Prediction of an earthquake is difficult and research is done on the basis of some precursors before an earthquake; but result of forecasting is still uncertain. Under such a situation there is a problem of forecasting vis-a-vis a law of the land. It is expected that science and law will intersect more frequently in future[1]. I narrate a similar issue which needs rethinking about existing laws.

I got a call around 5.10 pm (IST) on 12 September 2007 at my office (at CSIR–NGRI) from a reporter of a TV channel that an earthquake of magnitude 8.5 (epicentre location 4.517°S, 101.382°E; IST 16 : 40 : 26) has occurred in the southern Sumatra subduction zone (near Bengkulu). He was curious to know whether this earthquake will produce a tsunami which will reach the east coast of India, like the 26 December 2004 tsunami, which had killed about 250,000 people. More than 10,000 people also lost their lives in India. In this background he was questioning me about the probable time of the tsunami and the possibility of it hitting the Indian coast. I replied based on my pre-calculations that if the earthquake generates a tsunami it will take more than 2 h for it to reach the Indian coast. However, I asked the reporter to give me about 20–25 min to answer the other question, i.e. whether the direction of the tsunami will be towards India or not.

A tsunami modelling group was established at CSIR–NGRI after the great tsunamigenic earthquake of 26 December 2004. Immediately after the 12 September 2007 earthquake, this tsunami modelling group[2] analysed the problem on the basis of earthquake parameters of previous earthquakes in that area and found that this earthquake may produce a tsunami but it had the directivity towards open ocean; thus there was no possibility that the tsunami will hit the Indian coast. After about 25 min, the same reporter telephoned me to know my views on the expected tsunami. I explained to him that this tsunami is not moving towards the Indian coast, rather it is heading towards open ocean. This news was being telecast live by the TV channel to the viewers, particularly to Indian viewers. I was fully aware of its consequences if our forecast was found wrong, but strongly believed in our calculations.

Later using the USGS earthquake source parameters, tsunami propagation was prepared and was found similar to ours. Immediately we published our findings.

If the tsunami had propagated towards the Indian coast instead of open ocean contrary to our forecast being telecasted live on TV, then it could have had dire consequences. On the other hand, our analysis helped thousands of people from being evacuated. As of now, there are no clear laws for such issues. However, there are many circumstances where such lawsuits come into force eventually after the catastrophe, which includes not only the earthquakes but also the establishment of nuclear power plants and the related safety issues with respect to earthquakes and tsunami. On the other hand, if a scientist predicts an impending earthquake with date and time and no such event occurs, it only creates unnecessary panic among people[3]. Government of various countries should frame a suitable law for a nonlinear science. The expectation of people from scientists is high, otherwise it will result in diminishing their public advisory role[4].

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Potential of social network and internet media for biodiversity mapping and conservation

Internet and digital technology has revolutionized the rate and efficiency with which data and knowledge are transmitted and shared among people. In particular, the social media such as Facebook, Google+, Twitter, Flickr, e-mail discussion groups, etc.[1], has shrunk the communication space like never before and has turned out to be powerful agents for obtaining rapid news updates. Their relatively easy access through computers, mobile phones and a host of other gadgets have made these very user friendly so much so they are probably the most frequently used technologies today. No wonder then an army of social networking sites are set afoot that transmit and share information on almost infinite number of issues ranging from archaeology to zoology or from sighting traffic offenders to stars in the night sky. Here, I discuss a specific case of how social network and Internet media can effectively be used in biodiversity mapping and conservation.

Social network and Internet media (SIM) has revolutionized Citizen Science projects, where volunteers are involved in research[2]. Though citizen science has a long history[3], in the last ten years due to increased affordability of digital camera and mobile phones, there has been tremendous increase in the number of citizen science initiatives globally[4], especially in North America and Europe[3,5,6]. The advantage of Citizen Science is its rapid collection of data and cost effectiveness in creating awareness and in enhancing education spatially and temporally.

Inventorying, mapping, monitoring the change in species diversity and composition and phenological process is vital to assess the impacts of anthropogenic activity and global change. However, inventorying and monitoring by trained scientists at large spatial scale is time consuming and is very expensive[7]. The quantum of plant and animal photographs shared on sites like Facebook, Google+, Flickr and other photo-sharing sites has outpaced specimen collection effort[1]. For example, the number of photos uploaded in one of the India's free-photo sharing site, Indianaturewatch.net is nearly 3.57 lakhs (as of 31 January 2013; Figure 1). The amount of data in the form of checklists and tour reports in e-mail discussion groups, Bangalore Birds (bngbirds@yahoogroups.com) and ButterflyIndia (ButterflyIndia@yahoogroups.com) has also out- numbered the publications that deal with these groups (Figure 2). But the information is yet to be harnessed for biodiversity mapping and conservation in India. Affordable digital camera and smart phones with good resolution camera have helped many amateur naturalists, layman, students, etc., in documentation of biodiversity not only in and around the region where they live and work but also when they travel to other parts. In fact thanks to social network, internet media and digital technology there seems to be a 'Rebirth of Natural History' in India and elsewhere in the world.

Several studies have demonstrated the power of social network sites in generating public interest in citizen science project and in mapping, inventorying and monitoring biodiversity and in conservation education. Some examples are: fish taxonomy using Facebook by Smithsonian[8], Flickr BeeID project that has been used to map the bees of UK[7], Project Noah in USA that uses smart phone application to document and map plants and animals[9], Amphibian Bioblitz project by iNaturalist.org for carrying out census of all amphibians of the World[1] and University of Central Florida, Biology Department's programme in 'Using photography and social media to promote biodiversity'[10].

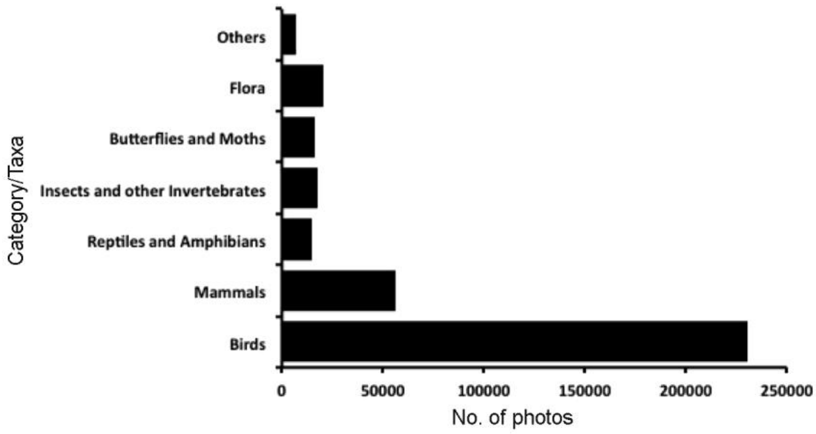

Figure 1. Number of photos posted in Indianaturewatch.net photo sharing website.

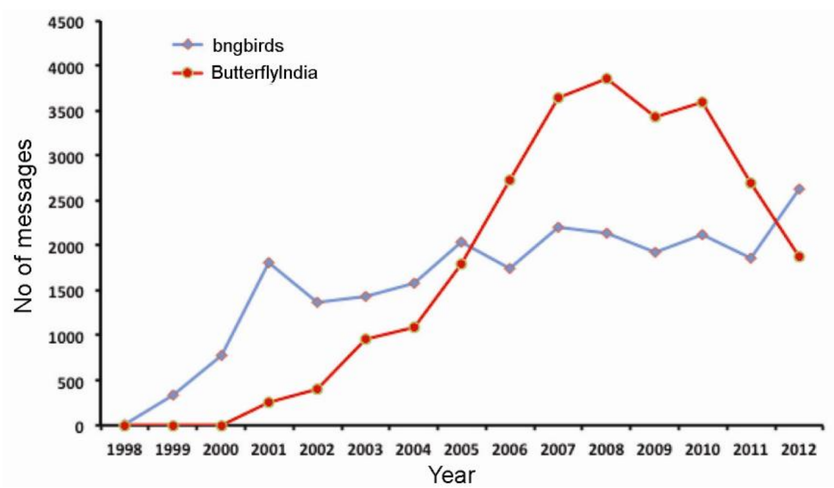

Figure 2. Number of messages posted in ButterflyIndia and bngbirds group ever since its inception (Note: 2012 data was included).

In the recent past, several initiatives have been taken up in India in using SIM to address issues related to biodiversity inventorization and conservation. For example, Migrantwatch (www.migrantwatch.in), Seasonwatch (www.seasonwatch.in), India Biodiversity Information Network (IBIN: www.ibin.co.in), Indiabiodiversity.org and theweternghats.org portals have been initiated to document the country's biodiversity. Considering the enormous biodiversity of the country and the multifarious threats faced by them, there is a good potential to harness the potential of SIM in bio-resource mapping and conservation. At the Ashoka Trust for Research in Ecology and the Environment (ATREE), SIM has been used in mapping bio-resources especially of amphibians, non-marine molluscs and butterflies. Using data from published sources and those from SIM, the geographic distribution patterns of anurans in the Western Ghats were analysed[11]; of the 2750 records, nearly 40% came from SIM. Again using SIM, the invasion pattern of the African Giant Snail (*Achatina fulica*) in India was analysed; in this case too nearly 50% of the data came from SIM sources.

Clearly, using SIM has several advantages in inventorying and mapping biodiversity such as: (a) in obtaining spatial information of taxa in a cost/time effective manner that is otherwise not possible through conventional means; (b) in facilitating Rapid Remote Taxonomic Identification that could help in filling the gap in our knowledge on both 'Linnean' and 'Wallacean Shortfall' and conservation education and awareness; (c) in rare or episodical animal sightings such as that of the Lesser Florican; the bird was reported from Bangalore after more than a century and the first report of the same from Coorg district by amateur workers[12]. Similarly several species of elusive butterflies and rare plants have been reported in the social media and discussion groups which are new reports to the Indian region[13]; (d) in spreading conservation message and creating awareness and education among public, especially in urban and semi-urban areas; (e) in monitoring changes such as of phenological events over large temporal and spatial scales; (f) in fulfilling the 'communication gap' between scientists and the public[9] and (g) in networking individuals with similar interest across different regions, thus increasing the size of the dataset and participation[7].

Despite the advantages of the SIM, there are several potential caveats as well. Some of these arise not as much due to the technology but due to the amateur nature of the contributors. Thus in many instances, the exact location of the sightings may not be provided or imprecisely provided[7]. Information could carry inaccurate/mis-identification of species. Since the data collection is not planned, information may tend to be non-uniformly spread across the region or country and biased to urban and semi-urban areas. Finally in most of the cases, the less charismatic and common species may be grossly under represented which will have implication while addressing species distribution patterns.

Despite of short comings, SIM can provide useful resources for scientific research, especially in engaging citizen scientists in research. Affordable camera, mobile phone with camera, GPS and Internet connection have opened the floodgate of information documentation and dissemination. Moreover this has a great multiplier effect. The idea proposed here is the first ever initiative in India to map the bio-resources using social network, Internet media and e-mail discussion groups. This is cost effective, efficient and has a far-reaching effect on mapping and conservation of bio-resources of India. SIM allows not only rapid remote taxonomic identification, bio-resources mapping but can also fill the gap in our knowledge on 'Wallacean Shortfall' and conservation education and awareness and also reconnect back to our natural world.

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Sustainable mountain development in Indian Himalayan region is under the shadow of regional instability

Indian Himalayan Region (IHR) is characterized by a complex socio-ecological system, rich cultural and biological diversity[1]. Himalaya forms a continuous chain of mountains from the West to East. However, the diversity in topography, latitudinal variations and rainfall factors in different parts of the Himalaya is incredible[2]. The Himalayan mountains, located in Northern India play a significant role in deriving ecological benefits for mountains and adjacent plains of the country[1]. Snow covered mountains, high altitude lakes and perennial rivers originating from the region are vital sources of drinking water, irrigation and hydroelectric power for nearly 1.5 billion people of eight countries located in IHR[3]. Approximately 207,937 sq. km of forest cover spreading in IHR is pivotal to the ecosystem. The value of Himalayan forests in terms of carbon sequestration has been estimated to be around Rs 943 billion/year[4]. IHR is also bestowed with a variety of medicinal plants[5]. There are nearly 99 wildlife sanctuaries, 28 national parks, 5 biosphere reserves, 4 tiger reserves, 11 elephant reserves and 2 world heritage sites[6]. Owing to the scenic topography, natural resources and sacred mountains (Figure 1), IHR is a leading destination for tourism, pilgrimage, generation of hydroelectric power, medicinal plants and establishment of natural resources-based enterprises.

But several factors are affecting the mountain ecosystem. The mountains are susceptible to frequent earthquakes, melting of glaciers, flash floods, forest fires, land slides and other natural hazards that have led to geophysical instability. Further, developmental activities like (i) quarrying, (ii) deforestation, (iii) road widening and construction of dams, (iv) frequent vehicular movement, (v) construction of multi-storey buildings along riverbanks and in subalpine–alpine–moraine habitats, (v) unregulated tourism and pilgrimage, and (vii) non-biodegradable waste deposits are degrading the mountain ecosystem. Migration is yet another factor that is hampering traditional conservation agricultural and agro-pastoral practices.

There is need to restore the lost glory of the mountain ecosystem. The government should (a) promote low-cost erosion control measures that are simple and easy to use, (b) create protected areas to save wild genetic material, (c) develop