Landscape Approach and Agrobiodiversity:

A Case Study from India

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Landscapes – Dynamic entity evolved of complex interactions between people and nature

- History of NRM to meet their multiple needs
- Farming, livestock, forestry and fisheries systems evolved, and been adapted to variable and changing environmental and socio-economic conditions.
- Factors like population growth or loss, tenure arrangements, labor availability, access to markets and economic growth, as well as cultural traditions and political strategies shape landscapes over time.
- These complex interactions have generated today's rich diversity of semi-natural and cultural landscapes.
- Such areas now been called SOCIO-ECOLOGICAL PRODUCTION LANDSCAPES & SEA SCAPES (SEPLS)

Landscape Approaches

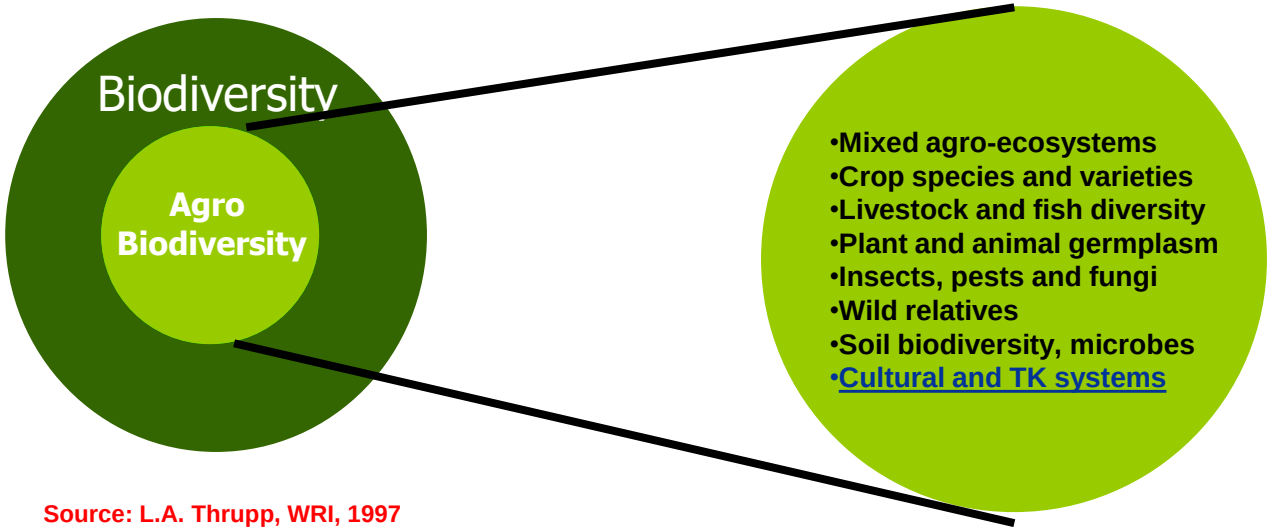
1. It combines NRM with environmental and livelihood considerations.
2. Optimization of production and resource use is treated at a larger scale – the landscape.
3. Placing human well-being and needs at the centre of the decision-making process, the rights and cultural values of involved communities are respected alongside their land use objectives.
4. The Landscape Approach requires a multidisciplinary perspective and multi-stakeholder activities to negotiate goals and priorities and implement actions.
5. Stakeholders must clearly define and agree on the goals and desired objectives and outcomes and then assess the current and future factors that will influence the process.
6. Trade-offs and synergies carefully assessed and appropriate landscape-scale management interventions identified. Planning approaches, such as participatory Integrated Land Use Planning (ILUP), can support these multi-dimensional processes.

- Landscape Approaches pose challenges to governance, particularly if implemented on larger scale.
- Capacity building at all levels is required to develop a shared vision and appropriate governance procedures for implementation and management.
- Suitable tools and indicators to measure ecological, social and economic processes in landscapes are required to allow for more accurate management decisions and policy interventions, and
- to evaluate and manage trade-offs between benefits and costs occurring at different temporal and spatial scales.

AGRO-BIODIVERSITY

"that part of biological diversity that nurtures people and that is nurtured by people". (FAO 1998)

A key element of sustainable landscapes



Source: L.A. Thrupp, WRI, 1997

"Agricultural biodiversity play a key role in Landscape Approaches, as it links human nutrition and resource needs with the requirements to maintain and increase productivity and ecosystem services in the wider landscape.

LANDSCAPES & AGBD are severely stressed by multiple interacting drivers

- Climate change
- International market
- Land & Water use change
- Pollution
- Over use of external inputs
- Overharvesting
- Invasive species

Nr. species known in total (approx)	**Nr. species domesticated** (approx)	**Most important to global-level food supply**	**Nr. domestic varieties & breeds**	**Nr. domestic varieties & breeds at risk**	**Nr. domestic breeds & varieties extinct**
Plants					
300,000	**200**	**Bananas/plantains, beans, cassava, maize, millet, potatoes, rice, sorghum, soybean, sugar cane, sweet potatoes, wheat**	**Many thousands**	**1000's**	**Not known**
Mammals					
5,000	20	cattle, pigs	> 3000	>500	238
Birds					
10,000	10	chickens	>860	>370	

Landscape approach for Agrobiodiversity mainstreaming: **The Case Project-Revitalizing Shade Coffee Farming**

The Problem

While the ecological and socio-economic costs and benefits associated with shade coffee are projected, many modern management schemes abandon shade practices and also there are many challenges to bridge sustainable coffee management with livelihood security

Need for the Project

Biodiversity declines within coffee systems are of particular concern, given that ecosystem services and carbon sequestration are worth billions annually

Coffee (*Coffea arabica* (de Jessieu) Linn) was introduced in India about 400 years ago in the Western Ghats-a global biodiversity hotspot.

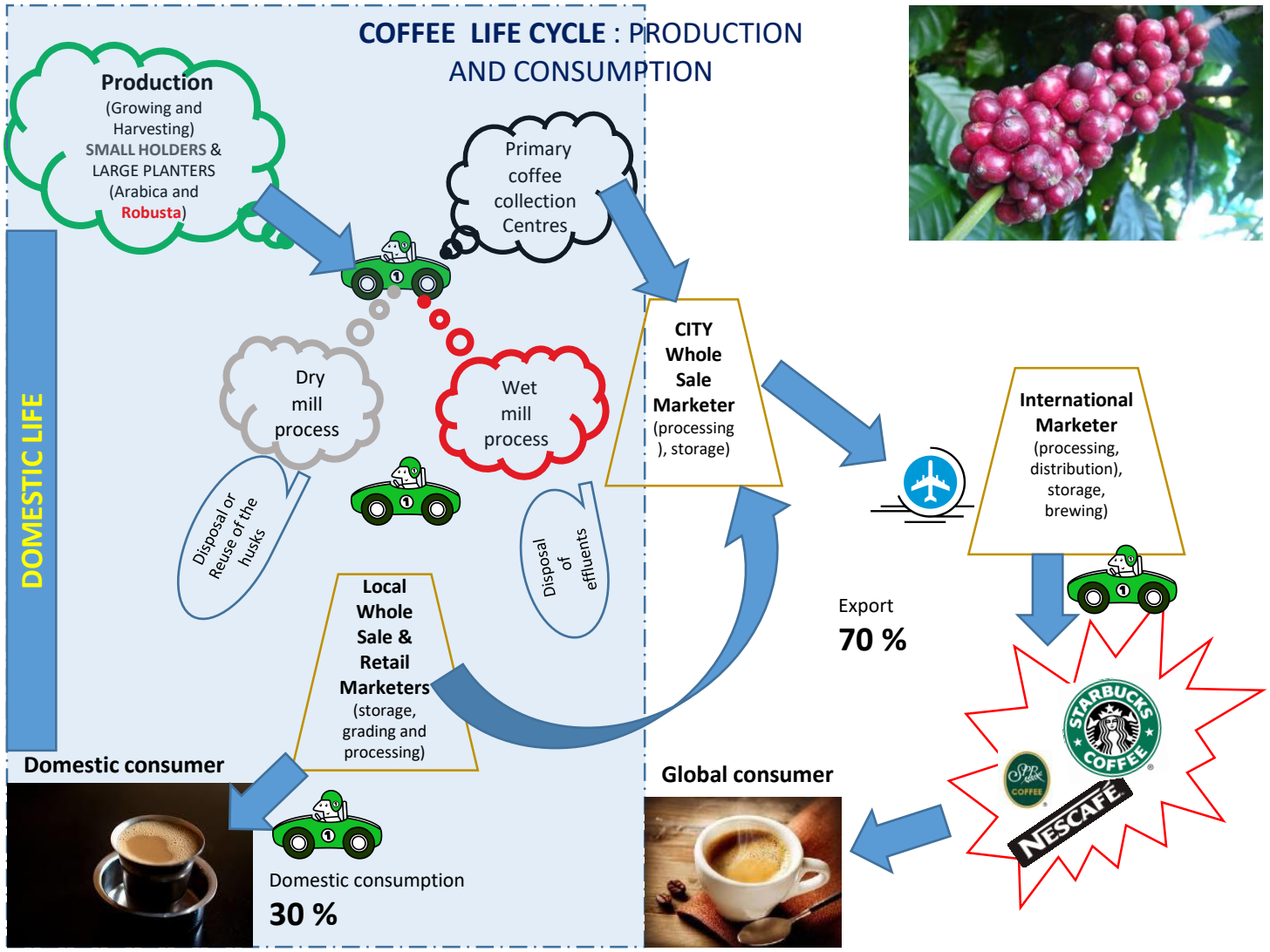
India has five wild coffee species,
C. bengalensis, C. travancorensis,
C. wightiana, C.khasiana and *C. jenkinsii,*

Since 1840, coffee cultivation is on a plantation mode in selectively cleared evergreen and moist-evergreen forest slopes of the medium elevation regions, mainly in south west and east regions (over 90% small holder farmers >2 ha farms)

Till early1990's "Arabica coffee" dominated the coffee plantation.

For the last 25-30 years with the preference over the Robusta variety (C. canephora) A sturdy, high yielding and sun-loving species-

Farmers' Reasons-
- No Berry Borer attack
- No much yield Loss


COFFEE LIFE CYCLE : PRODUCTION AND CONSUMPTION
Production
(Growing and Harvesting)
SMALL HOLDERS & LARGE PLANTERS
(Arabica and Robusta)
Primary coffee collection Centres
DOMESTIC LIFE
Dry mill process
Wet mill process
Disposal or Reuse of the husks
Disposal of effluents
CITY Whole Sale Marketer (processing), storage)
International Marketer (processing, distribution), storage, brewing)
Export
70 %
Local Whole Sale & Retail Marketers (storage, grading and processing)
Domestic consumer
Domestic consumption
30 %
Global consumer
STARBUCKS COFFEE
NESCAFÉ

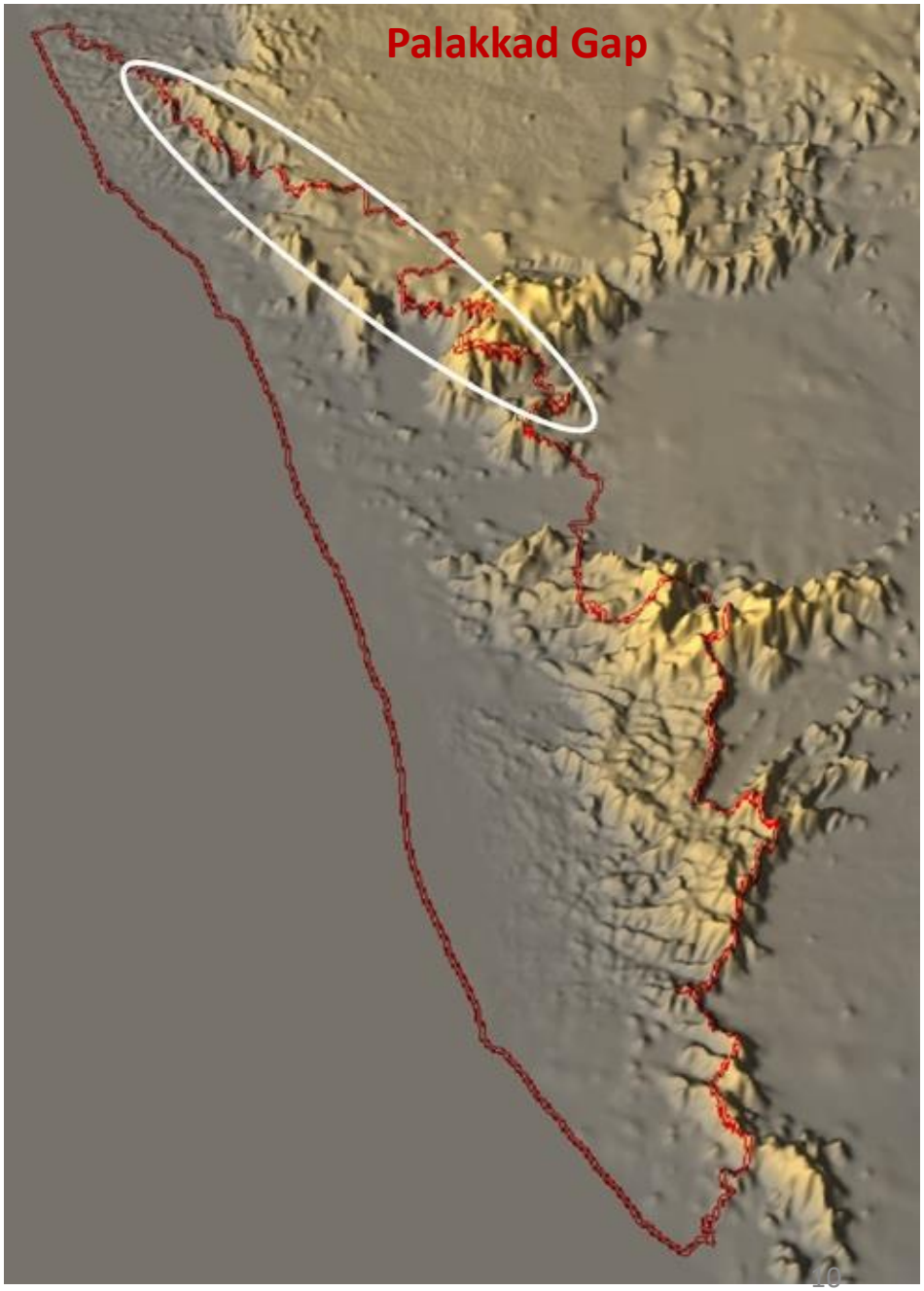
Shade grown coffee system is akin to tropical forest

➢Biodiversity benefits associated with shaded coffee practices

- maintenance of the local hydrological systems
- increased numbers and species of birds
- soil protection/erosion control
- carbon sequestration
- natural pest control
- improved pollination etc.,

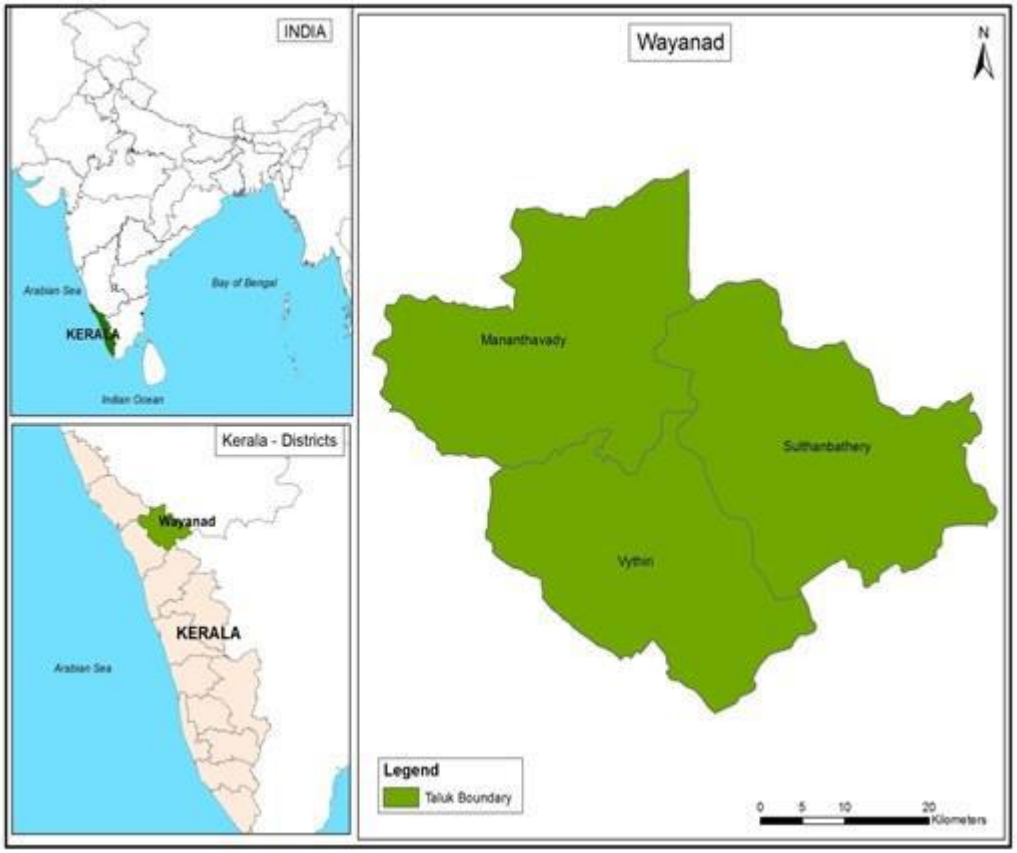
➢Shaded coffee has the potential to provide a viable business case to coffee smallholders and help the society to sink their carbon.

Kerala part of the Western Ghats is one of the floristic rich regions of the Indian Sub-Continent.



Nilgiri - Wyanad - Kodagu

Study Area (Coffee, climate & biodiversity)



Study Area: Wayanad, Kerala, India

- **Wayanad, Kerala, India**
- 700 to 2100m above sea-level

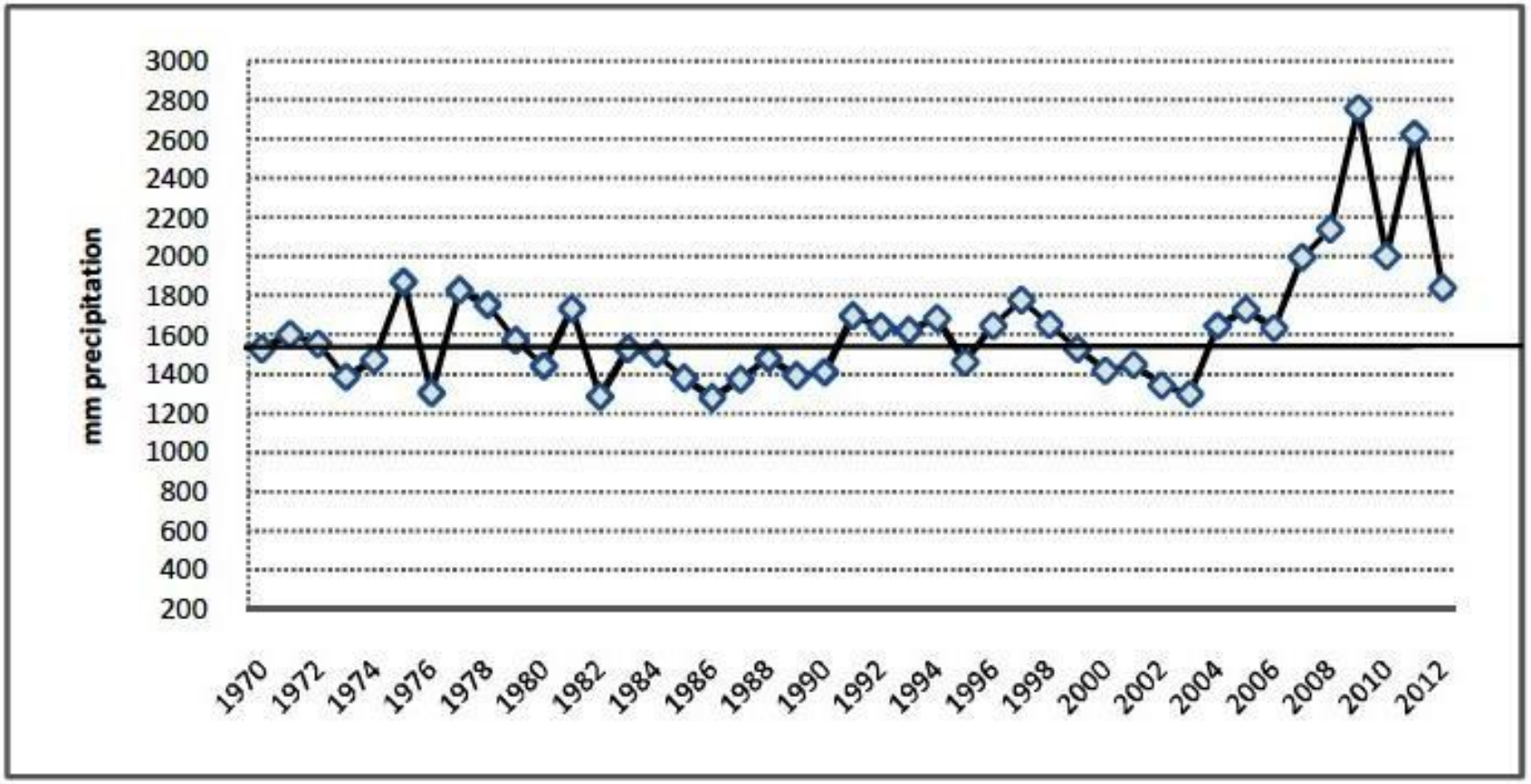
- Hot humid climate
- Min T 14 to 20 degree C
- Max T 25 to 32 degree C
- Rainfall 2000-3000mm per year

- Coffee important crop
- 2nd largest producer in India
- 23% total coffee output in India

- Rich wild biodiversity
- 229 species of pants,31 species of mammals, 15 species of birds,52 species of amphibians

- Vulnerable to varied rainfall, flash floods, prolonged drought, forest fire, landslides etc (20 years ago second highest rainfall area, last year 30% deficit in monsoon. Summer showers almost stopped)

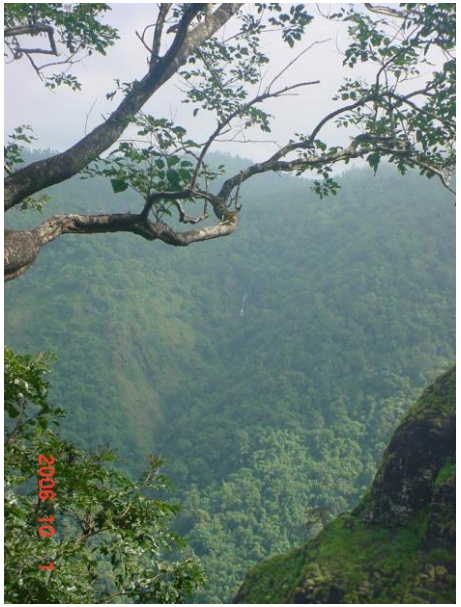
An example of Wayanad Climate Profile of Wayanad “Rainfall Pattern”



Annual Rainfall in Wayanad 1970–2012. Horizontal Line Indicates Annual Average for this Period

Ref: Muthulingam P and Gopalsamy P.(2013). Rainfall Trends:What Attitudes and Beliefs Motivate Farmers to Mitigate and Adapt to Climate Change? . In. Green India: Strategic Knowledge for Combating Climate Change: Prospects & Challenges. Pondicherry University, Pondicherry University, India

Forest landscapes of Wayanad

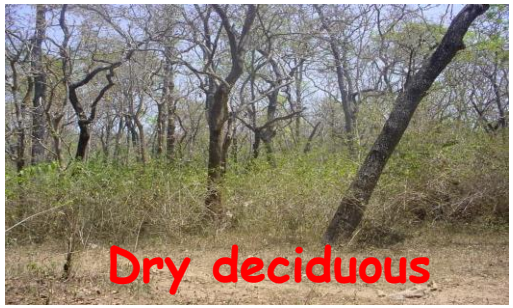


Evergreen

Shola

Grasslands

Moist deciduous



Dry deciduous

- By following Chandrasekharan (1962c) and Champion and Seth (1968) the natural vegetation of the study area can be broadly classified into 6 types
- Certain edaphic types such as reed brakes, moist bamboo brakes, secondary evergreen forests, and marshy grasslands are also present in the district

Shade coffee farms, Wayanad

Open or partially shaded Coffee Farm, Wayanad, Kerala, India

Rare, Endemic and Threatened Plants diversity in Shade Coffee Farms

Sl. No		Western Ghats	Wayanad	Shade Coffee Farms
1.	Total No. of plant species	4679	2123	>100
2.	Endemic to Western Ghats	1637	622	>50
3.	Threat category	325	148	24

Study Results:
Over 100 wild trees in shade coffee farms

Butterfly Diversity in the Garden

Sl. No		Western Ghats	Wayanad	Shade Coffee
1.	**Total No. of Species**	**334**	**150**	**55**
2.	**Endemic to Western Ghats**	**33**	**11**	**5**

Malabar Tree Nymph

Malabar Banded Swallow Tail

Buddha Peacock

Southern Birdwing

South Indian Blue Oakleaf

Frog Diversity in the shade coffee Farm

Sl. No		Western Ghats	Wayanad	Shade Coffee
1.	Total No. of Species	158	53	10
2.	Endemic to Western Ghats	138	49	07

Pseudophilatus wayanadensis

Raorchestes anili

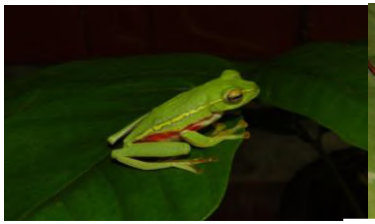
Raorchestes akroparallagii

Raorchestes glandulosus

Raorchestes ponmudi

Raorchestes nerostagona

Racophorus malabaricus



Racophorus laterralis

Polypedates pseudocruciger

Bird diversity in Shade coffee

Sl. No		Western Ghats	Wayanad	Shade Coffee
1.	Total No. of Species	508	302	70
2.	Endemic to Western Ghats	28	15	7

- Over 100 wild edible species

LESSONS: Nexus of carbon stock of coffee production system and biodiversity

- Carbon (C) storage in both living biomass and in the soil.

- Arabica and Robusta coffee farms become very prominent largely for increasing carbon removal

- One hectare shade grown coffee farm with large forest trees can sequester 70-80 tonnes of carbon per hectare. A fully sun –grown or open coffee in one hectare can only store less than 10 tonnes of carbon (Noponen et al. 2012).

- Higher C storage potential is believed to co-occur with biodiversity conservation (Venter 2014; Beenhouwer et al. 2016).

- Positive correlation between soil organic C and plant diversity (Richards and Mendez 2013).

THANK YOU