Agricultural systems: Case studies of tea plantation in India and mixed farming in Europe

Introduction

Agriculture is the most fundamental from of human activity. An area or region with similar functional attributes is termed as agricultural system as a widen term which emphasize on the functional attributes. An agricultural system may be single farm or group of interrelated farms having similarities of agricultural attributes.

Definition of Agriculture: "Agriculture is defined as the purposeful tending of crops & livestock." --M. Carty & Limberg

Definition of Region: "Region is that place on the earth surface which has some homogenous criteria." --D. E. Jong

Definition of Agricultural Region: "Agricultural Region is an uninterrupted area having some kind of homogeneity with specifically defined outer limit."

--Whittlesey (1936)

Major agricultural regions, Derwent Stainthorpe Whittlesey (1936)

Major agricultural regions of the Earth published in 1936 in the annals of Association of American geographers (vol.26: 199-240) **Whittlesey** in his monumental paper delineated the agricultural system of the earth on the following five characteristics of agriculture:

(1) The crop livestock association
(2) The methods used to grow the crops produce the stock
(3) The intensity of application to the land of labor capital organization the out turn of product which results
(4) The disposal of the products for consumption
(5) The ensemble of structures used to house facilitate the faring operations

Agricultural Region

- With the Boris of above indicators Whittlesey has identified the following types of agricultural system regions—
- 1. Nomadic herding
- 2. Livestock ranching
- 3. Shifting cultivation
- 4. Rudimentary tillage
- 5. Intensive subsistence tillage (with paddy dominance)
- 6. Intensive subsistence tillage (without paddy dominance)
- 7. Commercial plantation
- 8. Mediterranean agriculture
- 9. Commercial grain farming
- 10. Commercial livestock and crop farming
- 11. Subsistence crop & livestock farming.
- 12. Commercial dairy farming
- 13. Specialized horticulture

Agricultural Region

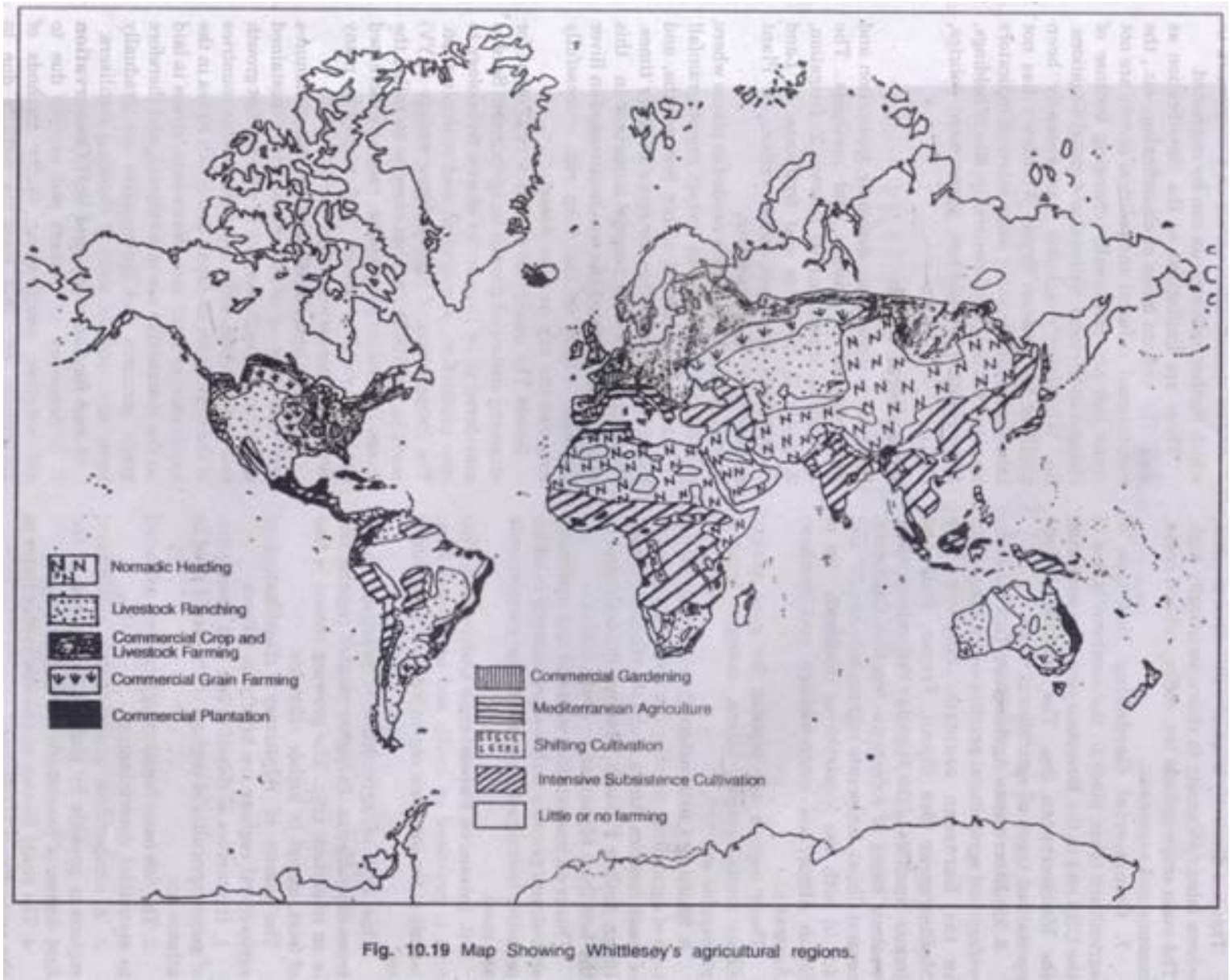


Fig. 10.19 Map Showing Whittlesey's agricultural regions.

Tea Plantation

Types of Tea
and Popular Varieties

Black Tea

Made from the Camellia sinensis tea plant – fully, or almost fully, oxidized

POPULAR VARIETIES

- Assam Tea
- Darjeeling Tea
- Earl Grey Tea
- English Breakfast Tea

Green Tea

Made from the Camellia sinensis tea plant – unoxidized

POPULAR VARIETIES

- Matcha
- Sencha
- Dragonwell Green Tea
- Gunpowder Green Tea

Herbal Tea

Made from infused dried herbs, fruits, and flowers

POPULAR VARIETIES

- Hibiscus Tea
- Chamomile Tea
- Peppermint
- Yerba maté

White Tea

Made from the Camellia sinensis tea plant – slightly oxidized

POPULAR VARIETIES

- Silver Needle (Baihao Yinzhen)
- White Peony (Bai Mudan)

Oolong Tea

Made from the Camellia sinensis tea plant – partially oxidized

POPULAR VARIETIES

- Ti Kuan Yin (Iron Goddess of Mercy)
- Dan Cong (Phoenix Tea)

Rooibos Tea

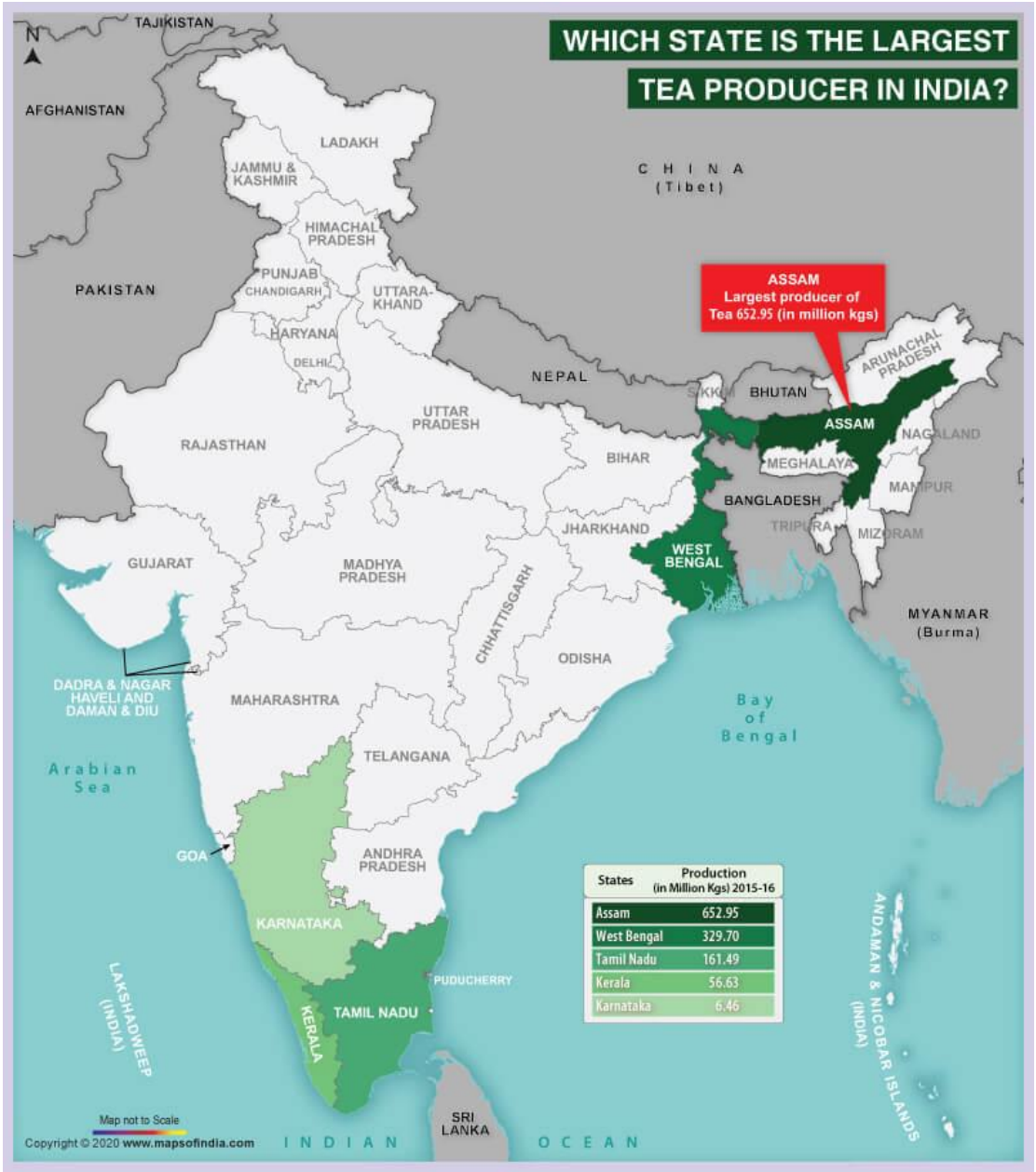
Made from the dried rooibos plant – partially oxidized

POPULAR VARIETIES

- Red Rooibos
- Green Rooibos

Health Benefits of Tea

Tea Plantation in India



History of Tea Plantation

Plantation agriculture had mostly spread during colonial period and now it is considered as one of the most successful commercial agriculture. In India also, tea plantation was popularised by British rulers.

In the 1830s, the first tea estates were established in the Indian state of Assam, using tea plants brought from China. Just like sugar, growing tea is very labour intensive and the obvious thing would have been to staff them with slaves.

Favourable Conditions

Physical Condition:

- Climate (Temperature, Rainfall)
- Soil (Texture, composition and fertility)
- Topography (Slope)

Socio-Economic Conditions:

- Large area of farm
- Capital
- Skilled labour
- Specialization
- Organisation
- Transport
- Market demand
- Technology
- Political Stability

Problems & Prospects

Problems:

- Declining global price
- Problems with small tea growers
- Tea Exports and Its Composition
- Labour and management conflict
- Poor infrastructure
- Traditional management
- Market dependency
- Influence of other sectors
- Role of Tea board

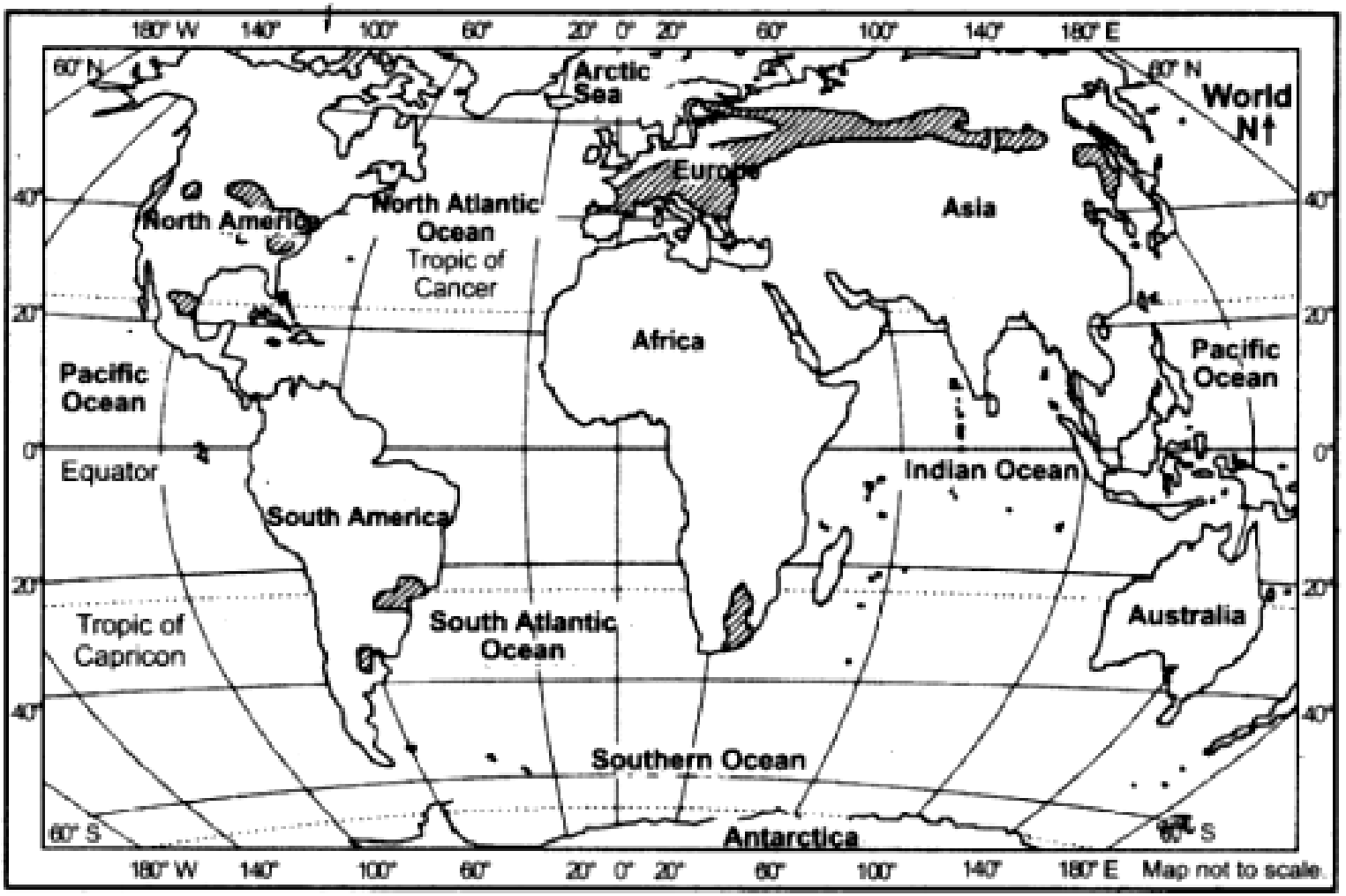
Prospects:

- Scientific management
- E-marketing
- Tourism attraction
- Commercial gain
- Economic contribution
- Job opportunity
- Scale of operation
- International demand

Mixed Farming

- In mixed farming, a farmer combines the cultivation of crops and the domestication of animals and gets income from both. Mixed farming can, therefore, serve as a transition between the animal-raising economics and the crop-raising ones.
- This type of mixed farming provides greater security than the growing of a single crop as in the extensive prairie wheat farms may suffer from market fluctuations and crop failures.
- Mixed farms are moderate in size and usually grow arable crops such as wheat, barley, oats or rye. Many practice crop rotation, growing root crops, like turnips or potatoes, and legumes, like peas, beans or clover as an alternative to cereals in some years. This maintains the fertility of the soil. Many mixed farms also grow some industrial crops such as sugar beet, hops, tobacco or flax.

Mixed Farming



Regions of Mixed Agriculture

Characteristics

- (i) The mixed farming is done for
  - (a) Sustenance of animals,
  - (b) For own consumption, and
  - (c) For commercial sale.
- (ii) Size of farm is huge (50-80 hectare). In mixed farming about 90 per cent land is devoted to agriculture.
- (iii) In mixed farming crop rotation is followed in order to maintain soil fertility.
- (iv) The sequence of cultivation in mixed farming is cereal and vegetable production for own consumption, followed by hay, alfalfa, clover, etc., for livestock consumption, and finally, some amount of cereal production, wheat, maize, etc., for commercial sale.

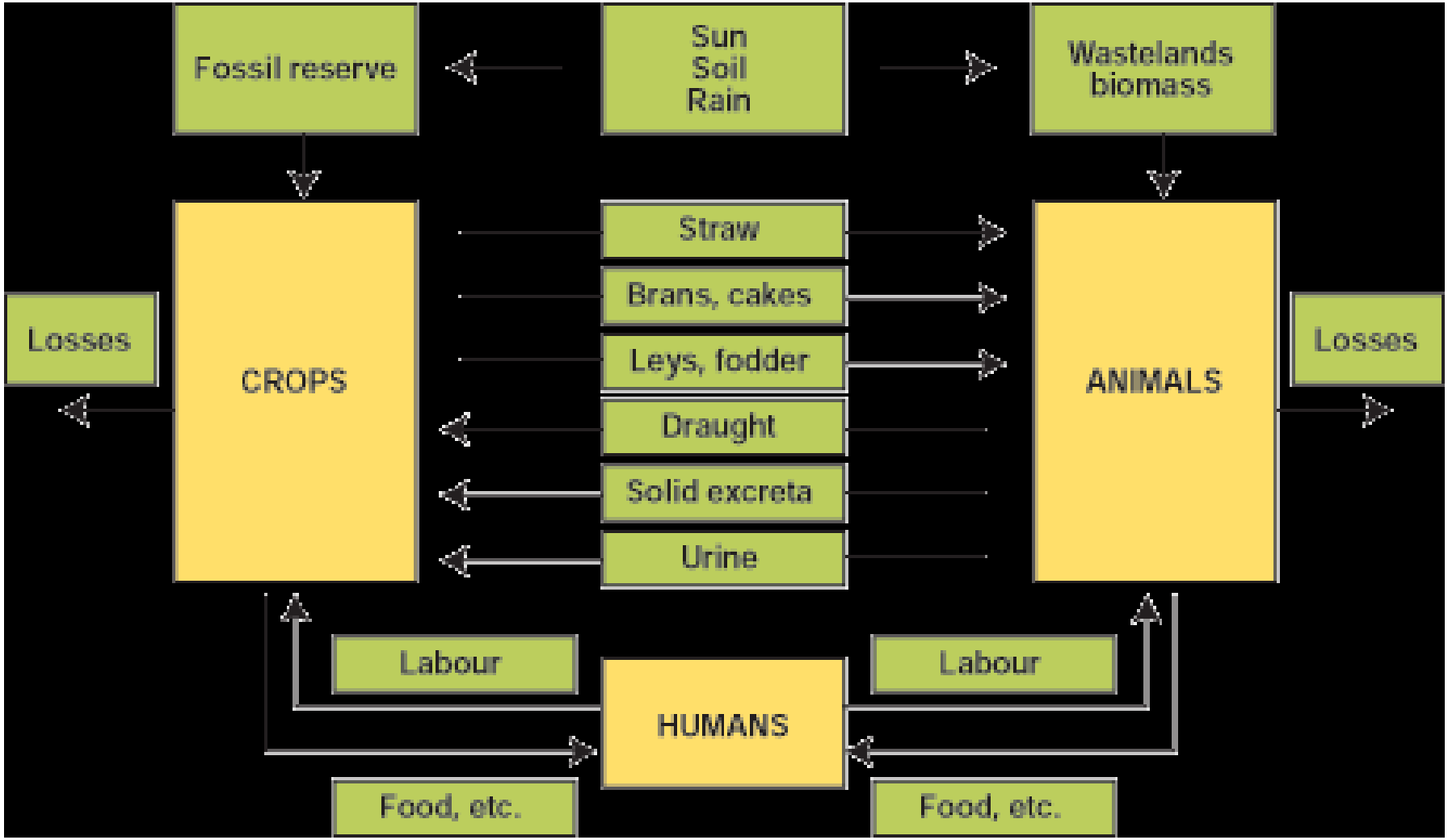
Characteristics

- (v) This farming is more mechanized. The use of heavy machines like tractors, harrowers, thrashers, etc., is very common.

- (vi) There is a large-scale use of both organic and inorganic fertilizers.

- (vii) The degree of commercialism varies considerably. In west-central Europe, the northern United States, and Argentina, mixed farming is highly commercialised, while in other areas the commercialisation is limited.
- (viii) It is more capital intensive and less labour intensive

Resources


Fossil reserve
Sun
Soil
Rain
Wastelands
biomass
Straw
Brans, cakes
Leys, fodder
Draught
Solid excreta
Urine
Losses
CROPS
ANIMALS
Losses
Labour
Labour
HUMANS
Food, etc.
Food, etc.

FORMS OF MIXED FARMING

- Mixed farming systems can be classified in many ways - based on land size, type of crops and animals, geographical distribution, market orientation, etc. Three major categories, in four different modes of farming, are distinguished here. The categories are:

- On-farm versus between-farm mixing
- Mixing within crops and/or animal systems
- Diversified versus integrated systems

- The modes of farming refer to different degrees of availability of land, labour and inputs, ranging from plenty of land to a shortage of land. The modes are characterized by Schiere and De Wit (1995) as expansion agriculture (EXPAGR, plenty of land), LEIA, HEIA and new conservation agriculture (NCA, a form of land use where shortages are overcome by more labour, more inputs and keen management).

Favourable Conditions

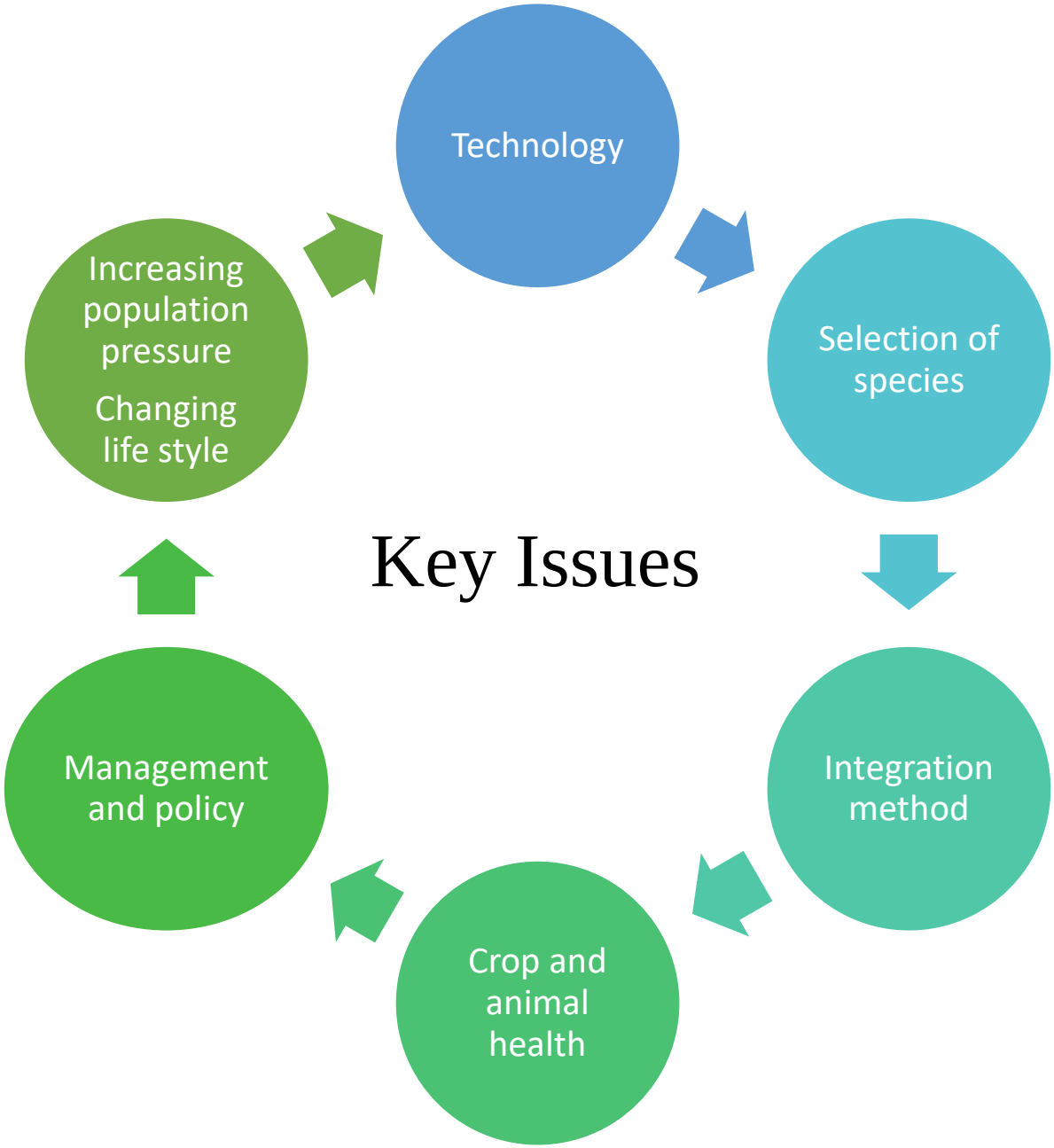
Physical Condition:

- Climate: Temperate with 50-100 cm annual rainfall
- Soil: Seirozem and chernozem
- Topography: Flat

Socio-Economic conditions:

- Large portion of land
- Technology
- Capital
- Demand
- Skilled labour
- Transport
- Economic condition of customers
- Food habit
- Man-land ratio

Key Issues


Technology
Selection of species
Integration method
Crop and animal health
Management and policy
Increasing population pressure
Changing life style

Sustainable Farm Management

Table 4: Indicators suggested to evaluate the economic dimension of sustainability of MFS

Criteria	Possible indicators	Relevance of the indicators for MFS
Long-term sustainability	1.Net income (farm level, share of cash crops and livestock) 2. Rate of diversification *(respective Gross Margins in livestock and in crops)* 3.Level of debt 4. Frequency of investments	MFS could balance risks between crops and livestock (specialised farm gets often better results but higher variability of income over years) ➔ *MFS are supposed to be more resilient as they could diversify product and be thus less sensitive to market fluctuation for one product* MFS invest more but could develop economies of scope (equipment, buildings, …) MFS needs a long term view
Short-term sustainability	1. Cash flow 2. Short-term debt (overdraft) 3. Labour productivity	Less sensitivity to the global market due to diversification of products sold (crops, livestock products,…) Farmers invest more in MFS (for both crops and livestock) If well-managed, farmers could have a great labour productivity in MFS in combining tasks over the year
Input use efficiency	1. Resource use efficiency (*input/output)* 2. Cost of inputs	MFS are supposed to better recycle N,P and C so to have a greater resource use efficiency and lower use in inputs (feed/fertilisers) Cost should be considered at local level and farm level

Table 5: Indicators suggested to evaluate the social dimension of sustainability of MFS

Criteria 	Possible indicators	Relevance of the indicators for MFS
Labour management	1. Hours of free time (labour balance evaluation) 2. Number of jobs created on-farm/locally	The multi-task labour organisation is higher in MFS More jobs are created in MFS both on-farm as more tasks have to be considered, and locally as diversified local products could be sold in the area
Cooperation between farms at regional level	1.Transactional costs (Time spent) *(including time spent helping others, in planning meetings, in training, …)*	Farmers collaborating for regional MFS need to share workload, planning and knowledge. Time spent in the establishment of regional MFS should be assessed to consider the involvement of the farmer.
Knowledge exchange	1. Time spent in training *(discussion/training groups, with adviser, internet/books, intergenerational exchange)*	Knowledge exchange is particularly needed in MFS as farmers have to develop diversified skills and knowledge As this could be achieved between farmers or through more conventional training or alone on the internet looking through references, different categories of knowledge exchange should be considered.

Table 6: Indicators suggested to evaluate the environmental dimension of sustainability of MFS

Criteria 	Possible indicators	Relevance of the indicators for MFS
Soil quality	1. Soil compaction 2. Soil texture 3. Soil organic matter 4. Carbon sequestration in grasslands 5. Share of soil covering (crops, grasslands, cover crops)	Key to measure the positive impacts of MFS on soils through arable-grasslands rotations and grazing (limiting erosion, …)
Water quality and quantity	1. N and P content of water 2. Quantity of water use by year and by crop	MFS are supposed to limit water pollution through arable-grasslands rotations and to have a lower use of water
Biodiversity **Landscape (proxys)**	1. Number of species 2. Number of habitats (agroecological elements, …) 3. Diversity of the landscape structure – (Shannon/Simpson index) or land cover	MFS are expected to encourage biodiversity MFS contribute to diversify landscape elements
Energy efficiency	1. Energy balance at the farm and regional levels	Energy balance is supposed to be better in MFS, as less energy is needed to import feed and fertiliser
Nutrient efficiency & climate change mitigation	1.Farmgate nutrient balance (N,P) 2.Carbon footprint	MFS are supposed to better recycle N,P and C so to have greater resource use efficiency and lower inputs use

Key issue	Ideas for Operational Groups
Labour-management	**Test new managerial solutions found by farmers to deal with complexity and risk in MFS** *Analyse existing case-studies of well-managed MFS; develop a labour-balances analysis based on farm surveys; develop participative approaches with groups of farmers to consider their management strategies and develop scenarios; identify management tools to assess MFS labour requirements and associated costs so as to facilitate integration between farms.*
Soil quality	**Identify best MFS practices in real farms to optimise soil quality** *A case-study approach would allow good practices to be considered, linking surveys on practices and soil analysis; mapping of soil quality and its evolution could be the base for discussions with farmers. In particular, identify proper use and optimisation of organic fertilisers (manure) in different pedo-climatic areas.*
Technical efficiency	**Develop locally-adapted multicriteria evaluation of MFS** *Identify and validate existing case-studies of MFS practices that generate positive impacts and increase farm profitability. Adapt multicriteria evaluation framework together with local actors; define the right balance in a multipurpose system (arable – grasslands – livestock – perennial crops) to achieve farmers' objectives and provide ecosystem services. Test the technical efficiency of mixed farming variants under several pedo-climatic conditions to enable more informed decision making.*
Technical efficiency	**Identify best practices to optimise energy/nutrient cycles including combination of already existing practices** *Consider and analyse technical and economic data in MFS developing arable-grasslands rotations including cover crops to feed the animals; explore new techniques and technologies (mixed crops, methanisation,…); consider for instance grazing systems based on grass or immature crops and mixed crops, arable-grasslands rotations, crop residues, etc.*
Marketing	**Develop marketing strategies to add value to MFS products and integrate specificities of MFS into already existing value chains** *Develop new products and analyse diversified bundles of services provided by MFS so as to diversify production and increase farm resilience. Develop new business models to make profit out of multifunctional approaches (for example, creating riparian buffers to prevent pollution, erosion etc.)*

References:

- http://www.fao.org/3/y0501e/y0501e03.htm
- http://www.fao.org/3/y1860e/y1860e06.htm