1. INTRODUCTION

1.1 Country Background

Nepal, the Himalayan biodiversity hotspot, is situated between the latitudes 26°22'N and 30°27'N and longitudes 80°04'E and 88°12'E. It occupies one third of the entire length of the Himalaya extending approximately 800 km from Sikkim and West Bengal states of India in the east to Uttaranchal state to west and 140 to 280 km from north to south. It is bordered by India (east, west and south) and China (north).

Nepal exhibits a great diversity of topography, climate and vegetation due to altitudinal variation ranges from 60 m to 8,848 m above mean sea level. Ecologically Nepal is divided into three ecological regions- lowland, midland and highland. Lowland includes southern plain area known as Tarai, a narrow band of fertile land and is the breadbasket of the country, within an elevational range of 60-300m and Churia or Siwalik range upto 1500m. The southern lowland, also known as the Terai, is.Churia hill is the narrow belt of rugged landscape. The lowland is represented by suptropical climate. The midland lies between Churiya hill and highland. It includes Mahabharat range and middle hill complex upto 3000m including major valleys of the country like Kathmandu, Pokhara, Trisuli, Tamor, Kali, Rapti, Panchkhal and Banepa. The highland or greater Himalayas is the northern stretch from east to west. There are more than 200 peaks of more than 7000m high. This is the chain of the highest land in the world. There are several inner Himalayan valleys with desert condition such as Mustang and Mugu valleys with altitude more than 3600m. These valleys have landscape of Tibetan plateau. It also includes some areas beyond the great Himalayas, known as the Trans-Himalayan Zone with arid climate and sparse vegetation. A large number of rivers flow down the mountains in the north-south direction. Some of the rivers are snow-fed while others are seasonal, depending upon the monsoon rains.

The monsoon rainfall occurs from June to September and accounts for 80 percent of the annual precipitation in Nepal. The average annual precipitation for Nepal is 1,600 mm, but the distribution is highly skewed. As the monsoon rains are driven by winds that blow in the north-western direction from the Bay of Bengal, the eastern part of Nepal receive a larger portion of the rainfall. Similarly, the southern slopes of the

mountains receive more rainfall while some of the northern slopes, especially in the Trans-Himalayan Zone receive minimal rainfall.

This unequal distribution of rainfall along with the variation in altitude has resulted in the formation of numerous vegetational zones in Nepal. These zones can be broadly classified as tropical, sub-tropical, warm-temperate, temperate, cool-temperate, sub-alpine and alpine. Zoo-geographically, Nepal is sandwiched between the Palearctic Realm towards the North and Oriental Realm towards the south. South-western Nepal lies in the Indian Sub-realm while south-eastern Nepal is a transition zone between the Indian and Indo-Chinese Sub-realm. Thus, Nepal is located where a number of zoogeographical realms and sub-realms inter-penetrate each other.

All these factors such as the altitude, rainfall, vegetation and zoogeography together result the country rich in biodiversity. Nepal, a biological hotspot houses remarkably high numbers of faunal species; 4.5% of all mammals, 9.5% of birds, 1.2% of amphibians, 2.03% of reptiles and 6.8% of butterflies and moths. China, which is 65 times greater in area than Nepal, is home to only 12.5% of the world's mammals, 6.3% of the birds, 9.1% of the amphibians and 18.8% of reptiles. Similarly, India is 16 times greater than Nepal, but can claim only 8.6% of the mammals in the world, 13.3% of the birds, 4.3% of the amphibians and 7.2% of the reptiles (Pei 1996 cited in Budha 2005).

Biodiversity conservation efforts have been made by the establishment of the protected areas in Nepal. The protected areas mainly categorized into National Parks (9), Buffer Zones (8), Conservation areas (3), Wildlife Reserves (3) and Hunting Reserve (1). The great efforts are being made to conserve large animals but there is still a lot to be done for the smaller animals. Reliable conservation database on the species composition, diversity and distribution pattern on many invertebrates is still lacking. Thapa (1997, 1998) gave the list of insects reported and described from Nepal in three volumes of "An inventory of Nepal's Insects" which is the only compiled database representing Nepalese insects. However, this wonderful work was not sufficient to cover all insects such as Moths and Beetles. Educators, policy makers, and researchers are still unaware about terrestrial malacofauna of Nepal and no data included in the national biodiversity profile. These small animals are very localized and limited to microhabitats. With the rapid and uncontrolled development

and human interference, they could easily become extinct before they are known to modern science.

1.2 The Kathmandu Valley

Three districts within Kathmandu valley namely Kathmandu, Lalitpur and Bhaktapur are surrounded by mountains. The valley is surrounded by four mountains Shivapuri, Phulchowki, Nagarjun and Chandragiri. The mountains are densely covered by forests and well managed either by protected area such as national parks (Shivapuri National Park) and other forested areas managed by communities.

Kathmandu Valley is rich in biodiversity. There are records of 3 species of Collembola, 6 species of Thysanoptera, 8 species of Mallophaga, 8 species of Psocoptera, 1 species of Ephemeroptera and 6 species of Neuroptera. Similarly, there are records of 2 species Siphanoptera, 22 species of Dermaptera, 6 species of Orthoptera, 1 species of Dictyoptera and 80 species of Odonata, 297 species of Hemiptera, 50 species of Hymenoptera 288 species of Coleoptera, 215 species of Moths and 246 species of Diptera from Nepal. Similarly, 359 species of butterflies have been recorded from Kathmandu Valley (Thapa, 1997, 2000; Khanal and Smith 1996).

1.3 Champadevi Forest

The present study is primarily focused on the distribution Pattern of terrestrial snails in the Champadevi Community Forest (1360-2260 m) which is only few kilometers south of Kathmandu City and is the part of midland of Central Himalayas. Majority of forest is facing the north direction with 70° inclinations. Forest is rich in hard rock which enabled to run a rock mine a long time back major soil types found in forest are red, brown and black soil. A holy temple along with Boudha Stupa and graveyards are some culturally significant sites of Champadevi.

Chapadevi hill includes secondary forests covers which was said to be completely exposed area due to deforestation before past 30 years ago. Champadevi hill forests have been handed over by the government to many local traditional user groups by

demarcating the forest area to each group. All three studied community forests were handed over in 1990. Although the local communities had been managing the nearby forests, the community management took the legal basis after 1990. The community managed forests are known as Community Forest (CF). The Community Forest can be simply define as the forest managed by the group of local people which depends upon the forest and which lives within a define geographical area. The forest cover has significantly improved after that period. The study area includes three community forest which is given Table 1.

Table 1. Community Forests (CF) in the sampling area of Champadevi hill

Name of CF	Area (in ha)	Plot sampled	Forest type	Remarks
Baghbhairav (2051BS)	105	1-18	Schima-Castanopsis type	Secondary forest
Champadevi (2051BS)	120	19-30	Rhododendron-Quercus type	Secondary forest
Bosan (2051BS)	55.91	31-50	Pinus-Schima- castanopsis type	Secondary forest

Number in brackets indicates handover year to community by DFO

1.4 Molluscs

Mollusca is the second largest phylum in the Animal Kingdom. Unlike many other invertebrates, mollusks are the best known groups in the world. The estimated number of molluscan species all over the world may exceed 200,000 including 40,000 terrestrial and 10,000 freshwater species (Lydeard *et al.* 2004). They are distributed throughout the world from seawater upto the depth of 11,020 m to the 4500m high in the Himalayas (Budha, 2007). The Himalayan region is the important global hotspot for the malacofauna and it comprised high number of endemic terrestrial mollusks.

Eastern and Central Himalayan region alone comprised 94.6 percent of endemic terrestrial mollusk (Day and Mitra 2000). Budha (2005) mentioned altogether 139 species of mollusks (83 freshwater terrestrial and 53 freshwater) reported so far from Nepal. This number may exceed many folds if the proper study will be carried out. Mollusk are important groups of animal kingdom which has the largest number of extinction rate. Many species have been listed threatened categories in the IUCN Red Data list. More than 1222 species of Freshwater mollusk have been kept in IUCN Red list (Lydeard *et al.* 2004).

1.5 Objectives of the Study

The main objective of the stud is to explore land snail fauna and their distribution pattern in Champadevi hill forests. The specific objectives are to;

1. identify land snail species in Champadevi hill forests,
2. find the diversity and distribution pattern of land snails in the study area,
3. find land snail diversity in different community forests in Chapadevi hill.

1.6 Rationale of the Study

Species distribution, diversity is affected by geographical, climatic; altitudinal variation and topographic complexity. Terrestrial land snails are distributed throughout tropical, subtropical and temperate forest contains. But there is very little information is available on the distribution patterns in the forest in the Central Nepal. The Champadevi hill is one of the nearby midhills of Kathmandu. There are not much faunal studies have been carried out in the hill. This thesis is the first attempt on terrestrial mollusks of Nepal. The work documents basic information on terrestrial land snails of Champadevi area to enable the upcoming researchers and the conservationists

1.7 Limitations of the Study

This study was carried out with limited time and financial constraints. The land snail survey was done only in the one season November 2009 to January 2010. Due to dense forest some plots were searched under poor visibility due to insufficient sunlight. Identification of snails was done mainly on the basis of morphological characters of the shells due to lack of enough live adult snails. Reproductive anatomy is very important to identify species level confirmation; however, the collected shells were compared with images of types and other identified specimens available with Prem B. Budha. He took images of types from Natural History Museum, London.

2. LITERATURE REVIEW

Molluscs of Indian subcontinent were well studied by British malacologists from 1830 to 1900s. During this period, molluscs were surveyed in Indian parts of the Himalayan region. These earlier reports on freshwater and terrestrial molluscs in the Western Himalaya (including those of Jammu-Kashmir, Himachal Pradesh and Gahrwal), and eastern Himalaya (including Assam, Darjeeling, Arunachal Pradesh, Megalaya and Burma) were available in three volumes of Fauna of British India (Blanford and Godwin-Austen 1908, Gude 1914, 1921). But none of the British Malcologists visited Nepal during that time and very little and scattered information is available. Budha (2005) made awake up call to investigate malacofauna of Nepal. Few Nepalese researchers have been motivated in carrying out ecology and taxonomic work on terrestrial and freshwater molluscs of Nepal. Due to lack of manpower in taxonomy and good established good relations with international experts and clear legislative provision in the country proper identification of snails is the main problem to native researchers. However, Prem B. Budha has been trying to fulfill the gap and independently working with Asian land and freshwater malacologists to develop taxonomic skills within the country. This initiation will fulfill the gap in documenting required information on the poorly known fauna. The inadequate data and information management is considered a significant threat to Nepal's biodiversity conservation (MFSC 2002).

The literature revels that past study were mainly confined to the Eastern and Western Himalayas. Such data is lacking for Nepal Himalaya (Budha, 2005). The systematic work on terrestrial molluscs reported in Nepal begins from 1973 when Nordsieck identified four new species of calusilids from Central Nepal. Other published papers primarily on Nepalese terrestrial molluscs are Schileyko and Frank 1994; Kuznotsov and Schileyko 1997, 1999, Schileyko and Kuznetsov 1998a,b; Subba and Ghosh 2000, 2001, 2008; Budha 2005, 2007, Subba 2003; Thapa 2003 and Budha and Naggs

2008). Recently published laminated colour guide on land snails of Nepal (Raheem *et al.* 2010 is very helpful publication for identifying Nepalese genera. Land molluscs reported from different regions of Nepal are geographically given as follows;

2.1 Eastern Nepal

Mirus(?) nilagiricus reported by Schileyko (1997) form the Solukhumbu district of Sagamatha zone. It was collected from steep rocks in dense bushes among grass roots at the elevation of 2000m.

Landouria coeni reported by Schileyko and Kuznetsov (1998) from the Solukhumbu district of Sagarmatha Zone. It was collected from deciduous forest zone, where it inhabits dense bushes, among stones and dead leaves, at 2700-2840m

Landouria aborensis reported by Schileyko and Kuznetsov (1998) from the Solukhumbu district of Sagarmatha Zone. The species inhabits the Oak forests, living in wet places in dense bushes among stones and dead leaves, at 1750-2350m

Cyclophorous fulguratus reported by Subba and Ghosh (2001) from the Jhapa, Illam. Morang, Sunsari and Dhankuta of Eastern Nepal. It prefers to inhabits old walls and stones covered with algae and mosses, found in the Terai, Siwalik hills up to 1500m

Cyclophorous aurantiacus also reported by Subba and Ghosh (2001) from the Mahabharat and Churia hills of Eastern Nepal and its altitude ranges from Terai upto 1676 m.

Likewise, *Macrochlymys indica* and *M. tugurium*, reported by Subba and Ghosh (2002) and found that they were found from the Eastern to Central Nepal, upto the elevation of 1676m

Bensonies nepalensis and *Oxytes sylvicola*, reported by Subba and Ghosh (2001) it elevation ranges, from Terai upto 1676m and found in eastern Nepal and Central Nepal.

Subba and Ghosh (2001) reported *Khasiella pansa* from Terai upto 1658 and said to be restricted to the Eastern part of Nepal. It was mainly found climbs up shrubs and remain adhered to the under surface of green leaves.

Subba and Ghosh (2001) reported *Lissachatina fulica* mainly from lowland of Terai and is invasive to vegetables. It was found upto 1500m but now spreading upto the Far-western Nepal. They also reported invasive terrestrial slug *Leavicaulis altae*, from Illam of Eastern Nepal. It is a small slug inhabiting nearby water sources such as Fish Ponds Reservoirs, water channels and paddy fields.

Bössneck (2006) reported *Devoceras laeve* from the Taplejung of Mechi Zone and Panchthar of Mechi Zone. Its elevation ranges from 800m upto 2200m.

Gerber and Bössneck (2009) reported *Vallonia tenuilabris* from Solukhumbu and Taplejung district of Eastern Nepal by This species was found on Alpine meadows, glacial moraines, sometime under shrubs, at elevation of 4800-5100m. They also reported new species of the genus *V. costohimala* and *V. kathrinae* Sagarmatha and Karnali Zone respectively within altitudinal range from 2300-4830m.

Wiktor (2001) described new slug *Anadenus altivagus* from the Bakari Kharkha ,16 miles from NE of Pokhara and Gurjkhani, 28 miles NW of Beni. It was found on damp soil, stone, grass or on an open hillside at the attitude of 3200-3350m.

2.2 Central Nepal

Nordsieck (1973) described new clusiilid species *Hemiphedusa kathmandica* from Phulchowki hill of Lalitpur district Central Nepal. Other clausilids he reported are *Hemiphedusa ioes jiriensis* reported from Jiri of Central Nepal.

Schileyko and Frank (1994) reported *Laevozcbrinus nepalensis, Oxytesta orobia Euaustenia monticola* from neighborhood of Kathmandu valley but exact locations were not mentioned.

Kuznetsov (1996) first described new species *Himalodiscus aculeatus* from Pulchowki hill of Kathmandu valley. It was found in the tropical Oak forest, under bushes among wet dead leave at 2350m altitude. This species was previously classified under the sub-family Discinae. But later after anatomical investigations Schileyko and Kuznetsov (1998) put under the family Ariophantidae. Along with *H. aculeatus* he also reported *Chamalycaeus (Cyclorix) otiphorus, C. (Dicharax) bicrenatus, Alycaeus lhohitensis, Diplommatina* sp., *Khasiella ornatissima,*

Macrochlamys nuda, M. Patane, Euaustenia monticola, Glessula subjerdoni and *Plectopylis (Endothyrella) minor.*

Schileyko and Kuznetsov (1996) were described new genera *Ranibania tenuispira* from Raniban, Balaju area of Kathmandu valley, at the elevation of 1480m. This erroneously described species without looking type specimens of *Rishetia tenuispira* redescribed again as *R. tenuispira.*

Bössneck (2006) reported *Deroceras laeve* reported from Thamel and Gokarna Park of Kathmandu Valley. It was found on elevation of 1300m

Schileyko and Kuznetsov (1998) described *Landouria savadiensis* from Balaju, Shivapuri area of Kathmandu and *Landouria aborensis* from Godawari and its adjoining area of Kathmandu and in Jiri and Shivalaya village of Janakpur zone. The former species was found in Oak forest along calcareous rocks, among dead leaves at elevation of 1450-1900m and later species was found in steep rock in dense forest among dead leaves at elevation of 1750-2350m.

Witkor (2001) described new terrestrial slug *Anadenus nepalensis* from Godawari, Kirtipur, Maharajgunj, Gokharna Park of Kathmandu Valley from Central Nepal. It was found on mixed deciduous forests, gardens and brick walls. The altitudes range between the 1300m to 1600m.It was collected from May to September. The type locality of *A. nepalensis* is Gandruk, Siklis 12 miles from Pokhara, at the elevation of 1850 m to 2000m.

2.3 Western Nepal

Nordsieck (1973) described new clausiilids from Nepal were *Hemiphaedusa m. martensiana* from Dhorpatan, Thakkhola, Lethe, Gorapani at the elevation at 2500-2900m. He also reported *Hemiphedusa. m. dhaulagirica* from Jaljala, Mayangi Khola near Muri at an elevation of 2300-2800m.

Schileyko and Kuznetsov (1998) reported *Landouria huttoni* from Bhurungdi-khola valley of Birethanti village, Tirkhedung a village, Kaski, ANP, Myagdi ,Dana-Tatopani track, Talbagar Village of Western Nepal. It was found on steep rocky slope, under bushes and stones of the elevation of 1100m-1800m. They also described

Landouria dhaulagarica and *Landouria rhododendronis.* The former species was known from Pholong-Dara ridge, right side of Kali-Gandaki Valley, Khabong Village, "Khabong-Tukuche" Track, Kalopani village on dry rocks, among dead leaves, under stones of the elevation of 2550-2650m. The *L. rhododendronis* was descibed from Ghorepani village along crest of Poon-Hill ridge of ANP in dense bushes of Rhododendron forests, under the stones at the elevation of 2950-3194m.

Schileyko and Kuznetsov (1998) reported *Bradybaena radicicola* from the Koketani village and Lete Khola valley of Kali-Gandaki valley. It was found in the rhododendron forest, among dead leaves at the elevation of 2630-2700m from the sea level. In addition another new species which was described new species of the family Bradybaenidae was *B.? thakkholenis* from Lamjung Village, Yamkim-khola Valley at Kali-Gandaki Valley. It was found in Pine forest under stores, among the dead leaves at the elevation of 2590-2650m.

Kuznetsov and Schileyko (1997) described a new species of Eneidae *Pupinidius tukuchensis* from Tukuche village, Kali-Gandaki valley . It was found on the dry rocks among *Astragalus* roots at the elevation of 2580-2700m. Other species form the same habitat of *P. tukuchensis*, were *Gastrocopta huttoniana, Pupilla eurina, P. triplicata, Trunacatelina* sp., *Vallonia ladacensis, Vallonia* sp., *Pyramidula humilis, Laevozebrinus nepalensis nepalensis, Euconulus fulvus, Marcochlamys sequex, M. sequis, Hawaiia* sp., and *Landouria* sp.

Kuznetsov and Schileyko (1997) described a new genus *Nepaliena* from Central Nepal. *Nepaliena ceratina* was described from SukeBazar village, Dana, Do-Khola village of Kali-Gandaki valley. It was found in cracks of mossy rocks under stones of old wall at the elevation of 1430-1180m. Other species reported from the same locations were *Cyclophorus pyrotrema, L. n. myagdiensis, Allopeas mauritianus prestoni, Macrochlamys longicauda, M. subjecta, Bensonies convexus, Cryptaustenia ovata, C. cf. globosa, Landouria huttoni, Endothrella ex. gr. affinis* on mossy shadowed rocks and under the stones at the elevation of 1430-1500m.

Kuznetsov and Schileyko (1997) reported *Laevozebrinus nepalensis nepalnesis* reported by from Pholong-Dara Ridge, Tukuche village, Marpha village, Yamkim-Khola valley, Chhairogaon village, Jomsom, Dhumpha village at Kali -Gandaki

valley. It was found on dry rocks among the grass roots on dry slope at the elevation of 2600-2900m. But another subspecies (*Laeozebrinus nepalensis myagdiensis)* was reported from in lower elevation in Tatopani-Dana" track at the elevation of 1500-1550m. Authors also described another new species *Laevozebrinus mustangensis* from Ghasa village, Lharkyo village, Yamkim-Khola valley of Kali-Gandaki valley, under stones of old wall at the elevation of 1950-2750m. Other species reported along with *L. mustangensis* were *Sinoennea* sp. *Macrochlamys lata(?), M. longicauda, M. subjecta, M.* sp., *Bensonies convexus, Oxytesta blanfordi, O. orobia, Euaustenia monticola, Syama p. prona, Kaliella barrakporensis, K. nana, Bradybaena r. radicicola* and *Landoria* sp. found under stones of old walls.

Himalodiscus echinatus reported by Shileyko and Kuznetsov (1998) from Lete-khola valley of Lete village, mustang District. It was found on Rhododendron forest among dead leaves at the altitude of 2650-2700m. Along with *H. echinatus* also reported *Hemiphaedusa m. martensiana, Macrochlyamys nuda, oxytesta blanfordi, Syama p. prona, Bradybaena radicicola* etc in the dense bamboo thicket, in wet leaf mould at 2650-2700m.

Kuznetsov and Schileyko (1999) described new species of Enidae namely *Pupinidius siniayevi* from Annapurna Conservation Area. The species was reported from Marpaha village, Syang village, Jomson, Samle village, Langpoghyun-Khola valley, Jomsom - Kagbeni track on dry rocks, under stones and grass roots at the elevation of 2750-3400m from the sea level. Similarly authors also described another new species *Pupinidus himalayanus* from Tukuche village to Marpha village, Chokhapani-Khola of Kali-Gandaki valley on the steep rocks covered with lichens of junipers forests at the altitude of 2600m

Gerber and Bossneck (2009) reported five species of Vallonidae including four new descriptions. Only one species was reported from Western Nepal. *Vallonia ladacencis* reported to be distributed in the highland westward from Mustang to Darchula. This species was found on Alpine Meadows, open field, Talus slopes, glacial Moraines, occasionally in open, rocky habitats, at elevation of 2800-4900m.

Witkor (2001) described the first new slug species from Nepal. The type locality of this new terrestrial slug *Anadenus nepalensis* was Ghandruk, Annapurna Conservation

Area. This species was also reported from different locations namely Goisakund, Churta, Balangchour. Maharigaon, Gothichaur. It was found on deciduous forest on granite rocks at the elevation of 1850-3700m.

Bossneck (2006) reported *Tricolimax cf. oli* from Chameliya Khola, Darchula at the elevation of 2050-2600m.

Wiktor and Bössneck (2004) described new slug species (*Limax seticus)* which is probably the only slug reported at an elevation about 5000m. It was moraine of a glacier at the base of rocks with very poor vegetation and high humidity.

2.4 Endemic Land Molluscs of Nepal

Although there are many unexplored area in Nepal the sporadic description prove that Nepal is rich in endemic terrestrial malacofauna. Endemic terrestrial snails to Nepal are *Bensonies nepalensis, Vallonia costohimala, V. kathrinae, Laevozcbrinus nepalensis, Himalodiscus aculeatus, Hemiphedusa kathmandica, Hemiphedusa ioes jiriensis, Landouria dhaulagarica, Landouria rhododendronis, Bradybaena thakkholenis, Pupinidius tukuchensis, Laevozebrinus nepalensis nepalensis, Nepaliena ceratina, Laevozebrinus mustangensis, Hemiphaedusa m. martensiana, Himalodiscus echinatus, Pupinidus siniayevi* and *Pupinidus himalayanus.* Similarly endemic slugs are *Limax seticus* and *Anadenus nepalensis*

3. MATERIALS AND METHODS

3.1 Description of the Study Area

The Champadevi hills situated in Kathmandu district of Bagmati Zone, which is located at 7 km southwest of Kathmandu city. It lies within 85˚14'E longitudes and 27˚39'N latitudes of Kirtipur Municipality (KM). It is situated in between Machegaun and Chalnakhel Village Development Committee (VDC) in north and south respectively and Ward no. 15,12,16,19 of KM and Sheshnarayan VDC is situated to its East and West. Its altitude varies from 1330m from the base of the hills to 2260m on its Summit.

The vegetation of Champadevi hill forest is mixed type. The dominant species are large and medium sized trees of *Pinus roxburghii, Myrica esculentat, Castanopsis indica, Schima wallichi* and among shrubs are *Eupatorium adenophrum, Rubus ellipticus* and *Duranta indica.* Similarly among grasses *Centela asiatica, Cynodon dactylon, Trifolium* sp., *Oxalis* sp. and *Imperatus* cylindrical were common.

The study was carries out in three community forest Champadevi, Baghbhairav and Bosan Community Forest. Champadevi CF is located on the Ward no. 8 of Kirtipur Municipality with the area of 120 hactre land. It is bordered with Baghbhairav CF in the East, Chunpairo CF and Panighat Khola in the west, Pusphalal Foundation Armed Force camp as well as school in the north side boundary line up to Bhasmasur on the south.

Baghbhairav CF is bordered wtih Bosan CF in the East, Rawtay Kholsa in the west, Baghbhairav temple along with Dudhpokhari village in the South and boundary line upto the Champadevi hills on the North.

Bosan CF is located on the Ward no. 1,2,3,4 of Chalnakhel VDC with the area of 55.91 hactre land. It is bordered with Bosan village in the East, Dollu CF in the West, Kumaridevi CF in the North and Baghbhairav CF in the south.

3.2 Climate of the Study Area

The climate of Champadevi hills is characterized by typical climate with rainy summer and dry winter. Dry temperature in summer reported to be raised beyond 30°c and falls below 20°c at night, and during winter from Dec-Feb, it ranges from 18°c to below 0°c. Pre-monsoon during march to may is mostly dry and warm. This period mostly characterized by hazy atmosphere with dust and winds. Later part of seasons brings down some precipitation with thunderstorm and is frequently associated with hailstorm over 80% of the total rainfall is encountered during monsoon period starting from early June and ending by late September. Few spells of rain are bowers, brought down during winter from January to February.

3.3 Vegetation of Study Area

The vegetation of Champadevi CF is Mixed type. The Natural Forest is around 120 hectare along with planted pine and alders forest spreading in 15 hectare land. The dominant species are large and medium sized trees of *Pinus roxburgii, Myrica, Schima-wallachi, Castanopsis* sp., *Rhododendron* spp., *Lyonia ovalifolia, Quercus* sp. Besides planted pine and alder forest which is confined to the base of Champadevi hills. The natural forest can be categorized as Schima-castanopsis forest just above planted one, Lyonia- Rhododendron-Lauraceous forest in middle Portion and Quercus forest on upper belt as well as top of the hill. With my best visual estimation, forest has dense canopy with high sapling density of tree species and seems to be a regenerating forest. Some NTFPs encountered flora of Champadevi during Field visits includes; *Swertia* spp, *Begonia* spp, *Rubus* spp, *Myria* spp, *Berberis* sp., *Rubia manjith, Astibe rivularis, Zanthoxylum armature, Diascorea* spp, many orchids,

Lichens etc and among grass *Centela, Cynodon dactylon*, *Trifolium* sp., *Oxalis* sp., *Imparatus cylindrica* were found common (Subedi, 1981).

3.4 Data Collection

The primary data were collected by visiting the study sites from Jan 2009 to Dec 2010. The secondary data were collected from internets, books, journals, articles, dissertation, thesis and other related reports of government, INGOs and NGOs.

3.4.1 Field Sampling

Sampling for terrestrial mollusc will be undertaken by a combination of direct search and litter sieving methods. Potential microhabitats such as leaf litter, base of the tree, tree trunk, foliage, fallen logs and stones, mosses etc will be carefully searched at different time interval thoroughly in the semi-natural habitats. The forest area will sampled at different altitude in 10×10m plot replicates modified from Tattarsfield (1996). Two subplots of 1×1m within each 10×10m plot will be taken to look microsnails. Smaller subplots will be examined thoroughly for 15 minutes/plot and leaf litter including surface soil will be collected in the polythene bag. The leaf litter including the soil will be spread over the paper sheet to air dry and passed through a course (4mm mesh size) to medium (0.5mm mesh size) sieve after drying up in the sun light/shed. Large species retained in the sieve will be removed and fine sieve fractions will be sorted under good illumination, until no further molluscs could be found. Sieved soil will be brought to the laboratory for pH. Sampling plot will be searched for an hour/person ensuring that all potential microhabitats, such as dead wood, rocks, tree trunks and leaf litters will be examined. Beating of the above ground vegetation in an inverted umbrella will be done to sample unseen mollusks above the ground in each plot. Physical plot characteristics will be recorded including topography, inclination, aspect, and vegetation & forest type including altitude.

3.4.2 Sorting Samples

All the collected samples will be separated in the shells and live animals and kept separately either in plastic vial or zip locked plastic bag with label of the representing microhabitats, location and date. Live animals will be kept in 70 percent alcohol

which will be replaced one to two times within a week depending upon the number of live specimens and brought to the Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal for the detail anatomical investigation.

3.4.3 Laboratory Work

Shell and animal morphology will be studied. Shape and size of the shell, presence/absence of varied shape sculpture on the shell surface, structure of the embryonic whorls, shape of lip and umbilicus will be carefully studied. Likewise colour of the body, presence/absence of mantle lobes and mucous pore, structure of the foot, will be noted at the laboratory. Animal will be dissected for the reproductive organs and sketched for species level confirmation.

3.4.4 Data Analysis

Species list will be determined for each sample plot and study site. Data will be analysed in descriptive way for the taxonomic work. But the relationships between mollusk diversity against altitude and soil pH was measured by using correlation. Species diversity will be calculated using Shannon winner's diversity index.

4. RESULTS

4.1. Land Snails Collected from Champadevi Hill Forest

A total of 628 specimens representing ten families, 16 genera and 26 species were reported from Champadevi hill forests. Figures of some species are provided in plate 1 and Plate 2. Details are given as follows;

Class Gastropoda

Sub-class- Prosobranchia

Order- Caenogastropoda

Family- Cyclophoridae

Genus *Theobaldius* G. Nevill, 1878

1. *Theobaldius phaenotopicus* (Benson, 1851)

Baghbhairab Community Forest 25 ix 2009 (2)

Champadevi Community Forest 6 xii 2009 (1), 30 xii 2009 (2)

Bosan Community Forest 21 xii 2009 (4), 02 i 2010 (2)

Total number of specimens: 11

Genus *Alycaeus* Gray, 1850

2. *Alycaeus* cf *gemma* Godwin-Austen, 1914

Baghbhairab Community Forest 07 xi 2009 (1), 21 xi 2009 (1)

Total number of specimens: 2

3. *Alycaeus plectochilus* Benson, 1859

Bosan Community Forest 22 xii 2009 (4), 02 i 2010 (2), 11 i 2010 (2)

Total number of specimens: 8

4. *Alycaeus digitatus* Blanford, 1871

Baghbhairab Community Forest 01 xii 2009 (1)

Champadevi Community Forest 6 xii 2009 (8), 12 xii 2009 (2)

Total number of specimens: 11

Family: Dilpommatinidae

Genus *Diplommatina* Benson, 1849

5. *Diplommatina folliculus* Benson, 1849

Champadevi Community Forest 6 xii 2009 (8), 12 xii 2009 (10)

Total number of specimens: 18

6. Diplommatina oviformis Fulton, 1901

Bosan Community Forest 02 i 2010 (17)

Total number of specimens: 17

Subclass Pulmonata

Order Stylommatophora

Family: Glessulidae

Genus: *Rishetia* Godwin-Austen, 1920

7. *Rishetia longispira* Godwin-Austen, 1920

Baghbhairab Community Forest 21 xii 2009 (5)

Bosan Community Forest 21 xii 2009 (10), 02 i 2010 (1), 11 i 2010 (3)

Total number of specimens: 19

8. *Rishetia* sp.

Baghbhairab Community Forest 07 xi 2009 (1), 21 xi 2009 (1)

Bosan Community Forest 11 i 2010 (11)

Total number of specimens: 13

Family: Streptaxidae

Genus: *Sinoennaea* Kobelt, 1904

9. *Sinoennaea* sp.

Champadevi Community Forest 6 xii 2009 (1)

Total number of specimens: 1

Family: Plectopylidae

Genus *Plectopylis* Benson, 1899

10. *Plectopylis minor* (Godwin-Austen, 1979)

Baghbhairab Community Forest 07 xi 2009 (13), 21 xi 2009 (1)

Bosan Community Forest 21 xii 2009 (11), 11 i 2010 (70)

Total number of specimens: 95

Family Euconulidae

Genus Euconulus

11. *Euconulus* sp.

Champadevi Community Forest 6 xii 2009 (4)

Bosan Community Forest 11 i 2010 (1)

Total number of specimens: 5

Family: Helicarionidae

Genus: *Cryptaustenia* Kockerell, 1898

12. *Cryptaustenia* sp.

Baghbhairab Community Forest 07 xi 2009 (1)

Bosan Community Forest 02i 2010 (2), 11 i 2010 (8)

Total number of specimens: 11

Genus: *Kaliella* Blanford, 1883

13. *Kaliella fastigiata* (Hutton, 1838)

Bosan Community Forest 02 i 2010 (1)

Total number of specimen: 1

14. *Kaliella nana* (Hutton, 1838)

Bosan Community Forest 02 i 2010 (2)

Total number of specimen: 2

15. *Kaliella* sp.

Baghbhairab Community Forest 07 xi 2009 (1), 21 xi 2009 (2)

Total number of specimens: 11

Family Ariophantidae

Genus: *Macrochlamys* Benson, 1832

16. *Macrochlamys subjecta* (Benson, 1852)

Baghbhairab Community Forest 07 xi 2009 (8), 21 xi 2009 (22), 25 xi 2009 (10), 01 ii 2009 (25)

Champadevi Community Forest 6 xii 2009 (14), 12 xii 2009 (7)

Bosan Community Forest 21 xii 2009 (6), 02 i 2010 (103), 11 i 2010 (3)

Total number of specimens: 104

17.*Macrochlamys longicauda* Godwin Austen, 1883

Baghbhairab Community Forest 25 xi 2009 (1)

Champadevi Community Forest 6 xii 2009 (6)

Bosan Community Forest 21 xii 2009 (1), 11 i 2010 (1)

Total number of specimens: 9

18. *Macrochlamys* sp A

Baghbhairab Community Forest 25 xi 2009 (1)

Champadevi Community Forest 6 xii 2009 (1), 12 xii 2009 (1)

Bosan Community Forest 11 i 2010 (1)

Total number of specimens: 4

19. *Macrochlamys* sp B

Baghbhairab Community Forest 25 xi 2009 (1)

Champadevi Community Forest 6 xii 2009 (10)

Bosan Community Forest 02 i 2010 (12), 11 i 2010 (1)

Total number of specimens: 24

Genus *Bensonies* H.B. Baker, 1938

20. *Bensonies nepalensis* (Nevill, 1878)

Baghbhairab Community Forest 07 xi 2009 (24)

Bosan Community Forest 11 i 2010 (103)

Total number of specimens: 127

21. *Bensonies* sp. A

Baghbhairab Community Forest 25 xi 2009 (18), 01 ii 2009 (3)

Champadevi Community Forest 6 xii 2009 (20), 12 xii 2009 (10)

Bosan Community Forest 21 xii 2009 (10), 02 i 2010 (29), 11 i 2010 (7)

Total number of specimens: 97

22. *Bensonies* sp. B (costulated)

Baghbhairab Community Forest 07 xi 2009 (8), 21 xi 2009 (22), 25 xi 2009 (10), 01 ii 2009 (25)

Champadevi Community Forest 6 xii 2009 (5), 12 xii 2009 (1)

Bosan Community Forest 11 i 2010 (6)

Total number of specimens: 12

Genus *Taphrospira* Blanford, 1905

23. *Taphrospira* cf *convallata* (Benson, 1856)

Champadevi Community Forest 6 xii 2009 (4), 12 xii 2009 (1)

Total number of specimens: 5

Family Camaenidae

Genus *Landouria* Godwin-Austen 1918

24. *Landouria savadiensis* (Nevill, 1877)

Baghbhairab Community Forest 25 xi 2009 (4), 01 ii 2009 (4)

Champadevi Community Forest 6 xii 2009 (2), 12 xii 2009 (2)

Bosan Community Forest 02 xii 2009 (1),11 i 2010 (6)

Total number of specimens: 19

Genus *Ganesella* Blanford, 1863

25. *Ganesella* sp.

Champadevi Community Forest 6 xii 2009 (1)

Total number of specimens: 1

Family Bradybaenidae

26. *Bradybaena radicicola* (Benson, 1848)

Champadevi Community Forest 6 xii 2009 (9)

Total number of specimens: 9

4.2. Diversity of Land Snails in Champadevi hill forests

Altogether 26 species were reported from Champadevi hill forests belonging to ten families. Family Ariophantidae was the dominant group among all reported families containing 8 species following Cycloporidae (4), Helicarionidae (4), Diplommatinidae (2), Glessulidae (2), Camaenidae (2), Streptaxidae(1), Plectopylidae(1), Euconulidae(1) and Bradybaenidae(1) (Fig. 1).

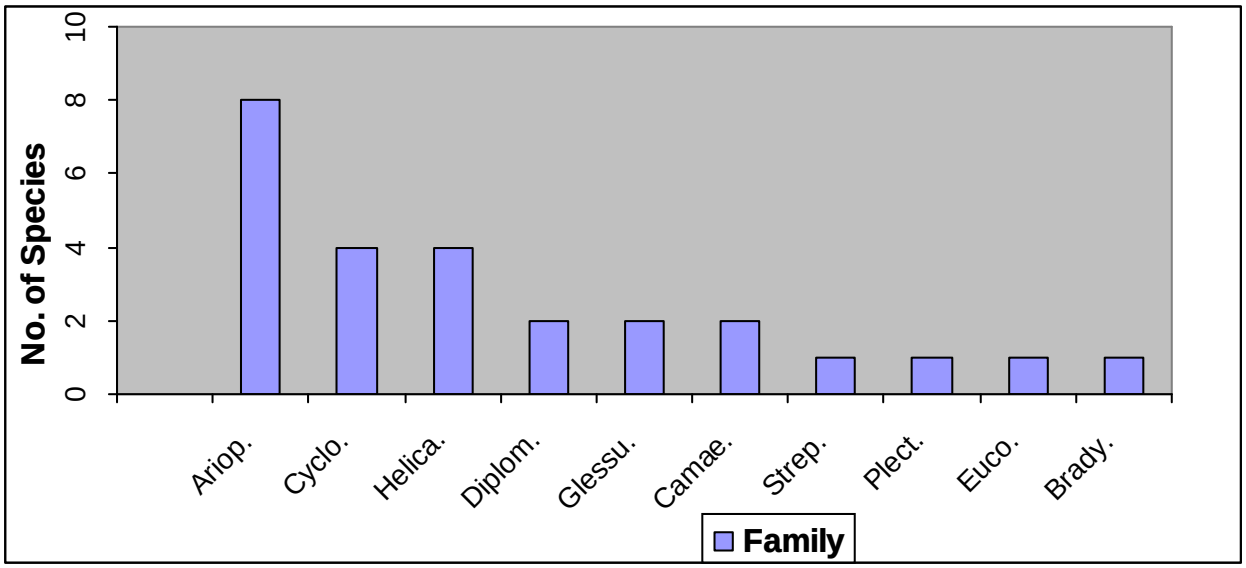

Figure 1. Diversity of land snails in Champadevi hill forests

To determine the relative abundance of individual species, the diversity index method was applied. Diversity index were based upon the relationship between the total number of individuals or species. A measured of species diversity based upon the relationship between total number of species and individual species within a family.

Table 2. Shannon Wiener's Species Diversity of Different Families

S.No	Family	H'= $\sum(pi).Ln(pi)$	$H_{\max} = \log K'$	$e = H' / H_{\max}$
1.	Ariophantidae	2.124	8.426	0.252
2.	Bradybaenidae	0	3.139	0
3.	Cyclophoridae	1.816	4.954	0.366
4.	Diplommatinidae	0.999	5.129	0.194
5.	Plectopylidae	0	4.247	0
6.	Camaenidae	0	4.169	0
7.	Glessulidae	0.974	5.00	0.194
8.	Streptaxidae	0	0	0
9.	Euconulidae	0	2.321928	0
10.	Helicarionidae	1.451	4.087	0.355

The eleven families in the Champadevi hills showed not much considerable difference in the diversity of land snails. Above Shannon's diversity index shows that family Ariophantidae was comparatively diverse in comparison with other families indicated Plectopylidae Camaenidae, Streptaxidae and Euconulidae each family with single species. Hence showed least diversity of land snail (H'=0). With evenness also zero. Evenness index is relatively highest of Cyclophoridae (e=0.366) and lowest with zero (Table2).

4.2.1 Diversity of land snails in Different Community Forests

Altogether 26 species belonging to 16 genera and 10 families have been reported from three community forests located in Champadevi hill (Table 3). Bosan community

forest occupy the highest number of species than Champadevi and Baghbhairab Community Forest (See Figure 2). Out of total reported species about one third species were common to all three community forests. Baghbhairab, Champadevi and Bosan each community forest has two, four and five species respectively restricted only in the single CF (Table 3).

Table 3. Land Snails in Community Forests in Champadevi Hill

Snails	Baghbhairav CF	Champadevi CF	Bosan CF	Remarks
Gastropoda/Prosobranchia/ Caenogastropoda/ Family CYCLOPHORIDAE				
Theobaldius phenotopicus	+	+	+	
Alycaeus cf gemma	+	-	-	
Alycaeus digitatus	+	+	-	
Alycaeus plectochilus	-	-	+	
Gastropoda/Prosobranchia/ Caenogastropoda/Family DIPLOMATINIDAE				
Diplommatina folliculus	-	+	-	
Diplommatina oviformis	-	-	+	
Gastropoda/Pulmonata/Stylommatophora/ Family GLESSULIDAE				
Rishetia longispira	+	+	+	
Rishtia sp.	+	-	+	
Gastropoda/Pulmonata/Stylommatophora/ Family STREPTAXIDAE				
Sinoennea sp	-	+	-	
Gastropoda/Pulmonata/Stylommatophora/ Family PLECTOPYLIDAE				
Plectopylis minor	-	-	+	
Gastropoda/Pulmonata/Stylommatophora/ Family EUCONULIDAE				
Euconulus sp	-	+	+	
Gastropoda/Pulmonata/Stylommatophora/ Family HELICARIONIDAE				
Cryptaustenia sp	+	-	+	
Kaliella fastigiata	-	-	+	
Kaliella nana	-	-	+	
Kaliella sp	+	-	-	
Gastropoda/Pulmonata/Stylommatophora/ Family ARIOPHANTIDAE				
Macrochlamys subjecta	+	+	+	
Macrochlamys longicauda	+	+	+	
Macrochlamys sp A	+	+	+	
Macrochlamys sp B	+	+	+	
Bensonies nepalensis	+	-	+	
Bensonies sp B	-	+	-	

Snails	Baghbhairav CF	Champadevi CF	Bosan CF	Remarks
Bensonies sp A	+	+	+	
Taphrospira cf convallata	-	+	-	
Gastropoda/Pulmonata/Stylommatophora/ Family CAMAENIDAE				
Landouria savadiensis	+	+	+	
Ganesella sp	-	+	-	
Gastropoda/Pulmonata/Stylommatophora/ Family BRADYBAENIDAE				
Bradybaena radicicola	-	+	-	
Total	15	16	17	

Note: plus (+) and minus (-) sign indicates the presence and absence

A total of 628 specimens from three community forests were collected. The average number of specimens per plot was highest (14) in Bosan Community Forest following Baghbhairab CF (7) and Champadevi CF (6). The number of species reported from Bosan CF was also highest number (17) following Champadevi (16) and Baghbhairab CF (15) (Fig. 2, Appendix, 1, 2 and 3).

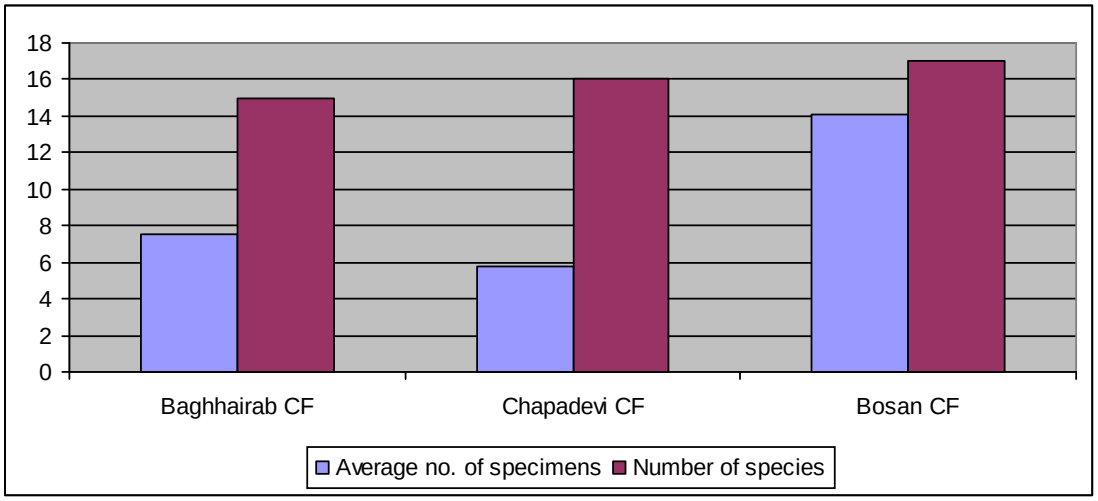

Figure. 2 Average number of specimens and species per plot in CFs

4.2.2 Altitudinal Distribution of Land Snails in Champadevi Hill Forest

Land snails were collected from 1400m to above 2200m asl. Reported land snail species shows that *Bensonies* sp. A and *Macrochlamys subjecta* were distributed throughout the altitudinal range from 1400m to 2200m. Many species were range restricted which were only confined to limited altitudinal range. *Cryptaustenia ovata*

was found only at 1400m elevation range while *Sinoennea stenopylis* and *Ganessela* sp. were reported above 2200m elevation (See table 4).

Table 4. Altitudinal Distribution of Land Snails in Champadevi Hill Forest

Species	Elevation in m asl								
	1400	1500	1600	1700	1800	1900	2000	2100	2200 +
Cryptaustenia ovata									
Alycaeus cf *gemma*									
Bensonies nepalensis									
Rishetia sp.									
Rishetia longispira									
Plectopylis minor									
Kaliella sp. *'A'*									
Kaliella fastigata									
Euconulus sp.									
Macrochlamys longicauda									
Bensonies sp. *A*									
Macrochlamys subjecta									
Landouria savadiensis									
Theobaldius phenotopicus									
Alycaeus digitatus									
Macrochlamys sp *B.*									
Taphrospira cf convallata									
Diplommatina folliculus									
Alycaeus pletochilus									
Diplommatina oviformis									
Bensonies sp. *B*									
Kaliella nana									
Macrochalmys sp. *A*									
Bradybaena radicicola									
Ganesella sp.									
Sinoennea stenopylis									

The distribution range of *Theobaldius phenotopicus* was from 1600-2000m. But *Alycaeus digitatus* and *Macrochlamys* sp.B were reported about 1700m only, while *Rishetia longispira* and *Plectopylis minor* were not found above 1700m.

4.2.3. Land snail fauna with different slope and soil pH value

pH value of each plot was measured in the lab and analyzed whether land snail faunal assemblage was correlated with slope and pH value. Land snail species were calculated within different pH value. Land snail diversity was reported highest in neutral or alkaline soil than the acidic one. Out of 26 land snail species reported 9 species were found within pH value 4-5. The species number increased to 10 in pH value 5-6, 19 in 6-7 and 20 in 7 & above ph value (Table 5).

Table 5. Land snails recorded in different soil pH value

	Slope	**pH value**		
Species	**4 to 5**	**5 to 6**	**6 to 7**	**7 & above**
Kaliella nana	+	+	-	-
Macrochlamys subjecta	+	+	+	+
Macrochlamys sp. B	+	+	+	+
Bensonies sp. A	+	+	+	+
Theobaldius phenotopicus	+	+	+	+
Plectopylis minor	+	+	+	+
Alycaeus plectochilus	+	+	+	-
Diplommatina oviformis	+	+	+	-
Cryptaustenia ovata	+	-	+	+
Kaliella fastigiata	-	+	-	-
Landouria savadiensis	-	+	+	+
Rishetia longispira	-	+	+	+
Rishetia sp.	-	+	-	+
Euconulus sp.	-	+	+	+
Macrochlamys longicauda	-	-	+	+
Macrochlamys sp.A	-	-	+	+
Alycaeus digitatus	-	-	+	+
Bensonies nepalensis	-	-	+	+
Bensonies sp. B	-	-	+	+
Diplommatina folliculus	-	-	+	+
Sinoennea sp.	-	-	+	-
Ganesella sp.	-	-	+	-
Taphrospira cf *convalata*	-	-	-	+
Bradybaena sp.	-	-	-	+
Alycaeus cf *gemma*	-	-	-	+
Kaliella sp. A	-	-	-	+
Total	9	13	19	20

Slopes of each plot were also noted from each sampling plot size. The land snail faunal diversity with slope was negatively correlated (r = -0.302) with slopes while with pH shows positive correlation with the diversity of snail.

Table 6. Correlation between Land Snail with slope and pH

Invertebrates	**Correlation Co-efficient (r) value**	
	Slope	**Soil pH**
Land-snails	-0.302	0.122

5. DISCUSSION

The diverse range of habitats in mountain ranges contributes to the high molluscan diversity. Land snail species reported around Kathmandu valley is not less than 16 species including terrestrial slugs (Schileyko and Frank 1994, Kuznetsov 1996, Scheilyko and Kuznetsov 1997 and Wiktor 201). The present study identified 26 species of land snail species in Champadevi hill forest alone in about 275 ha. of three community forests. The taxonomy of Nepalese snail species is little known because well known 19th century malacologists working in South Asian countries like, William Benson, Thomas Hutton, Godwin-Austen, Blanford, Sykes worked in the eastern and western Himalaya within Indian part only. They never visited Nepal territory. Hence Nepal's terrestrial malacofauna are very interesting for research Nordsieck 1973 reported three new species of Clausiliidae. Only then few foreign scientists published papers on land snail fauna of Nepal. Although reproductive anatomy is considered good solution for the species level confirmation, only morpho-species on the basis of shell characters were used in this study.

The land snail diversity and distribution was compared with three community forests in Champadevi hill. Bosan community forest comprised comparatively high number of land snails comprising 65.4 percent of the total species known from all community forests. The results compared with the management practices and condition of the forests. Although all three community forest were registered and handed over to the community in the same year 1993-94 (2051 BS), and the condition of Bosan community forest is comparatively better in having good crown cover and less disturbed than rest of the two community forests Baghbhairav and Champadevi Community forests.

There has not any past survey on land snails carried out in Champadevi hill, hence the present land snail fauna cannot be compared with the past report of the hill. But some publications on other hills of the Kathmandu valley were published from Phulchowki hill (Schileyko and Kuznetsov 1998, Kuznetsov, 1996) that can be compared with. The new genus *Himalodiscus* was described from Phulchowki hill which was not recorded from Champadevil hill forests. Only few species found to be common that indicates that terrestrial mollusc fauna are highly localized. The abundance of species

(Number of specimens) does not follow the same pattern of diversity. *Bensonies nepalensis* was the most abundant species (103 specimens) in Bosan CF, while *Macrochlamys subjecta* is abundant in Baghbhairab CF with 65 specimens. Similarly *Bensonies* sp.B was dominant in Champadevi CF with the highest number of collected specimens (32). Species density ranges from 2 to 111 per $100m^2$ plot. This number is comparable with 1-29 per $25m^2$ (Abury *et al*. 2005) in South eastern France. But the number is comparatively low with 19-167 per $400m^2$ per plot in Tanzanian forest (Tattersfield *et al.* 2006).

Sinoennea stenopylis, Ganesella sp. *Kaliella fastigiata* and *Euconulus* sp. were reported rare with single specimen of each species. Former two species were reported only above 2000m. Species diversity was comparatively low in lower and higher elevation of studied elevation altitudinal range from 1400-2200m. A sing species *Cryptaustenia ovata* was found in 1400m asl and only two species *Sinoennea stenopylis, Ganesella* sp. above 2200m. Tattersfield *et al.* (2001) demonstrated that mollusc faunas change gradually over the range 1782–2851 m and that faunal variation was more strongly related to rainfall than elevation per se; mollusc diversity declined with elevation over this range. In contrast, in north-east Tanzania, within a series of isolated forests between <100 and 1000 m, Emberton *et al.* (1997) reported the highest mollusc richness at the highest and lowest sites, although the pattern was probably strongly influenced by local factors, especially the presence of limestone at the lowest elevation.

Land snail species were calculated against the different pH value and positively correlated. Species diversity gradually increased with the increasing pH 4-5 (34.6%), pH 5-6(38.5%), pH 6-7 (73.1%) and pH 7^{+}(76.9%). According to Raheem *et. al.* (2008) the correlation of soil pH and species composition was weak.

6. CONCLUSION

A total of 628 specimens representing ten families, 16 genera and 26 species were reported from Champadevi hill forests within an altitudinal range of 1400 to 2200m above sea level. Family Ariophantidae was the dominant group among all reported families containing 8 species *Macrochlamys subjecta, M. longicauda, M.* sp.A, *M.* sp.B, *Bensonies nepalensis, B.* sp.A, *B.* sp.B, and *Taphrospira cf. convallata.* Other families Cycloporidae and Helicarionidae each one has four species while family Diplommatinidae, Glessulidae and Camaenidae each family included two species. Families with a single species are Streptaxidae, Plectopylidae, Euconulidae and Bradybaenidae.

Bosan community forest occupied the highest number of species (17) than Champadevi (16) and Baghbhairab (15) Community Forest. The average number of specimens per plot was also highest (14) in Bosan Community Forest following Baghbhairab CF (7) and Champadevi CF (6). Reported land snail species shows that *Bensonies* sp. A and *Macrochlamys subjecta* were distributed throughout the altitudinal range from 1400m to 2200m. Many species were range restricted which were only confined to limited altitudinal range. *Cryptaustenia ovata* was found only at 1400m elevation range while *Sinoennea stenopylis* and *Ganessela* sp. were reported above 2200m elevation. The distribution range of *Theobaldius phenotopicus* was from 1600-2000m. But *Alycaeus digitatus* and *Macrochlamys* sp.B were reported about 1700m only, while *Rishetia longispira* and *Plectopylis minor* were not found above 1700m.

RECOMMENDATION

- This is the first dissertation on forest land snails of Nepal and further study on this subject in different ecological zones and habitats is highly recommended.

- Land snails are very slow moving animals and have been distributed in a limited area. Most of the species are range restricted. Hence they are very important indicators for the climate change. Further investigations regarding to their distribution range in relation with climate change will be very useful.

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Appendix. 2 Land snails sampled in 10x10m plots in Bosan Community Forest

Family (Plot No)	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**
ARIOPHANTIDAE																	
Macrochlamys subjecta	1	2	0	2	1	0	1	0	0	1	0	6	1	1	0	0	0
Macrochlamys longicauda	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Macrochlamys sp A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Macrochlamys sp B	0	0	0	0	0	0	2	1	5	4	0	0	0	0	0	1	0
Bensonies nepalensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Bensonies sp A	1	0	2	2	3	4	3	2	1	2	6	8	3	1	2	0	0
CYCLOPHORIDAE																	
Theobaldius phenotopicus	1	0	1	1	1	0	0	1	0	0	0	0	1	0	0	0	0
Alycaeus plectochilus	0	1	1	0	0	0	1	0	1	0	0	0	0	0	1	1	0
DIPLOMATINIDAE																	
Diplommatina oviformis	0	0	0	0	0	1	2	5	2	1	5	0	1	0	0	0	0
PLECTOPYLIDAE																	
Plectopylis minor	1	2	2	0	4	0	0	0	0	0	0	0	0	27	3	25	5
CAMAENIDAE																	
Landouria savadiensis	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
GLESSULIDAE																	
Rishetia longispira	1	2	2	3	0	0	0	1	0	0	0	0	0	1	1	1	0
Rishtia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	1
EUCONULIDAE																	
Euconulus sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HELICARIONIDAE																	
Cryptaustenia sp	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	0	1
Kaliella fastigiata	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Kaliella nana	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Total Number of specimens	6	7	8	9	9	7	9	11	10	9	11	14	6	33	13	33	9