

due to the presence of more active zahe-rite along with gibbsite. It also indicates that mudbanks can be created artificially by introducing about 3–5% of zahe-rite–gibbsite–gypsum mixture into the near-shore clayey sediments, where waves exert maximum pressure on the bottom sediments. If the coasts are protected by creating mudbanks artificially, the cost

for coastal protection and its subsequent maintenance could be reduced. Moreover, this will not affect the aesthetic view of the beaches and will help to increase fish productivity.

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C. JAYAPRAKASH\*  
A. C. DINESH

*Marine Wing, Geological Survey of India,  
Mangalore 575 001, India  
\*e-mail: jayaprakashc@hotmail.com*

## Mangroves of Maharashtra: a fast disappearing asset

Mangroves are typical group of plants which are adopted for survival in sheltered brackish-water habitats along coasts of tropical and sub-tropical regions. They are known to be the primary producers, shoreline protectors, nursery grounds and habitat for a variety of animals, bridging components and unique biological resources. They provide erosion control and shoreline stabilization. The recent tsunami has proved the importance of mangroves as shoreline protectors. In today's biotechnological research they are used as a source of salt-tolerant genes.

Maharashtra is one of the important coastal state's of India with unique man-

grove diversity spread all along the 720 km coastline, distributed in about 55 estuaries in five districts. Studies have revealed that there are about 24 typical mangroves along with ten halophytes, 12 borderline species and 15 associates in Ratnagiri and Sindhudurg districts alone<sup>1</sup>. The rest of the districts show more or less similar composition. All these species play an important role in maintaining this fragile ecosystem.

Besides this mangrove diversity of Maharashtra, field studies<sup>1</sup> have revealed that the mangroves of this region are being threatened to a great extent. Several species have been recorded as 'Endangered' (EN) and 'Critically Endangered' (CR). Loss of habitat, human interference, pollution, Kharland bunding, aquaculture, grazing, commercial use, etc. are some of the threats affecting the mangrove forests. Due to these factors several thousand hectares of mangrove have been cleared. NRSA has recorded a decline of 7000 ha of mangrove from India during the period 1975–81.

Government initiatives like Kharland bunding are also responsible for the elimination of many sensitive species. It is also interesting to note that since the last many years though several projects, seminars, workshops and conferences devoted to mangroves are being organized in the state, the practical outcome regarding their conservation is in question. The major problem is the lack of participation of local people and awareness about mangroves. The policy makers hardly interact with the local people while deciding the conservation programmes.

The following conservation strategies are suggested: germplasm preservation, sustainable use, protection and preservation of value-added species, land-use pattern, etc.

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NARENDRA A. KULKARNI

*Department of Botany,  
Raje Ramrao College,  
Jat, Sangli 416 404, India  
e-mail: nakul24in@yahoo.com*



**Figure 1.** Typical mangrove *Rhizophora mucronata* with prop roots.

## Background radiation: no evidence of ill effects

Saroja and Roy<sup>1</sup> have made the following statements: 'Ionizing radiations are a grave threat around the high background regions of the globe. Selected pockets of Brazil, China and India are reportedly under the grip of high background radiation. Presence of monazite sand along the beaches of these regions, among other

factors, has contributed to these dreaded radiations'. '... The incomparably high values are certainly a major threat, affecting the region populated by the fishermen community'. The authors do not indicate why high background radiation is a 'grave threat', and why they qualify radiations as 'dreaded'.

They have measured uranium, and thorium from ten sampling stations in Kan-yakumari District, Tamil Nadu and obtained relatively high values. They refer to other similar studies, but do not refer to any of the health studies carried out in the high background radiation areas (HBRAs).

Sections of the media occasionally publish stories about excess cancer deaths in the HBRA in Kerala and Tamil Nadu. They seldom state that scientific studies do not substantiate such claims. One newspaper article<sup>2</sup> reviewed the health studies and argued that there is no evidence to indicate adverse health effects due to increase in background radiation.

K. S. B. Rose (UK Atomic Energy Research Establishment, Harwell) reviewed the health studies at HBRA till 1981 and concluded that none of them produced any reliable evidence that the high-level natural radioactivity in the area has a detectable adverse effect on the inhabitants<sup>3</sup>. More recent studies led to the same conclusion<sup>4,5</sup>.

Researchers from the Regional Cancer Centre, Thiruvananthapuram and Bhabha Atomic Research Centre, Mumbai did not find that cancer occurrence is consistently higher because of external gamma radiation exposure in the monazite-rich areas<sup>4</sup>.

Scientists did not observe significant differences in any of the reproductive parameters between the two population groups based on the monitoring of 26,151 newborns from HBRA and 10,654 from areas of normal background radiation in the Kerala coast<sup>5</sup>. Still-births or twinning showed no correlation with the natural radiation levels in different areas<sup>5</sup>.

One study found 22 mutations in individuals from the high radiation areas and another in persons from areas of low radiation<sup>6</sup>. They analysed mitochondrial DNA mutations in 248 families (mostly over three generations) that have been exposed to natural radiation throughout their lives. The media widely published the results as the authors, during interviews, suggested that people exposed to even low levels of radiation may be at the risk of cancer.

BBC's headline was 'Cancer risk for radiation workers'. Responding to my queries, Ray Dunne, Health Reporter, BBC News online, agreed that BBC did

not suggest that that was the conclusion of the original research. BBC focused on it as it were of more relevance to more people. It was purely speculative. A mutation to manifestation of cancer involves several steps.

Responding to my e-mail query, K. Sankaranarayanan, Leiden University Medical Centre, The Netherlands, stated that at the current state of knowledge, we cannot attach any importance to these mutations from the standpoint of adverse health effects at low doses of radiation. Sankaranarayanan has written all the reports on genetic effects of radiation for the United Nations Scientific Committee on the Effects of Atomic Radiation.

Ali and his team from the National Institute of Immunology, New Delhi, demonstrated that nature has a way of duplicating and hiding the precious part of the male gene in the reproductive cells, even when exposed to radiation of any kind<sup>7</sup>.

There is irrefutable evidence that high doses of ionizing radiation cause adverse effects in the exposed individuals. But effects of low levels of radiation are not demonstrated unambiguously.

Some mavericks – now no more a minority – argue that low-level radiation exposure is beneficial to man. But the International Commission on Radiological Protection has not accepted this view. While practices which lead to deliberate addition of substantial radiation exposure to vast sections of the population must be examined thoroughly, there is no basis to term natural background radiation as 'dreaded' and exposures to it as a 'grave threat'.

Notwithstanding this criticism, Saroja and Roy<sup>1</sup> have made an important contribution, as they have partly addressed radiation dose to public from natural background radiation. These researchers are among the handful of those who carried out studies on a topic on which specialists in the Department of Atomic Energy had virtual monopoly so far.

Since nuclear power, and medical and industrial uses of radiation will expand considerably, it is appropriate that we get a clear idea about the relative magnitudes of radiation dose to public from different sources. In 1990, scientists at the Atomic Energy Regulatory Board found that among students and faculty of the Indian Institute of Science, Bangalore; the Indian Institutes of Technology at Kanpur and Mumbai; the Saha Institute of Nuclear Physics, Kolkata; University of Roorkee and Tata Institute of Social Sciences, Mumbai, only one-third was aware of the fact that (a) of all the sources of radiation, natural radiation makes the highest contribution to radiation dose to public and (b) among man-made sources medical radiation makes the highest contribution. A large proportion believed that nuclear power makes the highest contribution to population exposure, contrary to the facts.

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K. S. PARTHASARATHY

*Strategic Planning Group,  
Department of Atomic Energy,  
Room No. 18, Ground Floor,  
North Wing, Vikram Sarabhai Bhavan,  
Mumbai 400 094, India  
e-mail: ksparth@yahoo.co.uk*