

Figure 4.2. Physiographic regions of Nepal (Source: Topographic Survey Branch, Department of Survey, His Majesty's Government, Nepal, 1983)

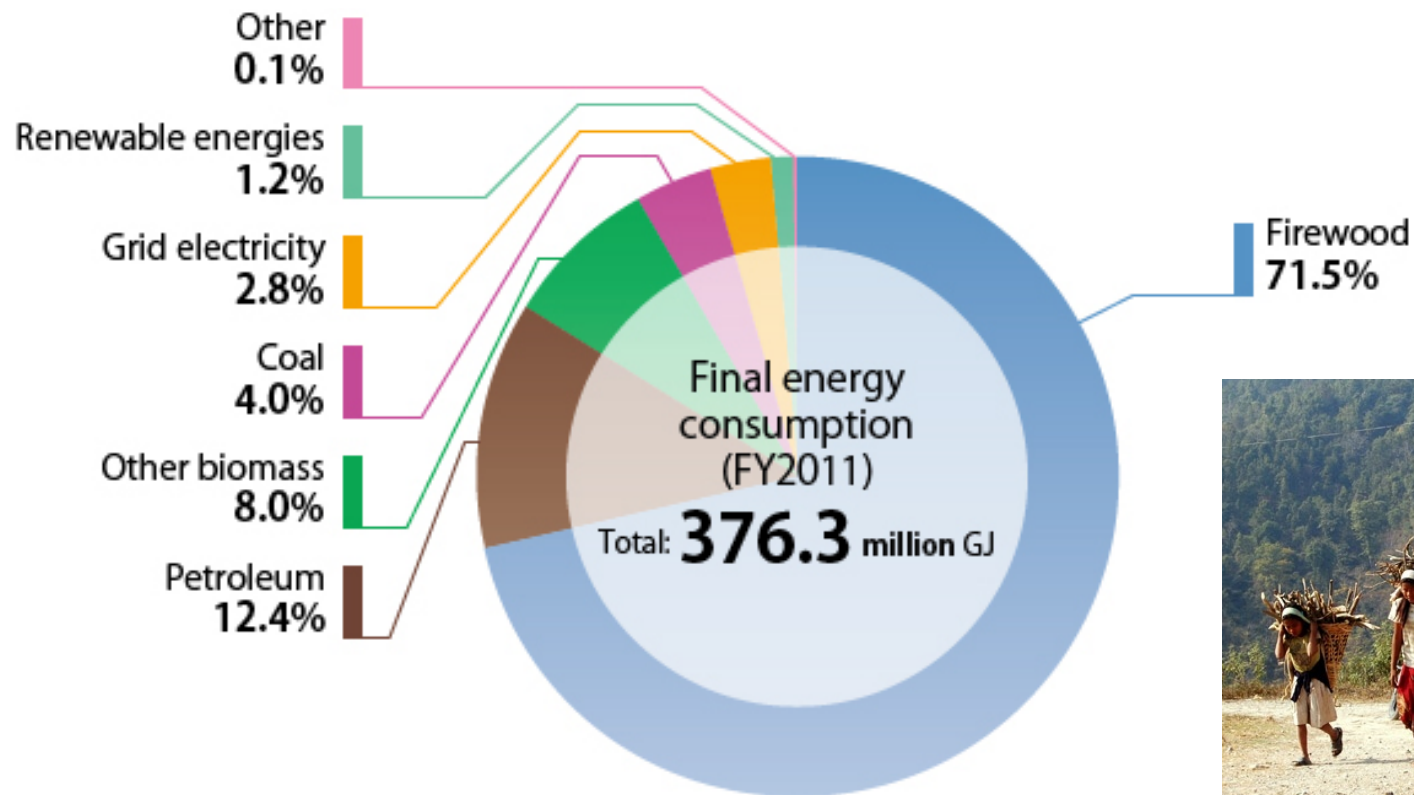


Sustainable Management of Bio-energy for Improving Livelihoods of Disadvantaged Communities in Nepal

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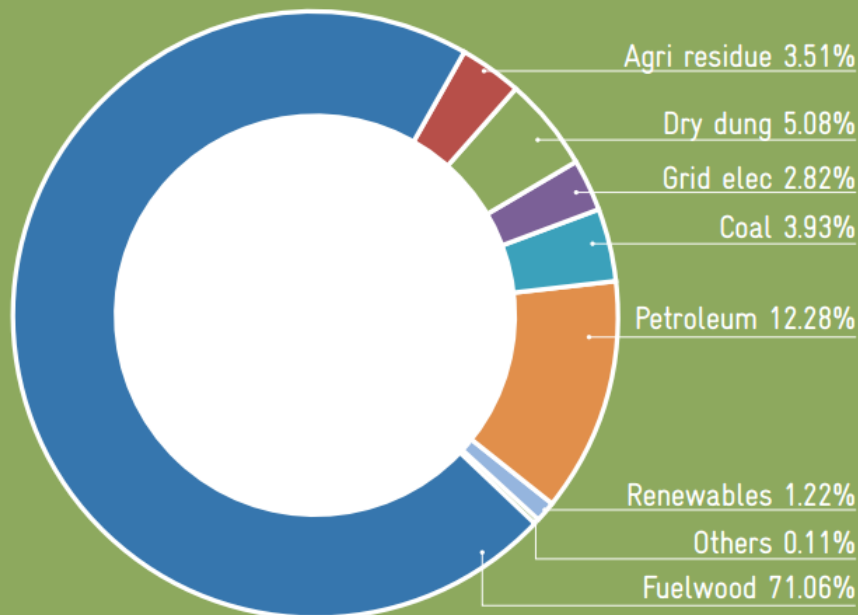


- Energy consumption in Nepal is merely one fifth of the world's average and less than half of the Asian's average.
- Nepal's per capita energy consumption (15GJ) is one of the lowest in the world
- Nearly one third households (33%) still do not have access to electricity

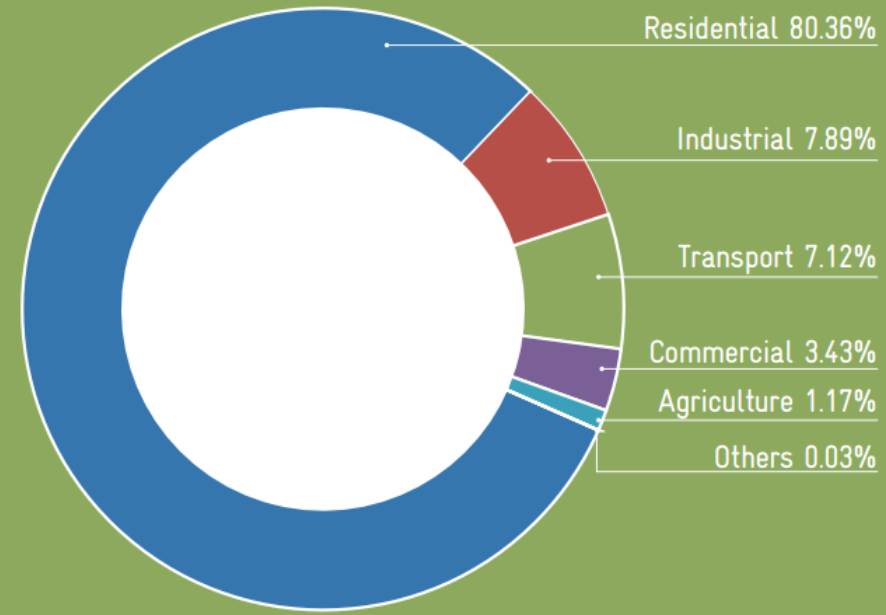
Energy Consumption Situation in Nepal (Year 2011/12)

(Total Consumption = 376.3 million GJ)

ENERGY CONSUMPTION BY FUEL TYPE



ENERGY CONSUMPTION BY ECONOMIC SECTORS



Water and Energy Commission Secretariat (WECS), Government of Nepal (June 2014)

Current Bioenergy Initiatives in Nepal

Development
of stationary
diesel engines

Development
of cooking
stoves and
lamps

Supplying oil
cakes
fertilizers

Limited to a
single
species *i.e.*
Jatropha (an
exotic
species)

Undermined
the
immense
potentials of
many
common
indigenous
plant
species

Sources of bioenergy

- **Woody biomass** (stems, branches and twigs)
- Non-woody biomass (leaves, leaf litter, grass)
- **Agriculture residue** (rice husk, straw)
- **Oil seeds, industrial residue** (molasses) and, **cattle dung** and human feces
- Potential biomass energy sources in Nepal:
 - *Mesua ferrea* (Nageshwor): 77% (Native species)
 - *Jatropha curcas* (Sajiwan): 45-55% (Exotic species)
 - Resin from pine trees: sources of bio-hydrocarbon
 - Molasses from sugarcane (sugar industry): sources of ethanol
 - **Organic waste**. Weeds: briquettes, biogas



Jatropha curcas

Energy Gardens for Small-Scale Farmers in Nepal: Institutions, Species and Technology (2014-2015)



The concept of energy gardens

Alternative energy projects not focused to meet household/
community energy needs

Though based on the **traditional bio resources** and knowledge of rural energy production and consumption this is still a virgin concept of rural energy production.

Major benefits of Energy gardens are:

- **Environment friendly**
- **No competition with food crops**, thus agricultural integrity can be kept intact
- **Highly inclusive**
- **Community empowerment** (led by community institutions)
- Provides multiple **goods and services**

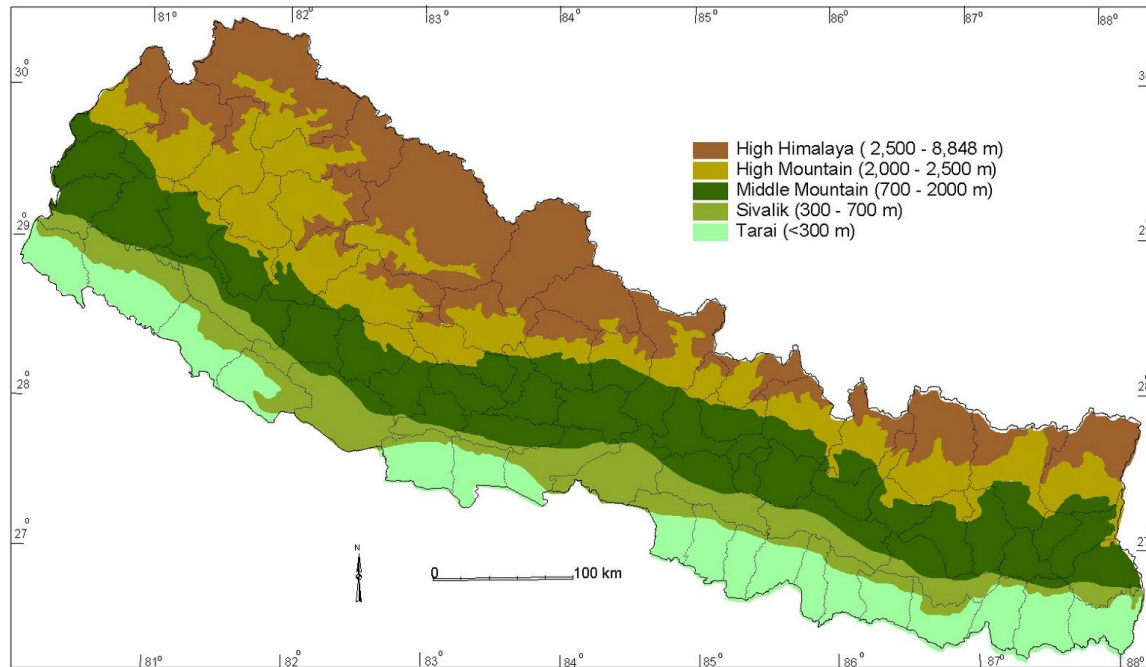
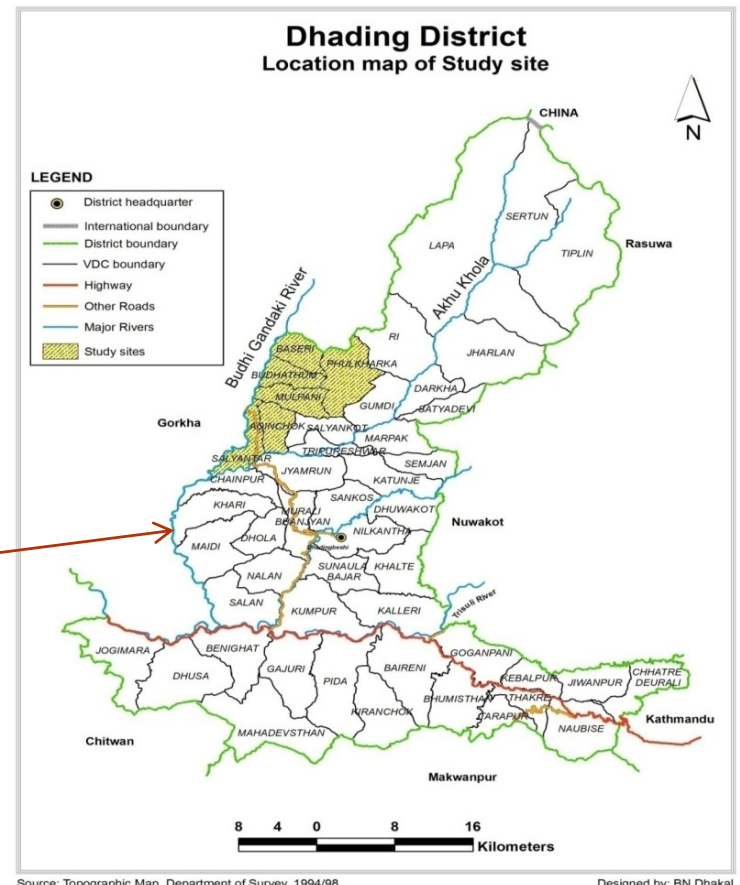
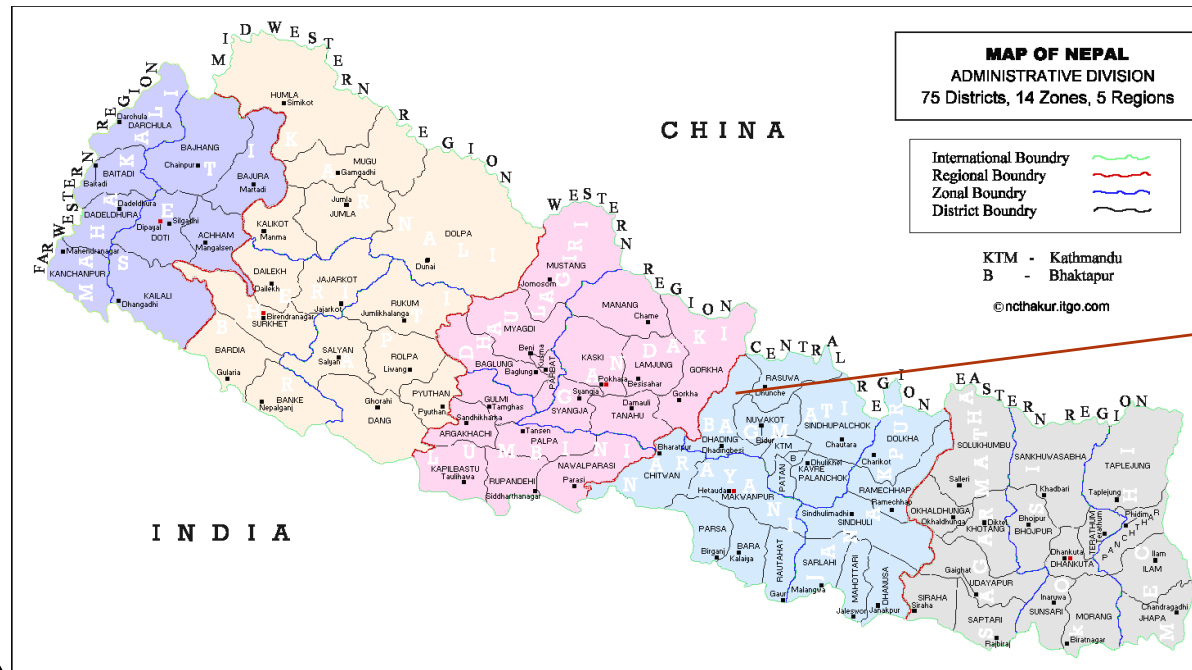


Figure 4.2. Physiographic regions of Nepal (Source: Topographic Survey Branch, Department of Survey, His Majesty's Government, Nepal, 1983)



Source: Topographic Map, Department of Survey, 1994/98

Designed by: BN Dhakal



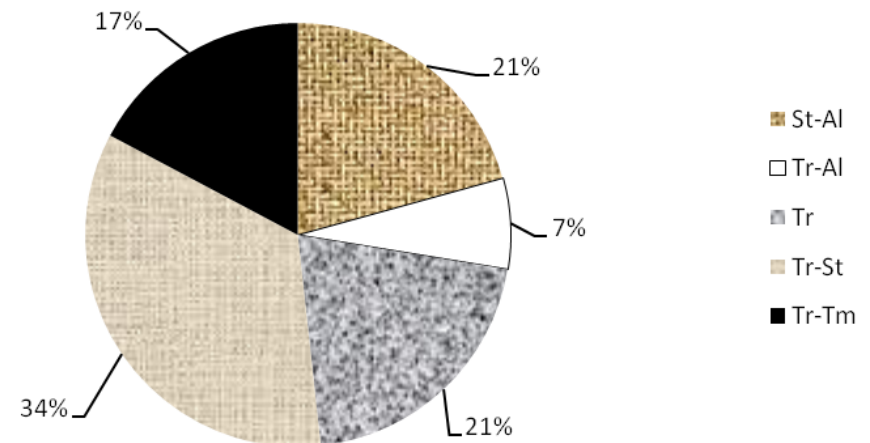
Indigenous Oil Yielding Plant Species

- ❑ 70 species of oil yielding species recorded and thoroughly reviewed
- ❑ High proportions of native/indigenous species
- ❑ A greater richness of such species in Mid-hill ecosystems

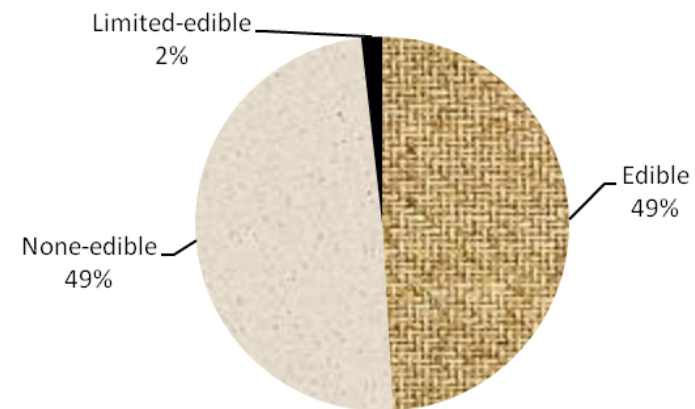
Mid-hills ecosystems with bio-energy potentials

- ❑ Significant proportions of degraded and fallow lands
- ❑ Rich indigenous knowledge of plant use and energy production e.g., rural lightening, bio-briquettes,
- ❑ charcoal production, etc.

Distribution of indigenous oil yielding plant species along the altitudinal gradient



Indigenous oil yielding plant species with edible and non-edible value



Major Oil Yielding Species

Jatropha curcas L. (Euphorbiaceae): (500-1200m)

EXOTIC; Crude oil value: 30-35%



Bassia butyracea Roxb. (Sapotaceae): (300-1500m)

NATIVE



Gaultheria fragrantissima Wall. (Ericaceae): (1200-2600m)

NATIVE



Sapindus mukorossi Gaertn. (Sapindaceae): (100-1200m)

NATIVE. Crude oil: 40-60%

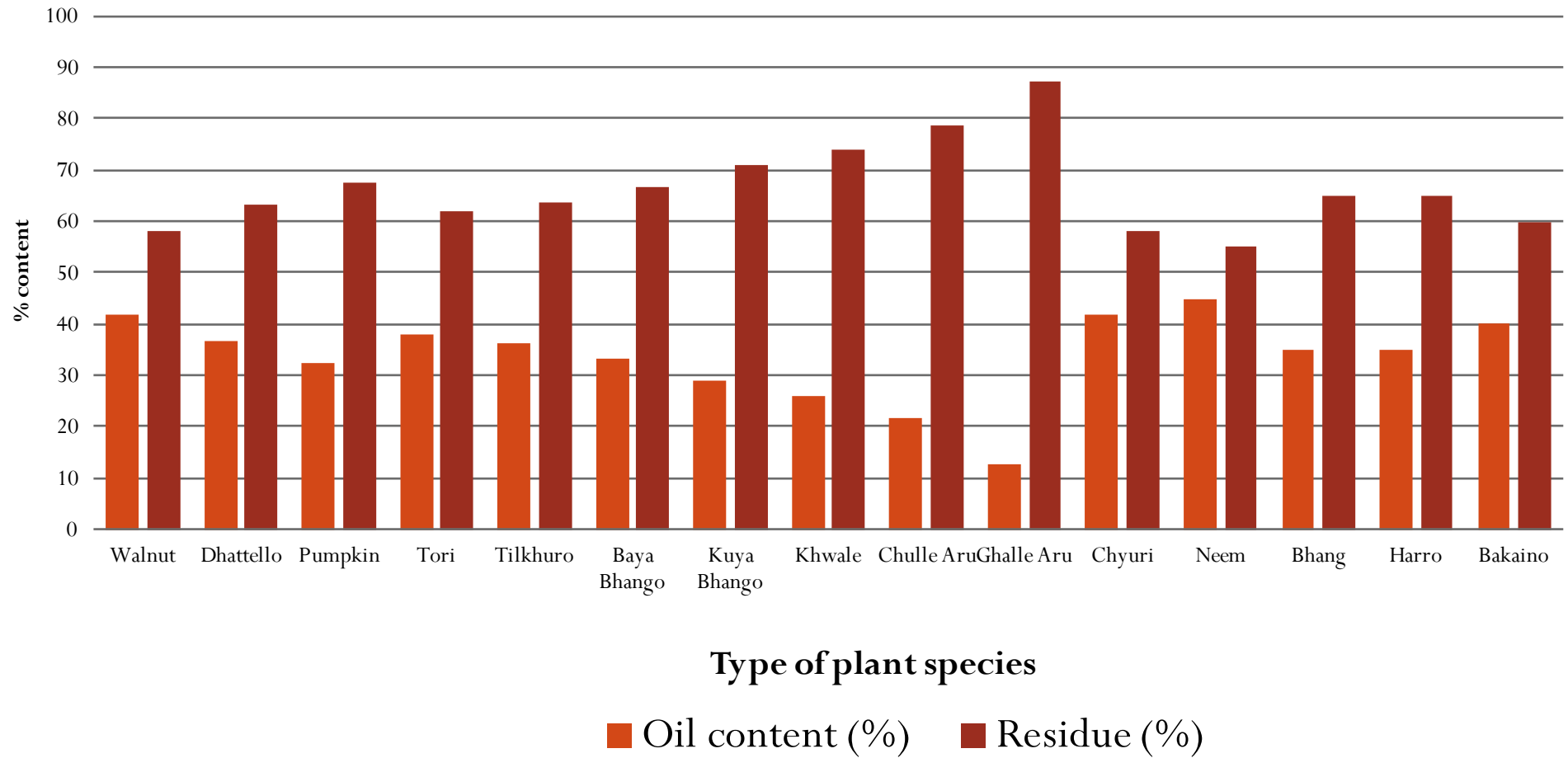


Ricinus communis L. (Euphorbiaceae) : (150-2400m)

EXOTIC; Crude oil: 45-50%



Oil content and residue of different plant species

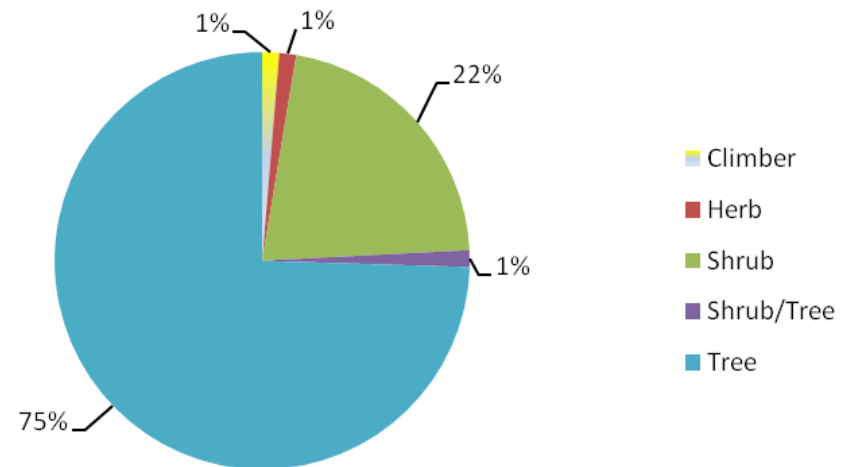


Indigenous Fuelwood Species

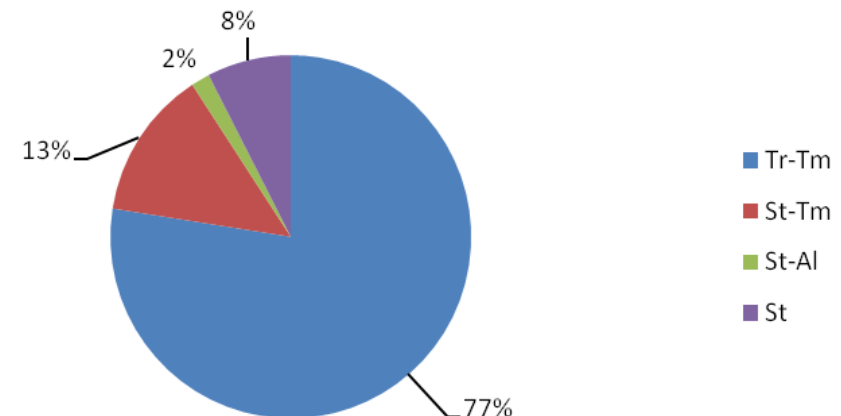
Records of **158 species of popular fuelwood**, representing 58 families



Life form diversity of indigenous fuelwood species



Distribution of indigenous fuelwood species along the altitudinal gradient



Major Fuelwood Species

Alnus nepalensis D. Don (Betulaceae): (500-2600m)
NATIVE



Pinus roxburghii Sarg. (Pinaceae): (1100-2100m)
NATIVE



Castanopsis indica (Roxb.) Miq. (Fagaceae) :
(1200-2900m), NATIVE



Litsea monopelata (Roxb.) Pers. (Lauraceae):
(500-1600m), NATIVE



Adina cordifolia (Willd. ex Roxb.) Benth. & Hook.
f. ex Brandis (Rubiaceae), (150-800m), NATIVE



Timber and Charcoal Producing Species

A total of 65 prioritized species for indigenous timber production and eight species for indigenous charcoal production in Nepal were identified



Major Charcoal Producing Species

Lyonia ovalifolia (Wall.) Drude (Ericaceae):
(1300-3300m); NATIVE
Uses: Firewood (charcoal), incense, medicine



Schima wallichii (DC.) Korth. (Theaceae):
(900-2100m); NATIVE



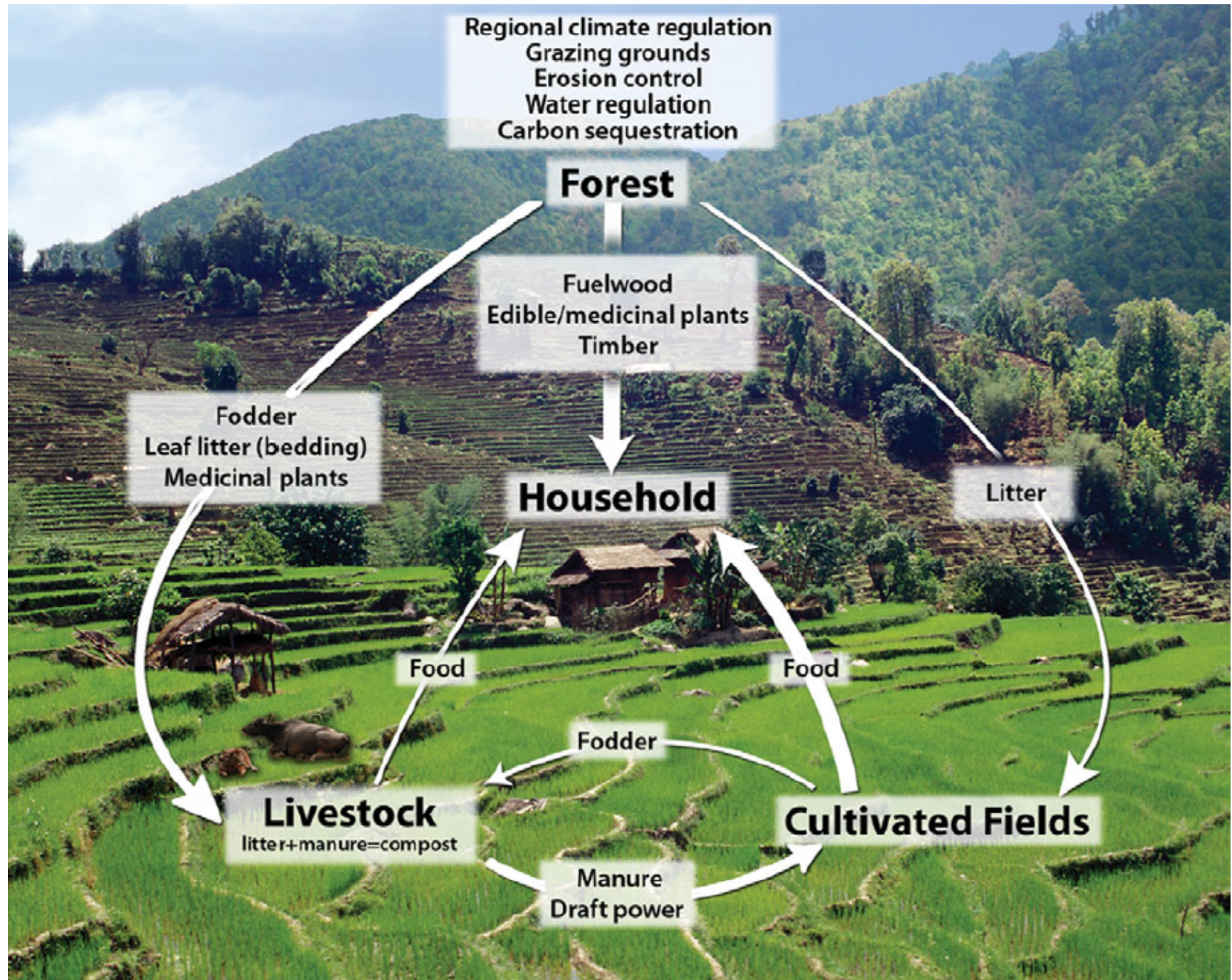
Ficus cunia Buch.-Ham. ex Roxb. (Moraceae) :
(200-1700m); NATIVE



Myrica esculenta Buch.-Ham. ex D. Don (Myricaceae):
(1200-2300m), NATIVE



Rhododendron arboreum Sm. (Ericaceae): Gurans;
NATIVE



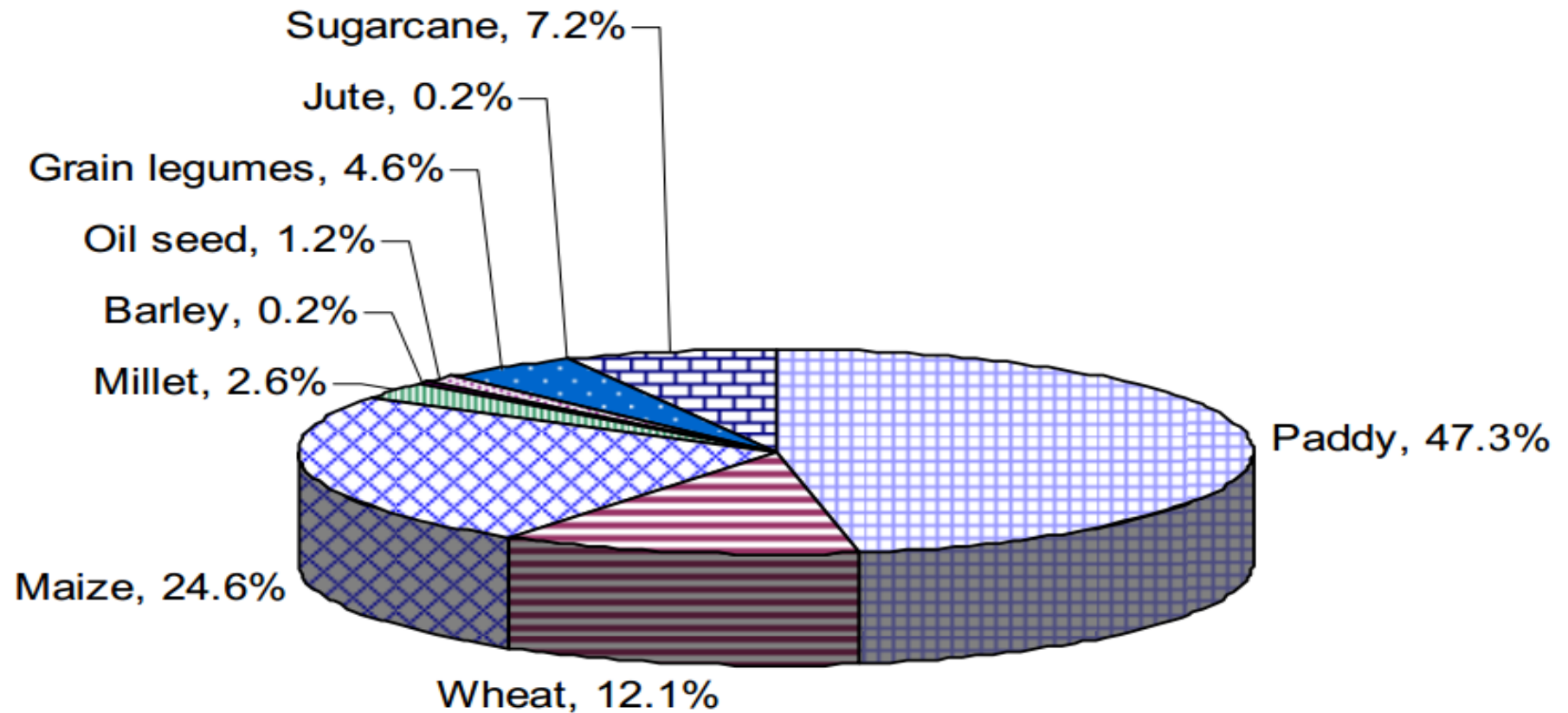
Maren et al. 2013. Environmental Conservation

Area, production and available residue from cash crops

Crop type	Area [Ha]	Crop Production [MT]	Residue type	RPR	Total Residue Production [MT]
Oil Seed	214835	179145	Stalk	4.01	71,837
Sugarcane	64472	2930047	Bagasse	0.29	849,714
			tops/leaves	0.3	879,014
			Total		1,728,728
Jute	10540	14424	Stick	2	28,848
Soybean	29281.8	28269.8	Total		98,944.3
			Straw	2.5	70,674.5
			Pods	1	28,269.8
Black Gram	27496.2	22482.4	Straw/stick	1.66	37,320
Cotton	135	133	Sticks	2.75	365.75
Coconut			Husk	0.419	NA
			Shell	0.12	NA
Coffee	1780	425000	Husk	2.1	892,500
Ground nut	2736	3869	Husk	0.477	1,845
			Straw	2.30	8,899

Source: Statistical information on Nepalese Agricultural 2011/2012

Agriculture Residue Production by Crop Types (2012/2013)



**Total Residue Production
19.4 M Tons**

New Initiative: Energy Smart Village

- Building on the findings of the first phase scoping study, the project is being extended to the diverse physiographic region of the **Kanchenjunga Landscape, Eastern Nepal.**
- A feasibility assessment will be carried out in four districts within the landscape to investigate the possibility of a **plantation of high value native multipurpose tree species**, and
- **Assessment of biomass residues** from households, agriculture and industries for the raw materials for biodiesel production and biomass gasification plant.
- Initiation of **biomass gasification** scheme for **rural electrification**, and create **Energy Smart Villages**





Table 4.6: Development and Poverty Index for different districts

Districts	HDI	HPI	Per Capita Income (\$)	% of poor
Taplejung	0.494	26.42	1,313	27.0
Panchthar	0.496	33.66	1,082	11.4
Ilam	0.526	26.96	1,260	7.3
Jhapa	0.518	21.82	1,226	10.6

Source: CBS (2013), GoN/UNDP (2014)

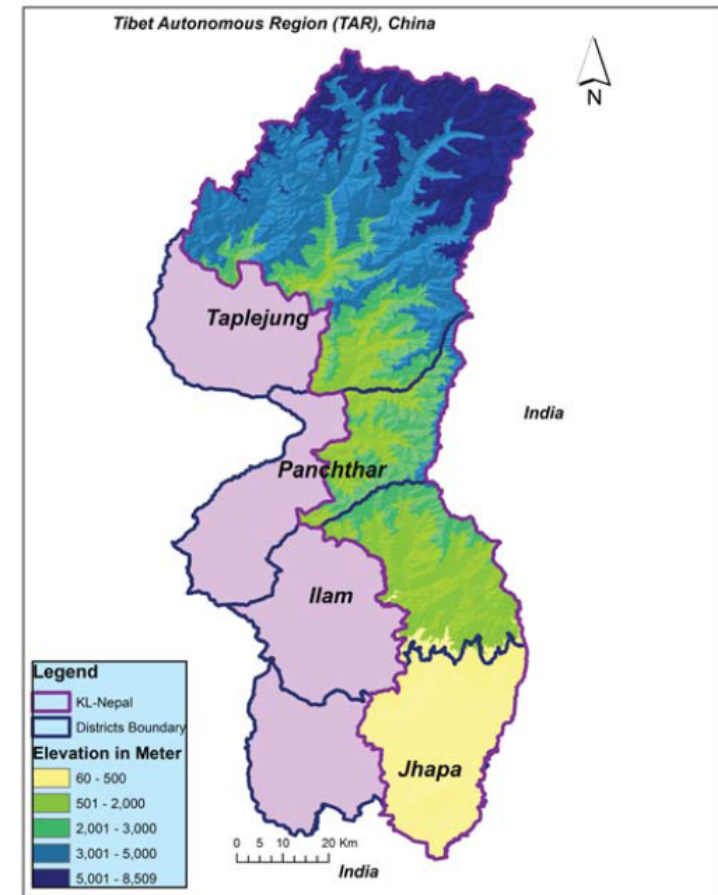
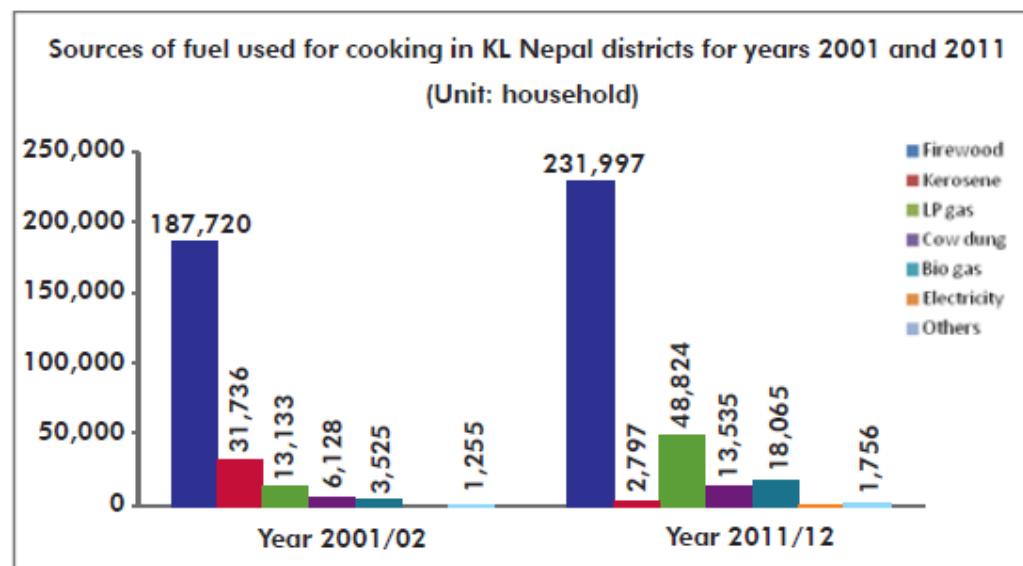


Table 5.2: Forest coverage of KL Nepal districts

Districts	Forest (ha)	Total area (ha)	% of total area of the district
Taplejung	112,262	365,337	30.72
Panchthar	57,794	122,165	47.30
Ilam	81,083	171,567	47.26
Jhapa	13,557	164,192	8.25
Total	264,696	823,261	32.15

Source: MoFSC (2013)

Figure 4.3: Pattern of fuel consumption for cooking



Source: CBS (2012c)

Table 4.9: Households in KL Nepal districts using different sources of fuel for cooking (comparison between 2001 and 2011)

Sources of fuel	Year	Taplejung (HH)	Panchthar (HH)	Ilam (HH)	Jhapa (HH)
Total	2001	24,763	37,260	54,566	125,949
	2011	26,471	41,176	64,477	184,384
Firewood	2001	24,167	35,663	42,797	83,092
	2011	25,287	37,916	58,179	108,604
Kerosene	2001	477	1,518	8,711	21,030
	2011	128	330	455	1,884
LP gas	2001	0	0	2,238	10,895
	2011	849	2,368	3,775	41,832
Cow dung	2001	0	0	0	6,128
	2011	5	134	108	13,288
Biogas	2001	0	0	175	3350
	2011	63	196	1,527	16,279
Electricity	2001	NA	NA	NA	NA
	2011	2	12	36	104
Others	2001	0	0	434	821
	2011	6	80	50	1,620
Not stated	2001	119	80	212	634
	2011	131	140	349	773

Source: CBS (2012c)

The Way Forward

Project activities

- Feasibility assessment within the different **physiographic landscapes**
- Implementation of a **pilot project** for the establishment of a **biomass gasification plant** and an energy garden

Major outputs

- To facilitate public awareness in **sustainable utilization of bio-energy** for upgrading livelihood of **under-privileged communities**
- To create **Energy Smart Villages** in remote areas of Nepal

Approaches

- **Collaboration** with national/ international organizations to **develop joint project proposal.**
- **Execution of project** and develop Energy Smart villages

Acknowledgements

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Practical Action Nepal

Feminist Dalit Organization (FEDO)

&

Botanic Gardens Conservation International (BGCI)

Hassan Biofuels Park, Maharashtra, India