

tries. Also, the lack of protection to intellectual property has led to blatant copying of processes with impunity, and hence failure to nurture research skills. Multinationals operating in India are also hesitant to bring newer technologies because of these reasons.

In spite of the tax concessions, Indian industries have so far not shared the burden of the R&D expenditure. Poor R&D management and short-term goals have led them to spend less on R&D.

Although this paper covers only the chemical literature, a similar picture may emerge if a corresponding study is carried out on R&D in other branches of

science. The watch-dogs of Indian R&D, namely, the Department of Science and Technology and the Department of Scientific and Industrial Research should be carrying out regular studies on the performance of Indian R&D, *vis-à-vis* the international scene, to help the science planners and managers to give better focus to the efforts of the scientific community.

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Decline of blackbuck (*Antilope cervicapra*) in an insular nature reserve: The Guindy National Park, Madras

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Based on the equilibrium theory of island biogeography¹, conservation biologists have predicted that insularization of nature reserves would lead to extinction of several species occurring within the reserves²⁻⁴. Some species are more likely to go extinct than others for a variety of reasons⁵. A classic example of such extinction in insular habitats is that of many bird species on Barro Colorado, which became an island in 1910 during the creation of the Panama Canal⁶. It is generally believed that small, insular reserves will need active management if specific conservation objectives have to be met.

Along with Selvakumar⁷, we (RKG and RS) have been making general ecological observations in Guindy National Park (GNP), Madras, since 1974. A more systematic study was begun in 1991. During this period the park has shrunk in size and enclosed by a wall, the vegetation has undergone qualitative changes, while the population of blackbuck (*Antilope cervicapra*), an endangered antelope endemic to the Indian sub-continent, has declined considerably. While the detailed results of our observations are being reported elsewhere⁸, here we highlight briefly the need to take urgent management action if the species is to be saved from its precarious position in the park.

Once covering an area of about 500 ha of one of the last remnants of the tropical dry evergreen forest of the Coromandel coast⁹ (now reclassified as the *Albizia amara* Boiv. Community¹⁰), the GNP was established as a Reserve Forest in 1910. It now occupies an area of only 270 ha, walled off since the late 1980s from the adjacent Raj Bhavan and Indian Institute of Technology (IIT) campus. At least 350 species of flowering plants are found here (C. Livingstone pers. commun. and RS pers. observ.) in addition to about 150 species of birds¹¹ (V. Santharam, pers. comm.) and several species of lower plants, invertebrates, fishes, amphibians, reptiles and mammals. The park has been regarded in the past as one of the native strongholds of blackbuck, although it is also popular for its sizeable population of chital or spotted deer (*Axis axis*) which was introduced into the park¹² probably less than 50 years ago.

Trends in blackbuck and chital populations

Our studies of the blackbuck and chital populations here during the 1970s were based on total counts⁷ and sample counts using belt transects^{13, 14} for esti-

mating population sizes, keeping records of population structure (age and sex class of animals) and, in the case of blackbuck, territoriality in males. During 1991-92 we used the statistically more robust line transect sampling¹⁵ to obtain estimates of population density and size, in addition to information on population structure, habitat use and territoriality⁸. Classification of animals was based on Schaller¹⁶, Mungall¹⁷ and Selvakumar⁷.

During 1975-80, censuses conducted under the auspices of the Forest Department using volunteers and naturalists (including two of us, RKG and RS) gave an average population of 295 blackbuck (unpublished records) for the combined GNP and Raj Bhavan areas. In 1979, a 'total count' gave a figure of 260 blackbuck⁷ which can be considered as a minimum number as some animals would have been missed due to poor visibility in denser vegetation. Sample counts during 1981-82 by Menon¹⁴ gave an average figure of 333 blackbuck for this area, which may have been a slight overestimate¹³. These observations indicate that at least 250 blackbuck were present in GNP and Raj Bhavan during 1975-82.

In contrast, the line transect estimate during 1991-92 was 22.9 (± 4.1 , 95% Confidence Interval) blackbuck/km² in