

# On life, lignin and *Leucaena*

Brian Lowry

Institute records probably show that the writer holds some sort of record for inactive expatriate membership. However retirement from employment of the last two decades induces reflection, and it occurs to me that the following synopsis may be of interest. Most is a long way from forestry in New Zealand. I have the temerity to offer it only because of the diversity that I have seen and enjoyed in the pages of the *New Zealand Journal of Forestry*.

I was admitted to NZIF as a full member in 1975 when I was working full time in FRI Rotorua as editor of the N.Z. Journal of Forestry Science. Although I did have a childhood at Tuai on the edge of the Urewera, I arrived at FRI via the non-obvious pathway of lecturing in chemistry at the University of Malaya in Kuala Lumpur. True, I did have modest editorial experience, but this arose in a negative way. When the university proposed to float an international journal, I argued against it, but being the only one in the department with an opinion, I was drafted as editor. Perhaps more relevant was that I had freedom for research and had become totally absorbed in tropical forest matters. Forest highlights of this period included the discovery of a new species of Citrus, found on a walk in which the other half of the party got lost in the montane forest overnight. Although "new" within the most restricted definition of the genus, the tree (it grew to 25 m) had been previously collected by colonial foresters who did not have time to worry about non-timber species.

My happily free-ranging natural product research made me aware of an immense potential and actual variety of non-wood forest products. A paper on Melaleuca oil got published in Nature by being able to conclude with the phrase "... thus solving a 300-year-old mystery of the spice trade". Young-leaf colour and other aspects of tropical forest plants were the subject of both research and speculation, so that the full autobiographic narrative is being titled "Pigments of the Imagination". During this time I became married. Grace comes from Sarawak, but I met her by another non-obvious pathway; home leave in New Zealand where she was a Colombo Plan student. Although piling up lots of research papers the future outlook in University of Malaya was not promising for an individual expatriate. Recruitment to FRI followed an interview with Tony Beveridge revisiting his old haunts at FRI Kepong, outside K.L

It was a wrench leaving research, but good to be back in New Zealand and to grapple with the many facets of forest science. Initially I was set on the right path by the late Hugo Hinds and the redoubtable Judy Griffith. Being editor of NZJFS could have been lonely - one was hardly likely to be popular, but most did not want to offend either. It was, however enjoyable. FRI was a great place to work, with great personalities. Working on papers from Rowland Burdon, Bob Fenton, Wink Sutton and many others was each a distinctive experience. On the

Photo 1: The author with his favourite tree legume, *Albizia lebbbeck*.



side I became interested in the unique contribution improved fuelwood utilisation could make in New Zealand. I published some articles, and built some odd devices; some of which continued operating after I left. I closed that book firmly when we went to the tropics. Twenty years on, and there is new talk of wood gasification, and a quick look at the Web suggests not much has changed and that massive improvements in fuelwood utilisation are still possible.

Peripheral activities included chairing the local branch of Forest and Bird during some tense times, including surviving the occasion when our AGM was supplemented with two bus loads of new members from Minginui. It did not occur to me to wonder if I had been at school with any of them in Tuai. Even more peripheral activities included starting the Rotorua branch of Hash House Harriers; an allusion that may be intelligible to some. In the event HHH went from strength to strength, in recent years hosting an international gathering of several thousand in Rotorua.



Photo 2: Canopy effect of *Albizia lebbbeck*; thick green *Panicum maximum* below the canopy, mature spear grass of low feed quality outside it.



One day in 1979 I saw an advertisement in Nature for a "Feed Chemist" in a major new Indonesian - Australian animal research institute, a development assistance project being managed by CSIRO. It must have been the only professional application that included "Joint Master: Kuala Lumpur Hash House Harriers" in the cv. Neither that nor having to reinvent myself as an animal nutritionist seemed to perturb the panel that convened below the august frowns of past CSIRO heads on the top floor of CSIRO HQ in Canberra.

So we left Rotorua and FRI at the end of 1979. Little did one imagine the turbulent later course of N.Z. forestry and science. One kept in contact in various ways. Oddly enough, not long afterward my sister Barbara Hedley became editor of New Zealand Forest Industries. The move to Indonesia was a big jump for the family, good to be back in the tropics, and the official status not unattractive after being an unaffiliated lecturer in Malaysia. I was promoted to program leader before I got there, and had extraordinary resources on first arrival. This turned out to be a high point as the entire project was reviewed soon after and the Australian input reduced.

One highlight involved the multipurpose tree legume, *Leucaena leucocephala*. This was being actively promoted for pulpwood, fuelwood, soil improvement and animal feed. However the feed use was constrained by a major toxicity problem that was very patchy in its occurrence. We showed that Indonesian village animals did not have this problem. In a heroic experiment both animals and leucaena were flown from Australia (initiated from there, where it really was a problem). We showed quite dramatically that toxicity could be solved by transferring rumen microbes from immune animals to non-adapted ones. Thus a development assistance project in Indonesia solved a problem in the donor country, Australia. It worked so well with widespread planting of leucaena that it now gets into the news only as a woody weed.

Also interesting was work on swamp sago. Here we have a natural palm forest community capable of being managed to yield starch at the rate of 12 tonnes/ha/year. Our contribution was to find that large amounts of free sugar were present in sago stems, but are lost during processing for starch recovery, suggesting some different utilisation strategies.

A fascinating aspect was to find two exotic species introduced for plantation forestry becoming adapted into village farming systems, with all conventional forestry operations having their counterpart on a village basis. *Albizia falcataria* is well known as a fast-growing hardwood, *Maesopsis emenii* perhaps less so. Both are planted in the complex mixed garden system of West Java. There is a high pruning to 10 m or more by someone skinning straight up the stem, producing a clear log that is eventually felled and pit-sawn on the spot for local house construction. The key factor is that the pruning is done by a villager who gets to feed the green branches to his animals.

We finally left Bogor at the end of 1984, my having long expended the leave without pay granted by NZ Forest Service. I stayed with CSIRO, moving to Townsville in North Queensland. In grappling with the problems of cattle nutrition in the dry-season tropics I became fascinated with the tree legume, *Albizia lebbbeck*. This species has an extremely valuable heartwood, marketed in Europe as "East Indian walnut", but in Australia it was known only as a street or shade tree, although native in the monsoon forests of the north. I became increasingly aware of its multiple feed value. It was not just green browse. From large trees, leaf flower and pod fell sequentially during the dry season and were all good feed, while isolated trees actually promoted the growth of pasture below the canopy. We published on the latter feature to general disbelief. After all, everyone knew that trees (i.e. pines or eucalypts) inhibited grass. However a string of African publications have now made this feature of certain species, not all legumes, respectable as the "savanna effect". The implications for purposeful agroforestry are obvious, but were not followed because of a restructuring.

Transfer to Brisbane, with an admonition to shelve my tree interests, had me working on forage fibre chemistry. The project, to develop bacteria better able to digest fibre, probably originated because of the success of the leucaena detoxification. Although nutritionists knew lignin was important in reducing the digestibility of forages, little work had been done on its chemistry compared with that in wood and pulping science. John Ralph, once at FRI Rotorua, was one of the few expert chemists to switch from wood to forage lignin. Most nutritionists concerned themselves simply with the amount present. It was measured by a cell wall fractionation method that would have seemed rather strange to wood and paper chemists. On commencing this work I was staggered to discover that this method grossly underestimated lignin in tropical grasses. The

prescribed pre-treatment removed two-thirds of the original lignin before you even tried to measure it!

Publishing that was facilitated by a U.S. group finding the same thing shortly after. This period at least got me to an APPITA conference! Various interesting consequences followed from realising that a lot of forage lignin is semi-dispersible, but that's another story.

Another restructure and I was able to initiate a new project, funded by the Rural Industries R&D Corporation, that got back to trees, and this time invoked some forestry concepts. The earlier results on *Albizia lebbeck* suggested in fact a new agroforestry system for the semi-arid tropics. Appropriate species could be grown at wide spacings in pasture to increase grazing animal production, but managed in the right way they could also yield timber that would have a small volume, high value market. What's more the cost of pruning and thinning could be offset by the feed value. Gathering data from existing trees in a variety of situations suggested several candidate species. Most showed good volume increments and it looked as though one could harvest at about age 20. When it came to my favourite, *Albizia lebbeck*, it was a nasty shock to do some coring and find that the sapwood to heartwood conversion took about eight years. A 20-year old stem was still mostly sapwood.

However this suggested a unique management option. It is an accepted practice in parts of Australia for graziers to lop native fodder trees for drought feeding, a practice that declines with the number of remaining trees. It is a biological fact that removing large amounts of a tree crown will hasten the conversion of sapwood to heartwood. We know that *Albizia lebbeck* and the other candidate species regrow vigorously after lopping. Thus in our new agroforestry system, from say age 20 one carries out savage lopping, as needed over a few years, for drought or dry season feeding. In the process one converts sapwood to heartwood. A case of "adding value but not volume". Alas, this idea has yet to be tested in practice.

A final flourish before retiring from CSIRO was to extend my agroforestry ideas to management of the "dry rain forests" that are a feature of much of Australia. The key element here is to take seriously recent findings that Australian vegetation was drastically changed around the time of first human settlement 40 k years ago. The role of humans, hunting, fire and climate is hotly disputed but hardly matters. Evidence is that the non-sclerophyll trees of interest can do well over much larger areas than their present range, suggesting the valuing and promoting of existing remnants. I modestly called this the "Return to Eden" hypothesis. Some people like it!

Why keep up membership in NZIF throughout all this? Well one motive might have been just to claim to be a forester in cases where it was a good conversation stopper, particularly with pasture scientists. More to the point I suppose was that there was always the chance one might come back to New Zealand and anyway I enjoyed keeping some awareness of the profession and its people. Long may they prosper!

## 2003 NZIF Awards

The recipients of the 2003 NZIF Awards were announced at the 2003 ANZIF Conference Dinner in Queenstown. There was strong interest in these awards with eight applications for the Undergraduate Scholarship and seven applications for the two travel awards.

### Scholarships

**Yvette Dickinson** received the NZIF Undergraduate Scholarship. Yvette is a fourth year Bachelor of Forestry Science Student at the University of Canterbury. During her study last year she received the MR Jacobs prize in Silviculture. Yvette assisted the dedicated team who put together the ANZIF Conference Proceedings.

The Frank Hutchinson Post Graduate Scholarship was awarded to **Bryan McKinley** from Hawkes Bay. Bryan is undertaking forestry related postgraduate study through Lincoln University.

The Mary Sutherland NZ Polytechnic Scholarship was awarded to **Arran Lang** of Rotorua. Arran is a second year Diploma of Forestry student at Waiariki.

### Travel Awards

The Chavasse Travel Award went to **John Moore** of Forest Research, Christchurch. John plans present a paper titled "Wind Damage in Alternative Silviculture Systems" at the 5-yearly IUFRO Conference on "Wind Effects on Trees" in Germany in September. John returned to NZ after completing his PhD at Oregon State University last year.

The Balneaves Travel Award was awarded to **Bill Dyck**. Bill works as an independent Science and Technology Broker. He plans to use the award for travel to arrange an international research programme on Pine Pitch Canker. Pine Pitch Canker is potentially a serious treat to New Zealand's radiata pine forests. Bill has already committed his own time to this project. Earlier in the year a joint FOA/MAF workshop reinforced the need for further research on Pine Pitch Canker.

As part of the travel award both John Moore and Bill Dyck have agreed to inform members about the outcomes from their travel by writing articles for the Journal. The Institute looks forward to hearing more from them in future issues.

**Paul Lane**