Ecological Surveys for
Sustainable Livestock Production

01 Introduction to Ecological Surveying

Livestock Production and Ecological Surveying: Why?

Species	Numbers [millions]	Biomass [million t]	Daily feed demand* [million t DM]	Daily faecal output** [million t DM]
Cattle & Buffalo	1 496	512	18	9
Sheep	1 065	40	1.4	0.7
Goat	780	27	1	0.5
Camelids	24	8.5	0.3	0.15
Equines	118	42	1.7	0.85
Total Herbivores		629.5	22.4	11.2

* Estimated 3.5% of live biomass for maintenance and low level performance; ** estimated 50% DM Digestibility

Common feed sources for domestic livestock

(1) Natural, derived, and improved pastures

(2) Forage crops

(3) Agricultural residues

(4) Food processing by-products

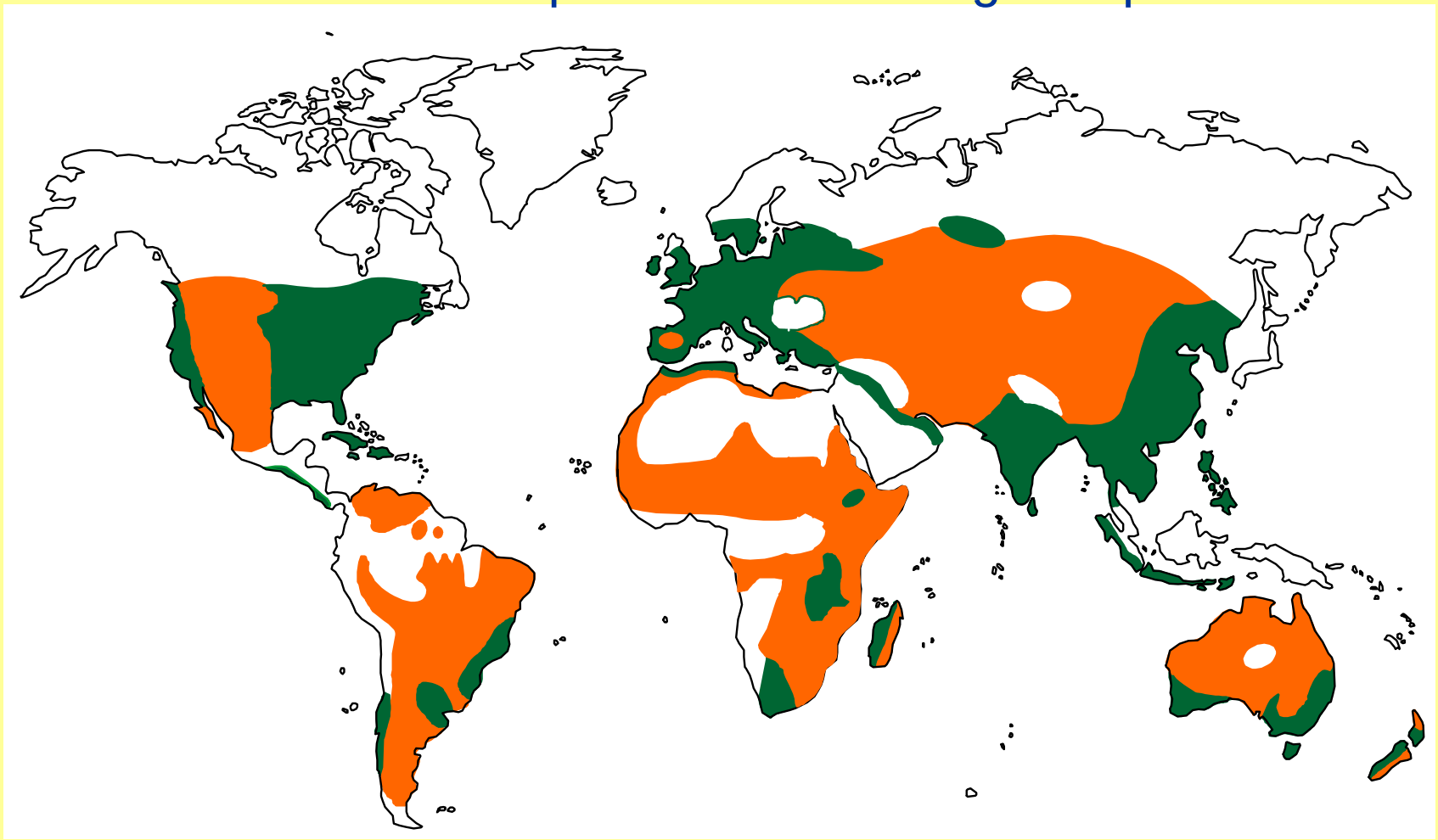
(5) Marine and sweet water organisms

(6) Rural and urban wastes

(7) Non-protein nitrogen

(8) Minerals

Worldwide distribution of natural and improved pastures and derived pastures and forage crops



Potential effects of prolonged pasture utilisation

(1) Biophysical Effects:
in situ: change of resource base, soil losses, change of nutrient balance, biological resilience
ex situ: regional hydrology, sediment loads in streams, silting of standing waters, groundwater contamination, fragmentation of habitats

(2) Ecological effects:
Change of floristic and faunal inventories

(3) Economic effects:
Farm income, income expectations, time horizons

(4) Social effects:
rural job opportunities, social infrastructures, migration

Descriptive Vegetation Analysis I

Differentiation of natural vegetation forms by:

Growth form: *forest, woodland, bush-land, grassland*

Growth form and habitat: *rain forest, riparian woodland, sub-humid savannah, semi-arid grassland*

Growth form and species group: *coniferous forest, thorn-bush savannah, annual grassland*

Growth form, species group and habitat: *montane pine forest, semi-arid thorn-bush savannah, dry annual grassland*

Botanical composition by species: *plant community*

Descriptive Vegetation Analysis II

Physiognomic and structural characteristics:

- external morphology
- Growth and or life form
- Habitat stratification
- Size of prevalent species
- Condition and vitality of vegetation formations

Application: in large scale classification and mapping of vegetation formations

Floristic characteristics:

- Presence, abundance and distribution of species

Application: in small scale classification and mapping of plant communities

Descriptive Vegetation Analysis III
Species Inventory

A tool for ecosystems analysis through indicator function

- Habitat factors
- System age and status
- Ecological disturbances
- History of use
- Potential for use
- System stability

Quantitative Vegetation Analysis (1)

Issues for analysis:

- Presence, absence and abundance of species, populations and/or communities
- Indicator functions for abiotic or biotic influences
- Primary production
- Feeding values for herbivores and decomposers
- Position in trophic hierarchies
- Habitat functions

Quantitative Vegetation Analysis (2)

Methodological approaches:

- Measurements or estimates
- Total counts or samples
- Direct or indirect measurements
- Status quo or time series
- Using indicators
- Systems modelling

Quantitative Vegetation Analysis (3)

Methods of analysis:

- 10 point frame
- sampling square
- direct and indirect measures
- destructive and non-destructive sampling
- plots, transects, plotless measures
- vertical photo (different distances)
- remote sensing

Quantitative Vegetation Analysis (4)

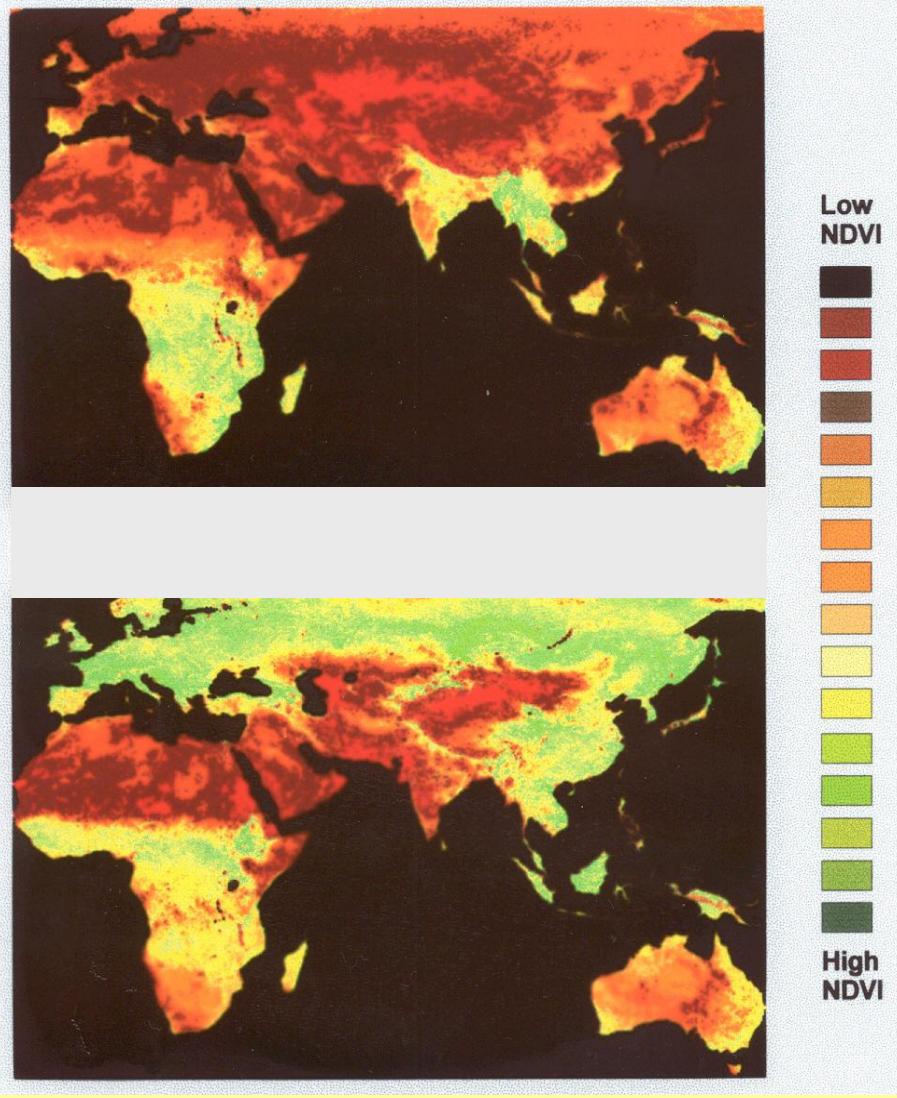
Areas of application:

- Inventories, mapping
- Prediction of succession under varying conditions
- Nature and species conservation
- Environmental impact studies
- Resource analysis for land use planning

Presence of photo-synthetically active vegetation observed at different times of the year in the old world, mapped using NOAA satellite data

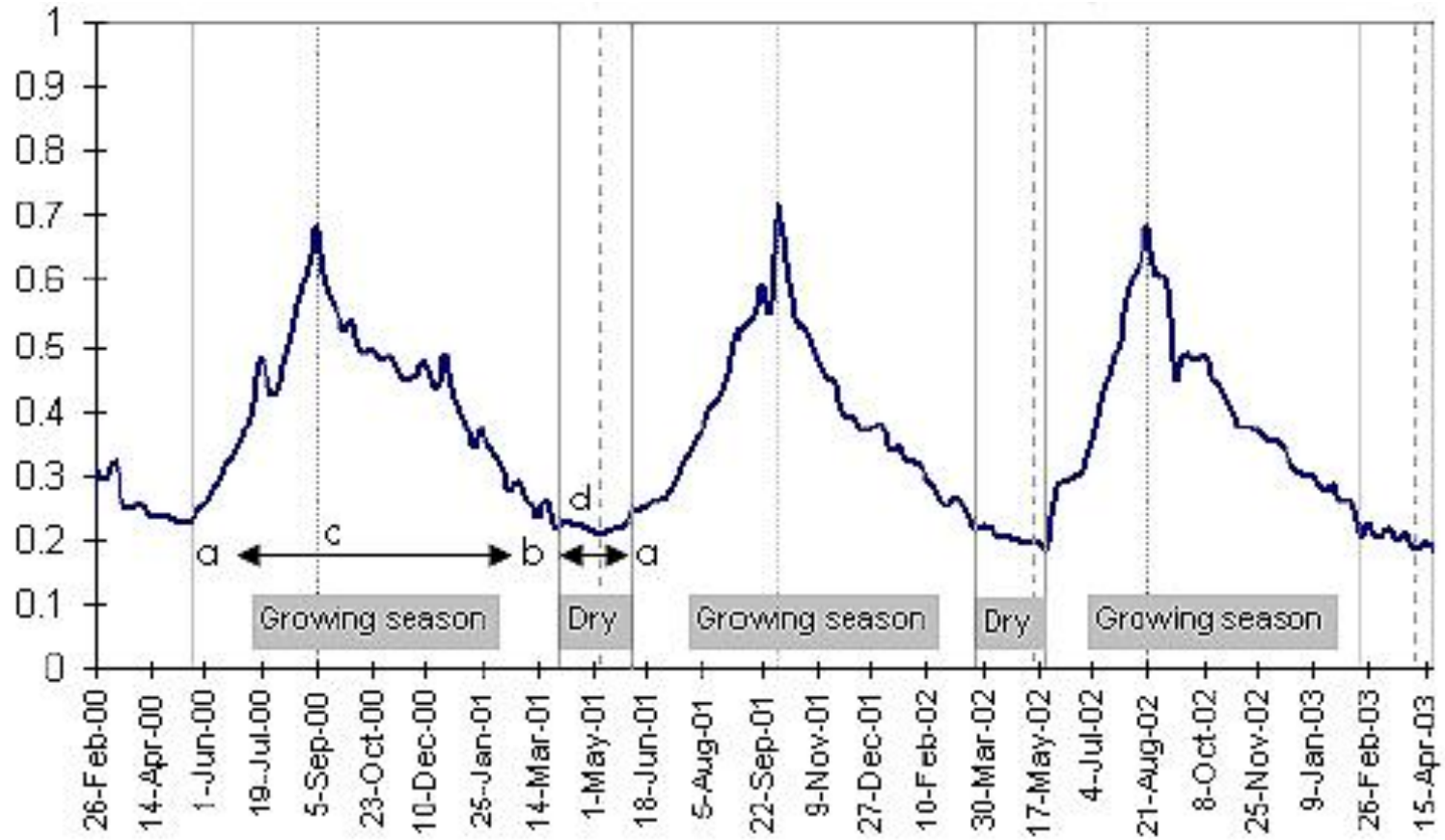
January 1998

July 1999



Seasonal changes of the mean NDVI of Vaiju Babhulgaon watershed

MODIS multi-temporal dataset 26 Feb 200 – 23 April 2003



Parameters of temporal and spatial dynamics of natural pasture systems (1)

Trophic structure of a pasture-ecosystem

- Primary production
- Herbivory (secondary production)
- Predation (tertiary production)
- Cropping (export)
- Decomposition (recycling & loss)

Parameters of temporal and spatial dynamics of natural pasture systems (2)

Primary production

- Gross and net primary production
- Standing biomass
- Cover and density
- Growth and maturity
- Diversity

Parameters of temporal and spatial dynamics of natural pasture systems (3)

Herbivory

- Feed intake preferences
- Reactions of plants to feeding
- Functional reactions of herbivores
- Numerical reactions of herbivores
- Reaction patterns

Parameters of temporal and spatial dynamics of natural pasture systems (4)

Predation and cropping

- Functional interactions
- Competition
- Plant-herbivore interactions
- Cropping effects

Parameters of temporal and spatial dynamics of natural pasture systems (5)

Decomposition

- Recycling of nutrients
- Losses
- Soil fertility dynamics