studies, we observed that the earlier snout (2006) portion has now become a moraine dammed lake (Figure 1 *b*) with ice-cored moraines around, and the current snout has receded further back. The field GPS points overlaid on the satellite data confirm this observation. Figure 1 *c* shows the old snout converted to ice-cored moraine and the active snout in the background. The active snout is located on the right-hand side of the glacier front having an irregular tongue and melt water comes out through the cave located at right side of the tongue (Figure 1 *a*). The snout is visible as a large, dirty ice-wall covered with debris. The retreat measurements carried out using the latest satellite data show a shift of 120 m from the earlier snout position in 2006 (Figure 1 *a*). Naming convention of the glaciers in the Himalaya follows a pattern of giving the name of the habitation/village to the glacier which is closest to it. Field evidences shows that earlier Milam Glacier had extended up to Milam village, which is now at a distance of 5 km away from the present snout. The presence of a long lateral/medial moraine of 1 km length near the Milam village (Figure 1 *d*) confirms the earlier extent of the Milam glacier. The broad, U-shaped valley with many recessional moraines (Figure 1 *e*) from Milam village to the present snout and the lateral/medial moraine near the Milam village indicate that the glacier remained in this stretch for a long time. The use of satellite data in conjunction with field evidences shows that the Milam Glacier is in a state of continuous retreat since 1906, and the rate of recession has accelerated during the last decade.

1. Raj, K. B. G., *Curr. Sci*., 2011, **100**, 1420–1425.

ACKNOWLEDGEMENTS. We thank Dr V. K. Dadhwal, Director, NRSC (ISRO), Hyderabad and Arun Chaturvedi, Director, Glaciology Division, GSI, Lucknow for providing the necessary support to carry out the joint research activities.

K. BABU GOVINDHA RAJ[1,*]
K. VINOD KUMAR[1]
RAKESH MISHRA[2]
MUNEER AHMAD MUKHTAR[2]

[1]*Geosciences Division,*
National Remote Sensing Centre (ISRO),
Hyderabad 500 037, India
[2]*Glaciology Division,*
Geological Survey of India,
Lucknow 226 024, India
**e-mail: babugovindraj@gmail.com*

Monitoring ecosystem boundaries in the Himalaya through an ‘eye in the sky’

This correspondence refers to a recent note[1] about monitoring alpine treeline in the Western Himalaya and few other recent studies[2–4] on the same aspect. Alpine zones in the Himalayas are the highest vegetation zones where seed-bearing plants are found, but tree growth is excluded. Upper and lower boundaries of alpine zones are traditionally set as ‘snowline’ (lowermost limit of permanent snow) and ‘timberline’ (uppermost limit of closed montane forests) respectively. Since alpine ‘treeline’ is the uppermost limit of the trees, it also marks the uppermost end of ‘timberline ecotone’ or forest tundra ecotone[5] (transition zone between montane forests and alpine zones), which starts at the timberline at the lower end. Despite the use of the word ‘line’, any natural boundary itself is a transition zone. Treelines are temperature-sensitive zones that are expected to respond to climate warming by advancing beyond their current position[6].

Monitoring the shift in such complicated natural boundaries due to climate change (mainly temperature elevation) is possible with the use of ‘an eye in the sky’ (remote sensing satellite) in the inaccessible Himalayan terrain (Figure 1), which has been recently attempted and reported[1–4]. As the remote-sensing images require interpretations rather than direct visual observations, the results may sometimes vary accordingly.

Singh *et al*.[1] conclude that the treeline has shifted 388 ± 80 m upwards in Uttarakhand Himalaya during 1970–2006. This change is alarming, since from what is known today, treelines have fluctuated much less in the past 10,000 years (< 200 m) than might have been expected from historical climate change, and current treelines are only a little depressed (< 100 m in temperate zone) compared to the post-glacial maximum[7]. In montane ecosystems it has been projected that a 1°C increase in mean annual temperature will result in a shift in isotherm of about 160 m in elevation[8] at a lapse rate of 6°C/1000 m. In India, mean annual temperature showed a warming trend of 0.51°C per 100 years during 1901–2007. During 1971–2007, accelerated warming of 0.2°C per decade was reported[9]. However, McDowell[10] has mentioned a 1°C elevation in average temperature during 1970–2002 in the Himalayas. Considering a 1°C temperature elevation, a maximum shift of 160 m may be expected. But the reported magnitude is more than double, indicating higher temperature elevation in the Himalayas, as also mentioned in the ICIMOD document[11]. In any case, it indicates a disastrous situation ahead. This upward shift is higher than reported elsewhere in the Himalayas. On the other hand, a third study[3], also based on satellite images and toposheets, mentioned the location of ‘timberline’ to be between 3900 and 4000 m in 1960. The present position of treeline (which is always above timberline) is 3542 m (ref. 1), thus suggesting a downward shift of not less than 350 m.

The treeline is a natural boundary responding to climate change but lagging in responses to it, since it involves immobile trees. The upward shift of the treeline requires introduction of seeds from lower altitudes (trees at the uppermost limit hardly produce seeds), germination, establishment and growth to exceed the depth of winter snow cover to reach a critical height (2 m, or more as set by conventions) to be identified as a treeline element. All this cannot happen in a single year in which the growing season is further reduced to 7–8 months at this altitude. Additionally, plants in the cold climate of the alpine zones grow extremely slowly and it may take decades to reach a minimum height of 2 m as they are growing at the uppermost edge of their tolerance limit. This long journey in time from seed germination to being a recognizable tree is also full of hazards in the form of annual climatic variations, early and late season frosts, needle-ice formation, desiccating and freezing winds, high UV radiation, diseases and pests, anthropogenic activities (grazing, fire, firewood collection and tourist activities), avalanches and landslides. Most of the new saplings perish and very few pass this hardest recruitment by nature. A gradually warming climate may certainly ease this recruitment, as indicated by Singh *et al.*[1], resulting in the upward shift of the treeline.

However, it is difficult to realize this upward shift in actual field conditions. A newly recruited tree as small as 2 m, isolated in a protected habitat or amongst the tall impenetrable *Rhododendron campanulatum* D.Don krumholz, or a little above other such trees, may easily escape notice under the trying conditions of the high-altitude terrain, where the landscape is dominated by two contrasting vegetation types – treeless alpine zones and closed montane forests separated by a scarcely fine-tuned boundary. Since the 'timberline' (and therefore, closed forests) does not show any upward shift, the change easily escapes notice. Had the timberline shifted upwards by the magnitude reported, the famous temples of Kedarnath, Tungnath and Rudranath would have been surrounded by dense woods at least on the adjacent hill slopes. These shrines were above, or at, the timberline decades before and are there even today, though some isolated tree recruits might have been silently established on the upper slopes. Even these recruits may have perished due to high human interference (grazing, fire, firewood collection, mountain tourism) in the area. But in the protected areas like Nanda Devi Biosphere Reserve or Valley of Flowers National Park where human interference is minimum, new recruits have been recorded and reported[1,12].

Epitomizing this phenomenon is another study[2] conducted with the help of an 'eye in the sky', which indicates an increase in subalpine forest canopy. This obviously means there is either new recruitment or regeneration in this ecotone zone. However, no geographical upward shift in timberline was found here. The results are in agreement with those of Holtmeier and Broll[13], who have mentioned that forests will not advance in a closed front but will follow sites that will become more favourable to tree establishment under the changed climatic conditions.

A fourth recently published study[4] with the help of remote sensing images of 1976 and 2005 assessed the impact of climate change on forest cover shift in the Western Himalaya. The authors have shown the current position of tropical semi-evergreen forests dominated by *Dipterocarpus* spp. (no *Dipterocarpus* species exist naturally in the Western Himalaya), *Shorea* spp. (only one species *S. robusta* Roxb. ex Gaertn.f. occurs in the Western Himalaya), *Mesua ferrea* (not a wild species in the Western Himalaya), *Terminalia* spp., *Bombax ceiba*, *Mangifera indica* (hardly seen as a common tree element in the forests of the Western Himalaya), *Michelia champaca* (a cultivated species), *Hopea parviflora* (an endangered endemic tree of Western Ghats) existing between 3000 and 4500 m altitude in the Western Himalaya. Authentic literature on forests of the Himalaya[14], however, mentions that some of these tree species exist in submontane forests and hardly reach up to 1500 m altitude even today in the area. The current position of temperate evergreen forests is indicated far above the current treeline (3542 m)[1]. Similarly, the current position of temperate conifer, subtropical conifer and tropical moist deciduous forests is unrealistic. Also, based on these unrealistic distributions of forest types, shifts in forest cover are predicted in different climate change scenarios, which mainly show upward distribution.

All these studies[1–4] utilized satellite images to compare the vegetation over a period of 30–35 years. While the first two studies[1,2] show the utility of the 'eye in the sky' in assessing the significant changes in timberline ecotone zone, the third one[3] was criticized for inappropriate methodology[15] and the fourth[4] depicts and predicts unrealistic pictures of forest distribution in the Western Himalaya. Obviously, the interpretation of satellite data may vary, sometimes drastically, and therefore, cannot be conclusive if used alone without extensive ground-truth verification (as possibly done in the fourth study[4]). Otherwise, we may reach false conclusions for example, that mango (*Mangifera indica* L., a tropical–subtropical fruit tree) can now be easily cultivated in alpine zones (above 4000 m altitude in the Western Himalaya), where no trees exist even today or that an endemic endangered tree of the Western Ghats may invade the Himalayas.

Are we still afraid of field work in the 21st century in the high altitudes of the Himalayas, where William Moorcroft,

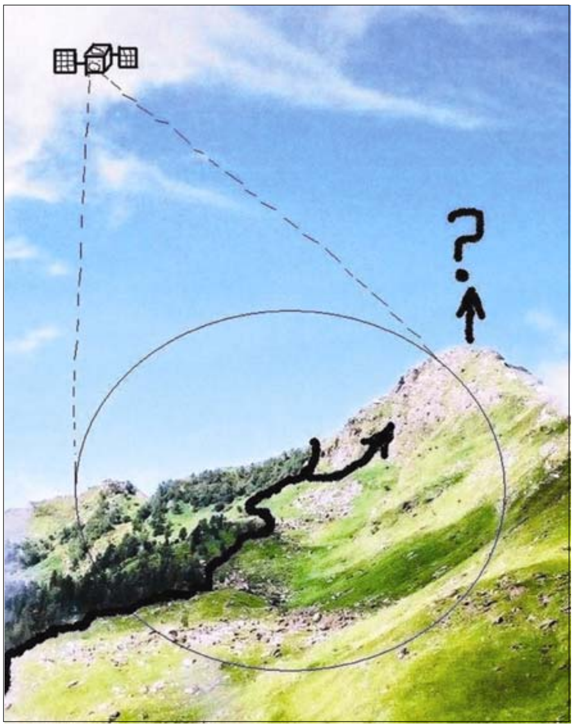

Figure 1. Artistic interpretation of monitoring upward shift in treeline.

Edward Madden, Hugh Falconer, Richard Strachey, J. E. Winterbottom, J. F. Duthie and many more conducted exploration works in inaccessible terrains as early as the 19th century? Or is the tradition of field work, in the lack of due recognition[16], dying in India?

1. Singh, C. P., Panigrahy, S., Thapliyal, A., Kimothi, M. M., Soni, P. and Parihar, J. S., *Curr. Sci.*, 2012, **102**, 559–562.
2. Bharti, R. R., Adhikari, B. S. and Rawat, G. S., *Int. J. Appl. Earth Obs. Geoinf.*, 2011, doi:10.1016/j.jag.2011.09.018.
3. Panigrahy, S., Anitha, G., Kimothi, M. M. and Singh, S. P., *Trop. Ecol.*, 2010, **51**, 87–91.
4. Joshi, P. K., Rawat, A., Narula, S. and Sinha, V., *J. For. Res.*, 2012, **23**, 75–80.
5. Camarero, J. J. and Gutierrez, E., *Climate Change*, 2004, **63**, 181–200.
6. Harsch, M. A., Hulme, P. E., McGlone, M. S. and Duncan, R. P., *Ecol. Lett.*, 2009, **12**, 1040–1049.
7. Korner, C., *Oekologia*, 1998, **115**, 445–459.
8. Xu, J., Grumbine, R. E., Shrestha, A., Eriksson, M., Yang, Y. and Wilkes, A., *Biol. Conserv*., 2009, **23**, 520–530.
9. Kothawale, D. R., Revadekar, J. V. and Rupa Kumar, K., *J. Earth Syst. Sci.*, 2010, **119**, 51–65.
10. McDowell, N., *Nature*, 2002, **416**, 776.
11. Eriksson, M., Xu, J., Shrestha, A. B., Vaidya, R. A., Nepal, S. and Sandstrom, K., Report, ICIMOD Kathmandu, Nepal, 2009, p. 23.
12. Rana, C. S., Rana, V. and Bisht, M. P. S., *Curr. Sci.*, 2010, **99**, 574–576.
13. Holtmeier, F.-K. and Broll, G., *Landsc. Online*, 2007, **1**, 1–33.
14. Singh, J. S. and Singh, S. P., *Forests of Himalaya*, Gyanodaya Publ, Naini Tal, 1992, p. 294.
15. Bharti, R. R., Rai, R. D., Adhikari, B. S. and Rawat, G. S., *Trop. Ecol.*, 2011, **52**, 133–137.
16. Valdiya, K. S., *Curr. Sci.*, 2012, **102**, 581–589.

D. S. RAWAT

Department of Biological Sciences,
College of Basic Sciences & Humanities,
G.B. Pant University of Agriculture and Technology,
Pantnagar 263 145, India
e-mail: drds_rawat@yahoo.com

Koinophilia and the exception reporting model of face recognition: Ill-fated solitary neologisms?

I read with interest the article by Unnikrishnan[1] on the evolutionary link between mate selection and face recognition[1]. While the arguments presented are convincing, I was surprised to see that koinophilia remains mostly unknown. The article quotes six papers on koinophilia, five of them in the *Journal of Theoretical Biology*, a prestigious journal with a strict peer-review record. It is unlikely that nobody noticed it. In spite of having parsimoniously explained several evolutionary paradigms, why has koinophilia been ignored for so long?

A *Google* search gave me a clue. Is it because the proponent of koinophilia hails from a relatively unknown university in South Africa, a developing nation[2]? Or is it because the author worked in isolation? Probably, it is a combination of both. Interestingly, five of the six papers on koinophilia, cited by Unnikrishnan, are single-author papers.

It would be interesting to study the fate of neologisms emerging from the developing world. Science thrives in the shadow of the West. With English taking over as the lingua franca of contemporary scientific communication, neologisms are almost always the monopoly of dominant players in the English-speaking world. Even the European countries such as Germany, France, etc. who contributed a lot before the world wars, are losing out. The developing world makes news only when things go wrong. For instance, recently, *Nature* promptly reported a series of cases on scientific misconduct by eminent Indians[3,4]. Even a letter about the reluctance of Indian professors to answer e-mails[5] instantly caught the imagination of *Nature India*[6].

I do not foresee a bright future for the exception reporting model of face recognition proposed by Unnikrishnan. Neologisms by solitary scientists from the developing world would be wiped clean from memory by stubborn silence from peers.

1. Unnikrishnan, M. K., *Curr. Sci.*, 2012, **102**, 563–570.
2. Koeslag, J. H., *J. Theor. Biol.*, 1990, **144**, 15–35.
3. Jayaraman, K. S., *Nature News*, http://www.nature.com/news/indian-science-adviser-caught-up-in-plagiarism-row-1.10102, accessed on 26 March 2012.
4. Priyadarshini, S., *Nature India – Indigenus*, http://blogs.nature.com/indigenus/2012/01/race-defense.html, accessed on 26 March 2012.
5. Sharma, A., Malhotra, A. and Sharma, P., *Curr. Sci.*, 2012, **102**, 9–10.
6. Priyadarshini, S., *Nature India*, http://www.nature.com/nindia/2012/120207/full/nindia.2012.18.html, accessed on 26 March 2012.

GEETHA MATHEW

SRA-16, Thrikkakara,
Kochi 682 021, India
e-mail: geeth_math@yahoo.co.in