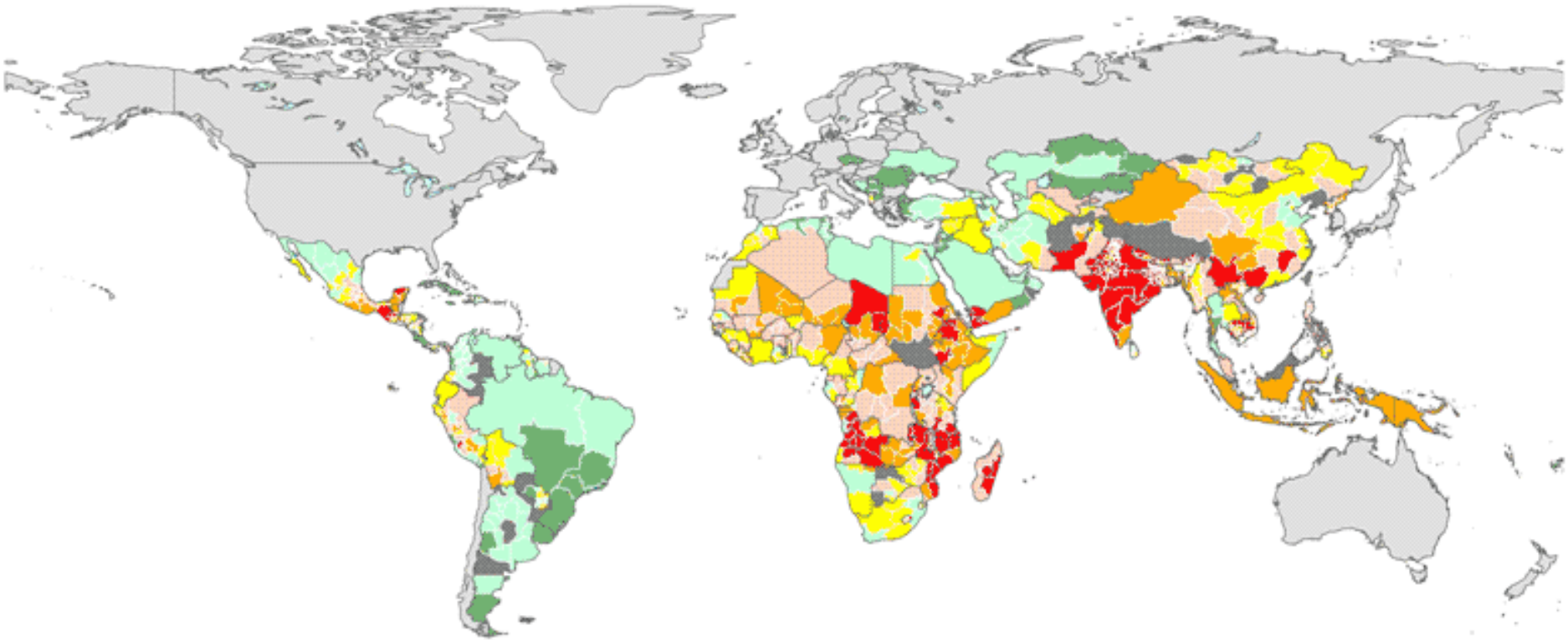


FAO, AGAL

FAO Poverty Mapping Project

Map 3.6: Prevalence of stunting among children under five, by lowest available subnational administrative unit, varying years

FGGD Module 3: Socio-economic and nutrition indicators



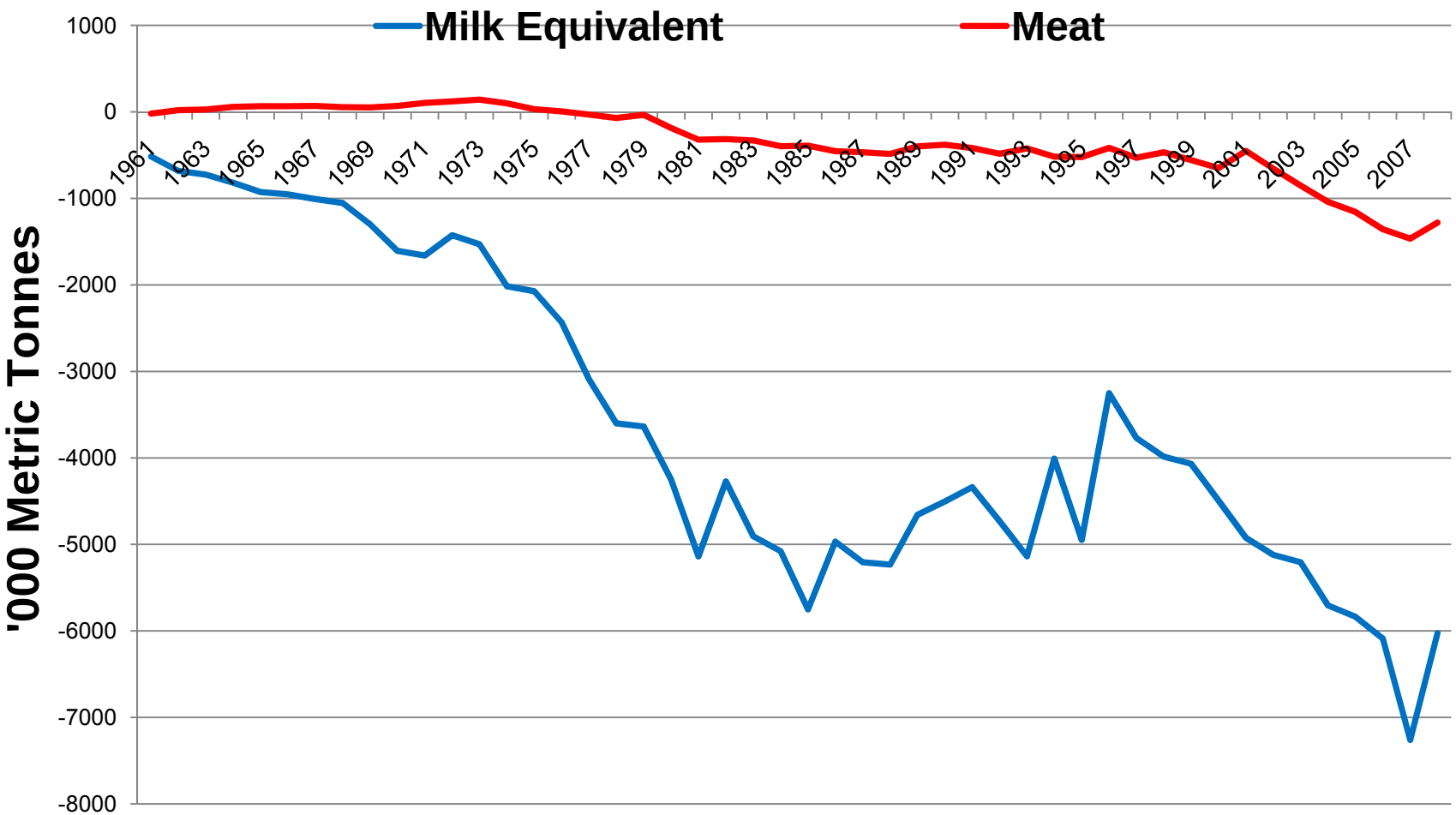
Percentage (%) of stunted children

- < 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- > 50
- not assessed
- no data
- inland water bodies

Reference: FAO. 2003. "Chronic undernutrition among children: an indicator of poverty". FAO/SDRN & ESNA, Rome.

This map was printed from the DVD included in "Food Insecurity, Poverty and Environment Global GIS Database: DVD and Atlas for the Year 2000", Environmental and Natural Resources Working Paper No. 26. FAO, Rome 2006.
The geographic representations employed on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, or of its authorities, or concerning the delimitation of its boundaries.
Please, see the full FAO disclamer in the above documents.
© FAO

Net trade in meat and milk: Africa



FAO, AGAL

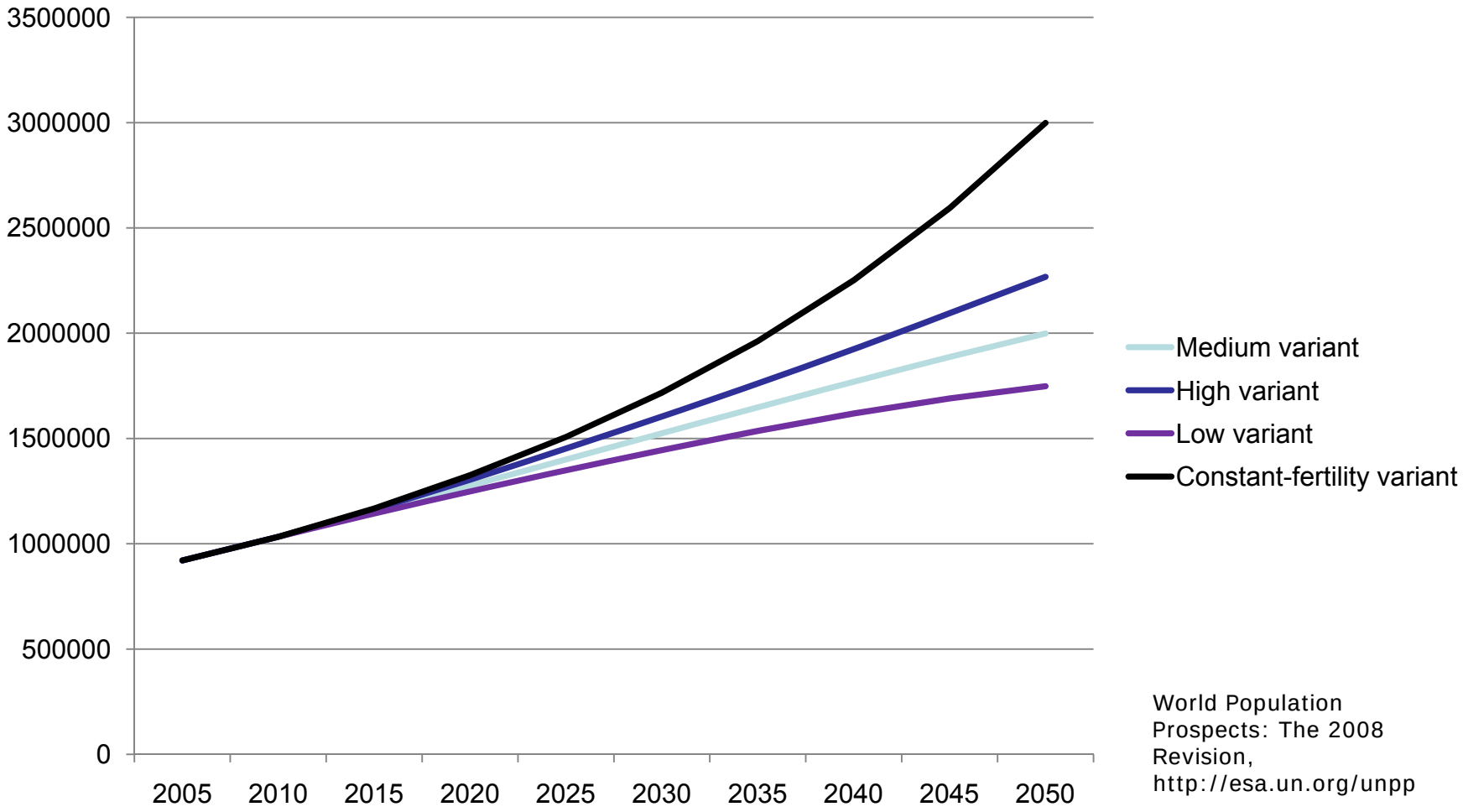
Promoting diversity

Challenges

Natural resources management and climate change adaptation/ mitigation

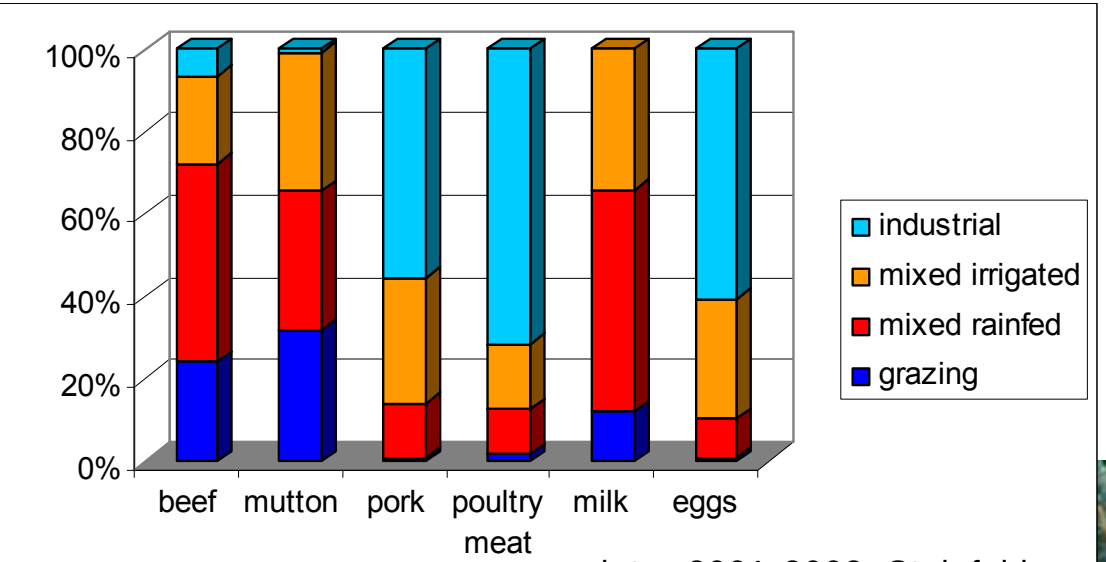
Food security and socio-economic development
Political stability

UN Population projections for Africa (1000)



World Population Prospects: The 2008 Revision, http://esa.un.org/unpp

Contribution of livestock production systems to food production

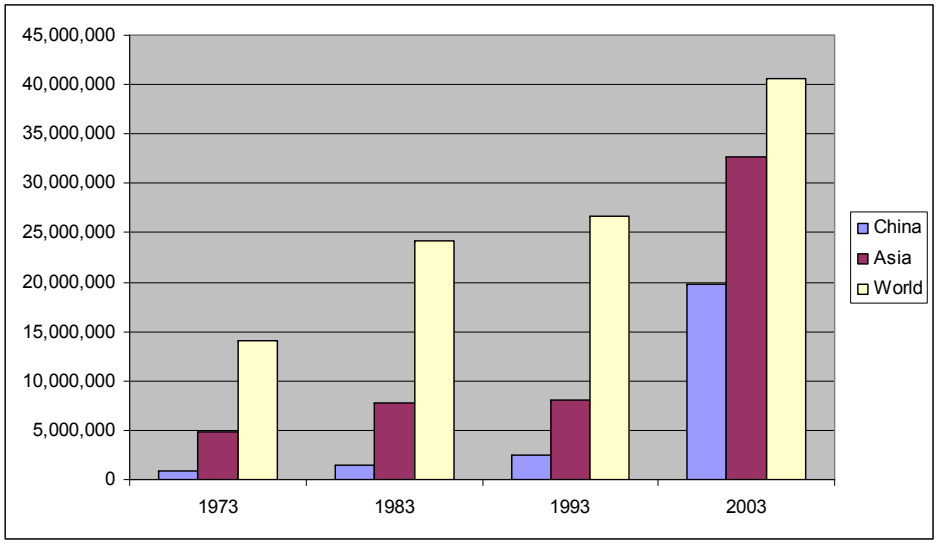


data: 2001-2003, Steinfeld et al 2006

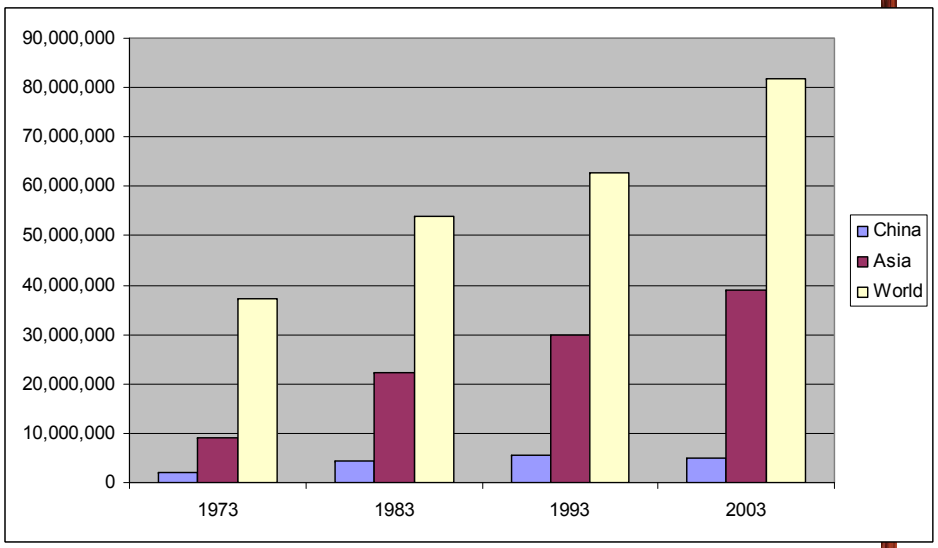
2009: 63% of pork, 73% of eggs and 79% of poultry meat globally from industrial systems

Increasing trade of feedstuff

Soybean imports (tons)



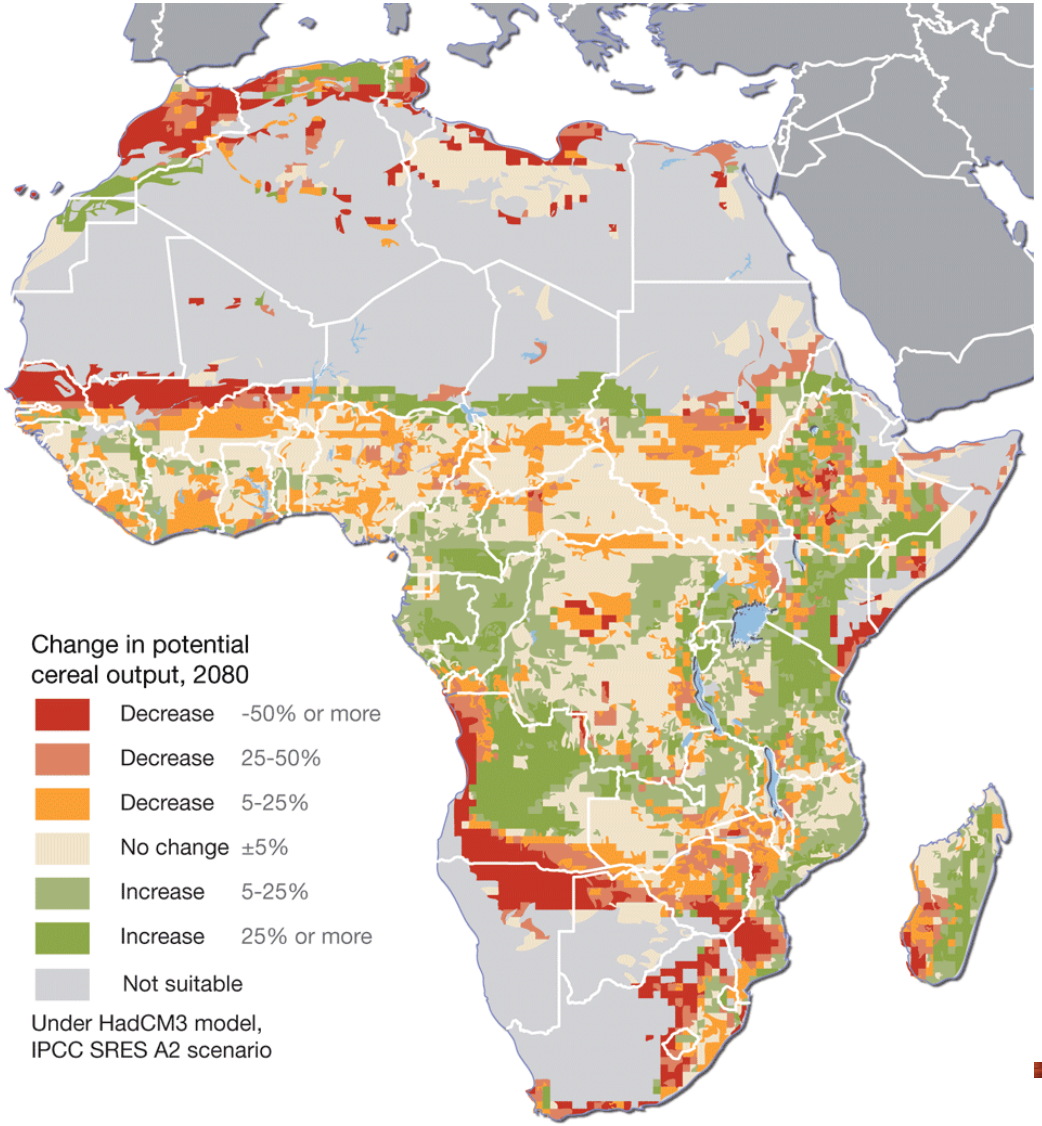
Maize imports (tons)



developing countries: trade deficit in coarse grain

Competition from non-agricultural sector

Projected climate change impacts for agriculture in Africa, in potential cereal output, for 2080

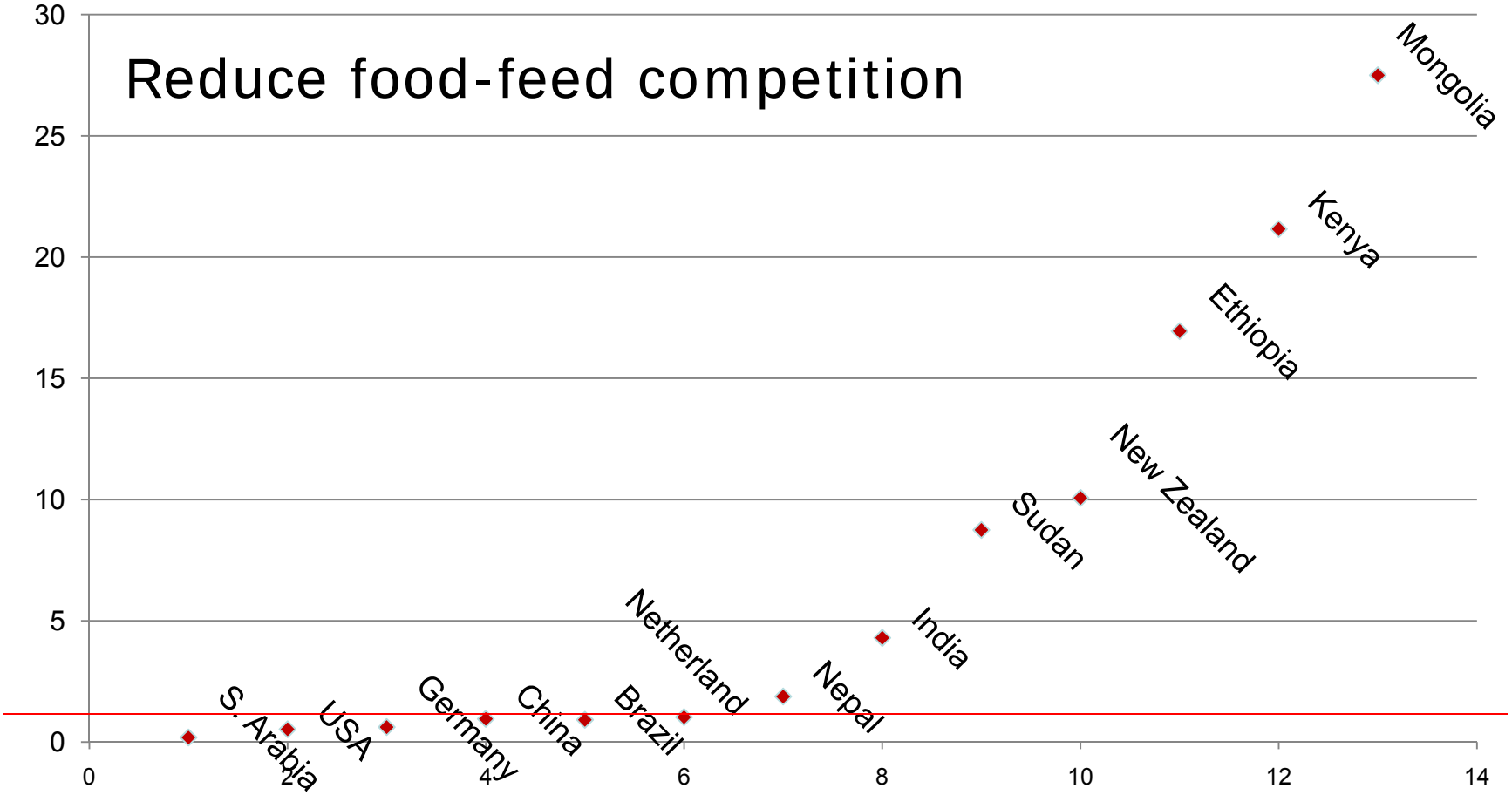


BUT with current technology

- Dryland crops yield *3
- Better use of crop-by products and oilseed cakes – FCR 1:1

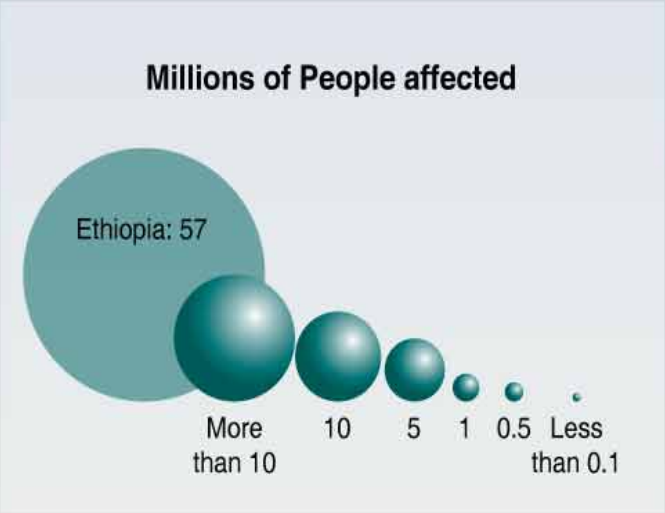
http://mappery.com/Projected-climate-change-impacts-for-agriculture-in-Africa-in-potential-cereal-output-for-2080-Map

Edible protein output/input



Edible protein input estimated from feed and primary crops that are edible by humans

People affected by Natural Disasters during the period 1971-2001

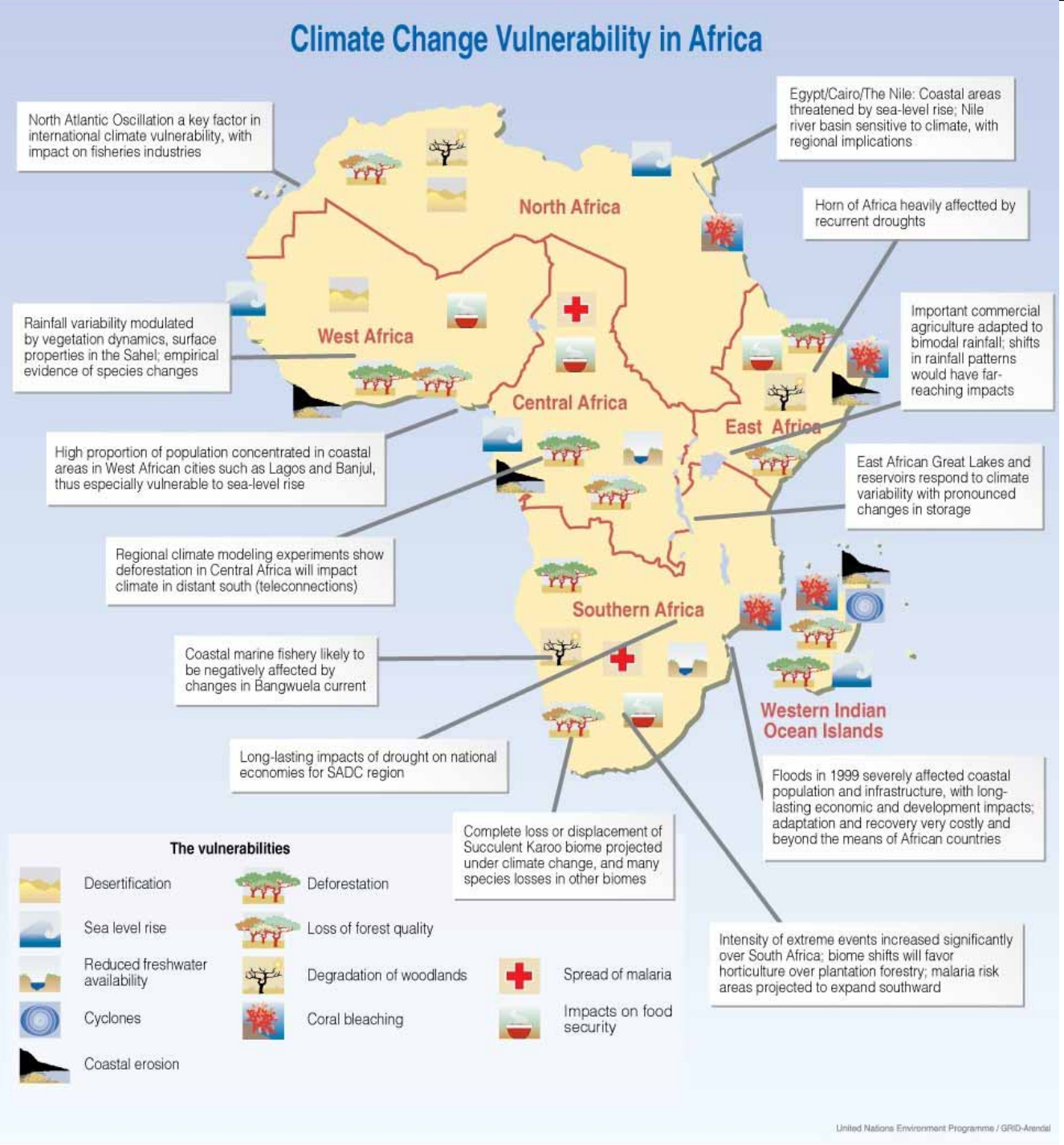


Source: The Office of U.S. Foreign Disaster Assistance (OFDA), The Centre for Research on the Epidemiology of Disasters (CRED), International Disaster Database, www.cred.be/emdat, Université Catholique de Louvain, Brussel, Belgium.

UNEP GRID Arendal

DELPHINE DIGOUT
BASED ON A SKETCH BY PHILIPPE REKACEWICZ
JUNE 2002

UNEP/GRID-Arendal
http://maps.grida.no/go/graphic/people_affected_by_natural_disasters_during_the_period_1971_to_2001



Regional shifts of production systems

- Croppers to livestock keepers?

Species shifts

- Camels for cattle?

Breed shifts

UNEP/GRID-Arendal
http://maps.grida.no/go/graphic/climate_change_vulnerability_in_africa

Way forward - Opportunities

GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES

Strategic Priority Area 1
Characterization, inventory and monitoring of trends and associated risks

- Surveying and monitoring
- Phenotypic characterization
- Molecular characterization

Strategic Priority Area 2
Sustainable use and development

- Breeding strategies
- Animal identification and performance recording

Strategic Priority Area 3
Conservation

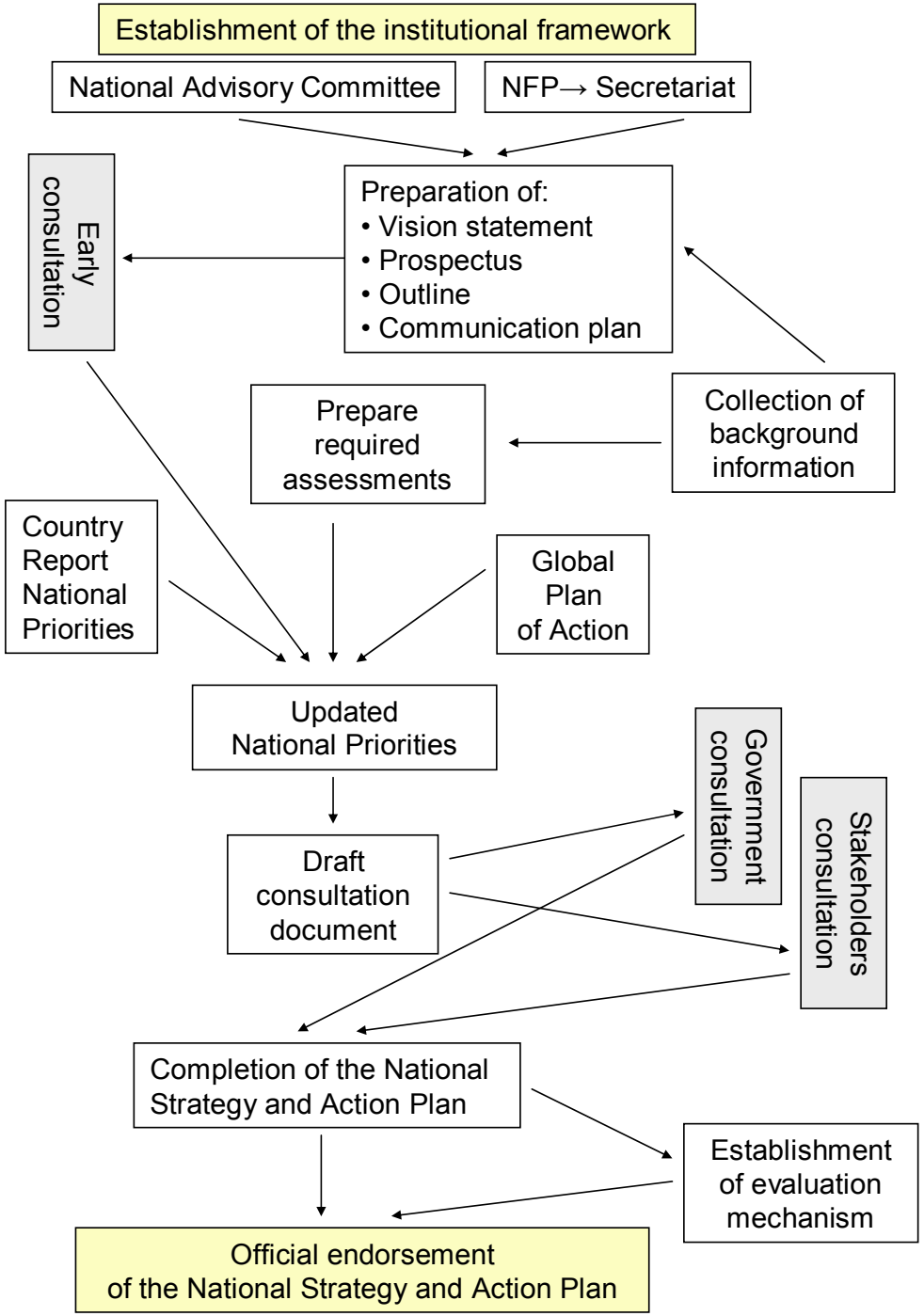
- Cryoconservation
- *In vivo* conservation

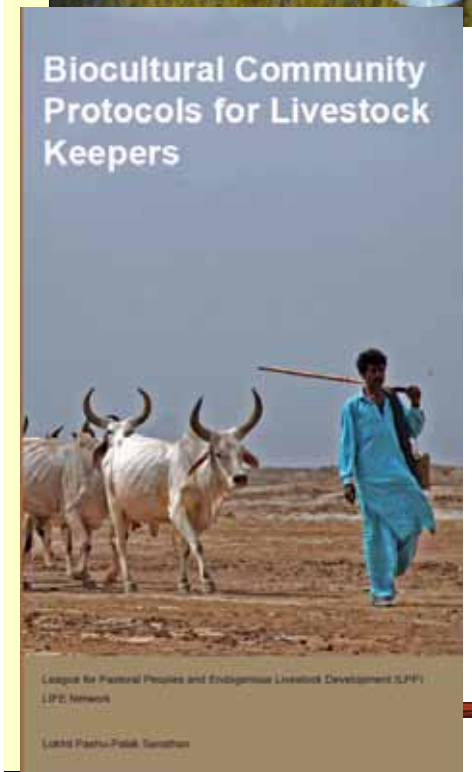
Strategic Priority Area 4
Policies, institutions and capacity-building

- Institutional arrangements

National strategies and action plans

Full participation of livestock keepers





(Sub)Regional coordination

Establishment of a (Sub)RFP in Central/West Africa

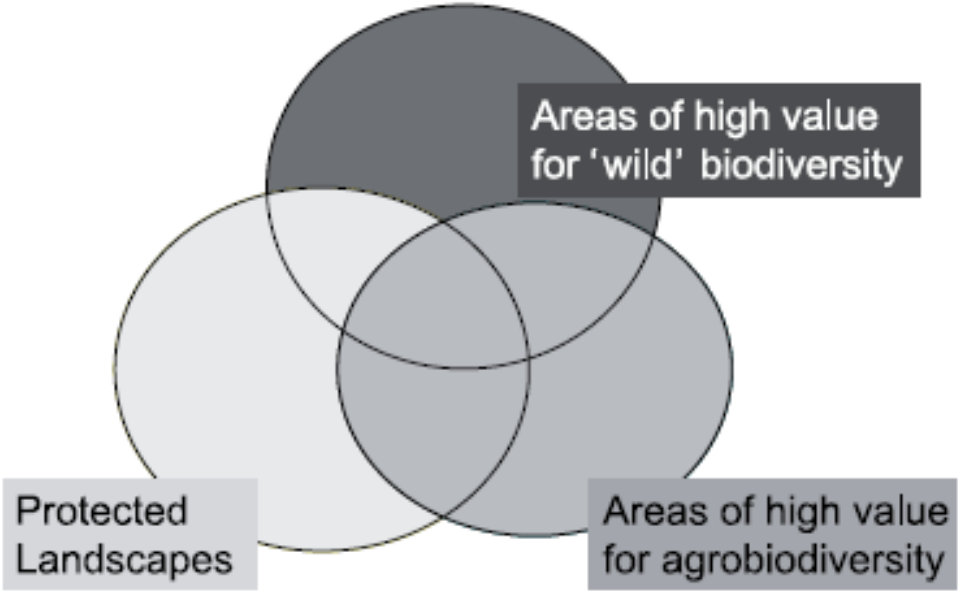
- 2 regional meetings, 2010
  - driven by National Coordinators
  - involvement of RECs and AU-IBAR
- Next step: Regional workshop for establishment of the (Sub)RFP and election of its PSC, June 2011 in Libreville, Gabon

Envisaged: RFP East/southern Africa

Regional Workshop on Sustainable Management of Animal Genetic Resources (AnGR) in West and Central Africa (22 - 25 March 2010, Dakar, Senegal)

Grazing systems: Link to other sectors

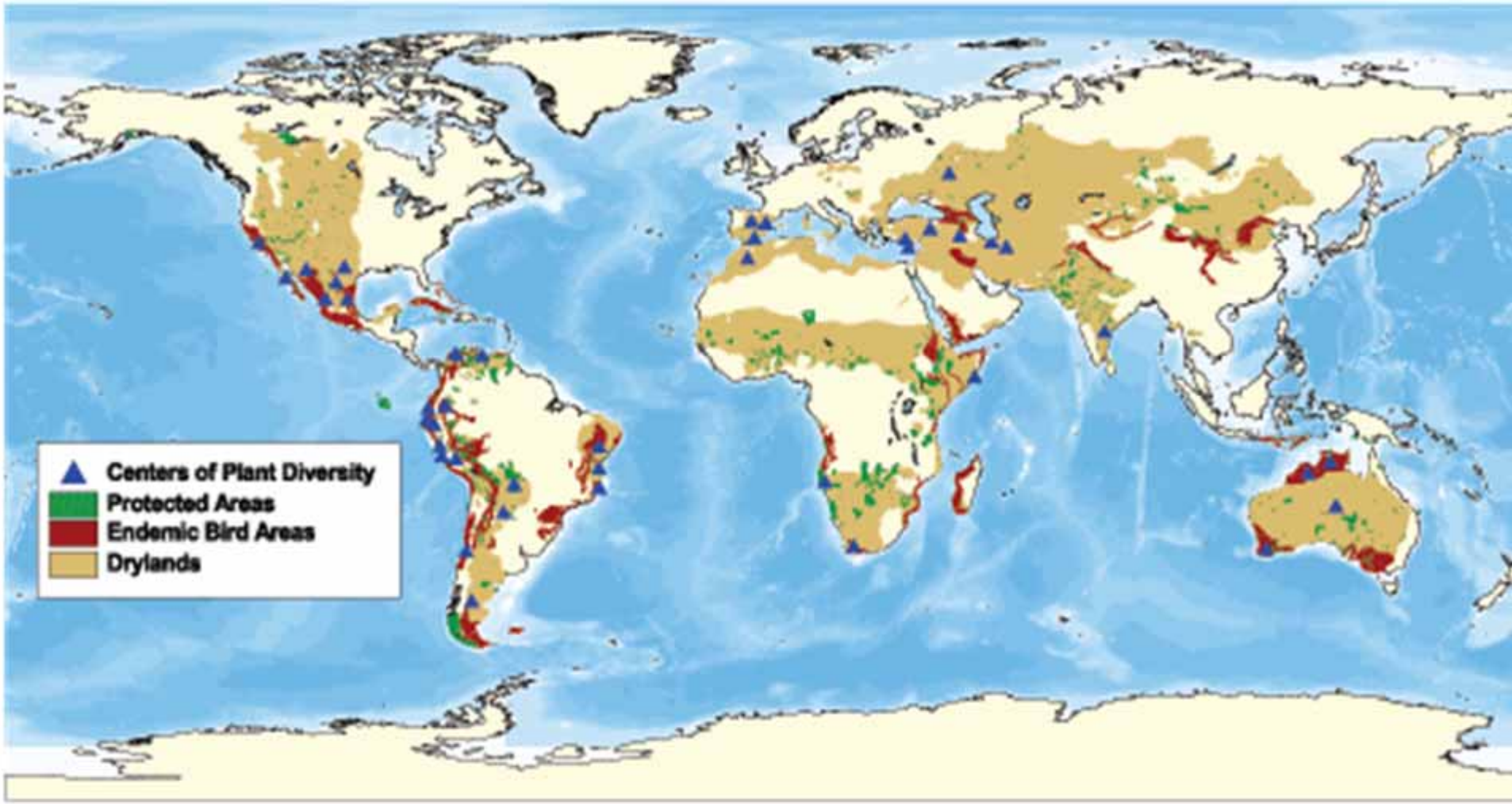
- What *types or proportion* of agrobiodiversity might be included within a protected area?



Protected Landscapes and Areas of High Value for Wild Biodiversity and Agrobiodiversity

Amendt et al, 2009

Biodiversity Conservation in Drylands



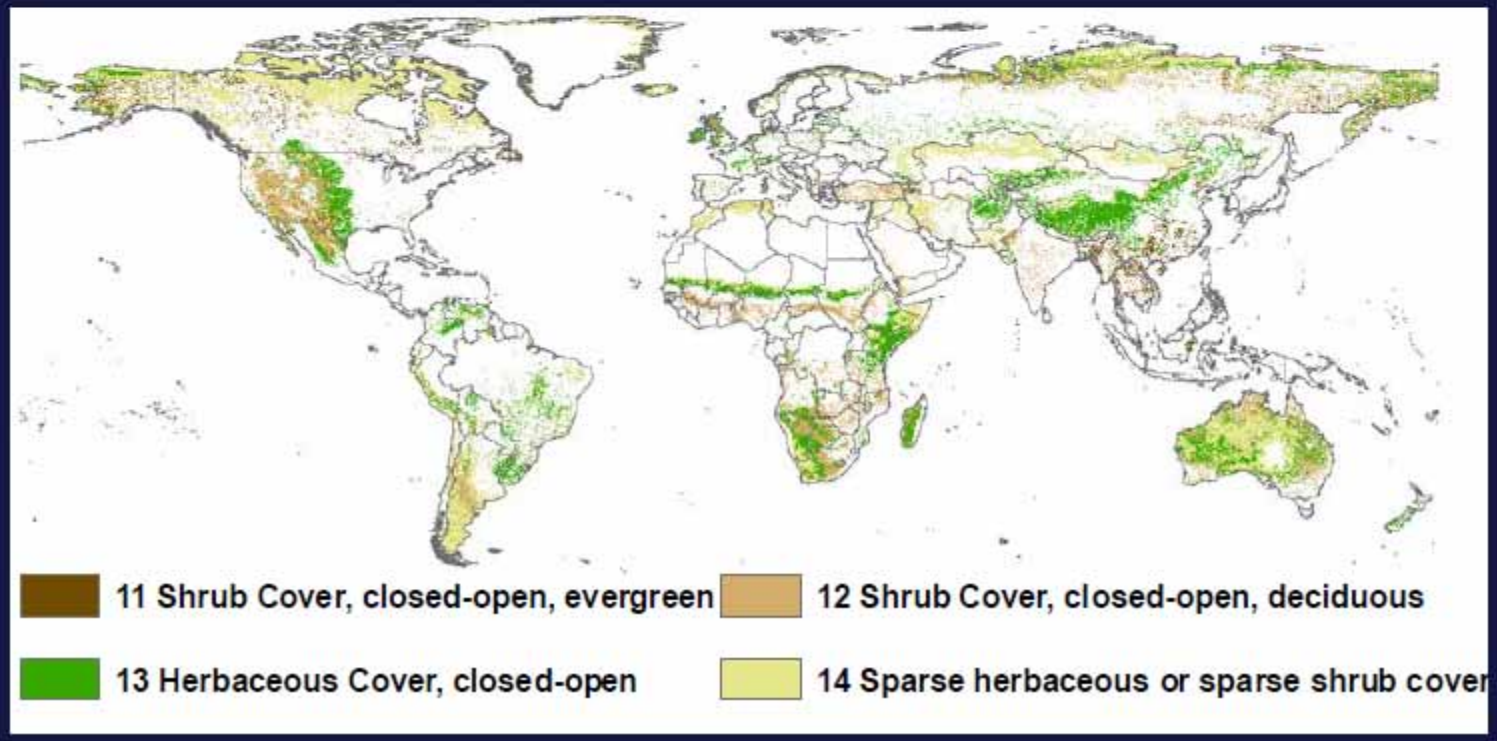
Source: Davis et al. 1994 and 1995; UNEP-WCMC 1999; Stattersfield et al. 1998; UNEP/GRID 1991.
Projection: Geographic

WRI, http://www.wri.org/publication/content/8241

Grasslands

- Grasslands occupy ~30% of the total emerged ice free world and 70% of the agricultural area.

- Grasslands store up to 8 % of the world's carbon and are an important terrestrial carbon sink - storing 230-260 Tonnes C per hectare (FAO 2006).



Dryland breeds in Africa – untapped potential

	East Africa	North and West Africa	Southern Africa	Total
Ass	11	15	2	28
Cattle	85	133	85	303
Dromedary	17	30	2	49
Goat	49	53	30	132
Horse	4	40	17	61
Sheep	52	93	45	190
Total	**218**	**364**	**181**	**763**

FAO, 2006

Results of an institutional survey – East/Southern Africa

Livestock Breeding Issues	Botswana	Kenya	Mozambique	Tanzania	Uganda	Zambia
Livestock policy	X	X	X	X	X	X
Livestock breeding policy		X			X	
Recording system for cattle	X	X				X
Recording system for small ruminants		X				
Semen distributor	X	X		X		
Research institute	X	X	X	X	X	X
University program	X	X		X	X	X
Farmers' organization	X	X		X		X
Breed society	X	X		X	X	

Zonabend et al. 2010

Region's share export+re-export, value US-$

	Africa	Asia	Europe	Latin America Caribbean	North America	Near East	Pacific
Cattle live pure breeding	1	0.3	77	4	7	0.06	11
Cattle semen	0.5	0.1	34	5	58	0.01	3
Swine live pure breeding	0.1	3	78	2	16	0.01	0.8
Swine live excpt. pure breeding <50 kg	0	3	73	0.01	24	0	0
Horses live pure breeding	1	2	82	0.5	11	0.1	6
Fowl live < 185 g	0.6	5	72	5	15	1,3	0.8
Avg	**1**	**2**	**69**	**3**	**22**	**0**	**4**

Avg. 199 1995, 200 2005, 2009, UN Comtrade

Region's share import+re-import, value US-$

	Africa	Asia	Europe	Latin America Caribbean	North America	Near East	Pacific
Cattle live pure breeding	2	13	53	12	1	19	0.3
Cattle semen	1	5	53	19	12	4	7
Swine live pure breeding	1	27	53	16	3.4	0.1	0.1
Swine live excpt. pure breeding <50 kg	0.01	3	74	0.1	22	0	0
Horses live pure breeding	0.8	9	81	1	5	0.8	2
Fowl live < 185 g	3	16	46	18	7	10	0.2
Avg	**1**	**12**	**60**	**11**	**8**	**6**	**2**

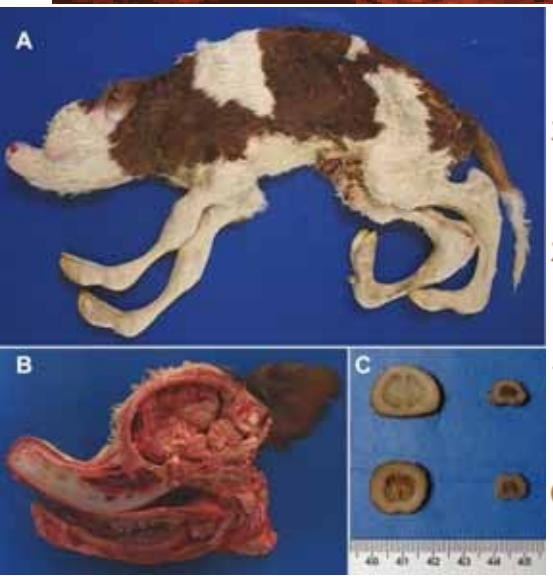
Avg. 199 1995, 200 2005, 2009, UN Comtrade

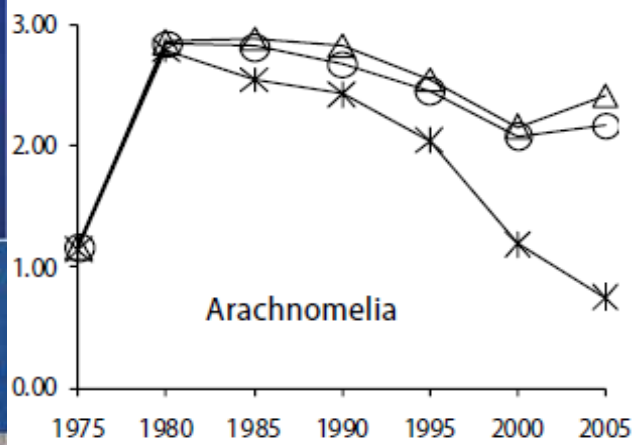
Importation of exotic breeds to improve performance

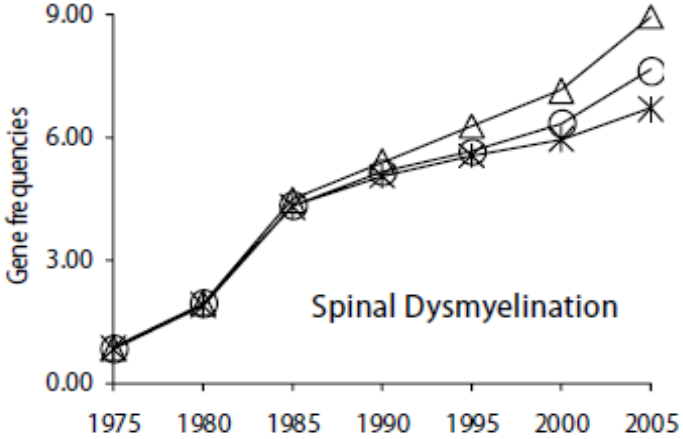
- Importation of recessive alleles
- Undetected spread of genetic disorders e.g. for Waver, Arachnomelia, Spinal Dysmyelination (SDM), Spinal Muscular Atrophy (SMA) for long period
- Over-proportional use of few carrier bulls favors the spread
- Easy to import, difficult to get rid of....

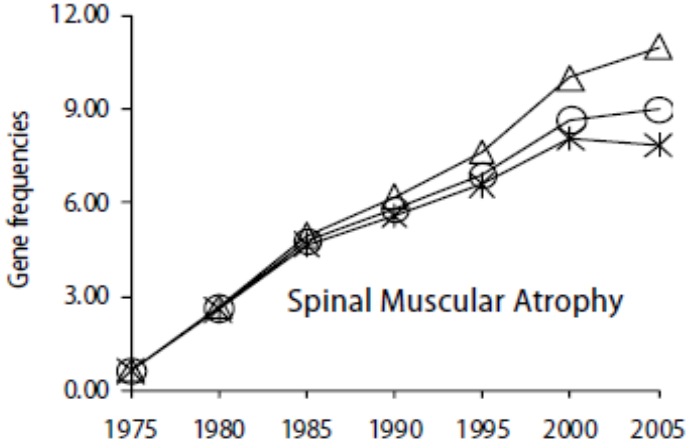
- Identification of carriers possible (pedigree records, gene tests...)
- Importation of semen from **tested** non-carriers!

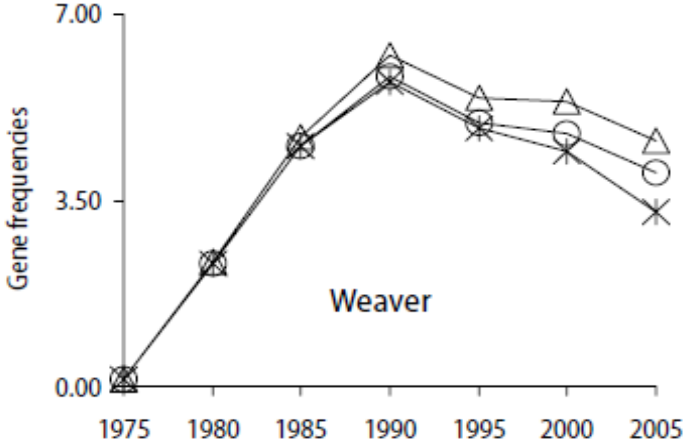
Spread of lethal alleles –Austrian Brown Swiss











Research and development needs – GPA implementation

Understand breed – environment interaction

- (Agro)ecosystem / production system characterization
  - Needed for future ecosystem / diseases management
  - Needed for PES (biodiversity, rangelands, C-sequestration etc.)
- Breed - Phenotypic characterization / performance recording
  - Most people-centered – social impact
  - Link to breeding
- Gene - Molecular characterization
  - Not (yet) well linked to other levels

Research and development needs – GPA implementation

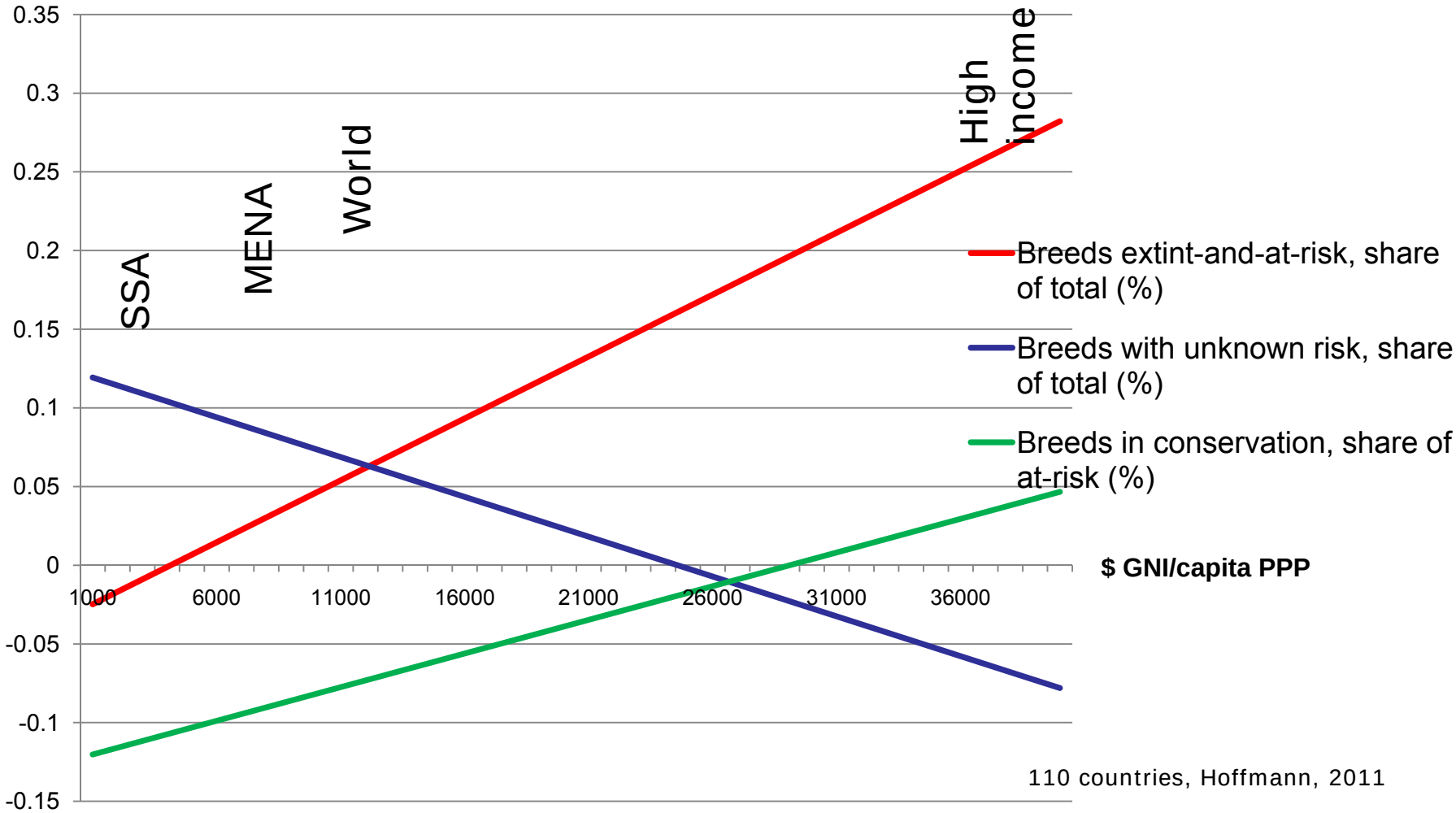
Breeding

- Selection for performance traits in adapted and adaptive traits in high-output breeds

Inventory and monitoring

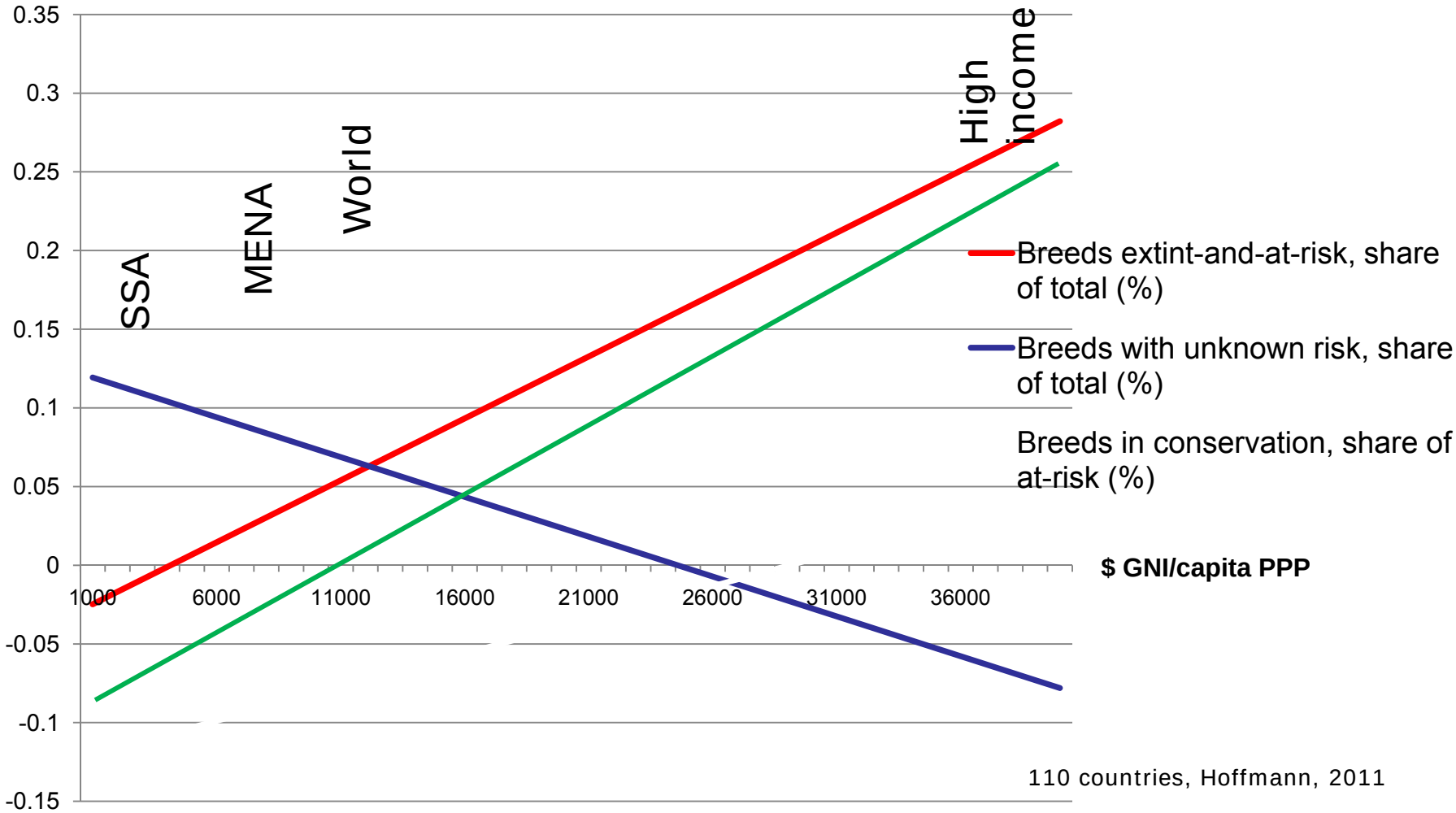
- More institutional / public service than research
- Link to agroecosystem / production system drivers AND gene level drivers

Breed shares and purchasing power



110 countries, Hoffmann, 2011

Breed shares and purchasing power



110 countries, Hoffmann, 2011

Gene Banking in Africa

- FAO International survey of national AnGR conservation activities (Boettcher and Akin, 2010)
- 35% of African countries indicated some cryoconservation activity (mostly cattle)
  - Second smallest (to Latin America)
  - vs. 72% in Europe
- Only 2 countries report “fully operational bank”
  - Mozambique and Zimbabwe
- Nearly 50% have no plans for a gene bank
  - 80% no further than discussion and planning stage

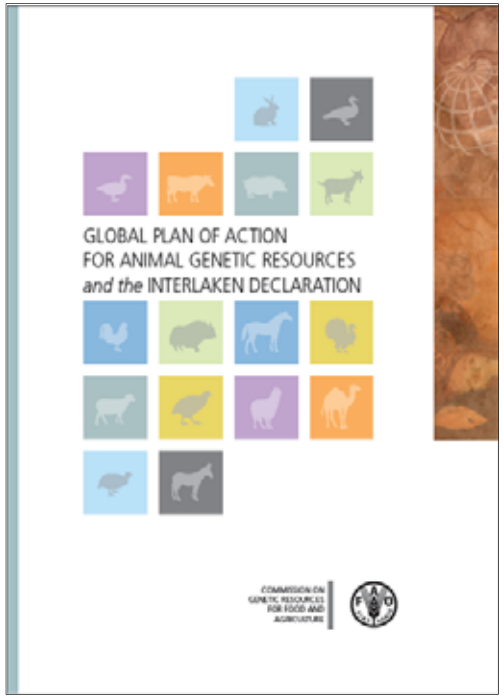
CONCLUSIONS

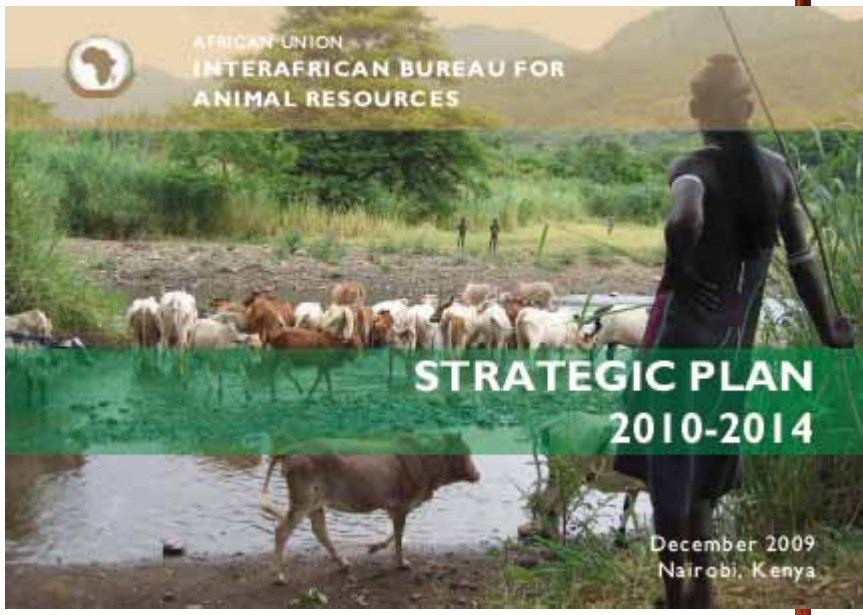
Yes, African local breeds may survive BUT

- Demand increase - enhance livestock productivity and resource efficiency
- Policy instruments are required to stimulate implementation of a portfolio of options
- Two-pronged approach
  - Mosaic of high / low external input systems
  - Make AnGR characterization, inventory, monitoring, breeding, conservation an integral component
- Agricultural biodiversity must be integrated in CC adaptation and mitigation
  - Focus on ruminants and forage-based systems
  - Breeding programmes to tap their potential

Institutional strengthening

Thank you for your attention !





Programme 2: Enhancing Africa's capacity to conserve and sustainably use its animal resources and their natural resource base

Objective: To catalyse the development of policies and actions that will lead to the sustainable use and management of animal resources and the natural resource base on which they depend.

Breeds are a social construct