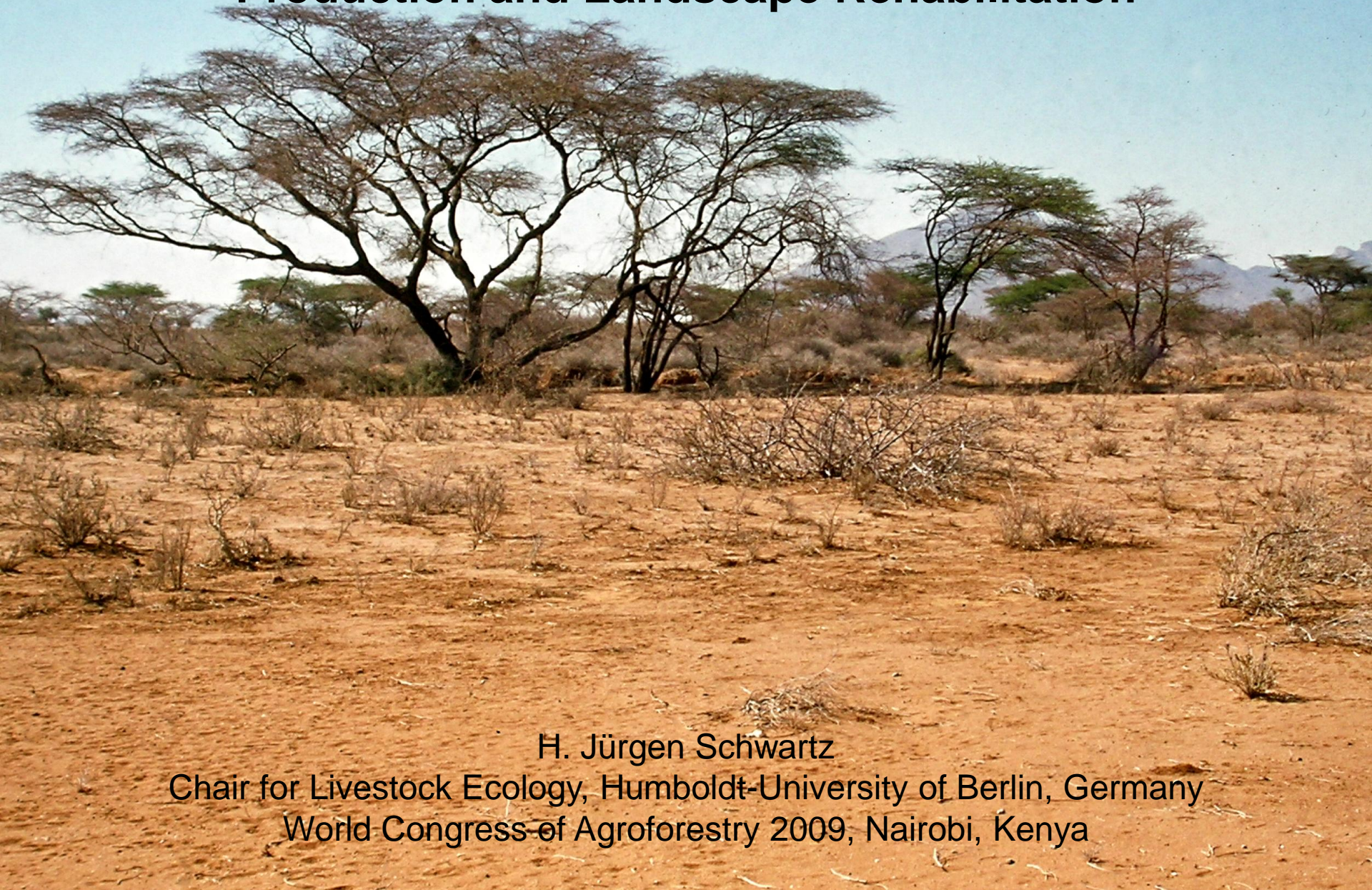


Forage Trees and Shrubs – Integrating Livestock Production and Landscape Rehabilitation



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World Congress of Agroforestry 2009, Nairobi, Kenya

Processes determining pasture systems

- Herbivory
- Water depletion (green and blue water)
- Product (nutrient) extraction
- Nutrient cycling
- Soil health (degradation or enhancement)
- Botanical shifts (degradation, resilience, rehabilitation)
- Fire (wild or prescribed)
- Management (overgrazing, soil compaction, erosion)
- Local climate change (evapo-transpiration, albedo)
- Carbon release and sequestration
- Atmospheric pollution

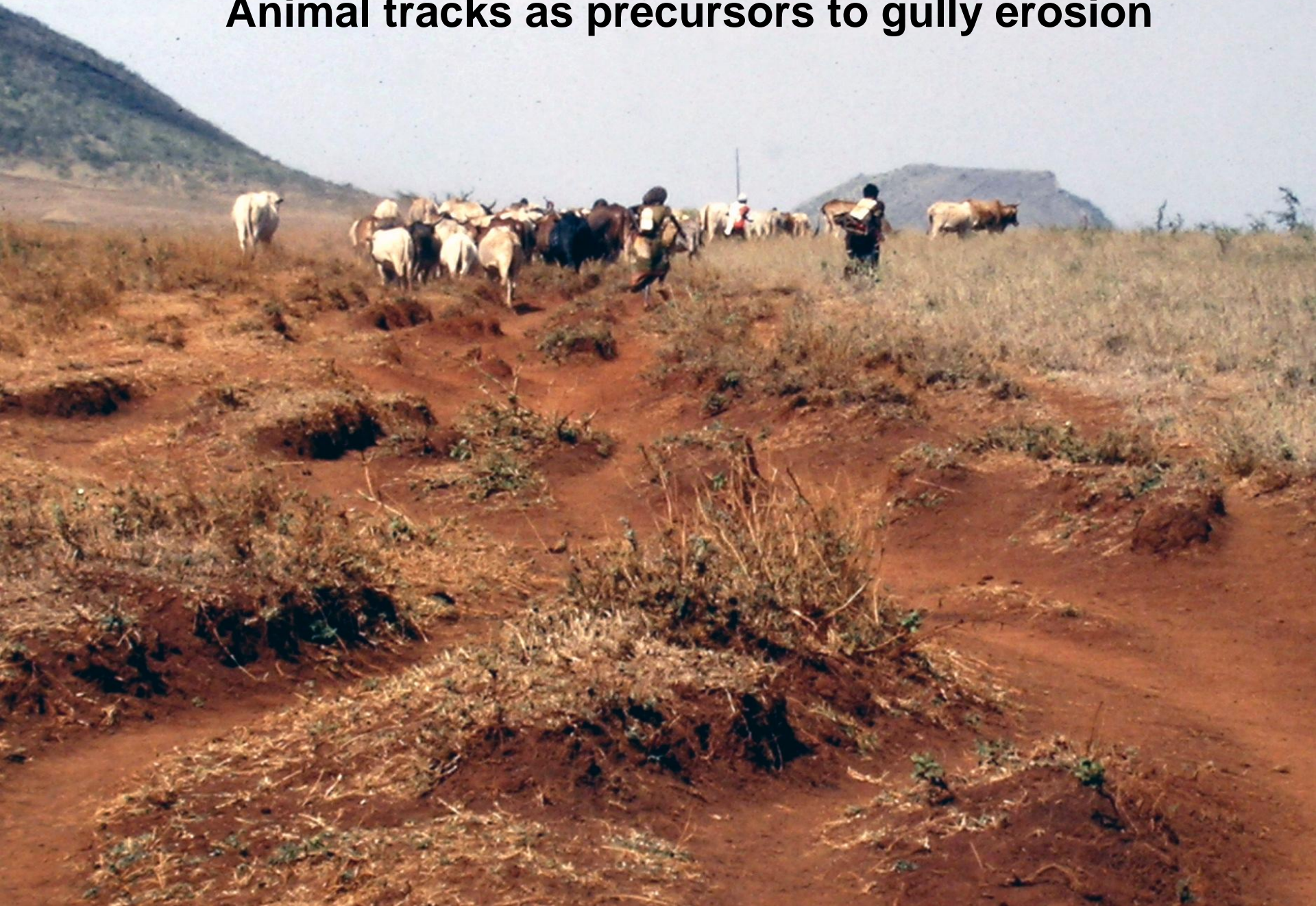
Constituent elements of herbivory

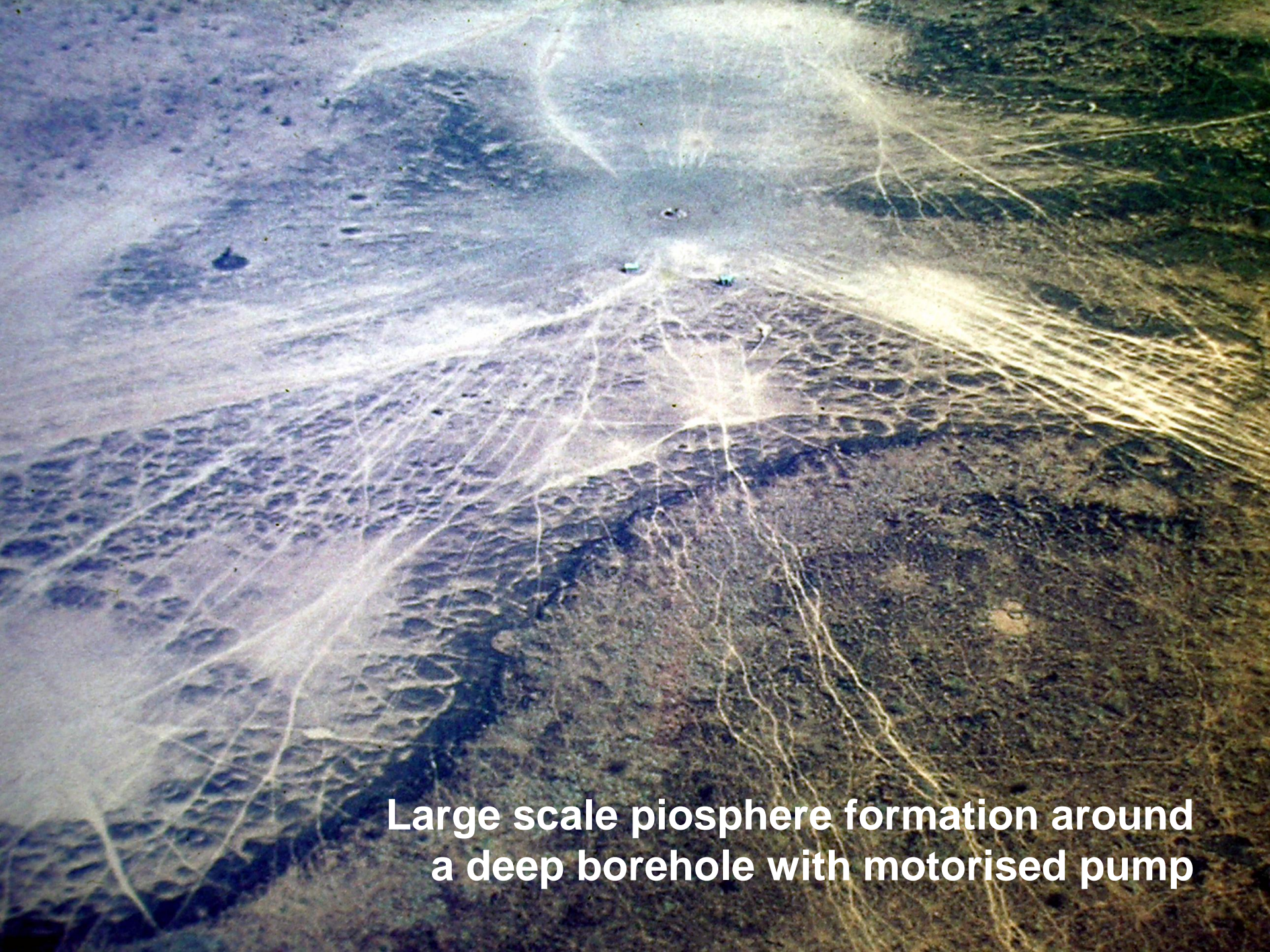
- Off-take of biomass
- In-take of biomass
- Trampling
- Seed dispersal
- Feed preferences and selectivity

Excessive biomass off-take, dramatically reduced ground cover, advanced sheet erosion



Animal tracks as precursors to gully erosion





**Large scale piosphere formation around
a deep borehole with motorised pump**



Ground cover destruction and gully erosion near frequently used shallow wells

Seed dispersal: *Tribulus terrestris* mono-culture near watering trough

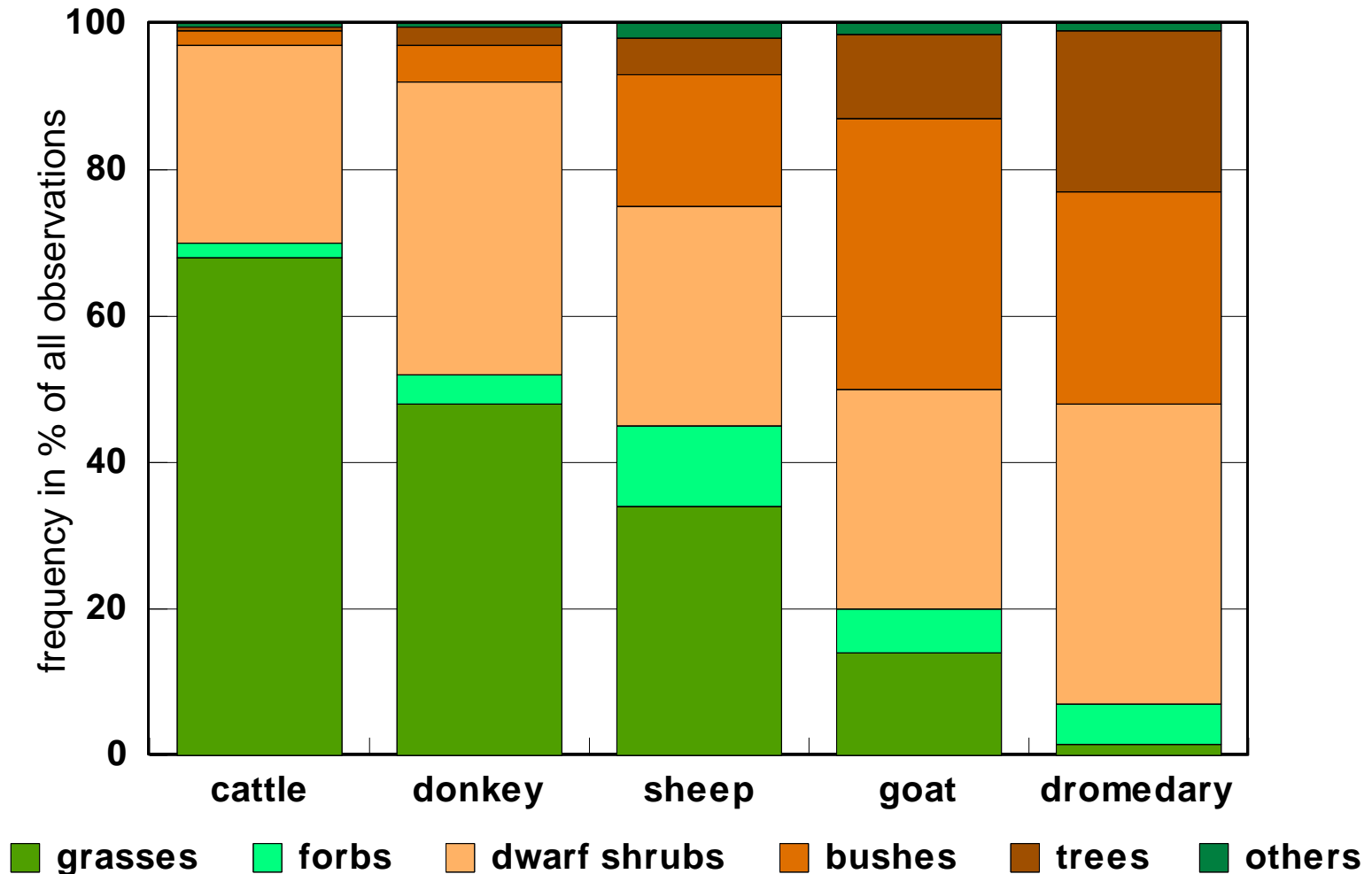


Feed preferences of herbivores are determined by

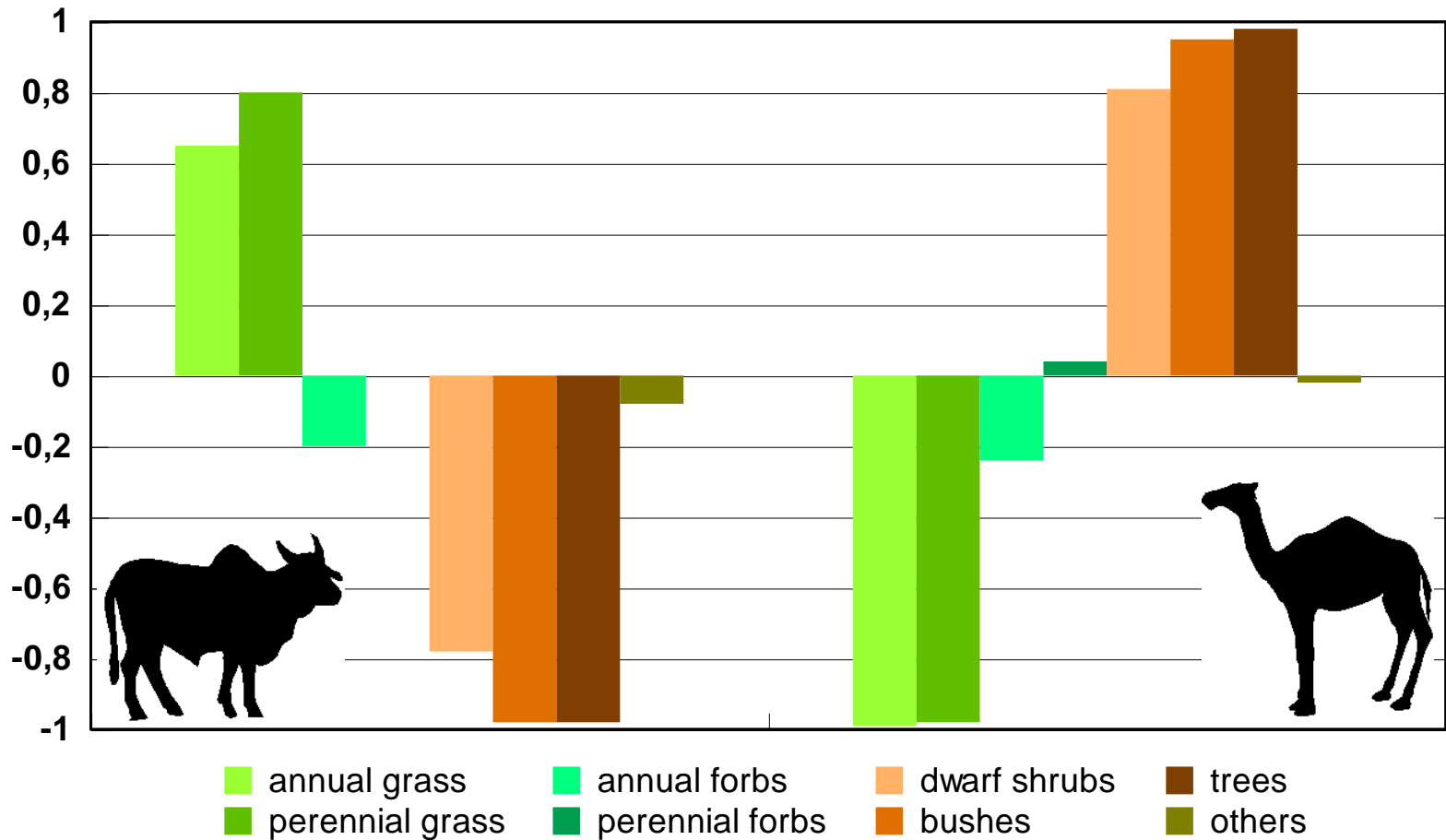
- growth or life form of the plant
- height of the plant above the ground
- nutrient contents of the plant
- physical characteristics of the plant
- proportion of a species in the plant community
- demand and intake capacity of the animal



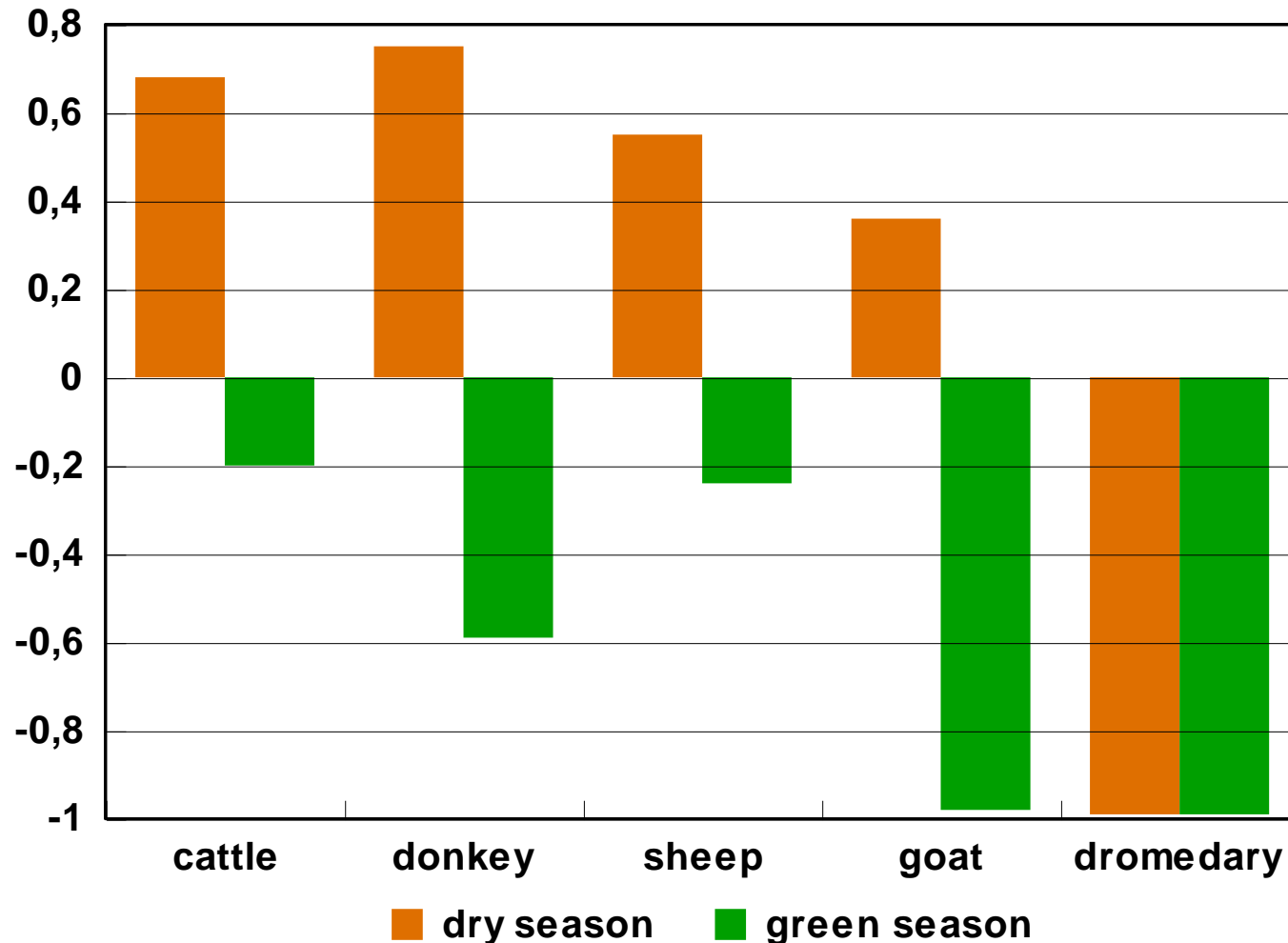
Observed frequency of occurrence (as % of all observations)
of plant species, grouped by growth form, in the diet of
free ranging domestic herbivores



Selectivity index E by growth form of forage plants for zebu cattle and dromedaries measured on a semi-arid thornbush savannah



Selectivity index E for *Chrysopogon plumulosus* during two seasons, calculated for domestic herbivores on a specific experimental pasture at the Ngare Ndare Research Station, Isiolo District



Percentage similarity* (lower left) and Horn's index of feed preference overlap*(upper right) in the ingested diet of free grazing domestic herbivores on a semi-arid thorn bush savannah

	Goat	Sheep	Cattle	Donkey	Dromedary
Goat		.607	.553	.614	.721
Sheep	.411		.757	.797	.558
Cattle	.329	.551		.872	.264
Donkey	.415	.636	.703		.435
Dromedary	.555	.398	.165	.348	

* Based on number of observed feeding stations per forage species

Note

All livestock are generalist feeders with expressed preferences when given a choice. Predominant browsers will be inefficient grazers, predominant grazers will be particularly inefficient browsers



Degraded perennial grassland with scattered *A. tortilis*



An aerial photograph of a savanna landscape. The terrain is covered with a dense carpet of low-lying, greyish-green dwarf shrubs. Scattered throughout this shrub layer are numerous acacia trees of varying sizes, characterized by their rounded, green canopies and dark trunks. The background shows a steep, rocky hillside on the left and a more distant, hilly area under a clear sky. The overall scene depicts a typical African savanna environment.

**Derived dwarf shrub &
A. tortilis woodland**

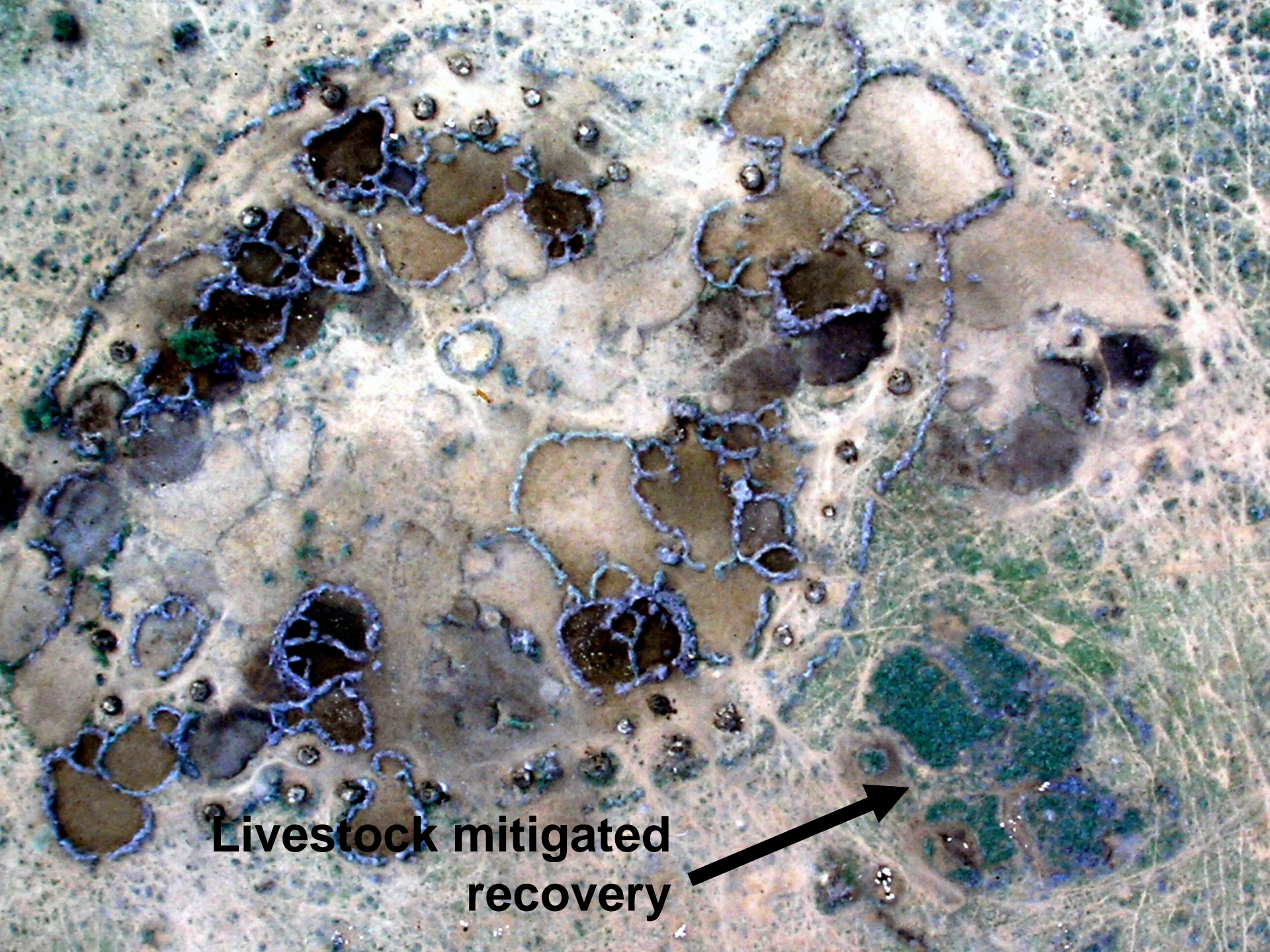


Ecosystem resilience



Ecosystem resilience

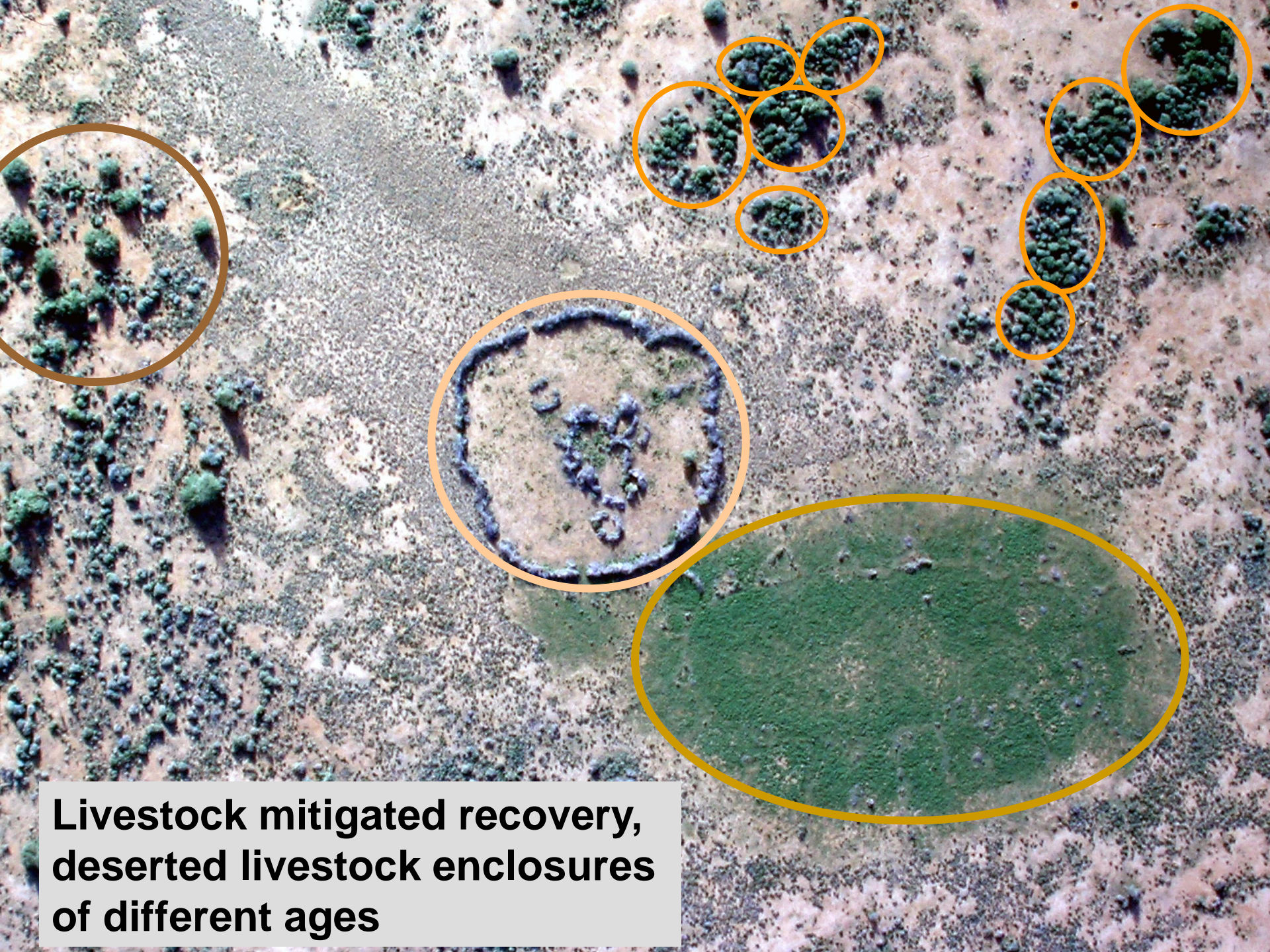




**Livestock mitigated
recovery**

A photograph showing a dense stand of 3-year-old *Acacia tortilis* shrubs. The shrubs are green and have a thorny, branching structure. They are growing in a dry, open landscape with sandy soil and scattered dry sticks and twigs. In the background, a flat horizon line is visible under a clear sky.

**Livestock mitigated recovery,
dense stand of 3 year old *A. tortilis***



**Livestock mitigated recovery,
deserted livestock enclosures
of different ages**

Active rehabilitation with *Atriplex* sp. and *Opuntia* sp.



Active rehabilitation with *Atriplex* sp. and *A. longifolia*





Photo: M.G. Walsh

Desert pavement caused by bush control within a Tsetse eradication programme (Garissa District, Kenya)



Thicket formation after introduction of *Prosopis juliflora* to combat desertification (Garissa District, Kenya)

Conclusions

- Domestic livestock have the potential to destroy vegetation and to degrade soils.
- Likewise they can contribute to landscape recovery and the maintenance of biodiversity.
- Ecosystem resilience can secure spontaneous recovery if stresses are sporadic and localised.
- Multiple species grazing systems facilitate a more benign utilisation of many different pasture types.
- Already degraded vegetation can not be restored alone by animal management.
- Management by fire, chaining, breaking of soil crusts, and reseedling can be feasible at higher ecological potential
- Active rehabilitation of degraded pastures is costly, often detrimental to local biodiversity and not always leading to the desired results.
- Management and land use policies favouring high mobility of pastoral herds will buttress sustainability of pastoral land use.

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