tern could possibly be used to explain the source for large-scale Deccan volcanism, separation of India from Africa, bolide impact, or plume activity, etc.

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ACKNOWLEDGEMENT. I am grateful to Dr H. K. Gupta, Director, NGRI, for permission to publish this work.

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Poaching, STF-activity and forest loss

Factors driving the forest cover change have become major issues of concern in our attempts to understand the patterns of loss in biodiversity. Occasionally unexpected factors such as certain local-specific social and/or cultural elements are shown to play a very significant role in bringing about the forest cover change. These changes can be quite unobvious and contrary to expectations. We report here one such change in the forest cover in Tamil Nadu that seems to be associated with the increased human activity in the forest. Our purpose is merely to draw attention to an unexpected pattern associated with a specific human activity and not to implicate any specific causal factor.

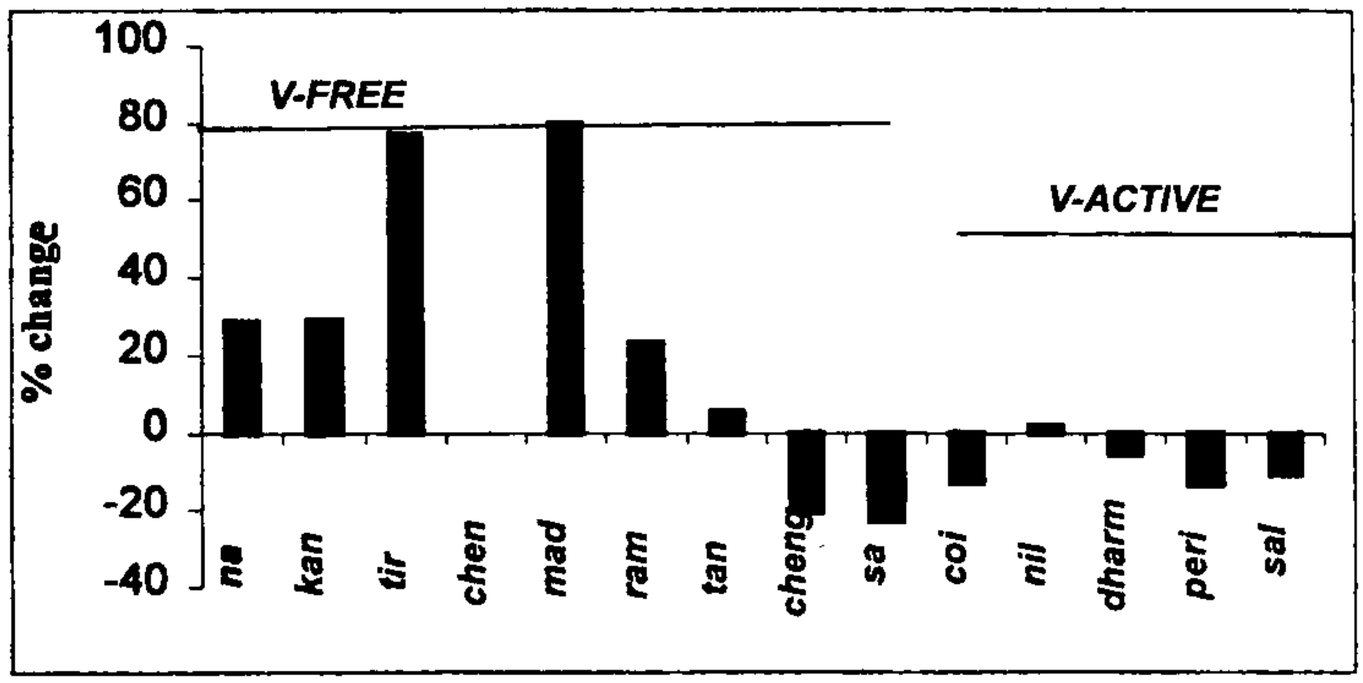

Figure 1. Change in the 'open' forest in the districts associated with Veerappan's activity (V-active) and those free from it (V-free). Note that generally there is a decrease in the 'open' forest of the former area. The districts are: na = North Arcot; kan = Kanyakumari; tir = Tirunelvelli; chen = Chennai; mad = Madurai; ram = Ramanadu; tan = Tanjavur; cheng = Chengulpattu; sa = South Arcot; coi = Coimbatore; nil = Nilgiri; dharm = Dharampuri; peri = Periyar; sal = salem.

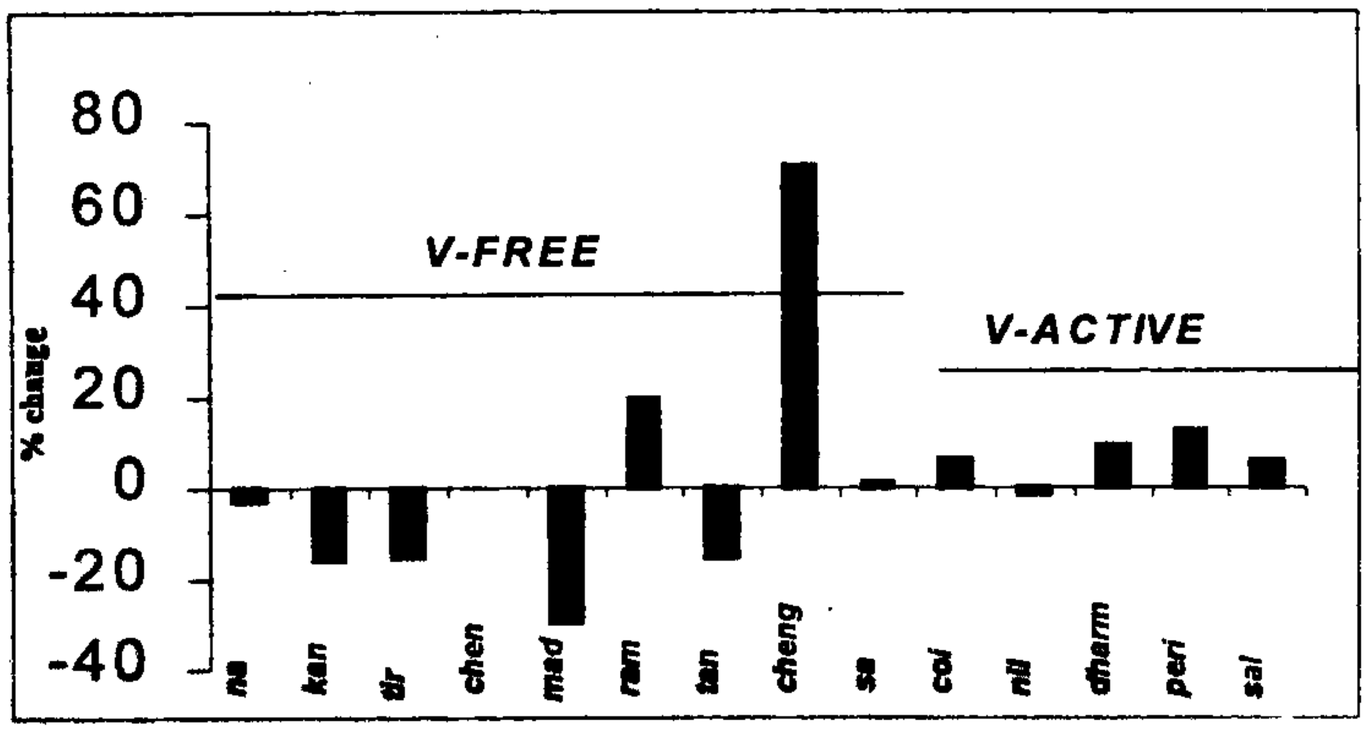

Figure 2. Change in the 'dense' forest in the districts associated with Veerappan's activity (V-active) and those free from it (V-free). Note that generally there is a decrease in the 'dense' forest of the former area. The districts are: na = North Arcot; kan = Kanyakumari; tir = Tirunelvelli; chen = Chennai; mad = Madurai; ram = Ramanadu; tan = Tanjavur; cheng = Chengulpattu; sa = South Arcot; coi = Coimbatore; nil = Nilgiri; dharm = Dharampuri; peri = Periyar; sal = salem.

Poaching is unanimously recognized as one of the important factors for forest loss. In Tamil Nadu (and Karnataka), the Dharmapuri, Periyar, Salem districts and their adjoining areas (Nilgiri and Coimbatore) are well known for the active presence of the notorious poacher Veerappan, and the Special Task Force (STF) has been active in and around these areas almost for the past eight years. Consequently, either because of a mass psycho built-up around these areas or due to severe restrictions laid by the STF for entering them, these forest divisions seem to have received a special protection leading to a significant improvement in the health of the forests. We found that during 1989–1995, when Veerappan's activity came to be highly publicized and the STF was pressed to action, there has been a general improvement in the health of the forest compared to other areas that are free from these factors. The per cent forest under dense cover[1] (> 40% forest cover) increased by 6.36 ± 1.60 while that under open forest (< 40% forest

Table 1. Total forest cover and area under different types of forest in Tamil Nadu district during 1995

District	Recorded forest area*	Area in sq. km			
		Dense	Open	Mangrove	Total
North Arcot	3144.722	1043	1213	0	2256
South Arcot	1125.485	267	722	9	998
Chengalpattu	405.082	89	206	0	295
Coimbatore	1585.517	964	368	0	1332
Dharmapuri	3506.61	1154	1106	0	2260
Kanyakumari	503.14	294	156	0	450
Periyar	2412.239	1090	926	0	2016
Tirunelvelli	1846.336	676	304	0	980
Madras	5.206	0	5	0	5
Madurai	2972.555	1066	1066	0	2132
Nilgiri	1379.342	964	605	0	1569
Ramanathapuram	862.765	186	352	0	538
Salem	1668.874	695	600	0	1295
Tanjavur, Trichy, Pudukottai	1210.459	200	738	–	938

*Source: Division-wise figures received from The Conservator of Forests, Vellore have been reconciled for districts.

cover) decreased by 8.22 ± 2.22 in the Veerappan- and STF-active areas (Figures 1 and 2; Table 1). On the contrary, the areas free from Veerappan and STF-activity recorded an increase in the open forest cover by 22.51 ± 9.52 and negligible change in dense forest cover ($1.34 \pm 6.42\%$). Thus it appears that a significant proportion of the open forest has been converted into dense forest in the Veerappan-active zone while in other areas, there is a substantial conversion of dense forest into open forest.

We do believe that these patterns are not merely by chance. A non-parametric test of direction of changes (increase or decrease eliminating the zero or insignificant changes) also showed that the pattern of change observed in the two categories are significant ($p = 0.03$ for dense and $p = 0.045$ for open forests) and not merely due to random factors. Further, since our comparisons are within a similar state management system, we do not think that the observed pattern can be attributed to any differences in conservation practices; for this reason we have avoided comparison with forests of other states especially Karnataka. While these patterns do suggest a strong influence of the presence of Veerappan and associated STF activity on the health of the forest in an unexpected direction, we do not imply that poaching has its positive impact. It is probable that this is more a local specific process. Hence studies concerning the loss of biodiversity should consider these local factors more seriously than is being done at present.

1. Forest cover is estimated by Survey of India periodically based on remote sensing and ground truthing. The values reported here are from a survey conducted by Survey of India.

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Fish skull from Palana Formation at Hadla–Bhatiyan, District Bikaner, Rajasthan

The present paper reports for the first time a fossil fish skull from the Palana Formation of the Bikaner – Ganganagar Basin in north-western India. Except for some algal and fungal remains[1,2], a rich pollen and spore assemblage[3,4] and a variety of foraminifers[5–8], no mega fossils have been reported from the Palana Formation of Paleocene – Eocene age[9]. The Palana Formation – an important source of lignite in western Rajasthan is characterized by the association of grey clay, grey and greenish-grey to variegated shales, carbonaceous shale, sandstone and lignite.

A well-preserved fish skull was discovered at a depth of about 90 m from the surface when a well was being dug in a field in Hadla–Bhatiyan village (27°46'05":73°03'15") about 45 km south-west of Bikaner town in western Rajasthan (Figure 1). Lithological succession of the study area, based on data from the well at Hadla–Bhatiyan is given in Table 1. The Palana Formation has been observed to rest unconformably over the Badhaura Formation of Permian age, in an exploratory well drilled by the Oil and Natural Gas Corporation at Pugal-1 village. However, the rocks of the Palana Formation show a gradational contact with the overlying rocks of the Marh Formation, Lower Eocene-age, which in turn is disconformably overlain by the Lower to Middle Eocene rocks of the Jogira Formation.

The specimen is the fossilized skull of an Actinopterygian – a fresh water fish (Figure 2 *a* and *b*), at present preserved in the Department of Geology, Faculty of Science, Jai Narain Vyas University, Jodhpur, India. The head measures about 11 cm in length and 8.8 cm in width. Total length of the maxilla and premaxilla is about 5.8 cm. The diameter of the eye is 1.4 cm. Dentary