

RESTORING GREENERY FOR SUSTAINABLE ECOSYSTEM SERVICES IN URBAN SPRAWL OF KATHMANDU VALLEY

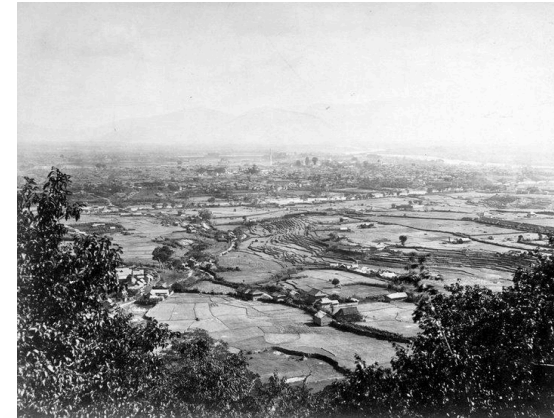
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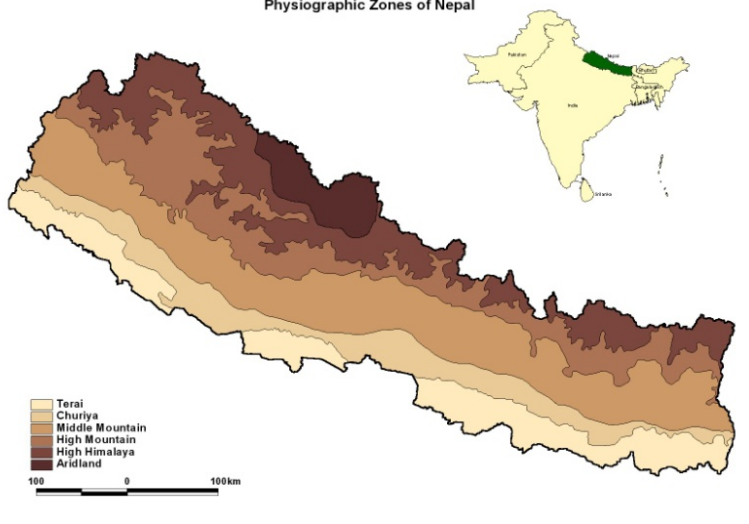


BACKGROUND

- Environmental Sustainability: a key issue of the five components of making urban prosperity
- Sustainable urban development: Supports valuable ecosystems; presents a major opportunity for improving lives and livelihoods.
- Increased tree cover in the cities reduce temperature during the summer, saving on cooling cost and electricity.
- Economic benefits of adding greenery in some of the world's cities found to increase the value of nearby residential properties by 15 percent.



Physiographic Zones of Nepal

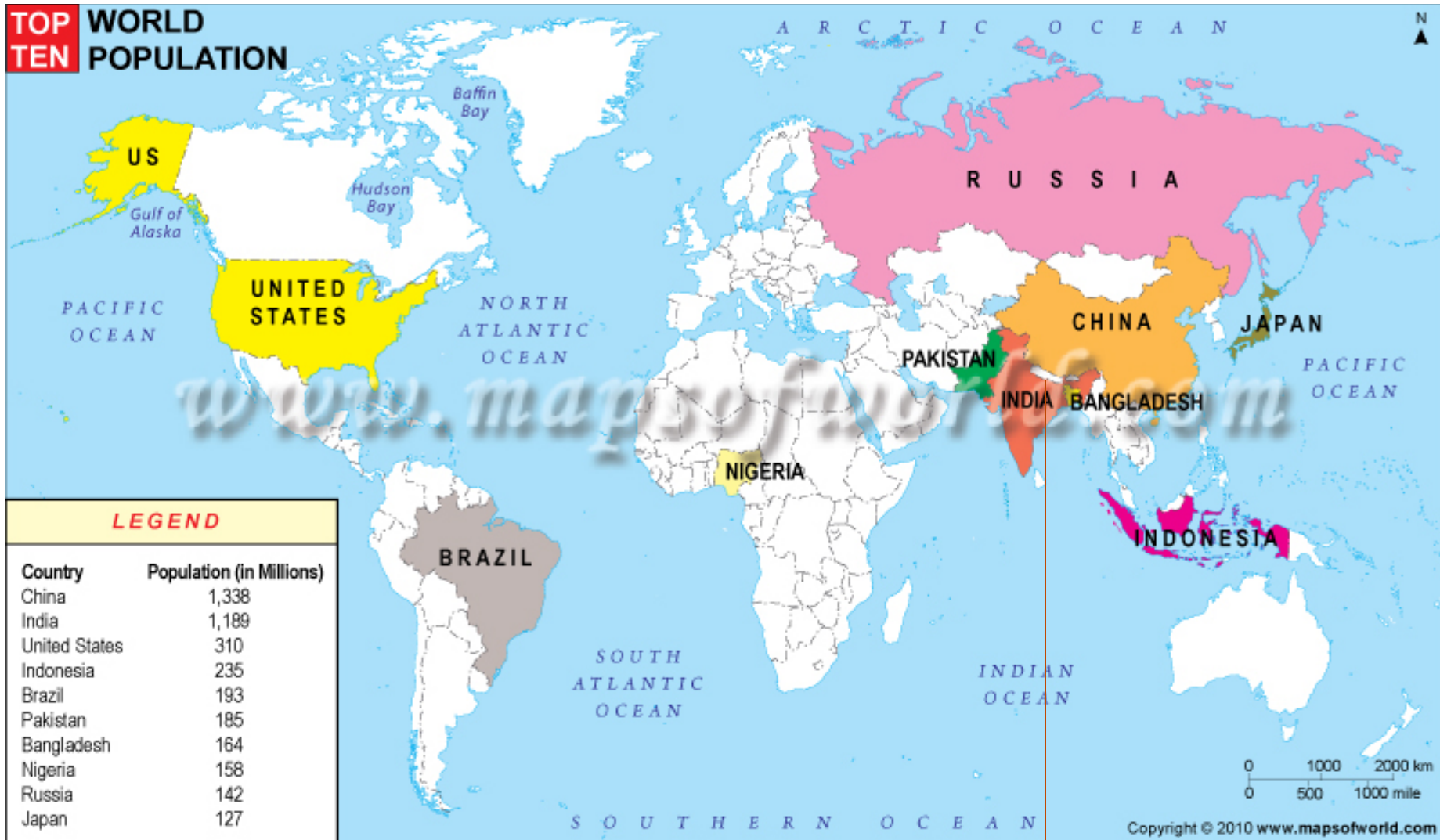


NEPAL: SOME FACTS

Particulars	Fact
Area (sq km); 93rd largest country by land mass	147,181
Altitude Range (meter)	60-8848
Total languages spoken in Nepal	123
Land covered by forest (% of total land)	36.0
Population; 41st most populous country (million)	27.47
Annual average population growth rate (%)	1.35
Urban population (%)	17.07
Fuel for cooking (total HH): Firewood (%)	64.0
Source of lighting (total HH): Electricity (%)	67.26
Average Life Expectancy at birth (years)	64.1
HDI (157 th position)	0.463
Per Capita USD	743



TOP TEN WORLD POPULATION



93. 140,800 KM² (0.1% land area of the earth)

40. Nepal (27.5 milion)

Vegetation pattern and Environmental gradient

- **Tropical zone (60 m – 1000 m)**
 - Sal – sisau forest (Shorea, Acacia, Dalbergia, Bombax, Terminalia, Butea, Cassia)
- **Subtropical zone (1000-2000 m)**
 - Schima-Castanopsis forest
- **Temperate zone (2000-3000 m)**
 - Evergreen forests of oaks, laurels and conifers
- **Subalpine zone (3000-4000 m)**
 - Rhododendrons, Abies, Betula, Junipers, and Ephedra
- **Alpine zone (4000-5000 m)**
 - Dwarf bushes of rhododendrons, and junipers
- **Nival zone (> 5000 m)**
 - Grasses, Arenaria, Stellaria, Lichens, etc.



Subtropical zone (1000-2000 m)

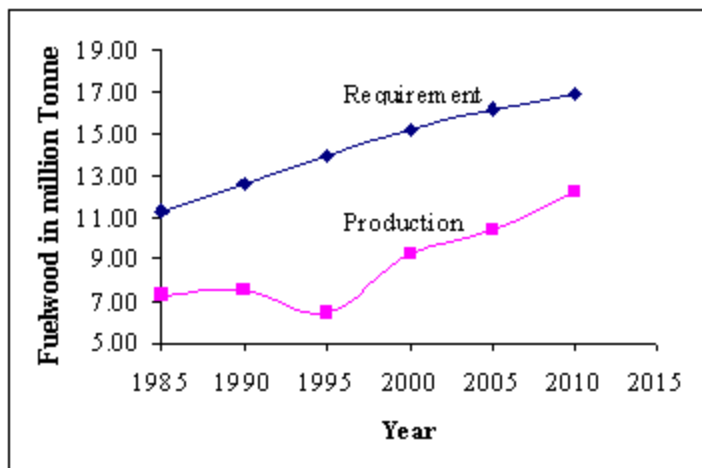


Schima-Castanopsis forest: *Schima wallichii* (chilaune), *Castanopsis indica* (katus), *Pinus roxburghii* (rani salla), *Rubus ellipticus* (aaiselu), orchids, laurels, etc.

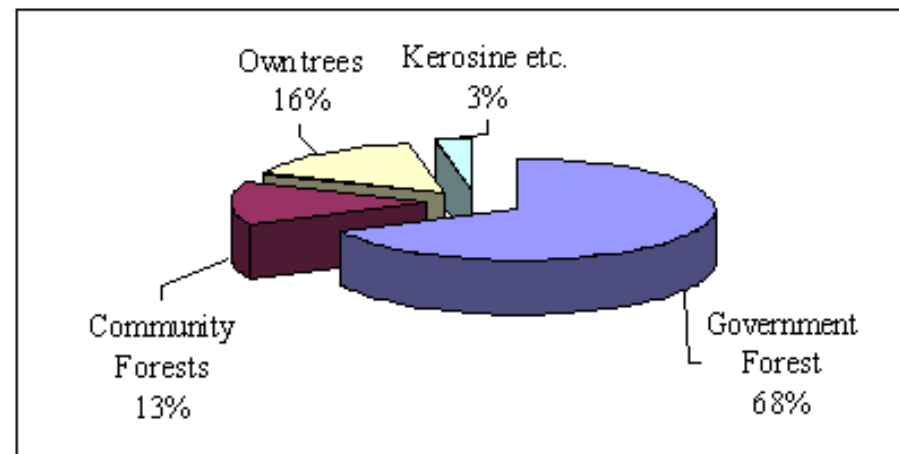
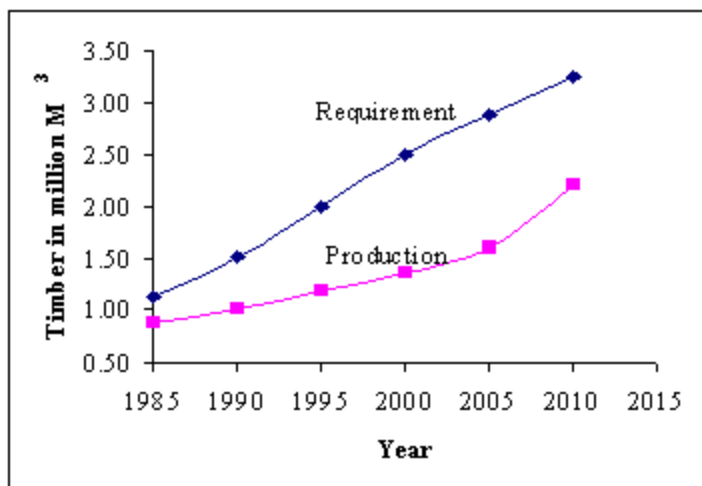


NEPAL: FOREST RESOURCE USE

(SOURCE: WWW.FAO.ORG)



Percent of households using different sources of fuel energy

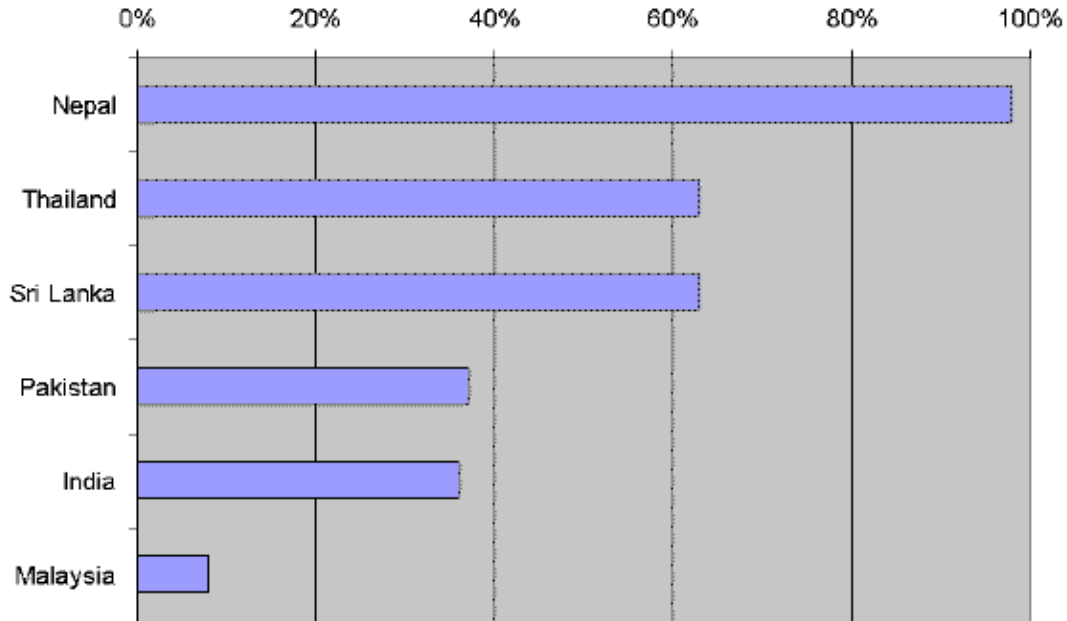


Requirement and production of timber

Requirement and production of fuelwood

FUELWOOD CONSUMPTION: ASIA AND NEPAL

Asia



solarcooking.wikia.com

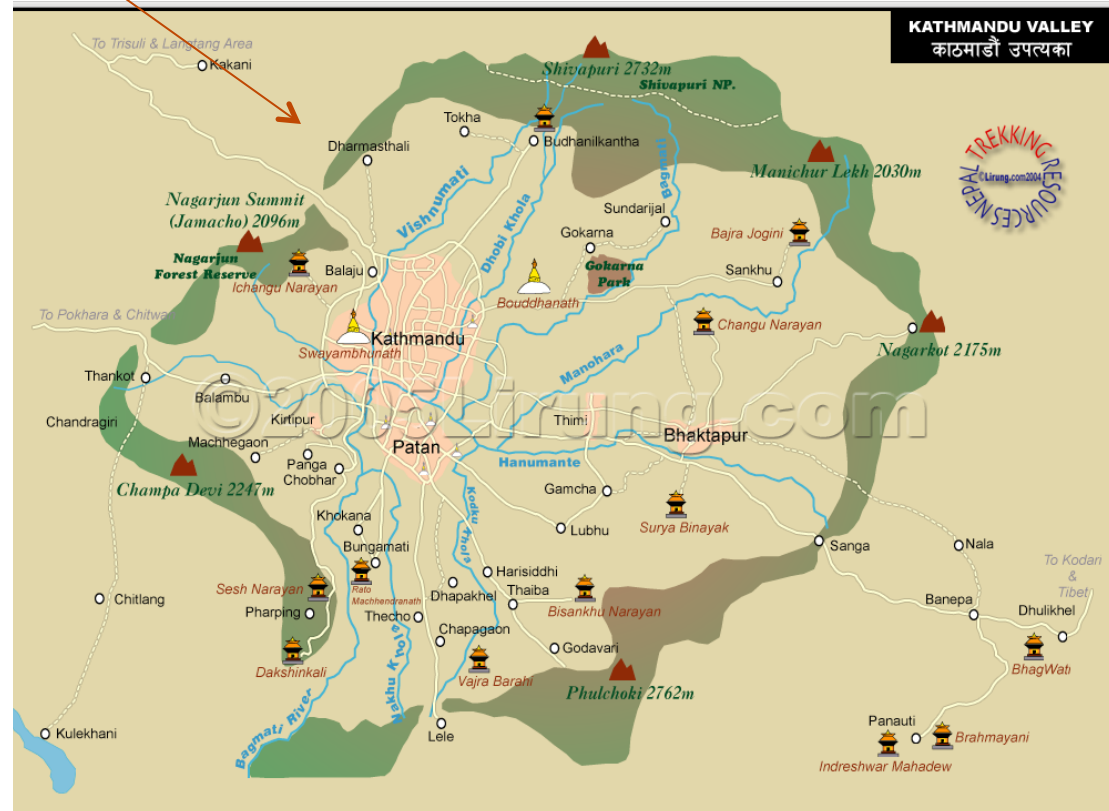


Courtesy: ekantipur.com





- Kathmandu Valley (area: 899 km²) consists of three main districts: Kathmandu, Lalitpur and Bhaktapur.
- Urban population is about 17% percent of the total population of the country.
- Kathmandu alone accounts for approximately one third of total Nepal's urban population, which has been growing at a rate of 4.76 % per year.



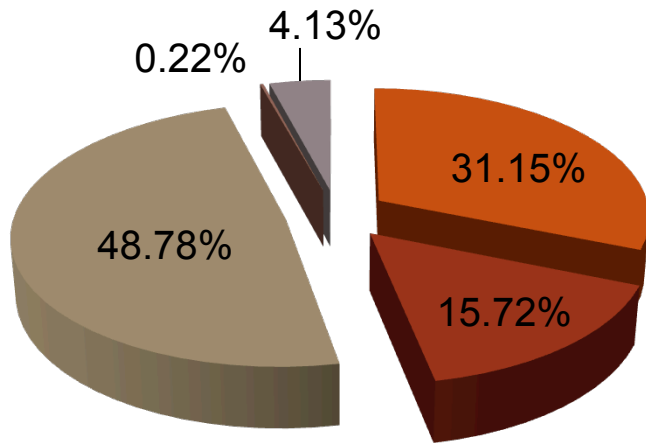
KATHMANDU VALLEY: ENVIRONMENTAL ISSUES

Kathmandu

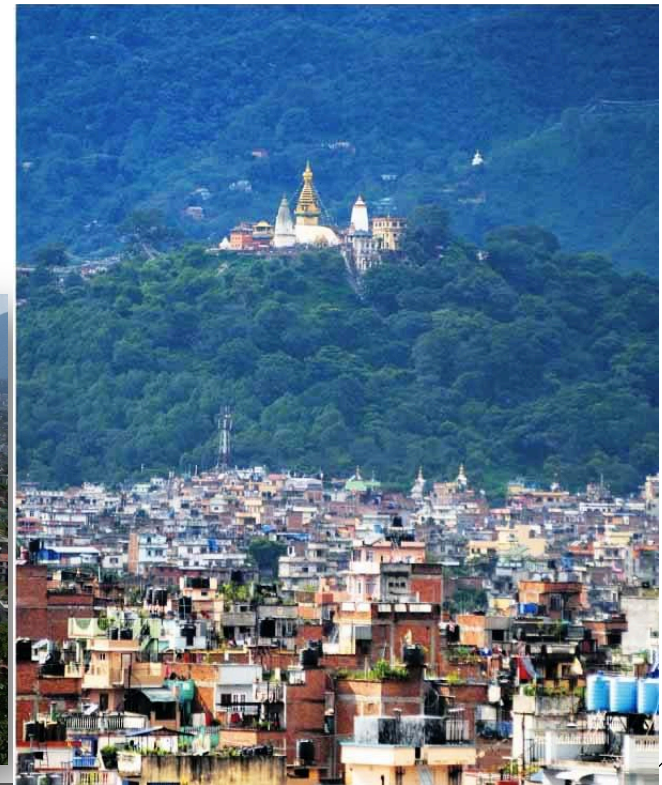
- Largest metropolitan city in Nepal, dating back 2000 years, ranks among the oldest human settlements in central Himalaya.
- Example of a relentless urban sprawl with few building regulations that keeps on growing in the recent days.
- Environmental chaos with severe noise, air, visual and water pollution.
- Environment Index: 0.704,
Quality of Life Index: 0.621



KATHMANDU VALLEY: LAND USE



- Forest Area
- Shrub
- Agri land/ grass
- Water Bodies
- Barren Land
- Snow
- Others

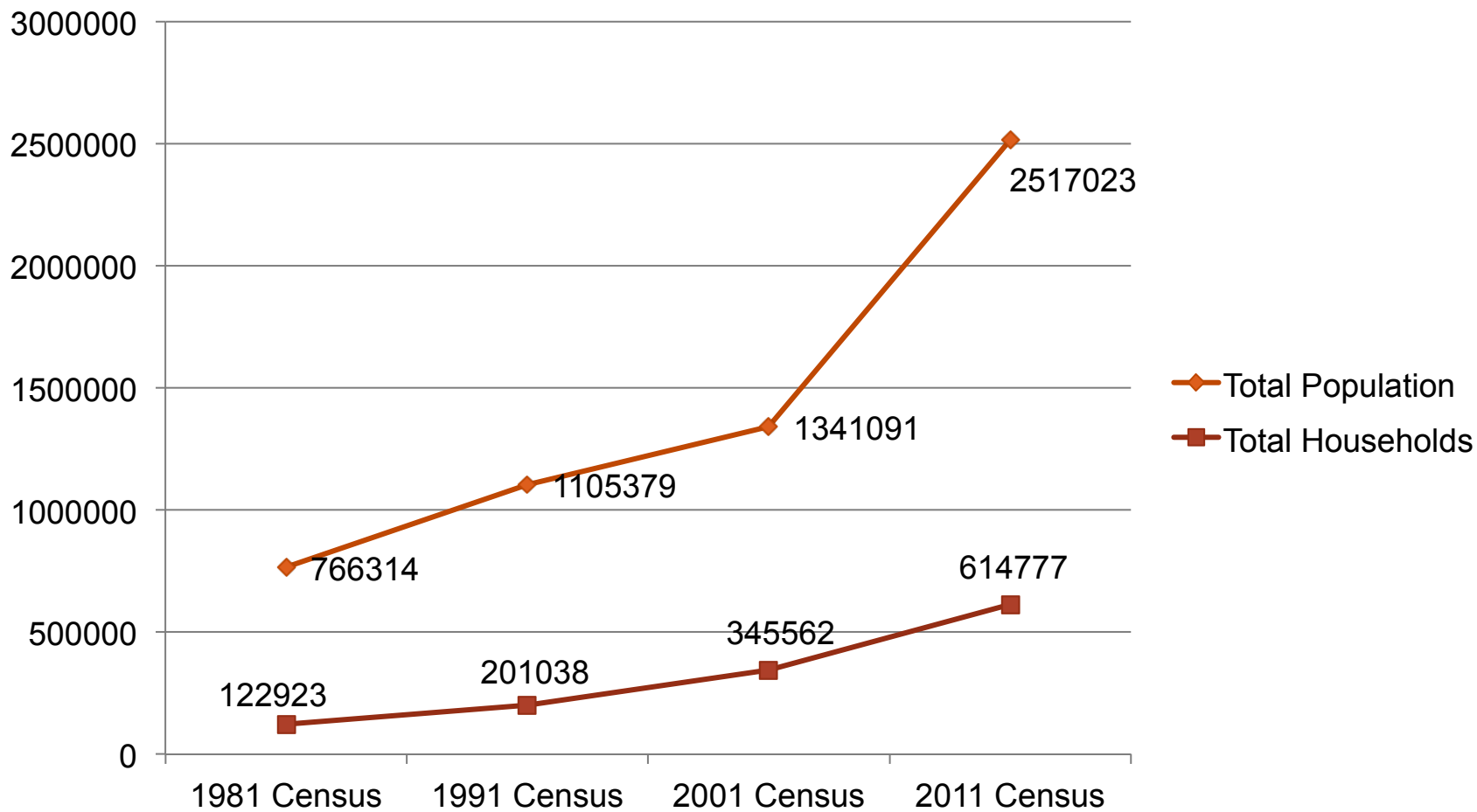


KATHMANDU VALLEY: PROBLEMS

- **Population:** Population increment three folds over the last four decades; Total households increased by six times.
- **Temperature:** Average annual rise by 0.05°C , comparatively higher than world average
- **Environmental Challenges:** Rapid growth in the number of vehicles; High particulate matter in the air; High rate of deforestation and loss of greenery; Unsustainable solid waste management
- Kathmandu as a second most polluted city in the world

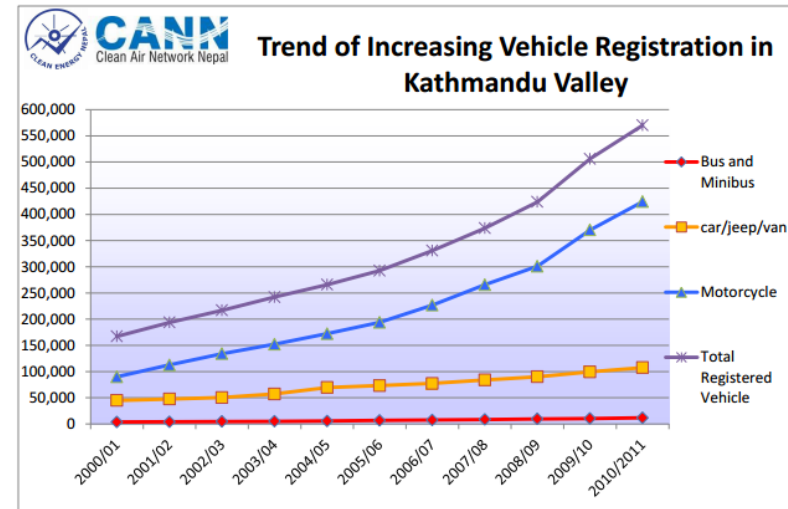


KATHMANDU VALLEY: POPULATION & HOUSEHOLD (1981-2011)



KATHMANDU VALLEY: AIR POLLUTION

- Kathmandu: 3rd most polluted (air) country
- Number of vehicles (2011): 11,26,763 (66% two-wheelers)
- Particulate matter (PM10) in Putalisadak (Kathmandu): 900 micrograms per cubic (over seven folds higher than WHO Air Quality Guidelines)
- About 1.5 million people in Kathmandu valley suffering from respiratory illness; Hospital visits for diseases attributed to air pollution: 16 per cent
- Every year over 1600 people in Kathmandu valley die due to air pollution (?)



KATHMANDU: WATER POLLUTION

- Most problematic: Total coliform (94%) and *Escherichia coli* bacteria (72%) of all the water samples (100)
- Nitrate and ammonia exceeded Nepali guidelines in 11 and 45% of the samples, respectively.
- Arsenic and mercury exceeded WHO guidelines in 7 and 10% of the samples, respectively
- Water Pollution is the most visible environmental problem in Kathmandu

Source: Warner et al (2008)

Table 1: Source wise Quality of Total bacterial Count of Water Samples.

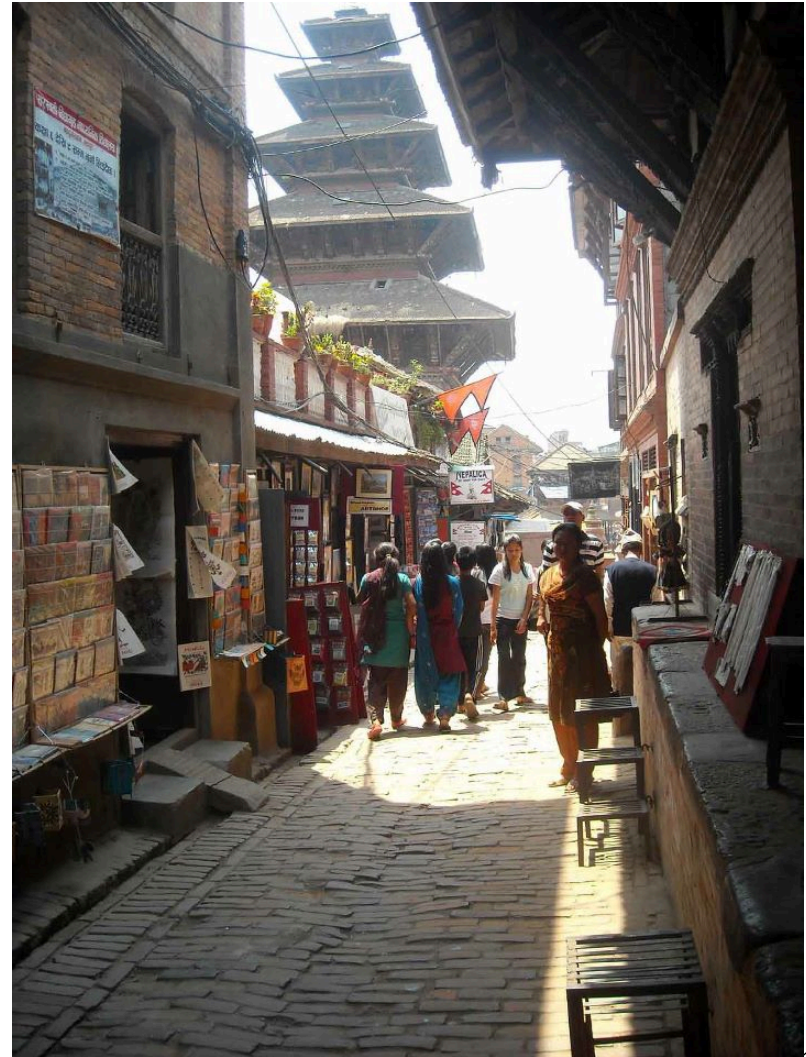
S N	Source	Percentage (%) of Samples compared with WHO guideline Value		Total number of Samples
		Guideline value (<10 cfu/ml)	Excess to Guideline value (>10 cfu/ml)	
1	Tube well	28.9 %	71.1 %	49
2	Well	10.5 %	89.5 %	57
3	Tap water	17.6 %	82.4 %	17
4	Stone Spout	0 %	100 %	9
Total		17.4 %	82.6 %	132

Source: Prasai et al 2007



Major Urban Governance Issues

- Economy
- Limited Health and Sanitation
- Inadequate Power Supply
- Shortage of drinking water
- Poor environment infrastructure and services
- Unplanned and haphazard housing developments
- Poor road network



Urban vulnerabilities in Kathmandu Valley

(Source: Bhattarai & Conway (2010))

- Population Growth and Urban density - Intensification
- Housing standard and Hygienic conditions
- Open spaces
- Road accessibilities
- Patterns of vulnerability and Resilience across Urban areas
- Strict imposition of Building Codes
- Conserving Urban spaces
- Improving Urban efficiency
- Creating new satellite cities



National Adaptation Programme of Action (NAPA) to climate change (GoN/MoE 2010)

- Human sensitivity due to climate change: Very high in Kathmandu and Bhaktapur and High in Lalitpur
- Combined multiple sensitivity index (human + ecological sensitivity): Very high in Kathmandu
- Ecosystem management through afforestation and promoting alternative energy technologies are prioritized as the major adaptation strategy for climate change adaptation in Nepal



THE WAY FORWARD

- Assess ecosystem services of Kathmandu urban sprawl
 - Restore greenery for sustainable ecosystem services
 - Plantation of indigenous multipurpose trees in road side
 - Adequate supply of drinking water
 - Management of solid waste disposal
 - Alternative energy Supply
 - Install low carbon energy lights for public places
 - Relocation of satellite cities
 - Establishment of Low Carbon Society
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- Collaboration with national and international organizations for the RESTORATION OF GREENERY FOR SUSTAINABLE ECOSYSTEMS IN URBAN SPRAWLS

