Science popularization and the Indian Constitution

Excited by the on going discussion among politicians, lawyers, academicians, etc. about the review of the Indian Constitution, I browsed through the parts of the Constitution dealing with fundamental rights and duties to find out whether these have anything to do with my 'right to information' as a scientist (in the sense one who searches for new information). When it came to fundamental duties, I was surprised to see one item very specific to scientists or intelligentsia. This part [article 51A(h)] reads, (citizens have a duty) 'to develop the scientific temper, humanism and the spirit of inquiry and reform'. All other items, totalling ten under duties, are perhaps ordinarily established by finer laws or regulations. Article 51A(h) alone is of a subtle nature and seems to need inputs from governments, NGOs and voluntary groups of educated or devoted citizens (especially scientists).

This item under basic duties is of great importance to those popularizing science, since they too are trying to develop scientific temper, humanism and spirit of inquiry and reform (or modernization). In India where biased regionalism, jingoism, superstitions, etc. are practised, popularizing science and its material benefits are good ways of reform and progress. Central government institutes like National Council for Science and Technology Communication (NCSTC), National Information System for Science and Technology (NISSAT), Central Health Education Bureau, Centre for Environment Education, National Institute of Science Communication (NISCOM) and Science magazines like *Science Reporter*, *Down to Earth*, *Resonance*, *Vigyan Pragati* and many newspapers are trying to popularize science. National Science Day is observed on 28 February in memory of C.V. Raman. National Children's Science Congress is regularly organized to encourage children (10–17 years) to relate the learning of science to their immediate social and physical environment. Schools, colleges and NGOs also contribute considerably to popularization of science. CSIR laboratories are expected to organize open days for the general public during the CSIR foundation day in September. (See *Vistas in S&T Communication*, 1992, Publications and Information Directorate, CSIR, New Delhi for elaborate details on science popularization in India.) Altogether, India seems to be on the right track in science popularization.

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NEWS

Multi-faceted aspects of tree ring analysis

Tree rings are recorded in many trees growing in different geographical regions due to seasonal activity of cambium. Dating and analyses of tree rings in varied applications are categorized under a specialized branch of science dendrochronology. In the beginning, this science was applied for dating archaeological structures, but now its applications are diverse. Some are: reconstruction of long seasonal to annual climate changes which would help to understand any long-term trend or cyclicity in climatic changes, dating of onset of events which had disastrous impacts in the past (like insect infestations in trees and natural hazards), the assessment of productivity of a forest, dating of glacial fluctuations by studying growth behaviour of trees growing at higher elevations close to snout, analysis of the content of trace elements, such as Hg, Cd, Zn, Cu, Ar in tree rings to get the chronological record of pollution from industrial activities. The criteria in such studies are based on the assumption that variation in several parameters of tree rings, viz. ring width, cell sizes, density of early and late wood and others depend on variations of several factors like changes in climate, competition among trees within a forest, changes in anthropogenic activities and others which influence the physiological processes of trees. Using various statistical analysis methods it has now been possible to isolate signatures of these factors attested in tree rings and by dating these rings, onset of events and assessment of growth productivity in temporal aspect could be made.

Though, in tree ring analysis, the selection of old trees in a region is not an essential criterion, it is desirable for synthesizing long information. World's oldest growing tree, *Pinus longaeva* attaining age of 4600 years is found on moisture stressed site in Eastern California and Nevada in North America (Figure 1). In India, there are reports of many old trees growing in many sites but so far the only precisely dated tree, attaining maximum age recorded 745 years, is *Cedrus deodara* growing in Harshil, Garhwal Himalayas (Figure 2). A disc of this tree stored in Wood Museum, FRI, Dehradun has 704 rings. This tree has excellent potential for tree ring climatic studies from the Himalayan region. It has distinct clear datable, climatically sensitive tree rings (Figure 3). There are other trees like *Juniperus*, *Taxus*, *Tsuga*, which seems to be very old but exact dates of their time span are yet to be determined. In tropics *Tectona grandis* and *Cederala toona* are known to have distinct datable growth rings and they are suitable for dendrochronological studies.

An International Symposium entitled 'Multifaceted aspects of tree ring analysis' held at Birbal Sahni Institute of Palaeobotany (BSIP), Lucknow, India during 15–19 November 1999, provided a platform to discuss recent trends and developments in this discipline. This was sponsored by BSIP. A large number of delegates including 13 from abroad rep-

resenting Germany, USA, Estonia, Japan, Switzerland, Brazil, Thailand and Republic of Korea attended the Symposium. Highlights of this Symposium are summarized here.

The papers were presented in 6 technical sessions besides poster presentations. These include: Tree ring and monsoon dynamics; Tropical dendrochronology; Palaeoecology: Tree rings in natural hazards; General dendrochronology including one special session where invited papers covered both tree rings and its allied branch, ecology.

The first lecture in the special session was by Dieter Eckstein (University of Hamburg, Germany). It was on significance of tree ring analysis from the tropical trees. He pointed out the problem of dating tree rings of tropical trees and emphasized special strategies for the development of climatically sensitive tropical tree ring chronologies from these trees. The other two lectures in this session were delivered by J. S. Singh (BHU, Varanasi) on the 'Ecology of Central Himalaya' and Ashok Sahni (Punjab University, Chandigarh) on 'Scenario of palaeoecology during the collision of India-Asia'.

In the second session 'Tree ring and monsoon dynamics', G. B. Pant (IITM, Pune) stressed on the significance of tree ring data in developing high resolution climate analysis with annual to interannual scale in both temporal and spatial aspects. The other papers were on the climatic reconstruction from many regions of south-east Asia using several tree ring parameters, i.e. ring width, density of early late wood, and vessel size. Brenden Buckley (Lamont Doherthy Earth Observatory, New York) in his keynote lecture depicted potentiality of tree ring analysis from *Pinus kesiya* and *P. merkusii* of north eastern Thailand in the long climatic reconstruction. On the basis of teleconnections recorded in tree ring indices and the sea surface temperature (SST) of the Bay of Bengal and Indian Ocean, he suggested that future study may provide clues to study synoptic scale climatic variation. Nathsuda Puminjumnong (Thailand) discussed teak vessel density as an indicator of south-east Asian monsoon temperature and H. P. Borgaonkar (IITM, Pune) pointed out the significance of tree ring density parameters over ring width data of Himalayan conifers for the reconstruction of premonsoon climate.

The third session dealt with 'Tropical dendrochronology' where problem and prospects of tree ring analysis from tropical trees were discussed. The theme was focused on India, Laos and Brazil.

In the fourth session 'Tree rings in natural hazards', K. F. Kaiser (Switzerland) gave a keynote lecture on the application of tree ring data in dating of debri flow. He presented debris flow chronology based on the dating of *Pinus mugo* of the Multetta debris fan, Val Müstair, eastern Swiss Alps. In another presentation Terutaka Katoh (Japan) discussed the prospect of using tree ring width of *Cryptomeria japonica* in analysing temporal snowfall variation.

In session five on 'Palaeoecology', Kaiser in his another keynote address presented a long record of fine resolution climatic changes during Bölling and Allrøid period of late glacial time based on tree ring proxy data and it was compared to other proxy records derived from marine and ice cores. In two other presentations in this session, J. S. Guleria and A. Rajanikanth (BSIP) discussed the significance of tree ring analysis in fossil woods in terms of wood productivity, climatic inference and palaeolatitudinal position of Indian sub-continent.

Session six was on 'General dendrochronology'. Won-Kyu Park (South Korea) in his key note lecture discussed reconstruction of May precipitation back to AD1731 of his country based on ring width data of *Pinus densiflora* and pointed out the prospect of extending this record far back by adding data from timbers used in old buildings. In another

Figure 1. World's oldest growing tree, *Pinus longaeva* (4600 years) in Eastern California and Nevada, North America (Photograph courtesy of H. C. Fritts, University of Arizona, USA).

Figure 2. *Cedrus deodara*, an oldest dated tree in India (745 years), growing in Harshil, Garhwal Himalayas.

Figure 3. Tree rings of *Cedrus deodara*.

lecture, Osamu Kobayashi (Japan) presented data indicating implications of tree rings in climatic reconstruction of Nepal. The last lecture in this session was by Achim Braüning (Germany) who discussed about the reconstruction of different seasonal aspects of climate of Tibet using several tree ring parameters and also from several trees like *Pinus*, *Abies* and *Juniperus*. This multi-seasonal climatic information would be useful to build up the synoptical weather condition for understanding wind system dynamics and monsoon variability in south-east Asia.

In the poster presentations, Seiji Ishibashi (Japan) displayed tree ring data in application to forest management. He described a new methodology to reconstruct diameter distribution of past broad-leaved forest. Vandana Chaudhary (BSIP) discussed tree ring analysis of *Larix griffithiana* from Sikkim and Arunachal Pradesh in reconstructing May temperature. A. Bhattacharyya (BSIP) presented tree ring data of *Abies pindrow* to date the glacial advancement of recent past around Dokriani Bamak Glacier, Garhwal Himalaya.

It has been proposed to publish proceedings of this Symposium in a special volume of *The Palaeobotanist*.

Since teak is established as the most potential tree for the dendrochronological studies from the tropical region, a field trip was undertaken to Madhya Pradesh to study teak forests at Delavari and other sites.

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C. N. R. Rao elected to French Academy

C. N. R. Rao, Linus Pauling Research Professor of the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, has been elected as Foreign Member of the prestigious Academy of Sciences of France. The French Academy is an exclusive body of 65 members and Rao is the first Indian scientist to be elected. Rao, one of India's most acclaimed scientists, is a member of all the major science academies of the world, such as the Royal Society (London), US National Academy of Sciences, Russian Academy, Japan Academy, Academie Europea, the Pontifical Academy (Vatican) and the American Philosophical Society. Rao will receive the honour in Paris at a special function to be held on 19 June 2000.