Introduction
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“Ants are everywhere, but only occasionally noticed. They run much of the terrestrial world as the premier soil turners, channelers of energy, dominatrices of the insect fauna - yet receive only passing mention in textbooks on ecology. They employ the most complex forms of chemical communication of any animals and their social organization provides an illuminating contrast to that of human beings, but not one biologist in a hundred can describe the life cycle of any species. The neglect of ants in science and natural history is a shortcoming that should be remedied, for they represent the culmination of insect evolution, in the same sense that human beings represent the summit of vertebrate evolution” .. (Holldobler and Wilson, 1990).

Since their origin in Cretaceous period about 135-140 mya, ants have undergone enormous diversification. K/T event towards the end of Mesozoic may have terminated their fossil forms, but primitive ponerines soldiered on. In Paleocene and early Eocene (Paleogene period) diversification of Angiosperms led to the expansion of ants. Phenotype plasticity coupled with fitness of genotype and instinct to survive led to the origin of eusociality in ants.

Ants belong to a single large family Formicidae, largest of order Hymenoptera. It is represented by 26 extant subfamilies with 14,711 valid species and 428 valid genera (Bolton, 2011); out of these 152 species are listed by IUCN. And from India, 12 subfamilies are represented by 87 genera with 652 species (Bharti, 2011). With this enormous diversity; the sheer ecological dominance as compared to other animal groups is attributed to the following facts:

1. Their direct impact on ecosystem can readily be judged from the fact that in a terrestrial ecosystem, their biomass and energy consumption is greater than all the vertebrate fauna combined (Holldobler and Wilson, 1990). According to La salle and Gauld (1993)
“Ants can be seen to dominate ecosystems in a way unequalled by any other organism. In addition to their sheer biomass, a multitude of mutualistic ant-plant associations are known which ensure the survival of many plant species, and ant mosaics are formed in which dominant ant species can not only affect and control the distribution of non-dominant ant species, but also influence both the species composition and abundance of other arthropod taxa.”

2. Trophic interactions are the basic unit of any food chain; those made by certain species of ants are of great importance (Holldobler and Wilson, 1990 and 2009).

3. Keystone species are those, which have disproportionately large influence on the character or structure of an ecosystem. When these are removed or lost or have their activities disrupted, there is a noticeable effect on the system and a cascade one. And, ants feature in all the main categories of keystone species, as:

   a) Predators,
   b) Ant-plant and Ant and other organism mutualisms, these interactions have shaped the evolution of a variety of other organisms to an astonishing degree. Ants participate in symbioses, both facultative and obligate, with more than 465 plant species in over 52 families (Jolivet, 1996), with thousands of arthropod species (Kistner, 1982; Holldobler & Wilson, 1990 and 2009) and with as-yet unknown numbers of fungi and microorganisms (Schultz & McGlynn, 2000; Mueller et al., 2001; Holldobler and Wilson, 2009 and Lach et al., 2010).
   c) Ants as resource species for soil and for vertebrates,
   d) Keystone dominants i.e. ant mosaics.

4. Biological invasions caused by ants is another aspect; an ecologically destructive phenomena affecting continental and Island ecosystems throughout the world. Currently at least 150 ant species are invasive (Holway et al., 2002). The red fire ant Solenopsis invicta is
a well known case and has extended its range from America to Hong Kong.

5. The great adaptability of ants has ensured their survival since Oligocene due to their flexible gene pool.

6. To sum up, ants display remarkable adaptive strategies and specializations; agriculture of fungi, seed harvesting, herding and milking of other invertebrates, communal nest weaving, cooperative hunting in packs, social parasitism and slave-making (Holldobler and Wilson, 2009; Lach et al., 2010).

Having said so, with growing anthropogenic activities into natural ecosystems, biodiversity assessments are carried for conservation purposes. An assessment of biodiversity provides good insight with respect to number of taxa in an area, but where to prioritize, why to prioritize, which taxa to be targeted for reflection of ecosystem health, and which protocols and modules should be followed; is unfortunately lacking in most of the studies.

Historically, measurements of surrogate parameters have been used in measuring ecosystem health. Measurements of species abundance and composition of such indicator groups have been proposed for health of an ecosystem, as indicator taxa detect environmental changes.

To be a successful indicator of ecosystem health, selected taxa should meet four basic criteria (Alonso, 2000):

1. Should be easily sampled and monitored.
2. Should represent fairly diverse groups or groups of biological importance in ecosystem.
3. Should have relationship to the diversity of other taxa.
4. Should respond to environmental change in an ecosystem.

Even so, most groups selected as potential indicators, do not fulfill all the above mentioned criteria. Most of the biodiversity surveys focus on vascular plants and vertebrates (Landres et al., 1988), as these
groups are readily sampled and are fairly easily identified (Wilson et al., 1996). Ecologically many of these groups have been proposed, although not verified to have broad requirements that encapsulate those of other species (Noss, 1990; Launer and Murphy, 1994). Other major factors which contribute for such a swing is our traditional Plant/Vertebrate-centric culture that still persists in most government and conservation management agencies, including those explicitly charged with managing biodiversity (Andersen and Majer, 2004).

The usefulness of indicator taxa basically rests on third and fourth criteria; conservation decisions based on these are more appropriate (Alonso, 2000). Insects are thought to have made good indicators because they respond quickly to environmental stress, have short generation times and are usually easily sampled and identified (Peck et al., 1998).

But among insects, ants have emerged as one of the useful and effective bio-indicators due to following reasons:
1. They are diverse (with more than 14000 species) and are found abundantly in almost every terrestrial habitat in the world.
2. They are hypersensitive to environmental change (many ant species have narrow tolerances).
3. Most species have stationary or perennial nests with fairly restricted foraging ranges (therefore in contrast to other insects which move frequently between habitats in search of food, ants can be more reliably sampled and monitored).
4. They function at many levels in an ecosystem (already discussed).
5. Can be easily sampled as compared to other flying insects.
6. They dominate the biomass of arthropods (Erwin, 1983; Holldobler and Wilson, 1990).
7. Ant species also effectively track environmental gradients (Peck et al., 1998).
The use of ants as bioindicators started in Australia in 1970 and has been successfully used (Majer, 1983). Later on, ants have been widely adopted by Australian mining industry as indicators (Andersen, 1997c). The monitoring protocols have been exported all over the world (Majer, 1992, 1995; Majer and de Kock, 1992; Andersen and Majer, 2004) and are effectively used as indicators. This concept of ants as indicators has grown to such an extent in developed nations that it's a part of their government strategies for ecosystem conservation, restoration and rehabilitation now. Not to mention here that mine workers in Australia now carry lists of ant functional groups to judge the state of ecosystem.

An indicator group is most effective when supported by a predictive understanding of its community dynamics (Andersen, 1999). In case of ants, a global model of ant community dynamics based on functional groups in relation to environmental stress and disturbance have been formalized. Nine functional groups have been designated reflecting level of stress/health of an ecosystem. These broadly include Dominant, Generalised, Opportunists, Subordinate, Hot climate specialists, Cryptic species, Tropical climate specialists, Cold climate specialists and Specialist predators (Andersen, 2000b; Andersen and Majer, 2004). Various subfamilies and genera are assigned under these groups. These functional groups provide an explicitly ecological context for interpreting responses to disturbances and act as good indicators. Furthermore, Andersen and Majer (2004) concluded that ants performed well in terms of effectiveness and cost efficiency as indicators as compared to other groups.

Demonstration of case studies for state and health of an ecosystem is the major requirement of present ongoing scenario. Mountain ecosystems like Himalaya already listed as fragile need attention.
As discussed in detail by Bharti (2008), Himalayan system stretches over 3000 kilometers, from Myanmar to east of Afghanistan (between longitudes 72° and 98° East and latitudes 27° and 36° North) and its width ranges from 80 kilometers to 300 kilometers (Mani, 1962, 1968, 1978 and Wadia, 2001). Himalaya proper is considered a mountain system from east of Brahmaputra to the bend of Indus in the west, but Himalayan system continues from Myanmar to Afghanistan. Keun Lun represents the northern extreme of Himalayan range, followed by the Tibetan plateau. The mountain system meets with high ranges of Central Asia (Hindu Kush, Trans Karakoram, Tian Shan, Kun Lun, Trans Alai) forming Pamir Knot, and to the north-east lies Tibet. Geographical Division of the region includes (Mani 1962, 1968, 1978 and Wadia, 2001):

a) The Eastern or Assam Himalaya: Between Namcha Barva peak (about 7750 meters above mean sea level) east of Brahmaputra and Tista river in the west; a span of 720 kilometers.

b) The Nepalese or Central Himalaya: Between Tista river and Kali in the west; stretch of about 800 kilometers. Mount Everest, Kanchenjunga, Makalu, and Dhaulagiri fall in this range.

c) The Kumaon Himalaya: Between Kali river and Satluj; Naini Tal, Almora and Garhwal with Nanda Devi, Badrinath, Gangotri and Kedarnath fall in this range. This stretch is of about 320 kilometers.

d) The North-West Himalaya: Between west of Satluj and east bend of Indus, just beyond Nanga Parbat, about 560 kilometers long. Karakoram, Ladakh, Zaskar and Lahaul fall in this range.

Himalayan system is not a single mountain chain, but a complex series of converging or parallel and bifurcating ranges, intersected by high longitudinal valleys and high plateaus. The ranges are: Siwalik range, the lesser Himalayan range, great Himalayan range and trans-Himalayan range.
Himalayan ecology is temperature-dependent. The snow line occurs at an average of 6000 meters above mean sea level and timber line at an average of 3000 meters (the highest altitude at which the forest ends). With this sort of environment, the micro-climate plays an important role for insects like ants, and such insects show varied degrees of adaptability to cope, survive and reproduce. The temperature, which is a crucial factor, shows a gradual decrease with increasing altitude. Ants have shown remarkable adaptations as compared to other insects in colonizing such a hostile environment. It is quite significant that the diversification of regional ants and development of Himalaya occurred almost at the same time. As elucidated by Moreau et al. (2006) the diversification of major ant lineages occurred from the beginning of the early Paleocene to the late Cretaceous, 60 to 100 million years ago in the age of angiosperms. Interestingly, it's the same time span during which the formation of Himalaya occurred. The initial mountain building processes were underway about 70 million years ago when North moving Indo-Australian plate collided with Eurasian plate, followed by a second phase of mountain development about 65 million years ago. Current estimates (International Commission on Stratigraphy, 2004) indicate that about 50 million years ago the Greater, Trans and Lesser Himalayan ranges (except the low Siwalik ranges whose origin is estimated to be 25 million years ago) were formed in Eocene, and when India collided with Eurasia, considerable faunal exchange occurred. The upliftment of Himalaya as an isolation barrier led to diversification, speciation and endemism. As per Bharti (2008), Himalayan ranges were likely invaded by different elements after their formation which showed varying degrees of adaptations to cold climates and started exploiting unused resources/niches. It still remains unclear how the speciation events proceeded in this region and what factors were responsible for them. Whether the speciation
patterns and rates which operated in this region and generated such high endemism are the same which we envisage for other groups of animals, is an important question for evolutionary biologists to address in future.

Out of the Himalayan eco-system discussed above, area of Jammu-Kashmir is biogeographically the most complex and diverse. The flora and fauna has passed through various stages during geomorphological evolution of this region. This region has been colonized at different times by Malayan, Afrotropical, Mediterranean, Central Asian and Temperate elements. Rigorous environment has further acted upon this mosaic of geographical forms leading to extinction of species, breaking up of distributional ranges and eventually induction of genetic variations with or without speciation; that is why this region has been targeted for present study.

Elevational gradients in biotic communities were central to some of the most general theories of life. Since their recognition by Linnaeus, elevational gradients continued to serve as a heuristic tool and natural experimental site for generations of scientists; Van Humboldt (1849), Darwin (1839, 1859), Wallace (1876, 1878) and Whittaker (1960) to mention a few. In recent years however, elevational gradients have received much less attention than what are viewed to be ecology’s most general pattern-latitudinal gradients. This seems unfortunate and unproductive as elevational gradients in addition to their distinguished historical position in the development of biogeography, ecology and evolutionary biology are more intricately related to species distribution.

The conceptual framework for present study is based on the fact that elevational gradients in species diversity and abundance result from a combination of ecological and evolutionary processes. Finally, to generate a comprehensive view from the proposed region, the study was planned to meet following objectives:
(1) To study species diversity of ants along an elevational gradient in Jammu-Kashmir Himalaya.

(2) To study species abundance of ants along an elevational gradient in the above stated region.

(3) To generate information regarding status of this ecosystem with respect to functional groups of ants.

(4) To work out endemism and zoogeographical affinities based on data with adjoining regions.

Thus the data generated from study would obviously reflect logistically feasible and ethically acceptable approach regarding large scale patterns of abundance and diversity in this montane system, as ecological experimentation carried on a small scale has a long over-reach. Given the impact of this type of study on biogeography, ecology, conservation and evolutionary biology, it is appalling that no such study has ever been carried from Himalayan region with genuine model indicator/surrogate organisms; which could truly reflect ecosystem health, status and intricacy.