

# Forestry - Agriculture Interfaces

Professional Forestry Training Course (2020-22)

for

IFS Probationers & Bhutanese Trainees

13 January 2021

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# Forestry & Agriculture – *Interfaces*

## INTERFACES

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- **Contexts and Perspectives**
- **Positioning *Agriculture and Forestry* in 21<sup>st</sup> Century Setting and Emerging Scenario –**
  - **Food Security**
  - **Water Security**
  - **Soil Security and Land Restoration**
  - **Biodiversity**
  - **Climate Change Ramifications**

*Sustainable Development Pathways*
- **Shared Pathways and Strategies**
- **Locating Research in Forestry-Agroforestry Interfaces**

# Agriculture & Forestry – *Interfaces*

## Agri“culture” ... Forestry – Silvi“culture” Analogies and Shared Contexts/Aspects

- **Most landscapes** – For thousands of years impacted by human footprints and interference – *commenced with human evolution, hunters-gatherers, nomadic-pastoral, domiculture, agriculture - shifting and sedentary*
- **Both Forestry and Agriculture Co-evolved and Diversified with *human civilization* – *Nature, Nurture & Culture***

Contexts  
and  
Perspectives

<u>AGRICULTURE-FORESTRY</u> CONTINUUM.....				
Managed Forestry... and Conservation Forests....	Live stock, Aquaculture, Fishery.....	Agro-fore stry.....	Shifting agriculture ...	Sedentary farming, Horticulture...

- *May be other way round in some landscapes – e.g. Amazon*
- **In India** – Majority of large landscapes *Agriculture subsumes Forestry*.  
*Exceptions: – Pockets in North-East, High elevation montane landscapes*

## Analogies, Shared Contexts/Aspects - 2

- In recent times till mid-20<sup>th</sup> Century – Agriculture and Forestry in all forms - the Mainstay of Development
- All kinds of *organized agriculture* and *managed forestry* practices targeted Maximizing Outputs and Productions by Intense Utilization of Natural resources and Ecosystems with Inputs – *chemical/mineral fertilizers, irrigation, pesticides*
- Mid-20<sup>th</sup> Century onwards – “*Efficient-Intensive-Industrial*” forms of agriculture and likewise *conventional forestry practices* -

### “Unsustainabilities” Environmental Impacts or Implications of:

<i>“Efficient Intensive- Industrial” Agriculture</i>	<i>“Conventional” Forestry</i>
Mining Natural Resource Base, Soil erosion and degradation, Ground water depletion, Water stress, Pest & Disease build-up, Contamination and Eutrophication of water bodies.....	Catchment Hydrology Impairment..., Soil degradation..., Biodiversity loss ....., Below-ground biodiversity...

# Agriculture & Forestry – *Interfaces*

## Positioning Agriculture and Forestry in 21<sup>st</sup> Century Setting and Emerging Scenario

- **Pronounced *Anthropocene* Dimensions**
  - Human, Environmental & Ecological Perspectives**
  - *Population Load, Human Footprints and Lifestyles*
  - *Water Security*
  - *Soil Conservation, Soil Health/Fertility*
  - *Balance & Resilience of Biosphere (Security of Life support system)*
  - *Biodiversity – Landscape, Community, Species, Sub-species and cultivars (agro-biodiversity)*
  
- **Sustainable Development Perspectives**
  - Sustainable Development Goals***
  - *Environmental - Ecological Concerns*
  - *Equity Concerns – Social Dimensions*
  - *Economic- political economy - dimensions*
  - *Ethical Concerns - Cultural*

Contexts  
and  
Perspectives

.....

# Positioning *Agriculture and Forestry* in 21<sup>st</sup> Century Setting and Emerging Scenario -2

## Challenges & Opportunities

### **Pronounced Anthropocene Dimensions – *Indian scenario***

#### ▪ **21<sup>st</sup> Century Perspectives & Challenges**

□ *Population 2050 onwards - 1.5 - 1.7 billion;*

□ *Economy - 7- 10 times Per Capita GDP*

□ *Middle Class Population – 1 billion:*

□ *Urban India – 60%*

*Gigantic throughput of Energy, Land use, Biomass and Material  
Involving and Impacting Environmental Systems – including agriculture  
and forest landscapes (2/3<sup>rd</sup> of landmass)*

#### ▪ **Techno-Scientific Opportunities for *Sustainable Technologies and Pathways***

*For navigating the Conservation-Development conflicts,  
Dilemmas and Paradoxes*

*Solutions from Agriculture and Forestry Resource Systems - Bio-Economy*

#### ▪ **India sharing global leadership in Sustainable Development (SDGs) : *Agriculture and Managed Forestry being nearest to nature – Key Role: Partner and Stakeholder***

Contexts  
and  
Perspectives



A new **bioeconomy** strategy for a sustainable Europe



		EMPLOYMENT (MILLION JOBS)	TURNOVER (BILLION EUR)	VALUE ADDED (BILLION EUR)
	AGRICULTURE	9.2	380	174
	FORESTRY	0.5	50	24
	FISHING AND AQUACULTURE	0.2	12	7

# Example – Biomass for Energy



**Growing energy demand**



**Depleting fossil fuel resource**



**Population Explosion**



**Increase in vehicle**



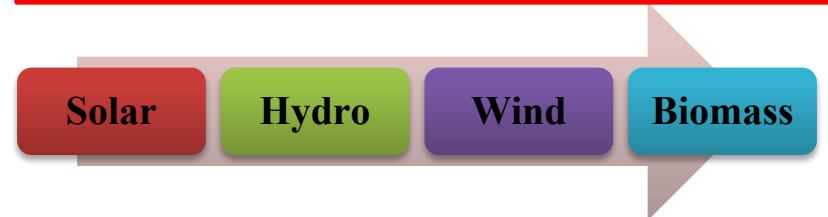
**Rise on the Import & Import bill**



**Uncertainty in fuel market**



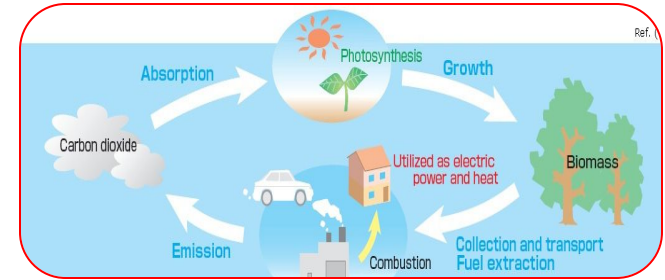
**Increasing pollution and climate change risk**





# BIOMASS – Agriculture & Forestry

Renewable organic matter generated by plants through photosynthesis



Energy plantation



Strains of tree & plant species



Organic wastes & Residues

organic residues or resources?



Grass  
es



Twig  
s



Bush  
es



Weed  
s

# DENDRO BIOMASS - SIGNIFICANCE

## 1. ECONOMIC

- ◆ Amenable for solid and liquid fuel
- ◆ Amenable for Agro & farm forestry
- ◆ Increases productivity and profitability
- ◆ Reduced rotation
- ◆ Reduces fossil fuels dependency
- ◆ Efficient land use system



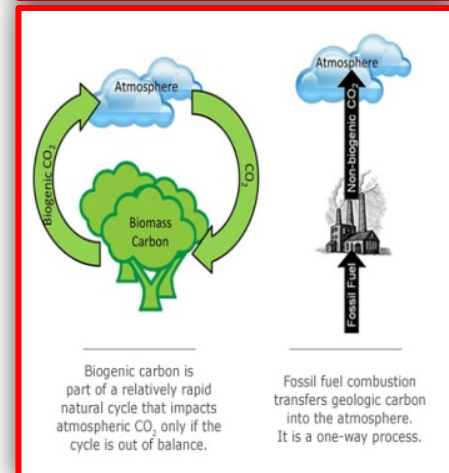
## 2. ENVIRONMENTAL

- ◆ Renewable - Efficient utilization
- ◆ Reduces climate change risks
- ◆ Reduces CO<sub>2</sub> & balances oxygen
- ◆ Green and Clean energy (IPCC)



## 3. SOCIAL

- ◆ Income & employment generation
- ◆ Distributed power generation
- ◆ Suited for rural areas
- ◆ Rural economic upliftment



# Positioning *Agriculture and Forestry* 21<sup>st</sup> Century Setting and Emerging Scenario

- **Sustainable Development Perspectives :**

## *Sustainable Development Goals*

### □ Environmental - Ecological Concerns

Degradation & Pollution of Land, Soil, Water, Air – Landscape impacts

Biodiversity – Loss + Biological Invasions, Food Security, Health hazards

Climate Change Impacts – Vulnerabilities and Adaptations.....

### □ Equity Concerns – Social Dimensions

Across - economic-class strata, regions, communities.....

### □ Ethical Concerns - Cultural Dimensions

Traditional Culture of farming, husbandry of livestock and management of forests .....

### □ Political - Economy Dimensions – Transformations

Composition, Modes, Means and Pace of Reforms & Transitions – Minimizing adverse impacts, destabilization  
.....

Challenges  
&  
Opportunities

# Positioning *Agriculture and Forestry* 21<sup>st</sup> Century Setting and Emerging Scenario

Challenges  
&  
Opportunities:

**Food  
Security**

- **Sustaining Agriculture - Farm Productions to meet food demand for 1.5+ billion Indians in 2050 – 300 MT in 2020**

**Impacts on and Impairments of the Bio-systems – *land – soil – moisture ... associated safeguards, resilience, immunity and buffers***  
**?????**

- **Sustainable Production from Forestry – Agroforestry, Farm Forestry, Sustainable Harvest of edible forest produce**

**Positioning *Agriculture and Forestry***  
**21<sup>st</sup> Century Setting and Emerging Scenario**

Challenges  
&  
Opportunities:  
  
Water  
Security

- **Sustaining Agriculture, Urbanization & Industrialization - for 1.5+ billion Indians in 2020**
  
- Impacts on and Impairments of the Hydrological Systems and Cycles – *Depleting Groundwater and Dwindling River flows*, besides other adverse impacts.....**
  
- **Restoration of River Catchments and Sustainable Land Use & Land Cover in Flood Plains through managed forestry interventions**

**Positioning *Agriculture and Forestry***  
**21<sup>st</sup> Century Setting and Emerging Scenario**

Challenges  
&  
Opportunities:

**Soil  
Security**

- **Sustaining Agriculture (+Horticulture) Farm Productions for 1.5+ billion Indians in 2020**

**Impacts on and Impairments of the Soil System –**

**Availability of Top Soil, and Soil Health (*Desertification of Soil*),  
*Below Ground Biodiversity***

- **Blending Forestry/Tree vegetation in predominantly agricultural landscapes for sustainable biomass production (food and non-food produces) with sustainable soil fertility and moisture regime.**

# Positioning *Agriculture and Forestry* 21<sup>st</sup> Century Setting and Emerging Scenario

Challenges  
&  
Opportunities:

Biodiversity  
Conservation

Biodiversity in wild – dwindling due to anthropogenic factors  
Fundamental for Sustainable Forest Management,

*Conservation Forestry—Production Forestry*

## Agrobiodiversity - Fundamental for Sustainable Agriculture

- **Agrobiodiversity – Traditional Agroecosystem Systems sustained by rich landscape level biodiversity – *Linked with forest landscapes and homestead jungle – Being lost in the current times***
- **In need of *dynamic conservation:***

***Knowledge Systems –***

*Mainstream Scientific Knowledge (Analytic and Reductionist);*

*Traditional Ecological Knowledge (Experiential, Cultural, Integrative)*

**Adaptation or modernization with contemporary scientific research and knowledge**

# Positioning *Agriculture and Forestry* 21<sup>st</sup> Century Setting and Emerging Scenario

Challenges  
&  
Opportunities:  
  
Climate  
Change  
Ramifications

- Climate Change Impacts on *agriculture and managed forestry*
  - Temperature, Precipitation regime affecting crops
  - Frequency of Extreme hydrometeorological events:
    - flash floods, heat and cold waves
- **Vulnerabilities of dependent community – large fraction of population in the farmers’ community, tribal communities of forest landscape and other traditional forest dwelling people**
- **Adaptation Strategy:**
  - ✓ Diversification of biomass (food and non-food) production systems  
Integrated and coordinated *land use and land cover for agriculture and production forestry*



# Shared Pathways, Strategies and Opportunities

## Factors

- Configuration and topological relation of *Agriculture landscapes* and *Forest landscapes*:  
**Enmeshed, Intertwined, Honeycombed, Embedded....**  
*Natural setting and Man-made*
- Geo-demographic configuration and trends
- Industrial – Urban and Infrastructural growth and expansion – the legacy and trend

## Eco-restructuring of Land Use

**Agriculture and Forestry (Managed Production Forestry)**

- Integrated approaches - Landscape levels land use strategy  
Ecosystems Approach
- Multiple Use – Multiple Functions/Roles  
Productive Pluralism
- Adapting Traditional Knowledge (Practices, Culture) with contemporary S&T  
Technological Pluralism and Technology Blending







## Shared Pathways and Strategies - 2

### Eco-restructuring of Land Use and Forestry- Agriculture

- ✓ **Complementarities and Synergisms between *Forestry and Agriculture* besides within .....** *to optimize throughputs of material and energy*
- ✓ **Mix of Products and Services or functions –** *(Food and Non-food, Wood and Non-wood, Amenities and Ecosystem services .....*)
- ✓ **Redesigning *Configuration (Spatial) and Composition: Agriculture – Agroforestry – Forestry***

**Eco-restructuri  
ng  
of  
Land Use  
and  
Forestry  
-Agriculture**

## **OPPORTUNITIES .....**

### Complementarity

- **Farm Forestry, Agroforestry - *Huge untapped potential***
- **Food produces from Forestry and Non-food produces from Agriculture: *Huge untapped potential; Require changes in consumption pattern, technology mix; Lifestyle behavior etc.***
- .....
- .....

# Shared Pathways, Strategies and Opportunities

## Policy and Programme Framework

### **Eco-restructuring of Land Use and *Agriculture – Forestry***

- **Policies related to Sustainable Agriculture, National Agroforestry Policy 2014**
- **National Forest Policy, National Forestry Action Plan**
- **Green India Mission, National Bamboo Mission**
- **National Action Plan and State Action Plans for Climate Change – *Components for Agriculture, Forest, and Disasters***
- **Biodiversity Conservation Act 2002**
- **Soil Health Card (Farm Soil and Forest Soils)**
- **River Rejuvenation Programme (NMCG....)**
- **Organic Farming**
- **National Biofuel Policy .....**
- **..... .....**

# QUESTIONS for REVIEW & ACTION

*Forestry-Agriculture Interfaces: Organic, Crucial, Critical*  
*Intensity and ramifications growing with time*

- Are **Mutual Action & Engagement** sufficient?
  - ✓ Deficits and lags in integration, cohesiveness, collaboration in *Programmes, Policies and Governance*
  - ✓ Compartmentalized mindsets, attitudes, approaches and working
- **Van Vigyan Kendras – Krishi Vigyan Kendras** - *Scope for cohesive works*
- **Institutional mechanism and Personnel deployment system** - *For enhancing constructive engagement in the interface areas.*
- **R & D orientation for Forestry-Agriculture Interfaces – Adequate?**
- **Do we need more/different systemic changes for better management of the Forestry-Agriculture Interfaces in the emergent scenarios?**
- .....?.....?.....?.....



# Shared Pathways, Strategies and Opportunities

## Locating RD&D Initiatives in *Agriculture –Forestry Interface*

Mainstreaming  
Ecosystems  
approach &  
operationalizing  
sustainability

### Research, Development & Demonstration

All agriculture and forestry research are *action research* with great deal of participatory components

- Ecosystems and Landscape approaches in Land use – *Forestry–Agriculture composites/complexes*
- Shock-proofing against Climate Change related impacts (slow onset) and calamities (episodic) – Diversification of crops and bio-produces
- Farming Practices with Ecosystems Approach in Transitional zones of Farm-Forests and Farms-Wetlands
- Eco-system based farming in areas ceded to tribal and other traditional forest dwellers under Forest Rights Act
- Genetic improvement of tree crops – reduction in maturity etc. for enhancing economic viability of tree crops

# Shared Pathways, Strategies and Opportunities

Locating  
RD&D  
Initiatives

in

*Agriculture  
–Forestry  
Interface*

Mainstreaming  
Ecosystems  
approach &  
operationalizing  
sustainability

## Research, Development & Demonstration

- **Soil Health and Restoration – Farm soils and Forest Soils.....**
- **Application of post harvest technology for forest based food resources**
- ***Homestead jungle* – traditional/cultural practices blended with contemporary science & technology – e.g. *High Productivity Polyculture System***
- **Landscape orientation in Pest Management – Bio control of agriculture pest and diseases – utilization of forest based bio-control agents**
- **Collectives, Cooperatives, Market institutions – *Agri-Forestry Interface***
- **Forest-Farmland Fringe areas: *Agriculture –Wildlife Interface* – *Livestock-Wildlife Interface - Mitigation of Conflicts* – Interventions through Crop design, Landscape Epidemiology**
- .....

Nature to be commanded first has to be obeyed – Francis Bacon

Thanks...

Nature's Demise spells the death of Agriculture (*includes forestry*)

- *Edward Souma, Fmr DG, FAO (italics mine)*