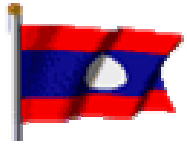


Environmental Monitoring by Satellite Remote Sensing Data and GIS in Laos:

*Human Appropriation of
NPP from photosynthesis of vegetative cover*

**APEIS Capacity Building Workshop, Sydney, Australia
27 –28 November 2003**





Lao PDR

Area: 236,800 km²

Population: 5.2 million

Population density: 22
p/km²

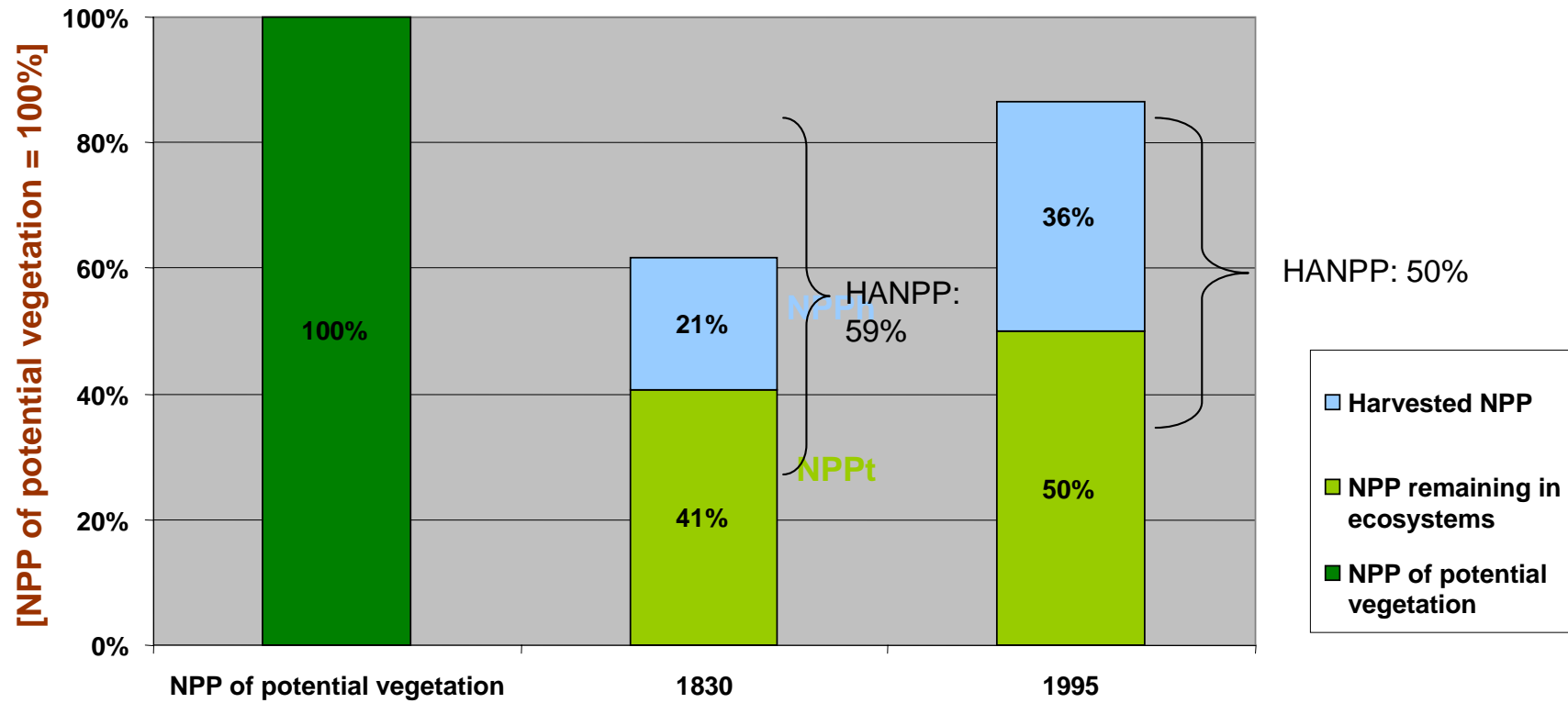
Ethnic group: 49



Objectives of study

- Environmental change assessment
- Assessment the effectiveness of natural resource utilization
- Recommendation for policy making on natural resource management

Concept of HANPP



Source: Fridolin Krausmann, 2000

Example: Austria 1830 and 1995

Concept of HANPP

$$\text{HANPP} = \text{NPP}_0 - \text{NPP}_t$$

$$\text{NPP}_t = \text{NPP}_{\text{act}} - \text{NPP}_{\text{h}}$$

Where:

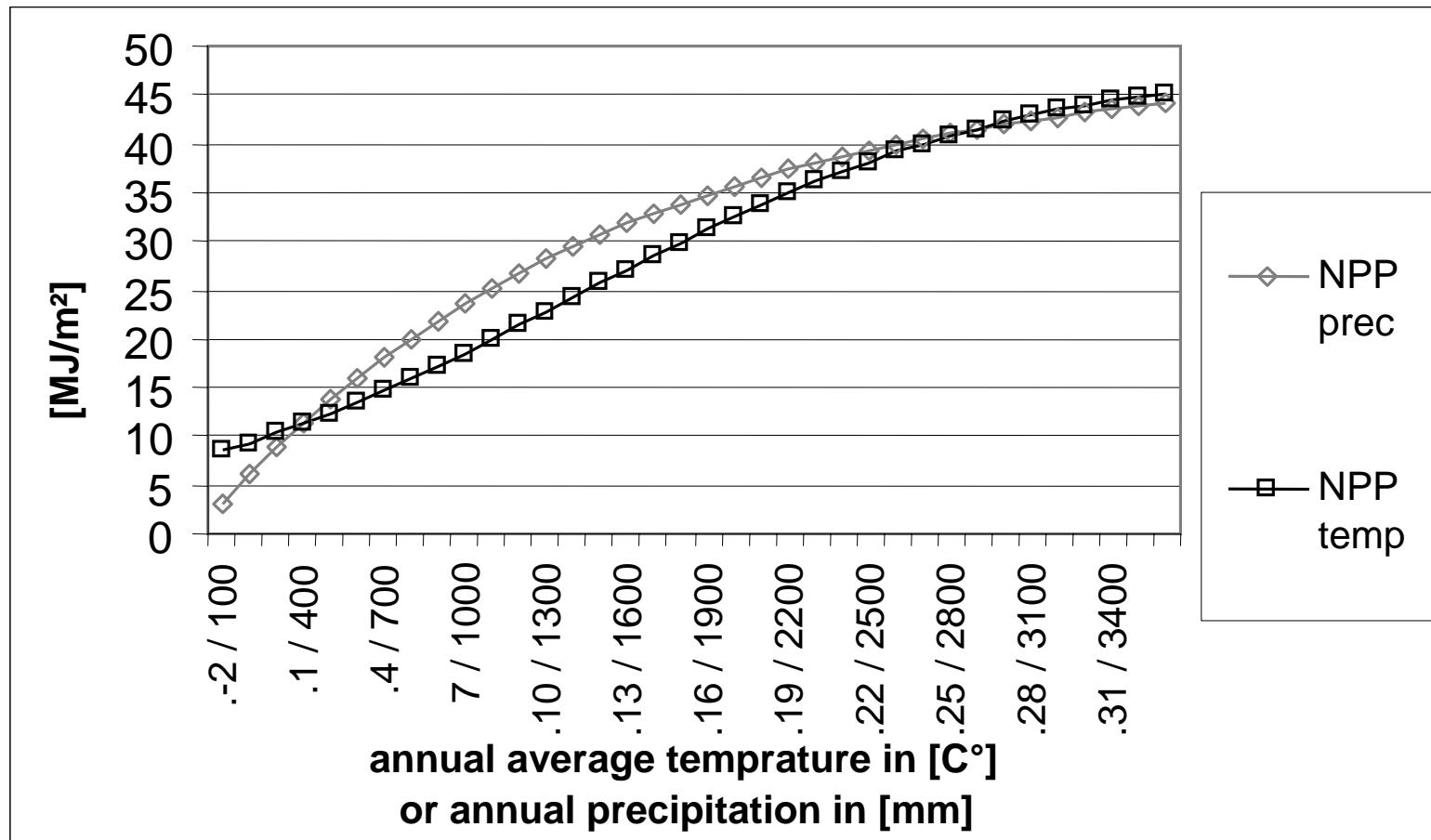
NPP_0 = NPP potential

NPP_{act} = The NPP of the actual vegetation

NPP_{h} = NPP harvested Biomass

NPP_t = NPP remaining in ecosystems

Potential NPP - the Miami model



Data basis for the HANPP account

- The HANPP calculation is based on a land use and cover categories derived from remote sensing data (Landsat)
- Productivity values stem from various sources: international data bases and literature.
- We developed a regionalised data set for the 134 districts of Loa PDR to capture the large variability of agricultural production systems.

Socio economic harvest of NPP includes:

- Harvest of agricultural crops
- Grazing of livestock
- Harvest of firewood and industrial wood for local construction
- Logging of timber for export
- Clearing of land for agriculture (shifting cultivation)

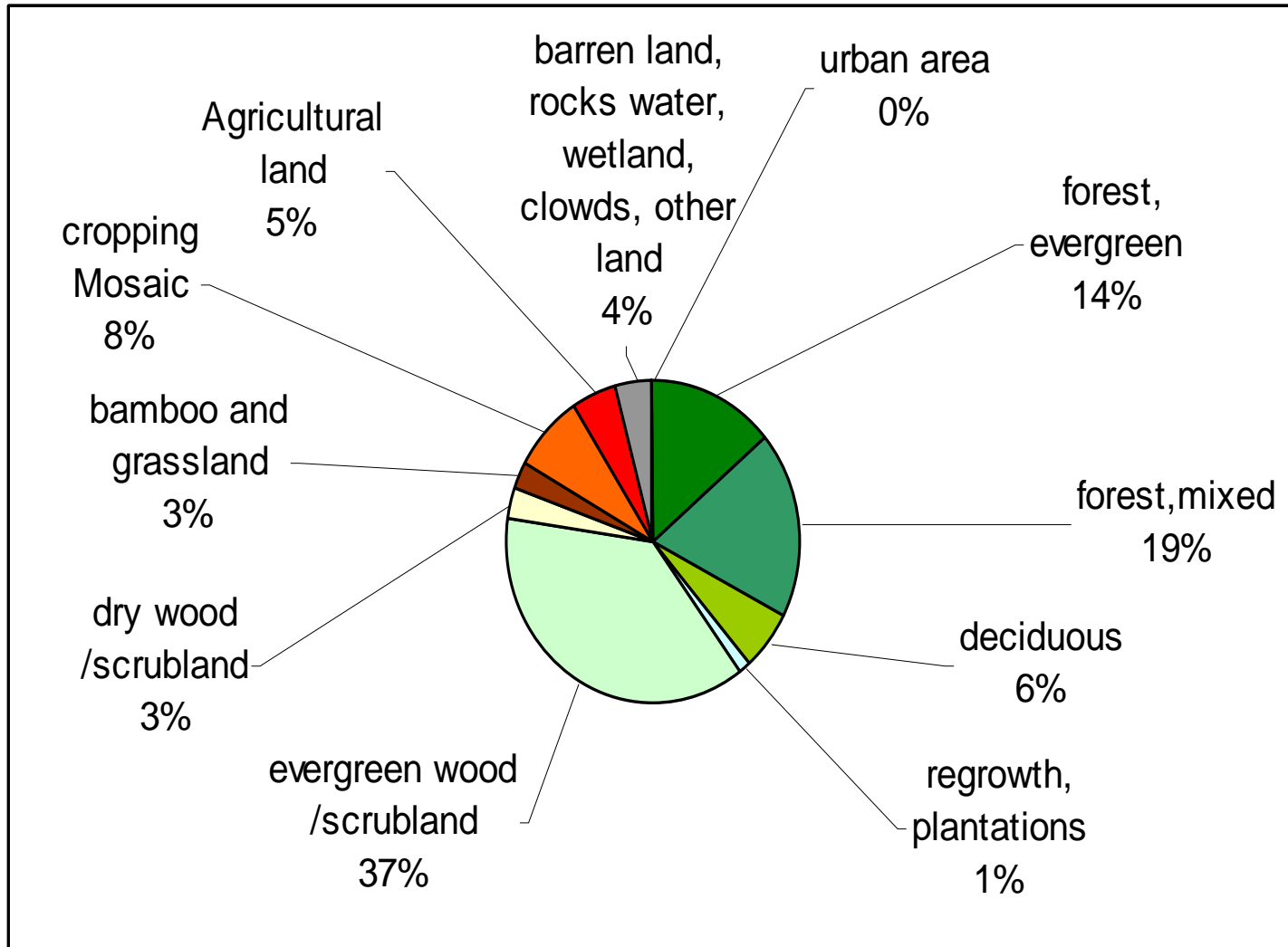
Climate

temperature

In ecological terms Laos is a very productive country. Without human influence it would be mainly covered with forest.

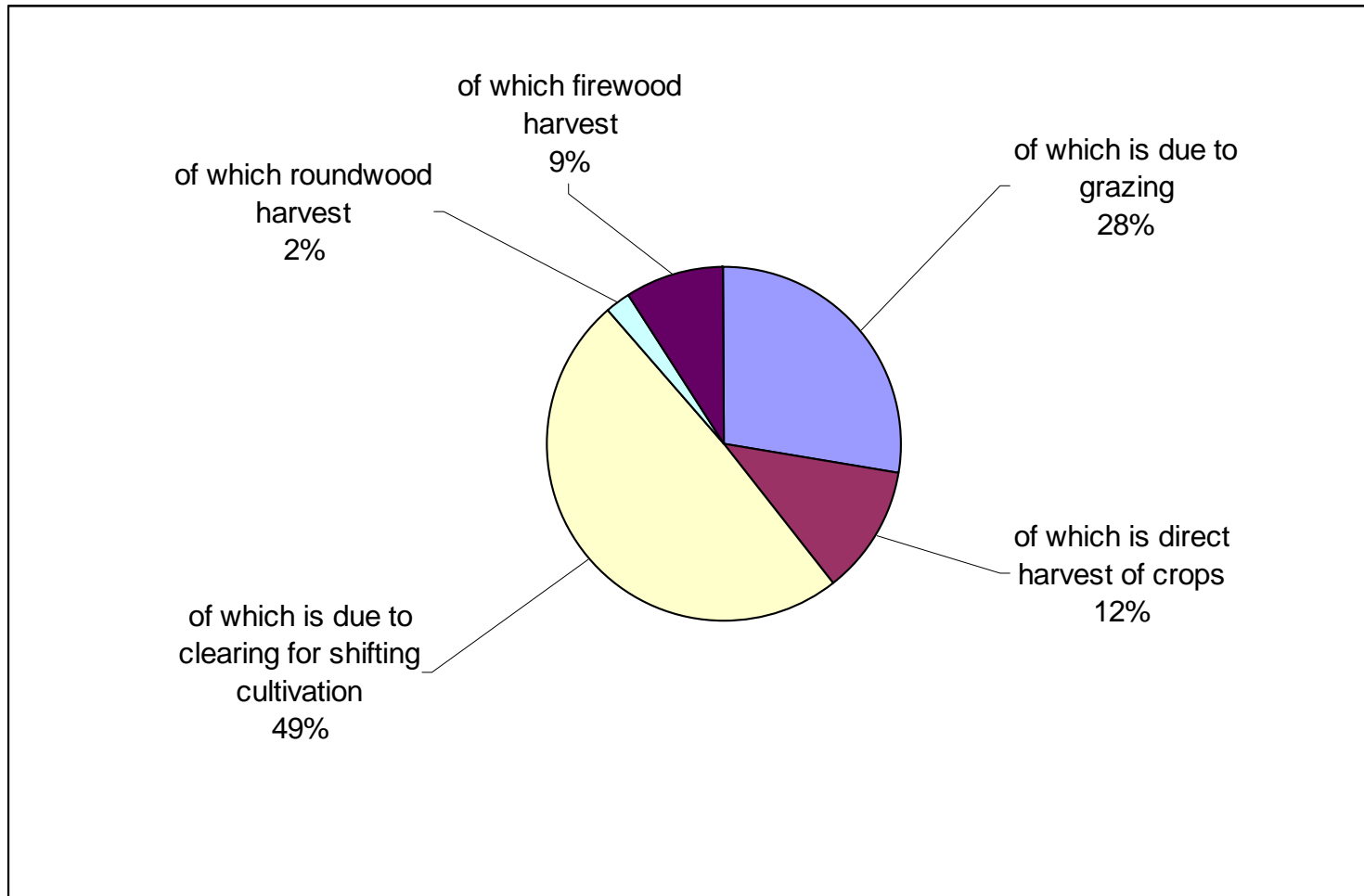
Land-cover

Land cover 1996/97



Due to socio-economic activities (land use change) the actual vegetation is reduced compared to potential vegetation.

harvest by socio economic activity, total: 235 PJ



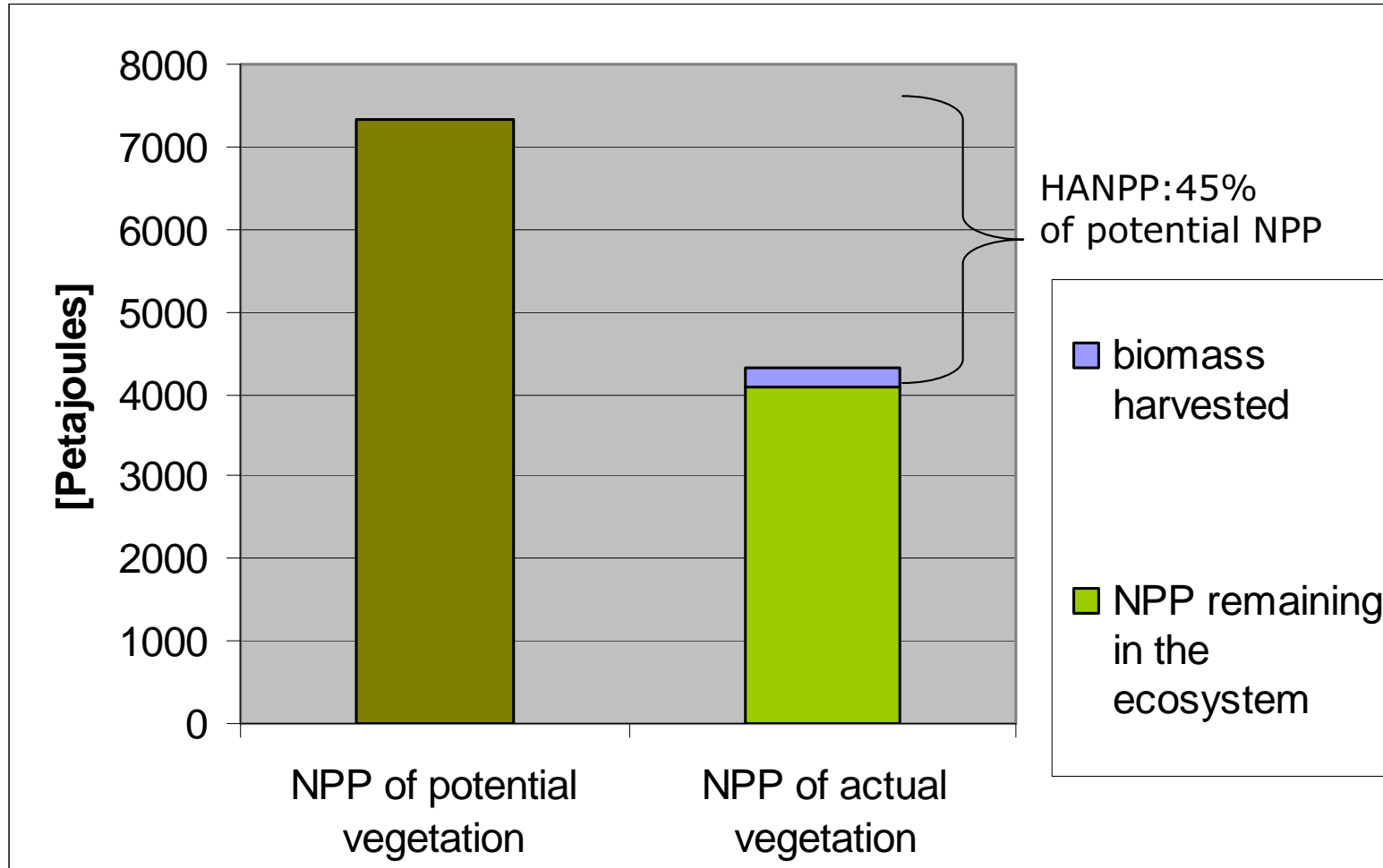
Harvest activities shown here
further contribute to NPP
reduction in the ecosystem.

The inverse picture shows the amount of HANPP appropriated by socio-economic activities.

The remaining NPP is what society leaves for all other species after changing the land and harvesting.

In some regions appropriation
is already high: 80% reduction.

HANPP in LAO PDR



HANPP due to Harvest	of which is due to grazing	of which is direct harvest of crops	of which is due to clearing for shifting cultivation	of which roundwood harvest	of which firewood harvest
[TJ]	[TJ]	[TJ]	[TJ]	[TJ]	[TJ]
234.836	66.405	27.533	117.511	5.441	8.205
GJ/cap	GJ/cap	GJ/cap	GJ/cap	GJ/cap	GJ/cap
48	14	6	24	1	2

Data limitations and methodological problems

- Harvest data for illegal logging is missing, clearing for shifting cultivation is based on estimates
- Also still missing: data on NTFPs and extend of illegal crops like poppy (less than 3% of arable area according to UNDCP estimates)
- NPP data of potential vegetation should be cross-checked with NPP0 derived from map of ecological zoning
- Literature data for NPP of actual vegetation is unreliable in the classes of degraded forest

Conclusions

- The analysis of HANPP shows low to medium values of total HANPP (45% of potential aboveground NPP) in Lao PDR 1996
- The harvest of Biomass in all sectors is equivalent to only 3% of the potential productivity, while the reductions in productivity due to land-cover change are equalling 42% of potential NPP
- This is largely due to the degradation of potentially closed forest to mixed or open forest and scrubland
- This degradation of forest is especially severe in the mountain forests (esp. northern region) that are very vulnerable to anthropogenic disturbance
- Further research is needed on the driving agents for forest degradation (ranging from uncontrolled logging to the effect of various farming techniques on ecosystem function and structure and other historic events)
- The database on the productivity of degraded forest ecosystems is poor and should be improved