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OASIS IN A POLLUTED MOUNTAIN VALLEY

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REMEMBER OUTDOORS?

History often reminds us that result-oriented landuse planning are always short in supply in developing countries especially in their large cities. For that reason alone, Kathmandu is no different from others. The Valley is under duress as open spaces and outdoors are diminishing fast and sizeable natural forests are long gone. Now, where can you camp in the Kathmandu Valley under a million stars, as you did twenty years back? How many Kathmandu children can play outdoors? Perhaps no one can even remember when thousands of cranes from Tibet, flew over the Kathmandu Valley highlighting the winter skyline. As space has become premium, urban crowding is inevitable which is seldom safe. For example, air quality of Kathmandu is starkly unhealthy as its quantity of PM10 (particulate matter less than or equal to 10 micrometer in diameter per cubic meter of air) ranges from 121 – 350. In contrast, good air has less than 60 of PM10. With high levels of suspended particulate matter in the air and diminishing forests, clean environment and quality outdoors have become a rarity in the Valley, except Shivapuri .

Shivapuri ($27^0$45'30" - 50'15"N and $85^0$16'32" - 29'43"E, elevation range: 1,300 – 2,800 m) provides 227 million liters of drinking water every day to the Kathmandu City Also, recreation for some 1,500 urbanites and 3,000 non-residents each year.

This paper is based on: 1) result of a two year field work in 1992 on vegetation ecology, butterfly diversity, mushroom, wildlife and socio-economic surveys conducted by then Resources Nepal (now Resources Himalaya); 2) synthesis of spatial and temporal analyses of time-series landuse changes (1958, 1978 and 1992) in Shivapuri; and 3) ensuing issues and implications of past interventions that relate to the maintenance of Shivapuri for now and in the future.

BIOLOGICAL RAREITIES

The whole watershed has six forest types: sal, Terai hardwood, lower slopes mixed hardwood, chirpine, oak and mixed hardwood (Amatya, 1993). However, the core area has no sal, and Terai hardwood. *Quercus semecarpfolia*, although a dominant tree species in the Park, is threatened because of poor regeneration and indiscriminate exploitation (Acharya, 1999).

Biologcial inventories include 98 tree species, 133 species of shrub, 277 species of herbs, more than 110 species of butterflies, 177 species of birds and 19 mammals. The 1992 Research Team prepared a mushroom inventory as they are sensitive to disturbance and degradation. Therefore, they could be used as indicators. Some 129 species of mushroom were identified and their usages (edible, poisonous) were recorded. Out of these, *Lactarius pleurotoideus* is new to science and 31 species were new to Nepal (Yonzon and Chaudhari, 1992).

Ypthima confusa, an endemic butterfly of the Nepal-Himalaya and Krishna Peacock *Papilio krishna*, a rare butterfly and *Troides aeacus*, a species listed on the IUCN red data book, have been recorded (Yonzon and Chaudhari, 1992). Also. *Epiophlebia laidlawi*, a relict Nepal dragonfly, occurs whose nearest-related single species survives in Japan (Saville et al.,1990).

BENCHMARK

Although the gazetted area is 144 km^2, digital mapping does not yield more 97.38 km^2. An additional area (buffer zone) of 118.64 km^2 around the Park, add up to 216 km^2 as the total watershed area. Re-defining the boundary or Park area that would actually encompass the gazetted area of 144 km^2 is much needed to avoid land-related, measurement disputes in future.

The 1992 Report suggest that forest are heavily influenced by humans. Mature tree stands occur only around the Shivapuri top. The dominant canopy tree species were *Quercus semecarpifolia, Q. lamellosa,* and *Rhododendron arboretum.* Many fodder species near the human habitations, were heavily lopped along with several old charcoal pits. Majority of the vegetation was secondary with a strata comprised of *Lyonia ovalifolia, Eurya acuminata, Lithocarpus spicata, Persea odoratissima* associated with *Maesa chisia*. Because of the influence of

intense human usages, a compact vegetation of uniform heights is regenerating between 1750 - 1900 m.

Based on the topographic map (scale 1:63,360) prepared by the Indian Survey General in 1958, Shivapuri had three main landuse types: forest (66%), shrub (28%) and farms (6%) (Table 1). Barren land was negligible, covering only 0.16 km^2. About 91% of farms occurred below 2,100 m and 88% of forest, largely broadleaved occurred between 1,800 – 2,400 m.

Using the classic treatise on island biogeography (MacArthur and Wilson, 1967), natural patch size and fragmentation are deterministic in knowing degradation in certain landuse types especially forest. In 1958, only two forest patches were there but they were large averaging 32 km^2, suggesting intactness. Farms occupied the middle of the forest area but the 104 farm patches were very small, each averaging 0.06 km^2, and totaled 6 km^2. Perhaps, the small, scattered farm patches indicated that the agricultural production may have begun to spread inside the forest because they would not be visible easily. Also, forest soils have high fertility, and agriculture land is mostly the outcome of deforestation.

Table 1. Landuse pattern Changes in Shivapuri.

Landuse Type (km^2)	Year 1958	Year 1978	Year 1992
Forest	64.09	82.23	68.99
Agriculture land (farms)	6.05	9.26	5.72
Shrub land	27.07	5.51	22.10
Grazing land	-	0.37	0.56
Barren land	0.16	-	-

KNOWING CHANGES BETWEEN 1978 - 1992

In the 1978 maps (Land Resource Mapping Project; scale 1:50,000), four landuse types dominated Shivapuri: agricultural land, forest, grazing land, and shrub land (Table 2). The 1958 barren land had disappeared, and grazing land that was not noticed before, had appeared (Fig. 1). The forest (64.09 km^2) had increased to 82.23 km^2. Also, agricultural land has increased to 9.26 km^2. However, shrub land had decreased to 5.51 km^2.

By 1992, Shivapuri forest had plunged to 69 km^2. Agriculture land also decreased but shrubland had increased. All noticeable changes occurred in shrub land as it had decreased from 27 km^2 in 1958 to 5.5 km^2 in 1978, which is 80% decrease and then rebounded and spread into 22 km^2 in 1992.

GROWING SHRUB & FOREST FRAGMENTATION

Historically, Mid hills have been densely populated. In this regard, Shivapuri being in the Mid hills and close to Kathmandu City, is no different where denuded hill slopes occurred even in 1958. The result of the human pressure on the natural resources showed particularly on the forest. By 1978, shrub land had shrunk and their no. decreased, enhancing forest cover (Table 2). Therefore, landuse in Shivapuri mainly relates to no. of shrub patch and their expansion. In Nepal's forestry, shrub land carry shades of gray (uncertainty) and has two schools of thoughts: 1) shrub (immature stands) regenerates into forests; and 2) forests have degraded into shrub. A reconnaissance in 2004, suggested some shrub areas have actually regenerated. Likewise, no cattle grazing and deforestation were visible at higher elevation forest (Saville, 1990). However, a complete and current landuse status is much needed, now.

Even more complex than shrub land dynamics, is forest fragmentation through humans and it has two consequences: 1) Forest cover is reduced; and/or 2) forests are appropriated into small, isolated patches (Saunders et al., 1993). Between 1958 and 1992, forest cover had increased from 64 to 69 km^2 but forest as a whole had fragmented from two to fifteen forest patches suggesting human appropriation and disturbance (Table 3). Also, more forest patches through fragmentation meant smaller and fewer habitat (forest type) patch size (Fig. 2). Therefore, irrespective of the total forest cover, fragmentation intensity can harm species diversity through patch size over years.

Table 2. Changes in shrub land in Shivapuri.

Year	No. of Patch	Average Patch Size (km^2)	Shrub Area (km^2)	Percent Land
1958	14	1.93	27.07	27.80
1978	10	0.55	5.51	5.66
1992	14	1.58	22.10	22.70

Table 3. Changes in forest patch and cover in Shivapuri.

Year	No. of Patch	Average Patch Size (km^2)	Forest Area (km^2)	Percent Land
1958	2	32.05	64.09	65.82
1978	4	20.55	82.23	84.45
1992	15	4.6	68.99	70.85

Figure 1. Time-series landuse changes in Shivapuri

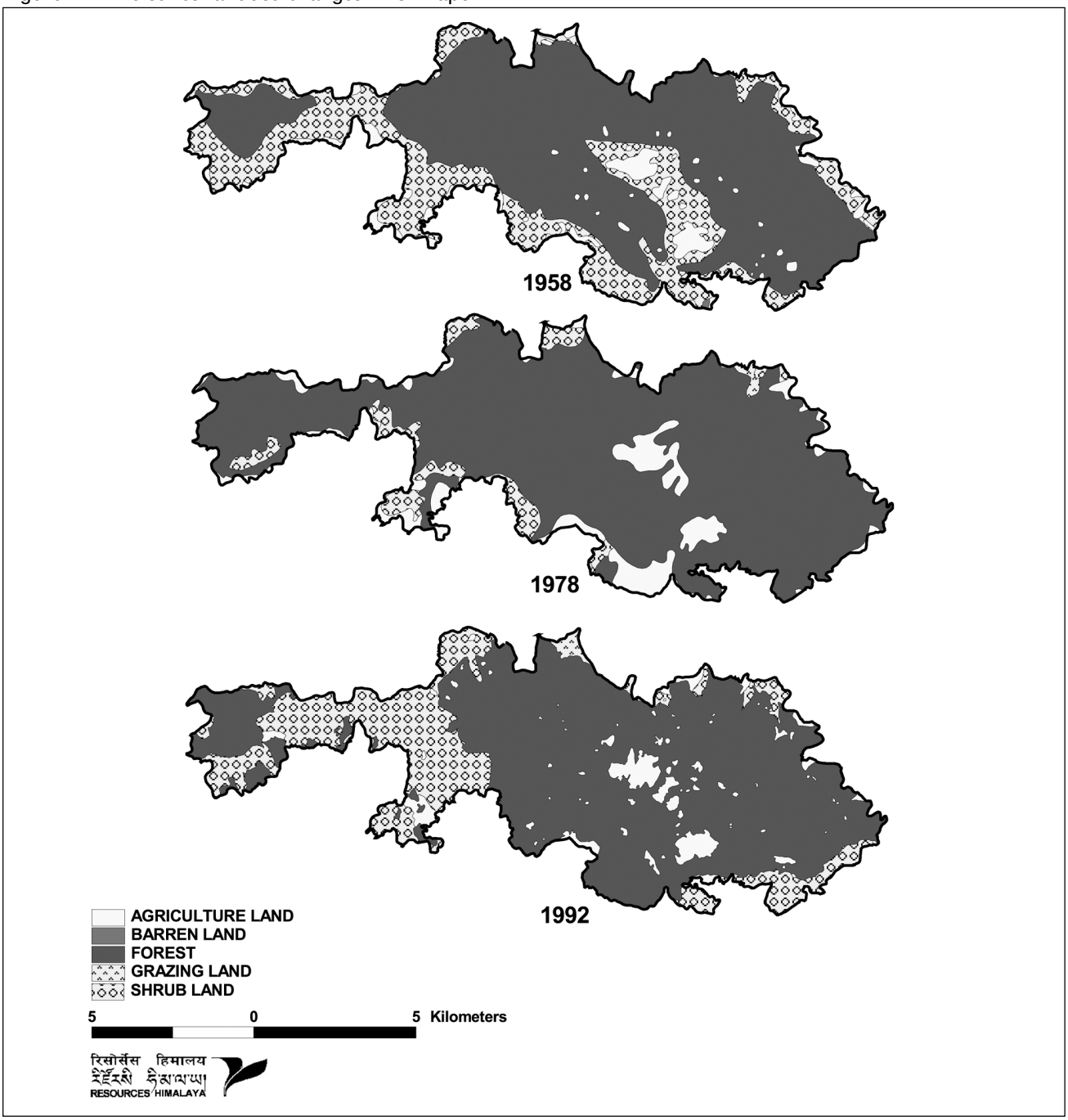
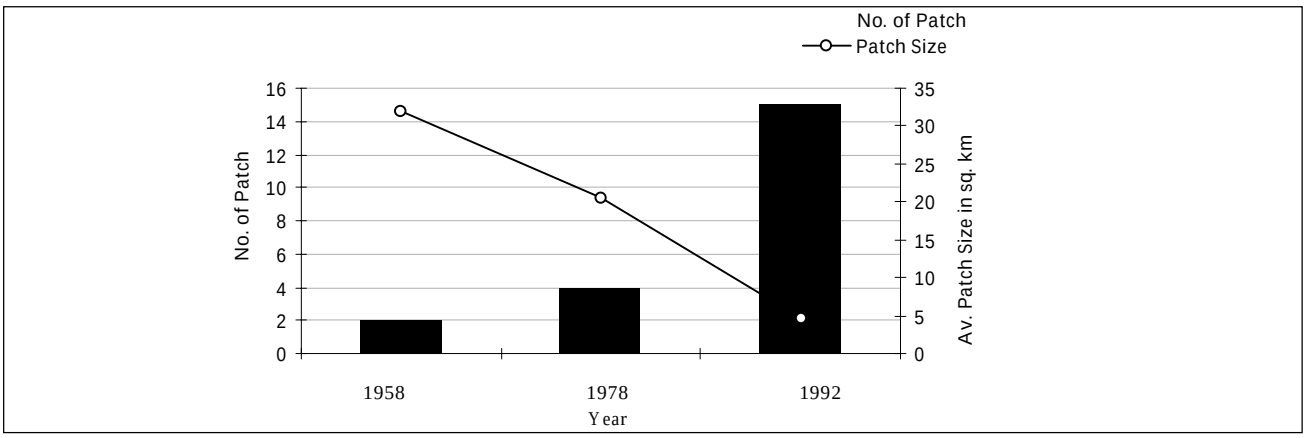


Figure 2. Average forest patch size and their occurrence frequencies from 1958 -1992.



MANAGING THE WATERSHED

In 1976, the Shivapuri Watershed Area was constituted. In 1982, it was upgraded to Protected Watershed Area, then Watershed and Wildlife Reserve in 1984, and finally, a National Park in 2002. From 1985 to 1997, two major 5 year grant assistance were executed. In 1985, the Shivapuri Watershed Management and Fuelwood Plantation Project worth 2.5 million dollar, was launched. Another US$ 2.3 million Shivapuri Integrated Watershed Development Project, was implemented in 1992 to ensure environmental protection with emphasis on safeguarding the water supply to the Kathmandu Valley. Activities included construction of a 114 km-long boundary wall, 95 km-long motorable road, improvement of 82 km of footpaths, reforestation in 2,684 ha, construction of 106 check-dams as well as gully control at 12 localities, provision of 20 guard posts and 30 units of cottages. Thus, Shivapuri has become the costliest per manged unit area ($4,930/km^2 in 10 years). In a nutshell, the major concern was all about infrastructure and the much needed achievements in watershed protection through people participation, were marginal.

THE INFAMOUS WALL

During these years, collaborators of the grant assistance erected the 114 km-long boundary wall all around Shivapuri was not necessary. Even then, erecting such wall was against the philosophy of long-term biodiversity conservation embraced by Nepal's PA management. All that needed then and now, is boundary demarcation not wall! By 2002, the Government had made a new institutional arrangement by declaring Shivapuri as a national park.

Shivapuri has 109 wards, 23 Village Development Committees (VDC) of Kathmandu, Nuwakot and Sindhupalchowk Districts, with 45,690 people from 9,645 households. Some 4,000 locals that reside in the core area, strongly feel that they are being denied of their rights, who are dependent on fuelwood and non-timber forest products (Mountain Forum Radio Project, 2004). The project argues that conservation has come to Shivapuri at the expense of the local communities.

In 1992, the boundary wall had nearly hundred illegal entry points (Yonzon and Chaudhary, 1992). The wall damage survey was grouped into four categories: 1) collapse, 2) collapse and recent use, 3) collapse and heavily used (including cattle access) and 4) damaged by humans and used. Wherever damaged walls occurred, it appeared that people either have broken the wall or hasten the process of collapse. All these were near to their farms or houses with obvious intent. Although it is argued that wildlife depredation and crop damage are intense, the survey result suggested that wildlife-related crop damage would not have been heightened if the wall was not damaged. As for the protection and maintenance of biodiversity, the wall has been effective when complemented with guard posts as it deters cattle gazing. Also, the wall has encouraged tree regeneration which is better than plantation with exclusion of cattle.

Likewise, in 1999, a doctoral study suggested that human disturbance was the principal casual factor and human disturbance index was negatively correlated with tree species diversity (Acharya, 1999). As locals discreetly collect fuelwood and grasses, these issues are to be addressed through village dialogues because sustaining the needs of the people to a limit also means conservation.

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Resources Himalaya aims to be a regional promoter of "good science" to facilitate "politically correct" decisions so that biodiversity conservation in the Himalaya is secured and benefits of conservation practices accrue to the poorest segment.