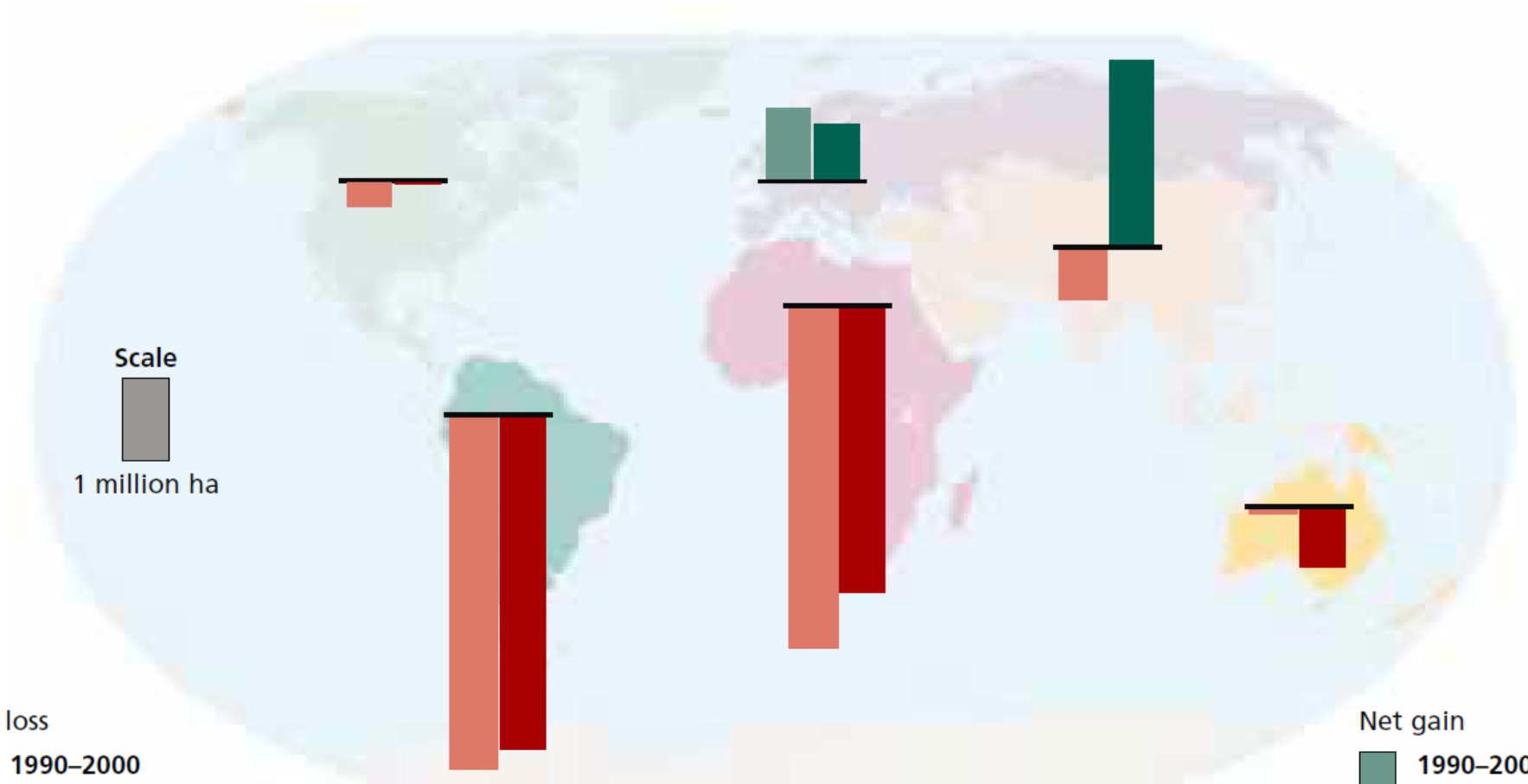


FORESTRY AS A BIOMASS RESOURCE IN INDIAN CONTEXT

Sanjeev K. Chauhan
chauhanpau@rediffmail.com



Annual change in forest area by region, 1990–2010



Net loss
1990–2000
2000–2010

Net gain
1990–2000
2000–2010

Africa Asia Europe North and Central America Oceania South America

(million ha/yr)

Requirement and availability of wood

Year	Requirement (million m ³)		
	Fuelwood	Timber	Total
2000	297	58	355
2005	329	74	403
2010	362	95	457
2015	398	123	521
2020	437	153	590

Availability (million m ³)						
Fuelwood			Timber			Total
Govt. forest	Pvt. land	Total	Govt. forest	Pvt. land	Total	
39	130	169	12	24	36	205

Growing stock 4740.8mm³
 Average vol. 74.42m³ per ha
 Annual increment in growing stock 87.62mm³ giving the av. Productivity of 1.38m³ per ha per yr

Requirement and availability of wood

Total requirement **355million m³ (297 fuelwood+58 timber)**

Total availability **205million m³ (169 fuelwood+36 timber)**

Deficit **150 million m³**



Wood demand Assessment

Industry

Type of Species

Short Rotation

Long rotation

Paper & paperboard	100	-
Newsprint	100	-
Rayon grade pulp	100	-
Construction industry	20	80
Package	50	50
Furniture	-	100
Agricultural implements	50	50
Railways sleepers	-	100
Sports	50	50
Handicraft	-	100
Plywood	75	25
Veneer	50	50
Particle board & MDF Board	-	100
Mining	50	50
Matchbox	100	-
Miscellaneous industry	50	50

Demand projection of industrial wood



	2000	2005	2010	2015	2020
Wood from SR species	27.87	37.30	50.18	68.76	87.70
Wood from LR species	29.85	36.62	44.92	54.40	65.10

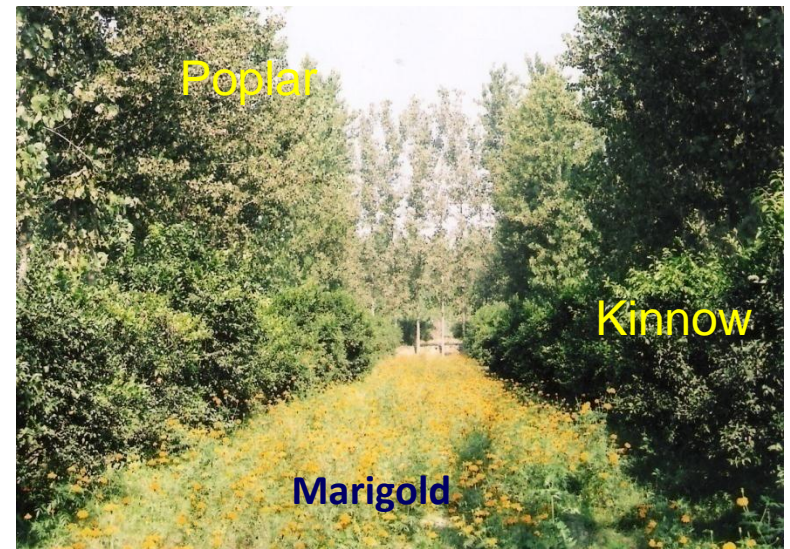
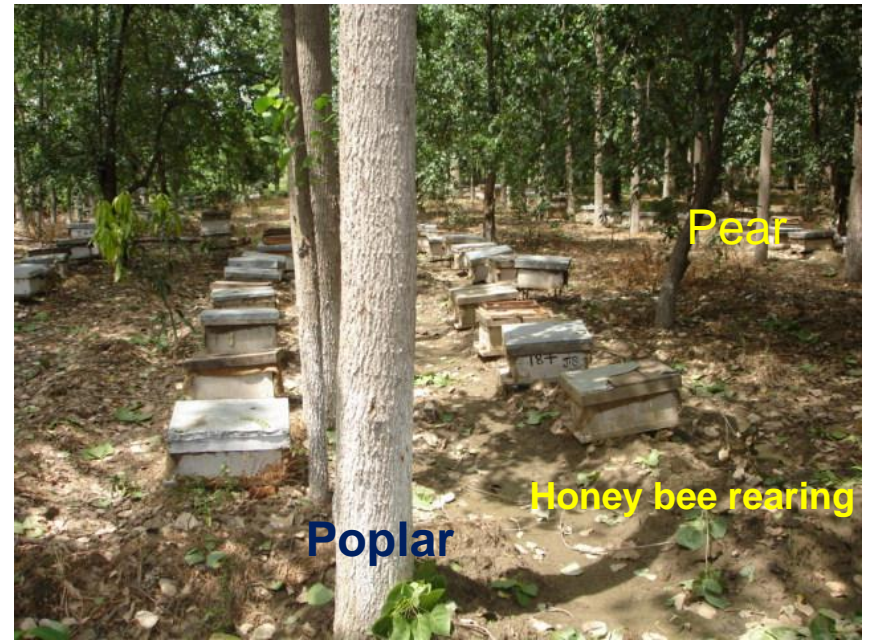
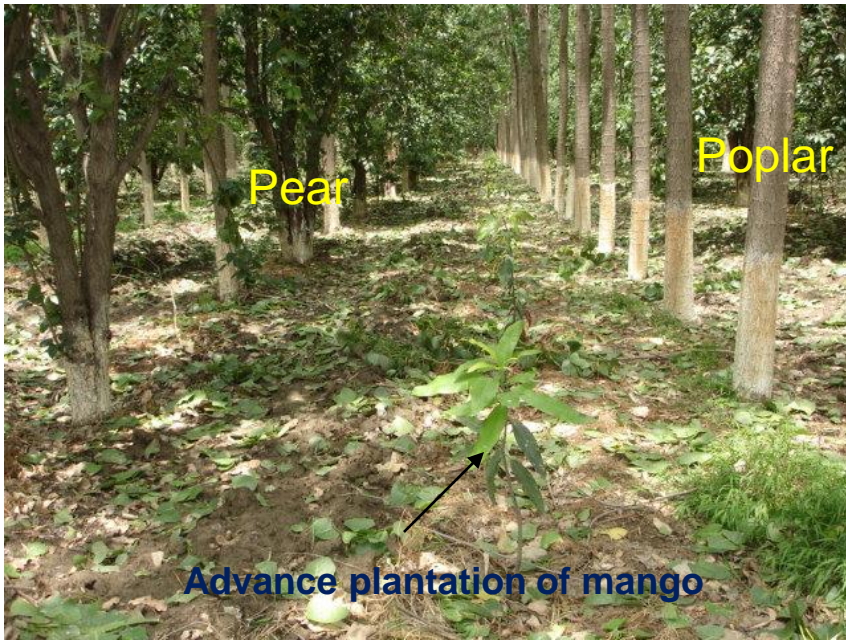


Strategy to enhance the production from forests

Production from dense forests

Production from social and agroforestry programmes

Future potential of wood production from non-forest lands



Land pressure for multiple cropping : extend vertically no scope horizontal expansion

Each & every part is usable



Leaves & small twigs being made into chips for fuel



Roots for charcoal



Leaves are collected they affect wheat germination



Ply making



Litter addition



Coal making



Leaves and branches chipped at farm itself



© WASH 12/26

Leaves and branches are chipped for energy



Pruning material transported for energy



Bioenergy unit at Muktsar uses all plant waste including roots



Cooking fuel

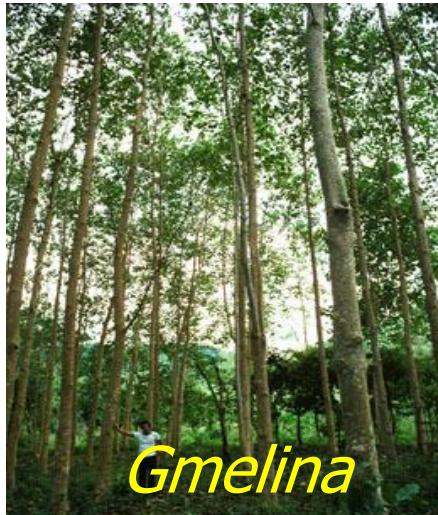
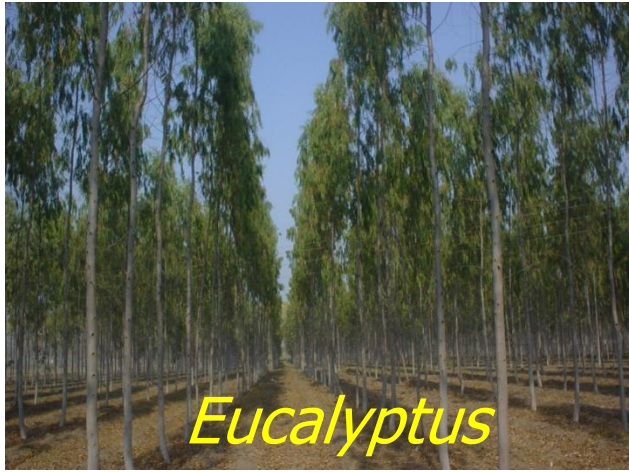
Most of the photographs reflect that the maximum possible biomass is taken away from the system, thus, the projected estimates of agroforestry system w.r.t. carbon sequestration are very different than the actual position. Though there are financial gains to the farmers with additional employment generation in the villages itself and enhanced landscape value.

Carbon sequestration



- * Long lived carbon storage
- * Heat from biomass combustion
- * Carbon storage from coal combustion

	Stem biomass (t/ha)	C storage (t/ha)	Long lived C (t)	Heat biomass (x10 ⁹)	C storage from coal substitution (t C/ha)	Total C Seq. (t/ha)	C Seq. (t C /ha/yr)
Block	49	22	9.30	516	8.67	17.97	3.59
Boundary	22	9.94	4.17	237	3.99	8.16	1.63



Cultivating Fast Growing Trees – Future Forestry

Above and below ground biomass (kg) of different agroforestry tree species

Species	Stem wt. (kg)	Branches wt. (kg)	Leaves wt. (kg)	Bark wt. (kg)	Above ground biomass (kg)	Root wt. (kg)	Stem:root ratio	Root:Shoot ratio
<i>Acacia catechu</i>	7.57	6.62	0.25	1.55	15.99	5.89	1.28	0.368
<i>Acacia nilotica</i>	5.94	5.53	0.23	1.31	13.01	4.46	1.33	0.343
<i>Acrocarpus fraxinifolius</i>	22.35	5.12	2.90	1.81	32.18	10.14	2.20	0.315
<i>Anthocephalus cadamba</i>	12.90	4.76	3.73	1.31	22.70	8.65	1.49	0.381
<i>Bombax ceiba</i>	5.39	2.18	1.68	1.58	10.83	4.65	1.16	0.429
<i>Dalbergia sissoo</i>	7.88	7.98	2.34	1.39	19.59	5.57	1.41	0.284
<i>Eucalyptus tereticornis</i>	16.16	5.77	1.98	3.18	27.09	9.31	1.73	0.344
<i>Gmelina arborea</i>	13.12	2.99	1.55	0.68	18.31	5.82	2.25	0.318
<i>Melia azedarach</i>	5.82	3.51	1.05	0.49	10.87	4.66	1.25	0.429
<i>Populus deltoides</i>	18.92	5.76	3.46	5.14	32.28	8.56	2.21	0.257
<i>Syzygium cumini</i>	2.84	1.39	1.89	0.58	6.70	1.58	1.80	0.236
<i>Terminalia arjuna</i>	9.22	5.58	2.50	1.22	18.52	3.97	2.32	0.214
<i>Toona ciliata</i>	5.87	2.19	2.09	0.66	10.81	5.17	1.07	0.478
CD (p=0.05)	9.38	5.30	1.43	1.74	8.78	NS	0.32	0.169

Performance of different tree species 2010 (2011)

Species	Collar Diameter (cm)	DBH (cm)	Plant spread (m)	Height (m)	Branch weight (kg)	Main stem weight (kg)	Leaf wt. (kg)	Total biomass (kg)
<i>Acacia auriculiformis</i>	18.1 (20.01)	13.1 (14.22)	5.05 (8.63)	7.7 (10.14)	30.19 (53.26)	63.65 (92.34)	45.13 (55.28)	138.97 (150.9)
<i>Pongamia pinnata</i>	18.53 (19.38)	11.27 (15.59)	6.54 (6.93)	7.87 (9.96)	68.30 (72.9)	82.8 (117.0)	43.17 (48.4)	194.27 (238.3)
<i>Ailanthus excelsa</i>	19.27 (26.29)	14.05 (20.81)	3.56 (6.93)	4.77 (9.8)	13.94 (27.0)	69.86 (150.4)	13.18 (15)	96.98 (190.6)
<i>Tectona grandis</i>	17.11 (18.73)	13.47 (14.98)	5.34 (5.93)	9.8 (16.23)	42.47 (42.0)	66.98 (90.8)	36.75 (47.4)	146.2 (180.2)
<i>Anthocephalus cadamba</i>	19.81 (23.73)	12 (13.09)	5.2 (5.99)	8.4 (11.72)	22 (30.1)	45.63 (50.4)	20.34 (27.5)	87.97 (108.4)
<i>Gmelina arborea</i> (clonal)	23.23 (30.94)	16.3 (27.46)	6.06 (7.26)	13.95 (17.25)	61.37 (65.0)	246.04 (335.0)	23.18 (27.2)	330.59 (427.2)
<i>Gmelina arborea</i> (seedling)	20.13 (27.33)	16.27 (23.83)	6.38 (7.10)	12.77 (16.64)	49.36 (58.7)	190.09 (234.0)	22.13 (23.3)	261.58 (316.4)
<i>Acacia nilotica</i>	16 (20.98)	14.33 (17.52)	5.08 (7.21)	8.2 (10.25)	42.9 (47.2)	46.23 (53.4)	14.27 (15.1)	103.4 (115.7)
<i>Eucalyptus tereticornis</i> (wimco)	23.57 (24.64)	18.15 (20.57)	6.22 (5.78)	15.28 (18.49)	70.99 (65.0)	256.04 (310.0)	30.53 (28.0)	357.56 (403.0)
<i>Eucalyptus camaldulensis</i> var. <i>obtus</i>	19.93 (20.62)	15.13 (17.52)	4.12 (4.83)	16.5 (18.68)	23.66 (40.0)	83.39 (110.0)	11.88 (20.0)	118.93 (170.0)
<i>Eucalyptus tereticornis</i>	22.9 (27.43)	17.8 (22.3)	3.99 (5.93)	15.73 (20.6)	51.67 (52.0)	235.66 (290.0)	26.9 (23.0)	314.23 (365.0)
<i>Eucalyptus tereticornis</i> var. <i>tereticornis</i>	18.5 (20.73)	13.23 (17.38)	3.80 (4.84)	11.77 (17.42)	29.6 (35.2)	128.15 (160.0)	18.2 (21.5)	175.95 (216.7)
<i>Populus deltoides</i>	25.43 (30.9)	20.5 (25.97)	5.34 (6.57)	10.91 (17.6)	32.71 (43.4)	204.56 (275.5)	14.57 (21.2)	251.84 (340.1)
<i>Eucalyptus</i> 288-44	20.83 (26.37)	16.37 (22.8)	4.08 (6.26)	17.55 (21.79)	40.0 (51.5)	266.53 (328.0)	19.51 (26.4)	326.04 (405.9)

Monetary Value of one Poplar tree after six years of harvest is worth Rs 3095 (USD 57)

Sticks
0.70qtl.
Rs.200/-per
qtl.
Rs.140/-

4

Leaves 0.50qtl.
Rs.100/-per qtl.
=Rs.50

5

Sokhta
0.70qtl. 10'-18'
Rs.650/-per qtl.
Rs.455/-

3

BOILER/PULP
UNDER
18-24'

2

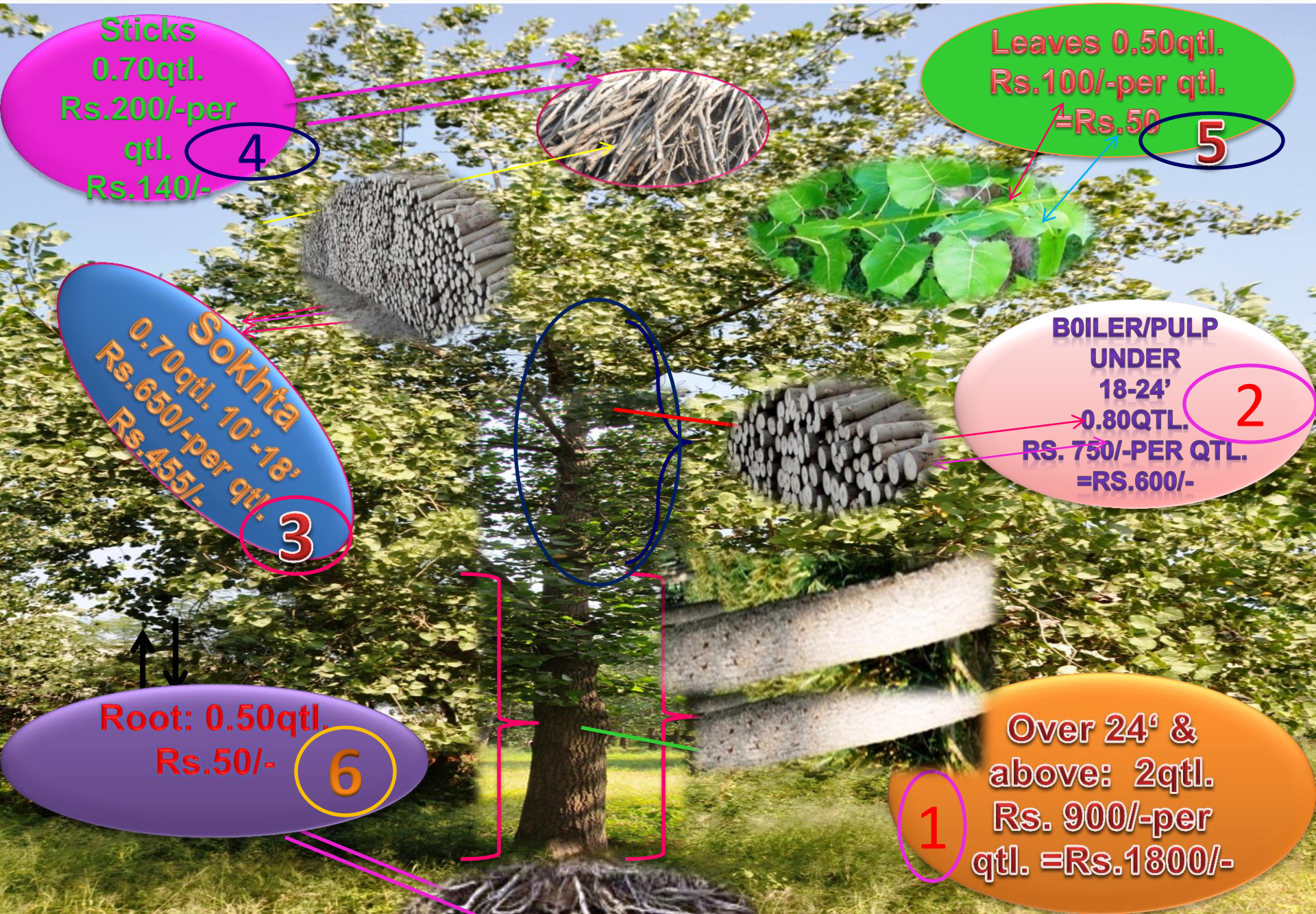
0.80QTL.
RS. 750/-PER QTL.
=RS.600/-

Root: 0.50qtl.
Rs.50/-

6

Over 24' &
above: 2qtl.
Rs. 900/-per
qtl. =Rs.1800/-

1



Statement of income & expenditure

Description	Qty. (qtls)	Rate (Rs)	Amount (Rs)
Over 24 inch and above	2 qtl.	900	1800
Under 18-24 inch	0.80 qtl.	750	600
Sokhta (Pulp) 10-18 inch	0.70qtl.	650	455
Dandi & Stumps	0.70qtl.	200	140
Leaves & Root	1.00 Qtl.	100	100
Total (One tree)	4.20qtl.		3095

Income from 190 trees at 90% success = 190×3095 588050

Expenditure on felling & sale etc.

Felling @ Rs. 32/-qtl. ($190 \times 4.20 \times 32$) 25536

Carriage of goods @ Rs 15/-qtl. ($190 \times 4.20 \times 15$) 11970

Market fee 1/-qtl. ($1 \times 4.20 \times 190$) 798

***Middle Man's commission 7%* 41163**

Total Expenditure 79467

Net benefit ($588050 - 79467$) 508583

**Rs. 84763 (USD
1570) per acre
(0.4ha) per year at
6 years rotation**



Introducing the objectives of organizing stakeholders workshop



Dr MS Kang, Vice-Chancellor PAU addressing the delegates



Participants of stakeholders workshop



PAU dignitaries, The Vice, Chancellor, Dean, Post Graduate, Dean COA, Additional Director of Research, Head, Dept. of Forestry & NR, etc. attended the workshop

LIST OF ORGANIZATIONS/INSTITUTIONS WHO ATTENDED THE STAKEHOLDERS WORKSHOP

Research organizations

Scientists from PAU, Institute of Renewable Energy, Kapurthala, (Ministry of New and Renewable Energy, GOI).
International Centre for Research in Agroforestry (ICRAF), South Asia Centre, New Delhi

Government Departments

Punjab Energy Development Agency, Chandigarh; Punjab State Forest Department, Chandigarh
Haryana State Forest Dept. Panchkula

Bioenergy industry

Green Planet Energy Pvt Ltd., Sec.34A Chandigarh
Universal Bio-mass Energy Pvt. Ltd, Village Channu, Dist- Muktsar
Multi fuel Management Pvt Ltd., Sec.34A Chandigarh
A2Z Power Ltd., Chandigarh, Malwa Power Ltd., Gulabewaa, Muktsar
Lehra Fuel Tech Pvt.Ltd., Jagera, Ludhiana
Ramky Enviro Engineers Ltd., Ludhiana [Bio-gas plant (FYM) based power plant]

Nursery growers

Pragati Biotechnology, Jalandhur
Prakriti Clonal Agrotech, Ambala
WIMCO Seedling Ltd. Ludhiana.

Paper industries

ABC Paper Ltd, Saila Khuard, Hoshiarpur
Shryans Paper Mill Ltd., Banah Nawanshahr
Abhishek Industries Pvt. Ltd., Ludhiana

NGOs, Farmers and students

Progressive farmers (PAU Kisan Club and PAU Tree Growers Association),
Students, NGO (Nature Tree Foundation), etc.



THANKS



[IUFRO SRF Coordinator \(1.03.00\)](mailto:chauhanpau@rediffmail.com)
chauhanpau@rediffmail.com

