Degradation of Himalayan forests

On the basis of only one satellite scene which covers 20,000 sq. km area and does not fully cover Almora and Pithoragarh districts, Prabhakar et al.\(^1\) have tried to draw conclusions on the degradation of forests in the entire Himalayas and criticized the estimates published by Forest Survey of India (FSI) in the State of Forest Report (SFR) 1999. FSI has undertaken monitoring of the forest cover of the entire country on a regular two-year interval since early 1980s.

It appears that the authors have not read the SFR 1999 of FSI carefully. The methodology followed by FSI in the forest cover assessment has been clearly mentioned in the report (pp. 2, 3).

The authors have used the satellite imagery of IRS-1D LISS III of 31 May 1998. It is well known that the month of May is the culmination of dry season in northern India and even some of the evergreen trees like pine (Pinus roxburghii), which is a major species in the study area, shed major portion of their leaves (as referred by Troup 1921). The ground is dry. Even if there are a few showers of rains in May (we checked the rainfall data from India Meteorological Department) in the hills, interpretation of the satellite data is bound to give a degraded look of the forest. For example, if a scientist assesses the forest cover of an area having dense moist/dry deciduous forest using satellite data of dry season (April/May), he may conclude that there is no forest in the area or it is highly degraded. Our experience shows that not only the reduced foliage/chlorophyll on the tree, even moisture stress affects the signature in the sensor. For monitoring the forest cover of the country, FSI procures cloud-free data from NRSA for the period from October to February, so that the correct reflectance of the tree having full crown and chlorophyll content is registered. In this case, FSI has used data for the said area for the period November 1996.

The authors have made a comparison of their findings with the FSI using (%) values and not absolute area figures. About 25% area of Pithoragarh district has been left out by the authors, which is under snow and in the nonforest category; whereas FSI has used the entire area of the district in the assessment. As area of the district goes in the denominator for working out forest cover percentage, comparing such percentages becomes incorrect.

The authors have not defined the ‘forest’, which is the key parameter of the study. The procedure to classify the degraded forest which is below 40% of canopy density and inclusive of scrub, has also not been described. On the other hand, FSI follows the standard international classification for canopy density. Scrubs having canopy density less than 10% are categorized as ‘nonforest’ by FSI. If the scrub is included in the degraded forest area, the percentage of the degraded forest would obviously be inflated. The most glaring inconsistency is in table 3. The total forest cover, including scrub, is 72% in Almora, whereas FSI has estimated it as only 48%. The additional 24% area of forests estimated by the authors seems to be due to the definition adopted by them. It appears that even grasses have been included in the forests, which have been subsequently categorized as degraded forests. Obviously, when this huge area of nonforest is included in the total forest area, the percentage of degraded forests in the total forest will increase accordingly. Comparisons of degradation as shown in table 3 are therefore unscientific.

It is to be appreciated that there is a difference between a study undertaken for research purpose and the one for state and national level planning. Mention of the confident intervals is more relevant when a study is for research purpose. In the estimates which are derived for a state and national level planning, confident intervals are not quoted. FSI has described the full method of estimation of error in SFR 2001 based on statistically sound principle.

Digital image processing was introduced in FSI in 1990s and became operational only in the year 2000. FSI results used by authors for comparison are based on visual interpretation of 1:250,000 scale images having minimum cartographic limit of 25 ha. The two datasets are therefore not comparable. If the authors were interested to make a scientific comparison.
of findings of their study with the results of those of FSI, it would have been appropriate to use SFR 2003 or SFR 2003 of FSI, which are based on digital processing of comparable datasets.


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Response:

D. Pandey and K. D. Singh address only the comparison of our results with those of the Forest Survey of India (FSI). It is worth mentioning that this was not the primary purpose of our article. Rather, the main aim was to present a method for ascertaining the extent of uncertainty in estimating how much of the forest area is degraded. We applied this method to a portion of the Himalayas and found, somewhat to our surprise, that the FSI’s figures for proportion of forest area degraded, was well below the lower end of our 90% confidence intervals in two districts covered by our study. This fact, which we discovered in the course of our investigations, was naturally worth mentioning and we did so in the article.

In response to the comment that the image was taken at the wrong time of the year, we would like to point out the following: First, since our classification was supervised, meaning that the signatures in our IRS LISS-3 image were classified on the basis of their correspondence with ground surveys and visual inspection of a high-resolution Ikonos image, the time of year is irrelevant. It would be relevant only if we had used unsupervised classification or used signatures from a different image. Second, in any case, we assessed the accuracy of the classification using the high-resolution Ikonos image. So we know the range of error in the classification, and we adjusted for it in calculating the areas degraded. Indeed, this was one of the main parts of our article.

It is also stated that we overestimate forest degradation by including scrub area in the forest area. In the Central Himalayas, scrub is the final stage of forest degradation (with the exception of naturally occurring, high-altitude scrub which is negligible in quantitative terms). As mentioned in the article, we believe that the FSI has grossly underestimated the area under scrub. Thus the FSI naturally underestimates the proportion of what was originally forest and subsequently degraded. We stated in the article that the FSI’s estimates for the area under scrub are unbelievably low. According to the FSI’s State of Forest Report (SFR) 1999 (table 3.26f [http://www.envfor.nic.in/fsi/sfr99/chap3/up/uttar.html#fr]), Almora District had a total geographical area of 5385 sq. km, of which only 21 sq. km was scrub. No one, who has been to Almora district could consider that such a low figure is possible. In fact, out of 62 districts in Uttar Pradesh listed in the table, FSI reports that 32 of them had 0 sq. km of scrub! It is evident that under-reporting of scrub was not confined to the hill districts.

Now, on the comment ‘it appears that even grasses have been included in the forests . . .’. In fact, we have made it perfectly clear in our article that we have not included grasses in forest or scrub (table 3: p. 63).

It has been pointed out that we have not referred to the latest SFR. This is correct. We used the 1999 report because the reference period for that report included 1998, the year of our image. We shall add, however, that using SFR 2003 does not change matters very much. The FSI has not reported district-level figures for area under scrub in SFR 2003 on its website. So we cannot make district-level comparisons. However, this report (available at http://www.fsiorg.net/fsi2003/index.asp) states that only 40,269 sq. km in India, about 1.2% of the total geographical area, is scrub. In contrast, the Ministry of Rural Development in its 2001–02 annual report (as quoted in IndiaStat.com) reported that about 639,000 sq. km or 19.5% of India’s area was wasteland. There are other categories of wasteland, of course, but it is unlikely that so little of it would be scrub. In Uttarakhand, 320 sq. km, about 0.6% of the geographical area is reported by the FSI to be scrub. We find this hard to believe. It is probably the case that in India as a whole, as is certainly true in Uttarakhand, a considerable part of the scrub that exists was once forest that is now degraded. Under-counting of scrub will underestimate forest degradation.