

tal in preserving the country's own biodiversity.

In the light of the current pursuit to implement means for wise management of natural resources, a pilot project was initiated to focus on the mangroves of Samoa. Sponsored by UNESCO as part of CSI Projects, the Science Component looked at raising the scientific understanding among the students with regard to mangroves. It is envisaged this would lead to appreciation and therefore greater awareness of the crucial roles of the trees. Consequently, wise practices would be encouraged.

Thus Practical Activities were written within the framework of the current National curriculum scope. With the support by the Department of Education, the Activities were then presented in the forms of two Booklets, one for Primary School level and another for Secondary level. These Activities would require the students to visit the recommended mangrove areas under supervision. The village people are involved by means of activities that have questionnaires. The Activities are numerous and creative, giving the teachers and students a number of options.

As part of training, workshops were scheduled to introduce the teachers to the Activities. An opportunity was also given to them for critique and discussions.

The final form of the Activities was a result of series of

steps. Firstly the achievable goals of the Activities were drawn up by a panel of writers from a spectrum of professionals—Primary and Secondary School Teachers, University Lecturers and Government Scientists. The Activities were planned after visiting every recognisable mangrove area in both Savai'i and Upolu Islands. The actual write-up took much of the time as each work was constantly scrutinised for improvement. The field testing phase was done by writers themselves and some University students. Some school teachers also volunteered for the task. Afterwards the Activities went through some stages of fine-tuning.

At the grass root level, not only this project provides opportunity for students and village people to be more aware of the mangroves and gain appreciation of their importance, but also the exercise is a Science Education in itself. It includes attempts to interpret some Samoan traditional practices in the light of Scientific knowledge and promotes sustainable management of mangroves.

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Environmental Monitoring in South East Asia Using Molecular Markers

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In the last decade, Southeast Asian countries have seen an exponential increase in urbanization and industrialization. This change has brought an increasing input of anthropogenic organic contaminants to the coastal zones. Deterioration of the environmental quality due to past and future industrialization is of concern. On the other hand, various measures for environmental protection have been implemented (e.g., construction of sewage treatment plants) and more will be carried out in coming decades. To evaluate the effectiveness of the measures and regulations, understanding of the current status of pollution in the coastal zones is essential. We have been conducting such **benchmark monitoring** during the past several years by using some molecular markers as follows.

Alkylbenzenes: Linear alkylbenzenes (LABs) are persistent impurities in synthetic detergents. Determination of LABs in sediments and mussels from South East Asian countries demonstrated input of untreated or poorly treated sewage. Also in some samples from Indonesia and Philippines,

branched-chain alkylbenzenes were detected, indicating pollution by non-degradable detergents, which have been phased-out in industrialized countries.

Coprostanol: Coprostanol is a kind of sterol and has been used as a chemical indicator of fecal pollution. The recent application of coprostanol in Asian sediments indicated serious pollution by human feces and inputs from animal feces. We are trying to propose a new criteria of fecal pollution based on the concurrent measurement of the sterols and *E. coli*.

Polycyclic aromatic hydrocarbons (PAHs): PAHs, hydrocarbons containing two or more fused benzene rings, are derived from the combustion of fossil fuel and are also contained in petroleum and petroleum products. Some of them are carcinogenic and estrogenic and the source-identification of PAHs is very important. Using fingerprinting of PAHs and other biomarkers, used crankcase oil from Malaysian estuaries was identified as one major PAHs source. There are concerns of similar situations in other South East Asian countries.