



# Forestry Department

Food and Agriculture Organization of the United Nations

## Forest Plantations Working Papers

### *ANNOTATED BIBLIOGRAPHY ON ENVIRONMENTAL, SOCIAL AND ECONOMIC IMPACTS OF EUCALYPTS*

Compilation from English, French and Spanish Literature

Between 1985-1994

Revised (Combined) Edition

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For further information, comments or feedback please contact:

Mr. Jim Carle, Senior Forestry Officer (Plantations and Protection),  
Forest Resources Development Service  
Forest Resources Division  
Forestry Department  
FAO  
Viale delle Terme di Caracalla  
I-00100 Rome (Italy)  
e-mail: [Jim.Carle@fao.org](mailto:Jim.Carle@fao.org)

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FAO (2002). Annotated bibliography on environmental, social and economic impacts of Eucalypts (Spanish Version), Forest Plantations Working Papers, Working Paper 16. Forest Resources Development Service, Forest Resources Division. FAO, Rome (*unpublished*).

This Working Paper is based on information originally published in three separate annotated bibliographies (FAO 1995). These covered, respectively, English, French and Spanish language literature. The original documents, which are still frequently requested, are presently out of print. Rather than re-printing the three documents, it was decided to assemble the information under one cover to facilitate access and use. While the format and style in this new Working Paper have been streamlined, the annotations are maintained in the original language.

The present Working Paper is complemented by Working Paper 17, in which an attempt was made in October, 1999 to further up-date the information in the subject, targeting a meeting on the environmental effects of species of the genus *Eucalyptus*, held that year in Mexico City.

We are aware of the fact that the documentation contained in Working Papers 16 and 17 is far from complete. We would much welcome comments and additional inputs and references.

## FOREWORD

FAO Forestry Paper no. 59 "The ecological effects of Eucalyptus" (1985) included an extensive bibliography concerned mainly with the environmental effects of *Eucalyptus* spp. plantations. Since then there has been an enormous output of studies published on the impacts of plantations of the eucalypts, with more emphasis on their social and economic as well as their ecological effects.

This annotated bibliography was prepared to update that produced in 1985 and to include references to the social and economic impacts of *Eucalyptus* spp. plantations. It was originally drafted for the expert consultation on *Eucalyptus* held in Bangkok in October 1993 by Mr Shyam Sunder, who prepared from it an overview of the environmental, economic and social effects of *Eucalyptus* plantations for the consultation.

It is hoped that foresters and others concerned with *Eucalyptus* spp. plantations in the tropics and sub-tropics will find it a useful list. Those with access to CAB Abstracts or the AGRIS database may find some references from other sources that are new to them, but the main target audience consists of foresters who do not have access to computer-aided data retrieval systems who can use this list to request publications referred to here.

The literature references were collected by Mr. S. Sunder Ms. Laura Russo (English literature: CD Rom, CAB, AGRIS, universities, research institutes, forestry departments and FAO libraries), Ms. C. Duhem (French literature : CAB, PASCAL, AGRITROP, SESAME, VELLEDA, CAB and AGRIS) and Mr. S. Bará Temes (Spanish literature: CAB, AGRIS).

In instances when the bibliographic researchers did not have access to original literature, they referred to the abstracts.

## LIST OF ACRONYMS

<b>AFRI</b>	Forest management and Industrial Reforestation, France (Aménagement forestier et reboisement industriel)
<b>AFNOR</b>	French Association for normalization (Association française de normalisation)
<b>APREFA</b>	Association for the Promotion of Teaching and Training, France (Association pour la promotion de l'enseignement et de la formation, France)
<b>ARMEF</b>	Forestry mechanisation Annals (Annales de Mécanisation Forestière, France)
<b>CATIE</b>	Tropical Agricultural Research and Higher Education Centre
<b>CEE</b>	European Economic Community ( Comunidad Económica Europea)
<b>CEASA</b>	Cellulose Company of Asturias, Spain (Celulosas de Asturias, España)
<b>CIDA</b>	Canadian International Development Agency
<b>CIEF</b>	Forest Use and Research Centre, Argentina (Centro de Investigación y Explotación Forestal, Argentina)
<b>CIRAD</b>	International Cooperation Centre in Agronomic Research for Development, France (Centre de Coopération Internationale en Recherche Agronomique pour le Développement)
<b>CNEARC</b>	National Centre for Agronomic Studies of Warm Regions, France (Centre National d'Etudes Agronomiques des Regions Chaudes)
<b>CSIRO</b>	Commonwealth Scientific & Industrial Research Organisation
<b>EMBRAPA</b>	Brazilian Enterprise for Agriculture and Animal Research)
<b>ENGREF</b>	National School of Rural issues, Water and Forests ( Ecole Nationale du Génie Rural des Eaux et des Forêts)
<b>EPPO</b>	European and Mediterranean Plant Protection Organisation
<b>FORSPA</b>	Forestry Research Support Programme for Asia and the Pacific
<b>GTZ</b>	German Technical Cooperation
<b>HDEP</b>	High Density Energy Plantations
<b>HPLC</b>	High Performance Liquid Chromatography
<b>ICFRE</b>	Indian Council of Forestry Research and Education
<b>IDRC</b>	International Development Research Centre, Canada
<b>INIA</b>	National Institute of Agrarian Research, Spain (Instituto Nacional de Investigaciones Agrarias )
<b>IPEF</b>	Research and Forest Studies Institute (Instituto de Pesquisas e Estudos Florestais)
<b>INGAR</b>	Institute for Development and Design, Argentina
<b>INRA</b>	National Institute of Agronomic Research, France (Institut National de la Recherche Agronomique)
<b>INRENARE</b>	National Institute of Renewable Natural Resources (Instituto Nacional de Recursos Naturales Renovables)
<b>IPPTA</b>	Indian Pulp & Paper Technical Association
<b>IUFRO</b>	International Union of Forest Research Organisations
<b>KEFRI</b>	Kenya Forestry Research Institute
<b>KFRI</b>	Kerala Forest Research Institute, India
<b>MANFLOR SYSTEM</b>	Forest Management system, Brazil
<b>NFTA</b>	Nitrogen Fixing Tree Association , USA
<b>NATO</b>	North Atlantic Treaty Organisation
<b>NRI</b>	Natural Resources Institute , U K.
<b>PICOP</b>	Philippines Integrated Company of Paper Products
<b>UAIC</b>	Industrial Afforestation Unit of Congo

**UNDP** United Nations Development Programme  
**USDA** United States Department of Agriculture  
**UCCAO** Union of Western Cooperatives, West Africa (Union des coopératives de l'Ouest)

## LITERATURE REFERENCES (ALPHABETIC BY AUTHOR)

- Abouelkhair,-KS. 1993. Effect of zinc on the growth and mineral contents of *Eucalyptus camaldulensis* seedlings grown in a sandy soil containing vesicular arbuscular mycorrhizae spores. *Alexandria Journal of Agricultural Research*. 1993, 38: 1, 243-255; 14 ref.** In the context of the use of industrial waste water for irrigation, a greenhouse study was conducted. The results indicate that irrigation water containing Zn levels up to 160 mg/litre could be used without harmful effects on the growth of *Eucalyptus camaldulensis* seedlings grown in a nursery soil containing spores of vesicular-arbuscular mycorrhizas.
- Abouelkhair,-KS. 1993. Influences of NH<sub>4</sub>/NO<sub>3</sub> ratios and pH on the growth and mineral contents of *Eucalyptus camaldulensis* seedlings grown in sandy soil containing vesicular arbuscular mycorrhizas. *Alexandria Journal of Agricultural Research*. 38: 1, 257-269; 14 ref.** A greenhouse pot experiment was conducted on one year old seedlings of *Eucalyptus camaldulensis* grown in sandy soil containing vesicular arbuscular mycorrhizas (*Acaulospora laevis*, *A. trappei* and *Gigaspora tricalypta*), and treated with different ratios of NH<sub>4</sub>/NO<sub>3</sub> (resulting in a pH range of 3.1-9.8).
- Adams,-MA. 1992. Phosphatase activity and phosphorus fractions in Karri (*Eucalyptus diversicolor* F. Muell.) forest soils. *Biology and Fertility of Soils*. 14: 3, 200-204; 31 ref.** Phosphatase activity and phosphorus fractions are described for recently burnt, undisturbed and logged Karri (*Eucalyptus diversicolor*) forest soils in Western Australia.
- Adegbihin-JO, Igboanugo-ABI, Omijeh-JE. 1990. Potentials of agroforestry for sustainable food and wood production in the savanna areas of Nigeria. *Savanna*. 11:2** Use of *Eucalyptus* spp. in the savanna region of Nigeria under silvo-pastoral systems and as shelterbelt is discussed. The need for increased production of firewood is stressed.
- Adkoli N.S. 1992. Social or industrial forestry; industry's view. in: Calder, IR; Hall, RL, Adlard, PG (eds). *Growth and water use of forest plantations*. 381 pp, Wiley & Sons, Chichester.** Some of the basic needs of the Society depend on forest based industries. Industrial forestry is a necessity.
- Adlard P.G, Kariyappa GS, Srinivasula NV. 1992. Spacing at planting of short rotation *Eucalyptus* in Karnataka. in Calder, IR; hall, RL; Adlard, PG eds. *Growth and water use of Forest Plantations*. 381 pp, Wiley & Sons, Chichester** Maximum volume increments occurred in higher densities with some evidence of maximum at 2500 to 3000 stems/ha at the age of 4 years. Mean stem diameter was 3 times greater at widest spacing compared with the closest.
- Adlard P.G. 1992. Research strategy for monitoring tree growth and site change. in: Calder, IR; Hall RL; Adlard PG, eds. *Growth and water use of Forest Plantations*. 381 pp, Wiley & Sons, Chichester.** There are contradictory data regarding effectiveness of eucalypts or otherwise in controlling soil erosion. The cause of erosion, where noticed, is more due to the management systems such as harvesting on very short rotation. Long rotations maintained growth and soil conditions. Reduction of productivity is inevitable with successive short rotations.

- Adlard,-PG. 1987. Review of the ecological effects of Eucalyptus. 59 pp.; 35 pp. of ref. Oxford, UK; Oxford Forestry Institute, Department of Plant Sciences, University of Oxford.** The *Eucalyptus* controversy is discussed in relation to social and psychological considerations, water use and effect on the hydrological cycle, effects on soil nutrients and structure, effects on crops and other trees, and effects on wildlife. Guidelines are given for effective use of eucalypts. An annotated bibliography is included.
- Agarwal. A, Neelay VR 1986. Effect of age on pulping characteristics and economy of Eucalyptus. Journal of Tropical Forestry, March 1986** Younger wood is superior for pulp with better strengthened qualities. Requirement of chemicals for cooking and bleaching is less.
- Agnihotri-Y, Mishra-PR, Sadhu-Sing, Singh-S 1989. Economics of reducing rotation in Eucalyptus hybrid. Indian-Journal-of-Forestry, 12:2.** Growth data are reported from plantations of *Eucalyptus* spp. hybrid established in Chandigarh in 1974. The study included planting of different size seedlings varying from 1 m to 3 m height. By adopting proper planting methods (pits-vs.-trenches) and plant size, the rotation cycle can be reduced.
- Alexander MJ. 1989. The long term effect of Eucalyptus plantations on tin-mine spoil and its implication for reclamation. Landscape and Urban Planning, 7,1.** As part of the reclamation strategy for tin-mine spoil, *Eucalyptus* spp. plantations (mainly *Eucalyptus camaldulensis*) were established on reclaimed sites. The results indicate that even after 20 years since establishment the plantations have had little impact on the morphology of the soils. If slash produced during coppicing of the plantations is left to decompose *in situ*, it may help to reduce long term deterioration of the soil.
- Alfaro-Murillo,MA.(Etude de cas sur la rentabilité et l'utilisation optimale des ressources en plantations forestières au Costa Rica) Estudio de caso sobre la rentabilidad y uso óptimo de recursos en plantaciones forestales en Costa Rica. CATIE, Turrialba. 1990. 162 pp.** (In Spanish).
- Allolli-TB; Nalawadi-UG; Sulikeri-GS 1988. Influence of different forest tree species on yield and yield attributes of Coorg mandarin. Myforest, 24:4.** Fruit yield of Coorg mandarin mixed with *Casuarina* spp., *Eucalyptus* spp. hybrid and siland silver oak was studied. Compared with the control, fruit yield was slightly greater in trees interplanted with *Casuarina* spp., lower with those planted under silver oak and very low with those planted under *Eucalyptus* hybrid. Soil organic carbon and moisture contents were lower under *Eucalyptus* spp.
- Almeida-AP-de; Riekerk-H; De-Almeida-AP. 1990. Water balance of Eucalyptus globulus and Quercus suber forest stands in south Portugal. Forest-Ecology-and-Management. 38: 1-2.** Two watersheds in Alentejo were studied. One-6-ha watershed contained scattered indigenous cork oak with a newly developing understorey of shrubs. An adjacent 19-ha watershed contained a mature *E.globulus* stand which was harvested for the study. Analyses of water balances showed no difference in monthly evapotranspiration between the two vegetation types during the pre-treatment period. The 11 mm/month reduction in evapotranspiration for the harvested eucalypt watershed lasted for only 3 months. After this period the regenerating eucalypt coppice matched water use of the oak stand and appeared to exceed this by 4 mm/month at the end of the drought cycle.

Harvesting increased first-year runoff only by 4mm and second year runoff by 36mm after soil water recharge by heavier rainfall.

**Alonso, M; Bará, S. 1989. *Análisis comparativo del contenido de ácidos fenólicos libres en hojas y hor. A<sub>0</sub> de suelos de E. globulus, P. pinaster y Q. robur. Com. INIA. Serie: Recursos naturales, n° 48. 47 pp. Madrid.*** Free phenolic acids were measured in fresh eucalypt, oak and pine leaves, as well as on A<sub>0</sub> soil layer, through HPLC. Eucalypt leaves showed the highest acid content, particularly galic acid. A<sub>0</sub> soil layer in the three species showed lower contents and no significant differences were found among them.

**Alvarenga-SC-de. 1976. *Economic study of the optimum time for felling eucalypts in the conditions of the Zona da Mata (forest zone) of Minas Gerais. Revista-Ceres., 23: 125.*** A study was made of the optimum length of the first and second rotation for coppice stands of *Eucalyptus* spp. grown for pulpwood on slopes unfit for agricultural purposes in this zone. The analysis is based on the theory of capital, and several possible rates of interest are considered. The general conclusion is that planting *Eucalyptus* spp. is not profitable in the zone unless highly productive fast-growing species are used.

**Alvarez Rodríguez, E.; Martínez Cortizas, A.; Veiga, A. 1992. *Composición iónica de la disolución de suelos de Galicia: Relación con el tipo de cubierta arbórea y el material de partida. Ecología, 6: 17-27. ICONA. Madrid.*** A study was made to assess the influence of *Quercus robur*, *Pinus radiata* and *Eucalyptus globulus* on ionic composition of soil dissolution developed on schist and granite. Mean values showed lower pH in soil dissolution under *Quercus robur* (4,96) compared to *Eucalyptus globulus* (5,14) and *Pinus radiata* (5,44). The two latter species showed lower pH on granite, while higher acidity is associated to schist in soils planted with oak. There is no clear influence or relation between the vegetation type and the ionic concentration of calcium, magnesium, potassium and sodium. The concentration of ammonium ion, nitrate and sulphate is higher in soils where oaks grow.

**Amatya-SM .1985 . *Renewable energy resource for rural development: a case study of Churiamai Village Panchayat. Nepal Forestry Technical Information Bulletin, Forest Research and Information Centre, Forest Survey and Research Office, Department of Forests, Nepal. No.11.*** The results are summarised from trial fuel plantations established in an area with insufficient fuelwood supply. Growth of 5 species of *Eucalyptus* and of the indigenous species *Dalbergia sissoo* was compared. At 3 years age all the *Eucalyptus* spp. had grown better than *Dalbergia sissoo* although there was a large variation between them.

**Amphlett-MB. 1990 . *A field study to assess the benefits of land husbandry in Malawi. in Soil erosion on agricultural land. Proceedings of a workshop sponsored by the British Geomorphological Research Group, Coventry, UK, January 1989.*** Four small catchments very similar except in land use were monitored during 4 rainy seasons for rainfall, runoff, soil loss, NPK losses, soil moisture and crop cover. The land use systems were: a land use plan according to land husbandry manual; intensive uncontrolled arable farming; physical conservation works but no planned land use; and a *Eucalyptus* spp. plantation. Following the recommended procedures for land management reduced erosion and runoff nearly to the levels found under eucalypts.

- Anderson-H.,1952. *The tannins of certain eucalypt species and Pinus radiata. Journal of the Society of Leather Trades' Chemists, Croydon 36(7).*** An extract prepared from a mixture of *E. sieberiana*, *E. baxterii*, *E. yangoura*, *E. consideriana* and *E. obliqua* is characterised by 60 percent tannin content and very high acidity.
- Anon. 1983. *Fast-growing trees. Proceedings of the IUFRO symposium on genetic improvement and productivity of fast-growing forest trees. Aguas de Sao Paulo, Brazil. 25-30 August 1980. Silvicultura, Brazil, 8:31, 8:32. summaries in en.fr. es.*** The Third and the fourth of 4 special issues. The third issue includes papers from sessions on exploration, conservation and variation of *Eucalyptus grandis* (12 papers); provenances collected and provenance tests in other *Eucalyptus* spp. (35 papers); selection and improvement methods for eucalypts (18 papers), and silviculture and yield in fast-growing *Eucalyptus* spp. forests (11 papers). The fourth issue includes papers on fertilization responses of eucalypt plantations (7 papers); evolution of short rotation ecosystems (9 papers); nutrient cycling and physiology of *Eucalyptus* spp. (8 papers); national, regional and international cooperation (20 papers); management of eucalypts for seed production - hybridisation in *Eucalyptus* spp. and vegetative propagation (23 papers); wood quality of fast-growing trees (effects of species, provenance and cultural treatments on wood properties) (11 papers).
- Anon. 1948. *Artificial regeneration for the preservation of our forest reserves. Brasil madeireiro 4 (41).*** Presents a comparison of costs for creating and maintaining *Eucalyptus* spp. stands for charcoal with the profits obtained from the product. A list of 10 *Eucalyptus* species and the nature and amount of by-products obtained during charcoal manufacture are included.
- Anon .1984. *Workshop on Eucalyptus plantation - Papers and proceedings. Indian statistical Institute, Bangalore-I.*** Papers and proceedings of the workshop on *Eucalyptus* spp., held in June 1984. Fifteen papers dealing with social and ecological aspects of eucalypts are included.
- Anon .1992. *ITC Bhadrachalam paper boards - in the service of farmers. ITC Bhadrachalam Paper Boards, Secunderabad.*** The brochure details the assistance and the technical extension services provided to the farmers by the company to promote *Eucalyptus* spp. planting. Seedlings made available to the farmers yield 20 m<sup>3</sup>/ha year at 3 years age in rainfed condition.
- Anon. 1987. *Energy plantations for marginal and problematic lands in Pakistan. FAO, Bangkok.*** In Pakistan, nearly 3 million ha. of canal commanded area is affected by salinisation. *Eucaplyptus* spp. are some of the most successful species planted in these areas. The importance of these plantations as a source of fuelwood is highlighted.
- Anon. 1990. *Eucalypts in Portugal : Visions of sustainable development. Instituto Nacional de Ambiente.*** An overview on the use of *Eucalyptus* spp. in forestry in Portugal.
- Anon. 1989 *Proceedings of the first Cuban Forestry Congress and International Symposium on Agroforestry Techniques. Novembre 1989. I Congreso forestal de Cuba y Simposio internacional sobre técnicas agroforestales: Memorias, Noviembre 1989. 215 pp. Habana, Cuba; Centro de Información y Documentación Agropecuario***

(CIDA).

Two out of ten papers presented at the Forestry congress specifically deal with eucalypts: 1) furniture production from tropical timber (*Eucalyptus saligna*, *Pinus caribea* and *Cedrela odorata*), 2) tannin extraction from the bark of 5 species (3 *Pinus* spp., *Casuarina equisetifolia* and *Eucalyptus saligna*). The three papers from the symposium deal with agroforestry systems in Cuba. (In Spanish).

**Anon. 1947. Railway Forest plantations. Brasil madeireiro 3(24).** Practices to be followed in establishing *Eucalyptus* spp. plantations in Brazil are briefly set out with an estimate of costs. The plantations are destined to provide the railways with wood for fuel, sleepers and posts. Species most suitable for fuel are *E. saligna* and *E. alba*, while *E. citriodora* and *E. alba* are recommended for sleepers and posts.

**Anon. 1948. Pole plantations in Bechuanaland. Rep. For. Dep. Bechuanald. (1-3).** Successful pole and fuel production from *Eucalyptus* spp. plantations is discussed.

**Anon. 1949. Extractives of wood. Rep. For Prod. Aust. 1948-1949** An unexplored source of tanning is the Kino in *Eucalyptus marginata*. It may be possible to extract it from Jarrah waste.

**Anon. 1952. Report on Madagascar., 1st Conf. for interafric., Abidjan (521-44).** Rehabilitation of the degraded forests is discussed. It recommends the summer rainfall species from the northern territory of Australia.

**Anon. 1954. Eucalypts for afforestation. FAO For. & For. Prod. Stud. No.11.** A monograph on *Eucalyptus* spp. with details covering individual species most useful for afforestation. Management of plantations and use of eucalypts in farm lands are detailed.

**Anon. 1957, Mem. Com. Nac. Eucalipto, Madrid. Report for 1957.** The report consists of two parts: (1) The work carried out by the Spanish National Eucalyptus Commission, including five-year work and research plans and a review of the present situation and future possibilities in 10 provinces, and (2) The Spanish legislation governing the cultivation and exploitation of *Eucalyptus* spp. and an updated list of Spanish publications.

**Anon. 1961. Second World Eucalypts Conference, Sao Paulo, Brazil, 13-26 August 1961. Supplement to the Australian National Statement. Bibliography on Eucalyptus 1956-1961, 42 pp. CSIRO and Forestry and Timber Bureau, Canberra.** Papers contributed to this topic include: Rutin content of leaves of *Eucalyptus macrorrhyncha* from Argentina (H.M. Valente (Span) (cf.F.A. 26 No. 1551); Essential oils of *Eucalyptus* spp. (M.P. Feereirinha (Port)) (a background paper); eucalypts oil as a fly repellent in chicken feeds containing sugarcane molasses (T.Texeira Mendes (Port) and the usefulness of *Eucalyptus* spp. for apiculture (G.Ladislau (Port)).

**Anon. 1980. Lesotho's Woodlot Project serves the need of a nation. South-African-Forestry-Journal. No.112.** The Woodlot Project was set up in 1972 to plant copses of trees to provide fuelwood and poles. About 2500 ha have been planted, exclusively on the western low altitude side of the country, which is the main inhabited area. The trees are 90 percent eucalypts and 4 percent black wattles, with an anticipated rotation of 12 yr.

- Anon. 1981 *Eucalypts for planting. FAO Forestry Series.*** A very useful comprehensive publication.
- Anon. 1983. *Proceedings of the panel discussions organised by the Economic and Planning Council of Karnataka on the subject of eucalypts. Government of Karnataka.*** The leading critics of eucalypts were invited to present their case on ecological and socio-economic issues. After analysing these the Council came to the conclusion that raising *Eucalyptus* spp. hybrid in marginal agricultural or degraded land, had neither negative ecological nor socio-economic impacts. On the contrary, considering the acute shortage of tree cover and the deficit of firewood, tree planting with eucalypts in the drought prone zone was to be welcomed.
- Anon. 1985. *Environmental impact of Eucalyptus plantations with special reference to Eucalyptus camaldulensis in the Socialist Republic of the Union of Burma. Bulletin F.R.I. Yezin, Burma.*** In Burma none of the ecological effects of *Eucalyptus* spp. reported in some of the other countries have been observed.
- Anon. 1986. "Gums" for soil conservation. Streamland No.47.** The use of *Eucalyptus* spp. for soil conservation is discussed. The species shown to be most suitable in trials in various parts of New Zealand are given. The characteristics of a range of species are listed.
- Anon. 1986. *Do eucalypts 'waste' water? Hornbill, No.4, 24-27; Reprinted from Rural Forestry Newsletter, Forestry.*** A brief discussion of the hypothesis, noting some of the arguments for and against, and the prejudices involved.
- Anon. 1988. *Eucalyptus planting sparks fiery protest : Villagers attack forestry office The Nation, June 14, 1988, Bangkok.*** Forestry officials houses and offices were burned during a two day rampage as part of a growing resistance by villagers against the Government's eucalypts planting policy (*Eucalyptus* spp. are recognized as a useful source of firewood and timber, but it is considered to take too much water and nutrients). The protest was suspended when, apart from other conditions, it was agreed to permit the villagers to use the land occupied by them. It seems that the real issue is dispute over land and not eucalypts.
- Anon. 1989. *Eucalyptus: planting techniques, disputes and commercial profitability. Center for industrial informatics, New Delhi.*** The book describes the qualities of eucalypts which make it suitable for agro-forestry and tree planting in marginal areas. Over production is likely to create depressed market conditions in certain regions.
- Anon. 1991. *Huiles essentielles. Huile essentielle d'Eucalyptus citriodora. Association Française de Normalisation, Puteaux. Mars 1991. 7 pp.*** (In French).
- Anon. 1986. *Crecimiento y rendimiento de especies para leña, en áreas secas y húmedas de América Central. Informe técnico. Centro Agron. Trop. de Inv. y Enseñanza, CATIE, 79 (1): 691 pp; (2): 724 pp. Turrialba. Costa Rica. (FA, 1987, 048-05294).*** This publication contains data on 135 species, among them, *E. camaldulensis*, including provenance, planting methods, growth, production and calorific value. This is a multinational project.

**Anopam-Agrawal; Neelay-VR. 1986. Effect of age on pulping characteristics and economy of Eucalyptus. Journal of Tropical Forestry, 2:1.** Cold soda, semi-chemical pulping experiments were carried out on 6-yr and 18-yr-old eucalypt hybrid (*E. tereticornis*) wood (grown in Gujarat and Madhya Pradesh respectively). Results showed that yield and strength properties of bleached and unbleached pulps deteriorated as age increased. Chemical requirements for cooking and bleaching were also higher for 18-yr-old wood, probably because of increases in specific gravity, lignin content percentage etc. A cost analysis showed that pulp produced from 6-yr-old wood cost Rs.497/t less than that produced from 18-yr-old wood.

**Ara,-I.; Yahya,-N.S.M. 1990. Profitability of Eucalyptus camaldulensis plantation in Bangladesh. Bangladesh Journal of Forest Science v. 19(1 and 2) p. 45-55.** *Eucalyptus camaldulensis* is one of the major fast growing exotics in Bangladesh. The paper attempts to determine the optimum cutting time and the profitability of plantation of the species for fuelwood in Bangladesh. All decision criteria indicate an optimum rotation length in between 6 and 8 years in case of firewood plantation on average sites at 1.83 m x 1.83 m spacing. Profitability analysis indicates the economic feasibility of plantation with high land expectation value of Tk 14,000 and internal rate of return 23 percent ha at the age of 6 to 8 years. Sensitivity analysis indicates that the plantation remains profitable for a wide range of relevant parameters.

**Arangüena Fanego, J.M. 1992. El comercio de la madera en Galicia. La perspectiva empresarial. Economía Política Forestal, 235-239. Xunta de Galicia. España.** An analysis of the problems faced by forestry industries in Galicia, Spain. It estimates the annual deficit of *Eucalyptus* spp. timber in one million m<sup>3</sup> s.c. and considers that demand will grow in the next few years.

**Arnold, J.E.M. Les arbres dans les systèmes cultureux. Unasylva 1990. (No. 160): 35-41 (24 ref.)** The main purpose of this article is to identify the reasons why farmers plant trees. The studies focuses on three types of situations: extensive agricultural systems (cultivation in corridors), intensive agricultural systems (family gardens), and tree planting for income generation (farm forest). Tree planting for income generation purposes, seems to be related to increasing cost and scarcity of manpower; low profitability of agricultural production; risk reduction goals, and finally, the existence of a stable market.

**Arnould, J. Plantations forestières en Israël: techniques et réalisations. Revue forestière française 1988. VOL. 40; ( No. 5): 405-412 (10 ref.)** This article summarizes a series of reforestation techniques (choice of species, nurseries, planting techniques, clearing and planting densities, silvicultural treatments), and also some achievements. The more frequently used species are *Pinus halepensis* in hill areas, *Pinus brutia* in difficult conditions, *Cupressus sempervirens* to establish wind-breaks, *Tamarix articulata* and *Acacia cyanophylla* in semi-arid areas. 13 varieties of *Eucalyptus* spp. are being introduced in sandy soils in depression areas. *Eucalyptus camaldulensis* is not used for wind-breaks (because it competes with the other crops it is supposed to protect).

**Association Francaise de Normalisation. 1991. (Óleos esenciales de *Eucalyptus citriodora*.) Huiles essentielles d'*Eucalyptus citriodora*. Puteaux, Francia. AFNOR, 7 .p**

**Aziz Abdul. 1991. Economics of alternative uses of marginal land by class of farmers and their market limbs. Institute for Social & Economic Change, Bangalore 560 072.** Results of a study conducted in Malur Taluk of Kolar District are presented. *Eucalyptus* spp. hybrid represents for the small and medium farmers a hedge against undependable rainfed crops. The main products are pulpwood, poles and firewood. Bark and leaves are used by local households and small scale industries. Cultivation is more profitable than traditional annual crops.

**Babu-R, Agarwal-MC, Vishwanathan-MK, Joshie-P. 1982. Economics and benefit-cost ratio of the *Eucalyptus* plantation for fuel purpose in denuded lands of Doon Valley. Van-Vigan, 20 : 1/2.** Production from the seedling crop planted in 1969 felled in 1978 and the expected coppice growth to be felled in 1983 has shown that growing *Eucalyptus tereticornis* plantations in denuded lands of Doon Valley is economically feasible. Additionally there is gain in hydrological characteristics (lower runoff and peak rate of discharge) and soil conservation.

**Baconguis,-S.R.TI. 1991. Evaluation of *Leucaena leucocephala* de Wit., *Tectona grandis* Linn., *Pterocarpus indicus* Wild. and *Eucalyptus deglupta* Blume for streambank stabilization in the Agusan River Basin [Philippines]. Sylvatrop. (Philippines). Technical Journal for Philippine Ecosystems and Natural Resources. v. 1(1) p. 79-101.** *Leucaena leucocephala* de Wit. (Ipil-ipil), *Tectona grandis* Linn. (Teak), *Pterocarpus indicus* Wild. (Narra), and *Eucalyptus deglupta* Blume (Bagras) were evaluated as to their adaptability and erosion control potential in the stream banks of Agusan river basin. Plant survival 30 months after planting respectively were 98.5, 97.6, 89. and 78.6 percent for *O. grandis*, *L. leucocephala*, *P. indicus* and *E. deglupta*, respectively. Soil erosion rate under the different plant species respectively were 46.0, 49.0, 203.0, and 208.0 cu.m/ha/yr for *T. grandis*, *L. leucocephala*, *E. deglupta* and *P. indicus*. The soil erosion rate for the control treatment is 271.0 cu m/ha/yr. The lower erosion rate in plots covered by *T. grandis* and *L. leucocephala* was attributable to the species' more developed canopy, thus providing more ground cover than the other two species in protecting the soil from the erosive impact of rain drops.

**Badege-Bishaw. 1988. An afforestation programme in the Legeambo Farmers' Producer Cooperative, Harerge Highlands, Ethiopia. African mountains and highlands. Proceedings of an international workshop organised by the Commission on Mountain Geoecology of the International Geographical Union on behalf of the United Nations University, Addis Ababa, Ethiopia, 18-26 October 1986.** Harerge Highlands in Ethiopia have been heavily exploited and have only remnants of the previous dense forest. A community afforestation programme was established to produce fuelwood and construction materials, conserve soil and establish roadside and border row planting to serve as shelterbelts and windbreaks. Different species of *Eucalyptus* spp. together with other exotics are availed of.

**Balagopalan, M; Thomas, T.P., Mary, M.V.; Sankar, S; Alexander, TG. 1992. Soil properties in teak, bombax and eucalypt plantations of Trichur Forest Division,**

- Kerala. *Journal of tropical Forest Science* 5(1): 35-43.** The paper highlights soils characteristics of monocultures of *Tectona* spp. *Eucalyptus* spp. (coppiced and uncoppiced), and mixed stands of *Tectona* spp. and bombax plantations. The relatively low value of pH, organic carbon, exchangeable bases and exchange acidity in *Tectona* spp. and *Eucalyptus* spp. in relation to mixed *Tectona* spp. and bombax necessitate positive measures in the former ones to preserve and enhance the fertility of the land.
- Balagopalan-M, Alexander-TG. 1985. *Soil organic carbon distribution along transects in teak and eucalypt plantations. Journal of Tree Sciences* 4.2.** *Eucalyptus* spp. plantations had relatively lower soil organic carbon contents than natural forests in some places and in some others the trend was upset. The latter trend is attributed to well established root-systems and the addition of coppice material to the soil.
- Baldwin-JH, Bandhu-D. 1990. *Social forestry in Karnataka State, India (in Budd, WW; Duchhart, I; Hardesty, LH; Steiner, F. eds. Planning for agroforestry. Selected contributions from an international symposium held at Washington State University, Pullman, Washington, on 24-27 April 1989), 293-320; 34 ref. Amsterdam, Elsevier Science Publishers.*** The Social forestry programme in Karnataka was taken up to provide fuel, fodder and wood products to the rural poor. However, the Karnataka Social Forestry Programme appears to have benefited the large land holders to raise eucalypts in agricultural lands, industries and the urban population.
- Ballabh,-V; Saxena,-NC. 1992. *Farm forestry - a review of issues and prospects. Research Paper Institute of Rural Management, Anand. No. 12, 39pp.; ISAE. Anand, India.*** This paper reviews issues related to farm forestry in India and suggests policies which will increase farmers' involvement in tree cultivation and protection.
- Ballard-R. 1978. *Use of fertilisers at establishment of exotic forest plantations in New Zealand. Special issue on fertilisation of forests in New Zealand. New Zealand Journal of Forestry Science, 8:1, 70-104.*** Increasing use of fertilizers in areas with deficiencies of nutrients is explained.
- Balvinder Singh, Gupta-GN, Prasad-KG .1986. *Managing the eroded sloping lands for higher biomass production of Eucalyptus grandis. Indian-Forester. 112 4.*** Trees were measured and soil samples and profiles were examined in the plantations in Kottayam Forest Division, Kerala, with good or average growth, stunted growth or high mortality. Results showed that soils from stands with stunted growth or high mortality were deficient in N, P and Ca. On severely eroded sites with skeletal compacted soil profiles both N and P treatment significantly enhanced biomass and stem volume production.
- Bará Temes S. 1990a. *Fertilización Forestal. Xunta de Galicia. España. 175 pp*** Soil characteristics in different tree formations are described (shrub, oak woods, pine woods, eucalypt woods) including the results of fertilization experiments with those tree species.

- Bará Temes, S. 1986. *Relación eucaliptal-suelo en las zonas húmedas de la península ibérica. Celulosas de Pontevedra. 17 pp. Se trata de un resumen del trabajo anterior, con la aportación de índices derivados de los datos.* (In Spanish).**
- Bará Temes, S.; Montero de Burgos, J.L.; Rigueiro Rodríguez, A. 1990. *Sobre el eucalipto. Asociación para el Progreso Forestal. 31 pp. Madrid.*** Using non specialized language, this publication reviews the different aspects concerning the debate on *Eucalyptus spp.* Data are not included.
- Bará, S. 1989 *¿Es el eucalipto un árbol desertizante?. Actualidad Forestal de Galicia, 111-112: 3-6. (BBV). La Coruña. España*** This paper is based on a previous work dating from 1985.
- Bará, S.; Rigueiro, A.; Gil, M.C.; Mansilla, P.; Alonso, M. 1985. *Efectos ecológicos del E. globulus en Galicia. Estudio comparativo con P. pinaster y Q. robur. Monografías INIA. 381 pp. Madrid.*** An extensive study on effects of three tree *Eucalyptus* species in 8 locations of Galicia (Spain). Physical and chemical soil analysis, microbiological analysis, floristic and mesofauna inventories were carried out. The hypothesis that nutrient reserves in eucalypt soils were impoverished, was discarded. Mesofauna is similar in soils of the three species analysed. Floristic diversity is similar both, in pine and eucalypt soils, although it is poorer in oak soils.
- Barbier, C. *Etude de la minéralomasse et du maintien de la fertilité dans les plantations à courtes et très courtes rotations en Guyane française. Agence française pour la maîtrise de l'énergie, Paris ; Centre technique forestier tropical, Nogent-sur-Marne ; Centre technique forestier tropical. Centre de Guyane, Kourou, 1986. 92 p. (14 ref.)* (In French).** This paper presents a study on the influence of *Eucalyptus urophylla* coppice plantations on soil fertility, particularly in two rotations (stumps and first shoots) and two different spacings. The analysis showed three main elements (N,P,K) and three secondary elements (Ca,Mg,Na) five oligo-elements (B,Fe,Mn,Cu,Zn) in different parts of the tree (wood-stem, bark-stem, branches and leaves). The contents measured in one category (stumps or shoots) depend more from spacing, rather than the part of the tree where they are located. They are globally higher in shoots than in stumps. An estimate suggests to exploit stems only (wood and bark).
- Barbier, C.; Gbadoe, E.; Taponot, M. *Les plantations du projet AFRI. Aménagement forestier et reboisement industriel dans le Sud-Togo. Bois et Forêts des Tropiques 1990. (No. 224): 5-20 (11 ref.)*** The AFRI project was launched in 1981 and aimed at planting *Eucalyptus spp.* in 4 000 ha for an 8-year period. Plantations were to provide charcoal and fuelwood to Lomé, the capital of Togo. Production costs of charcoal and fuelwood have proved to be higher than the project estimated cost. The authors highlight the lack of solid references on the experiment during the initial phase of the project, the absence of accompanying research and the lack of accurate data on wood products demand.
- Barbier-C, Gbadoe-E, Taponot-M. 1990. *Plantations of the AFRI project. Forest management and industrial reforestation in south Togo. Bois et Forest des Tropiques. No. 224.*** Description of a project established in 1981 to plant *Eucalyptus spp.* in the Eto forest to supply fuelwood and charcoal to the capital. As a result of the plantation programme, prices of fuel supplies decreased, with charcoal

price being cheaper in 1987 than in 1981. There was decreased logging pressure on natural forests, soil protection, increase in beekeeping and employment in fuelwood/charcoal or round wood production.

**Bargali,-S.S.; Singh,-R.P.; Joshi,-M.u. 1993. *Changes in soil characteristics in eucalypt plantations replacing neutral broad-leaved forests. Journal of Vegetation Science v. 4(1) p. 25-28.***

**Bari-MA, Schofield-NJ 1991. *Effects of agroforestry pasture associations on groundwater level and salinity. Agroforestry Systems. 16:1.***

**Bari-Ma, Schofield-NJ 1992. . *Lowering of a shallow, saline water table by extensive eucalypt reforestation. Journal of Hydrology Amsterdam. 133.*** These two papers show examples about the use of *Eucalyptus* spp. to lower the ground water level and reduce salinity.

**Baris, P.; Zaslavski, J. *La politique de reboisement au Burundi : analyse socio-économique. Mission d'évaluation. Ministère de la Coopération, Paris 1986. 118 p. et annexes.*** A report on wood supply/demand in Burundi. It analyses the charcoal and timber production lines (circuits, costs and limits at the different levels) of round wood. It illustrates the forest policy carried out by the government and the different reforestation projects in place: projects carried out with industrial means, communal and private afforestation schemes. Project costs are compared by looking at the species planted, the projects goals (protection and production) and the way they were implemented. The authors finally analyse the macroeconomic effects of forest policies.

**Barros Asenjo, S. 1990. *Ensayos de procedencias de Eucalyptus Camaldulensis Denhn. en la zona semiárida de Chile. Ciencia e Inv. Forest., 4 (2): 171-182. Inst. Forest. Santiago. Chile. (FA, 1992, 053-06252).*** Provenance trials with 14 samples from Australia were started in 1984. Survival rates, height and diameter data after a 4 - year- period are included. The best results were obtained from two samples from Lake Albacutya, Victoria.

**Barros Asenjo, S. 1991. *Forestación en zonas áridas y semiáridas. Ciencia e Inv. Forest., vol. 5 (1): 151-164. Santiago. Chile.*** Experimental plantations with demonstrative purposes were established with *E. camaldulensis* and *E. globulus* spp. Good survival and growth results, compared to those produced by traditional methods, were obtained through manure application, soil preparation with tractors and weed control.

**Barros, ZX; Cardoso, LG; Campos, S. (Evaluation des changements dans l'utilisation du sol par l'eucalyptus, la canne à sucre, le café, à travers les photographies aériennes dans la région de Botucatu, Sao Paulo, 1962-1977). *Annais do 20 Congresso Brasileiro de Engenharia Agrícola. Londrina, PR. Brésil. 1992. v.1 p 44-53.*** (In Portuguese).

**Barros, ZX; Cardoso, LG; Campos, S. 1992. (Evaluation of changes in the soil use by eucalyptus, sugar cane and coffee by means of aerial photographs in the country of Botucatu, Sao Paulo, 1962-1977). *Annais do 20 Congresso Brasileiro de Engenharia Agrícola. Londrina, PR. Brazil. v.1 44-53 pp.*** (In Portuguese).

- Bartle-J. 1991. *Tree crops for profit and land improvement. Journal of Agriculture Western Australia, 32:1.*** *Eucalyptus globulus* is the main species grown in shelterbelts managed for timber and shelter. Other promising species for pulpwood are *E. camaldulensis* (for its salt tolerance), *E. bortryoides* (for its water logging tolerance) and nitrogen-fixing *Acacia* spp. (for infertile soils). The economics of timber belt share farming contracts with state or private investments are discussed.
- Basu-PK Aparajita-Mandi. 1987. *Effect of eucalypts monoculture on the soils of South West Bengal, Midnapore District. Journal of Tropical Forestry. 3 3.*** Vegetation parameters and soil characteristics were studied in 3 plantations of *Eucalyptus* spp. established in 1971, 1975 and 1981 on sites on which *Shorea robusta* had been the dominant species of forest vegetation. There was a general increase in soil fertility with plantation age.
- Bayoumi-AA. 1977. *The role of shelterbelts in Sudanese irrigated agriculture with particular reference to the Gezira. Part II: A proposed scheme for shelterbelts in the Gezira. Sudan-Silva. 3:22.*** Proposals are made for the establishment and management of irrigated shelterbelts of *Eucalyptus microtheca* and *Oxytenanthera abyssinica* occupying 1.5 percent of the cultivated land in the Gezira irrigation scheme. The estimated saving in irrigation water should enable the area of cultivated land to be increased by 6 percent.
- Beadle CL, Turnbull CRA. 1992. *Comparative growth rates of eucalypts in native forest and in plantation monoculture. in Calder, IR; Hall, RL; Adlard PG eds. Growth and water use of Forest Plantations. 381 pp - Wiley and Sons, Chichester.*** An examination of the growth of contrasting *Eucalyptus* spp. is used to identify factors which limit their growth potential in native forest and in plantation monoculture. In mixed forest, growth rates of species are observed to change with time. A few eucalypts which have been selected for plantations are those with higher growth rates early in the rotation. Differences between species in their response to the environmental constraints have been identified.
- Becker-G, Desta-AA. 1989. *The contribution of forestry to the employment situation in developing countries in comparison with agricultural forms of use; results of a field study in Ethiopia. Forestarchi. 60:3.*** A study was made of 20 land use projects of various sizes and types in Ethiopia. Although agricultural land use projects offer more employment opportunities, forestry projects offer, for subsistence farmers, opportunity to earn extra money in a more flexible way that can be adjusted to the needs of their rain fed crops.
- Becker-M. 1967. *Private initiative in forestry and wood industry in developing countries. The Brazilian fibreboard industry as an example. Forstarchiv 38 (9).*** Briefly describes the organization of the supply of raw materials (eucalypts) by the Duratexmills at Jundiá, Sao Paulo. The company has its own plantations and encourages eucalypt planting by local farmers. The market for Brazilian fibreboard is discussed.
- Bell-RW, Schofield-NJ, Loh-IC, Bari-MA. 1990. *Groundwater response to reforestation in the Darling Range of Western Australia. Journal of Hydrology Amsterdam. 115: 1-4.*** Replacement of deep-rooted perennial vegetation with annual crops and pastures led to rise groundwater tables and soil erosion levels in Western Australia. Trials to determine the potential of reforestation aimed at reversing this process

initiated in 1976. The paper shows the results achieved between 1979 and 1986. The change in groundwater levels under reforestation ranged from 0.6 m to 3 m below the ground surface. Groundwater levels under reforestation in all cases decreased as compared to ground water levels under pasture. The salinity of the water table decreased by 12 percent under reforestation and by 32 percent under pasture over the period.

**Benchekroun, F. *La consommation de bois de feu au Maroc. Le cas du Gharb et du Moyen Atlas. Forêt méditerranéenne 1987 (No 2): 143-150 (7 ref.)*** Survey results on consumption and commercialisation of fuelwood in the Gharb and the Middle Atlas are reported. Eucalyptus spp. account for 25 percent of fuelwood production in Morocco. In the Gharb, Eucalyptus spp. production is mainly aimed at supplying wood to a pulp mill (55 percent), poles (25 percent) and fuelwood (20 percent). Since the firewood crises, even production from old plantations is used to make charcoal.

**Berger-R, Garlipp-RCD, Pereira-RS. 1983. *Maximum land price for reforestation: its importance in the viability of forestry enterprises. IPEF Instituto de Pesquisas e Estudos Forestais No. 23.*** A study designed to indicate land prices at which reforestation with eucalypts in Brazil could be profitable, using soil expectation value and taking into account planting and maintenance costs, a range of discount rates and income from timber sales.

**Berger-R, Simoes-JW, Leite-NB. 1974. *Method for economic evaluation of ways of regenerating stands of Eucalyptus spp. IPEF, No. 8, 55-62; 7 ref.*** Compares two methods of regeneration after clear felling: coppicing and re-planting. The comparison is made by calculating the cost of wood produced. On this basis, a table is constructed showing the minimum amounts of wood that must be produced in order for coppicing to be economic.

**Bernhard-Reversat, F. *Le recyclage des éléments minéraux par la strate herbacée dans un peuplement naturel à Acacia et dans une plantation d'Eucalyptus au Sénégal. Acta oecologica. Oecologia generalis, 1986. 7 (4): 353-364 (18 ref.)*** A study about recycling of mineral elements in the grass cover of natural vegetation, in poor soils of the Soudanese-Sahelian area in Senegal, and a reforested area planted with *Eucalyptus camaldulensis*. Aerial vegetation biomass is similar in both locations, ranging from 0,2 to 3,2 T/ha depending on the year. No direct relation was established between total annual rainfall measurements, because the rain distribution plays an important role. Mineral element contents, except P, are lower in plantations where the topsoil layer is poor. N, P and Ca fixation are higher in natural vegetation (23, 45 and 23 kg/ha respectively) than in plantations (14, 26 and 11 kg/ha respectively). In both environments K is more abundant.

**Bernhard-Reversat, F. *Les cycles des éléments minéraux dans un peuplement à Acacia seyal et leur modification en plantation d'Eucalyptus au Sénégal. Acta oecologica. Oecologia generalis, 1987. 8 (1): 3-16 (32 ref.)*** Recycling of mineral elements through litter, rain leaching and grass cover are studied in semi-arid environments with precipitations ranging from 300 to 600 mm, in an *Acacia seyal* natural population, as well as in an *Eucalyptus camaldulensis* plantation established in poor soils. Tree litter in natural vegetation annually provides the soil with 27 Kg of N, 2 Kg of P, 13 Kg of K, 33 kg of Ca and 5 Kg of Mg per

hectare. The replacement of such vegetation with *Eucalyptus* spp. showed 8 years later, a lower level of N and P, and a higher level of K and Ca. Rain leaching was low but it was higher in natural vegetation than in plantations. Annual total provision through aerial parts is very high, particularly of K, and it may be compared to the rate found in temperate forests. In natural vegetation the estimates are 54 kg of N, 3 Kg of P, 70 kg of K, 68 Kg of Ca and 14 Kg of Mg per hectare, per year. In plantations the content of N was lower.

**Bernhard-Reversat, F. Premières données sur le cycle de l'azote en plantations d'*Eucalyptus* et d'*Acacias* sur sols sableux au Congo. Document ORSTOM Pointe-Noire 1989. 14 p.** This paper reports on the advancement of research carried out in plots managed by the Industrial Afforestation Unit of Congo (UAIC) and in the experimental plots of *Acacia mangium* and *A. auriculiformis*. These plots are compared with the *Loudetia* spp. in the savanna, the original vegetation in the area. *Eucalyptus* and *Acacia* spp. are compared by looking at the following aspects: litter provision, nitrogen provision to soil, litter decomposition, nitrogen mineralization.

**Bernhard-Reversat, F. Quelques observations sur l'effet allélopathique des *Eucalyptus* plantés au Congo. ORSTOM Pointe-Noire 1986. 10p. (13 ref.)** The allelopathic effect of *Eucalyptus* spp. litter and leaves was highlighted by removing the litter under eucalypt hybrids (*Eucalyptus platyphylla* and *Eucalyptus urophylla*) and by measuring its effect on test plants (rice and vegetables). This effect is linked to the presence of toxins acting particularly on the genesis of rice rhizogenesis. The toxic effect disappears when litter decomposes.

**Berry-PA. 1974. Field observations of the seasonal variations in the yields of the essential oil of eucalypts. Australian Chemical Institute Journal and Proceedings, Melbourne 14 (5).** Optimum time for collection of leaves for distillation to maximise yields are discussed with reference to *Eucalyptus cneorifolia*.

**Bertrand A. Analyse économique de l'approvisionnement d'Antananarivo en produits forestiers et propositions de réforme de la réglementation et des redevances forestières. CTFT, mars 1989.**  
VOLUME I: Summary, conclusions and recommendations, 19 p. The author presents the main results of an economic analysis on forest products supply in Antananarivo. It analyses forest policy in Madagascar and proposes to reform regulation and forest taxation regimes.

VOLUME II: Forest-timber sectors are analysed from an economic point of view in the wood supply area of Antananarivo, 73 p. Charcoal, firewood and fuelwood production lines are mainly fed by *Eucalyptus* spp. It includes prices at each stage of the main production lines, as well as profit-making figures achieved in each sector.

VOLUME III: Forest policies, regulations and taxation, 61 p. These aspects are presented in the following order: analysis of forest policy in Madagascar and its results, the objectives and main lines of forest regulation and taxation reform.

VOLUME IV : Annexes, 48 p.

**Bertrand A.; Le Roy E. Appui méthodologique aux volets "foncier" et "Economie forestière", deuxième mission, CIRAD-Forêt/APREFA, juillet 1993. 107 p. (15 ref.)**

The author emphasizes research based on a retrospective and comparative history of land-tenure, forest and agriculture in different territories. According to this paper, silviculture of *Eucalyptus* spp. by farmers is the agricultural production that has more rapidly advanced in the last thirty years in the highlands.

**Bertrand A.; Le Roy E. *Appui méthodologique aux volets "foncier" et "Economie forestière". Première mission, CIRAD-Forêt/APREFA, avril 1991. 82 p. (9 ref.)***

This document has been produced in the framework of a FOFIFA/CIRAD research project titled: "Forestry Production in the Rural Economy of Madagascar Highlands: land, rural family and communities in the regions of Manjakandriana and Vinavinony". The author illustrates the problems posed by research and makes several methodological proposals concerning various aspects of research: "Forest lands in the highlands", The "forest exploitation economy in the highlands" and "the farmer's forest in the economy of the highlands".

**Bertrand A.; Madon G.; Matly M. *Propositions de réforme du dispositif de contrôle forestier et de taxation du bois-énergie. SEED-CTFT, Projet Energie II - Energie domestique, Niamey, 1990. 34 p. et annexes.***

This paper harbours a series of proposals to reform regulation and taxation measures related to fuelwood for energy. One of the objectives is to favour conservation management of natural forests and the establishment of private, individual or collective forest plantations, through a differentiated tax on fuelwood.

**Bertrand, A. *La foresterie privée à Madagascar. Lettre du Réseau Arbres Tropicaux 1989. (No.11): 10-13 (2ref.)***

This article regards two regions of Madagascar: Manjakandriana and Anjozorobé. These two regions harbour a series of private coppice plantations *Eucalyptus* spp. on short-rotation (2 to 4 years) aimed at producing charcoal. In Manjakandriana region, these stands have been progressively invaded by Tanety (rainy season crop); the income generated from wood is basically used to buy rice. In Anjozorobé region, where land pressure is minor, it is possible to see afforestation areas established by individuals on available land; the income generated from *Eucalyptus* spp. accounts for 80 percent of the family income and is the basis of a farmer accumulation process (to buy livestock, harnesses, carts).

**Bertrand, A. *Les actions forestières de l'Etat et les marchés du bois au Rwanda. Bois de feu et énergie 1992 (No27): 20-23 (3 ref.)***

The article deals with landscape evolution in Rwanda and plantation dynamics. The study is supported by the results from an agroforestry survey carried out in the framework of the PAP project in Ngabisindu, in 1987.

**Bertrand, A. *Les nouvelles politiques de foresterie en milieu rural au Sahel. Réglementations foncières et forestières et gestion des ressources ligneuses naturelles dans les pays de la zone soudano-sahélienne. Bois et forêts des tropiques, 1986. (No 207): 23-39 (27 ref.)***

The article introduces the firewood energy crisis in the Sahel, including the links with population growth and the crisis of farming systems. It shows the background history of land-tenure regulations (customary laws, colonial regulations and their evolution after independence), it examines forest regulations particularly focusing on the evolution of forest taxation and special felling permit systems. It illustrates the new forest policies in rural areas in certain countries. It finally shows which are the necessary conditions to mobilize farmers: reforming land-tenure regime and forest regulations, raising awareness and providing technical support to

farmers, redefining the role of forest services, providing techniques and adapted planting material to local population.

**Bertrand, A. *Les problèmes fonciers de forêts tropicales africaines : le foncier de l'arbre et les fonciers forestiers. Bois et Forêts des Tropiques 1991. (No. 227): 11-16***

The article deals with the different aspects of a specific land-tenure problem related to trees present in the cultivated plots; the aspects linked to the natural forest and to land tenure in afforestation areas. It highlights the dangers associated with inherited forest codes dating from the colonial era, according to which «all the resources that are not subject to property or use, belong to the public domain », this principle limits and makes insecure any traditional and legitimate land tenure management system of collective nature, used by the local people.

**Bertrand-A. 1989. *Private forestry in Madagascar. Lettre du Réseau Arbres Tropicaux No. 11.***

Utilization of coppice *Eucalyptus grandis* plantations aimed at providing fuelwood (or charcoal), is described for Anjozorobe and Manjakandriana, two areas located respectively 100 Km N and NE of the capital Antananarivo. Economic aspects of forestry activities are stressed.

**Bhat KM .1986. *Can plantation grown eucalypts meet the wood quality requirement of the industries ? (in: Eucalyptus in India: Past, Present and Future) KFRI, PG, Kerala.***

In future, at least some of the forest based industries will have to depend on fast growing plantation timbers, such as eucalypts, as the source of raw-material. *Eucalyptus grandis* and *Eucalyptus tereticornis* have considerable potential for both pulp and non-pulp uses. The undesirable features in eucalypts are larger when used as solid wood. Many of these difficulties can be effectively controlled by genetic modification.

**Bhattacharya-PK .1985. *Social forestry: an answer to rural energy problem - A study in Ambala and Fatehabad divisions of Haryana. Proceedings, Seminar on rural energy; problem of crisis, 23rd-24th January 1985. 8 tab. Bangalore, India.***

The study refers to two divisions, one with favourable conditions (maximum rainfall, maximum area under forest), and the other with unfavourable ones. The paper states that the programme is economically and ecologically viable and if properly managed, it can meet the fuelwood needs of rural Haryana. Planting of *Eucalyptus* spp. mixed with other species should be encouraged.

**Bi,-HQ; Turvey,-ND. 1994. *Effects of Eucalyptus obliqua (L'Herit) density on young stands of even-aged Pinus radiata (D. Don). New-Forests. 8: 1, 25-42; 53 ref.***

In a 10-year-old *Pinus radiata* plantation in Mt. Cole State Forest, Victoria, Australia, increasing densities of *Eucalyptus obliqua*, a woody weed species, caused reductions in canopy leaf area and total stem volume of *P. radiata*.

**Bianchi,-A. 1992. *(Desarrollo cooperativo: el proyecto forestal Ciudad Dario-Terrabona en Nicaragua.) Sviluppo cooperativo: il progetto Ciudad Dario Terrabona in Nicaragua. Monti-e-Boschi. 43: 1, 45-48; 4 ref.***

A brief account of an Italian NGO-sponsored project in the Matagalpa region of Nicaragua to encourage afforestation of exotic, (*Eucalyptus* spp., *Leucaena* spp., and *Albizia* spp.) and indigenous (*Cedrela odorata*, *Cordia alliodora*) species. Although lack of experimental data on tree survival and site conditions are accounted for the low results obtained, the main reason was the failure to engage the support of the local

farmers, who in a period of great social, political and economic upheaval, were concerned with short-term survival, rather than medium- or long-term environmental benefits of reforestation. (In Italian).

**Biddiscombe-EF, Rogers-AL, Greenwood-EAN, Boer ES de. 1985. Growth of tree species near salt seeps, as estimated by leaf area, crown volume and height. Australian Forest Research, 15:2.** Success with *Eucalyptus globulus*, *Eucalyptus occidentalis* and *E.cladocalyx* in salt affected areas is reported.

**Bigot Y.; Rakotondrasana M.F.; Razafindraibe R. L'installation d'un réseau d'observations par placettes dans les plantations familiales d'Eucalyptus robusta de Sambaina Manjakandriana. FOFIFA/CIRAD, mai 1992. 47 p. (28 ref.)** This document was developed in the framework of a FOFIFA/CIRAD research project titled "forestry production in the rural economy of Malgache highlands". The first chapter presents the tools used to carry out the research. The following chapters introduce the first findings on forest land ownership, the technical and economic conditions existing during the development of *Eucalyptus* spp. plantations established by the farmers, harvesting management practices and scheme evolution. The last chapter recalls what possibilities and limits exist to extend *Eucalyptus* spp. plantation by farmers.

**Binkley,-D; Dunkin,-KA; DeBell,-D; Ryan,-MG. 1992. Production and nutrient cycling in mixed plantations of Eucalyptus and Albizia in Hawaii. Forest-Science. 38: 2, 393-408; 39 ref.** Productivity and nutrient cycling were examined at age 6 yr in experimental plantations of pure *Eucalyptus saligna*, pure *Albizia falcataria* and 5 proportions of mixtures of these species established in 1982 at a site at 480 m altitude, near Hakalau, Hawaii. N, P and K fertilizers were applied to some of the plots. The *E. saligna*/*A. falcataria* mixtures tested were in the proportions 34/66, 50/50, 66/34, 75/25 and 89/11 percent, respectively. Biomass production was greatest for the 34 percent *E. saligna*/66 percent *A. falcataria* mixture, averaging 174 t/ha. The 34percent of *E. saligna*/66 percent *A. falcataria* mixture also had the greatest above-ground net annual primary production (52 t/ha) and annual increment (39 t/ha). The Nutrient use efficiency, was greater for *E. saligna*. Light use efficiency ranged from about 14 kJ/MJ of intercepted light in pure *A. falcataria* to 17 kJ/MJ in pure *E. saligna* and 18 kJ/MJ in the 34 percent *E. saligna*/66 percent *A. falcataria* mixture. Patterns of productivity across the mixtures resulted from the combination of (1) greater nutrient efficiency of *E. saligna*, (2) greater nutrient cycling under *A. falcataria* and (3) greater light capture and high light use efficiency in mixed stands.

**Bisalaiah.S. 1990. Development of Social Forestry : Some second generation concerns. University of Agricultural Sciences, Bangalore, 65.** The paper seeks to identify some second generation concerns which have emerged during the last decade upon implementation of the Social Forestry programme in India. It mentions the steep production fall of *Eucalyptus* spp. seedlings in Government nurseries because of the criticism in the press and the concerns expressed by review teams about bad publicity.

**Bisht-RP, Singh-RR, Tokyo-OP. 1989. Water consumption in eucalypts; the facts & myths. Myforest, 25:1.** A brief summary and discussion of studies in India.

- Bisla-SS, Nandal-DPS, Narwal-SS. 1992. Influence of aqueous leaf extracts of *Eucalyptus* and poplar on the germination and seedling growth of winter crops. Proceedings of the first national symposium on Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992, held at CCS Haryana Agricultural University, India.** Inhibitory effects are reported of aqueous extracts of dry leaves of *Eucalyptus tereticornis* and *Populus* spp. on the seed germination and seedling growth of 5 winter crops. Activity varied with extract concentration and in some cases initial stimulatory effects were obtained. The inhibitory effects of *Eucalyptus* spp. was less than that of *P.deltoides*.
- Blake-T, Bevilacqua-E, Barbosa M de M. 1988. Early selection of fast-growing *Eucalyptus* clones and species. IPEF Instituto de Pesquisas e Estudos Florestais, No.40.** Differences in success and growth based on height measures of *E.grandis* were studied. It was found that size differences at transplanting were poor indicators of growth performance.
- Boden-DI. 1991. The relationship between soil water status, rainfall and the growth of *Eucalyptus grandis*. South African Forestry Journal. No.156.** In 7-year-old plantations of *E.grandis* with mean annual increment of 26, 16 and 6 t/ha per annum, soil water status (SWS) and annual increments were studied. It was noticed that in the sites with maximum biomass production, SWS and increment were the lowest compared to the site with minimum biomass production. Growth adjusts itself to availability of moisture.
- Bohnens-J. 1987. The present status and prospects of cultivating fast-growing tree species on short rotations in Europe. Holzzuch. 41: 1-2.** A short historical review is given of the situation in 15 countries in Europe. It is concluded that the only commercial applications of short rotation forestry to date are *Eucalyptus* spp. plantations for pulpwood production in Spain and Portugal. It will not be possible to estimate the potential for biomass production until a systematic network of large-scale production and demonstration plots are established.
- Boomsma-CD .1972. Native trees of South Australia. Bulletin Woods and Forests Department of South Australia. No.19.** In addition to other information on *Eucalyptus* spp. it gives detailed information on honey and pollen yields for all the species and flowering periods.
- Booth, TH; Nix, HA; Hutchinson, MF; Jovanovic, T. 1988. Niche analysis and tree species introduction. Forest Ecology and Management. 23:1, 47-59; 29 ref.** A method to determine the climatic requirements of tree species is outlined. The method is demonstrated using *E. citriodora*, *E. cladocalyx*, *E. fastigata*, *E. globulus*, *E. gomphocephala*, *E. grandis*, *E. maculata*, *E. paniculata*, *E. regnans*, *E. resinifera*, *E. robusta*, *E. sideroxylon* and *E. tereticornis*. The bioclimatics of their natural distributions in Australia are compared with conditions at trial sites in Africa.
- Booth. TH, Pryor. LD. 1991. . Climatic requirements of some commercially important *Eucalyptus* species. Forest Ecology and Management 43.** The paper indicates the progress made in identifying climatic requirements for 21 species of eucalypts based on trials around the world. Considerable work in this field has been done by Booth T.H, Brown A.G, Carlowitz, Eldridge K.G. and others.

**Bosch-JM, Smith-RE. 1989. *The effect of afforestation of indigenous scrub forest with eucalypts on stream flow from a small catchment in the Transvaal, South Africa. South African Forestry Journal No.150.*** Hydrological response to afforestation with eucalypts is discussed. A small catchment was cleared of scrub growth and planted with eucalypts. This resulted in decrease in stream flow of 200 mm/yr (48 percent of mean annual stream flow) within three years after planting.

**Bose-RK, Bandyopadhyay-SK. 1986. *Economics of energy plantations in alkali soils of Indian semi arid regions. Biomass. 11:1.*** Results are reported from a field experiment on 4.7 ha of salt affected community land in the Gurgaon district of Haryana, India, with *Prosopis juliflora*, *Acacia nilotica*, Eucalyptus hybrid (*E. tereticornis*), *Dalbergia sissoo*, *Leucaena leucocephala*, *Azadirachta indica* and *Albizia lebbek*. Mortality rates 3 months after planting were high for *A. nilotica* (27 percent) and *E.tereticornis* (19 percent). Height after 2 yr was best in *E. tereticornis* (3.04 m) and least in *A. indica* (0.5 m). Fuelwood plantations on such sites are thought to be economically feasible.

**Boulefred, A. 1988. *(Estudio sobre Eucalyptus camaldulensis en la región de Frenda (Tiaret). Etude d'un peuplement d'Eucalyptus camaldulensis Denhn dans la région de Frenda (Tiaret). Institut National Agronomique (El Harrach), Alger. Argelia. 70 p.*** An *Eucalyptus camaldulensis* afforestation area was studied in the Frenda region (Tiaret). Agronomical National Institute, Algiers.

**Bouvet, J. M.; Andrianirina, G.L'Eucalyptus grandis à Madagascar. Potentialités, bilan et orientations des travaux d'amélioration génétique. Bois et Forêts des Tropiques 1990. (No. 226): 5-19 (9 ref.)** The earliest introductions of *Eucalyptus grandis* in Madagascar (approximately in 1930) were made in the Andrimbe station, in Analamazaotra (Périnet) and in privately owned land in the regions of Anjiro (Mangoro) and Fianarantsoa (Chauvet, 1967). Once the growth potential of the species was noticed, new introductions were made in the framework of a group of arboreta established throughout Madagascar (1950-1960). Research was basically focused on genetic improvement and a first group of provenance trials was established along the East coast and in the Highlands ( in 1973, 1974) in five different stations. *Eucalyptus grandis* showed a high growth potential, as well as flexibility and frugality. It is not clear yet how resistant *E. grandis* is to fires in the savanna, or what is its shoot growth capacity in the framework of coppicing management practices (the most common type of management in privately owned afforestation areas).

**Bowen-MR. 1985. *Ethiopia: Selection and adaptation of tree species for plantation use in diverse ecosystems. xi Consultant's Report ICD/UNDP/ETH/85/014. London, UK; Parsons & Whittemore Lyddon Ltd.*** There is pressing need to rehabilitate eroded sites in the highlands, produce fuelwood/charcoal on a sustained yield basis near population centres, and provide shelter belts and livestock browse in the low lands, in addition to supplying timber for poles, construction and furniture. The method of selecting tree species for each ecosystem is discussed at length. The recommendation is made that the dependence on *Eucalyptus camaldulensis* and *E.globulus* should be reduced.

- Brandani, A. 1991.** (*Management of high productivity forest and ecological dynamics.*) *Manejo de bosques de alta productividad y dinámica ecológica. Centro de Investigaciones y Experiencias Forestales, Buenos Aires. Jornadas sobre eucalipto. 5-6 dic. 1991. 22 pp.* (In Spanish).
- Brandao-LG. 1984.** *Short-rotation forestry for energy and industry.* (in : Egneus, H; Ellegard, A. eds. *Bioenergy 84. Proceedings of conference 15-21 June 1984. Goteborg. Sweden. Volume II. Biomass resources*) 77-85. *Barking, UK : Elsevier Applied Science Publishers.* This paper provides general information, including data on wood consumption by the industry and for energy, growth and projected volume production and market characteristics of present and future plantations of *Eucalyptus* spp. and *Pinus* spp. in Brazil. A brief account is given of the company Aracruz Cellulose. Productivity gains resulting from genetic improvement are discussed.
- Bredenkamp-GL. 1977.** *The honey producing eucalypts of the highveld.* (in: Fletcher, D.J.C.(Ed.) *African bees: taxonomy, biology and economic use.*) Pretoria, South Africa; *Apimondia Publishing House.* The flowering characteristics, distribution, nectar and pollen productivity and honey quality are given for 9 species of eucalypts.
- Brinkmann E F.J. 1992.** (*Market study and economic analysis of eucalyptus plantations.*) *Estudio de mercado y análisis económico de plantaciones de eucalipto. Universidad Católica de Chile, Santiago (Chile). Fac. de Agronomía. 84 p.* (In Spanish).
- Bryant-PAV; Sutton-WRJ; Maree-HB; Destremau-DX; Bussche, GH von dem; Waki-K, Willen-PW. 1984.** *B9, General silviculture and implications. IUFRO symposium on site and productivity of fast growing plantations, Pretoria and Pietermaritzburg, 30 April - 11 May 1984., 403-431, 799-846, Pretoria, South African Forest Research Institute.* The papers include 1) the impact of fast-growing tree plantations on wood quality and utilisation, 2) economic and strategic implications of fast-growth plantations and 3) the silvicultural and yield of eucalypt stands grown for pole production.
- Buckley-Gp. 1987.** *The forests of the Jos Plateau, Nigeria; I. The development of the forest estate. Commonwealth Forestry Review. 66:2.* Efforts to reforest the denuded Jos Plateau, begun in 1924, is discussed. Good survival and growth quality shown by 5 *Eucalyptus* spp. and 3 *Pinus* spp.
- Bunyavejchewin,-S. 1989.** *Primary production of plots of five young close-spaced fast-growing tree species - III. Dry matter and nutrient content of litterfall. Natural History Bulletin of the Siam Society. 37: 1, 65-73; 5 ref.*
- Bunyavejchewin,-S; Kiratiprayoon,-S; Kumpun,-T. 1989.** *Primary production of plots of five young close-spaced fast-growing tree species - II. Above-ground biomass, nutrient and energy content. Natural History Bulletin of the Siam Society. 37: 1, 57-63; 7 ref.* Data are presented from 5-year-old plantations of *Acacia auriculiformis*, *Azadirachta indica* var. *siamensis*, *Cassia siamea*, *Eucalyptus camaldulensis* and *Leucaena leucocephala* in Thailand, with a view to assess their suitability as plantations for fuelwood production.

**Burgers-TF. 1943. Yield regulation and financial rotation in coppice forest of *Eucalyptus globulus* (in Andalusia) Ned. Boschb-Tijdschr. 16(6) (248-56).** Article on the *Eucalyptus* spp. plantations in Andalusia which includes the provisional local yield table for *E. globulus* for which the financial rotation is calculated as 52 years or four -13-year rotation rounds. Projections show a considerable gain. It is unknown whether yields from a second rotation of pure *Eucalyptus* spp. would be satisfactory. But, probably a change of crop will be desirable. A very interesting recommendation, made 5 decades ago.

**Burgess Michael. 1992. Dangers of Environmental extremism. Economic and Political Weekly, October 3, 1992.** An analysis of the approaches of some of the environmentalists leads to the conclusion that the methods adopted are questionable and conclusions arrived to are irrespective of the evidence available. Author finds credibility gaps in the figures and data furnished by Vandana Shiva and Bandyopadhyay in their paper dealing with the subject of eucalypts and social-forestry in Karnataka. The extremism may result in environmentalists losing their credibility.

**Butin, V. Bois irrigués et gazogènes : études de cas en Inde. GRET-AFME-Ministère de la Coopération 1987. 129 p.** This study concerns intensive plantation methods and the use of gasifier technology. Intensive production may produce saturation in the timber market; plans have been made to use wood surplus to feed a gasifier in order to produce energy aimed at irrigation. An annex includes the characteristics of a small gasifier, the perimeter of an agroforestry area irrigated by a diesel motor pump and an economic analysis.

**Butin, V. Planter des arbres : quelques techniques originales développées en Inde. Bois de feu informations 1986. (No 16): 14-18** This article briefly introduces "social forestry" carried out in India since 1976. It illustrates two experiences of forest plantation in an agricultural and privately owned area. The first case deals with high density plantations of *Eucalyptus* spp. hybrids (with irrigation, manure and selective felling practices). This kind of forestry is currently facing market saturation (therefore projects have been made to produce electric power by means of a gasifier and a generator. The second case deals with *Leucaena leucocephala* plantations.

**Buttoud, G. Législation forestière et crise agraire : le cas de Madagascar. ENGREF Nancy 1987. 21 p. (13 ref.)** A forest legislation study and its implementation in Madagascar highlights the gap existing between the legal framework and policies, on one side, and the social use of forest resources, on the other. Hints for reflection are suggested: replacing specific regulations for general rural development rights whose prescriptions in the forestry domain would be a key component; replacement of policing methods and establishment of positive rules based on incentives to create and conserve resources.

**Cáceres, D. 1991. Eucalyptus -selección de las especies más adecuadas. Revista Forestal, 7 (1): 10-14. Univ. Nac. de Asunción. Paraguay. (FA, 1992, 053-06251).** This paper includes a list of *Eucalyptus* spp. deemed appropriate for each of the five climatic regions of Paraguay.

**Cadoche, L.; López, G.D. 1989. Análisis comparativo de pretratamientos lignocelulósicos para la obtención de etanol. Ingeniería Química, 21 (248): 199-207. INGAR.**

- Argentina. (IF Forest Products Abstracts, 1992, 015- 02306).** A technical and economic assessment of pre-treatment techniques that may be applied to several wood and cellulose waste materials (of hardwoods, softwoods, bagasse and other agricultural waste material), for a maximum production of ethanol through a chemical-biological process. In optimal conditions, the residues and waste material of *Eucalyptus* spp. produce the highest degree of saccharification.
- Calder I.R. 1992. A water use and growth model for eucalypts plantations in water limited conditions. in Calder, IR; Hall RL; Adlard PG eds. Growth and water use of Forest Plantations. 381 pp. Wiley and Sons, Chichester.** The model is based on the measurement of the interrelation between transpiration rate and basal cross sectional area and soil moisture availability. The volume growth rate in water limited conditions is assumed to be proportional to the volume of water transpired.
- Calder I.R. 1992. Water use of Eucalyptus; a review. in Calder, IR; Hall, RL; Adlard PG eds. Growth and water use of Forest plantations. 381 pp, Wiley & Sons, Chicester.** Knowledge of the water use of *Eucalyptus* spp., gained from studies conducted in many countries of the world, is discussed in relation to their transpiration and interception characteristics. A very interesting presentation.
- Calder IR, Hall Robin-L, Prasanna KT . 1993. Hydrological impact of Eucalyptus plantation in India (paper to be presented at the Conference in Canberra in November 1993) Institute of Hydrology - UK.** Hydrological studies in southern India, on the effects of plantations of *Eucalyptus tereticornis* and other fast growing exotic tree species on water resources, erosion and soil nutrients are examined. Studies have confirmed that in the dry zone of southern India, water availability is the prelimiting factor on growth. When water is available nutrient limitations become important. Removal of both water and nutrient stress results typically in a five-fold increase in volume growth for the first year of growth.
- Calder,-IR; Swaminath,-MH; Kariyappa,-GS; Srinivasalu,-NV; Murty,-KVS; Mumtaz,-J; Srinivasa-Murty,-KV. 1992. Deuterium tracing for the estimation of transpiration from trees. Part 3. Measurements of transpiration from Eucalyptus plantation, India. Journal-of-Hydrology-Amsterdam. 130: 1-4, 37-48; 9 ref.** Measurements of transpiration made using a deuterium tracer method are presented from individual trees of *E. tereticornis* and *E. camaldulensis* from plantations in Karnataka, India. Equations are given for daily transpiration rates for individual trees and on a unit ground area basis. For all the sites studied, although there is evidence for the 'mining' of soil water (at one site the annual transpiration rates for the first few years of growth was higher than the annual rainfall rate), there is no evidence for direct abstraction from the water table.
- Calder-IR. 1986. Water use of eucalypts: a review with special reference to South India. Agricultural Water Management. 11:3/4.** Current knowledge of the water use characteristics of *Eucalyptus* spp. in terms of transpiration and interception loss is discussed. It is argued that only in exceptional circumstances, in particular when *Eucalyptus* spp. which do not exhibit stomatal control are planted in areas with shallow water tables, the fears of 'voracious' water use are justified.

- Calderón Sánchez, S. 1991. *Respuesta del Eucalyptus globulus spp. globulus a fertilizaciones de apoyo en la VIII región. Ciencia e Inv. Forest.*, 5 (1): 5-21. Santiago, Chile.** Trials were carried out in the humid temperate coastal areas of Concepción province (a) and in humid areas of the Andes range (b). The results show that in (a) urea is more efficient and provides profitability rates higher than 12 percent. In (b), the best combination was a mixture of N, P, K and B, with a high survival rate and the highest volumetric yield and the same profitability reached in (a).
- Calvo de Anta, R. 1992. *El eucalipto y las propiedades del suelo, en Galicia. Cadernos da Area Cienc. Biológicas. Sem. Estud. Galegos*, 4: 9-26. Santiago de Compostela, España.** A series of data and estimates on water and nutrient cycles, the state of the acid soils under *E. globulus* vegetation in Galicia, Spain are presented. Vegetation appears as a minor factor compared to climate, geology, soil type. Few differences exist between *Quercus*, *Pinus* and *Eucalyptus* spp. respective influence on soils. No generalizations should be made about other areas with different climates and soils.
- Calvo de Anta, R. 1992a. *El eucalipto en Galicia. Sus relaciones con el medio natural. Universidade de Santiago de Compostela. España. 209 pp.*** A summary of several papers written by the author with additional contributions. Chapters are dedicated to: *Eucalyptus* spp. and soil acidity; soil nutrients; water cycle; Galicia's vocation for *Eucalyptus* spp. production; conservation of natural systems; planning. Conclusions indicate that: after examining all the soils there are no differences among forest systems with different types of vegetation. In new soils, where rocks are close to the surface, acid neutralization capacity may last hundreds (thousands) of years. Although fast-growing species consume more nutrients than slow-growing ones, larger nutrient consumption barely reflects in soil composition, yet the need to fertilize the soil in latter generations cannot be discarded. It must be admitted that *Eucalyptus* spp. trees should not be rejected, nevertheless their use must be subject to planning.
- Cannon, P.G.; Roca Calienes, L.; Borgo, G. 1985. *Ensayos de especies forestales exóticas y guía para su zonificación en la Sierra Peruana. Proyecto FAO/Holanda. 87 pp. Lima. Perú. (FA, 1986, 047-00496)*** This report gathers data on the history of repopulation, geology, climate and trial of species. Survival and growth rates of 80 species of *Eucalyptus*, *Pinus* and *Cupressus* spp. are also included.
- Cannon-PG; Roca-Calienes-L, Borgo-G. 1985. *Trials of exotic forest species and guide to their zonation in the Sierra Peruana. Project FAO/Holanda/INFOR/GCP/PER/027/MET. Lima, Peru ; INFOR/FAO.*** The history of reforestation activities in Peru is discussed. Amongst most promising species i.e. those exhibiting superior growth and ecological plasticity, were a large number *Eucalyptus* spp.
- Carre, S. *La filière Eucalyptus en République Populaire du Congo. ENGREF Nancy 1987. 36 p. et annexes.*** This study illustrates silvicultural techniques on clonal plantations of *Eucalyptus* spp. for clonal exploitation in the Industrial Afforestation Unit of Congo. It also shows the marketing potential of these products (the firsts plots were harvested in 1987, but cellulose exploitation was never implemented).

- Carvalho-JC. 1988. *The role of small and medium farmers in Brazilian forestry development. Bilateral symposium Brazil-Finland on forestry actualities. 16-22 October 1988, Curitiba, Parana, Brazil.*** Farmer integration to the reforestation effort is seen as one of the best ways of increasing local and regional supplies of forest produce. The reasons why the farmers participated in the programme are examined.
- Casal, M. 1993. *El Plan Forestal de Galicia, a examen. Ecosistemas, 4: 28-30. España.*** The paper criticizes the forestry plan implemented in Galicia, Spain. The author considers the plan mainly focuses on productive goals.
- Castroviejo, S. 1992. *O monte, o lume e o eucalipto en Galicia. Resumen. Cadernos da Area de Ciencias Biolóxicas. Sem. de Estudos Galegos, 4: 87-88. Santiago de Compostela. España.*** This paper considers that forest fires are an old problem, nevertheless, they have been kept under control. The fact that several tree and shrub species have adapted to fire confirm this assumption. Usually the forest burns easily due to its natural conditions; some people in rural areas use fire to clear the forest; organic matter is no longer gathered because herding and firewood collection have decreased; some *Pinus* spp. plantations and specially *Eucalyptus* spp. burn easily; a new culture exists now and it has little knowledge of the forest.
- CATIE. 1986. *Silvicultura de especies promisorias para producción de leña en América Central: resultados de cinco años de investigación. Centro Agronóm. Trop. de Inv. y Enseñanza. Turrialba. Costa Rica. 228 pp.*** Many species, good for firewood production are described, among them several *Eucalyptus* spp.
- Catinot, R. *En Afrique francophone, l'avenir forestier tropical se jouera dans le cadre du monde rural. Bois et Forêts des Tropiques 1984. (No. 203): 7-43*** The author illustrates some forest related problems and the energy crisis in savannas and dense forests. Certain errors incurred in by researchers and development agents are highlighted. The paper illustrates some of the actions implemented and their results. The article shows several tables with figures on productivity per ha, in different types of natural and planted stands.
- Caulfield,-JP; Schonau,-APG; Donald,-DGM. 1993. *Making eucalyptus species-site selection decisions using stochastic dominance analysis. Forest Ecology and Management. 56: 1-4, 147-162; 23 ref.*** Stochastic dominance analysis (SDA) along with the mean variance and expected value rules, is used to make species-site selection decisions using fourth-year volumes from a species comparison trial of ten eucalypt species in the south-eastern Transvaal, South Africa. Comparisons are made for different soil depths, soil types and altitudes.
- Chahbra-R. 1989. *Sewage water utilisation through forestry. Bulletin Central Soil Salinity Research Institute-ICAR. No.15.*** In pollution control, use of untreated sewage for irrigating forest plantations is discussed. Growth of *Populus* spp. was best followed by *E. tereticornis*. However, since *Populus* spp. is deciduous and does not 'biodrain' the sewage in winter, use of *E. tereticornis* is recommended.
- Chambard-P, Jullien-I. 1952. *Tanning with the tannin from the bark of E. sideroxylon. Bulletin de l'Association Francaise des Chimistes des Industries du Cuir, Paris.*** Results of tests show that the tannin from the bark of *E. sideroxylon* can be used as a

bleached extract, and as a bleached extract treated with a suitable synthetic tannin. The latter gives better results in tanning, particularly when mixed with the 'sweetened' chestnut extract.

**Chand Basha S. (1986) Performance of eucalypts in Kerala. (in: Eucalypts in India : Past, Present and Future.) Kerala Forest Research Institute, Peechi, India.** Introduction of *E. grandis* and other species of eucalypts in Kerala is discussed. Its yield, management and disease problems are brought out. The public opinion regarding the "ill effects" of the species is dealt with. Research priorities to remove the hostility towards *Eucalyptus* spp. are indicated.

**Chandrakanth MG, Ranganath Sastri KN. 1984. Deliberate extension of areas under eucalypts conclusively without disaster? Indian Statistical Institute, Bangalore-1.** Authors think that *Eucalyptus* spp. are poor as firewood and are of use mainly in rayon pulp and paper industries that pollute the environment during the production stage.

**Chandrashekar DM, Krishnamurthy BV, Ramaswamy S.R. 1987. Social Forestry in Karnataka - An impact analysis. Economic and political Weekly, No.24 June 13.** The authors argue that social forestry, as it is practised, serves only the cause of industries and the rich people. The international funding agencies abet this.

**Chaperon, H. Notes de voyage en Afrique du Sud. Informations-Forêts 1988. (No 3): 219-229** This article illustrates the history of plantations in South Africa. Artificial forest covers 1 150 000 ha, of which 75 percent belongs to large private corporations: 600 000 ha are *Pinus* spp. plantations, while 390 000 are *Eucalyptus* spp. (80 percent of *Eucalyptus grandis*), 120 000 ha are planted to *Acacia* spp. These plantations are managed by applying intensive silvicultural practices (clonal propagation with very intensive genetic selection). Forest policy is strongly influenced by large industrial corporations governing all the stages of the wood industry, from plantation to the end-product.

**Chapuis, P. 20 ans de recherche forestière à Cuba. Bois et Forêts des Tropiques 1990. (No. 223): 43-50** The author illustrates the history of the Forest Research Institute in Cuba, and the evolution of the forestry sector. *Eucalyptus* spp. were introduced in Cuba approximately in 1929 and have been subject to intensive plantation since 1955. Plantations are often established in areas where coffee constitutes the understorey. This type of reforestation is aimed at several simple objectives: to achieve forested areas and provide jobs to rural manpower. The author highlights that no research has been carried out on forest economics.

**Charfi, M. Analyse de l'efficacité aérodynamique de divers types de brise-vent vivants en climat aride. INRF, Ariana, Tunisie. Note de Recherche - Institut National de Recherches Forestières 1987. (No. 19): 16 pp. (15 ref.)** This analysis looks at the efficiency of different types of *Eucalyptus* spp. wind-breaks (*Eucalyptus salmonophloia* and *Eucalyptus torquata*), *Acacia cyanophylla*, and several associations of *Eucalyptus* and *Acacia* spp. The most efficient are the mixed wind-breaks that include a row of *Acacia* spp.

**Charmes, J. L'Eucalyptus sur les Hauts-Plateaux malgaches : témoin, acteur et victime de comportements sociaux et politiques. Cahiers ORSTOM série Sciences**

- Humaines 1980. vol.17 (No 3-4): 267-268** This short article does not include references. The author highlights the problems arising from competition between *Eucalyptus* spp. and food crops: on hill areas, the close presence of *Eucalyptus* spp. decreases the yield in rice fields. These fields were bought by slave descendants (Andavo). *Eucalyptus* spp. appears to be more resilient than *Pinups* spp. as it regards traditional practices of fire use.
- Chatha,-IS; Singh,-J. 1993. Trends of forestry in Punjab with a special reference to Eucalyptus marketing. Indian Journal of Agricultural Marketing. 6: 2, 97-103.** This study examines production trends of forests (and *Eucalyptus* spp. in particular), the commercialisation model and the problems faced by *Eucalyptus* spp. farmers, and the role of the Forest Corporation in the marketing of *Eucalyptus* spp. The paper points out that there has only been a small forest area increase in the Indian Punjab. Undue emphasis on planting of short-duration trees like *Eucalyptus* spp., mainly aimed at earning quick returns, has created a glut in the timber market which has resulted in much less *Eucalyptus* spp. plantations being established each year.
- Chaturvedi AN Sivaji P. Jayaram Prasad D.V.1989. Eucalyptus provenances trials in Andhra Pradesh. Indian Forester - July 1989.** Several provenance of *Eucalyptus camaldulensis* and *Eucalyptus tereticornis* have showed better growth in average diameter and average height, but no single provenance has performed consistently well in all experiments. It would be a mistake to depend on a single provenance all over.
- Chaturvedi AN, Bhatia Shubra, Debas Manoj. 1993. Productivity - spacing in Eucalyptus plantations. Accepted for publication in the International Tree Crops journal.** The paper discusses the growth of farm forestry practices in Northern India. It deprecates the high density planting with short rotation now adopted. In these cases, as thinnings are not useful, farmers have to harvest even when there is slump in the market. This has resulted in disenchantment. High financial returns are obtained where the spacing has been 3 x 2 m coupled with a rotation of 9 years and more. The expected use of eucalypts for plywood is sure to increase the profitability with wider spacing.
- Chaturvedi AN, Sharma SC, Srinivasan Ramji. 1988. Water consumption and biomass production of some forest tree crops. The International Tree Crop Journal No.5** Water consumption and biomass production of 10 species are compared. *Eucalyptus* hybrid found to be most efficient.
- Chaturvedi AN. 1988. Silvicultural requirements of eucalypts for small farms. (in: Multipurpose tree species for small-farm use. Proceedings of an international workshop held November 2-5 1987 in Pattaya, Thailand) Co-published with the International Development Research Centre, Canada, Arlington, Virginia, USA; Winrock International Institute for Agricultural Development.** The paper discusses the controversy over eucalypts and water uptake. Brief descriptions are given of growth characteristics, effects on the soils, spacing, coppicing, clonal propagation, chlorosis in plantations, mycorrhizal associations and growth, and tree crop rotation. Brief data are given showing that wood density and strength (and, therefore, market values) increase with age. The economic felling age for pulpwood is discussed. Planting guidelines are given.

- Chaturvedi AN. 1988. *Silvicultural requirements of small farmers. My Forest - Volume 24 - No.4, December 1988.*** Eucalyptus hybrid is a boon to farmers both as pure crop and in agro-forestry provided proper management practices are adopted. Dense planting and short felling cycles are not desirable both from the point of silvicultural techniques and economic returns.
- Chaturvedi- MD .1951. *Rotational lopping of Eucalyptus in the Nilgris. Indian For. 77 (12), (726-8).*** Experience gained in private estates suggests the adoption of regulated lopping of the state fuel plantations of eucalypts (mainly *E. globulus*, *E. eugenioides* and *E. paniculata*) for oil production. Retention of the crown at the top, and a rest of 4 full growing seasons between loppings, should be enforced.
- Chaturvedi-AN. 1983. *Eucalypts for farming. UP Forest Bulletin Forest Department Uttar Pradesh No.48.*** Private tree planting is relatively new in India, although Forest Departments have been raising eucalypt plantations on public land for over a century. The paper provides an account of the biological and silvicultural characteristics, management problems, and economics of *Eucalyptus* spp. for the use of the farmer.
- Chhabra-R; Baddesha-HS; Rao-DLN. 1985. *Untreated waste water as a source of tree nutrients. Ambio, 14 : 6.*** Use of untreated municipal sewage in *Eucalyptus tereticornis* plantation in the first 2 years after planting is reported. *Eucalyptus tereticornis* showed no visible symptoms of adverse effects, and produced 55.45 t dry weight of wood, after 2 years.
- Chouhan-GS, Mathur AN, Bhandari-MMC; Jat-RK. 1992. . *Allelopathic effect of some tree species on associated grasses under silvipastoral system. Proceedings, First National Symposium on Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992 held at CCS Haryana Agricultural University, Hisar-125004, India.*** Six fuelwood species were planted in a trial at Udaipur, Rajasthan in 1986 under rainfed conditions. Litter from the trees was allowed to remain *in-situ*. Dry matter production of grasses sown after the establishment of the trees was measured: it was similar under different tree species up to 1989, and in 1990 and 1991 it was greatest under *Leucaena leucocephala* and least under *Eucalyptus* hybrid and *Prosopis juliflora*.
- Chowdhury,-MK. 1992. *Kendbona Eco-Development Project - a novel approach to wasteland reclamation. Indian-Forester. 118: 12, 879-886.*** An account is given of a participatory project between the West Bengal Forest Development Corporation and the village of Kendbona, covering 54 ha of waste land. Plantations of fast growing species were established to be grown on a short rotation and intercropping was done to obtain early returns. Plantations included *Acacia auriculiformis*, *Eucalyptus*, *Pongamia pinnata*, and neem for fuelwood. Details are given of selection and involvement of the beneficiaries, planting patterns and species used, costs and benefits. Immediate economic returns were achieved, and the project was considered highly successful.
- Christo, SSM de; Santos, OS dos. 1990. *(Efectos del yeso y del boro sobre el crecimiento de plantas de Eucalyptus citriodora en vivero). Efeitos do gesso e do boro na producao de mudas de Eucalyptus citriodora. Revista do Centro de Ciencia Rurais, Universidade Federal de Santa Maria. 1990 20: 1-2, 173-184; 13 ref.***

A study on fertilization using N, P, K, Ca, S and B. It was observed an increase in height and dry matter production when clay was added, plus an increased concentration of Ca and S; the addition of clay determined an decreased concentration of K. Plant height and dry matter production were reduced by adding 0.1 p.p.m. of B, this outcome suggested that such element has a toxic effect. (In Portuguese).

**Christo,-SSM-de; Santos,-OS-dos. 1990. (Effects of gypsum and boron on growth of *Eucalyptus citriodora* seedlings). *Efeitos do gesso e do boro na producao de mudas de Eucalyptus citriodora. Revista do Centro de Ciencia Rurais, Universidade Federal de Santa Maria. 20: 1-2, 173-184; 13 ref.* Seedling height was measured 30, 60 and 90 days after fertilizer application. Above-ground dry matter production and concentrations of N, P, K, Ca, S and B in it were measured after 90 days. Gypsum increased height, dry matter production, and Ca and S concentrations; K concentration was reduced by gypsum. Seedling height and dry matter production was reduced by application of 0.1 p.p.m. B, suggesting a phytotoxic effect of B. Dry matter production and height were greatest for seedlings in the 2 t gypsum/ha plus 0.05 p.p.m. B treatment.**

**Ciancio, O.; Portoghesi, L.; Maetzke, F.; Menguzzato, G. 1990. (Arboricoltura de madera en el ambiente mediterraneo. El ejemplo de la hacienda Massanova [Campania]) *Arboricoltura da legno in ambiente mediterraneo: il piano culturale dell'azienda Massanova. Annali dell'Istituto Sperimentale per la Selvicoltura, Arezzo (Italia). 1990. 21 p. 556. Publ. 1992.* Productivity data (at ages 9 and 10 years) and silvicultural treatment costs for various fast-growing tree species in a former agricultural estate in southern Italy. Mean annual growth of *Pinus radiata* and *Eucalyptus* spp. (mainly *Eucalyptus globulus* and *E. bicostata*, *E. maidenii*, *E. viminalis*) was similar: 7.4 and 7.6 m<sup>3</sup>/ha, respectively. However, *Eucalyptus* spp. showed fairly greater sensitivity to site conditions (annual increment varied from 5.5 to 14.3 m<sup>3</sup>/ha). Harvest projections for the estate over the following 7 years are discussed. The role of government grants (for roads, initial investments etc.), and the socio-economic benefits of afforestation are noted. (In Italian).**

**Ciancio-O. 1972. *Trials on thinning stems in coppice stands of Eucalyptus camaldulensis at Piazza Armerina (Silicy). Annali dell' Istituto Sperimentale per la Selvicoltura Arezzo. (3).* The effects on coppice growth and volume yield of *E. camaldulensis* were studied. The number of stems two years after coppicing was reduced to two, three or four. At the end of rotation, the greatest total volume of wood was obtained from the unthinned stand, but the greatest volume of commercial pulpwood from the stand with three stems per stump.**

**Ciancio-O; Eccher-A; Gemignani-G. 1980. *Eucalypts, Radiata pine, Douglas fir, and other fast-growing forest species. Timber and paper pulp: Legno e cellulosa. Italia Agricola. 117: 1, 190-218; 63 ref.* Ecological aspects of cultivation and productivity of 10 *Eucalyptus* species, Douglas fir and *Pinus radiata* are discussed in detail and brief notes are given on several broadleaves and conifers.**

**Conroy,-C.1993. *Eucalyptus sales by small farmers in eastern Gujarat. Agroforestry Systems 23(1) p. 1-10.* This article describes the situation in eastern Gujarat, in an area where a local NGO (Sadguru Water and Development Foundation, SWDF) initiated a social forestry programme in 1982, initially with *Eucalyptus***

- tereticornis*, but later with other species. Farmers sold their *Eucalyptus* spp. directly to buyers at prices close to those in organized wood markets. An important reason for this unusual situation is the absence in Gujarat of controls on eucalypts sales, which has helped producers to avoid dependence on rent-seeking intermediaries. The study shows that growing *Eucalyptus* spp. can be a profitable activity for small farmers, given the right circumstances.
- Conroy-C. 1992. *Can eucalypts be appropriate for poor farmers? Appropriate Technology, 19:1.*** This paper suggests that criticism of eucalypts is not always valid and planting *Eucalyptus* spp. can be an appropriate technology for resource poor farmers.
- Coppen,-J.J.W.; Hone,-G.A.TI. 1992. *Eucalyptus oils: a review of production and markets. Chatham (United Kingdom). NRI. 1992. 45 p.*** This book provides information on the technical and economic aspects of the production of steam-volatile oils from eucalyptus leaf, including the harvesting of the leaf and its distillation. It also reviews recent trends in the world market for eucalyptus oils. It is intended for prospective new producers of eucalyptus oils as well as organisations and individuals appraising projects involving their production. It is particularly intended for those in developing countries.
- Coppen,-JJW; Dyer,-LR: 1993. *Eucalyptus and its leaf oils: an indexed bibliography. Chatham, UK; Natural Resources Institute (NRI) vi + 205 pp.; 456 ref.*** Literature from the 1920s to late 1992 is cited on the volatile oil distilled from *Eucalyptus* leaves. The introduction (in English, French, Latin American Spanish and Brazilian Portuguese) explains the format of the bibliography and the terminology used. The list of references, in alphabetical order of author, includes bibliographic data and keywords. A species index (including subspecies, varieties and hybrids) and a geographical index are provided.
- Cortes,-FS. 1992. *Reforestation by agroforestry: the Madang Province experience. Tropical forest ecology and management in the Asia-Pacific region. Proceedings of a workshop held at Lae, Papua New Guinea, 20 June-1 July 1988. 1992, 113-120. London, UK; Commonwealth Science Council.*** An account is given of a participatory community agroforestry system in Trans-Gogol, Madang Province, Papua New Guinea, an area where the virgin forest has been clear felled, and traditional farming utilizes a fallow system in gardens. The system uses some of the royalties for purchases of cocoa seedlings (the agricultural crop) and trees (*Eucalyptus deglupta* and *Leucaena* spp.) are distributed to the land owners free. The effects of the project are described with emphasis on their influence on the people and on provincial government policies.
- Cortez-F. 1986. *Community forestry in customary lands : lessons from Papua New Guinea. (in: Rao, YS; Hoskins, MW; Vergara, NT; Castro, CP. eds. Community forestry: lessons from case studies in Asia and the Pacific region), received 1989. Joint publication with Environment and Policy Institute, East-West Center, Honolulu, Hi. USA, Bangkok, Thailand; FAO Regional Office for Asia and the Pacific.*** Afforestation through community forestry and agroforestry systems engaging the local people is explained.

- Costa-A-Fernandes. 1962. *The essential oils of Eucalypts cultivated in Angola. Garcia de Orta, Lisboa 10(2), (349-57), 8 refs.*** Presents the results of chemical analyses of oil produced by *Eucalyptus smithii*, *E. maidenii*, *E. bridgesiana* and *E. radiata*.
- Couto, L; Binkley, D; Betters, DR; Moniz, CVD. 1994. *Intercropping eucalypts with maize in Minas Gerais, Brazil. Agroforestry Systems, 26: 147-156.*** The objective was to study the effect of 1, 2, 3 and 4 rows of maize between eucalyptus seedlings. One row of maize did not lower the initial growth and survival of trees, but did reduce the costs of the eucalypt plantation by 60 percent. The other treatments reduced plantation costs but also reduced the initial growth and survival of the trees.
- Cromer,-RN; Cameron,-DM; Rance,-SJ; Ryan,-PA; Brown,-M. 1993. *Response to nutrients in Eucalyptus grandis. 1. Biomass accumulation. Forest Ecology and Management. 62: 1-4, 211-230; 37 ref.***
- Cromer,-RN; Cameron,-DM; Rance,-SJ; Ryan,-PA; Brown,-M. 1993. *Response to nutrients in Eucalyptus grandis. 2. Nitrogen accumulation. Forest-Ecology-and-Management. 62: 1-4, 231-243; 27 ref.*** Two papers by the same authors on *Eucalyptus* spp. nutrition in Australia.
- Cunningham-MW, Geary-TF. 1989. *The influence of container dimensions on the growth of Eucalyptus camaldulensis Dehn. seedlings and rooted cuttings. Commonwealth Forestry Review. 68:1.*** Greenhouse studies showed that large differences in container size caused only small differences in seedling height and root-collar diameter but more marked differences in shoot and root dry weights. Root dry weight and root/shoot ratio responded to length of container.
- Dabral-BG, Raturi-AS. 1985. *Water consumption by Eucalyptus hybrid. Indian Forester, 111:12, 1053-1070.*** Six month old seedlings were planted in 3 x 3 x 3 m lysimeters in 1978 and soil moisture determined at monthly intervals for 27 months at 30, 60, 120 and 200 cm depth. Water consumption from soil 30 to 245 cm deep was slightly less than rainfall received, although, for the entire soil depth, consumption exceeded rainfall, presumably reducing stored soil water. Consumption was highest during the rains and lowest during the summer. It was estimated that 167 mm of water are required to produce 1 kg dry weight of above ground biomass.
- Dalal-MR; Dahiya-DS Sarmah-MK; Narwal-SS. 1992. *Suppression effects of arid-zone trees on plant stand and growth of crops. Proceedings. First National Symposium on Allelopathy in agro ecosystems (agriculture & forestry), February 12-14, 1992 held at CCS Haryana Agricultural University, India.*** Data were collected in 1992 from farmers' fields around Hisar, Haryana on crop growth in relation to the major 7 tree species found. *Acacia nilotica*, was the most inhibitory tree species to the crops while *Ziziphus*, *Azadirachta indica* and *E. tereticornis* were less inhibitory.
- Daniels-RJR, Malati-Hegde, Madhav-Gadgil, Hegde-M;Gadgil-M. 1990. *Birds of the man made ecosystems: the plantations. Proceedings of the Indian Academy of Sciences, Animal Sciences, 99:1.*** A sample survey of bird species diversity has shown that while evergreen /semi evergreen forests had the lowest bird species diversity, eucalypt and teak plantations had higher values. However, it was found that particularly in the *Eucalyptus* spp. plantation, despite the apparent increased

diversity, bird species composition gradually shifted from the typical evergreen forests to that of more urban and scrubby habitats.

**D'Antonio-D. 1988. Forests return to the Ionian coast of Basilicata *Economia Montana Linea Ecologica* 20:2 11-22; 9 ref** Since the 1950s dune stabilization and reclamation projects, as well as plantations, have improved previously poorly drained areas. *Eucalyptus* spp. together with *Acacia*, *Pinus* and *Cupressus* spp. are availed of.

**Das,-DK; Ravender-Singh; Singh,-AK; Singh,-R. 1990. Root water extraction and evapotranspiration by young *Leucaena* and *Eucalyptus* plantations under semi-arid climate. *Annals-of-Agricultural-Research*. 11: 1, 1-13; 12 ref.** Root water extraction and evapotranspiration by *Leucaena leucocephala* and *Eucalyptus* hybrid (*E. tereticornis*) were studied for a period of 6 months in 1-year-old plantations on alluvial sandy loam soils in the semiarid climate of Delhi. The results indicate that both species could extract soil water to low matric potential values under conditions of low water availability, but demonstrate that *L. leucocephala* was more efficient in this respect. The latter species may, therefore, be better suited for use in farm forestry/agroforestry plantings on coarse textured soil with limited soil water availability.

**Davidson J. 1985. Setting aside the idea that eucalypts are always bad. FAO-UNDP/FAO Project BED/79/017. Working paper no 10.** The paper answers some of the ecological issues raised against *Eucalyptus* spp.

**Davidson J. 1986. *Eucalypts in Australia*. in: Davidson, J; Das, S. eds. *Eucalypts in Bangladesh*, Bangladesh Forest Research Institute, Chittagong.** The highest quality *Eucalyptus* spp. forests are located in water catchment areas and are considered the best vegetation cover for water yield and quality.

**Davidson J. et al. Provenance trials of eucalypts established in 1978 in: *Eucalypts in Bangladesh*. Bangladesh Forest Research Institute, Chittagong.** The very high differences in yield of the different *Eucalyptus* spp. and, within the species, of 4 different provenances brings out the scope for increase in production.

**Davidson, J; Das S. eds. 1986 *Eucalypts in Bangladesh*. Bangladesh Forest Research Institute, Chittagong.** The performance of *E. camaldulensis*, *E. tereticornis* and *E. bassiana* which have proved superior to over 20 others tested is brought out. The stability of particular provenances for the environmental conditions of Bangladesh is discussed. *Eucalyptus camaldulensis* from Petford has had excellent economic returns even from now fallow land.

**Davis-Dc, Abbott-DF. 1989. Industrial forestry development in Solomon Islands. Kolombangara Forest Products Limited. *Pacific Economic Bulletin*. 4:1.** Forestry sector in terms of export earnings is important to the Solomon Islands economy. Plantations of *Gmelina* and *Eucalyptus* spp. have been raised with the aim to establish a chip and sawmill complex for processing timber export. The programme enhances employment prospects in the Islands.

**DeBell-DS, Whitesell, CD, Schubert-TH. 1985. Mixed plantations of eucalypts and leguminous trees enhance biomass production. Research Paper, Pacific**

- Southwest Forest and Range Experiment Station USDA Forest Service, No. PSW-175.** *Eucalyptus* spp. were grown alone or with *Acacia melanoxylon* or *Albizia falcataria* in 1:1 mixtures. *Eucalyptus* spp. grown in mixtures were taller and had greater d.b.h. than *Eucalyptus* spp. in pure plots. Despite increased *Eucalyptus* spp. mortality in *Eucalyptus* mixed treatments, total dry yield of *Eucalyptus*/*Acacia* spp. and of *Eucalyptus*/*Albizia* spp. were respectively 37 percent and 150 percent greater than in pure *Eucalyptus* spp.
- Delwaulle, J. C. Plantations clonales d'*Eucalyptus* hybrides au Congo. Bois et Forêts des Tropiques 1985. (No. 208): 37-42 (communication présentée au IXe Congrès Forestier Mondial)**  
Clonal selection techniques to obtain *Eucalyptus* spp. hybrids, through controlled pollination and propagation by cuttings have enabled the establishment of a very homogeneous plantation of 18 000 ha in Pointe-Noire (Congo). The plantation boasts high productivity and makes it necessary to apply adapted silvicultural techniques, whose main aspects are presented by the author (plantation techniques, chemical fertilizer application, treatments).
- Delwaulle, J. C. Production papetière de peuplements clonaux d'*Eucalyptus* au Congo. Bois et Forêts des Tropiques 1985. (No. 208): 43-48 (7 ref.)**  
The Industrial Afforestation Unit of Congo (UAIC) is responsible for establishing 30 000 ha of *Eucalyptus* spp. to supply a pulp mill. The author illustrates why vegetative propagation is important when carrying out afforestation for paper production and shows the criteria taken into account by the forester in charge of the selection.
- Delwaulle, J. C.; Laplace, Y. La culture industrielle de l'*Eucalyptus* hybride en République Populaire du Congo: de la recherche au développement. Bois et Forêts des Tropiques 1988. (No. 216): 35 - 42 (15 ref).** The author gives background information on research carried out by the CTFT in Congo, its achievements: vegetative propagation of *Eucalyptus* spp. hybrids, and the UAIC perspectives. The author provides productivity projections and cost estimates for planting.
- Depari-KS (1954). Some notes on *E. globulus*. Rimba Indonesia 3 (8/10).** A description of the tree, with data on distillation yields, nursery practice, planting in mixtures, and uses.
- Depommier, D. Aspects de la foresterie villageoise dans l'Ouest et le Nord Cameroun. Rapport CTFT-INRA Yaoundé, Cameroun. 1983 18 p. et annexes (9 ref.)**  
This report is based on different aspects of community forestry in the north and west of Cameroon, it focuses on the Bangou region, where *Eucalyptus saligna* plantations have been developed since the 1950s. The author briefly outlines the conditions for plantation development, the techniques applied and organization of work. It also provides production and profit estimates.
- Depommier, D. Propagation et comportement d'espèces à usages multiples en haies vives pour la zone sahélo-soudanienne : résultats préliminaires d'essais menés à Gonse et Dinderesso. Dans "Physiologie des arbres et arbustes en zones arides et semi-arides", Groupe d'étude de l'Arbre. Séminaire tenu à Nancy et à Paris 20 mars-6 avril 1990. Editions John Libbey 1993. 155-165 (9 ref.)**  
Thirty woody and semi-woody tree species (13 *Acacia* spp. and one *Eucalyptus*

- camaldulensis*) have been tested in live wind-barriers in two sahelian-sudanese sites in Burkina Faso. Propagation by seedlings was not satisfactory in most of the species. In order to assess the efficiency of living wind-barriers constituted by defensive species, a classification system was established taking into account: survival rates, height increase, crown diameter and height point of thinning area at the base.
- Deshpande R.S, Chandrashekar H. 1984. *Is eucalypts farming really uneconomic? Indian Statistical Institute, Bangalore - 1.*** *Eucalyptus tereticornis* is grown in Kolar on marginal lands and not in good quality sites. The paper argues that eucalypts consume more water and lower the water table. The argument that *Eucalyptus* spp. farming has adverse effects on foodgrain production is based on limited or fragmentary data. However, *Eucalyptus* spp. increase disparity because they are cultivated mainly by the large farmers.
- Dhanda,-RS. 1990. *From a deficit state to a surplus state in Eucalyptus timber, Punjab (India). Fast growing trees and nitrogen fixing trees: international conference Marburg, October 8th-12th, 1989 [edited by Werner, D.; Muller, P.]. 82-91; 9 ref. Stuttgart, Germany; Gustav Fischer.*** *Eucalyptus* hybrid (*E. tereticornis*) has been grown under intensive cultivation in social and farm forestry schemes in the Indian Punjab since 1978-79. This has led to a surplus of eucalypt timber while there is a shortage of newsprint, an important import commodity. Strategies adopted by farmers in agroforestry and farm forestry systems, the non-matching development of the wood marketing infrastructure and the paper and pulpwood industry, and remedial measures and policy changes required to ensure a fair price for producers are discussed.
- Díaz González, T.E. 1992. *La problemática de las plantaciones de eucalipto en Asturias. Resumen. Cuadernos da Area de Ciencias Biolóxicas. Sem. de Estud. Galegos, 4: 85-86. Santiago de Compostela. España.*** This paper examines the criticism expressed on *Eucalyptus* spp., which is often indicated by the media, as a source of forest fires and soil degradation. It refers to public protests occurred in Tazones, (Asturias, Spain), due to plantation of *Eucalyptus* spp. It therefore suggests an analysis of all the problems posed by this type of reforestation and seeks for a balanced approach for the common good.
- Dilip Kumar P. J. 1992. *Eucalypts in industrial and social plantations in Karnataka. Growth and water use of forest plantations. Wiley & Sons. Chichester.*** The paper stresses the importance and urgency of raising plantations of fast-growing species if natural forests are to be saved. The success of farm forestry as an insurance against drought is explained. Its adoption is not restricted to big farmers.
- Domínguez de Juan, M.T. 1987. *Influencia de nutrientes y polifenoles vegetales en la humificación de la hojarasca de especies autóctonas e introducidas en la provincia de Huelva. Tesis Doctoral. Universidad Autónoma. Madrid. España. 193 pp.*** This paper studies the evolution of *E. globulus* and *E. Camaldulensis* foliage, compared to that of *Quercus suber*, *Q. ilex*, *Pinus pinea*, *Cistus ladaniferus* and *Halimium halimifolium*, by determining the concentration of nutrients and polyphenols in green and dry leaves. The polyphenol content appears to be equal in eucalypts and other trees with similar fruits (covered by a "dome"), but it is higher in *Pinus* spp., while the *Halimium halimifolium* accounts for the maximum

concentration. The liberation of nitrogen is higher when polyphenol contents are lower. Leaf decomposition is faster for species such as *E. globulus*, followed by *Q. suber*, while that of *Pinus* spp. is slower. Water-soluble extract of *E. Globulus* inhibits seed germination of lettuce, while *Cistus* reduces it. These seeds are not inhibited if they are planted in eucalypt soil, which proves that such effect disappears in the soil.

**Domínguez de Juan, M.T.; González Esparcia, E.; Penalva Rodríguez, F. 1989 *Influencia de nutrientes y polifenoles vegetales en la descomposición de la hojarasca de especies autóctonas e introducidas en el sureste español. Anales de Edafol. y Agrobiol., XX: 1429-1442. Madrid.*** A summary of the thesis dated 1987.

**Domínguez de Juan, M.T.; González Esparcia, E.; Penalva, F. 1988. *Efecto sobre la germinación de semillas del extracto hidrosoluble de hojas de especies mediterráneas introducidas : Eucalyptus globulus Labill, y autóctonas: Quercus suber L., Pinus pinea L., Cistus ladanifer L. y Halimium halimifolium Wk. Anales de Edafol. y Agrobiol., 47 (5-6): 948-953. Madrid.*** This is a summary of the thesis mentioned above.

**Dos Santos, A. J.; Peyron, J. L. *Panorama forestier d'un état du Brésil : le Parana. Revue Forestière Française 1992. (No 2): 177-188*** A review on the Parana forestry sector, including a background history of forest plantations and the different forestry exploitation sectors. Forest exploitation in Parana started in the 19<sup>th</sup> century when sawmills were established in the coastal area, soon after the railroad was introduced. Since 1930 deforestation for agricultural land use progressively decreased. Since 1966, a federal reforestation policy, based on tax incentives has been promoted.

**Dunn, -GM; Connor, -DJ. 1993. *An analysis of sap flow in mountain ash (Eucalyptus regnans) forests of different age. Tree-Physiology. 13: 4, 321-336; 16 ref.*** To test the hypothesis that old growth *Eucalyptus regnans* forests in SE Australia transpire less than regrowth forests, diurnal measurements of sap flow velocity were made in 50-, 90-, 150- and 230-yr-old forests in Victoria. Over the experimental period, water use of the over storey decreased with age ranging, on average, from 1.86 mm/day (50-yr-old plot) to 0.81 mm/day (230-yr-old plot). Annual water use decreased with forest age from 679 mm (50-yr-old stand) to 296 mm (230-yr-old stand). This difference corresponds to 3.8X10<sup>3</sup>/m<sup>3</sup>/ha. Results are discussed in the context of stream flow and catchment forest age.

**Durieu de Madron, H.; Mortier, F. *La filière bois au Portugal. Incitations techniques et financières en faveur de son développement. Rapport ENGREF 1989.*** This paper reports on forests in Portugal (three million ha, of which 14 percent is planted to *Eucalyptus* spp.), the wood industry is based on three components : wood, resin and cork, it is also supported by technical and financial incentives (incentives, taxation, research.)

**Dury S.J, Manjunath BE. 1992. *The influence of site factors on Eucalyptus growth in Karnataka. Growth and water use of Forest Plantations. Wiley & Sons, Chichester.*** *Eucalyptus* spp. annual increase range from 0.2 to 7.0 m<sup>3</sup>/ha/yr at 6 years of age. Fertilizer trials show no clear growth response to N or P. Practices to alleviate moisture stress are discussed.

- Dye P.J., Olbrich 1992. Heat Pulse observations of *Eucalyptus grandis* transpiration in South Africa. Growth and water use of Forest Plantations, Wiley & Sons, Chichester.** *Eucalyptus* spp. represent 37 percent of the 1.18 million ha of forest plantations in South Africa. This paper describes the heat pulse velocity technique for measuring sap flow in even aged plantations.
- Dyson-WG .1974. Experiments on growing *Eucalypt* wood fuel in the semi-deciduous forest zone in Kenya. East African Agricultural and Forestry Journal. 39.4.** Describes experiments over 12 years on growing *Eucalyptus* spp. for fuelwood at Muguga. *Eucalyptus grandis* from New South Wales gave the most satisfactory results. Average yields at 6 years of age are 178 m<sup>3</sup>/ha for the first rotation and 227 m<sup>3</sup>/ha for the second and third rotations.
- Earl-De. 1975. Forest energy and economic development. Oxford. UK : Clarendon Press.** An economic and statistical study of the worldwide consumption of forest fuel in relation to levels of economic development and the present energy crisis. Appendices include fuelwood consumption in Nepal and the costs of growing *E.grandis* fuelwood in Uganda.
- Eastham,J; Rose, CW. 1990. Tree pasture interactions at a range of trees densities in an agroforestry experiment. I. Rooting patterns. Australian Journal of Agricultural Research. 41: 4, 683-695; 27 ref.**
- Eastham, J; Rose, CW.; Cameron, DM; Rance, SJ; Talsma, T. 1988. The effect of tree spacing on evaporation from an agroforestry experiment. Agricultural and Forestry Meteorology. 42:4, 355-368; 31 ref.** Components of water balance over 2 years were measured at 3 spacings of *E. grandis* planted in a pasture in Queensland. Total water loss per unit area by evapotranspiration increased and drainage losses decreased with increased planting density. At the closest spacing, subsoil water contents were depleted to wilting point down to the maximum depth of measurement (5.6 m).
- Eastham, J; Rose, CW.; Cameron, DM; Rance, SJ; Talsma, T; Charles-Edward, DA. 1990. Tree pasture interactions at a range of trees densities in an agroforestry experiment. II. Water uptake in relation to rooting patterns. Australian Journal of Agricultural Research. 41: 4, 697-707; 18 ref.**
- Eastham,J; Rose, CW.; Cameron, DM; Rance, SJ; Talsma, T; Charles-Edward, DA. 1990. Tree pasture interactions at a range of trees densities in an agroforestry experiment. III. Water uptake in relation to soil hydraulic conductivity and rooting patterns. Australian Journal of Agricultural Research. 41: 4, 709-718; 24 ref.** Three papers on the interactions of *E. grandis* with pasture dominated by *Setaria sphacelata* cv *Kazungula*, in Queensland, Australia.
- Eastham,-J; Rose,-CW; Charles-Edwards,-DA; Cameron,-DM; Rance,-SJ. 1990. Planting density effects of water use efficiency of trees and pasture in an agroforestry experiment. New-Zealand-Journal-of-Forestry-Science. 20: 1, 39-53; 35 ref.** Water use by *Eucalyptus grandis* and pasture (dominated by *Setaria sphacelata* cv. *Kazungula*) was studied at 3 tree densities in an agroforestry experiment in Queensland. Biomass production and water use of trees were consistently lower at the higher tree densities throughout the study. Water use efficiency of trees was

greatest in the densely planted plots. Pasture evaporation was generally lowest under the densely planted trees where soil water contents in the pasture root zone were lowest. Pasture production was greatest at the medium tree density and this was associated with a greater water use efficiency than was found from pasture under high and low tree densities.

**Echeverria-I. 1943. *Fast-growing exotic tree species in Spanish forest economy. Intersyla -3 M.E.W.*** In Spain, eucalypts have been planted successfully to replace the indigenous oaks and chestnuts which have suffered heavily from disease. Recommendations are made to take up intensive afforestation to reduce Spain's wood import.

**Egger, K. *L'intensification écologique. Conservation (LAE) et amélioration des sols tropicaux par les systèmes agro-sylvo-pastoraux. Collection Documents Systèmes Agraires 1986. (No.6): 129-135*** An agro-pastoral project in Rwanda is used to illustrate a tropical soil conservation approach for "environmental enhancement". Tree and shrub species have been recommended in order to reinforce bench terraces and build terraces: *Grevillea robusta*, *Albizia versicolor*, *Croton macrostachys*, *Acrocarpus fraxinifolius*, *Cassia spectabilis*, *Cedrela odorata*, *Casuarina equisetifolia*, *Millettia dura* and *Maesopsis eminii* at an optimal density of 200-400 trees/ha. The use of *Eucalyptus*, *Cupressus* and *Pinus* spp. has not been planned. It is also recommended to replace the savanna planted to *Tripsacum laxum*, *Setaria* and *Pennisetum* by *Leucaena*, *Calliandra calothyrsus* and *Cajanus cajan*.

**El-Baha, -AM 1991. *Effect of nitrogen fertilization on biomass production and nutrient accumulation in Eucalyptus camaldulensis. Alexandria Journal of Agricultural Research. 36: 3, 141-154; 15 ref.*** Biomass production and nutrient accumulation were studied in a 7-yr-old *Eucalyptus camaldulensis* plantation grown on a very poor sandy soil in Al-Bosely region near Rosetta, Egypt. Fertilizing with N increased not only the N content in the main components of the trees (stems, branches and foliage), but also the content of other nutrients tested (P, K, Ca and Mg), except that K content decreased in stems and branches.

**Eldridge, KG. 1990. *Conservation of forest genetic resources with particular reference to Eucalyptus species. Commonwealth Forestry review, 69: 1, 45-53; 21 ref.*** The paper illustrates the need for well planned conservation strategies through the consideration of the genetic history of 8 fast growing plantation species in Australia.

**Eldridge-Kg, Griffin Ar. 1990. *Genetic improvement of E.globulus and E.nitrus. CSIRO, Canberra.*** Both species are currently the subjects of intensive selection and breeding in several countries. The advances achieved in breeding projects at Cellulose Beira Industrial in Portugal and by Associated Pulp and Paper Mills in Tasmania are touched upon. The relevance of bluegum breeding for China is highlighted.

**Eldridge-Kg. 1963. *Effect of honey bees on seed production of Eucalyptus regnans. For tech. Pap. For. Comm. Vict. No. 13, Limited distribution.*** The placement of bee hives in a stand of pole-sized *E. regnans* did not have any effect on the seed yield. However, the experiment showed that *E. regnans* is a useful species for supplying pollen in autumn.

**El-Lakany - MH. 1986. Fuel and wood production on salt affected soils. (in: Barrett-Lennard, E.G, Malcolm, C.V, Stern, W.R, Wilkins, S.M eds. Forage and fuel production from salt affected wasteland). 305-317, 45 ref; reprinted from Reclamation and Revegetation Research (1986) 5 (1/3), Amsterdam, Netherlands; Elsevier** A discussion of published works with particular reference to *Eucalyptus* spp., *Casuarina* spp. and mangroves.

**El-Lakany,-MH; Mohamed,-SY. 1993. Effects of species combination on the root characteristics of young *Acacia saligna*, *Casuarina cunninghamiana* and *Eucalyptus camaldulensis* trees. Alexandria Journal of Agricultural Research. 38: 1, 211-227; 10 ref.** Three wind-breaks were studied: *Acacia saligna*/*Casuarina cunninghamiana*; *A. saligna*/*Eucalyptus camaldulensis*; *C. cunninghamiana*/*E. camaldulensis*. At 6 year old, *A. saligna* was the most competitive species, in terms of overall growth, horizontal expansion and vertical depth of its root system, followed by *E. camaldulensis*, and *C. cunninghamiana*. Combination of species had different effect on single species root development. The results indicate that to minimize competition with crops only *C. cunninghamiana* should be used as wind-break and confine *A. saligna* and *E. camaldulensis* to woodlots. If mixed species wind-breaks are desirable, *C. cunninghamiana* should be planted on the inside, and *A. saligna* or *E. camaldulensis* on the outer side of the wind-break.

**Elvira Martín, L.M.; Hernando Lara, C. 1989. Inflamabilidad y energía de las especies de sotobosque. Estudio piloto con aplicación a los incendios forestales. Monografía n° 68, CIT-INIA. Madrid. España. 99 pp.** A study on the flammability of 40 species is carried out every month. The study includes *Eucalyptus globulus* and *E. camaldulensis*. The values themselves do not allow to precisely define the degree of fire hazard. For instance, *Quercus ilex* is very flammable all the year, and it could be dangerous if shrub vegetation exists. *Q. suber* implies a similar risk. *E. camaldulensis* is very flammable all the year, nevertheless it does not allow the grass cover to grow. On the contrary *E. globulus* and *Pinus spp.* have mean variable flammability, but the organic matter cover grows abundantly.

**Escobar Munera, M.L. 1988. Toxicidad de Aluminio en *Eucalyptus grandis* Hill ex Maiden y su posible corrección. Serv. Nac. de Protección Forestal., 2 (1): 49-62. INDERENA. Medellín. Colombia.** Aluminium toxicity in hydroponic dissolution is the subject of this study. High dosages reduce growth.

**Escobar-M, ML; Del Valle A, JI. 1988. (Possible allelopathy of *Melinis minutiflora* in a young plantation of *Eucalyptus grandis*.) Posible alelopatía de *Melinis minutiflora* en una plantación joven de *Eucalyptus grandis*. Investigaciones Forestales Instituto Nacional de los Recursos Naturales Renovables y del Ambiente. No. 24, 11 pp.; 12 ref., 1 pl. Medellín, Colombia.** The effects of grass competition on soil and tree foliar nutrients were studied in 2 year old 2 *Eucalyptus grandis* plantations in Sevilla, Colombia. One plantation showing good growth was associated with *Pennisetum clandestinum* and *Axonopus micay*, while the plantation showing poor growth was associated with *Melinis minutiflora*. (In Spanish).

**Evans-HBL. 1990. Forestry extension in EMI districts, Kenya. Commonwealth Forestry Review. 69:4.** In the context of depletion of fuelwood stocks, research on species

most suitable for the arid and semiarid lands is taken up. *Eucalyptus camaldulensis* and *E.tereticornis* show the most promise, but farmers perceive *Eucalyptus* spp. as a threat to crop because of excessive water use.

**Evans-J. 1989. Community forestry in Ethiopia; the Bilate project Rural Development in practice** The report describes a social forestry project as part of the fight against deforestation in the area and to prevent erosion of steep slopes. Tree planting included *Eucalyptus*, *Acacia*, *Grevillea* spp. etc. The reasons of success are described.

**Eyog-Matig, O.; Dreyer, E. Fonctionnement hydrique de 4 essences de reboisement au Nord-Cameroun : évolution saisonnière du potentiel hydrique et de la conductance somatique. Dans "Physiologie des arbres et arbustes en zones arides et semi-arides", Groupe d'étude de l'Arbre. Séminaire tenu à Nancy et à Paris 20 mars-6 avril 1990. Editions John Libbey 1993. 85-92.**

A first analysis of the hydrological function of 4 species used for afforestation in Cameroon, (*Dalbergia sissoo*, *Khaya senegalensis*, *Azadirachta indica*, *Eucalyptus camaldulensis*). Measurements of the foliar hydrological potential and somatic conductance were carried out during three years. The highest hydraulic efficiency was expressed by *Dalbergia* spp.

**Fairweather-JR, MacIntyre-AA. 1989. An economic evaluation of coppice fuelwood production for Canterbury. Research Report Agribusiness and Economics Research Unit Lincoln College No.199.** An assessment of short-rotation intensive cultivation of *Eucalyptus* spp. for fuelwood production.

**Fathi,R-A Martin ,B., Dir the Étude et comparaison de la tolérance au sel de jeunes plants d'Eucalyptus de populations de variabilité de plus en plus réduite. Univ.: Nancy 1; th. doct-ing. : Biol. physiol. veg. ; 1987. 198 p. (17 p. de ref.)** The paper illustrates a comparative study carried out on three *Eucalyptus* spp. (*E. microtheca*, *E. alba*, *E. camaldulensis*). The species were chosen according to plasticity and criteria of variability characterizing this genus). The study was aimed at selecting plants with high salt tolerance in order to introduce them in relatively arid sites for firewood production. Salt tolerance is higher among *Eucalyptus microtheca*. While *E. camaldulensis* has little tolerance to salt.

**Fauvel. J H. 1961. These strange Eucalyptus trees. Parfum. Cosmet. Savons 4, (99-102),** Presents data on the crude oil yields of *E.globulus*, *E.leucoxydon*, *E.goniocalyx*, and *E.rostrata* grown in Algeria, and *E.amygdalina* and *E.citriodora* from Australia, with details of their characteristic odour and colour.

**Favrichon,V. Aménagement intégré de bassin versant. Réflexions à partir du cas des bassins représentatifs pilotes de Bafing et Bale (Fouta-Djallon, République de Guinée). Bois et Forêts des Tropiques 1991. (No. 228): 25-40 (7 ref.)** The Fouta Djallon massif is, among other things, the place where the Senegal and the Niger rivers have their origin. This article presents the pilot projects established in the Prefecture of Mamou, with the aim of promoting sustainable rural development and ensuring soil and natural resources conservation. Exotic woody species are produced in nurseries (*Eucalyptus* and *Pinus* spp.) as well as species aimed at agroforestry uses (*Acacia*, *Parkia biglobosa*, etc.)

**Fazli-Subhan. 1990. Financial analysis of selected shelterbelt systems in Pakistan. Pakistan Journal of Forestry. 40: 3, 247-252; 8 ref.** Economic analyses were made of shelterbelt agroforestry systems in 3 regions of Pakistan: wheat or sugarcane in combination with poplar (*Populus* spp.) or shisham (*Dalbergia sissoo*), in the NWFP, wheat in combination with poplar or shisham in Punjab, and wheat or cotton and *Eucalyptus* spp. in Sind. Crop yields were reduced (compared with the pure crop) least with wheat in NWFP (0.27-1.14 percent) and *Eucalyptus* spp. (0 percent). The soundest financial options were wheat and sugarcane with poplar in NWFP, wheat and shisham in Punjab, and wheat and *Eucalyptus* spp. in Sind; all these options were superior to agricultural monocrops.

**Fearnside-PM. 1989. The charcoal of Carajas: a threat to the forests of Brazil's eastern Amazon region. Ambio 18:2.** The raising of large-scale plantations of *Eucalyptus* spp. for production of charcoal for smelting of pig-iron from the high-grade iron ore of Carajas is discussed from the point of view of environmental destruction.

**Fernández, N.R. 1990. Bibliografía sobre el género Eucalyptus en la Región Pampeana. Jornadas sobre eucaliptos. Actas, 23-24 de Julio, 1990: 262-271; Centro de Inv. y Exp. Forestales. Buenos Aires. Argentina.** This paper includes 102 references on general aspects of the species.

**Fernando-US; Cabbage-FW (1983). Analysis of fuelwood in plantation in Sri Lanka. Sri Lanka Forester, 16 : 1-2, 11-17.** Information on silvicultural needs, input costs, yields and market prices of *Eucalyptus* spp. *E. camaldulensis* plantations raised for production of fuelwood on land of almost any quality using a 6 percent discount rate, had a positive net present value; rotations of 36 to 42 years were the most profitable.

**Ferrand, J.C. Quelques essences exotiques pour la constitution de peuplements méditerranéens à couvert dense. Revue Forestière Française 1990. (No. spécial): 195-201(8ref.)**

This research is aimed at studying dense cover species (*Eucalyptus dalrympleana*, *E. delegatensis* and *E. nitens*) with potential for thinnings in a management framework aimed at decreasing vulnerability to forest fires. The first two species are not appropriate to achieve ground cover control, because their canopy is too narrow to master the vegetation growing in the understorey.

**Fiedler-HJ; Belay-G. 1988. Forests and their importance for soil conservation in Ethiopia. Archiv fur Naturschutz und Landschaftsforschung. 283.** Forest land covers 3.6 percent of the area in Ethiopia and is restricted to the highlands. Tree planting (mainly *E. globulus*) is carried out to combat soil erosion in the highlands, caused by deforestation, overgrazing and poor farming practices. 150 000 ha have already been treated in this way.

**Florence-RG .1986. Cultural problems of eucalypts as exotics. Commonwealth Forestry Review., 65:2.** A summary of discussions about growing eucalypts as exotics. Examinations are made of the nature of genetic material in existing overseas plantings, genetic variation in natural populations and the effective use of that material in exotic plantations. The use of nutrients and water by *Eucalyptus* spp. and their effect on the biological conditions of the soil are discussed.

**Foggie-A. 1967. Report to the government of the Sudan on forestry and forest policy in the Gezira area. FAO Report No.TA 2411, pp.95 (34 refs). FAO, Rome.** Includes a section on the economics of irrigated *Eucalyptus* spp. plantations

**Fotsing, J. M. En marge de l'UCCAO: les associations des non-caféiculteurs de la province de l'Ouest du Cameroun. Cahiers de la Recherche-Développement 1992. (No. 31/1): 41-48 (16 ref.)** The article presents the general aspects of farming systems in this province and their evolution in the context of farmers income decrease and the end of subsidies in Cameroon. The district of Bangou has granitic soils that are not appropriate for agriculture and where the population density is relatively scarce. This district has specialised in *Eucalyptus* spp. silviculture aimed at producing saplings. The people have organised themselves in the Bangou district Association of Eucalyptus producers (APEAB).

**Fox,-LR; Morrow,-PA. 1992. Eucalypt responses to fertilization and reduced herbivory. Oecologia. 89: 2, 214-222; many ref.** Field studies were conducted in New South Wales, Australia, to determine the response of *Eucalyptus pauciflora* and *E. stellulata* to the manipulation of soil fertility and insect herbivory. Both *Eucalyptus* species responded in similar ways to simultaneous insecticide and fertilizer treatments. Eliminating herbivorous insects improved plant growth, increased leaf nitrogen (N) and phosphorus (P), and reduced the leaf specific density. Fertilizer regime modified some leaf properties but had little effect on tree growth. It is concluded that in this system, herbivorous insects exacerbated the effects of nutrient-poor soils, and may affect dominance of *Eucalyptus* spp. in mature forests.

**Francis Raj Rajan MCRk; Rajagopal KA Mathur HN. 1986. Some hydrological investigations on bluegum on Osamund (Niligirs). in: Eucalyptus in India : Past, present and future KFRI, Peechi Kerala.** The results of the investigation carried out since 1977 on various aspects of the hydrological cycle under bluegum in grasslands and sholas are discussed. No adverse effect on the hydrological cycle is noticed; there is no evidence that local groundwater and soil moisture regime and water quality had been adversely affected by bluegum planting. Bluegum planting for effective flood reduction is recommended.

**Francllet, A; Bonlay - M. 1989. Rejuvenation and clonal silviculture for eucalypts and forest species harvested through short rotation (in: Pereira, JS; Landsberg,JJ eds. Biomass production by fast growing trees). 267-274; 31 ref NATO ASI Series. Series E, applied Sciences 166, Dordrecht, Kluwer Academic Publishers.** A discussion of development and phase changes in trees in relation to juvenility and senility and their effects on somatic embryo genesis and micro propagation, and early clonal selection for short rotation coppice systems. Examples are drawn from studies on *Sequoia sempervirens* and *Eucalyptus* spp.

**Francllet, A Leçons à tirer des nouvelles forêts d'Eucalyptus. Informations-Forêt 1987. (No 3):183-193.**

In Brazil, reforestation with *Eucalyptus* spp. started a long time ago (since 1900 in Sao Paulo) and was driven by the need to supply firewood and railroad ties to such companies. Reforestation became extensive since legislation encouraged it and allowed the private industries to invest their benefits, in order not to pay taxes. Reforestation sites are established on terrain cleared by the people who exploited charcoal in the original forest. Steelwork companies thus opened the road to

*Eucalyptus* coppicing on a 7-year rotation period. They were followed later by paper mill industries that used adapted silvicultural methods: intensive cultivation, genetic improvement, short rotation and who are currently applying clonal forestry techniques.

**Francllet, A .1970. *Eucalypts and honey production. Var. sci. Inst. Rebois. Tunis No.7.*** French translation of the section on *Eucalyptus* spp. and honey production included in "The Eucalypts" by A.R. Penfold and J.L. Willis. The species suitable for honey production that are or could be grown in the Mogods and Kef regions of Tunisia are listed, with data on their season of flowering, productivity, and their value for other uses including timber production.

**Freitas Mde .1978. *Restocking eucalypt coppice. Boletim Informativo IPEF Instituto de Pesquisas e Estudos Florestais Brazil, 6:16, C1-C6.*** Volume production from *Eucalyptus* coppice established in Brazil at a time when less was known about eucalypt management may be increased by clearing plantations and restocking with improved material.

**Gama, M. M. da; Nogueira ,A.; Murias dos Santos, A. F. A. *Effets du reboisement par Eucalyptus globulus sur les Collemboles édaphiques. Revue d'Ecologie et de Biologie du Sol 1991. 28 (1): 9-18 (3 ref.)*** The effects of reforestation with *Eucalyptus globulus* in edaphic Collemboles were studied and compared with a *Quercus suber* stand. The analysis showed significant differences between the two sites regarding the Collemboles populations. The diversity of species is higher on organic layers and in soils where *Quercus suber* grows.

**Gandullo, J.M. 1990. *Informe sobre las consecuencias ecológicas de las repoblaciones de eucaliptos en España, y en concreto en Galicia. Universidad Politécnica de Madrid. Dpto. de Silvopascicultura. 16 pp.*** Based on published data, this paper analyses the criticism advanced on reforestation with *Eucalyptus* spp. It takes into consideration the following aspects: 1) environmental degradation; 2) nutrient extraction; 3) water regime; 4) biodiversity; 5) landscape and aesthetic values. Finally, it illustrates a series of environmental conditions that reforestation areas should comply with.

**García Arrese, A.M.; Macías Vázquez, F. 1993. *Incorporación de nutrientes a través de la hojarasca en sistemas forestales. Congreso For. Español. Lourizán, I: 319-322. España.*** A study on nutrients release and fixation factors that might be involved in *Quercus*, *Pinus* and *Eucalyptus* spp.

**García Arrese, A.M.; Macías, F. 1993. *Variación anual de la mineralización del nitrógeno inorgánico en sistemas forestales de Galicia. Congreso For. Español. Lourizán, I: 145-150. España.*** Inorganic nitrogen dynamics are studied in three forest systems (*Quercus robur*, *Pinus radiata* and *Eucalyptus globulus*) in Galicia (Spain), in field conditions, during one year. Concentration and production of N mineral decreases in the following sequence: *Eucalyptus-Quercus-Pinus* spp., and corresponds to decrease of mean humidity of soil.

**Garcia, CH. Corradine, L. Alvarenga, SF. 1991. *Comportamiento florestal do Eucalyptus grandis e Eucalyptus saligna em diferentes espaçamentos. (Comportamiento de***

- Eucalyptus grandis* y *E. saligna* en diferentes espaciamientos). Instituto de Pesquisas e Estudos Florestais, Piracicaba, SP, Brasil. 8 p. (In Portuguese).
- Garthe-RJ. 1983. Pole production from Gympie messmate (*Eucalyptus cloeziana* F. Muell) plantations in south east Queensland. Technical paper, Department of Forestry, Queensland. No.37, 11 pp.; 10 ref.** Growth data are presented for *E. cloeziana* plantations between 20 and 30-35 years old. Site index curves are constructed. Pole productivity of selected stands indicates that it would be profitable to produce poles > 14.0 m long on a 30 yr rotation.
- Gautier, D. Haies bamiléké et systèmes de production : l'exemple de la chefferie de Bafou (Ouest Cameroun). Cahiers de la Recherche-Développement 1992. (No. 31/1): 65-78 (18 ref.)** Evolution of bamiléké wind barriers is analysed in the framework of current transformations occurring in production systems. Traditional wind barriers of bamiléké stands are complex, they has several species and accomplish many functions (enclosure barrier for animals, property borders, forest reserve, etc.). Under land pressure conditions, the northern grazing areas have been colonized and pioneering *Eucalyptus* spp. wind barriers have been established to delimit property, to protect the area from animals, to provide timber. (see "Connaissances et pratiques agroforestières d'une communauté rurale. Exemple de la chefferie de Bafu". Mémoire Agronomie Tropicale, options Forêts, CNEARC/ESAT, 1989, 57 p by the same author.)
- Genty . 1958. Report to the Government of Persia on the main lines to be followed as regards forest policy. Expanded Technical Assistance Program, FAO, Rome. FAO Report No.790, pp. 27 Limited distribution.** A general paper analysing the forest situation and making recommendations on land use, forest conservation, forest improvement, tree growing (poplars, eucalypts and walnut), grazing, soil restoration, and forest legislation and administration.
- George M .1986. Nutrients uptake and cycling in a young *Eucalyptus* hybrid plantations. My Forest, March 1986.** Production of total biomass and non photosynthetic biomass in a 5 year *Eucalyptus* hybrid plantation is analysed. Amounts of nutrients used and recycled are indicated. Maximum retention is for phosphorus. The results suggest the necessity of fertilizer application for sustained biomass production.
- George M. 1986. Nutrient status in *Eucalyptus* plantations. *Eucalyptus in India : Past, Present and Future. KFRI, PG, Kerala.*** Total above ground biomass utilised as pulpwood is 71 percent while leaves, bark and small branches make up 29 percent. Even a percent reduction of non-photosynthetic biomass will add about 1500 kg/h to stem wood. Breeding programmes should include biomass transfer as one of the desired characters for the genetic improvement of the species.
- George,-SJ; Mohan-Kumar,-B; Rajiv,-GR. 1993. Nature of secondary succession in the abandoned *Eucalyptus* plantations of Neyyar (Kerala) in Peninsular India. *Journal of Tropical Forest Science. 1993, 5: 3, 372-386; 45 ref.*** The paper reports the analysis of vegetation structure and floristic composition of a 15-year-old secondary forest in an abandoned *Eucalyptus tereticornis* plantation in the Western Ghats of India. Diversity index values were comparable with those of a mature forest stand of the Western Ghats. Girth class frequency distribution and the height-diameter relations suggested that the forest has adequate regeneration

and the *E. tereticornis* over storey has not influenced forest development. The abundance of evergreen heliophytes with deciduous species suggests eventual development into a semi-evergreen forest type. The present state of the stand may be characterized as a 'pre-equilibrium' stage in forest development.

**George. M; Varghese. G 1990. Nutrient Cycling in Eucalyptus globulus plantation : Organic matter production, nutrients accumulation in standing crop and nutrients removal through harvest. Indian Forester, 1990, 116:1, 42-48; 18 ref.**

**George.M and Varghese.G 1990. Nutrient cycling in Eucalyptus globulus plantation. II Litter production and nutrients return. Indian Forester, December 1990.**

**George.M and Varghese.G 1991. . Nutrient cycling in Eucalyptus globulus plantation III - Nutrients retained, returned, uptake and nutrient cycling. Indian Forester - February 1991.** These three papers cover various aspects of Eucalyptus nutrition. As far as nutrient uptake, the maximum drain of nutrients occurs through wood harvest and among the nutrients the highest drain occurs for N & K. Leaf return contributed maximum amount of all nutrients returned to the soil. Results are compared with other plantation species.

**Ghulam-Akbar, Munir-Ahmad, Shahid-Rafique, Babar-KN. 1990. Effect of trees on the yield of wheat crop. Agroforestry Systems., 11:1.** Effect on wheat yield of 4 tree species (*Eucalyptus camaldulensis*, *Albizia procera*, *Morus alba*, *Leucaena leucocephala*) was studied in Pakistan. Wheat was planted when the trees were 4 yr old. There were no significant differences in wheat yield between the different tree species and in general no statistically significant trends in wheat yield with distance for any tree species. However, the wheat yield was numerically lowest at 2 m distance from all 4 tree species and at 2 m distance from the field boundary in the control.

**Gill-HS, Abrol-IP 1987. Salt affected soils and their amelioration through afforestation. (in: Prinsley, RT; Swift, MJ; eds. Amelioration of soil by trees. A review of current concepts and practices), 43-53; 10 ref. London** Afforestation can be a promising land use for about 7 million ha. of salt affected land in India. The paper presents a review of current concepts and practices. Techniques for the amelioration of limited root zone for initial establishment and for planting *Acacia nilotica* and *Eucalyptus tereticornis* are discussed. The ameliorative effect of both species on the soil and on the microclimate is considerable.

**Gill-HS, Abrol-IP 1991. Salt affected soils, their afforestation and its ameliorating influence. International Tree Crops Journal. 1991., 6:4.** A summary of the results of field experiments carried out since 1971 at the Central Soil Salinity Institute. Amongst a large number of species tried *Acacia nilotica*, *Eucalyptus tereticornis*, *Prosopis juliflora*, *Casuarina equisetifolia* and *Albizia lebbek* showed higher tolerance of sodic conditions.

**Gill-HS, Abrol-IP, Samra-JS. 1987. Nutrient recycling through litter production in young plantations of Acacia nilotica and Eucalyptus tereticornis in a highly alkaline soil. Forest Ecology and Management. 22 1-2.** A field study in Haryana, India, from July 1982 to June 1986 showed that litter production in an *Acacia* spp. plantation was significantly higher than in a *Eucalyptus* spp. plantation of the same age and

stocking rate. Good decomposability and low Na accumulation in the litter of *Acacia* spp. favour raising *Acacia* plantations on highly alkaline sites for their amelioration.

**Gill-HS, Abrol-IP. 1990. Evaluation of coastal sandy soils and their saline ground waters for afforestation - a case study from India. *New-Forests*, 4:1, 35-53.** In coastal Andhra Pradesh, *Casuarina equisetifolia* and *E.tereticornis* are the two most popular species for afforestation. In these soils, and under irrigation with saline groundwater, growth performance of *C.equisetifolia* is significantly better than *E. tereticornis*.

**Gogate.M.G and Dhanundiyal. U.D. 1988. An evaluation of Eucalyptus introduction trials at New Forest, Dehra Dun. *Indian Forester*, Feb. 1988.** Eucalypts introduction trial with 24 species is reviewed. Based on their performance, species have been broadly categorised as promising, average and failure. Important factors contributing to success or failure are identified.

**Gogate-MG. 1983. An assessment of high density energy plantations (HDEP) in Gujarat on silvicultural, ecological, management and economic aspects. *Indian Forester*. 109:7, 427-447.** Data are analysed from intensively managed plantations of Eucalyptus 'Mysore hybrid' at spacings of 60 x 60 cm which constitute the major component of HDEP in Gujarat. Projected cost/benefits show attractive returns and the practice is gaining popularity, but it is noted that some of the growth trends observed do not confirm the economic forecasts. Effects of intensive Eucalyptus management techniques are indicated, with special regard to water and nutrient supplies and long-term ecological effects.

**Golfari, L. 1985. Distribución regional y condiciones ecológicas de los eucaliptos cultivados en la Argentina. *Problemas inherentes. Centro de Inv. y Exp. Forest. (CIEF). Publ. Técnica n° 1, 19 pp. Buenos Aires. Argentina.*** The most appropriate geographical areas for *Eucalyptus* spp. in Argentina are indicated and information on its climatic and edaphic conditions is also provided.

**González Esparcia, E.; Penalva Rodríguez, F.; Rodríguez Fernández, V.; Gómez Altamirano, C. 1985. Concentración foliar de nutrientes en *Eucalyptus globulus*, según el tratamiento fertilizante y época de su aplicación. *Anal. Inst. Nac. Inv. Agrarias. INIA, 9: 47-56. Madrid. España.*** Nitrogen is the element that mostly influences growth volume of stem, while spring is the most appropriate season for its application.

**González Alonso, S.; González Abril, A. 1993. Consideraciones ambientales en los planes y proyectos forestales. *Ecosistemas*, 4: 20-24. España.** Other aspects than those of the productive domain exist, conservation criteria consider other aspects such as biodiversity, landscape, etc.)

**González Esparcia, E.; Penalva Rodríguez, F.; Gomez Altamirano, C. 1985a. Exigencias nutritivas del *Eucalyptus globulus* en el sureste español, comparadas con las de otras especies. *Anal. Inst. Nac. Inv. Agrarias. INIA, 9: 63-74. Madrid.*** A study on the different parts of eucalypts. The results show higher nutrient concentration levels than those of *Pinus* spp., but lower than those of other fast-growing species. In order to keep the fertility level, recommendation is made to add 200 Kg of superfosphate and 70 Kg of Nitrogen at the end of each rotation.

- González Giménez, R.C. 1991. Características del carbón de *Eucalyptus globulus* y *E. citriodora*. *Revista Forestal*, VII (1): 6-9. Asunción. Paraguay. (IF Forest Products Abstracts, 1992, 015-02539).** Charcoal was prepared in the laboratory, with the help of an electric oven, at a temperature ranging from 300 to 500 °C. The best charcoal quality for steel production may be obtained at 500 °C.
- González Hernández, F.; López Arias, M.; Minaya Gallego, M.T. 1993. Intercepción, trascolación y escorrentía cortical en masas de *Eucalyptus globulus* Labill y *Pinus pinea* L., del sur de la provincia de Huelva. *Congreso Fores. Español. Lourizán, III: 81-85. España*** Daily assessment carried out in demonstration plots in 1983 and 1989, in order to monitor different precipitation flows, interception (a), traslocation (b) and stem runoff (c) in *Eucalyptus* and *Pinus* spp. stands. Global results show proportions of (a), (b) and (c) at 6,6; 91,2 and 2,3 percent for *Eucalyptus* spp. and at 22,8; 77,0 y 0,15 percent for *Pinus* spp.
- Goudet, J. P. Equilibre du milieu naturel en Afrique tropicale sèche. *Végétation ligneuse et désertification. Bois et Forêts des Tropiques* 1986. (No. 207): 3-15** The author illustrates the different roles a tree plays in production systems: pastoral, agricultural and forest systems. The paper examines the possibilities offered by natural stands, rainfed and irrigated industrial plantations, woody plantations at household level. Finally, it focuses on the importance to be given to management of natural woody stands, the development of farmer plantations, problems posed by wood exploitation sectors in many countries.
- Goudet, J. P. Les productions arborées ligneuses et non ligneuses. *Savanes d'Afrique, terres fertiles? Compte-rendu de la conférence tenue à Montpellier, 10-14 Décembre 1990. CIRAD-CTFT ; Ministère de la Coopération et du Développement, Paris, France.1991. 195-214 (8ref.)*** The author deals with aspects such as wood products, the possibilities to sustainably increase wood production, the factors that contribute to wood production decrease, the management directives for forested savanas and what justifies the existence of wood production plantations in Sudanese areas. Finally, he deals with non-wood forest products and multiple use trees.
- Graca,-LR (Editor). 1989. *Proceedings of the first Brazilian conference on forest planning, Curitiba, 46 October 1989. 356 pp.; many ref. Curitiba, Brazil; CNPF.*** The texts of 26 papers presented at the conference are compiled. The main theme of the conference dealt with the economic problems posed by regeneration of forest plantations. Most papers concerned planning and management of *Eucalyptus* spp. plantations in Brazil, but 2 papers focused on *Pinus taeda* and *P. elliottii* plantations. There were also papers on simulation of forest management and forest assessment. (One paper in English, the rest in Portuguese).
- Graca-LR; Campos-CHO .1986. *Analyses of economic use of forest residue. Boletim de Pesquisa Florestal. No.13.*** Data analysis of *Eucalyptus* spp. and *Pinus* spp. stands indicated that using residues for energy and buying chemical fertilizers was more profitable than to leaving slash on site for nutrient recycling. Unfortunately, in regions in which residues are used for energy, investing in fertilizers is way beyond the means of people. Social necessities override economic considerations.

- Gras Lope, J.M. 1991. Los consumos de agua de lluvia por intercepción en las masas de *Eucalyptus globulus*. Actualidad Forestal de Galicia. (121-122): 9-11. (BBV). La Coruña. España.** This paper contains partial data from a study carried out in 1993.
- Gras Lope, J.M. 1992. Influencia en el régimen hidrológico de las plantaciones de *Eucalyptus globulus* en Galicia. Cuadernos da área de Ciencias Biolóxicas. Sem. de Estudos Galegos, 4: 27-48. Santiago de Compostela. España.** This paper contains partial data from a study carried out in 1993.
- Gras Lope, J.M. 1993. Investigación sobre las relaciones hídricas de las plantaciones de *Eucalyptus globulus* en Galicia. Tesis Doctoral. Esc. Téc. Sup. de Ing. de Montes. Univ. Politécnica. Madrid. España. 150 pp** During the last few years a study has been carried out in two experimental watersheds, in order to assess the behaviour of pure stands of *Pinus* and *Eucalyptus* spp., as well as the interception, stem runoff, fog capture, rainfall consumption, nutrient intake and nutrient export in watersheds. Both watersheds behaved in a conservative way; the nutrient balance showed that nutrient intake was higher than nutrient export. *Eucalyptus* spp. caught 10 percent less rainfall than *Pinus* spp. Estimates show that water consumption in Galicia (Spain), in average watersheds planted with *Eucalyptus* spp. in years of high precipitation and low water deficit on soil, range between 1000-1100 mm, while *Pinus* spp. have similar water consumption levels.
- Gras, J.M.; Vega, J.A.; Bará, S; Cuiñas, P.; de los Santos, J.A.; Fonturbel, T. 1993a. La investigación en cuencas forestales de especies de crecimiento rápido en Galicia. Congreso For. Español. Lourizán, III: 91-96. España.** This paper includes partial data from a study carried out in 1993.
- Greenwood EAN. 1991. Water use by eucalypts measurement and indications for Australia and India. Growth and water use of Forest Plantations Wiley and Sons Chichester.** The differences in conditions between Australia and India are discussed.
- Grewal S.S, Singh Kehar and Juneja.M.L 1992. Nitrogen fertilisation of short rotation and high density plantation of eucalypts raised on light textured alluvial soil of North India. Journal of Tropical forestry, April-June 1992, Vol 8(2) .** Result of fertiliser trial is reported. *Eucalyptus* spp. farming gave a return of Rs.3032 to Rs.3604/ha/year against Rs.700/ha/year from traditional crops.
- Grewal, S.S.; Juneja, ML; Singh, K. 1994. Rainwater conservation and use by energy plantation of *Eucalyptus tereticornis* and rainfed crops in north India. Journal of Tropical Forest Science 6(4): 408-421.**
- Grewal,-SS. 1992. *Eucalyptus* and bhabar-grass together conserve rainwater in the Shiwaliks. Indian-Farming. 42: 5, 12-14.** Results are reported from trials on raising *Eucalyptus tereticornis* (for fuelwood and poles) in combination with bhabar grass (*Eulaliopsis binata*, for paper pulp and ropes) with the aim of conserving rainwater. Runoff and soil loss occurred only in the high rainfall years of 1988 and 1990, when they were still low; nearly all rainwater was, therefore, conserved. Annual water balances and economic data are given. Although the *E. tereticornis* plantation used 29 percent more water per year than field crops from the top 300 cm of the water profile, this extra use was made after conserving 251 mm of rainwater that would otherwise have been lost by runoff.

- Grewal,-SS; Juneja,-ML. 1991. Effect of nitrogen source on the growth and fuelwood yield of short rotation and high density plantation of *Eucalyptus*. *Indian Journal of Forestry*. 14: 4, 303-307; 14 ref.** A field trial was conducted on a sandy loam alluvial soil to study the growth and yield responses to basal application of N on a short rotation and high density (10 000 stems/ha) plantation of *Eucalyptus tereticornis*. Heights, diameters at breast height, air dry stem wood and total net returns were recorded at harvest 42 months after planting from the N treatments.
- Grewal,-SS; Kehar-Singh; Juneja,-ML; Singh,-K. 1993. Response of high density energy plantation of *Eucalyptus tereticornis* to basal nitrogen source, dose and phosphorus application on an alluvial soil. *Journal of Tropical Forest Science*. 5: 3, 387-402; 26 ref.** Another paper on the response of a high-density *Eucalyptus tereticornis* plantation in north India. The study considered unlikely that such nutrient-poor soil can support additional rotations without balanced fertilization. However, the tree farming was economically more viable than rainfed agriculture (providing much higher net returns) under the moisture and nutrient stress conditions of this tropical region.
- Grewal-SS, Mittal-SP, Surjit-Dyal, Agnihotri-Y, Dyal-S. 1992. . Agroforestry systems for soil and water conservation and sustainable production from foothill areas of north India. *Agroforestry Systems*. 17:3.** In the foothills of Himalayas, an agroforestry system with *Eucalyptus tereticornis* and Bhabbar grass (*Eulaliopsis binata*) gave higher returns than agricultural crop. Returns were higher in this combination than that of *Leucaena leucocephala* and maize, blackgram and cluster in better sites.
- Grewal-SS; Juneja-ML; Kehar-Singh; Singh-K.1990. Growth performance of *Eucalyptus tereticornis* on two alluvial soils of north India. *Indian Journal of Agricultural Sciences*. 60 : 7.** Growth performance of *Eucalyptus tereticornis* in a uniform sandy-loam and in a 2-layered soil was studied. The plants in 2-layered soil exploited the stored moisture in lower layers by extending a deeper root system than in the uniform soil. The study indicated much better economics of *Eucalyptus* spp. when growth on the 2-layered soil; this type could be identified by soil surveys and allocated to tree farming.
- Griffin-Ar 1989. Strategies for the genetic improvement of yield in eucalypts. in: Biomass production by fast-growing trees. *Proceedings of a NATO Advanced Research Workshop edited by Pereira, J.S.Landsberg,J.J.* 247-265:62 ref. NATO ASI Series. Series E, Applied Sciences 166, Dordreeht, Netherlands, Kluwer Academic Publishers.** Issues facing *Eucalyptus* spp. breeders when developing strategies for genetic improvement are discussed in relation to fast-growing species for industrial wood production in temperate regions. Breeding programmes in Australia, the USA and France are used as examples.
- Groume, H.G.; Ruiz Perez, M.; Llorca, A. Quelques arguments économiques pour la valorisation et la conservation des forêts naturelles en Espagne. *Forêt Méditerranéenne* 1985. (No.2): 169-172 (17 ref.)** The authors present the background history of forestry in Spain and the development, since 1941, of fast-growing species monoculture. From the economic point of view, the authors highlight that price evolution and market needs, make it reasonable to favour natural indigenous forest instead, because it allows both, multipurpose use of the territory in harmony with agricultural, silvicultural and pastoral traditional practices.

- Grove-TS. 1988. Growth responses of trees and understorey to applied nitrogen and phosphorus in karri (*Eucalyptus diversicolor*) forest. *Forest Ecology and Management*. 23:2-3.** Fertilizer experiments on regrowth of *Eucalyptus diversicolor* in its natural stand was carried out. The effect of P was greater where N was also added. 5 years after treatments, mean tree weights on plots with the highest added N (200 kg/ha) and P (200 kg/ha) were double than those in unfertilised plots.
- Guenther-E. 1968. Australian Eucalyptus oils : a report of a field survey. *Perfum, essent. Oil Rec., Lond.* 59 (9), (634-41).** Discusses a series of issues: species used, oil types and quantities produced, harvesting methods and distillation, the industry organization, and the reasons for its decline (difficult working conditions, high wages, extension of wheat agriculture etc.). It is suggested that the industry could be revived by the establishment of plantations of suitable species.
- Gueye, N.; Le Page, M., Dirthe Rôle des termites dans des plantations forestières du Cap-Vert (Mbao, Sénégal) Univ.: Paris 06 ; Th. doct. : Ecol.; 1987 159 p. (118 ref).** A study on the role of termites in three sites: one in a secondary forest, and two in plantation sites. The termite population is more important in the forest. Clearing decreases the number of individuals that regenerate quickly. During the dry season, termites stay underground. Dead wood collection by termites varies according to the seasons. Termites are not a problem for healthy trees. On the contrary, termites may be a hazard for young trees and young, withered trees. There is a positive interrelation between the degree of decay and the risk of being attacked. Termites attack and reduce *Eucalyptus* litter to fragments after two years.
- Guggenberger.C, Ndulu.P, Shepherd.G. 1989. After Ujjama : farmer needs, nurseries and project sustainability in Mwanza, Tanzania. Network paper - Social Forestry Network - Overseas Development Institute, London, U.K.** Policy of communalisation of trees implemented in the 1970s was resented by the people. Farmers preferred indigenous timber and pole species and fruit trees rather than *Eucalyptus* and *Pinus* spp. originally recommended by the government.
- Guibelalde Iñurrítegui, J.J. 1989. Perspectivas de las industrias papeleras y la producción forestal: sus aplicaciones al medio ambiente. *Actualidad Forestal de Galicia, (113-114): 18-24. (BBV). La Coruña. España.*** This document estimates that paper and cardboard consumption will increase at world level. The use of short fibre pulp is increasing. It also estimates *Eucalyptus* spp. consumption at world level will be 4 500 million tons in 1993.
- Guimaraes, DP; Da Fonseca, CEL. 1990. (Preliminary considerations on the use of shelterbelts in cerrado vegetation) Consideracoes preliminares sobre o uso de quebra-ventos nos cerrados. *Documentos Centro de Pesquisa Agropecuaria dos Cerrados. No. 34, 21 pp.; 24 ref.*** A discussion on the use of wind-breaks, with particular reference to their use in the cerrado region of Brazil. Species recommended for use in wind-breaks include *Eucalyptus grandis*, *E. urophylla*, *E. camaldulensis*, *E. citriodora*, *Pinus oocarpa*, *P. caribaea* var. *hondurensis*, *Grevillea robusta*, *Casuarina equisetifolia*, *Swietenia macrophylla*, *Carapa guianensis*, *Syzygium cumini*, *Leucaena leucocephala*, *Dalbergia nigra*, *Albizia lebbek* and *Mimosa caesalpinifolia*. (In Portuguese).

- Gulati-BC, Duhan-SPS, Bhattacharya-AK. 1968. Observations on the production of *Eucalyptus citriodora* oil. *perfum. essent. Oil Rec, Lond.* 59 (4).** Describes the cultivation, growth characteristics and harvesting of *E. citriodora* in India. About 4 400 trees can give a small yield of oil in the first year, 60-70 kg. in the second, and 100 to 110 kg. in the third. The citronella content improves along with the plant age. Selection of plants, on the basis of leaf appearance, at an early stage of growth, is suggested for improving the odour value.
- Gulshan-Ahuja; Ranbir-Chhabra; Ahuja,-G; Chhabra,-R. 1993. *Eucalyptus* for charcoal manufacturing - a case study. *Indian-Forester.* 119: 12, 999-1003; 2 ref.** Tests were carried out on charcoal production from two sizes of *Eucalyptus* spp. for fuelwood. Properties of *Eucalyptus* spp. charcoal are tabulated and compared with those of *Acacia nilotica* charcoal. Calorific value of the *Eucalyptus* spp. charcoal was 28 000 kJ/kg (about twice that of air-dry wood). Carbon content was 99,45 percent and *Eucalyptus* spp. charcoal is, therefore, a useful source of high purity reactive carbon for metallurgy and chemical processes where the wood itself is not suitable. Bulk density, ash content, carbon percentage and cracking behaviour were all marginally better for *Eucalyptus* spp. than for *A. nilotica* charcoal. Based on cost and profit analyses, greater profits could be expected from using thin fuelwood for charcoal production rather than directly as fuelwood.
- Gupta. T.R. 1979. Some natural resource management aspects of commercial cultivation of irrigated eucalypts in Gujarat, India. *Indian Journal of Forestry,* 2:2, 118-137.** A detailed economic analysis was made of 160 acre irrigated *Eucalyptus* spp. farm on sandy loam with brackish water in the Ahmedabad District based on data for 8 years. Returns are estimated to be much larger than for annual crops.
- Gupta-Rk .1986. Role of *Eucalyptus* in soil and water conservation with reference to social/agro forestry. in: *Eucalyptus in India. Past, present and future. Proceedings of the national seminar held at Kerala Forest Research Institute, Peechi, Kerala, India. January 30-31, 1984 (edited by Sharma, J.K. Nair, C.T.S, Kedharnath. S, Kondas. S) 1986, 139-148, 32 ref. Peechi, India, Kerala Forest Research Institute.*** A discussion on published data, including evaluation and choice of species, interactions with agricultural crops and comparisons with indigenous multipurpose species.
- Gurumurti,-K; Rawat,-PS. 1992. Water consumption by *Eucalyptus* - analysis. *Journal of Tropical Forestry.* 8: 1, 18-25; 12 ref.** A brief review of results obtained in various countries is given.
- Gurumurti.K and Rawat.P.S. 1992. Water Consumption by eucalypts: analysis. *Journal of Tropical forestry, Vol 8(1).18-25*** Water use efficiency of *Eucalyptus* spp. based on two case studies, is presented. In the absence of the water table, evapotranspiration is always less than rainfall. Copious transpiration when water is freely available, and when its use is reduced due to lower availability, are discussed.
- Hansenclever-B-M, Rivelli-M-JG. 1984. Man-made forests for wood and charcoal in Brazil. *Revista-Energetica-B, Ecuador,* 8.** Data on the establishment of *Eucalyptus* spp. plantations in Brazil are provided (including species choice, seedling production and spacing) as well as on charcoal production. Total costs of charcoal production, including stand establishment, are provided.

**Harmand, J.M.** *Effets des techniques d'aménagement de surface. Dans "Les terres hardé. Caractérisation et réhabilitation dans le bassin du Lac Tchad". Cahiers scientifiques n°11ORSTOM-CIRAD-Forêt,199381-97.* The author highlights the development of several tree species planted on Hardé soils (soils with poor woody vegetation) aimed at restoring soils and ensuring a limited production of wood, fruit and other products for the farmers. One of the trials permitted to compare growth of *Eucalyptus camaldulensis* after using several soil preparation methods. Afforestation tends to disappear when soil preparation is not practiced. Mechanized labour temporarily increases production at 1 m<sup>3</sup>/ha/an, but this is too low to make the establishment cost-effective. Total cost of tree planting on this kind of soil is 230 000 FCFA/ha, with subsoiling, and 130 000 FCFA/ha with grooves.

**Harmand, J.M** *L'opération "Pôles Verts". Plantations et brise-vent irrigués expérimentaux dans la basse vallée et le delta du fleuve Sénégal. Bois et Forêts des Tropiques 1990. (No 18): 3-32 (14 ref.,10 col .pl.).* The "Green poles" project was implemented in Senegal by the Ministry for the Protection of Nature and it was funded by the EEC, with the technical support of CTFT. Instead of promoting the creation of plots entirely reserved to wood production, that require special maintenance practices, the project emphasized the need to plant wind-breaks associated to irrigated crops. These plantations had a double purpose: crop protection and wood production. The author presents a technical evaluation of results, and social and economic impacts. It is noticeable that *E. camaldulensis* and *E.microtheca* are the only species accepted by the farmers in the rice paddy areas, because when it is planted in rows, it barely attracts birds.

**Harmand-JM.** 1988. *(The 'Green Areas' project. Experimental irrigated plantations and windbreaks in the valley and delta of the Senegal River). Bois et Forests des Tropiques. 1988, publ. 1990, No. 218, 3-32.* The main species used in wind-breaks was *Eucalyptus camaldulensis* which could also provide timber. Although initially contrary to the introduction of trees, the villagers gradually became aware of the environmental degradation and the importance of wind-breaks against wind erosion.

**Hartsough,-BR; Nakamura,-G.** 1990. *Harvesting Eucalyptus for fuel chips. California-Agriculture. 1990, 44: 1, 7-8.* Costs and productivity were determined for the mechanized harvest of a 6-year-old *Eucalyptus camaldulensis* plantation for fuel chips near Orland, California. Costs exceeded the value of the chips delivered to a power plant. Data collected during the harvest were also used to develop a local volume and biomass table.

**Hasey-JK, Stanford-RB, Connor-JM, Sachs-RM.** 1988. *Low-elevation foothill fuelwood plantation. California Agriculture, 42:6.* Results of an intensively managed test plantation of *Eucalyptus globulus*, *E.camaldulensis*, *E.viminalis*, *E.dalrympleana* and *Populus deltoides* in the Yuba Country foothills. *E.globulus* had the greatest average height and diameter and *E.camaldulensis* (C-I clone) the lowest. The largest yields per acre at 43 months (23.2 cords) were the same for *E.globulus* and *E.camaldulensis* (C-2 clone). The C-2 clone and *E.globulus* seedlings exhibited low variability. All the *Eucalyptus* spp tolerated temperatures of 16 F without frost damage.

**Helin-WH.** 1989. *Irrigated agroforestry-the Luuq experience. Mogadishu, Somalia, Church World Service.* In 1984-85 *Leucaena leucocephala* was the most commonly

- planted species (57 percent) with 14 percent *Eucalyptus camaldulensis*. In 1989 respective figures were 38 and 23 percent. Most farmers planted trees in otherwise unused areas. Costs were low and returns good, mostly from the sale of construction materials, rather than from fuelwood.
- Herbert-HJ, Uibrig-H. 1991. . Economics of a pole and fuelwood production project in the Hararghe highlands, eastern Ethiopia. First international symposium on horticultural economics in developing countries. Alemaya, Ethiopia, 16-23 July 1989 Acta-Horticulturae, No.270 BLDSC.** The investigation is based on *Acacia saligna* for fuelwood and *Eucalyptus* spp. for pole and fuelwood production through a farmers Producers' Cooperative. The study concluded that since the investments in wood production play an important role in the efficiency of community forestry projects, afforestation has to be done carefully and young forest stands should be consciously protected by the whole community.
- Herbert-MA. 1990. Fertiliser / site interactions on the growth and foliar nutrient levels of *Eucalyptus grandis*. (in: Nambiar, E.K.S.; Squire.R; Cromer.R; Turner.J. ; Boardman, R. eds. Management of water and nutrient relations to increase forest growth.) *Forest Ecology and Management*, 30: 1-4.** This study was aimed at optimising recommendations on fertilizers and characterize their effect on growth of *E. grandis*. Experiments were assessed and compared at 4 years old. The major growth responses were to N and/or P, N being suitable only on sandy soils low in organic matter. Topsoils with very high mineralizable N responded to applications of P only. Sites with moderate amounts of organic matter required both N and P. Potassium generally had a depressive effect. The importance in yield as a result of fertilization was relatively greatest on poor sites. However, there was a trend for the response in absolute terms to increase with site quality. For fertilizer recommendations to be optimised, the sites need to be classified in terms of their soil water availability, and topsoil organic matter content and texture. As improvements in growth increase with time, they are probably due to changes in root development and structure, rather than overall nutrient status. Thus, fertilizing must be viewed only as an integrated part of establishment practices.
- Herwitz-SR, Gutterman-Y. 1990. Biomass production and transpiration efficiencies of eucalyptus in the Nege desert. *Forest Ecology and Management*, 31: 1-2.** In Nege desert where potential evaporation rate is 2140 mm/yr, soil is calcareous loam, mean annual rainfall is approx. 100 mm, with trickle irrigation providing a supplement of 150 mm/yr, *Eucalyptus salubris* and *E. torquata* have the highest potential for afforestation.
- Hilbert-FL. 1949. Mallet bark and extract, *Leather and Shoes*, Chicago 118 (24).** Mallet bark is the bark from several *Eucalyptus* spp, *E. erythronema*, *E. falcata*, *E. gardneri*, *E. redunca*, *E. occidentalis*, and *E. occidentalis astringens*. It contains 45-55 percent extractable tannin, and yields very strong tannin liquors.
- Hillis, WE; Brown AG, (eds.). 1978. *Eucalypts for wood production*. CSIRO, Adelaide, Australia.** A comprehensive textbook, mainly referring to Australia.
- Hinners-K. 1986. Forestry investment possibilities overseas. *Forest und Holzwirt*, 41:18.** The profitability of investing in fast-growing plantations in tropical countries is illustrated with a detailed example showing the costs and returns in the production of

*Eucalyptus* spp. industrial wood on an 11-year rotation; the profit is calculated to be 3170 DM/ha. The consequences for Europe due to forestry investment overseas are outlined.

**Holgen-P, Svensson-M. 1990. *Loss of inorganic nutrients by whole tree utilisation for firewood in Ethiopia. A minor field study. Working Paper International Rural Development Centre, Swedish University of Agricultural Sciences. no.150.*** The effect of removing inorganic nutrients through whole tree utilisation was examined in three forest compartments of different age classes in 1989. It was found that the loss of nutrients in a single rotation of *E. globulus* is considerable compared to the total supply of available nutrients in the soil. To avoid depletion of soils used for plantations with *Eucalyptus* spp. the input of nutrients to the ecosystem should be increased by leaving litter and leaves on the ground or through a fertilising programme. Plantations should not be harvested until at least five years old.

**Honeysett,-JL; Beadle,-CL; Turnbull,-CRA. 1992. *Evapotranspiration and growth of two contrasting species of eucalypts under non-limiting and limiting water availability. Forest-Ecology-and-Management. 50: 3-4, 203-216; 22 ref.*** Changes in root zone water storage between 0 and 1 m depth were monitored under contrasting canopies of *Eucalyptus nitens* and *Eucalyptus delegatensis* during their fourth and fifth years of growth and periods of non-limiting and limiting water availability, respectively. A cumulative plot of volume growth as a function of total evapotranspiration suggested that stem volume growth of *E. nitens* was less sensitive to severe water stress than that of *E. delegatensis*.

**Hopmans,-P; Stewart,-HTL; Flinn,-DW. 1993. *Impacts of harvesting on nutrients in a eucalypt ecosystem in southeastern Australia. Forest Ecology and Management. 59: 1-2, 29-51; 51 ref.*** The study was undertaken in *Eucalyptus* spp. forests managed on rotations of at least 80 years. Nutrient removals in wood (saw logs and pulpwood) represented only a small percentage of available soil reserves. Exports of nutrients (Ca and Mn in particular) were significantly reduced by debarking logs on site. Estimated losses to the atmosphere during burning of logging residues were substantially greater than removals in wood. Alternative methods of regeneration that excluded burning of residues would conserve considerable quantities of nutrients. In general, removals of S, P, K, Mg, Fe, Mn, Zn and Cu are unlikely to cause a significant decline in availability of these nutrients over a number of 80-yr rotations. However, there is a potential risk that serious depletion of Ca and B may limit future long-term productivity of these forest ecosystems.

**House APN. 1992. *Eucalyptus: curse or cure ? Australian Center for International Agricultural Research.*** The main issues concerning *Eucalyptus* spp. are posed and explained. The reasons for the extensive use of eucalypts in plantations are discussed.

**Howlett-K, Gamache-A. 1977. *Silvicultural biomass farms. Volume II: the biomass potential of short-rotation farms.*(in Inman, R.E. : *Silvicultural biomass farms. Volume I: Summary*) Mitre Technical Report, No.7347, Springfield, Va., USA: National Technical Information Services, Unites States Department of Commerce.** The requirements for species selection aimed at silvicultural biomass farms are

discussed. Genetically improved strains and better management techniques could increase the production considerably.

**Hummel, L.** *Etude sur les systèmes de production agricole et le rôle des arbres dans l'exploitation agricole : le cas de la commune de Muyaga. Communications du Dept de Foresterie, Institut des Sciences Agronomiques du Rwanda 1986. (No. 4): 6 p.* This study describes agroforestry techniques used in Muyaga community where land was distributed to farmers coming from overpopulated regions, in the 1950s. The main agricultural products are beans, sorghum, yam, bananas, coffee and fruit trees or multipurpose trees, particularly *Grevillea robusta*, *Persea americana*, *Carica papaya*, *Ficus thonningii*, *Eucalyptus* spp. and *Senecio mannii*.

**Hutchinson, I.** 198? *Conversando sobre el eucalipto. CATIE. INRENARE.* An overview on the possible negative impact of *Eucalyptus* spp., where the author did not find evidence showing that *Eucalyptus* spp. have a higher water and nutrient intake than other tree species. Wood uses and their particular treatment are reviewed. The paper is a transcription of a talk about this topic.

**Igboanugo-ABI, Omijeh-JE, Adegbehin-JO.** 1990. *Pasture floristic composition in different Eucalyptus species plantations in some parts of northern Guinea Savanna zone of Nigeria. Agroforestry Systems. 12:3.* Results in this study indicate the potential for establishing silvopastoralism farms with *Eucalyptus* spp. in the savanna zone of Nigeria, where, due to the drastic reduction in pasture areas, nomadic herdsmen already graze their herds in *Eucalyptus* spp. plantations.

**Igboanugo-ABI.** 1988. *Effects of some eucalypts on yields of Vigna unguiculata L. Walp., Zea mays L. and Sorghum bicolor L., Agriculture Ecosystems and Environment, 24:4.* Cowpeas, maize and sorghum were grown with or without NPK on tilled savanna grassland with some shade from *Isobertinia doka* trees or on tilled areas in a thin 20-year-old plantation of 3 *Eucalyptus* spp. Results indicated that cowpea may be incompatible with *Eucalyptus* spp., but application of NPK partly offset the adverse effects.

**Infante L., P.; Ipinza C., R.; Prado, J.A.** 1991a. *Bases para la mejora genética de las especies del género Eucalyptus en Chile. Ciencia e Inv. Forest., 5 (1): 71-95. Inst. Forestal. Santiago. Chile.* The first stage of this programme is focused on the following species *E. camaldulensis*, *E. globulus*, *E. nitens*, *E. delegatensis*, *E. regnans* and *E. viminalis*.

**Infante L., P; Prado, J.A.** 1991. *Crecimiento juvenil de 32 procedencias y 203 familias de Eucalyptus globulus ssp. globulus en la zona costera de la VIII Región de Chile. Ciencia e Inv. Forest., 5 (2): 252-265. Inst. Forestal. Santiago. Chile.* Although geographical differences were not clear, the results showed that the best provenances were SE from Tasmania, Cabo Barren Island, Flinders island and Otway (Victoria).

**Infante L.; Prado D., J.A.** 1989. *Crecimiento de 35 procedencias de Eucalyptus globulus spp. globulus en la etapa de vivero. Ciencia e Inv. Forest., 7: 83-89. Inst. Forest. Santiago. Chile. (FA, 1991, 052-05186).* The best performance in growth was obtained from Victoria, E. Tasmania and King Island provenances.

**Inoue,-MT; Stohr,-GWDTI. 1991. (Technical and economical feasibility of the use of coppice with standards in *Eucalyptus grandis* plantations.) Viabilidade tecnica e economica da talhadia composta em *Eucalyptus grandis*. O desafio das florestas neotropicais, Brasil, Curitiba 7 a 12 Abril 1991 [coordinated by Seitz, R.A.]. 330-343; 13 ref. Curitiba, Brazil; Universidade Federal do Parana.** A field trial was established in a *Eucalyptus grandis* plantation at Uberaba, Minas Gerais, Brazil. Trees were cut 7 years after planting, leaving 0, 25, 50, 100 or 200 standards/ha. Three sprouts per stump were left to grow. After 4 years, height and diameter at breast height (d.b.h.) were measured. Basal area, volume and average d.b.h. of sprouts decreased with increasing numbers of standards. There was no significant difference in the total (sprouts plus standards) basal area and volume between treatments. (In Portuguese)

**Institut des Sciences Agronomiques du Rwanda Compte-rendu du premier séminaire national sur la sylviculture des plantations forestières au Rwanda (septembre 1987) Département de Foresterie, Institut des Sciences Agronomiques du Rwanda. Edité par Pleines, 1988.** This document deals with: soils and afforestation (Butunga V.); ecological impact of *Eucalyptus* spp. plantation (Munyarugerero, G.); *Eucalyptus* spp. plantations: relations with and impact on soil and hydrology (Nshubemuki, L.) ; Decreased productivity in short-rotation forest plantations (Gasana, J.K.); site classification in the GBK project, Rwanda (Ahimana, C.); Introduction and trials of species for reforestation purposes: summary and recommendations (Habiyaambere T.); Background of the project titled Support to Reforestation by farmers (Munyonge A.) ; Taungya method in Rwanda (Mushimyimana D.) .

**Ismat Ara Yahya NSM. 1988. Studies on growth and yield of seedling crops of *Eucalyptus camaldulensis* in Bangladesh. Bone Bigyan Patrika - Vol. 17, Nos. 1 & 2 -** One of the major objectives of forest policy in Bangladesh is the establishment of large-scale plantations of multipurpose fast-growing species. Advantages of *Eucalyptus* spp. planting on denuded and degraded sites are considered.

**IUFRO Fast growing trees. IUFRO symposium on genetic improvement and productivity of fast-growing forest trees. International Union of Forestry Research Organizations, Brazil, Sociedade Brasileira de Silvicultura. Silvicultura, Brazil 1983.8 (31), 396-616; 8 (32): 617-840.** The symposium proceedings are compiled in the third and fourth volumes. The meeting was held in Sao Paulo, Brazil from 25 to 30 August, 1980. The content deals in particular with : III) the reaction of *Eucalyptus* spp. to fertilization, ecosystem evolution in short-term rotation, nutrients physiology, cycle and quality of fast-growing trees for wood production. IV) *Eucalyptus grandis* (provenance, variation, conservation), selection methods, silviculture and fast growing tree production.

**Jain,-JD; Rajput,-SS; Satish-Kumar; Kumar,-S. 1991. *Eucalyptus* pole - a low cost alternative to energy intensive RCC/tubular steel pole for overhead power and telecommunication lines. Journal of the Timber Development Association of India. 37: 2, 39-45; 17 ref.** A technical appraisal of the use of *Eucalyptus* spp. for transmission poles in India was undertaken using test results of *Eucalyptus tereticornis* from different states.

**Jha MN et al. 1982. Soil constraints in raising eucalypts on marginal sites and remedial measures. Proceedings Agro-forestry in India, FRI - Dehradun.** The paper

suggests remedial measures for the mortality of *Eucalyptus* spp. in Haryana, in soil with high pH and free CaCO<sub>3</sub> content.

**Jha Mohan. 1991. Species-cum-Provenance and trial of eucalypts in dry zone of Maharashtra. Indian Forester, Vol 117, August 1991.** The study reinforces the scope for productivity improvement of *Eucalyptus* spp. plantations in India through raising better selected provenances from Australian natural stands.

**Johanson-S, Kaarakka-V, Luukkanen-O, Mulatya-J. 1990. Forestry in irrigation schemes. I. Research activities at Bura, Kenya 1984-87. Tropical Forestry Reports Department of Silviculture, University of Helsinki. No.4** In species trials, *Prosopis juliflora* outperformed other species for fuelwood production under irrigation. *Eucalyptus microtheca* from selected seed sources showed a yield that may be in the same range as that of *Prosopis juliflora*. Initial results indicate that irrigated plantations yield 5 to 10 times more fuelwood than rainfed plantations.

**Johanson-S. 1988. Forestry research in the Bura Irrigation Settlement Project, Tana River District. Kenya. Working Paper Bura Forestry Research Project No.37 Joint Publication with Department of Silviculture, University of Helsinki; Kenya Forestry Research Institute (KEFRI).** Irrigation trials on tree species have shown that *Prosopis* spp. had the greatest potential while *Eucalyptus* spp. performed poorly. Growth data for the different species are provided.

**Jordaan,-JV (Editor).1992. Papers presented at the IUFRO symposium: Intensive forestry: the role of eucalypts, held in Durban, South Africa, [2-6] September 1991. South-African-Forestry-Journal. No. 160, i + 1-74; many ref.** Ten papers are presented in this special issue; they cover silvicultural, genetic and breeding aspects of *Eucalyptus* spp., and include 2 papers on responses to fire (on regeneration and fire-induced erosion on sites partially afforested with *Eucalyptus* spp.).

**Jorgensen-JR; Wells-CG. 1986. Tree nutrition and fast-growing plantations in developing countries. International Tree Crops Journal 3:4** Theoretical nutrient balance sheets for K and N for different harvest systems for *Eucalyptus* spp. and *Pinus oocarpa* on both high and low fertility soils show that, on some soils under consideration for plantation establishment, supplemental nutrient applications will be essential for maintaining high yields.

**Joshie, P; Narain, P. 1994. Vegetation characteristics and nutrient composition of underwood flora in Sal, Eucalyptus and brushwood forest watersheds of Doon Valley. Indian Forester.** Results of ecological studies on underwood flora are reported, including number of species, quotient of similarity values, density, comparative basal cover, diversity, concentration of dominance, understory biomass, nutrient contents.

**Joshi-PC, Om-Prakash, Prakash-O. 1992. Allelopathic effects of litter extract of some tree species on germination and seedling growth of agricultural crops. Proceedings, First National Symposium on Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992 held at CCS Haryana Agricultural University, India.** Distilled water extracts were prepared from fresh and partially decomposed litter of 10 tree species. Seeds of 4 agricultural crops were soaked in the extracts and

- allowed to germinate under incubator conditions. Fresh litter extracts reduced the germination of all crops with those of *E. tereticornis* and 4 other species having the greatest effect. Extracts from partially decomposed litter were less inhibitory to seed germination.
- Joyce-C. 1988. *The tree that caused a riot. New-Scientist, 117:1600.*** An account of criticisms over the widespread use of *Eucalyptus* spp. in social forestry projects, relating to its ecological effects. Examples are given from Brazil, India, Ethiopia and Kenya.
- Kale Radha D and Krishnamoorthy RV. 1981. *Litter preferences in the earthworm Lampito mauritii Proc Indian Acad Sci (Anim Sci) Vol 90, No.1*** Food preferences of the earthworm *Lampito mauritii* is linked to the rate of disintegration of leaf matter. Under multiple choice the preference was as follows: Mango, ragi, paddy, guava, cashew, eucalypts. *Eucalyptus* spp. was very well consumed in the second and third month of the experiment.
- Kalish-J .1979. *Using trees for energy. Pulp-and-Paper-International, 21:5*** Examples include the use of wood for energy production in Scandinavia, USA, and Canada; the productivity of short-rotation energy plantations of broadleaves and *Eucalyptus* spp. are estimated in case studies from Brazil and Sweden.
- Kalish-J. 1977. *South Africa's forests: fast-growing exotics. large plantations offer strong forestry potential. World-Wood. 18:12*** An account is given of resources, wood use and future raw material potential of South African forests, with particular emphasis on *Eucalyptus grandis*, *Pinus patula*, *Pinus elliottii* and *Pinus taeda*.
- Kamaluddin,-M; Bhuiyan- MK. 1985. *Growth and fuelwood yield of Petford provenance of Eucalyptus camaldulensis Dehn. grown in rural marginal land. Pakistan Journal of Forestry. 35:1*** A 0.018-ha plantation (spacing 1.6 x 1.6 m) was grown on the banks of rural ponds in Chittagong, Bangladesh. After 5 years sample trees were felled and measured. Survival rate was 96 percent and trees had reached a height of 11.5 m and a d.b.h. of 11.6 cm. Yield of fuelwood including bark and branches was 139.1 t/ha with 12 percent m.c.
- Kannan-K. 1958. *The Eucalyptus that came to the plains, Indian Fmg. 8 (6), (22-3)*** An account of *E. citriodora*, covering description, propagation, tending, and the distillation of its oil. Examination of costs shows it to be an economically worthwhile crop, and its growing on a large scale should be encouraged.
- Kapur S.K. 1992. *Necessity and role of pulp and paper industry IPPTA - Vol. IV*** Economics of line planting of *Eucalyptus* spp. in bunds had promoted block planting by farmers at close spacing for the production of small wood for pulp and firewood. Lack of demand has caused heavy glut and fall in prices.
- Kapur-SK, Dogra-AS. 1989. *Fast growing species for meeting rural and industrial needs of Punjab - present status and future research needs. Indian Forester. 115:4*** Projections are given of wood demand in the Indian Punjab, which has extremely limited productive forest area. The Government has encouraged farm forestry with *Eucalyptus tereticornis* and agroforestry with *Populus* spp. Utilisation of *Eucalyptus* spp. wood is discussed and some prices are given. These indicate that *E. tereticornis*

farming is a sound investment, especially when planting at wide spacings and with 12-year rotations.

**Karch,-GE. 1992. Comparison of agroforestry practices in Senegal using financial analysis. Financial and economic analyses of agroforestry systems: proceedings of a workshop held in Honolulu, Hawaii, USA, July 1991 [edited by Sullivan, G. M.; Huke, S. M.; Fox, J. M.]. 1992, 109-124; 16 ref. Paia, USA; Nitrogen Fixing Tree Association (NFTA).**

**Kardell-L, Steen-E, Fabiao-A .1986. Eucalyptus in Portugal - a threat or a promise ? *Ambio*, 15,1.** In the last 30 years, large-scale plantations of *E. globulus* have been undertaken for the pulp industry. It is estimated that *Eucalyptus* spp. plantations now cover about 300,000 ha. This paper analyses the effects that *Eucalyptus* spp. planting has had in the context of Portugal's natural history, environmental management and risks, the long-term production capacity of the species, and its relations to other plant and animal life, to the landscape and to employment.

**Kariyappa GS, Jagdishchandra: BK. 1992. Forest based industries and industrial forestry. The Mysore Paper Mills, Bangalore-1** A summary of the plantation programmes and the results with different species are provided. In the dry zone *Eucalyptus camaldulensis*, (Petford provenance) has given much better results than *Eucalyptus* spp. hybrid. The programme has generated employment to about 2 500 local people continuously. It makes available about 10 500 tonnes of wood to the Forest Department for release to the public. The local people collected about 23 000 tonnes of bark, lops and tops every year.

**Kashio, M. in press. Proceedings of the Regional Expert Consultation on Eucalyptus, FAO, Bangkok October 1993.**

**Katar-Singh, Bhattacharjee-S. 1991. . Privatisation of common pool resources of land; a case study in West Bengal. Case Study Institute of Rural Management Anand, No.6, iv.** The study presents an overview of privatisation of common property resources in West Bengal and evaluates the impact of the process on the population. Blocks of degraded government land were distributed to the landless for planting *Eucalyptus* spp.

**Kaumi - SYS .1988. Fuel and pole yields of coppiced *Eucalyptus saligna*. Commonwealth Forestry Review, 67:4** In a coppice thinning experiment at Muguga, Kenya, reduction in number of stems per stump at 18 months in a 6 or 9 1/2 yr rotation reduced fuelwood volumes but increased size of poles. Stump survival was not affected.

**Khan - MiuR .1955. The genus eucalypts, its past and future in West Pakistan, Pakistan J. For. 5 (4)** A short historical account of the introduction and trials of various *Eucalyptus* spp., a summary of silvicultural requirements from experiments carried out during the 1950s, some growth data, notes on utilization including essential oils, and an annotated list of 60 species being raised from seed imported in 1954-55.

**Khanchandani-MS. 1981. Establishment of forest energy resource base in Gujarat. Indian Forester 107:12** A comparative analysis of various energy sources in Gujarat shows that energy plantations are economically competitive for power generation

when the high cost of transport is considered. Ample land is available to grow trees for fuelwood, and power stations could be decentralized, with 350 ha being required for each megawatt capacity. *Prosopis juliflora*, *Eucalyptus* spp. and *Sesbania grandiflora* appear to be promising species for growing at high densities on short rotations. Some of the economic, environmental and social benefits of energy forestry are discussed.

**Khanduja-SD. 1987. Short rotation firewood forestry on sodic soil in northern India: research imperatives. *Indian-Journal-of Forestry*. 1987., 10:2** In India there are about 42 million ha. of wasteland of which 7 million ha. have saline or alkaline soils which could be used for short rotation fuelwood production. Suggestions are made on the species for trial which include *Eucalyptus* spp.

**Khybri-ML, Gupta-RK, Sewa-Ram, Tomar-HPS, Ram-S. 1992. Crop yields of rice and wheat grown in rotation as intercrops with three tree species in the outer hills of Western Himalaya. *Agroforestry Systems*. 17;3** A 13 year duration study in the outer hills of Western Himalayas of tree/crop interaction under rainfed conditions with *Grewia optiva*, *Morus alba* and *Eucalyptus* spp. hybrid with a rice/wheat rotation showed that tree species depress crop yields. Soil moisture was the least under *G. optiva*.

**King, JA; Campbell, BM. 1994. Soil organic matter relations in five land cover types in the miombo region (Zimbabwe). *Forest Ecology and Management*: 67, 225-239** The objective of this work aimed at contrasting soil characteristics, with a focus on soil organic matter, in five adjacent land cover types (including *Eucalyptus* spp. and *Pinus* spp. plantations).

**Knockaert, C. Biomasse aérienne d'*Eucalyptus camaldulensis* planté à forte densité en Mamora orientale. *Annales de la Recherche Forestière au Maroc* 1983. 23 131-188 (20 ref.)** A report on the biomass produced in experimental plantations on poor and sandy soils in western Mamora, during rotation periods between 2 and 10 years. In short rotation periods it may be observed a maximum foliar biomass production, and little wood biomass. The shortest rotation period is at least 4 years.

**Knockaert, C. Production d'*Eucalyptus camaldulensis* dans le sud du Rharb : résultats d'une expérience de préparation du sol et d'une expérience de mode de coupe. *Annales de la Recherche Forestière au Maroc* 1984. 24 37-56 (13 ref.)** Five soil preparation methods (deep soil and top soil preparation) were tested during a first experiment. After eleven years, no significant difference was noticed between plots: cover-crop preparation seems to be the most cost-effective method. In a second experiment, trees were felled at different heights in a mature stand site and production was measured 18 months and 13 years after felling: no significant difference was found between the different methods used.

**Knockaert, C. Production d'*Eucalyptus camaldulensis* origine Lake Albacutya durant la première et la seconde rotation. *Annales de la Recherche Forestière au Maroc* 1984. 24 127-148 (16 ref.)** The paper reports on the results of six *Eucalyptus camaldulensis* trials in an 18-year-old plantation with 2 rotations of nine years in southern Rhab. A drop in production was observed during the second rotation, partly due to the lack of precipitations. There are noticeable variations between the six experimental sites.

- Knockaert, C.** *Production et densité de plantation d'Eucalyptus sideroxylon dans les forêts de la Mamora et de Ben Slimane. Annales de la Recherche Forestière au Maroc 1984. 24 101-125 (15 ref).* The paper reports on trial results of spacings at 3X3, 4X4 and 6X6 m. The highest total volume increase was obtained with the highest densities. The best level of resistance to *Phoracantha semipunctata* and the largest stem diameter were obtained with 4X4 m spacings.
- Knudson-D, Yahner-JE, Correa-H.** 1970. *Fertilizing eucalypts on Brazilian savanna soils, Commw. For. Rev. 49(1), (30-40)* Describes the first and second-year results of 18 fertilizer treatments applied to *Eucalyptus saligna* on the red savanna soils of the jaguara plantation in central Minas Gerais. Response to N.P.B and Zn was promising. The cost of fertilizing with a mixture of these elements was considered economically acceptable.
- Kohler, J.M.** *Notes sociologiques sur le programme de reboisement de Tango. Document de travail ORSTOM, Nouméa 1980. 70 p.* Although this study does not concern *Eucalyptus* but *Pinus* spp. reforestation, it provides an interesting methodological approach by attempting to answer to the following questions: how does population perceive the reforestation projects with an exotic species, what are the real implications? The paper reproduces the approach developed by Melanesians about the reforestation programme and analyses economic and social returns (particularly job remuneration, income generated and their use.)
- Kohne-JS, Kremling-U.** 1988. *Reduction in yield in avocado orchards bordering on eucalyptus plantations. Yearbook South African Avocado Growers' Association. 11, 56* Competition for light, water and mineral nutrients by *Eucalyptus* spp. was accountable for the reduction in fruit yield.
- Kolar-M.** 1963. *Financial and timber yields of Eucalyptus camaldulensis Dehn (E. rostrata) over six rotations. Contributions on eucalypts in Israel II. National & University Institute of Agriculture, Ilanot.* Describes a plantation of *E. rostrata* near Hadera, established in 1900 mainly on swampy ground, and now mostly in the 4th, 5th or 6th coppice rotations. M.A.I. averaged 12.5 m<sup>3</sup>/ha/y on light sandy loam, and 9 m<sup>3</sup>/ha/y on heavy alluvial soils. No decline for the later rotations was observed. Rotations varied from 5 to 35 years. Increment could be increased by intermediate thinning.
- Konar-J Kushari-DP.** 1989. *Effect of leaf leachate of four species on sprouting behaviour of rhizomes, seedling growth and diosgenin content of Costus speciosus. Bulletin of the Torrey Botanical Club. 116;4* *C. speciosus* is widely grown in West Bengal under the shade of various plantation trees. Leaf leachate of Mango, sal, teak and eucalypts were tried for studying the sprouting behaviour of rhizomes. Leaf leachate of *Eucalyptus* spp. Inhibits sprouting and growth.
- Kowsar-A.** 1991. *Floodwater spreading for desertification control: an integrated approach. Desertification Control Bulletin, No.19* Flash floods, common to most deserts, are harnessed to control desertification. Artificial groundwater recharge is utilised to produce food, feed, fibre and fuelwood. In Iran, in this programme, *Eucalyptus* spp. have given good results.
- Krasuhin-MN.** 1952. *Tanning extract from Eucalypt bark, Legkaja Promyslennostj, Moskva 12(7), (20-1)* The Bark of Russian grown *Eucalyptus* spp. has been found to

contain 1.5-20 percent tannins. The *Eucalyptus* spp. bark extract can be used alone for Russian leather.

- Krilov-A; Dowden-H 1987. *The influence of defects on the utilization of small diameter logs. Holz als Roh und Werkstoff. 45:9*** Small-sized regrowth consisting mainly of *Eucalyptus* spp. is gradually being recognised as a marketable commodity in Australia. Some specific conversion problems are outlined relating to equipment and material.
- Krishna,-S; Badhwar-RL. 1949. *Aromatic plants of India, Part XII, Family 46, Myrtaceae, J. sci. industr. Res. India 8 (12), (suppl. 195-220) (Forest Research Institute, Dehra Dun)***. Covers *Baeckea* spp., *Callistemon* spp. and *Eucalyptus* spp. Includes descriptions of 90 *Eucalyptus* species, including notes on their growth in India and tables showing characteristics of their oils.
- Krishnamurthy-T, Karira-GV, Sood-VK. 1965. *Note on Eucalyptus fruticetorum F. Muell, syn. E. polybractea R.T. Baker, Indian For. 91(11)*** *E. fruticetorum* leaf has a high yield of medicinal oil in Australia and attempts to grow this species at Dehra Dun were made from 1948 to 1955. Not only was survival and growth poor, but the yield, density, and optical rotation of the oil and its cineol content, were lower than normal for this species (Cf. F.A. 7 No. 137).
- Kushalappa K.A. 1993. *Productivity studies in Mysore Gum. Associated publishing company, New Delhi***. Yield and nutrient status of *Eucalyptus tereticornis* are discussed in detail on the basis of a study carried out in a region where these plantations have existed for over thirty years. The results indicate that in well-managed plantations with a felling cycle of over 12 years, the soil recoups the loss of nutrients.
- Kushalappa KA. 1987. *Nutrient status under Mysore gum plantation for ten years near Bangalore. Journal-of-Tropical-Forestry 3.2*** Data were gathered on a Mysore Gum Plantation established in 1977, until 1986. There was a general improvement in soil structure and nutrient status. Some of the changes are attributed to the protection of the area from fire.
- Kushalappa-KA. 1985. *Economics of Eucalyptus hybrid and Casuarina plantations under farm forestry in Karnataka. Van-Vigyan, 23; 1-2*** The silvicultural characteristics of the *Eucalyptus tereticornis* and *Casuarina equisetifolia* planted by private farmers on marginal lands are described and their management and economics discussed. Comparative investment and return data indicate that *Eucalyptus* spp. plantations are more profitable than *Casuarina* spp. but the use of different species or provenances could alter this situation.
- Kushalappa-KA. 1985. *Nutrient status in Eucalyptus hybrid monoculture. Indian Journal of Forestry, 8:4*** Results of a study of nutrient status in an *Eucalyptus* hybrid plantation, over a period of 5 years, are reported. There was variable increase in organic C and in P. Soil pH was relatively stable.
- Labarthe, F.; Reiche C., C. 1989. *Consumo de leña y otros combustibles en los trapiches de San Ramón, Costa Rica. Dep. Recursos Nat. Renovables. Ser. Técnica, CATIE, 153: 75 pp. Turrialba. Costa Rica. (1F Forest Products Abstracts, 1990, 013-***

01816) *Eucalyptus saligna* stands among the most promising species for reforestation.

**Ladrach-WE. 1978. Yield of eucalyptus planted along field boundaries in the del Valle plain. Investigation-Forestal,-Colombia, No.32.** Yield tables for *Eucalyptus* spp. planted along field lines have been calculated for an area in the district of del Valle, Colombia. *Eucalyptus camaldulensis* gave the highest yields. Observations in the district suggest that pulpwood production along field boundaries should not affect agricultural output from the farm.

**Lage Picos, J. 1991. Cultura forestal e incendios forestales en Galicia. Actualidad Forestal de Galicia, (119-120): 1-5. (BBV). La Coruña. España** Results of a survey undertaken in 1991 are reported.

**Lahiri,-AK. 1992. Silvo-pasture practices on lateritic tract of south west Bengal. Indian-Forester. 118: 12, 887-892; 1 ref.** An account is given of silvo-pastoral systems developed in West Bengal as part of the Social Forestry Project and the fuelwood and fodder project of the Indian government. The system includes fuelwood species (*Eucalyptus* and *Acacia auriculiformis*), fodder trees (*Sesbania grandiflora* and *Leucaena leucocephala*) planted on eroded land and fodder species (*Pennisetum pedicellatum*, *P. polystachyion*, *Stylosanthes guianensis*, *S. scabra*, *S. humilis* and *S. hamata*) planted or sown between them. Details of average yields are given. The practice is viewed as promising, but the proposed method of cut-and-carry for cattle feeding (in order to reduce pressure on the forest) is not accepted by the farmers who prefer to bring their cattle to graze in the forest.

**Lanier, L. Maladies de l'Eucalyptus. EPPO Bulletin 1986. 16 (2): 255-263 (10 ref.)** *Eucalyptus* spp. pathogens and diseases, their geographic distribution and importance are reported. Several phytosanitary measures are proposed to limit the presence and development of the most dangerous pathogens.

**Lapeyrie,F.; Bruchet, G. Dir Les mycorrhizes de l'Eucalyptus en conditions d'excès de carbonate de calcium : approche écologique et physiologie des associés ectomycorrhiziens Univ.: Lyon 1 ; Th. : Biochim. 1987. 219 p. (253 ref.)** The role of mycorrhization during the growth process of *Eucalyptus* spp. in limestone soils is analysed here from an ecological perspective. The study was carried out on a complete plant growing in limestone soil in Australia, the plant was successively examined under the physiological perspective through the study of an ectomycorrhizian mushroom in pure culture. Tolerance to limestone soils was attributed to symbiotic mushrooms. The interaction of soil bicarbonate ions was examined, as well as calcium oxalate formation in the mushroom and phosphate-composed nutrition of the hosting plant.

**Laplace, Y.; Quillet,G.; Martin, B. L'UAIC. Informations-Forêts, 1989. (No. 2):57-72** This article presents the Industrial Afforestation Unit of Congo, a state company from Congo, its background history, of *Eucalyptus* spp. plantations management. It does not include data on the ecological and economic aspects.

**Ledig-FT. 1989. Improvement of eucalypts for fuel and fiber in California. (in Pereira, J.S, Landsberg, J.J. eds. Biomass production by fast-growing trees.) 231-245, 26 ref**

- NATO ASI Series. Series E, Applied Sciences 166. Dordrecht, Netherlands, Kluwer Academic Publishers.* As a result of accumulated experience of species trials, *Eucalyptus globulus*, *E. camaldulensis*, *E. viminalis*, *E. dalrympleana*, *E. nitens* and *E. grandis* have been identified as growing exceptionally well in California. Early steps in their breeding are reported, particularly seed source selection, within seed sources, and seed orchard establishment and multiple-line breeding.
- Legeay, D. Bilan de 10 années d'activité du Volet Pépinières rurales et agroforesterie. Provinces de Bururi et Makamba. Projet de reboisement Banque Mondiale/FAC, AFVP, BURUNDI. 1990. 47 p. et annexes (16 ref.)**  
This report shows the result of activities undertaken by the project on rural nurseries and agroforestry. It presents a series of interesting data, particularly on plant production costs, the evolution of communal plantations (in decrease) and private plantations (increasing). Demand of *Eucalyptus* spp. is decreasing, while demand of other timber species is growing. The author proves that no follow-up on private plantations was done, thus appraisal of the real impact of project is not possible.
- Legeay, D. Etude des acheteurs de plants. Campagne 1989-90. Secteur sud. Pépinières rurales. Projet de reboisement Banque Mondiale/FAC, AFVP, BURUNDI. 1990. 9p.** This study aims at identifying the clientele buying plants from the project's nursery, according to their social and professional category. Farmers represent 70 percent of buyers, but only 25 percent of the total figure of plants are bought by them. Officers, entrepreneurs and institutions represent 30 percent of buyers while 75 percent of plants are bought by them. *Eucalyptus* spp. is the more popular species in the market, except among institutions, who prefer to invest in timber species.
- Leggat-G. 1952. Eucalypts in the urban and rural economy of Uganda, E.Afr. agric.J. 17 (4)**  
An account on fuelwood plantations established in different periods since 1916.
- Leslie-AJ. 1956. Cellulose forestry. Proc. Aust. Pulp. Ind. tech. Ass. 10.** An analysis of requirements for the final product, based on kraft Eucalypt pulp in the Maryvale mill (Australia), leads to the concept of cellulose forestry as the scientific management of forests for the continuous production of wood fibres having the optimum properties for paper-making.
- Leuning,-R; Cromer,-RN; Rance,-S. 1991. Spatial distributions of foliar nitrogen and phosphorus in crowns of Eucalyptus grandis. Oecologia. 88: 4, 504-510; 24 ref.**  
The effects of plant nutrition on photosynthesis and growth were examined. Gas exchange measurements on sample leaves were used to estimate parameters of a model of C3 photosynthesis as a function of leaf N and P concentrations.
- Leuning,-R; Wang,-YP; Cromer,-RN. 1991. Model simulations of spatial distributions and daily totals of photosynthesis in Eucalyptus grandis canopies. Oecologia. 88: 4, 494-503; 31 ref.** A brief outline of the model (MAESTRO) is presented and simulations performed for young *Eucalyptus grandis* (6, 9, 12 and 16 months old) under 4 factorial combinations of [N] fertilizer treatment and irrigation.
- Leuning-R, Kriedemann-PE, McMurtric-RE. 1991. Simulation of evapotranspiration by trees. Agricultural-Water-Management. 19:3** To serve as a guide for selecting *Eucalyptus* spp. for lower water tables in salt-affected drylands in South West Australia, a model of plant water consumption was used to simulate seasonal

- patterns of soil water storage in a forested catchment. The model predicted that trees with low stomatal sensitivity to water vapour pressure deficit (VPD) or with high leaf area index (LAI) will deplete soil water more rapidly than trees sensitive to the VPD or with low LAI. Total water consumption would be the same for both types of plants after a sufficiently long period when a new equilibrium between annual rainfall and evapotranspiration would be reached. The conclusion is interesting.
- Lewan-L. 1987. *Effect of windbreaks on evapotranspiration and wind speed in Sidi Bouzid, central Tunisia. Part 3 Study of three windbreak systems, March-May 1986. Working-Paper, International Rural Development Centre, Swedish University of Agricultural Sciences, No.43.*** Both wind speed and evaporation were considerably reduced in the nursery by surrounding rows of eucalypts. Details from the study are presented.
- Lewis-AM .1989. *The production of salt tolerant trees. Combined Proceedings International Plant Propagators' Society. publ. 1990., 39, 61-63*** The salt tolerance of 48 provenances representing 19 *Eucalyptus* spp. from Western Australia was assessed by growing seedlings for 5 weeks under drained or waterlogged conditions with and without the addition of saline solution. Plants with superior salt tolerance could be multiplied by tissue culture and used to reclaim and rehabilitate salt-affected areas of Western Australia.
- Ligne, A. de Dossier Burundi. *Histoire de la Recherche Forestière. Bois et Forêts des Tropiques 1992. (No. 233): 7-12*** Forest research in Burundi started in 1930 and its evolution may be divided into three different phases: knowledge of natural forest, introduction of exotic species for reforestation with productive purposes, research of traditional species adapted to ridges, and finally, the integration of trees in agricultural exploitation.
- Lima W-de-P and O'Loughlin EM. *The hydrology of eucalypt forests in Australia - a review. IPEF (Piracicaba, Brazil)*** A comprehensive and valuable review.
- Lima W-de-P. 1988. *Surface runoff, soil and nutrient losses in plots reforested with eucalypts in sandy soils in Sao Simao country, Sao Paulo. IPEF Instituto de-Pesquisas-e-Estudos-Florestais, No.38.*** Data were collected in 1983-86 for plots kept free from vegetation (control) or planted with *Eucalyptus grandis* in 1983 and given different site preparation, spacing and silvicultural treatments. In the first year, runoff and soil loss were relatively high in all plots, decreasing in the *E. grandis* plots in the following years. Runoff and soil loss remained fairly high in the control plot throughout. Nutrient losses were related to runoff and decreased markedly with the growth of the trees. Nutrient input in rainfall was generally higher than the losses in runoff.
- Lima, W de P. 1990. *Overland flow and soil and nutrient losses from Eucalyptus plantations. IPEF International. No. 1, 35-44; 35 ref.*** (In Portuguese).
- Lima, W de P. 1993. *(Efectos ambientales del eucalyptus). Efeitos ambientais do Eucalypto. Sao Paulo, Brasil; Editora da Universidade de Sao Paulo. 1993. 301 pp.; 51 pp. de ref.*** This book reviews 'O reflorestamento com eucalipto e seus impactos ambientais' [Lima, W. de P., 1987. Brasil; Sao Paulo Art Press, 114 pp.] (reforestation with eucalypts and its impact on the environment) Environmental

- effects of *Eucalyptus* spp. Plantations are assessed, with special attention to Brazil. After an introductory chapter, six chapters follow: (1) plantations; (2) hydrology of *Eucalyptus* spp. plantations; (3) soil and *Eucalyptus* spp. (4) flora, fauna and *Eucalyptus* spp. (5) agroforestry systems and *Eucalyptus* spp. (5) plantations and environment; and (6) research priorities. (In Portuguese).
- Lima, W de P; Zakia, MJB; Libardi, PL; De Souza Filho, AP. 1990. Comparative evapotranspiration of eucalyptus, pine and natural cerrado vegetation measured by the soil water balance method. IPEF-International. No. 1, 511; 19 ref. Piracicaba, Brazil; Instituto de Pesquisas e Estudos Florestais.** Measurements were made of precipitation, soil water storage and soil water potential in cerrado, a 5-year-old *Eucalyptus grandis* stand and a 5-year-old *Pinus caribaea* var. *hondurensis* stand in the Jequitinhonha Valley, Minas Gerais. The study concluded that establishment of forest plantations of *Eucalyptus* and *Pinus* in this region will not adversely affect the soil water regime. (In Portuguese).
- Lima-W-de-P. 1987. Reforestation with the eucalypt and its environmental impacts. Sao Paulo, Brazil, Artpress.** The effects of eucalypts throughout the world are described and discussed in 7 chapters followed by general conclusions.
- Lisanework,-N.; Michelsen,-A. 1993. Allelopathy in agroforestry systems: the effects of leaf extracts of Cupressus lusitanica and three Eucalyptus spp. on four Ethiopian crops. Agroforestry Systems 21(1) p. 63-74.** The potential allelopathic effect of *Cupressus lusitanica*, *Eucalyptus globulus*, *E. camaldulensis* and *E. saligna* on seed germination, and radicle and seedling growth was investigated with four crops: *Cicer arietinum* (chickpeas), *Zea mays* (maize), *Pisum sativum* (peas) and *Eragrostis tef* (teff). Aqueous leaf extracts of all the tree species significantly reduced both germination and radicle growth of the majority of the crops, usually starting from concentrations of 1 or 2.5 percent. From the overall data the leaf extracts of the four tree species can be arranged according to increasing allelopathic potential: *C. lusitanica*<*E. globulus*<*E. saligna*<*E. camaldulensis*. It is suggested that the planting of *E. camaldulensis* and *E. saligna* in integrated land use systems should be minimized, whereas the use of *C. lusitanica* and *E. globulus* seems less environmentally damaging in this respect.
- Liu Guanqiong. 1990. Eucalypts : Water and Soil Conservation. Royal Forest Department, Thailand.** In South China, *Eucalyptus* spp. are planted as erosion control measures in the severely eroded catchments of rivers, in the embankments of contour ditches.
- Lohmann-L. 1990. Commercial tree plantations in Thailand: deforestation by another name. Ecologist. 20:1.** A report from Buriram province, on the economic and ecological issues arising in relation to local peoples' protests over plans to extend *Eucalyptus camaldulensis* plantations within National Reserve Forests. Multinationals, UN organizations and bilateral agencies are criticized for encouraging eucalypt plantations, for wood chip/paper pulp.
- Lonner Goran, Parikka Matti. 1989. Economic potential of intensively cultivated energy forests in Sweden. Moderating of energy forestry growth, water relations and economics. Pudo Wageningen** Intensively cultivated energy forest could be an alternative to surplus agricultural crops. The paper analyses the result of a small scale privately managed plantation established in 1986.

**Loock-EEM. 1970. *Eucalyptus* species suitable for the production of honey. Bulletin Department of Forestry South-Africa No.46.** The main *Eucalyptus* spp. and some other important exotics growing in S.Africa are listed with an indication of their distribution, flowering times and product (nectar and/or pollen). Short notes (descriptions and value for honey and timber) are given for *Eucalyptus sideroxylon*, *E.melliodora*, *E. polyanthemos*, *E.camaldulensis*, *E.cladocalyx*, *E. viminalis*, *E.cinerea*, *E.grandis*, *E.robusta*, *E.globoidea*, *E.rubida*, *E.bridgesiana*, *E. maculata*, *E.paniculata*.

**Lopez Arias, M. 1991. Ciclo biológico de los elementos biogénicos en una plantación de *Eucalyptus globulus* del SO de España. Investigación Agraria. Sist. y Rec. Forestales, vol. 0:75-91. Madrid. España** This study was undertaken in the province of Huelva (Spain). It aims at characterizing: nutrient distribution in eucalypt; nutrient return in above ground vegetation; increase of biomass contained in each compartment (canopy level, tree layer, organic matter on topsoil, total roots and rooting zone); balance of nutrients in reforestation; emission of nutrients in the atmosphere ; absorption, recycling interval and annual requirement of elements.

**Loubelo, E. Touffet, J. (Dir the) Etude comparative de quelques éléments du fonctionnement de deux peuplements d'*Eucalyptus* au Congo. Univ.: Rennes 1; Thèse Doctorat: Sci .biologiques; 1990. 150 p. (5p.ref.).** This research aims at studying the biogenetic elements circulation in two sites planted to *Eucalyptus* spp. Hybrids, at 6-years-old. The study was done in the framework of accompanying research carried out by the Industrial Afforestation Unit of Congo. The research was oriented towards organic matter dynamics, through the study of litter soil fauna, the analysis of various stages in the cycle of major biogenetic elements (N, P, K, Mg, Ca) and towards the evolution of physiochemical characteristics of reforested soils. After 5 years, reforested soils show an outstanding clay leaching, a tendency towards acidification, an impoverishment of total organic matter in top layers, loss of biogenetic elements. The exploitation of unbarked stems exports biogenetic elements, while unbarked stem exploitation allows to devolve these elements through the bark.

**Loumeto, J. Importance de la phase immobilisation dans le cycle des éléments minéraux nutritifs d'un *Eucalyptus* hybride du Congo. Arbres pour le développement en Afrique sud-saharienne. Compte-rendu d'un séminaire régional IFS, ICRAF, Nairobi, Kenya, Février 1989. 20-25** *Eucalyptus alba* X *Eucalyptus urophylla* hybrid is frequently used in Congo. The characteristics of this hybrid are subject to study in order to understand the mineral elements cycle, particularly the quantity of mineral elements that are not mobilized in trees at 6/7 years old, the felling age.

**Loumeto, J.J.; Touffet, J. (Dirthe) Contribution à l'étude de la distribution minérale dans les *Eucalyptus* du Congo Univ.: Rennes 1 ; Th. 3e cycle : Sci. ; 1986. 129 p. (109 ref.)** *Eucalyptus alba* x *urophylla* (or E.PF SUB 1 in the reforested area) have been analysed. Biogenetic elements (N, P, K, Ca, Mg, Na, Mn, Fe) have been identified in the leaves, branches, bark and wood through complex sampling. Mineral contents vary according to compartments. About 77 percent of total weight of bio elements are retained in the stem (41 percent in the wood and 36 in the bark). The exploitation of trees, fixed at 6-7 years old, consisting in the extraction of stem from the ecosystem, may produce an important loss of mineral matter. The litter and soils under the clonal plantations of *E. alba* x *urophylla* and clonal plantations of *E. alba*

- x urophylla* and *E. 12 ABL x saligna*, (*E. 12 ABL* = *E. tereticornis*) have been analysed. The litter of trees that had reached the exploitation age, showed a low decomposition rate (about 12 percent) and poor nutrient content, as well as the soil, with the exception of phosphorus in the latter.
- Loumeto, J. J.; Touffet J.** *L'exportation minérale dans les plantations d'Eucalyptus du Congo (1. Distribution des éléments biogènes dans un peuplement d'Eucalyptus.) Botanica Rhedonica, série A, 1983. (No. 18): 27-42 (12 ref.)* This study aims, on one side at identifying element distribution in the different aerial compartments of an individual clone; and on the other, to understand better interclonal variation. The study has been carried out on *Eucalyptus* PF1 hybrid (*Eucalyptus alba x Eucalyptus urophylla*), or *Eucalyptus urophylla* and *Eucalyptus alba*. Interclonal variation difference is apparently not significant.
- Luque Benito, J.L. de.** 1993. *El cultivo del eucalipto en el desarrollo del medio rural: Programas de asistencia y posibilidades. Congreso Fores. Español. Lourizán, IV: 501-504. España* This paper aims at shedding light on the advantages of *Eucalyptus* spp. cultivation in the Cantabric area and Galicia region aimed at the development of rural population, in times when agriculture and livestock are not appropriate alternatives.
- Macías Vázquez, F.** 1990. *Críticas y comentarios sobre el informe "Effects des plantations d'eucalyptus dans le Nord de l'Espagne" por González Bernáldez et al. (1989), realizado para la CEE. Axencia de Calidade Ambiental de Galicia. Consellería de Ordenación do Territorio e Obras Públicas. Xunta de Galicia. España. 36 pp* The author provides comments on each section of the report in the light of existing knowledge on the subject. The study concludes that: yields in *Eucalyptus* spp. are higher than those of any other woody species introduced in the poor soils of Galicia. There is no contradiction between *Eucalyptus* spp. planted areas and other agronomic alternatives. There is no evidence to affirm that *Eucalyptus* spp. facilitates acidification or podzolization, or produces negative impacts. No risks of excessive consumption of water resources were identified. There is no relationship between the presence of *Eucalyptus* spp. and forest fires. Management that takes into account the capacity, vulnerability and limits of different areas and distinct uses, is necessary.
- Mackenzie Debora.** 1988. *Kenya's President causes panic among foresters. New Scientist 18 Feb 1988.* This article discusses the problems that could arise from the implementation of the presidential decree imposing that 90 percent of all the seedlings grown in nurseries should be of native species.
- Madeira-MAV.** 1989. *Changes in soil properties under Eucalyptus plantations in Portugal. Biomass production by fast-growing trees. Proceedings of a NATO Advanced Research Workshop (edited by Pereira, J.S. Landsberg. J.J.) 1989. 81-99, 45 ref NATO ASI Series. Series E, Applied Sciences 166, Dordrecht, Netherlands, Kluwer Academic Publishers.* Studies were made in short-rotation *E.globulus* stands in central Portugal and in a natural vegetation stand (mainly *Quercus suber*) to assess the effects of leaf litter on soil, cultivation techniques (ploughing or harrowing), soil management and silvicultural techniques. Soil properties studied included bulk density, porosity, compaction, water infiltration rates, organic carbon,

exchange complexes, and pH. It was found that most variations were related to management (i.e. soil preparation and silviculture).

- Maithani-GP, Sharma-DC. 1987. Initial spacing in eucalypt planting. Indian-Forester, 113:5.** A brief review of spacing trials and the discussion of the silvicultural implications are provided. Spacings are recommended for fuelwood production, for pulpwood and poles, for saw logs, for wind-breaks and shelterbelts. A useful study.
- Majer,-JD; Recher,-HF; Ganeshanandam,-S. 1992. Variation in foliar nutrients in Eucalyptus trees in eastern and Western Australia. Australian Journal of Ecology. 17: 4, 383-393; 33 ref.** Levels of N, P and K were measured for the foliage of *Eucalyptus crebra* and *E. mollucana* [*E. moluccana*]. Samples were collected from the canopy and subcanopy. Differences observed in foliar nutrient levels are discussed, particularly with reference to observed trends of abundance and diversity of foliage arthropods, and the use of trees in the diet of birds.
- Malan-FS. 1991. Variation, association and inheritance of juvenile wood properties of Eucalyptus grandis Hill ex Maiden with special reference to the effect of rate of growth. South African Forestry Journal. No.157.** The juvenile wood properties of *Eucalyptus grandis* are poorly documented, even though this species is a major commercial hardwood in South Africa. Its study has revealed that there are no significant negative genetic correlations between growth rate and wood properties. A substantial increase in growth rate should not have any detrimental effect on wood quality. On the other hand, negative genetic correlations of growth rate with wood density and fibre length were found.
- Malik-RS, Sharma-SK. 1990. Moisture extraction and crop yield as a function of distance from a row of Eucalyptus tereticornis. Agroforestry Systems. 12:2.** A study was made on the effect of a single east-west tree line of 3.5 year old *Eucalyptus tereticornis* in a farmer's field in Haryana on soil physical parameters and adjoining mustard and wheat crops. It is concluded that *E.tereticornis* is not suitable species for row plantations in agroforestry systems in the deep water table conditions of semi-arid regions.
- Manathuragi Math-B.B, Bulgannavar-BN, Parameswarappa.S, Burley-J. 1991. Provenance trial on Eucalyptus cloeziana in Western Ghats of Karnataka, India. Indian Forester, December 1991** *Eucalyptus tereticornis* was the most popular species in low rainfall areas, but is now replaced by *E.camaldulensis*. *Eucalyptus cloeziana* from 5 provenances. At 5 years, these species showed that MAI varied from 13.01 to 33.54 m<sup>3</sup> in high rainfall area.
- Marcar-NE, Leppert-PM. 1990. Salt and water logging tolerance of frost-resistant eucalypts. Management of soil salinity in south east Australia. Proceedings of a symposium held at Albury, New South Wales. Australia, on September 18-20, 1989 (edited by Humphreys, E.; Muirhead, W.A; Lelij. A van der), Riverina, Australian Society of Soil Science.** The salt tolerance of several frost-resistant *Eucalyptus* spp. were tried with and without imposed water logging under greenhouse conditions. Without water logging, *E. camaldulensis*, *E. tereticornis* and *E. occidentalis* were the most salt-tolerant species. Under waterlogged conditions good salt-tolerance was shown by *E. camaldulensis*, *E. aggregata*, *E. globulus* and *E. gunnii*; only *E. camaldulensis*

survived long term exposure to salt level and water logging. All species survived prolonged water logging (50 days) without exposure to salt.

- Maree - HB. 1979. *The development of a pruning policy for the fast growing eucalypt species in State forests. South African Forestry Journal No.109*** In order to supply the saw milling industry with high quality, defect-free saw logs, it was found necessary to prune the trees in state owned *Eucalyptus* spp. stands in South Africa. The historical background and the principles considered in developing a suitable pruning policy are discussed.
- Marien, J. N.; Cauvin, B. *Influence du reboisement sur la station. Annales de Recherches Sylvicoles, AFOCEL, France, 1982. Paris, France; Association Forêt-Cellulose 1983. 234-261 (30 ref., 9 pl.)*** The evolution of soil characteristics was studied in experimental plot planted to 20 forestry species at 10 years old. Afforestation had little impact on chemical characteristics of soils, with the exception of an increase of pH under *Eucalyptus macarthuri*. The fast growing species restored mineral balance of original stands, while no balance was restored in cleared plots that did not undergo reforestation.
- Marlats, R.M.; Pérez, F. 1991. *Selección de especies, orígenes y procedencias de Eucalyptus, resistentes a bajas temperaturas, en plantas de vivero para el norte de la Depresión del Salado, Provincia de Buenos Aires. Argentina. Sistemas y Recursos Forestales, n° 0: 151-161. Investigación Agraria. INIA. Madrid*** In the Lobos nursery, in Argentina, 55 seed provenances of 11 *Eucalyptus* spp. were studied. The best results were shown by: *E. camaldulensis* in high latitudes (Lago Albacutya, Victoria), *E. tereticornis* in 29° S, *E. delegatensis*, *E. fastigata*, *E. dunii*, including all the remaining provenances of *E. viminalis*.
- Marrero-J (1946). *The planting of eucalypts in the Ecuador Sierra 1946, Carib. For 1946. 7(1) (Tropical Forest Exp. Sta., Puerto Rico)*** The introduction of *E. globulus* in Ecuador, for timber production is discussed.
- Marriage-A. 1977. *Fast growing firewood. Quarterly Journal of Forestry 71:4*** Measurements of height and girth are tabulated for a number of fast-growing species in SW England.
- Martin, B. *Amélioration génétique des arbres tropicaux. Contribution majeure à la foresterie clonale. Thèse Sciences Paris I 218 p. et annexes (ref 12 p.)*** The thesis summarizes improvement activities of tropical *Eucalyptus* spp., mainly in Congo. It argues in favour of clonal forestry.
- Martin, B.; Marien, J. N.; Cauvin, B.; Gemignani, G.; Thibout, H.; Lopez Arias, M.; Alcaraz, L.; Andonoski, A. *Especies et provenances pour les climats méditerranéens. Colloque international sur les Eucalyptus résistants au froid. Bordeaux, France, 26-30 Sept. 1983. Association Forêt-Cellulose 1984.153-251.*** Seven presentations are included : Martin, B. Cold tolerance of *Eucalyptus* spp.: species and provenances for Mediterranean climates. 155-173 [46 ref., 1 pl.] Marien, J.N.; Cauvin, B. *Eucalyptus* spp. in France: volume functions and biomass production. 174-193 [7 ref., 3 pl.]. Gemignani, G. Experimentation in Italy of cold tolerant *Eucalyptus* spp. 194-195. Thibout, H. Contribution to the understanding of *Eucalyptus dalrympleana*. 196-212 [4 ref., 5 pl.]. Lopez Arias, M. Plantation trials

of several *Eucalyptus* spp. in different cold and dry locations in continental Spain. 213-235. Alcaraz, L. Cold tolerant *Eucalyptus* spp. in Catalonia. 236-242. Andonoski, A. The introduction of *Eucalyptus* spp. in Yugoslavia. 243-251 [13 ref., 2 pl.].

**Martínez H., H.; Zanotti, J.R. 1985. *Comportamiento de algunas especies para leña en Guatemala. Centro Agron. Trop. de Inv. y Enseñanza. CATIE. 21 pp. Turrialba. Costa Rica*** This study provides data on development of several species, the most promising one in terms of its fast-growing characteristics, was *Eucalyptus saligna*.

**Martínez H., H.A. 1990. *Camaldulensis: Eucalyptus camaldulensis Dehnh., especie de árbol de uso múltiple en América Central. Informe Técnico n° 158, 58 pp., Centro Agron. Trop. de Inv. y Enseñanza. CATIE. Turrialba. Costa Rica*** A silvicultural guide of *Eucalyptus* spp., including botanic, ecology, implantation and management.

**Martínez Higuera, H.; Rodríguez Martín, G. 1987. *Comportamiento de 21 especies forestales en San José de Guaviare, Colombia. Serie Técnica, 26: 28 pp., CONIF. Bogotá. (FA, 1990, 051-06712)***. This paper describes, among other things, survival rate, diameter, height and stem morphology in five *Eucalyptus* spp. established in degraded forests for firewood, pole and timber production.

**Martinez, F.; Martin, C. *Influence de la technique d'abattage sur la régénération d'un taillis d'Eucalyptus. Annales de Mécanisation Forestière, ARMEF, France 1984. 313-345 (10 ref.)*** This article shows a study carried out close to Toulouse with *Eucalyptus bridgesiana* to assess the feasibility of totally mechanized felling operations. Several felling techniques are compared. Results show that mechanization does not pose important technical problems. Eventually, there may be long-term (10-30 years) damages produced to *Eucalyptus* spp., which require further study.

**Mata, A. de la. 1989. *Unha política forestal para Galicia. V Xornadas Agrarias Galegas. (1987), 386-410. Xunta de Galicia. España*** The author is in favour of maintaining a balance between local species and fast-growing species, taking into account the aspects related to conservation and economic planning.

**Mathur-RS, Sharma-KK, Ansari-MY. 1984. *Economics of Eucalyptus plantations under agroforestry. Indian forester. 110:2*** Assessments are made of the economic feasibility of planting *Eucalyptus* hybrid with or without agriculture on field bunds or in blocks at wide spacings. It is concluded that raising *Eucalyptus* spp. without intercropping at 2.5 x 2.5 m with 3 coppice crops on a 8-year rotation gave higher net returns than at 3 x 1.5 m spacing. The other combinations and their economic viability are brought out. The paper concludes that for small farmers, planting of *Eucalyptus* spp. on bunds is economically feasible, and cultivation of *Eucalyptus* spp. with wider spacing between the lines on a 8-year rotation with agriculture is also profitable.

**May-FE, Ash-JE. 1990. *An assessment of the allelopathic potential of eucalypts. Australian-journal-of-Botany.*** Germination of *Lolium perenne* and growth of *L. perenne*, *Lemna minor*, were studied. Fresh intact leaves caused little growth suppression in contrast to coarsely chopped leaves and extracted leaf essential oils which were both highly suppressive. It is apparent that allelopathy must be

considered in relation to rainfall and the soil water balance. Decay was shown to reduce the allelopathic effects of leaf and bark litter leachates but some inhibitory chemicals remain after 5 months. It was concluded that allelopathy is likely to be the cause of understorey suppression by *Eucalyptus* spp. especially in drier climates.

**McCormick, I. (Editor. 1987. *Análisis económico de las inversiones en plantaciones forestales en Ecuador. Dirección Nac. Forest. Ministerio de Agricultura. Quito. (FA, 1989, 050-02995).*** One chapter is dedicated to productivity of *Eucalyptus globulus* in the highlands of Ecuador.

**McKelvie,-L; Bills,-J; Peat,-A. 1994. *Jojoba, blue mallee and broombush: market assessment and outlook. ABARE-Research-Report. No. 94.9, vi + 57pp.; 39 ref. Canberra, Australia; Australian Bureau of Agricultural and Resource Economics.*** This report analyses the current market situation and provides an indication of likely market developments for each of the commodities produced from the three plants (jojoba oil, eucalyptus oil and brush). Australian production of eucalyptus oil is currently around 80 t per year. Medicinal quality oil is the main commercial use in Australia. World prices are well below Australian costs of production. In high volume, low value markets Australia cannot compete with low cost eucalyptus oils from China. The current Australian eucalyptus oil industry survives by exporting to niche markets which offer high prices for low quantity, high quality oils, but there appear to be few prospects for increased demand in these markets.

**McKenny,-DW; Davis,-JS; Turnbull,-JW; Searle,-SD. 1993. *Impact of Australian tree species selection research in China: an economic perspective. Forest-Ecology-and-Management. 60: 1-2, 59-76; 30 ref.*** The Australian Centre for International Agricultural Research (ACIAR), through collaborative projects with the Commonwealth Scientific and Industrial Research Organisation, Australia (CSIRO) and the Chinese Academy of Forestry (CAF), has been involved in tree species selection trials in southern China since 1984. In particular, the trials have examined the potential of fast-growing species of *Eucalyptus*, *Acacia* and *Casuarina* spp. This paper presents an assessment of the possible economic impact of these trials.

**Medema - EL, Lyon - GW. 1985. *The determination of financial rotation ages for coppicing tree species. Forest-Science , 31:2.*** An analytical method is described for simultaneously determining optimum harvest age and optimum number of harvests before stand reestablishment, given a specific yield function, based on land rent. An example is given of coppicing *Eucalyptus camaldulensis* in Sri Lanka.

**Medina Muñoz, L.G.; Cardich Briseno, P. 1989. *Simulación del crecimiento y rendimiento en rodales de Eucalyptus globulus en Cajamarca. Revista Forest. del Perú, 16 (1): 31-40. Univ. Nac. Agraria. Lima. (FA, 1991, 052-05408).*** Permanent 29-year-old plots helped producing data on growth and production indicators through analysis and regression methods. The information was used to determine the best management of stands.

**Mehta-KK. 1989. *Eucalypts for alkali soils. Advances in forestry research in India, Volume III, 1988. 1989, Dehra Dun, India, International Book Distributors.*** A 12-year research project to reclaim alkaline land is presented. Agriculture was carried out for

5 years with addition of gypsum, after which *Eucalyptus* spp. was planted. The trees had very little adverse effect on the agricultural crops except when planted in an east-west direction (this had a negative effect on wheat crops on the northern side).

**Mehta-KK. 1989. Grow trees on waste alkali soils. *Indian-Farming*. 39:4, 25.** A technique developed in Karnal, Haryana, for planting trees on highly alkaline soil is discussed. Recommended species for large-scale plantings are *Populus deltoides* and *Eucalyptus* spp. in combination with agriculture. *Eucalyptus* spp. are not indicated.

**Melo Poblete, J.V.; Bueno Zárate, J. 1988. Obtención de carbón activado de *Eucalyptus globulus*. *Revista Forest. del Perú*, 15 (2): 59-66. *Fac. de Cienc. Forestales. Lima. (IF Forest Products Abstracts, 1991, 014- 02108)*.** Charcoal is produced by using hot steam at 800-1000 °C. Absorption capacity is higher in fine grain material obtained at 1000 ° C. The product obtained may be compared to commercial quality standards.

**Melo,-EFRQ; Santos,-OS-dos. 1990.Importance of boron to eucalypts. *Importancia do boro para o eucalipto. Revista do Centro de Ciencia Rurais, Universidade-Federal-de-Santa-Maria*. 20: 1-2, 185-202; 56 ref.** A review is presented of boron nutrition in *Eucalyptus* spp. in Brazil. Boron is usually present in low concentrations in soils in Brazil and therefore, deficiency of the element is more common than toxicity. The sensitivity of various *Eucalyptus* spp. is briefly discussed. (In Portuguese).

**Mercadet, A.; González Abreu, A.; Martínez, J.A.; Romeo, P; Rodríguez, G. 1990. Primeras experiencias en el empleo de zeolita para la producción de posturas de *Eucalyptus pellita* destinadas a la reforestación de la savana serpentina de Camagüey. *Revista Forestal, Baracoa*, 20 (2): 89-93. *Inst. Forest. Siboney, La Habana. Cuba*.** The best growing rates are possible with 20 percent of zeolite, while irrigation needs are smaller.

**Meskimen-G, Franklin-EC. 1978. Spacing *Eucalyptus grandis* in southern Florida. A question of merchantable versus total volume. *Southern Journal of Applied Forestry*. 2:1.** After 7 years the volume in merchantable trees (4 inches d.b.h. and larger) of *E. grandis* planted at different spacing did not significantly differ between the spacings. Merchantable yields could therefore be obtained from the wider spacings at lower cost for establishment and harvest. Total volume in all stems was 1.7 times greater at the closest spacing than at the two widest spacings. Neither wood quality nor tree height was significantly affected by stand density over the range of spacings tested.

**Messina,-MG. 1992. Response of *Eucalyptus regnans* F. Muell. to thinning and urea fertilization in New Zealand. *Forest-Ecology-and-Management*. 51: 4, 269-283; 19 ref.** A 7-year-old *E. regnans* plantation on the North Island of New Zealand was fertilized with urea (230 or 460 kg N/ha) and thinned to 350 and 150 trees/ha (TPH) from an initial stand density of 1200 TPH. Diameter growth, stand basal area and volume increment responded positively at the intermediate levels of both treatments. Thinning decreased height growth while fertilizer application had a small positive effect on it. Live crown ratio was increased by either treatment. Radical thinning did not offer any growth advantage over less extreme thinning.

The heaviest rate of fertilizer application at any level of thinning did not increase growth.

**Mhando,-ML; Maliondo,-SM; Mugasha,-AG. 1993. Early response of *Eucalyptus saligna* to site preparation and fertilisation at Sao Hill, Tanzania. *Forest Ecology and Management*. 62: 1-4, 303-311; 18 ref.** The effect of site preparation and fertilization on survival and growth of *Eucalyptus saligna* over 4 years and 10 months in southern Tanzania is discussed. In general, results suggest that for improved initial performance of *E. saligna* at Sao Hill, complete tillage should replace strip tillage, and NPK be applied in addition to B.

**Michelsen,-A; Lisanework,-N; Friis,-I. 1993. Impacts of tree plantations in the Ethiopian highland on soil fertility, shoot and root growth, nutrient utilisation and mycorrhizal colonisation. *Forest Ecology and Management*. 61: 3/4, 299-324; 38 ref.** Above-ground herbaceous biomass and nutrient content, fine root biomass and productivity and mycorrhizal colonization were studied in a natural montane forest dominated by *Juniperus* sp., *Olea europaea*, *Podocarpus falcatus*, and in adjacent plantations of the exotic species *Cupressus lusitanica* and *Eucalyptus globulus* and the indigenous *Juniperus procera*. The *Cupressus* and *Eucalyptus* spp. soils had lower nutrient content than the *Juniperus procera* soil and that of the natural forest. The negative effect of *E. globulus* on the growth of *Eragrostis tef* in the bioessay should be considered when future land use in Ethiopia is planned, as these are the most widely planted tree and crop species.

**Midgley -SJ, Turnbull-JW, Hartney-VJ. 1986. Fuelwood species for salt affected sites. (in: Barrett-Lennard, EG; Malcom, CV.; Stern, WR; Wilkins, SM, eds. *Forage and fuel production from salt affected wasteland*.); reprinted from *Reclamation and Revegetation Research*. Amsterdam : Elsevier.** Shortages of fuelwood in Africa, the Indian sub continent and Latin America are discussed. Species selection for saline sites is described.

**Midgley, SJ; Eldridge, KG; Doran, JC. 1989. Genetic resources of *Eucalyptus camaldulensis*. *Commonwealth Forestry Review*, 68:4, 295-308; 35 ref.** A review of genetic variations in *E. camaldulensis*: provenance variation (which illustrates the importance of selecting appropriate genetic material for new introductions, trials and breeding programmes), growth rates, tolerance to salt, drought and frost, leaf oil content, wood properties are described. Future genetic developments for species improvement are suggested.

**Ministère des Relations extérieures, Coopération et Développement Evaluation du Projet *Eucalyptus* UAIC (Pointe-Noire, Congo) 1982.** This report draws a balance of achievements reached by the Industrial Afforestation Unit of Congo until 1982 (9 900 ha of plantations, of which 8 900 ha are *Eucalyptus* spp.). Successively it provides perspectives on the potential uses of *Eucalyptus* spp.: paper pulp or firewood production.

**Mishra,-S.; Melkania,-U. 1993. Soil condition as affected by various age groups of *Eucalyptus* and *Populus* plantations in Tarai region of U.P. *Proc. of Indian National Science Academy*, v. 59(1) p. 67-70.** A comparative study on soil nutrient status of 3-, 6-, and 9-year-old plantations of *Eucalyptus tereticornis*, *Populus deltoides* and natural forest revealed that the latter had greater organic

carbon, nitrogen, phosphorus and potassium contents. Soil moisture, water holding capacity and herbaceous biomass on the forest floor were also greater under natural forest. Soil nutrient status of both plantation species, showed that in terms of nutrient status soil under *P. deltoides* was better than that under *E. tereticornis*. It is suggested that plantations should not be harvested at an early stage (9-10 years old), and that unused tree parts (bark, twigs, leaves and roots) should be left on the forest floor after harvesting in order to improve the soil nutrient status.

**Mohinder Paul, Raturi D.P. 1991. Growth, Biomass production and dry matter distribution pattern of Eucalyptus hybrid grown in an energy plantation. Indian Forester, March 1991.** In a 3-year-old rainfed plantation of *Eucalyptus* spp. hybrid at a spacing of 1 x 1 m., stems were classified into 3 categories according to girth. There were 11 percent stems in the first girth category, 21 percent in the second and 68 percent in the third, but the first category accounts for the largest contribution to biomass. Utilizable biomass is also the highest in the first category. This clearly establishes the need for proper selection of genetically superior strains for planting.

**Mohinder-Pal; Raturi,-DP; Pal,-M. 1991. Growth, biomass production and dry matter distribution pattern of Eucalyptus hybrid grown in an energy plantation. Indian-Forester. 117: 3, 187-192; 4 ref.** A presentation of data from studies undertaken in 1983 in a 3-yr-old plantation of *Eucalyptus tereticornis* on a semi-arid site at Indroda, Gujarat.

**Molitor, C. 1991. . Pioneer ADB reforestation forest relieves poverty - Eucalyptus camaldulensis, a fast growing tree is showing striking results in Nepal. ADB Quarterly Review, October 1990 .** In Nepal, between 1963 and 1983, 2.1 million ha of natural forest were lost due to firewood cutting. In the Terai region, *Eucalyptus camaldulensis* and *Dalbergia sissoo* have fared well, but *Eucalyptus* spp. attains in 9 years the growth which *Dalbergia Sissoo* does in 25 years; Sal which occurs naturally would take a 100 years to reach the same girth. The taungya system is adopted: the landless farmer raises agricultural crops, and the plantation is expected to produce firewood, poles, and timber.

**Molle, J. F. Production d'énergie non-alimentaire par l'agriculture. Bulletin Technique du Machinisme et de l'Équipement Agricoles 1987. (No. 15-16): 39-44** Biomass resources in Europe and in tropical regions are briefly described. In Europe, intensive wood and cellulose production from poplars *Populus* spp. and *Eucalyptus* spp. seems to be a good long-term solution. In tropical regions, solutions may be particularly found in agroindustrial waste materials, aquatic biomass and tropical forests. Thermodynamic conversion transformation methods are introduced along with the economic implications they may have.

**Moncur-MW, Kleinschmidt-G, Somerville-D. 1991. The role of acacia and eucalypt plantations for honey production. Advances in tropical acacia research. Proceedings of an international workshop held in Bangkok, Thailand, 11-15 February 1991. ACIAR-Proceedings-Series., No.35.** Large areas of land in South East Asia are being planted to *Acacia* and *Eucalyptus* spp. for timber, paper and pulp production but the potential of these plantings for honey production has not been evaluated. A management system for honey production incorporating plantations of these species is presented, and the role of bees in pollination is discussed.

- Monnier, Y. 1965. *The current problems of the Argan forests of Morocco. Rev for frame. 17(11)*** Discusses the background history, management practices and pressure on forests. Transfer of state forests to private ownership in the less arid areas for production of small wood on short rotations is suggested.
- Montero de Burgos, J.L. 1990. *El eucalipto en España. (Comentarios a un problema). ICONA. Serie Técnica, 44 pp.. Madrid.*** This paper provides a general review of the negative effects attributed to *Eucalyptus* spp. It also provides an interesting insight on forest fires and flammability of fast-growing species (*Pinus* and *Eucalyptus* spp.). The author is favourable to reforestation in accordance with conservation ecology criteria and current opinions about the natural environment.
- Montero de Burgos, J.L.; Bará Temes, S.; Rigueiro Rodríguez, A. 1989. *Repoblación forestal y terrazas. Estudio realizado para Celulosas de Asturias. CEASA, Navia. España.*** A study was made on reforestation on terraces planted with *E. Globulus* and also *E. Regnans*, *Pinus radiata* P. *Sylvestris*, between North-North-West of Lugo and N-North-East of Asturias. Each species was planted in specific stands and were compared with other non-terraced stands located nearby. The results refer to terraces between 2 and eleven-years-old. Physical and chemical analysis of soils were carried out, as well as floristic and biomass inventories, plus a series of indicators was formulated in order to better understand evolution and progress in time, of soil vegetation and biomass.
- Montoya Oliver, J.M. *Aménagement sylvopastoral de la suberaie de la Mamora (Maroc). Forêt Méditerranéenne 1987. 9 (1): 35-40 (7 ref.)*** *Quercus suber* stands cover 60 000 ha of forest in la Mamora, on sandy soils and in semi-arid climate. A management programme has been proposed with the aim of protecting the natural forest against the invasion of *Eucalyptus* spp, overgrazing and soil degradation.
- Montoya Oliver, J.M. 1993. *¿Eucalipto? Depende, Gracias. Montes (31): 32. Madrid.*** Although the negative impacts attributed to *Eucalyptus* spp. may not be certain, the author is prone to the idea of using the forest for environmental purposes. He does not believe that *Eucalyptus* spp. may bring economic benefits.
- Morokawa, T. 1988. *Alternativas para la producción de carbón vegetal para las industrias siderúrgicas del proyecto " Ferro Carajas", Brasil. Facultad de Cienc. Forestales. Univ. de los Andes, Mérida. Tesis Doctoral, 136 pp. Venezuela. (FA, 1992, 053-04551)*** The "Ferro Carajas" project, in the North of Brazil, produces more than one million tons of cast iron. A study was undertaken to find alternatives to supply the annual demand of 3 800 000 m<sup>3</sup> of charcoal. The study showed that all the charcoal demand could be produced from 1996 on, by carrying reforestation with *Eucalyptus* spp. in 262,000 ha of land. According to the study 43 to 63 percent of the demand could be obtained from deforested areas that were converted to agricultural use; 13 percent of the charcoal required could be obtained from the remaining land located in the mountains, or used for silvo-pastoral purposes in the savannas and other residual land.
- Mueller-Dombois, D. 1991. *Sustainable forestry : The role of Eucalypts and lessons from natural and artificial monoculture systems IUFRO symposium on intensive forestry : The role of Eucalyptus, Durban South Africa - Sept 1991.*** The paper postulates that the long-term sustainability of exotic *Eucalyptus* spp. monocultures

may be threatened by vulnerability to insect pests, due to the cycle of N and P fertilization to maintain productivity, unless (a) 'spatial diversity' of tree taxa, including native tree species is introduced in small-area segments of plantations, and (b) the principle of 'diversity in time' is introduced, involving alteration of taxa and allowing colonization of natural successional species during a fallow period.

**Mughini, G. 1991.** (*Behaviour of some species of Eucalyptus in three trials in the South of Italy.*) *Comportamento di alcune specie di eucalitto in tre prove in Italia meridionale. Cellolosa e Carta. v. 42(6) 2-7; 5 ref.* Growth and survival rates of 31 provenances of 18 *Eucalyptus* spp. were assessed 8 years later. The species were grown in two different regions, two sites in Calabria and one site in Sicily. Seedlots were supplied by the Association Foret-Cellulose (AFOCEL) of France. Many provenances grew faster and survived better than the control species, *E. trabutii*, widely planted in southern Italy, particularly: *E. globulus* 791 104 and 791 114, *E. camaldulensis* 791 074, and *E. grandis* 791 115 and 791 111. (In Italian).

**Mughini,-G.TI. 1993.** (*Performance of some Eucalyptus viminalis Labill. ssp. Viminalis provenances in Central Italy. Preliminary results [Latium].*) *Comportamento di alcune provenienze di Eucalyptus viminalis Labill. ssp. Viminalis in Italia centrale. Risultati preliminari [Lazio]. Monti e Boschi (Italy). v. 44(2) p. 48-51.* Growth performance of some *Eucalyptus viminalis* provenances was compared in a test established near Rome. Considering that trees were only 3 years old, the results must be considered as a preliminary outcome and should be confirmed by a similar trend at mid-rotation (5-6 years). The central-northern VIC provenances and southern NSW provenances, (coming from an area located between 37°00'-37°30' S lat., and 147°30'- 149°00'E long.) seem to have performed better. Similar results were obtained with a northern NSW provenance "Nullo Mt NE Rylstone". Italian secondary provenances, particularly 3488, perform as well as the best Australian ones. Such Italian provenances are probably hybrid and, consequently, profit by heterosis. It is suggested to use these last provenances in industrial plantations but to exclude them from breeding programmes. (In Italian).

**Mughini,-GTI. 1992.** (*Provenance trials of Eucalyptus nitens in central Italy: preliminary results. Confronto di provenienze di Eucalyptus nitens (Deane & Maid.) Maid. in Italia centrale: risultati preliminari.*) *Monti e Boschi. 43: 2, 53-56; 20 ref.* Performance of nine provenances (Victoria and New South Wales, Australia) was assessed 3 years after planting on an experimental site near Rome, Italy. Victorian provenances had best growth performance at this age, and appeared to be well-suited to the soil and climatic conditions. (In Italian).

**Mullin-LJ, Pswarayi-I. 1990.** *Flowering periodicity in provenances of Eucalyptus camaldulensis in Zimbabwe. Commonwealth-Forestry-Review. 69:1.* Results of periodicity studies carried out in 1974-89 in plots of 33 widely distributed natural and exotic provenances of *E.camaldulensis* in Zimbabwe are presented. Their flowering periods are indicated and important implications for the management of breeding programmes are highlighted.

**Muthanna.K.U 1986.** *Eucalypt in arid zone Social-forestry. in: Eucalypts in India; Past, Present and Future KFRI, PG, Kerala.* In arid parts of India about 15 species of

eucalypts have done well according to trials conducted by the Central Arid Zone Research Institute.

- Muthappa-BM. 1979. Rock bee culture in forests. Myforest. 1979, reed. 1985, 15:3.** Most of the rock bee honey in India comes from forest areas. Afforestation policy consisting of planting *Eucalyptus* spp. in Karnataka will improve the potential for rock bee culture as these species provide ample bee forage from September to June. Tables showing the characteristics of 43 *Eucalyptus* spp. used in apiculture are provided.
- Nadkarni. MU. 1989. The Political Economy of Forest Use of Management Sage publications, New Delhi/London.** References are made to the *Eucalyptus* spp. controversy. Economic aspects of Government supported tree planting, price subsidies and associated criticism, as well as the formation of grower cooperatives are analysed.
- Nahal, I. Eucalyptus et conditions écologiques en région méditerranéenne. Forêt Méditerranéenne 1989. 11 (1): 3-8 (11 ref.)** A list of *Eucalyptus* spp., based on observations carried out in Syria, Lebanon, Tunisia, Algeria and Morocco is presented. These species have adapted to different climatic Mediterranean areas with high pH, and high salinity levels, or have shown good tolerance to *Phoracantha semipunctata*.
- Nair-JM, Deo-AD, Nair-TJC. 1986. Reclamation of grasslands at Kulamavu, Kerala. in: Eucalypts in India. Past, present and future. Proceedings of the national seminar held at Kerala Forest Research Institute, Peechi, Kerala, India January 30-31, 1984, 1986, Peechi. India; Kerala Forest Research Institute.** The results of treatments with micro and macronutrients in reducing tree mortality are reported.
- Nandal-DPS, Bisla-SS, Narwal-SS. 1992. Allelopathic influence of eucalypts and poplar aqueous leaf extracts on the germination and seedling growth of winter vegetables. Proceedings of First National Symposium on Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992, held at CCS Haryana Agricultural University, Hisar-125 004, India.** Inhibitory effects are reported of aqueous extracts of senescent leaves of *Eucalyptus tereticornis* and poplar (*Populus deltoides*) on the seed germination and seedling growth of 4 winter vegetables. Activity varied with extract concentration, and in some cases (especially with *E.tereticornis* extracts) stimulatory effects were obtained.
- Narwal-SS; Sarmah-MK. 1992. Suppression effect of Eucalyptus tereticornis on the field crops. Proceedings of First National Symposium on Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992, held at CCS Haryana Agricultural University, Hisar-125 004, India.** Another paper on effects of *Eucalyptus* spp. and other tree species on agricultural crops.
- Nath,-S; Das,-PK; Gangopadhyay,-SK; Balvinder-Singh; Banerjee,-SK; Singh,-B. 1990. Suitability of different forest species for social forestry programme under different soil conditions. Part II - lateritic soil. Indian-Forester. 116: 6, 464-473; 6 ref.** The best performances were by *Acacia auriculiformis*, *Delonix regia* and *Eucalyptus* sp., while *Albizia* sp., *Cassia siamea*, *Dalbergia sissoo*, *Gmelina arborea* and *Peltophorum ferrugineum* showed good to moderate performance. It is suggested that these 8 species are promising fuelwood/fodder species for the

- region. The remaining species (*Acacia nilotica*, *Casuarina equisetifolia*, *Parkinsonia aculeata* and *Pongamia pinnata*) did not perform well.
- Nath,-S; Das,-PK; Gangopadhyay,-SK; Banerjee,-SK; Balvinder-Singh; Singh,-B. 1991.** *Suitability of different forest species for social forestry programme under different soil conditions. Part III - coastal soil. Indian-Forester. 117: 8, 625-631; 7 ref.* Overall best performances were given by *Acacia auriculiformis*, *Acacia nilotica*, *Casuarina equisetifolia*, *Eucalyptus* sp. and *Albizia* sp., and the poorest performances by *Azadirachta indica*, *Dalbergia sissoo*, *Delonix regia* and *Peltophorum ferrugineum*.
- Navarro, C. 1985.** *Producción de biomasa de Eucalyptus deglupta en una plantación de ocho años en Turrialba, Costa Rica. Silvoenergía, 8: 4pp. (FA, 1898, 050-05702).* Average annual increases were: 3,5 m in height; (a 1,30 m) 2,6 cm in diameter; and 31,5 m<sup>3</sup>/Ha in volume.
- Negi-JDS, Sharma-SC, Bisht-APS. 1988.** *Forest floor and soil nutrient inventories in old growth eucalypts plantations. Indian Forester, August 1998.* Studies on forest floor and soil nutrients were carried out in plantations hosting 5 *Eucalyptus* spp. in Nilgiris. The studies reveal that the forest floor behaviour is similar to that of tropical forest while the soil nutrient status was akin to the temperate forest. Thus the soil nutrient status is well developed under those *Eucalyptus* spp. plantations.
- Neves-AR, Ladeira-HP, Paula-Neto, F-De Alvarenga-SC-De. 1981.** *Socioeconomic evaluation of a reforestation programme in the region of Carbonita, Vale do Jequitinhonha, Minas Gerais. Revista-Arvore, 5:1.* A prediction was made of the effect of planting 6000 ha/yr of *Eucalyptus* spp. on a 21-year rotation. Economic and social benefits are discussed.
- Neybergh-AG. 1953.** *Some plants grown for their essential oils in the east of the Belgian Congo., Bull. agric. Congo belge 14 91* Gives analytical data on the essential oils of a number of species, including *Eucalyptus smithii*, *E. citriodora*, *E. dives*, *E. macarthurii*, *E. maidenii*, *E. globulus*, *Leptospermum citratum*, *Melaleuca leucadendron*, and *Cupressus sempervirens*.
- Ngulube-MR. 1990.** *Evaluation of multi-purpose trees for social forestry in Malawi. International-Tree-Crops-Journal., 6:2-3* Successful trials with some exotics and indigenous species have shown that their performance compared well with that of *Eucalyptus camaldulensis*. This species has been until now one of the most commonly used species in social-forestry programmes.
- Njoukam, R. Sylviculture d'Eucalyptus saligna en savane d'altitude (Province de l'Ouest et du Nord-Ouest du Cameroun). INRA Station de Kumba, Cameroun 1989. 47 p. et annexes (9 ref.)** This study briefly introduces the natural environment and *Eucalyptus saligna*, the most widespread species in Cameroon, along with *Eucalyptus grandis*. Successively, several silvicultural techniques deemed appropriate are presented: nurseries, land preparation, establishment, maintenance and management techniques of afforested areas and finally, an economic appraisal including production costs and benefits expected.

- Nkaonja,-RSW (1985). *Fuelwood and polewood research project for the rural population of Malawi. Forestry-Research-Record, Forestry Research Institute, Malawi. No.62***  
The results of species trials are reported. The best adapted and more productive species were *Eucalyptus camaldulensis* and *E. tereticornis*, followed by *Cassia siamea*, *Melia azedarach*, *Gmelina arborea*, *Albizia lebbek* and *Acacia albida*. *Azadirachta indica* and *Leucaena leucocephala* grew well on sites with pH 6.5 or more, and *E. maidenii*, *E. pellita* and *E. grandis* grew best on hydromorphic soils.
- Nongamani,A. *Dynamique de la végétation et des sols sous forêts d'Eucalyptus et de Pins. Cas de Loudima. Mémoire pour l'obtention du diplôme d'Ingénieur de développement Rural .IDR Brazzaville 1988 98 p.*** Studies were carried out on plantations located in the research station of Loudima. Plots planted to *Eucalyptus* spp. were compared to *Pinus* spp. plots and to natural original vegetation (savanna with *Hyparrhenia* dominance). The study particularly focuses on the evolution of the following elements in soils: total nitrogen, C/N relation, organic matter level, phosphorus, pH.
- Nuberg,-IK; Evans,-DG. 1993. *Alley cropping and analogue forests for soil conservation in the dry uplands of Sri Lanka. Agroforestry-Systems. 24: 3, 247-269; 37 ref.*** The paper presents an assessment of 7 desktop farm models with different combinations of 5 production systems (including one with *Eucalyptus* spp.) established in alleys between hedgerows of *Gliricidia sepium*. Characteristics used for the evaluation included: profitability, time taken for profit to be realised, labour requirements, seasonal distribution of labour, environmental and economic stability, biophysical sustainability, the contribution of the system to the domestic needs of the farm family, adoptability of the system, and successful management of the hedgerows. The extension of an analogue forest concept in other tropical uplands is discussed.
- Nyasaland. 1946. *Annual report of the Forestry Department for the year ended 31st December, 1945. 1946, Govt. Printer, Zomba.*** In Nyasaland, it was found that the production performed from indigenous species was very poor compared to that of *Eucalyptus* spp. for firewood. However, in the case of eucalypts there was heavy variation in yield between good class areas and poorer sites.
- O'Connell-AM. 1986. *Effect of legume under storey on decomposition and nutrient content of eucalypt forest litter. Plant-and-soil., 92:2*** In Jarrah (*Eucalyptus marginata*) forest of south-western Australia dense germination and regeneration of the native legume *Acacia pulchella* can occur following moderate to high intensity fires. The effect of this legume understorey on rate of decomposition and change in nutrient content of *E.marginata* litter was investigated. The results indicate that introduction of *A. pulchella* can be a useful practice in countries where eucalypts is introduced as an exotic species.
- Oliveira-AI-de, Couto-L. 1986. *Simulation and economic comparison of regeneration, density increase and interplanting in eucalypt stands, using the MANFLOR system - a case study. IPEF Instituto de Pesquisas e Estudos Florestais. No.34.*** A computer package is described and 5 management options are compared using data from private forestry companies in Brazil.

**Onyewotu-LOZ. 1985. Establishment considerations for optimum spacing of shelterbelts in the Sahel and Sudan zones of Nigeria. Proceedings, 15th Annual Conference of the Forestry Association of Nigeria, Yola, 25-29 November, 1985.** The sheltering efficiency of 2 shelterbelts of different species composition was compared as a basis for determining the extent of effective erosion control. The limit of effective shelter extended to a distance of 13 times mean height for *Azadirachta indica* and 16 times mean height for *E.camaldulensis*. An optimum spacing between shelterbelts of 200 m of *Eucalyptus camaldulensis* and 140 m for *A. indica* is recommended where these species form the main crop.

**Osorio, J;Pereira J S. (Effets of drougth on productivity, efficiency and discrimination of  $C^{13}$  in *Eucalyptus globulus* clons). Effetti della siccità sulla produttività, sull'efficienza e sulla discriminazione del  $C^{13}$  nei cloni di *Eucalyptus globulus*. Agricoltura e Ricerca. 1993, 15. 146, 13-14. (In Italian).**

**Padhy-B, Khan-PA, Acharya-B, Baxipatra-NP. 1992. Allelopathic effects of *Eucalyptus* leaves on seed germination and seedling growth of finger millet. Proceedings of First National Symposium on Allelopathy in agroecosystems (agriculture & forestry), February 12-14, 1992, held at CCS Haryana Agricultural University, India.** Leachates of senescing and freshly fallen leaves of *Eucalyptus globulus* were tested in the laboratory for their allelopathic effects on an improved cultivar of finger millet (ragi, Eleusine coracana cv. AKP-2) used by farmers in South Orissa and Andhra Pradesh. Both germination and seedling shoot and root growth were inhibited, with the effects increasing with leachate concentration.

**Palmer, J.R. JARI: leçons pour les responsables de mise en valeur des terres sous les tropiques Bois et forêts des tropiques, 1988. (No. 212): 3-15 (2 ref.)** This article presents the background history of plantation in the Jari company in eastern Amazonia in Brazil. Several hundreds of ha of natural forest were to be felled and replaced by artificial plantations in order to feed pulp to a paper mill. The author presents the errors that may occur when plantation species are chosen (*Gmelina*, then *Pinus* and *Eucalyptus* spp.), as well as during clearing and soil preparation. No study has ever been carried out to assess the ecological impact of this enterprise.

**Pande,-PK; Sharma,-SC. 1993. Biochemical cycling and nutrient conservation strategy in some plantations. Indian-Forester. 1993, 119: 4, 299-305; 16 ref.** Monthly measurements of litter fall were made in permanent litter plots set up in plantations of sal (*Shorea robusta*), teak (*Tectona grandis*), *Pinus* and *Eucalyptus* spp. Data are tabulated on the monthly and annual conservation (in litter) of the major nutrients (N, P, K, Ca, Mg) present, and on annual nutrient return. In general, teak and sal conserved more nutrients than pine and eucalypts, and conservation of N and P was greater than that of other nutrients.

**Pande-MC, Tandon-VN, Rawat-HS. 1987. Organic matter production and distribution of nutrients in *Eucalyptus* hybrid plantation ecosystems in Karnataka. Indian Forester - November 1987.** Biomass ranges from 19 t/ha in Kolar Forest Division and 5 t/ha to 16 t/ha in Madahalli Afforestation Center. A substantial amount of nutrients is drawn off when the whole tree is harvested. Leaving foliage, which contains 30 to 40 percent of micro-nutrients, on the site, would reduce nutrient export. Debarking at site is also suggested to check the drain of Ca.

- Parker-T. 1986. Coppice fuelwood. New-Zealand-Tree-Grower, 7:3.** Recommendations are given for the establishment of plants for coppicing. Establishment and tending costs for the first and second rotations and productivity and profits are evaluated. *Eucalyptus saligna*, *E.botryoides*, *E.nitens* and *E.camaldulensis* are recommended as suitable fuelwood species for New Zealand.
- Parsons,-WA. 1993. The genus *Euca* and its value to flavours. Food-Technology-International,-Europe. 163, 165, 167; 4 ref.** The economic importance of *Eucalyptus* spp. in South Africa is due to their role as a major timber resource and to their commercial exploitation for wood distillates, tannins, essential oils, nectar, pollen and sundry minor products. Details are given on the oil composition of the most used species, emphasizing their use in flavouring.
- Parvez-Ahmed. 1989. Eucalyptus in agroforestry; its effects on agricultural production and economics. Agroforestry Systems, 8:1.** The economics of *Eucalyptus* spp. (mainly *E. tereticornis*) in agroforestry and its effects on agricultural crops in Haryana were studied using observations made during harvests in agricultural fields and information supplied by progressive farmers. Three rotations of *Eucalyptus* spp. (8,9 and 10 years) in agroforestry were selected for comparative study of its return and relative loss to the crops. The optimum rotation (i.e. the one giving the maximum internal rate of return with minimum loss to agricultural crops) was 8 years.
- Patanapongsa-N. 1990. Private forestry development in Thailand; a survey of tree growers in the north east region. Commonwealth Forestry Review. 69:1.** Natural forests in N E Thailand have come down from 55.4 percent in 1962 to 14.8 percent in 1982. Yet farmers cannot be persuaded to plant *Eucalyptus* spp.
- Patel-GA. 1984. Gujarat experience of Eucalyptus. Indian-Forester, 1984, 110:6.** A review of the Social Forestry Programme undertaken by the Gujarat Forest Department in 'non-traditional' areas. Eighty percent of seedlings planted are *Eucalyptus tereticornis*. More than 263 000 farmers have raised trees, mostly on field boundaries, fallow land, and areas unsuitable for agricultural crops. Socio-economic information about the farmers and their experience of *Eucalyptus* spp. plantations are discussed.
- Patel-VJ. 1988. A new strategy for increased biomass through high density energy plantation. Advances-in-Forestry Research-in-India. , 2.** Describes the high density tree planting at the Jivrajbhai Patel Agroforestry Centre, in a semi-arid area of Gujarat. The density of planting is as high as 25,000 per ha. The plantation is provided with fertilizer and irrigation. The system has led to problems with the saturation of the market for small sized material.
- Pearman-RW. 1953. The eucalypts as tanning materials., Colon. Plant Anim. Prod. 3(3).** Notes on the eucalypts utilised as tanstuffs in various parts of the world (from both wild stands and plantations, bark and wood), and on the tanning properties and chemistry of eucalypts extracts.
- Pélissié, D. La prime au boisement des terres agricoles : quel enjeux pour l'avenir ? Revue Forestière Française 1992 (No 6)** Decree No. 91-1227 , dated 6th June, 1991 accords an annual incentive to farmers that carry out total or partial reforestation in their land (1000 Francs/ha are provided during 5 years, the short rotation period for

exploitation). This article draws a balance of measures implemented and analyses their future evolution, specially in the light of European community policies. Subsidy demands are few, because the amount provided is low compared to the gross income generated by exploitation per hectare. Recommendation is made for an in depth study on land tenure aspects and forestry training of farmers.

**Peltier, R. *L'arbre dans les terroirs villageois. Savanes d'Afrique, terres fertiles? Comptendu de la conférence tenue à Montpellier, 10-14 Décembre 1990. CIRAD-CTFT; Ministère de la Coopération et du Développement, Paris, France. 1991. 507-530 (9ref.)***

A description of different types of sylvo-agriculture-pastoralism associations. This study appraises the current state of research and how it can be improved. Several issues are dealt with: fallow, irrigated fruit tree cultivation, maintenance of young afforestation areas for wood production through intercrop associations, then pastures, forest-fallow enriched with tree plantations, shelterbelts, live wind barriers, cultivation in corridors, row planting, forested parks, anti-erosion belts.

**Peltier, R.; Eyog-Matig, O. *Les essais d'agroforesterie au Nord-Cameroun. Bois et Forêts des Tropiques 1988, publ. 1990. (No. 217): 3-31 (18 col. pl.)***

This article deals with agroforestry trials carried out by CTFT in Maroua (Cameroon). Two types of experiments were undertaken. Both of them were based on successive cultivation/afforestation practices in the same area (the "Laf" method: intercrop cultivation in young forested areas with *Eucalyptus camaldulensis*), either through a permanent association tree/crops (shelterbelts, live wind barriers, cultivation in corridors, row planting, or associations like those in *Faidherbia* park.

**Peltier, R.; Eyog-Matig, O. *Un essai sylvo-pastoral au Nord-Cameroun. Mise en place d'un dispositif d'étude de la régénération et de la gestion d'une savane arborée dégradée en zone soudano-sahélienne à Laf-Badjava, premiers résultats. Bois et Forêts des Tropiques 1989. (No. 217): 3-23***

This paper illustrates a trial experiment carried out in the Maroua region, aimed at measuring the effect of three different parameters (pastures, fires, felling) on wood and pasture production in a forested savanna. Conclusions recommend to undertake a social-economic impact assessment, in order to find out what are the effects of such operations in the rural environment.

**Peltier, R.; Ballé Pity. *De la culture itinérante sur brûlis au jardin agroforestier en passant par les jachères enrichies. Bois et Forêts des Tropiques 1993, (No. 235): 49-57***

This article shows different management approaches for trees and agrosystems in humid equatorial areas, as well as their intensification in the context of growing population pressure. The practices go from archaic exploitation of spontaneous woody tree species to regenerate impoverished soils by slash and burn practices, to sustainable agroforestry gardens, characterized by diversification and continuous mutation.

**Peltier, R.; Triboulet, C.; Njiti, C.F.; Armand, J.M. *Les fronts pionniers soudaniens. Evaluation des défrichements par télédétection. Contribution des projets de développement et de la recherche forestière à un aménagement durable. Bois et Forêts des Tropiques 1993. (No. 236): 5-24***

This article deals with problems associated to population migration in Central and West Africa involving large extensions of slash and burn cultivation in forested

savannas. Two projects located in Cameroon, close to Garoua, are described: North-east Bénoué project, and the South-west Bénoué project. The article draws conclusions on failures and successes of these projects and considers that imposed schemes were inefficient. Conclusions stress that farmer participation is necessary as well as adaptation of technical solutions to local social and economic conditions.

**Peltier-R, Eyog-Matig-O. 1988. Agroforestry trials in northern Cameroon. Bois-et-Forets-des-Tropiques. 1988, Publ. 1990. No. 217.** In traditional farming systems in Cameroon, trees were interspersed with crops. Based on this system, a method was developed for growing crops with *Eucalyptus camaldulensis*, Coppice used for fuelwood and building poles. Cropping rotation suitable is recommended.

**Penfold-AR, Morrison-FR. 1944. Commercial Eucalyptus oils. , Bull. technol. Mus. Sydney. No.2.** Species of *Eucalyptus* spp. yielding oil are described.

**Penfold-AR, Willis-JL. 1961. The eucalypts: Botany, cultivation, chemistry, and utilization. Leonard Hills (Books) Limited, London; Interscience Publishers, Inc., New York.** Includes chapters on: *Eucalyptus* spp. as exotics; trees for shelter, shade, and ornament; pests and parasites (of wood as well as living trees); timber; essential oils; honey flora and descriptions of species and varieties. (cf. F.A. 17 No. 3683).

**Pereira,-JS; Chaves,-MM; Fonseca,-F; Araujo,-MC; Torres,-F. 1992. Photosynthetic capacity of leaves of *Eucalyptus globulus* (Labill.) growing in the field with different nutrient and water supplies. Tree-Physiology. 11: 4, 381-389; 28 ref.** The effects of water and nutrient availability on photosynthetic capacity of juvenile and adult leaves of *E. globulus* seedlings were evaluated by measuring oxygen evolution at light and CO<sub>2</sub> saturation.

**Pereira-AR, Brandi-RM. 1982. Minimizing stand establishment costs with high plant density. Revista-Arvore, 6:2, 166-169.** *Eucalyptus grandis* stands established in Minas Gerais by planting containers with 2 or 3 seedlings per container cost less than those established with one seedling (at the same container spacing), which needed replanting 3 years after initial planting.

**Pereira-AR, Vale-AB (1984). Intermediate thinnings in fast growing stands for charcoal production. IPEF Instituto de Pesquisas e Estudos Florestais. No.26.** A 3-year-old-*Eucalyptus grandis* stand in Minas Gerais was thinned by leaving only the most vigorous trees per hold. Thinnings were used to make charcoal that produced an intermediate income, without affecting plantation development.

**Perera-WRH. 1961. An economic study of the up-country forest plantations of Ceylon., Ceylon For. (n.s) 5 (1/2), (82-100)** The costs and financial yield of these plantations (largely *Eucalyptus* spp.) are compared with those of tea plantations in the same region. Though tea is the more profitable crop with a financial yield of 10.1 percent for a 7-year period against 10.1 percent for 40 years for forest plantations, these are considered to be very attractive when account is taken of differences in silvicultural and agricultural methods.

**Pérez Moreira, R. 1992. Ecoloxía Forestal e ordenación do bosque. Edicions do Castro. 262 pp. La Coruña. España.** This paper deals with the ecological impact of *Eucalyptus* spp. After a wide bibliographic review on the different aspects concerning the

- theme, it finds out that water and nutrient consumption levels are similar to those of the other forest species. It points out there is lower biodiversity under *Eucalyptus* spp. When planting *Eucalyptus* spp., other factors, besides those related with production, will have to be taken into account. Such factors depend on aspects related to landscape, cultural tradition etc. The author draws an integrated vision of nature, where all the elements must create a harmonious complex.
- Pérez Vilariño, J. 1993. *Organización y cultura forestales. Congreso Forestal Español. Lourizán, IV: 487-499.*** The growing importance and interdependence of the triple function -economic, recreational and environmental- of the forest and deriving activities, have made of forests one of the most surveyed environments from the social point of view, because of its important political role. Developing new models to organize this sector is necessary, but they must take into account all its functions and promote a new forest culture that works as integrating factor of the different trends.
- Perez-Vilarino-J. 1989. *Economic forest policy and organizational strategy. Agricultura-y-Sociedad. No.51.*** A strategy is proposed for developing a forest policy for Europe which takes account of both the economic basis and also the symbolic component of the forest sector in the European Community. The discussion is illustrated with data on the *Eucalyptus* spp. plantations of Galicia (NW Spain).
- Perttu Kurth. 1991. *Short rotation forestry; an alternative energy resource. Moderating of energy forestry growth, water relations and economics. Pudo Wageningen, 1989.*** Fossil fuels create environmental problems. Biomass is therefore an attractive alternative to such fuels. The author feels that energy forestry in Sweden can compete with coal peat and Conventional Forest Wood.
- Petit, H.; Laurier, J.P. *Récolte mécanisée des taillis à courte rotation de peuplier et d'Eucalyptus. Informations-Forêts 1989. (No. 4): 203-213***  
The author presents the results obtained from recent experiments on different manual and mechanical processes. Several economic data (costs and time required for the collection tasks).
- Phairot Suvanakorn. 1990. *A Report on the visit to People's Republic of China, International Academic eucalypts Symposium. Royal Forest Department, Thailand.*** In China *Eucalyptus* spp. planting is done on large-scale, both under Government programme and under Farm forestry. It is also raised around farm fields for improving the environment. It serves the social needs of firewood, furniture wood, fibre, oil in perfumery/pharmaceuticals, honey and tanning. People have no bias against the species. Setting up of paper mills, fibre plant, board units are under consideration. China could become a major supplier of wood chips to Japan, Korea and Taiwan. Recognising its importance, China has set up a *Eucalyptus* Research Center.
- Piare Lal. 1992. *Recent advances in mass clonal multiplication of Forest Trees for plantation programmes. CISARVA, BOGOR Indonesia*** The need for genetic improvement and use of clonal planting is stressed. Vegetation propagation methods are discussed.

**Piare Lal. 1993. *The Technology for improving productivity of plantations. ITC Bhadrachalam Paper Boards, Secunderabad.*** Strategies for supporting tree planting in the private sector are brought up.

**Piare-Lal; Kulkarni,-HD; Rao,-SN; Lal,-P. 1993. *Improving land productivity and returns from agroforestry plantations. Indian-Forester. 119: 6, 431-440; 10 ref.*** This paper describes ITC Bhadrachalam Paperboards Ltd. activities under the farm forestry project in Andhra Pradesh. The project envisages planting 1500 ha of marginal agricultural land (owned by individual farmers) with fast growing tree species (such as *Eucalyptus* and *Casuarina* spp.) in 8 districts. Trees are planted along field bunds, boundaries and irrigation channels in rows, and as blocks combined with intercrops. Services provided by the company to farmers include the supply of high-quality seedlings (from improved stock), extension services, a buy-back guarantee for pulpwood, assistance in loan procurement, and research and development support.

**Pino Vicente, D. 1992. *A forestación na Ordenación Territorial Galega. Cadernos da Area de Ciencias Biolóxicas. Sem. de Estudos Galegos, 4: 49-70. Santiago de Compostela. España.*** The main objective spelled out in this paper is to associate income generating exploitation of forests with global territorial management by consensus. The forest crisis is due to change of its traditional roles and to the existing confusion on which roles it should play today. The absence of territorial management guidelines lead to a "de facto" management where economic interests prevail. Fast-growing species (*Eucalyptus* and *Pinus* spp.) lead to an ecologic disaster, and to the destruction of the social and economic structure.

**Pohjonen-V and Pukkala-T. 1990. *Eucalyptus globulus in Ethiopian Forestry. Forest-Ecology and Management, 36-1.*** An assessment of past and present use of *Eucalyptus globulus* in the Central highlands of Ethiopia. The success of the 100 000 ha. planted so far is based on adaptability of *E.globulus* to the highland climate and soil conditions, its coppicing capacity and non-palatability for livestock. It is suitable for fuel and small construction poles. Additional planting of *Eucalyptus globulus* is justified until the current fuelwood shortage is eliminated.

**Pohjonen-V, Pukkala-T. 1988. *Profitability of establishing Eucalyptus globulus plantations in the Central Highlands of Ethiopia. Silva-Fennica. 22:4.*** An economic analysis of *Eucalyptus globulus* plantations, based on computer simulations of a seedling rotation and 3 successive coppice rotations is presented. The rotation that maximised the land expectation value is 12 to 20 years for seedling rotation and 8 to 16 years for coppice rotations. The annual mean wood production is more than 40 m<sup>3</sup>/ha in the best site class and about 10 m<sup>3</sup>/ha in the poorest class. Thinning resulted in a slight increase in wood production and land expectation value in areas suitable for *Eucalyptus globulus* growth. The land expectation value is considerably higher in forestry than in agriculture, except in very poor areas, or with a very high rate of interest.

**Polk Peggy. *There is no such thing as a fascist tree. Ceres 134.*** The article illustrates the advantages of tree planting, presents the scope for increased production with *Eucalyptus* spp. and also explains the causes for misconceptions about eucalypts.

**Pombo Liria, M. 1992. *El comercio de la madera en Galicia. La perspectiva empresarial. Economía Política Forestal*, 229-233. Xunta de Galicia. España.** This paper deems fast-growing species (*Pinus* and *Eucalyptus* spp.) exploitation have not been appropriately exploited, because ha/year yields could increase. Forest waste material is being used as fuel in Galicia, Spain, thus allowing to save more than 100 000 tons of fuel per year. Actions that could increase productivity and exploitation are highlighted.

**Pook-EW. 1985. *Canopy dynamics of Eucalyptus maculata Hook III Effects of drought. Australian-Journal-of Botany*, 33:1.** Responses of *Eucalyptus maculata* forest on the South coast of New South Wales, Australia in 1980 and 1982, when annual rainfall was respectively the second lowest and the lowest in a century, are described. The behaviour of *Eucalyptus* spp. to maintain an adequate internal water status even during the worst droughts is explained.

**Prabhu-VV, Thyagarajan-KS. 1977. *Utilization of Eucalyptus hybrid (Mysore gum) bark for production of oxalic acid. Indian-Forester*. 103:7,** In a small-scale laboratory trial, *Eucalyptus* hybrid (Mysore hybrid) bark from sites in Karnataka and Tamil Nadu gave yields of oxalic acid of 45-50 percent of the oven-dry weight of bark. It is recommended that bark from *Eucalyptus* spp. (widely planted in Karnataka for pulpwood) should be used for oxalic acid production in place of *Terminalia* spp. bark, which is a rich source of tannins.

**Prado Donoso, J.A.; Alarcón Araya, C. 1991. *Funciones de biomasa de Eucalyptus globulus ssp. globulus en la región costera central. Ciencia e Inv. Forest.*, 5 (1): 59-70. Santiago. Chile.** The authors develop a series of functions that allow estimating total weight of stem, according to diameter, and bark weight, thus producing good estimates that cannot be extrapolated to other regions.

**Prajapathi R.C, Srinivasa N. 1991. *Eucalyptus farming in Kolar District of Karnataka. Myforest - March 1991.*** *Eucalyptus* spp. planting has been undertaken in this District since 1951. It has given opportunity for putting subsistence agricultural land to more economic production.

**Prasad,-KG; Rawat,-VRS. 1992. *Fertilizer use efficiency of different tree species for higher biomass production. Indian-Forester*. 1992, 118: 4, 265-270; 8 ref.** Greenhouse pot experiments were carried out with 10 multipurpose species (*Eucalyptus camaldulensis*, *E. citriodora* and *Acacia nilotica*, *Acacia catechu*, *E. grandis*, *E. tereticornis* 'FRI-5', *Prosopis juliflora*, *Albizia lebbeck*, *Leucaena leucocephala* (var. K8) and *E. tereticornis* 'FRI-4') planted in loamy soil and treated by application of NPK fertilizer. Tree responses and variations in specific (i.e. N, P or K) fertilizer use efficiency in the presence of other fertilizers are discussed.

**Prasad-KG, Gupta-GN, Singh-J, Mohan-S. 1985. *Effect of fertilizer application on biomass production from two years old Eucalyptus grandis plantation. Journal-of-Tropical-Forestry*. 1:4, 302-308.** An estimation of economic returns indicated that 60 kg/ha N with 30 kg/ha P<sub>205</sub> produced a return of 2.3 kg/ha per rupee invested, compared with 0.44 kg/ha on untreated controlled plots. Investment on fertilizer was profitable.

**Prasad-KG, Kumar-D, Nair-TJC, Mohan-S, Nair-JM, Deo-Ad. 1984. Fertilization in *Eucalyptus grandis* on severely truncated soil. I: Growth studies. *Indian-Forester* 1984. 110:2.** A randomised-block experiment with urea, super phosphate and muriate of potash on an eroded soil in Kerala. Results for the different combinations are indicated.

**Prasad-U. 1984. *Eucalyptus* trials for rural firewood plantations in Bihar. *Indian-Forester* 110:5, 510-517; 5 ref.** *Eucalyptus camaldulensis* provenance trials were made in 11 districts of Bihar chronically affected by fuelwood shortages. Of the 17 provenances tried, Katharine gave the highest volume production, with zero mortality, followed in volume production by Bullock Creek, with mortality of 2.5 percent. Coppicing power of stumps is discussed, on the basis of a trial with *E. tereticornis*.

**Prem Boonvuang. Marketing of *Eucalyptus* wood in Thailand. IFAP Documentation Center, RAPA.** *Eucalyptus* spp. in Thailand have various economic uses: in industries as pulp and paper, fibre board, particle board, wood cement board, parquet, plywood and veneer. Other uses are as fences, fence poles, housing posts or electric poles, housing walls, housing floors, furniture, agricultural tools, beekeeping. *Eucalyptus* spp. (singly or with other species from private plantations) are expected to ease the crisis faced by tobacco curing industry, porcelain and ceramic industries and lime industry due to fall in supplies from natural forests.

**Price,-C; Trivedi,-SN. 1994. Plantation appraisal under the threat of illicit felling. in *The economics of project appraisal and the environment* [edited by Weiss, J.]. 67-79; 19 ref. Aldershot, UK; Edward Elgar Publishing Ltd.** The problem of illicit tree removal during the course of the planned rotation in tropical plantation projects is examined in relation to 3 factors that affect the seriousness of losses: the way in which losses are physically concentrated in the plantation and subsequent pattern of plantation growth; the boundary within which project costs and benefits are evaluated; and the criteria used to judge an investment whose financial, economic and social value is threatened by the attrition. The effect of these factors is examined for *Eucalyptus* plantations in Bihar State, India.

**Priest-DT, Malan-FS, Knuffel-WE. 1982. Degrade in *Eucalyptus grandis* sawn timber dried in three different ways. Special Report National Timber Research Institute; South-Africa.** Three equally representative samples of 24-year-old *E. grandis* boards, 25 mm thick, were dried from green to 10 percent m.c by (a) complete kiln drying; (b) air and kiln drying; and (c) complete air drying method. (a) was cheapest and produced the least degrade. The preferred method was (b) which produced results similar to (c) with the advantage that final m.c. was more uniform and accurate.

**Pudjhartana-A .1986. Effects of some tree species on water conservation at Ciwidey, South Bandung. Bulletin Penelitian Hutan Pusat Penelitian dan Encaptions. Bogor, Indonesia.** Studies on the water cycle of stands of *Pinus merkusii*, *Schima wallichii* and *Eucalyptus urophylla* were carried out. Water use efficiency was higher in *S.wallichii*, followed by *E.urophylla*, *P. merkusii*. Runoff under the forest stands was less than that on bare soil.

**Pukkala-T, Pohjonen-V. 1990. Yield models for *Eucalyptus globulus* fuelwood plantations in Ethiopia. *Biomass*.21:2.** Data are presented on the growth of various species useful as fuelwood. 7 species of eucalypts have been found to be useful.

**Puntasen,-A; Siriprachai,-S; Punyasavatsut,-C. 1992. Political economy of *Eucalyptus*: business, bureaucracy and the Thai government. *Journal of Contemporary Asia*. 22: 2, 187-206; 37 ref.** This paper examines the introduction of *Eucalyptus* spp. to Thailand by the Royal Forest Department. Aspects covered include *Eucalyptus* spp. as a source of raw material for the pulp and paper industries, benefits from *Eucalyptus* spp. planting (improved land ownership status for planters), business and political corrections, ecological and environmental impacts of *Eucalyptus* spp. planting, and protests against their use.

**Puri-S 1992. The allelopathic effects of *Eucalyptus tereticornis* in an agroforestry system. in: *Proceedings of First National Symposium. Allelopathy in agroecosystem (agriculture & forestry), February 12-14, 1992, held at CCS Haryana Agricultural University, Hisar-125 004, India.*** In a field experiment in Haryana seeds of *Phaseolus vulgaris* sown in an area with *E.tereticornis* planted at 3 x 3 m, germinated but did not survive. Subsequent laboratory investigations showed that 25-100 percent leaf and bark leachates of *E. tereticornis* were toxic to the germination and growth of *P.vulgaris* seedlings (in the order brown leaves, green leaves, decayed leaves, bark, with decayed leaves actually stimulating growth.)

**Quezel, P.; Barbero, M.; Loisel, R. Les reboisements en région méditerranéenne. Incidences biologiques et économiques. *Forêt Méditerranéenne* 1990. 12 (2): 103-114 (37 ref.)**This article provides a balance of reforestation activities in the Mediterranean regions of France and Morocco. *Eucalyptus* spp. cover more than one million ha of which 750 000 are in Southern Europe (essentially in Spain: 400 000 ha and Portugal : 300 000 ha) and 280 000 ha are in Morocco. A few species are used, mainly: *Eucalyptus camaldulensis*, *E. globulus* and *E. gomphocephala*. The article deals with the problems linked to forest productivity, the choice of tree species for reforestation purposes, environmental constraints, parasite attacks, and litter decomposition. Problems linked to the use of *Eucalyptus* and *Acacia* spp. are given particular emphasis. The article concludes that Mediterranean forest species with good growing rate, adapted to this environment and with fast-degrading litter, must be used.

**Quinteros Doldan, M.E. 1989. Crecimiento de especies y procedencias del género *Eucalyptus* en suelo de pradera natural. *Revista Forestal*, V (2): 42-50. Asunción. Paraguay.** This study partially analyses an experiment carried out with six *Eucalyptus* spp. (*E. robusta*, *E.citriodora*, *E. tereticornis*, *E. grandis*, *E. saligna*), in acid soils, in natural hydromorphic grasslands poor in nutrients, except Potassium. At 7 years-old, the species that better adapted to local conditions were: *E. robusta*, *E. tereticornis* (provenance from Rhodesia del Sur), *E. saligna*, *E. grandis* (provenance from Río Claro, Brazil) and *E. urophylla*. Growth rates may improve with fertilization.

**Rabetaliana, H. Le paysan malgache est-il un paysan de l'arbre ? Quelques exemples de systèmes agroforestiers de la Côte est et des hauts-Plateaux de Madagascar. *Moémoire de DEA Sciences et techniques, Montpellier* 1989. 40p.** This study is based on 4 examples: Beparasy, Moramanga, Andapanangoy and Marosoroka (Sainte-Marie island), Imerina (Hauts-Plateaux). It shows 3 agroforestry

projects currently underway: Operation Savoka (development of an aquatic rice variety, fish farming, terrace building), the Beforona microproject (study on agroforestry models), and the village reforestation support project (reforestation with *Eucalyptus Pinus*, *Cupressus* sop and fruit trees).

**Rabinovich, H.T.S.; Bueno, J. 1986. *Obtención de pulpa soluble de Eucalyptus globulus Labill. mediante el proceso al sulfato con prehidrólisis. Revista Forestal del Perú, 1 3 (2): 27-35. (IF Forest Products Abstracts, 1991, 014- 00322).*** Paste from 10 year old *Eucalyptus* sop is used for Rayon textile production. Provenances are from Peru.

**Raimondi,-S; Messineo,-E. 1991. (Adaptability of *Eucalyptus camaldulensis* to three soil types in a hot, arid environment in Sicily.) *Adattabilità di Eucalyptus camaldulensis a tre tipi di suolo in un ambiente caldo e secco in Sicilia. Cellulosa-e-Carta. 42: 6, 8-15; 18 ref.*** Volume increment (total and merchantable), stem and total height, and diameter at breast height were evaluated for 20- to 23-year-old *E. camaldulensis* in plantations on three soils - a Vertic Xerofluent (alluvial), a Gypsic/Typic Xerorthent (loamy sand), and a Calcixerollic Xerochrept (calcareous, silty) in central Sicily. Soil profiles are described. Annual productivity on the 3 soils was 5.46 m<sup>3</sup>/ha, 1.96 m<sup>3</sup>/ha and 2.65 m<sup>3</sup>/ha, respectively. (In Italian).

**Raimondi,-S; Messineo,-E. 1991. (Adaptability of *Eucalyptus occidentalis* to several soil types in a hot, arid environment in Sicily.) *Adattabilità di Eucalyptus occidentalis a vari tipi di terreno in un ambiente caldo e secco in Sicilia. Cellulosa-e-Carta. 42: 6, 16-24; 18 ref.*** Volume increment (total and merchantable), and total height were measured for 19-year-old *E. occidentalis*, grown on four soils - a Gypsic Vertic Xerochrept (calcareous loam), Vertic Xerofluent (alluvial), Vertic Xerochrept (loam), and a Calcixerollic Xerochrept (calcareous silty) in central Sicily. Soil profiles are described. Annual productivity was 6.80 m<sup>3</sup>/ha, 6.23 m<sup>3</sup>/ha, 3.58 m<sup>3</sup>/ha and 3.50 m<sup>3</sup>/ha, respectively. (In Italian).

**Raintree,-JB. 1991. *Socioeconomic attributes of trees and tree planting. FAO-Community-Forestry-Note. 1991, No. 9, vi + 115 pp.; 19 pp. of ref. Rome, Italy; Food and Agriculture Organization (FAO).*** This study explores socio-economic relevant characteristics of trees and discusses how they are considered when attempting to do an unbiased choice of species for different users and circumstances. Chapter 3 explores "What we can learn from the great debate on eucalypts?".

**Rai-RSV, Srinivasan-VM .1990. *High Density short Rotation Studies E.tereticornis and C. equisetifolia. Sv. Intl. Tree Crop Jl. 6:2-3.*** One year stem volume at 40 000 stems/ha, was nearly 20 times as much as at the conventional density of 2 500 stems/ha. Percentage of bark was concomitantly high.

**Rajan-BKC. 1986. *Apiculture and farm forestry in semi-arid tracts of Karnataka. Myforest 1986, 22:1.*** A discussion on the need to grow trees on farms in the context of the reduced forest area in the region. The advantages of planting *Eucalyptus* spp., *Leucaena leucocephala* and *Moringa* are analysed in terms of benefits to apiculture.

**Rajan-BKC. 1987. *Versatile Eucalyptus*. xii + 245 pp. + 20 pl.; 8 pp. of ref. Bangalore, India; Diana Publications.** This book is an exhaustive review of published work on eucalypts with particular reference to *Eucalyptus* spp. hybrid in India. It covers all the issues including the eucalypt controversy.

**Raj-FH, Rajan-NCM, Rajagopal-KX, Mathur-HN 1986. *Some hydrological investigations on blue gum at Osamund (Nilgiris)*. in: *Eucalypts in India. Past, present and future. Proceedings of the National Seminar held at Kerala Forest Research Institute, Peechi, Kerala, India. January 30-31, 1984*. Groundwater regimes, infiltration, soil moisture and soil bulk density, surface runoff and pH were recorded in 1979-83 below plantations of *Eucalyptus globulus* and *Pinus patula* and below grass. No adverse effects of bluegum on the hydrological cycle were revealed. Results indicated that soil bulk density below gum, pine and natural shola was lower and water holding capacity higher than below grass. It is suggested that pine and gum could be planted on wasteland for flood control.**

**Rakoto Ramiarantsoa, H. *Occupation du sol et situation juridique des terres : une évolution en phase ? Les formations d'Eucalyptus comme éléments d'une analyse spatiale de cette relation*. FOFIPA/CIRAD 1992. 41 p. (6 ref.)**. This study was carried out in two locations (Sambaina and Ambohibary). The first part illustrates the increasing density in space occupation since 1949, the dynamics of *Eucalyptus* spp. establishment, the huge variety of patterns of *Eucalyptus* spp. forest. The author illustrates the main aspects of land tenure (ownership, distribution, movements) by analysing land-registry documents. The last part is dedicated to conclusions where ownership data are superposed onto *Eucalyptus* spp. population maps.

**Rakotomahandry, Th. *Evolution de l'occupation de l'espace dans le Vakiniadiana et l'Amorokay*. Mémoire de CAPEN en histoire-géographie. Université d'Antananarivo. 1989.**

This study aims at clearly illustrating how space occupation has evolved, by comparing satellite images corresponding to different periods and field surveys. In a densely populated area (Ankorona) *Eucalyptus* spp. forests cover from one third to half of the area; and occupy less than 10 percent in uninhabited areas. The author concludes that high population density does not necessarily mean that the forest extension decreases, as long as the forest is planted, owned and is intensively exploited in areas where hill agriculture is poor.

**Ramamonjisoa, B. S. *Approvisionnement d'Antananarivo en combustibles ligneux*. Thèse de doctorat-ingénieur. ESSA Antananarivo 1989. 337 p. et annexes.**

The first part of the thesis shows a study on household energy consumption. Wood represents 88 percent of energy consumed (in 1989, 115 000 tons of charcoal and 84 000 tons of wood). The second part describes the different distribution networks existing in the capital. According to the author, such distribution networks employs 10 000 people.

**Ramamonjisoa, B. S. *L'organisation d'une filière commerciale: le négoce du charbon de bois à Antananarivo*. ESSA, Université d'Antananarivo, Madagascar. Akon'ny Ala 1989. (No.4):1-19 (10 ref.)** Nine charcoal marketing lines were identified, the paper gives details on volume produced, prices and agents. About 80 percent of

charcoal comes from *Eucalyptus* spp. plantations, the majority of which are old and overexploited.

**Ramaswamy-MN, Srinath-KV. 1966. Oil of Eucalyptus-the problem and the possibilities in India. Indian Forester 92(3)** The paper suggests that the market for medicinal and perfumery oils is of sufficient importance to be considered when *Eucalyptus* spp. are being selected for afforestation in India.

**Ramdhawa-MS, Shetty-KAB, Mishra-PR, Gupta-RK, Chaugale-DS, Sharma-OP. 1977. Farm forestry and Social forestry. Indian farming, 26:11.** Importance and relevance of Social Forestry in India are discussed.

**Ramprasad 1989. Comparative growth and yield of seedling origin crop and first coppice crop in Eucalyptus hybrid. Indian Forester, May 1989.** Yield obtained from first coppice growth estimated to be much more than that from the initial seedling growth.

**Ramshe-DG, Umrani-NK, Walunekar-RB, Kumbhar-TT, Shinde-SH 1990 Agroforestry: effects of associated tree species on grain production of arable crops. Journal of Maharashtra Agricultural Universities 15:3** Effects on agricultural crops grown between rows of *Leucaena leucocephala*, *Azadirachta indica*, *Eucalyptus* spp hybrid and *Dalbergia sissoo* in different alley were studied. In the second year, there was reduced grain yield especially at the closest spacing. *Leucaena* sop had the greatest negative effect followed by *Eucalyptus* sop.

**Randrianjafy,H.Contribution à l'étude de la production des taillis d'Eucalyptus robusta sur les hautes terres centrales : les vieux peuplements de Manjakandriana. ESSA, Université d'Antananarivo, Madagascar. Akon'ny Ala 1989. (No. 4): 5-10 (18 ref.)**Average height and volume increase of stand volume was measured in *Eucalyptus robusta* populations aged 2, 4, 6, 8 and 12- years-old. Height and weight curb diagrams show that the ideal rotation period goes from 8 to 9 years. At present, felling operations are more frequent (from 2 to 3 years.)

**Rao-AV, Kiran-Bala, Lahiri-AN, Bala-K. 1989. Influence of trees on micro-organisms of aridisol and its fertility. Indian-Forester 1989., 115:9.** Data are tabulated and discussed on the percentage of organic carbon and nitrogen and the population of micro-organisms in soil samples at 0-15 cm depth under 22-year-old plantations of 10 species at CAZRI Central Research Farm, Rajasthan. The species included 5 different *Eucalyptus* sop and 5 of others. Compared with the values found on bare sites, all the tree species increased the parameters recorded. In general, the greatest increases in C, N and micro organisms were promoted by *E.coolabah*, *Acacia tortilis* and *T.undulata* with the eucalypts other than *E.coolabah* promoting smaller increments.

**Rao-HS, Shiva-MP, Jain-PP. 1970. Eucalyptus oil potential from large-scale plantations, Indian Forester 96 (2).** Data are given on the essential oil yield of leaves of *Eucalyptus tereticornis* and *E. camaldulensis* from New Forest, Dehra Dun. The physico-chemical properties of the oils were compared with existing standards. (Cf. F.A 29 No. 4843) The properties of oils from both species were similar to those of *E. globulus*, so far the only commercially exploited Eucalyptus oil in India.

- Rao-NR. 1989. Afforestation in poverty alleviation. *Indian Journal of Forestry*. 12:2** A case is made for marginal and small farmers in India afforesting parts of their land in order to improve their economic returns. *Eucalyptus* spp, *Leucaena leucocephala* and *Dalbergia Sissoo* are recommended for planting on farm and private lands.
- Rawal,-VRS; Bist,-APS; Sharma,-SC. 1992. Diurnal variation in water status of *Eucalyptus* and poplar leaves in a warm sunny day. *Indian-Forester*. 118: 12, 963-965; 4 ref.** Measurements were made of the leaf water potential and relative water content of old and new leaves in adjoining 3-yr-old *Eucalyptus* spp hybrid, *E. tereticornis*, and poplar, *Populus* spp. plantations in Uttar Pradesh. Diurnal patterns were similar for the 2 species although amplitudes of change differed. Diurnal trends in young and old leaves were markedly different in poplar but not in eucalypts.
- Rawat-JK. 1989. Economic behaviour of a wood producing firm. *Indian Forester*. 115-10.** A model is developed and analysed for a private woodlot being managed commercially for fuelwood and/or pulpwood production in a competitive market. The determination of the optimum rotation age is found to be the most important decision to be taken by the company. An increase in the regeneration costs tends to lengthen it. The model is tested using published yield data from a *Eucalyptus* spp. plantation in Uttar Pradesh.
- Rawat-JK. 1990. Economic spacing and rotation decisions in farm forestry. *Indian-Forester*., 116:5.** A model for a *Eucalyptus* spp. farm managed by a profit maximizing owner has been developed, based on the assumption of one seedling crop followed by one coppice crop of *Eucalyptus tereticornis* from Haryana. The result showed that at discount rate of 12 to 15 percent and a planting cost more than Rs. 1.00 per plant, the optimum rotation length is 9 years or longer and the optimum spacing wider than 2 x 2 m.
- Reddy-MV, Venkataiah-B. 1990. Effects of tree plantation on qualitative composition of soil arthropods of semi-arid tropical savanna. *Environment-and-Ecology*. 8:1B, 361-367 13 ref.** The qualitative and quantitative composition of soil macro-and micro arthropod communities were significantly enhanced by plantation (mainly *Eucalyptus* spp.) on tropical savanna in Andhra Pradesh.
- Reddy-ST. 1985. Who prefers *Eucalyptus* and why. *Social-Action*., 35:4.** Use of the social forestry programme to circumvent the land ceiling limits through *Eucalyptus* spp. planting is made out.
- Redhead J.F. 1991. Results from intercropping fast growing trees and food crops at Morabora, Tanzania. *Growth and water use of Forest Plantations* Wiley & Sons, Chichester** Good returns were obtained in the first and second year. Thereafter there was a fall. Short rotation depletes the soil as in case of other crops.
- Reiche,-CC. 1992. Economic analysis of living fences in Central America: development of a methodology for the collection and analysis of data with an illustrative example. *Financial and economic analyses of agroforestry systems: proceedings of a workshop held in Honolulu, Hawaii, USA, July 1991* [edited by Sullivan, G. M.; Huke, S. M.; Fox, J. M.]. 1992, 193-205; 23 ref. Paia, USA; Nitrogen Fixing Tree Association (NFTA).**

**Reiche-C 1987.** *Advances in economic studies of agroforestry plantations in Central America. Advances in agroforestry research. Proceedings of a seminar held in CATIE, Turrialba, Costa Rica from September 1-11th, 1985, and sponsored by CATIE and GTZ. Serie Tecnica Informe Tecnico CATIE No.117* In Central America fuelwood represents more than 50 percent of the energy used. A project has been promoted to establish agroforestry demonstration units. The preliminary financial indications are that production of fuelwood from agroforestry systems is a viable alternative. *Eucalyptus saligna* was the major species availed of.

**Reynolds-L, Lawson-Ec. 1978.** *A comparison of the fuelwood value of Gmelina arborea and Eucalyptus spp. from the Bundaforest. Research Bulletin Bunda College of Agriculture University of Malawi.* Calorific values of dry matter were 4.53 Mcal/kg for *G.arborea* firewood and 4.54 for *Eucalyptus* spp. Dry matter contents were 45 percent and 56 percent respectively, and therefore the heating value of *Eucalyptus* spp. was greater than of *G.arborea*. The fresh weight of firewood bought in 1 m<sup>3</sup> lots was significantly correlated with butt size.

**Riedacker, A.; Knockaert, C. ; Zaidi, A .***Production ligneuse des taillis d'Eucalyptus : effet de la fréquence de coupe et de la densité de plantation. Annales des Sciences Forestières 1985. 42 (1): 39-52 (6 ref.)* This article describes two trials carried out in Morocco on *Eucalyptus camaldulensis* plantations. During the first trial, wood production was measured in 12 year-old plantations, with different felling rates (at 2, 4, 6, 8 and 10 years). The second test was applied to different plantation densities, with varying felling rates. On poor soils, a strong population density significantly increased wood production.

**Rigueiro Rodríguez, A. 1993.** *El eucalipto: Un árbol controvertido. Montes, 31: 43- 46. Madrid. España.* This paper provides an overview on negative characteristics attributed to *Eucalyptus* spp. and shows disagreement with those assumptions. It also considers that with the help of technical criteria applied to well planned and well managed plantations, this tree species is compatible with the natural environment conservation in Galicia, Spain.

**Rigueiro Rodríguez, A.; Romero Franco, R.; Fernández Lorenzo, J.L. 1993a** *Recuperación de la vegetación en montes aterrazados del norte de Galicia repoblados con Eucalyptus globulus. Congreso For. Español. Lourizán, I: 417-421. España.* A summarized progression index of vegetation is proposed. The index integrates several parameters of the plant community and it applies to plant groups of different ages (2,8 and 20 years) established in terraces. With the help of participating communities, it explains how vegetation may be recovered over time with terraced forests planted with *Eucalyptus* spp. The paper concludes that: soil preparation for reforestation through terraces has a negative impact on natural vegetation. This impact is felt over the first years after terraces are introduced. The impact of terraces on natural vegetation, after 8 years of establishment, within a geographic area in the North of Lugo province, was a positive experience compared with non terraced areas. This beneficial influence lasts in time, although it decreases due to the effects caused by its own expansion and by silvicultural work and exploitation of forest understorey.

- Roberts,-J.; Rosier,-P.T.W. 1993. *Physiological studies in young Eucalyptus stands in southern India and derived estimates of forest transpiration. Agricultural Water Management 24(2) p. 103-118.***
- Roberts-K. 1988. *The eucalypt dilemma. 26 pp. FAO Rome, Italy. A popular version of FAO Forestry Paper No. 59*** This paper deals with the ecological effects of *Eucalyptus* spp. (including plantations) in relation to water supply, erosion, nutrients, wildlife, vegetation, and people.
- Rockwood,-D.L.; Dippon,-D.R. 1989. *Biological and economic potentials of Eucalyptus grandis and slash pine as biomass energy crops. Southern Biomass Conference. Auburn Univ., Alabama (USA). 26-28 Jul 1988. Biomass 20(3-4) p. 155-165.***
- Rockwood-DL, Comer-CW, Dippon-DR, Huffman-JB. 1985. *Woody biomass production options for Florida. Bulletin Agricultural Experiment Stations, University of Florida. No.856.*** The feasibility of silvicultural biomass farms as alternative uses for forest and non-forest land is discussed with reference to species, spacing, site amendment, genetic variation, and economic, energetic and environmental factors. Promising species included *Eucalyptus grandis*, *Pinus elliotti* and *P.clausia* var. *immuginata*.
- Rodríguez Chacón, J.; Vásques, W. 1991. *Saligna: Eucalyptus saligna Smith, especie de árbol de uso múltiple en América Central. Serie Técnica. Informe Técnico n° 184, 66 pp. Centro Agron. Tropical de Inv. y Enseñanza, CATIE. Turrialba. Costa Rica.*** Forestry guide to the species, including botany, ecology, establishment and management.
- Rodríguez S., S.K.; Torres U., M.H. 1991. *Obtención de pulpa kraft de desechos y astillas comerciales de eucalipto. Ciencia e Inv. Forestal, 5 (2): 203-215. Univ. Austral de Chile. Valdivia.*** Several trials were carried out with *E. globulus*, at different periods of time and with different temperatures. Pulp yields were 48.2-56.8 percent, with Kappa numbers from 11 to 30. Physical and chemical properties were acceptable.
- Rodríguez, V. 1985. *Análisis de la evolución de los restos orgánicos en los horizontes superiores de los suelos bajo distintas formaciones vegetales en una comarca de la provincia de La Coruña. Publ. INIA, 498 pp., Inst: Nac. de Inv. Agrarias. Madrid. España.*** A study carried out in las Mariñas region, la Coruña, Spain. It included grassland, shrub, *Eucalyptus* spp, *Pinus pinaster*, *Pinus radiata* and hardwood trees formations. Organic matter was fractionated and humic acids were identified. The results showed that the organic matter is very similar in qualitative terms and it may be classified, from higher to lower quality as follows: grassland, hardwood tree species, *P. radiata*, *E. globulus*, *P. pinaster*, shrub.
- Roederer, Y. *Expérimentation forestière et agroforestière. Essais zones sèches - Cote ouest. Bois et Forêts des Tropiques 1991. (No. 229): 51-60 (9 ref.)*** This article presents forestry and agroforestry experiments carried out since 1989, in dry areas in the western region of La Réunion island, with the technical help of CTFT. Trials were particularly oriented towards behaviour tests of different local and exotic species, including *Eucalyptus camaldulensis* aimed at coastal and dune protection purposes and agroforestry trials in trial plots and in agricultural land.

- Rojas V., P.; Arce J., J.P.; Arriagada B., M. 1987. *Propagación vegetativa por estacas en Eucalyptus camaldulensis*. *Ciencia e Inv. Forestal*, 1 (2): 1-9. *Inst. Forest. Santiago. Chile. (FA, 1991, 052-00083)*. A study on tree variability, hormone IBA concentrations and planting environment, by observing root development of little plants deriving from epicormic basal shoots.**
- Rollet-B (1980). *Jari; success or failure ? An example of agro-sylvo-pastoral and industrial development in Brazilian Amazonia*. *Bois-et-Forests-des-Tropiques*. No. 192, 3-34.** The Jari Florestal e Agropecuaria Ltda has raised, after clearing the Amazonian forest, about 11 000 ha of plantation with *Gmelina* spp. and *Pinus caribaea*. The company has decided to replace *Gmelina* with *Eucalyptus* spp. including planting of *Eucalyptus* spp., yet this activity has raised strong criticism in the press due to its large extension and its American ownership.
- Roman-Amat, R.; Steinmetz, G. *Bilan technique et économique de l'amélioration génétique des arbres forestiers*. *Revue Forestière Française* 1986. (No sp. *Amélioration génétique des arbres forestiers*):263-271.** This article features a calculation method to measure profit and yield rates of investment in research for genetic improvement, according to species and wood prices.
- Romero García, A. 1991. *Producción y destinos comerciales de la madera en Galicia durante 1989*. *Actualidad Forestal de Galicia*, (121-122): 1-4. (BBV). *La Coruña. España*.** This paper deals with the progress achieved by a study on market flows and wood industrial processes in Galicia, Spain.
- Roose, E. *La GCES, une nouvelle stratégie de lutte anti-érosive appliquée à l'aménagement de terroirs en zone soudano-sahélienne du Burkina Faso*. *Bois et Forêts des Tropiques* 1992. (No. 233): 49-63** In acknowledging the failure of projects to combat erosion that do not take into account farmers needs, this paper proposes a new approach: conservation management of water and soil (GCES). Protection of soils is an immediate product of research aimed at small farmers development. The main lines of this approach are water management and soil fertility management, based on traditional yet renewed farmer practices. The author insists on the major role of trees in semi-arid areas management and the need to associate anti-erosion techniques to adapted cultivation techniques.
- Roy, C. *Le programme Eucalyptus en quelques chiffres*. *Revue Forestière Française* 1984. 36 (3): 221-224** This programme aims at establishing a solution to complement the needs of paper industry supply. A funding mechanism for forestry investment with low profitability has been implemented (lending rates have been prepared according to wood prices and reimbursement was set at the first crop. The article shows a financial balance for growers and expected results (18 000 ha.)
- Ruiz-Meza, P. (Comportement initial de plusieurs sources de germoplasme d'*Eucalyptus camaldulensis* Dehn en Amérique centrale.) *Comportamento inicial de varias fuentes de germoplasma de *Eucalyptus camaldulensis* en América Central*. *CATIE, Turrialba Costa Rica*. 1991. 113 p. (In Spanish).**
- Ruiz-Meza, P. 1991. (Initial behaviour of several sources of germplasm of *Eucalyptus camaldulensis* Dehn in Central America.) *Comportamento inicial de algunas***

- fuentes de germoplasma de Eucalyptus camaldulensis Dehn in América Central. CATIE, Turrialba Costa Rica. 1991. 113 pp.* (In Spanish).
- Ruiz-Meza, P. 1991. Comportamiento inicial de varias fuentes de germoplasma de Eucalyptus camaldulensis Dehn en América central. CATIE, Turrialba Costa Rica. 1991. 113 p.**
- Rusk-GD. 1983. The influence of cost recording on the profitability of growing timber. Forestry Quo Vadis ? Proceedings, Symposium of the Southern African Institute of Forestry, Pietermaritzburg, 23 June 1983., South Africa; SA Institute of Forestry.** Details are given on the initiation of a forest Cost Recording System by the South African Timber Growers' Association to assist timber growers in monitoring their cost of production. The system provides growers with a management tool to increase productivity and accurate production costs, to support their claims in price negotiations.
- Russell A. Michael (1993). Ethiopia's Notorious Saviour; The Eucalyptus Tropical Agriculture Association, UK. Newsletter, June 1993.** The author's views, based on a personal visit to Ethiopia, on the role played by *E. globulus* and *E. camaldulensis* in rectifying the ecological damages caused to the country are presented.
- Sabas-E, Kalaghe-AG. 1986. The influence of weeding on early growth of Eucalyptus camaldulensis Dehn. at Igwata, Mwanza Tanzania. Tanzania Silviculture Research Note. No.44.** The results of weeding trials suggest that *E. camaldulensis* is very sensitive to weed competition and clean weeding regime is obligatory for its successful establishment in the semi-arid parts of Tanzania.
- Sachs-RM, Ripperda-J, Forister-G, Miller-G, Kasemsap-P, Murphy-M, Beyl-J. 1988. Maximum biomass yields on prime agricultural land. California Agriculture. 42:6.** Five intensively-managed plantations of *Eucalyptus camaldulensis* and *E. grandis* were established in California. The highest estimated yields of *E. camaldulensis* were obtained for a small 4-year-old plantation with 2719 trees per acre, receiving an average of 400 pounds nitrogen/acre/y. At 20 tons/acre/y and prices of 20-30 US dollars per biomass ton, the return was estimated to be competitive with tree and row crops in prime agricultural land.
- Sahay,-VK. 1992. Agro-forestry in Palamu, Bihar - a bold venture. Indian-Forester. 118: 4, 308-309.** Successful intercropping is reported of groundnuts, ladyfinger (okras) and wheat with *Eucalyptus* spp. in Palamu District, Bihar. Good crop yields were obtained by planting crops in ploughed strips between tree rows.
- Sahunalu-P, Puriyakorn-B, Dhanmanonda-P, Hiranpan- P. 1990. Production of small size fuelwood from the thinning of Eucalyptus camaldulensis Dehnh. plantation. Kasetsart-Journal,-Natural-Sciences, 24:3.** The study reported the experiment on thinnings in plantations raised at different spacings.
- Saiz de Omenaca, J; Gomez-Martinez, D; Reimat MJ. 1993. Análisis sociológico de la opinión entre la población rural de Cantabria sobre el impacto de las plantaciones de eucalypto. Investigación Agraria. Sistemas y Recursos Forestales (España), v.2(1) p. 71-88. recibido enero 1994.** (In Spanish).

- Saiz de Omenaca, J; Gomez-martinez, D; Reimat MJ. 1993. Environmental impact of eucalyptus plantations: analysis of rural people's opinion in Cantabria (Spain). *Investigacion Agraria. Sistemas y Recursos Forestales*, June 1993. v.2(1) 71-88. recvd. Jan 1994. (In Spanish).**
- Saiz de Omenaca, J; Gomez-Martinez, D; Reimat MJ. (Analyse sociologique de l'opinion de la population rurale en Cantabrie (Espagne) sur l'impact des plantations d'eucalyptus.) Análisis sociológico de la opinión entre la población rural de Cantabria sobre el impacto de las plantaciones de eucalypto. *Investigacion Agraria. Sistemas y Recursos Forestales*, Juin 1993. v.2(1) p. 71-88. reçu Jan 1994 (In Spanish).**
- Salazar, R. 1986. Producción de leña de *Eucalyptus saligna* en San Ramón, Costa Rica. *Silvoenergía*, 15: 4 pp. CATIE: Turrialba. Costa Rica. (FA, 1989, 050-07349). This paper presents data on biomass production and growth 30 months after plantation, in four locations with maize intercropping.**
- Salazar, R. 1987. *Eucalyptus deglupta*: una especie para las zonas bajas muy húmedas del trópico. *Silvoenergía*, 24: 4 pp. CATIE. Turrialba. Costa Rica. (FA, 1990, 051-02611). This paper shows production methods in nurseries and management of the species in Central America. Growth rates from 1.2 to 10 years, in Costa Rica (20 sites), Guatemala (1 site) and Nicaragua (2 sites).**
- Salazar, R.; Jiménez, V. 1988. Comportamiento del *Eucalyptus deglupta* Costa Rica. *Silvoenergía*, 27: 4 pp. CATIE. Turrialba. Costa Rica. This paper present height projections ( according to age or diameter), diameter (according to age) and volume, up to 20-years-old.**
- Sall, P.N.; Aussenac, G.; Dreyer,E. ;Granier ,A. Limitation par la sécheresse de la croissance d'*Eucalyptus camaldulensis* Dehn. en climat sahélo-soudanien au Sénégal. *Revue Forestière Française* 1991. 43 (4): 309-316 (18 ref.) This article shows experiments carried out to evaluate the influence of drought on production capacity of the species in Sudanese-Sahelian climate (with annual precipitations of 400 mm) in an attempt to improve utilization conditions. Finally, *Eucalyptus camaldulensis* shows a strong tolerance capacity to water stress, but its productivity remains low (1,03 m<sup>3</sup>/ha/year). These results pose the problem of researching local and exotic species that show significant wood productivity in areas with annual precipitations of 500 mm.**
- Sall, P.N. Etude écophysiological de *Eucalyptus camaldulensis* dehn. en zone soudano-sahélienne. Exemple du PARFOB. Univ.: Nancy 1 ; Th. Doctorat : biologie végétale et forestière; 1988. 202 p. et annexes (10p. ref.) Research has lead to a comparative study on water consumption in *Eucalyptus camaldulensis* plantations and *Acacia seyal* natural forests. Results show that annual rainfall below 450 mm is entirely evaporated by *Eucalyptus* spp. and it continues extracting water reserves in the soil. If precipitations are above 450 mm, water reserves in the soil remain intact. In such case, *Eucalyptus* spp. production does not grow above 2m<sup>3</sup>/ha/year. Phenologic cycle of *Acacia seyal* does not allow for a rapid reestablishment of foliar activity before the beginning of wintering. In low precipitation years, *Acacia* spp. may use water resources in the soil. Grass understorey may have an ETR above that of plantation. Conclusions are that**

reforestation with *Eucalyptus* spp. in Sudanese-sahelian land, after production, is likely to fail.

**Samra,-JS; Grewal,-SS; Singh,-G. 1993. Modelling competition of paired columns of *Eucalyptus* on interplanted grass. *Agroforestry-Systems*. 21: 2, 177-190; 7 ref.**

The paper present the results of a study of competition interfaces in an experiment with *E. tereticornis* and bhabbar grass, *Eulaliopsis binata*, carried out at the Mansa Devi Farm of the Central Soil and Water Conservation Training Institute at Chandigarh.

**Samraj.P. 1984. A review of *Eucalyptus globulus* plantations in the Nilgiris. *Indian Statistical Institute, Bangalore - 1*.**

The economic importance by way of yield of fuel, timber, pulp and employment potential due to industrial development of the region, outweighs the small loss in water yield. Regulated supply of clear water is a great asset of these plantations.

**Sandhu,-SS. 1990. Impact and yield of *Eucalyptus* plantations in Hathad area of Faridkot District. *Indian-Journal-of-Forestry*. 13: 1, 21-25; 3 ref.**

The paper reports data on land holding area and value, land ownership (absentee or local farmer), labour availability and requirement, area under *Eucalyptus* spp., year of planting, spacing, cultural operations, intercropping (not common), height growth and yield, sale price and end use (sale to contractors or paper mills).

**Sandhu-SS, Gurbaz-Singh. 1986. Economics of block plantation of (kikar) *Acacia nilotica* subsp. *indica* (Benth) on marginal soils of Punjab. *Indian-Journal-of-Forestry*. 9:2.**

Returns from *Acacia nilotica* plantations estimated at 21 per cent were poorer than figures published on *Eucalyptus* spp. on similar sites.

**Sanginga,-N.; Mulongoy,-K.; Swift,-M.J. 1989. Contribution of nitrogen by *Leucaena leucocephala* and *Eucalyptus grandis* to soils and a subsequent maize crop. *Trees for development in Sub-Saharan Africa. Proceedings of a regional seminar held by the International Foundation for Science (IFS), ICRAF House, Nairobi, Kenya, February 20-25, 1989. Stockholm (Sweden). International Foundation for Science. 1989. p. 253-258.***

**Sankaran,-KV. 1993. Decomposition of leaf litter of *albizia* (*Paraserianthes falcataria*), *eucalypt* (*Eucalyptus tereticornis*) and *teak* (*Tectona grandis*) in Kerala, India. *Forest Ecology and Management*. 56: 1-4, 225-242; 40 ref.**

*Ex-situ* decomposition of leaf litter of *P.Albizia falcataria*, *E. tereticornis* and *T. grandis* was studied under field and laboratory conditions. The amount of CO<sub>2</sub> evolved from the decaying litter and the associated populations of fungi, bacteria and actinomycetes were quantified. *T. grandis* litter decomposed rapidly compared with the others and decomposition of *E. tereticornis* litter was the slowest.

**Sant'Anna e Castro. 1992. (La contaminación atmosférica y el stress hídrico en el síndrome de seca de las ramas terminales de los eucalyptus SPEVDR en Brasil). *La pollution atmosphérique et le stress hydrique dans la syndrome de déssechement des pousses terminales des eucalyptus au Brésil. Faculté des Sciences Agronomiques de Gembloux. 143 pp.***

**Sanyal-P. 1975. Rehabilitation of 'degraded coppice Sal' forests vis a vis conversion to Eucalyptus plantations in South Bengal: a financial study. Indian-Forester. 101:1.** There are large tracts of forest in South Bengal which owing to the pressure of population, have been degraded to scrub dominated by *S.robusta* coppice. A comparison of the profitability of *E.tereticornis* plantations with the costs of rehabilitating these degraded forests indicated that it would be profitable to replace with pulpwood plantations, sites of qualities I,II and III (for *Eucalyptus* spp.), only if the existing coppice forest contains less than 328, 215 or 162 viable stools/ha respectively. In forests with root stock of coppicing species this type of analysis would be useful.

**Sarrailh, J. M. Mise en valeur de l'écosystème forestier guyanais. Opération ECEREX : résumé des premiers résultats. Bois et Forêts des Tropiques 1984. (No. 206): 13-32 (20 ref.)** The paper presents the ECEREX operation, consisting on the development of the Guyanese forest ecosystem: "An ecological study on its evolution due to transformation". The project was outlined in 1976 to respond to problems posed by the development of a paper mill. This productive activity was to use natural forest first, and fast-growing species (*Pinus* and *Eucalyptus* spp.) in reforestation areas later. This article shows the methodology used to carry out the study in 10 experimental watersheds. The methodology followed all the process from the natural forest to the simplified ecosystem production created (reforested areas, grasslands, orchards. The impact of transformations was analysed: water balance, erosion, runoff, organic matter evolution, regrowth flora, soil biota. The duration of plantations established (*Pinus caribea*, *Eucalyptus urophylla* in particular) was not measured due to the length of experimentation.

**Sarrailh, J. M.; Boulet, R.; Grimaldi, C.; Grimaldi, M.; Fritsch, J. M.; Bereau, M. L'opération ECEREX. Études sur la mise en valeur de l'écosystème forestier guyanais après déboisement. Le point sur les recherches en cours. Bois et Forêts des Tropiques 1990. (No. 219): 79-97 (35 ref., 2 col. pl.)** Assessment is made of research carried out in 10 experimental watersheds in order to measure the impact of natural forest transformation in forest and agricultural establishments. Results include: study of soil and water chemistry, hydrology, runoff and erosion, botany, productivity of plantations. The study shows that forest clearing may have irreversible consequences on soil fertility, due to runoff and erosion. Reforestation carried out in the least appropriate soils for agriculture needs manual and expensive maintenance, thus making hill reforestation an obsolete hypothesis. Orchards and grasslands seem to better adapt to the environment, but economic feasibility of these systems, particularly for livestock is not secure.

**Saxena,-N.C. 1992. Eucalyptus on farmlands in India: what went wrong? Unasylva (FAO). (1992). v. 43 (no.127) p. 53-58.**

**Saxena,-NC. 1990. Farm forestry in north-west India: lessons from the 1980s. Studies in Sustainable Forest Management. Ford-Foundation. No. 4, iv + 40 pp.; 5 pp. of ref. New Delhi, India.** This account is presented in 6 chapters: I. Introduction; II. *Eucalyptus* spp.: the first phase 1982-86; III. Planting of *Eucalyptus* spp. after 1986; IV. Marketing of *Eucalyptus* spp. V. Legal restrictions; and VI. Conclusions: summary and recommendations.

**Saxena,-NC. 1994. *India's Eucalyptus craze: the god that failed*. 264 pp.; 20 pp. of ref. Also published in London, UK, by Sage Publications Ltd. & in Thousand Oaks, California, USA, by Sage Publications Inc. New Delhi, India; Sage Publications India Pvt Ltd.** The book examines the adoption of *Eucalyptus* spp. by farmers in NW India during 1980-86, and its subsequent rejection after 1986-87. It is based on a doctoral research for the Oxford University, UK. It reports the findings of a survey on the socio-economic characteristics of *Eucalyptus* spp. growers, the regional pattern of planting, and problems in production and marketing of *Eucalyptus* spp.

**Saxena-NC .1991. *Marketing constraints of Eucalyptus from farm lands in India. Agroforestry Systems. 13:1.*** The field work by the author has shown that since 1986 farmers in India have almost stopped growing eucalypts because of marketing problems. The pole market became saturated, paper mills did not pay a remunerative price and fuelwood prices were low and uneconomical. Legal restrictions on the transport and sale of wood posed problems. Excessive production of *Eucalyptus* spp. has not helped to ease the timber shortage in India because, due to the planting practices used, the wood supply is not of high enough quality.

**Saxena-NC 1992. *Eucalypts planting as a response to farm management problems faced by 'on-site' and 'off-site' farmers. Agroforestry systems. 19:2.*** The success of the green revolution in the fertile and the rich agricultural plains of western Uttar Pradesh in North India led to labour shortages and increased opportunities for off-farm investments by landowners. These changes impelled landowners to adopt strategies which saved family labour and supervision time in cultivation. Many farmers with high ratio of owned land to male members of the family resorted to tree farming, many of them *Eucalyptus* spp. Conversely, farmers with small holdings, subsistence orientation and cheap labour showed little enthusiasm for planting eucalypts.

**Saxena-NC. 1991. *Crop losses and their economic implications due to growing of eucalypts on field bunds - a pilot study. Agroforestry Systems. 16:3.*** Due to a decreasing demand, the large profits expected from *Eucalyptus* spp. plantations have diminished. The average benefit/cost ratio at 15 percent discount rate expected to be 9.2 without loss in crops, was reduced to about 2. The reduced profit margin was not perceived to be sufficiently high to cover production risks and fluctuating output prices. Hence, none of the farmers replanted *Eucalyptus* spp. after sale in the region of study, in North-West Uttar Pradesh, India.

**Saxena-NC. 1991. *Village tree planting in north-west India. Commonwealth Forestry Review. 70:3.*** Planting of farm trees (*Eucalyptus* spp.) in 2 villages in Uttar Pradesh is examined and contrasted.

**Saxena-NC. 1992. *Adoption of a long-gestation crop : Eucalyptus growers in North-West India. Journal-of-Agricultural-Economics. 43:2.*** A survey was carried out in four villages to observe the different approaches by poor and rich farmers to *Eucalyptus* spp. adoption. Besides management constraints, small farmers did not risk adopting *Eucalyptus* spp. because, with assured irrigation and fertile soils, annual crops provided a more suitable income.

- Saxena-NC. 1992. *Farm forestry and Land use in India: Some policy issues. Ambio Vol 21, No. 6.*** Success and failure of Social forestry in India are analysed. The author suggests that while market led farm forestry may continue without subsidies on a reduced scale, Government attention should shift to strengthening the traditional agroforestry practices based on indigenous species.
- Schofield-NJ, Bari-MA. 1991. *Valley reforestation to lower saline groundwater tables : results from Stene's Farm, Western Australia. Australian Journal of Soil Research 29:5.*** Reforestation with *Eucalyptus* spp. was successful in lowering the groundwater table by 1.5 m between 1979-1989 whilst groundwater levels under nearby pasture had risen by 1.8 m. The groundwater salinity beneath reforestation decreased by 30 percent over the study period, allaying fears of a detrimental groundwater salinity increase brought about by transpirative concentration.
- Schonau-APG, Coetzee-J. 1989. *Initial spacing stand density and thinning in eucalypt plantations. Forest-Ecology-and-Management, 29:4*** Research into closely related subjects covering initial spacing, stand density, and thinning of *Eucalyptus* spp. plantations is documented. It is recommended that thinnings should start early and be carried out at frequent intervals and that the first one should be heavier than the later ones.
- Schonau-APG, Herbert-MA. 1989. *Fertilizing eucalypts at plantation establishment. Forest-Ecology-and Management 29:4*** The experiments in fertilizer research with *Eucalyptus* spp. at the time of planting are reviewed, the oldest trial dating back to 1946. Responses to fertilizer application of 33 species in 19 different countries are given together with the considerable increase in evidence over the last 2 decades of fertilizer effects on yields at clear-felling.
- Schonau-APG, Lambret-MJ, Cromer-RN, Mattos-CM, Maciel-R, Zech-W. 1984. *Fertilization of broadleaved species and foliar analysis. IUFRO symposium on site and productivity of fast growing plantations, Pretoria and Pietermaritzburg South Africa. 30 April - 11 May 1984., 253-291, 669-699. Pretoria. South Africa: South African Forest Research Institute.*** A study was made on 13 species for high biomass production and valued for industrial wood and fuelwood, with irrigation. Biomass production was increased by irrigation for all species. Maximum production under irrigated conditions was by *Cassia siamea* (55.55 t/ha/y) followed by *E.camaldulensis* (40.13 t/ha/y) and *E. tereticornis* (33.84/ha/y).
- Schonau-APG, Pennefather-M. 1975. *A first account of profits at harvesting as a result of fertilizing Eucalyptus grandis at time of planting in Southern Africa. South-African-Forestry-Journal. 1975., No.94, 29-35; 16 ref.*** Reports the results of trials, in which *E.grandis* were treated with NPK fertilizer within two weeks after planting. Super phosphate fertilizer gave highly profitable results with significant responses in all growth parameters. The application of fertilizer greatly increased timbers (significantly more in the best sites).
- Schonau-APG. 1970. *Planting, espacement and pruning of Eucalyptus grandis on a low quality site. S.Afr.For.J73), (11-5).*** Reports a controlled experiment in the Natal Midlands, comparing spacings and pruning. Results were assessed at 7 years. Higher stand densities yielded a greater volume of timber, but severe live pruning (for pole production) reduced the potential timber yield by 25 percent. It is concluded that,

even on sites as poor as those studied, growing *Acacia mearnsii* for bark and timber would have been more profitable than growing *E. grandis* for timber alone.

**Schonau-APG. 1982. *The planned production period for short rotation Eucalyptus grandis.* South African Forestry Journal, No. 122, 10-13.** Short rotations of *E. grandis* in South Africa are analysed against the criteria for max. yield, max. income, max. internal rate of return and max. turnover.

**Schonau-APG. 1991. *Role of eucalypt plantations in timber supply and forest conservation in sub-Saharan Africa.* South African Forestry Journal No. 156.** It is estimated that in sub Saharan Africa 25 million ha plantations and woodlots are required to satisfy the demand for fuelwood and other rural uses if natural forests and open woodlands are to be conserved. The total eucalypt estate exceeds 1 million ha. representing 16 percent of world *Eucalyptus* spp. plantations of which 75 percent are for commercial purposes. In the Congo, clonal eucalypts forestry has been successful.

**Schreiner,-HG. 1989. *(Intercropping of soyabean with eucalypts in southern and south-eastern Brazil).* Culturas intercalares de soja em reflorestamentos de eucaliptos no sul-sudeste do Brasil. Boletim de Pesquisa Florestal. No. 18/19, 1-10; 8 ref.** Three densities of soyabean (330 000, 360 000 or 400 000 plants/ha) were planted between rows of *E. grandis* (2X3 m spacing). After 18 months, the average timber volume of *E. grandis* for all plots planted with soyabean was greater than that in plots without soyabean. Soyabean yield was greatest at the density of 400 000 plants/ha. (In Portuguese.)

**Schreiner-HG, Balloni-EA. 1986. *Intercropping of beans (Phaseolus vulgaris) with Eucalyptus grandis in southeastern Brazil.* Boletim-de-Pesquisa-Florestal, EMBRAPA, Brazil. No. 12.** Inter-cropping beans in the Sao Paulo region, Brazil, has benefited the tree crop of *Eucalyptus grandis*. There was also good return on investment from beans.

**Schreuder,-G.F.; Barros,-A.A.A.-de; Hill,-D.A.TI. 1990. *The global supply and cost-price structure of eucalyptus.* in Root,-D.F. (ed.). *Global resources and markets : issues and trends : 2nd International Symposium on Pulp and Paper.* Seattle, Wash. (USA). Institute of Forest Resources, University of Washington. p. 81-92.**

**Schubert-TH, DeBell-DS, Whitesell-OD, Bell-DS-de. 1988. *Eucalyptus/legume mixtures for biomass production in Hawaii.* Nitrogen Fixing Tree Research Reports. 6.** A summary on the results of experiments being conducted on the potential use of *Eucalyptus* spp. and legume mixtures on nitrogen poor soil in Hawaii, as a means of supplying nitrogen other than as fertilizer. There was considerable improvement in height and diameter in the *Eucalyptus* spp. with *Acacia melanoxylon* and *Albizia falcataria*. Proper choice of legume mixtures would be a useful practice.

**Schutz-CJ (1976). *Fertilization of fast-growing Pines and eucalypts in South Africa.* South African Forestry Journal. No.98, 44-47:12 ref.** Responses to fertilizer applications are reviewed for the 4 most important species of Pine (*Pinus patula*, *P.elliotti*, *P.pinaster* and *P.radiata*) and for *Eucalyptus grandis*. Pines respond well to fertilizers, particularly *Pinus* spp., *E. grandis* responds well to NP; N is unnecessary

when *Eucalyptus* spp. are planted on old Wattle sites. Fertilizers are most effective if applied to the surface of the soil within one month after planting.

**Sedjo-RA. 1980. Forest plantations in Brazil and their possible effects on world pulp markets. *Journal-of-Forestry*. 78:11, 702-705; 6 ref.** By the end of 1979, industrial firms had established 3.8 million ha plantations, mainly *Eucalyptus* spp. (about 2.5 million ha) loblolly and slash pines (about 1.3 million ha) mainly because of tax incentives offered by the Government. Projections for 1995 suggest that Brazil could provide 10-33 percent (short fibre) and 35-125 percent (long fibre) of the world's pulp requirement, depending on allowances for domestic needs (pulp, charcoal for the steel industry, and solid wood).

**Semana-JA. 1978. Fast-growing plantation hardwoods for pulp and paper production. in: Auchter, R.J. (coordinator): Proceedings of conference on improved utilization of tropical forests, May 21-26, 1978. Madison, Wisconsin, USA: USDA Forest Service, Forest Products Laboratory.** Data on chemical composition, fibre morphology, sulphate pulping, hand sheet properties and growth rates are presented and discussed for some Philippine woods: *Eucalyptus deglupta*, *Leucaena leucocephala*; *Anthocephalus chinensis*, and *Albizia falcataria*.

**Serrada Hierro, R. 1992. Los ecosistemas forestales y el medio ambiente. *Economía Política Forestal, Xunta de Galicia, España*. 305-309.** After examining the different implications of forest plantations, this paper concluded that: reforestation with productive purposes is highly justified due to economic reasons. It is also highly recommended in degraded shrub land. Nevertheless this treatment is not adequate to secure biodiversity or landscape quality. Environmental effects of well-planned intensive silviculture that has been appropriately implemented will not be irreversible over time, and will stop as soon as the soil is used differently. Generalizations and inaccurate analysis, both of critics and defenders of reforestation aimed at production, become an obstacle to reach a clear knowledge.

**Serralheiro-F, Madeira-M 1990. Changes in arthropod soil fauna due to afforestation with *Eucalyptus globulus*. *Agrokemia-es-Talajtan*. 1990., 39; 3-4, Proceedings of the Tenth International Symposium on Soil Biology, Keszthely, Hungary, 1989.** The density of arthropod populations was measured over a year in soils under *Eucalyptus globulus* and *Quercus suber*. Number of arthropods was always significantly lower under *Eucalyptus globulus*.

**Sesbou, A. Stratégie de développement des plantations d'*Eucalyptus camaldulensis* au Maroc. Univ.: Bordeaux I ; Th. Docteur d'Etat es Sciences ; 1990.** The initial part of this work describes the current situation of forest resources, silvicultural practices for *Eucalyptus camaldulensis*, industrial use from paper to honey production. The second part assesses research carried out on *Eucalyptus camaldulensis* in Morocco (silviculture, wood valuation and processing procedures). The third part proposes a development strategy based on genetic improvement through clonal means and in wood quality.

**Shah-SA. 1988. Experiences with eucalypts in social forestry in India. Lessons learnt. The international forestry conference for the Australian Bicentenary 1988. Proceedings of papers contributed and/or presented and histories of Australian forestry and forest products institutions and associations. Friday 29th April.**

- Volume V of V. Albury-Wodonga 25th April-1st May 1988. 15 pp; 22 ref. Australia; Australian Forest Development Institute.* A brief history, describing the different types of planting carried out (plantations, village woodlots, agroforestry, reclamation of degraded or marginal areas) and understorey vegetation in eucalypt plantations. The effects of *Eucalyptus* spp. on soil fertility, water consumption by *Eucalyptus* spp., and the controversy over the use of eucalypts are discussed.
- Shah-T 1988. Gains from social forestry; lessons from West Bengal. Discussion Paper Institute of Development Studies University of Sussex. No.243, ii.** West Bengal's group farming forestry model has been widely acknowledged as a cost effective means of combining wasteland afforestation with the improvement of livelihood of poor people. The first of such plantations was harvested in 1986. The returns were considerable.
- Sharada-VN, Samraj-P, Chinnamanai-S, Lakshmanan-V 1988. Hydrological behaviour of the Nilgiri sub-watersheds as affected by bluegum plantations, Part II. Monthly water balances at different rainfall and runoff probabilities. Journal-of Hydrology-Netherlands. 103: 3-4.** The rainfall and runoff data for 2 adjacent watersheds, one of natural grassland and other planted with *Eucalyptus* spp. are reported; the reduction in water flow with planting of *Eucalyptus* spp. in relation to hydro-electric reservoirs is discussed.
- Sharma, JK; Nair, CTS; Kedarnath, S; Kondas, S. 1986. Eucalypts in India, past, present and future Kerala Forest Research Institute, Peechi, Kerala, India. Editors: Sharma J.K. Nair CTS, Kedarnath S, Kondas S. Proceedings of a symposium held on Jan 30 - 31, 1984.** A series of papers on *Eucalyptus* spp. in productive forestry status papers (12 papers); soil and other environmental aspects of *Eucalyptus* spp. (10 papers); silviculture and management of *Eucalyptus* spp. (9 papers); *Eucalyptus* spp. in social forestry (8 papers); genetics and tree breeding (7 papers); pest and disease problems (12 papers); utilisation of wood and other products (4 papers); Socio- economic and policy aspects of *Eucalyptus* spp. cultivation.
- Sharma,-RA. 1993. Agro forestry vs. forestry for the rural poor: a socio-economic evaluation. Agroforestry-Systems. 22: 2, 131-143; 22 ref.** This paper evaluates the Forest Farming for the Rural Poor (FFRP) component of social forestry in the Indian State of Orissa. The scheme grants user rights on unused government land to landless poor to manage agroforestry (crops grown for the first 3 years after planting *Eucalyptus tereticornis*) and dense plantations of fast growing biomass species such as *Eucalyptus* spp. Both, the distribution equity and efficiency aspects are accounted for in the analysis.
- Sharma,-RD. 1992. Economics of fuelwood production in wastelands. 188 pp.; 87 ref. New Delhi, India; Concept Publishing Company.** This book contains 7 chapters dealing with the energy situation in India and the economics of reclaiming waste lands through the establishment of fuel plantations. Case studies are presented detailing the economics of various species (*Eucalyptus*, *Leucaena leucocephala*, *Prosopis juliflora*, *populus* spp. and *Acacia nilotica*) and of mixed-species fuel plantations in various parts of India.

**Sharma-K, Dhillon-MS, Dhingra-KK. 1987. Presence of germination inhibitors in the leaf leachates of some farm grown trees. Indian Forester. 113:12.** Laboratory studies are reported on the effect of leachates from 4 commonly grown farm tree species on the germination and growth of 4 crops. Leachates of *Morus alba* had the most toxic effect on all crops, followed by *Dalbergia sissoo*, and *Eucalyptus tereticornis*. *Acacia nilotica* showed the least toxic effect.

**Sharma-RA, McGregor-MJ 1991. The socio-economic evaluation of agro-forestry in Orissa. Forest Ecology and Management 45** Landless rural poor are allotted 0.5 ha each, of Government unused land for practising agro-forestry. Agricultural crop is grown for 3 years. A computer programme projects high socio-economic benefits for site qualities I and II while in case III it is negative. Site quality III could be viable by subsidising the labour component.

**Sharma-SD et al. Salinity and Alkalinity tolerance by selected Eucalyptus species. Van-Vigyan-Vol.29, Dehradun.** Levels up to which *Eucalyptus tereticornis* and *Eucalyptus camaldulensis* can stand salinity and alkalinity are discussed.

**Sharma-SK, Prasad-KG and Gupta-GN. 1986. Fertiliser application and growth of Eucalyptus grandis on a severely truncated soil. in: Eucalypts in India : Past, Present and Future. Kerala Forest Research Institute, Peechi, India.** In a severely truncated soil, above ground biomass of one year old *E. grandis* increased 16 fold due to the combined application of urea and super phosphate. The increases in foliage, twigs, stems and roots were 9, 15, 12 and 20 times respectively. The effect of nitrogen treatment was more prominent than the phosphorus on tree growth as well as nutrient intake.

**Sharma-SK, Singhal-RM, Samra-JS, Banerjee-SP, Singh-K, Sharma-SD. 1988. Study of some difficult sites of Siwalik Forest Division with respect to their management. Vana-Vigyan. 26: 1-2.** Performance of *Tectona grandis*, *Eucalyptus tereticornis* and a mixed plantation of *Acacia catechu*, *Morus alba* and *Dalbergia sissoo* in poor soils is discussed. *E.tereticornis* showed the best growth.

**Shimizu-JY. 1986. Suitability of species and provenances of Eucalyptus for reforestation on the Rio Grande do Sul plateau, Brazil. Boletim de Pesquisa Florestal, Centro Nacional de Pesquisa de Florestas, EMBRAPA-Brazil No.12.** A study of height growth and survival at 7 and 9 year old plantations of different *Eucalyptus* spp. was carried out. Species suitable for timber production and for soil conservation in marginal areas of the region, are recommended.

**Shingi.P.M, Seetharam SP. Satan's Eucalyptus; a case study of Mr. Vinayak Rao Patil. FORSPA Library.** Patil believes that after the successful milk and sugar cane cooperatives, *Eucalyptus* spp. cooperatives would be the third major step in the history of agro-processing through large-scale cooperatives in India. The venture was taken up to utilise fallow lands and areas under unprofitable agriculture. The produce will be utilised in a paper factory to be set up. Since then 22 cooperatives have been formed in other Districts on the same lines in Maharashtra.

**Shiva-MP et al. 1988. Role of Eucalyptus and Agroforestry and Essential Oil Production Potential. Indian Forester-Vol.114, November 1988.** Field data reveal that growth

and yield of plants of the graminaceae family, including paddy and aromatic grasses, improve by adding eucalypt leaf litter.

**Shivaprakash,-AR; Gowda,-MVS. 1992. Comparative economics of eucalyptus, casuarina and ragi. Agricultural-Situation-in-India. 46: 12, 931-933; 8 ref., 3 tab.** This paper examines the economic viability of *Eucalyptus* and *Casuarina*, spp. compared with a competing field crop, (millet), in the dry tracts of Karnataka. The results suggest that all three are viable with *Eucalyptus* spp. performing better than its perennial counterpart *Casuarina* spp. which did not fare any better than millet.

**Shrivastava-MB. 1988. Economics of agro-forestry in Indo-Gangetic alluvium of Uttar Pradesh. Indian-Journal-of-Forestry. 11:4.** A case study in Kanpur, India of a trial under an agro-silvicultural system with eucalypts and a mixture of agricultural crops. The trees are to be harvested in 6 year cycles and the inter-cropping is to be carried out during the first 3 years. The cost/benefit ratio is expected to be about 4.0. The system also generates employment.

**Shukla.SK. Eucalyptus for planting Extension series, No.4, Forest Research Institute, Dehra Dun.** Water use by *Eucalyptus* spp. is compared with species of other genera: it is found to be the lowest in case of *Eucalyptus* hybrid. The paper gives details on planting of *Eucalyptus* spp. in arid regions in Iraq, Jordan, Morocco, Libya and Israel, as well as brief notes on large scale plantations of *Eucalyptus* spp. in Spain, Portugal, Brazil, Argentina, Chile, Uruguay, South Africa, Madagascar, India and China. Qualities of *Eucalyptus tereticornis* as timber and other uses are described.

**Shumacher, M.V.; Poggiani, F.; Simões, J.W. 1994. (Nutrient translocation from the canopy to the soil by leaf-fall stands of *Eucalyptus camaldulensis*, *E. grandis* and *E. torelliana*.) Transferências de nutrientes das copas para o solo através da deposição de folheto em povoamentos de *Eucalyptus camaldulensis*, *E. grandis* e *E. torelliana*. IPEF, Piracicaba (47):56-61.** Nutrient translocation from the canopy to the soil in three pure stands of *E. camaldulensis* (7 yrs old), *E. grandis* (7-yrs old) and *E. torelliana* (10-yrs old) was studied for two years. The stands are located in the central part of São Paulo state on poor sandy soil. The three *Eucalyptus* spp. showed different periods of high leaf-fall. *E. camaldulensis* stand produced an annual leaf-fall of 7.2 t/ha, *E. grandis* produced only 3.1 t/ha and *E. torelliana* produced 5.8 t/ha of leaf-litter. *E. grandis* showed the best increment, however returned the lowest amount of nutrient to soil. (In Portuguese).

**Shyam Sunder. S, Parameswarappa-S. 1987. Social forestry in Karnataka. Economic and Political weekly, November 21, 1987.** Various data are presented on the social forestry programme, and the continuing controversy over eucalypts planting is discussed.

**Shyam Sunder.S 1988. Eucalyptus experiment: Brazil. Indian Forester 114:12.** *Eucalyptus* spp. were introduced to Brazil about 150 years ago but planting increased since 1966 due to tax incentives and the development of clonal production of rooted cuttings. The paper describes the Silvicultural practices used by the Aracruz Florestal Pulp Company.

**Shyam Sunder.S, and Parameshwarappa. S. 1987. Forestry in India: the Forester's view. Ambio Vol 16, No 6.** Development of forest management in India is described. The

present situation of ecological degradation is analysed. The efforts to contain the problem through Social Forestry Programme are explained.

**Siddiqui,-KM. 1991. *Financial analyses of different types of tree plantations in Pakistan. Pakistan-Journal-of-Forestry. 41: 2, 60-68; 7 ref.*** Financial analyses were carried out for 5 multipurpose tree species (poplar, *Populus deltoides*; shisham, *Dalbergia sissoo*; mulberry, *Morus alba*; babul, *Acacia nilotica*; and *Eucalyptus camaldulensis*) planted in the form of both linear and block plantations on irrigated plains (state owned) and private farmlands throughout the country.

**Silva-JM-Barata-da. 1959. *The fuelwood problem in the Mozambique tea-growing zones. Gazeta do Agricultor, Lourenco Marques 11 (119).*** *Eucalyptus* spp. are considered to be the answer to the fuel problem in the tea-growing areas of the upper Zambesi in Mozambique. Technical instructions for plantation establishment and recommendations for the selection of species are given for the individual undertakings in Socone, Gurue Milange and Tacuane.

**Silva-Pando, FJ; Gonzalez-Hernandez, MP. 1992. *Agroforestry helps prevent forest fires. Agroforestry-Today. 4: 4, 7-8; 7 ref.*** A brief account is given of the introduction of livestock into reforestation areas in Spain (dominated by *Eucalyptus globulus*, *E. linearis*, *E. obliqua*, *Pinus pinaster* and *P. sylvestris*), as a means of both increasing meat production and clearing undergrowth in order to reduce fire risk. Effects on the ecology and on soil are summarized, and early results suggest that the silvo-pastoral use of plantations is compatible with wood production and may help prevent fires.

**Simoës-JW, Brandi-RM, Malinovsky-JR. 1976. *Establishment of forests with fast-growing species. FAI-Report No. PNUD/FAO/IBDF/BRA-45, Serie Divulgacao 6*** An illustrated account of the silvicultural techniques adopted by forestry enterprises engaged in afforestation work in Brazil with special emphasis on afforestation with *Eucalyptus* spp. and *Pinus* spp.

**Singh Harswarup. 1988. *Comparative Economics of trees and crop production in Haryana. Indian Journal of Agriculture Economics Volume 43 - No. 3*** The paper suggests that the farmers should be encouraged to plant *Eucalyptus* and *Populus* spp. along field boundaries to earn higher returns and meet the deficit of forest products in that state.

**Singh,-AK; Gupta,-BN. 1993. *Biomass production and nutrient distribution in some important tree species on Bhata soils of Raipur (Madhya Pradesh), India. Annals-of-Forestry. 1: 1, 47-53; 16 ref.*** On the basis of the results obtained, it is suggested that the most suitable species for planting on waste land soils are *Phyllanthus emblica*, *Acacia auriculiformis* and *Eucalyptus tereticornis*, since their growth is good and their nutrient requirements are relatively low; *Hardwickia binata* grows well but contains relatively more nutrients, and *Tectona grandis* and *Dalbergia sissoo* grow poorly.

**Singh,-D.; Kohli,-R.K. 1992. *Impact of Eucalyptus tereticornis Sm. shelterbelts on crops. Agroforestry Systems 20(3) p. 253-266.*** The yield of chickpeas (*Cicer arietinum*), lentils (*Lens esculentum* [*L. culinaris*]), wheat (*Triticum aestivum*), cauliflower (*Brassica oleracea*), berseem (*Trifolium alexandrinum*) and toria (*B. campestris*

var. *toria*) in shelterbelts of *E. tereticornis* in agricultural fields at 3 sites in Chandigarh, India, was reduced by more than half. Among the crops under study, the yield of chickpeas was mostly reduced. The content of soil phytotoxins (allelopathins) in different soil samples was measured. The study concluded that the poor performance of crops in the sheltered area is related to an allelopathic effect of the shelterbelts of *E. tereticornis*.

**Singh,-SB; Pramod-Kumar; Prasad,-KG; Kumar,-P. 1993.** *Potential water requirement of Eucalyptus - a preliminary study. Indian-Forester. 119: 7, 549-552; 4 ref.* Responses to mulching and irrigation of *Eucalyptus tereticornis* seedlings are studied. Nearly all mulching treatments increased biomass production over the control value. Biomass production decreased with decreasing irrigation, but water use efficiency increased. Nearly all mulching treatments increased water use efficiency, following a similar pattern to that shown in biomass production.

**Singhal, RM; Rawat, JK. (eds) 1990.** *Effects of growing eucalyptus. ICFRE, Dehra Dun.*

**Singhal,-RM; Pokhriyal,-TC; Laxmi-Rawat; Ramola,-BC; Bisht,-MS; Rawat,-L. 1990.** *Investigating soil moisture under Eucalyptus and other species using neutron probe moisture meter. Indian-Journal-of-Forestry. 13: 3, 199-206; 10 ref.* The paper presents the study of soil moisture status under plantations of *Eucalyptus* sp., chir (*Pinus roxburghii*), sal (*Shorea robusta*), and in treeless (fallow) areas. Soil moisture content was greatest under *P. roxburghii* and lowest under *Shorea robusta*. The fallow land had minimum moisture due to a low retention capacity. The nature of the litter added by the different forest types to the soil is suggested as the probable cause for this variation. Of the 2 broadleaved species, *Eucalyptus* produced a more favourable type of humus capable of modifying soil structure and retaining soil moisture.

**Singhal-PM. 1986.** *Effect of growing eucalypts on the status of solid organic matter of Dehradun Forest. in: Eucalypts in India : Past, Present and Future KFRI PG Kerala.* The study carried out in West Dehradun Division in Uttar Pradesh shows that the content of organic matter in the soil was more under Sal than of *Eucalyptus* spp. The quantity of organic matter humified was more under *Eucalyptus* spp. The chances of loss of organic matter in case of *Eucalyptus* spp. was considerably reduced. The chemical composition of humified and non-humified residues is compared.

**Singh-SB, Prasad-KG, Gupta-GN, Subramaniam-V. 1988.** *Causes of decline of Eucalyptus grandis in Nagaramara Range, Kerala: a survey note. Journal of Tropical Forestry, 4:3.* Data are presented on the growth of 8 plantations of *E. grandis* (2-17 year-old) at 4 sites identified as having good, average and poor growth, and high mortality in relation to the soil characteristics of each site. Remedial measures are suggested.

**Singh-SP (1981).** *Fuelwood as energy source. Indian-Forester. 107:12* Increased use of smallwood for pulp and board manufacture has caused a major fall in the volume of fuelwood available from commercial plantations in India and has made it necessary to establish fast growing fuel plantations all the more urgent.

- Someshwar Shiv Sharan. 1991. Community and Social Forestry in Kolar, India. in: John Friedman (Ed) - Environmental action in the third world - 1993, Kumarian press.** Social aspects of eucalypts cultivation in Kolar are discussed.
- Somyos Kijkar. Producing rooted cuttings of *E. camaldulensis*. Canada Forest Tree Seed Centre, Muak Lik, Thailand** Through clonal forestry the yield of *E. camaldulensis* has been increased from 16-22 m<sup>3</sup>/ha/yr to 45 m<sup>3</sup>/ha/yr. In better areas with high soil moisture, a maximum of 80 m<sup>3</sup>/ha/yr is expected. The paper recommends changing dependence on seedlings and implementing clonal forestry.
- Soni-P, Naithani-S, Mathur-HN. 1985. Infiltration studies under different vegetation cover. Indian-Journal-of-Forestry. 8:3** Infiltration rates were measured in Uttar Pradesh under plantation of chir (*Pinus roxburghii*) teak, sal, eucalypts, bamboos and in ungrazed but cut grassland. Infiltration rate was highest below *Eucalyptus* spp. and lowest below *Pinus* spp. after burning.
- Sood-VK, Karnik-MG, Narain-H .1964. Studies in oils of Indian *Eucalyptus citriodora*. Indian Forester 90:3** This study gives comparative data for oils derived from Australia and from three sites in India (Madras, Naini Tal and Dehra Dun). All Indian specimens had a high citronellal content.
- Sorrentino F., A. 1990. Rendimiento de especies forestales exóticas en el Uruguay. Univ. de la Rep., Facultad de Agronomía. Boletín de Inv. n° 27. Montevideo. Uruguay** A paper presenting tables on average yield rates of *Pinus* and *Eucalyptus* spp., at the national level. Among the latter, *Eucalyptus globulus*, *E. grandis*, *E. camaldulensis*, *E. tereticornis*.
- Sorrentino F., A. 1991. Indices de sitio preliminares para las principales especies forestales, cultivadas en el Uruguay. Univ. de la Rep., Facultad de Agronomía. Boletín de Inv. n° 33. Montevideo. Uruguay.** A first classification on volumetric yields of the main exotic forestry species, among them *Eucalyptus* spp. are included in this paper.
- Souleres, G. Sur les aménagements forestiers en Afrique de l'ouest soudano-sahélienne. Revue Forestière Française 1991. 43 (2): 163-174** An assessment of forestry programmes carried out since the 1960s in semi-arid areas in Western Africa. The author confirms that these programmes failed both, in reducing deforestation rates, and in producing a significant quantity of fuelwood energy. Such failures are particularly attributed to the fact that the programmes ignored local practices; local population needs; forestry dynamics and a deceiving performance of fast-growing species such as *Eucalyptus* spp.
- Souto, X.C.; González, L.; Reigosa, M.J. 1993. Estudio de los efectos alelopáticos producidos por partes aéreas de distintas especies arbóreas (*Eucalyptus globulus*, *Acacia melanoxylon*, *Quercus robur*, *Pinus radiata*) en descomposición en el suelo. Congreso Forest. Español. Lourizán, I: 189-194. España.** Trials with recently fallen leaves were carried out. The process involved burying leaves under topsoil at variable periods of time, and further extracting them with the help of water during 24 hours. The paper concludes that allelopathic effects may be produced due to decomposition of residues of these species. It must be noticed that *Eucalyptus* and *Acacia* spp. residues have a high allelopathic potential. Residues of *Quercus* and *Pinus* spp. have scarce or no toxic capacity.

**Souvannavong-O 1992. Development high yielding clonal plantations of *Eucalyptus* hybrids in the Congo. in: Rapid propagation of fast growing woody species. Proceedings of a symposium held in 1989 (Edited by Baker, F.W.G.) 1992, C A S A F A Report Series No. 3 Wallingford, UK, CAB International.** A brief account of the influence of rapid mass vegetative propagation techniques in developing large-scale clonal plantations for production of pulpwood, poles and fuelwood in the coastal savanna surrounding Pointe Noire in the Congo. Topics include: species and provenance selection; clonal utilization of interspecific *Eucalyptus* spp. hybrids (the technique for successful rooting of shoot cuttings is described); and breeding programmes.

**Spaak, J. D. Boiser les Iles du Cap-Vert - pourquoi, comment, pour qui? Bois et Forêts des Tropiques 1990. (No 225): 47-54 (13 ref.)** Twelve thousand hectares of land have undergone reforestation since 1978 thanks to the financial support to fight ecological degradation, restore water and soils and develop forest and fodder production. Nevertheless, the future of these reforested areas seems to be uncertain due to continuous increase in the number of cattle, sheep and goats.

**Srinivasan,-VM; Subramaniam,-S; Rai,-RSV. 1990. A note on allelopathy and tree age up to which intercropping is feasible. Journal of Tropical Forest Science. 3: 1, 89-92; 11 ref.** This note presents data from inter-cropping experiments with 3 multipurpose trees (*Eucalyptus tereticornis*, *Casuarina equisetifolia* and *Leucaena leucocephala*) and 11 agricultural crops (sunflowers, cotton, green gram, sesame, sorghum, cowpeas, soybeans, turmeric, maize, black gram, groundnuts), carried out at the Forest Research Station at Mettupalayam, Tamil Nadu.

**Srinivasan-K, Ramasamy-M, Shantha-R. 1990. Tolerance of pulse crops to allelochemicals of tree species. Indian-Journal-of Pulses-Research. 3:1.** In a pot experiment in 1988-89, *Vigna mungo*, *V.radiata*, cowpea, pigeonpea and soybean were grown for 30 days in topsoil taken from under *Eucalyptus tereticornis*, *Casuarina equisetifolia*, *Leucaena leucocephala*, and *Acacia holosericea*. Topsoil from under all 4 tree species reduced crop germination and growth. *E.tereticornis* had the greatest inhibitory effect. Soyabeans were the most sensitive crop. Soybean germination in topsoil from under *E.tereticornis* was 69 percent of germination in control plants and dry matter production was reduced by 10 percent. Cowpeas were the most tolerant crop.

**Srinivasan-VM, Subramanian-S, Rai-RSV. 1990. Studies on intercropping with multipurpose trees-resource sharing ability of the trees. in: Advances in Casuarina spp.research and utilization. Proceedings of the Second International Casuarina Workshop, Cairo, Egypt, January 15-20, 1990 (edited by El-Lankany, M.H; Turnbull, J.W.; Brewbacker,J.L) 1990., Cairo, Egypt; Desert Development Center, American University in Cairo.** Eleven agricultural crops were interplanted with 3 multipurpose tree species (*Eucalyptus tereticornis*., *Casuarina equisetifolia* and *Leucaena leucocephala*) under rain fed condition. By the time the trees were 32 months old, yield of all intercrops was severely inhibited with greatest reduction in *L. leucocephala* and least in *C.equisetifolia*. The yield reduction is attributed primarily to reduced light transmission.

**Srivastav, AK. 1993. Change in physical and chemical properties of soil in irrigated eucalyptus plantation in Gujarat State. Indian Forester.**

- Srivastava-RJ, Misra-CM. 1987. Behavioural study on water uptake by different forest species. Indian-Journal-of-Forestry, 10.2.** While slow-growing species consumed less water than fast-growing ones, on the basis of dry weight production, efficiency of the fast-growing species was higher. *E.tereticornis* was found to be most efficient and *P.pinnata* the least. The studies limited to the first year of planting only.
- Sterk-A, Ginneken-P Van. 1988. Cost benefit analysis of forest plantations in a watershed in north eastern Thailand. in: Multipurpose tree species for small farm use. I D R C and Winrock International Institute for Agriculture Development.** An economic analysis of integrated development is presented. This refers to areas encroached for cultivation of cassava where Government is keen to establish reforestation. The data indicate that forest plantations can compete with cassava in terms of net present value, return to labour and employment generation.
- Stewart-HTL, Allender-E, Sandell-P, Kube-P. 1986. Irrigation of tree plantations with recycled water 1. Research Developments and case studies. Australian-Forestry. 49:2.** Successful use of recycling municipal effluent is described. Species used were *Populus* spp. for timber production, *Eucalyptus grandis* and *E.camaldulensis* for fuelwood production.
- Stewart-HTL, Hopmans-P, Flinn-DW. 1990. Harvesting effects on phosphorus availability in a mixed eucalypt ecosystem in southeastern Australia. Forest Ecology and Management 36: 2-4.** Indigenous *Eucalyptus* spp. forests in the foothills of eastern Victoria are being managed for sustained production of hardwood timbers on at least 80-year rotations. The likely effects of intensive harvesting on soil phosphorus results were investigated. The combined losses from harvesting and burning represented 18 percent of the accessible phosphorus. It was concluded that these eucalypt ecosystems could be intensively harvested for at least 5 rotations before a measurable change in site productivity would be detected as a result of P depletion.
- Stewart-HTL, Lingen-SA-Van-der, Van-der-Lingen,SA 1988. Soil chemical properties under miombo woodland and eucalypt plantation on Kalahari sand in Zimbabwe. East African Agricultural and Forestry Journal Publ. 1990., 52:4.** *Eucalyptus camaldulensis*, *E.resinifera* and *E.tereticornis* had been established over 60 years and harvested by regenerated coppice on five occasions. Soils at both sites were strongly acidic and infertile. Although there was evidence of some depletion of N and P at the site, foliar nutrient levels were satisfactory and growth of the fifth coppice crop was vigorous, thus showing the suitability of eucalypts for afforestation on infertile soils such as Kalahari sand.
- Stewart-HTL, Salmon-GR 1986. Irrigation of tree plantations with recycled water 2. Some economic analyses. Australian-Forestry. 49:2.** Analyses in terms of economic costs of tree plantations irrigation with effluent are presented for 3 Australian case studies. The species were *Pinus radiata* for sawlogs, *Populus* spp. for peeler logs, and *Eucalyptus grandis* for firewood. If costs of land and irrigation are charged, the first two are profitable at low interest rates which is not the case with *E.grandis*.
- Stocking Michael. 1993. Eucalyptus - Cardamom system in Sri Lanka. Agroforestry Today, March 1993.** The article describes the combination of *Eucalyptus grandis* and Cardamom in a degraded tree site. The system is a success both financially and from the point of view of prevention of soil loss.

- Street,-DR. 1992. Haitian tree farm financial case studies. Financial and economic analyses of agroforestry systems: proceedings of a workshop held in Honolulu, Hawaii, USA, July 1991 [edited by Sullivan, G. M.; Huke, S. M.; Fox, J. M.]. 1992, 222-237; 9 ref. Paia, USA; Nitrogen Fixing Tree Association (NFTA).**
- Sugiyama-T. 1986. Change of water level and condition of ecology in the arid area by plantation. in: Rangelands: a resource under siege. Proceedings of the 2nd International Rangeland Congress, Adelaide, Australia, 13 May 1984. 1986., 69 Canberra, Australia; Australian Academy of Science.** The paper reports a case in Punjab, India, in which Landsat images showed that *Eucalyptus* spp. plantations, established in 1963, had changed the subsurface water level, which in turn had converted the arid area to arable land. The paper suggests that *Eucalyptus* spp. plantations if properly planned can be a counter-measure against desertification.
- Sun,-D; Dickinson,-G. 1993. Responses to salt stress of 16 *Eucalyptus* species, *Grevillea robusta*, *Lophostemon confertus* and *Pinus caribaea* var. *hondurensis*. *Forest-Ecology-and-Management*. 60: 1-2, 1-14; 19 ref.** Of all the species studied, *Eucalyptus drepanophylla*, *Eucalyptus argophloia*, *Eucalyptus camaldulensis* and *Eucalyptus robusta* were the most salt-tolerant ones while *Eucalyptus cloeziana* and *Eucalyptus pilularis* were the least.
- Sundara Raju.R, ChinnaThurai.AK, Vijayakumar.R. 1991. Application of fertilizer and micro-nutrients on *Eucalyptus tereticornis* and *Eucalyptus camaldulensis* nursery. *Indian Forester*, December, 1991.** Application of fertilizer and micro-nutrients based on analysis of soil would reduce the maintenance period of seedlings in nursery resulting in savings.
- Suresh-KK, Rai-RSV. 1988. Allelopathic exclusion of under storey by a few multipurpose trees. *International Tree Crops Journal*. 5:3.** The floristic composition and biomass of weed species in the understorey was assessed in woodlots of 3-4 year-old multipurpose tree species. Compared with 28 species of ground cover found in the open, *Leucaena* spp. harboured only 5, *Eucalyptus tereticornis* 12, and *Casuarina* spp. 18. Conclusions are that these effects are due to reduced light transmission.
- Tanji,-KK; Karajeh,-FF. 1992. Feasibility of agroforestry systems to reduce problem agricultural drain waters. Proceedings 16th ICID European regional conference Vol.2. Ecological, technological and socio-economical impacts on agricultural water management. 1992, 385-392; 3 ref. Budapest, Hungary, International Commission on Irrigation and Drainage.** The paper presents data on soil water and salt fluxes in a tile-drained 9 ha *Eucalyptus* spp. plantation in San Joaquin Valley, California. The tree plantation was successful in lowering the water table from 0.6 to 2.3 m and reducing the consumptive use of the saline irrigation water. After several years of drainwater reuse, salinity and boron have increased throughout the soil profile to the extent that the trees cannot extract the available soil water fully. The estimated leaching fraction (16 percent in the 1990 irrigation season) will need to be increased.
- Tapia Bodega, G. 1993. Problemas jurídicos que originan las plantaciones de eucaliptos. *Congreso Forest. Español. Lourizán, IV: 744-480. España.*** This paper concludes that forestry activities carried out with *Eucalyptus* spp. are different from those with traditional plantations and require special legislation due to increasing extension,

thus requiring regulation with clear and realistic criteria devoid of excessive politicised positions.

**Tejada Arana, M.; González Mora, E. 1989. Obtención de pulpa de *Eucalyptus globulus* mediante procesos al sulfato y a la sosa con antraquinona. *Revista Forest. del Perú*, 16 (1): 47-54. Facultad de Cienc. Forest. Lima. Perú. (IF Forest Products Abstracts, 1991, 014-02089).** Paper pulp processing using sulphate or soda with different dosages of antraquinone is presented here. Adding this compost produces a significant increase in production: 53 percent up to 55 percent. Yet tearing and ripping characteristics also increase.

**Thapliyal-GB. 1986. Performance of eucalypt plantations in the State of West Bengal with special reference to the laterite tract. in: *Eucalypts in India : Past, Present and Future Kerala Forest Research Institute, Peechi, India*** There are extensive wastelands and degraded forests in the laterite tracts of W. Bengal. Efforts with indigenous species to afforest these areas since 1948 had failed. *Eucalyptus* spp. hybrid and *Acacia auriculiformis*, tried initially in 1957 gave good results. These species are now used on a large scale.

**Theagarajan-KS, Prabhu-VV. 1981. Complete tree utilization of a fast growing species: *Eucalyptus hybrid*. *Journal of the Indian Academy of Wood Science.*, 12:2.** Potential uses of foliage and bark wastes of *Eucalyptus* ('Mysore') hybrid in southern India for the production of cineol and oxalic acid respectively (see FA 32, 1789, FPA 1, 1253) are discussed. Only certain strains are cineol-rich and these are being successfully grown through vegetative propagation at the authors' laboratory.

**Thompson-K .1970. The Australian fever tree in California; *Eucalyptus* and malaria prophylaxis. *Annals of the Association of American Geographers* 60 (2), (230-44)** Discusses the planting of *Eucalyptus* spp. in California from the middle of the 19th century, for various purposes, including timber and fuel, windbreaks and recreation purposes, and, especially, in the hope that eucalypts (particularly *Eucalyptus globulus*), would diminish the serious malaria problem in the country.

**Thongmee-U, Vannaprasert-M. 1990. Soil and water losses on plots with different land use in the Phu Wiang watershed. *Research needs and applications to reduce erosion and sedimentation in tropical steeplands* (edited by Ziemar R.R; O'Loughlin, C.L.; Hamilton, L.S) IAHS-Publication. No. 192.** Soil loss in slopes of 8 to 10 percent was greatest on the bare soil and smallest on the forest plantations including under *Eucalyptus* spp. Similarly, the runoff was greatest on the agroforestry treatment and smallest on the forest plantation.

**Thorburn,-PJ; Hatton,-TJ; Walker,-GR. 1993. Combining measurements of transpiration and stable isotopes of water to determine groundwater discharge from forests. *Journal of Hydrology Amsterdam*. 150: 2/4, 563-587; 34 ref. Paper presented at the International Symposium on Forest Hydrology, Canberra, Australia, 22-26 November 1993.** The groundwater discharge fluxes from *Eucalyptus* spp. forests were determined on the floodplain of the River Murray, South Australia, underlain by a shallow saline unconfined aquifer. The groundwater was used by the forests despite its salinity and made up 100 percent of transpiration in more than half of the measurements and 40-80 percent in the rest. *E. largiflorens* at one site and *E. camaldulensis* at all sites tended to take up shallow soil water and groundwater

simultaneously but at the driest sampling time the groundwater was the only water source. Trees at the remaining *E. largiflorens* sites generally relied solely on groundwater.

**Tianyu-HU. 1990. *Eucalyptus* plantation along 4 sides in Aichuan. Royal Forest Department, Thailand.** The principle of shelterbelt planting where eucalypts improve the environmental conditions and produce firewood and timber is explained.

**Tiwari D.N. 1992. *Monograph on Eucalyptus* Surya publications, Dehradun, India.** A comprehensive book dealing with all aspects of eucalypts both in Australia and in different countries of the world.

**Toky O.P, Bisht R.P and Arya. S. 1992. *Growing of Eucalyptus in India: An ecological perspective.* FORSPA - Bangkok.** Reviews information on species-site reaction, growth performance, production, nutrient cycling, water consumption and soil fertility in different age plantations of eucalypts, other exotics and indigenous species.

**Toledo-PE-de-N, Yamazoe-G, Moraes-JL-de. 1986. *Cost/return analysis of eucalypt production on a farm property.* Boletim Tecnico do Instituto Florestal Sao Paulo, 40A:2.** A paper presented at V Brazilian Forest Congress, Olinda, 1986, comprising a comparison of investment over 24 years in 2 management systems; selective thinning of *Eucalyptus citriodora* (at 8, 12, 16 and 20 yr with final felling at 24 yr); and short rotation (coppice) management of *E.urophylla* felled at 6, 12, 18 and 24 yr. Coppice management had the greater internal rate of return and shorter payback period (6 yr compared with 16 yr for the thinning system), but selective thinning showed a higher benefit/cost ratio.

**Tomar,-V.P.S.; Narain,-P.; Dadhwal,-K.S. 1992. *Effect of perennial mulches on moisture conservation and soil-building properties through agroforestry.* Agroforestry Systems, 19(3) p. 241-252.**

**Tomboc-CC. 1978. *Growth yield and economic rotation of bagras (Eucalyptus deglupta) pulp timber in the PICOP plantations (Mindanao) Part 3; Economic rotation.* Sylvatrop. 3:2.** Using the net present value method and the author's version of Faustmann's formula at 18 percent rate of interest, economic rotations were 10 years for the better sites and 11 years for the poorer sites. The present value and the land expectation value for the stands are given. The effects of accessibility, site quality and rate of interest on the length of rotation are discussed.

**Toral Ibañez, I.; Rosende B., R.; Pablo B., G. de. 1988. *Evaluación de raleos en monte bajo de Eucalyptus globulus (Labill.). V región. Ciencia e Inv. Forest., 5: 1-11.* Instituto Forestal, Santiago. Chile. (FA, 1991, 052-05327).** Responses to thinnings at different points were measured: a) top thinning, b) lower thinning or c) no thinnings, in a coppice stand in the coastal central region. Both thinning treatments removed 30 percent of trees. The highest increase percentage is produced when the basal area is 9.9 m<sup>2</sup>/ha.; with lower basal areas at 7.2 m<sup>2</sup>/ha., growth does not exceed controlled growth. Absolute volume production, total biomass, firewood production and cineol were higher in (b) and (c) than in (a).

- Toral Ibañez, M.; Rojas Vergara, P. 1988a. Resultados preliminares en fertilizaciones de apoyo para *Eucalyptus globulus*. *Ciencia e Inv. Forest.*, 2 (5): 45-56. Santiago, Chile.** Two fertilization trials carried out in recently established *E. globulus* plantations are analysed by testing different dosages of urea, triple superphosphate, potassium sulphate, boronatrocalcite and boric acid. One area obtained good results with nitrogen and phosphorous and a second one treated to nitrogen produced the best results. Soil analysis during these trials is not provided.
- Trivedi-SN. 1986. Financial appraisal for some afforestation species in Bihar (India) under the risk of illicit felling. *Forest Ecology and Management*. 17:4.** Major afforestation schemes in the State of Bihar consist of coppicing of degenerated natural forests, mainly *Shorea robusta*, and raising plantations of various species (mainly *Eucalyptus* spp. hybrid and *Dalbergia Sissoo*) at a spacing of 2 x 2 m. A detailed financial analysis was separately made for the 3 species, while management options are discussed regarding rotation choices for each species under the risk of illicit felling.
- Trouve,-C; Mariotti,-A; Schwartz,-D; Guillet,-B. 1994. Soil organic carbon dynamics under *Eucalyptus* and *Pinus* planted on savannas in the Congo. *Soil Biology and Biochemistry*. 26: 2, 287-295; 29 ref.** The study of soil organic matter dynamics (SOM) in Congo's savanna, on ferralic arenosols, showed that with time, the SOM inherited from the savanna disappeared with a half-life of 16.5 yr, illustrating the rapid SOM turnover of savanna ecosystems in this kind of soils. The fraction of organic C of tree origin increased linearly with time, with an annual increment of 0.3 mg C/g, but this could not be extrapolated over more than 30 yr. Models predicted that after 30 years soil organic carbon would contain 1.8 mg C/g of savanna origin and 9.4 mg C/g of tree origin.
- Turner-J, Lambert-M. 1986. Effects of forest harvesting nutrient removals on soil nutrient reserves. *Oecologia*. 70-1.** Intensive harvesting of native *Eucalyptus* spp. forest is carried out in the Eden area in SE coastal region of New South Wales, Australia. Based on typical forest harvesting systems, it was found that 3-4 kg P would be removed per ha. Due to equilibrium between the various soil P components, depletion would not be solely from the more available pools. It is expected that at least 4 forest rotations (320 yr) would be required before any detectable changes would occur within forest communities.
- Tuset, R.; García Taibo, R. 1987. Producción de durmientes de eucalipto. *Boletín de Investig.*, 4: 33 pp. Facultad de Agron. Montevideo. Uruguay. (IF Forest Products Abstracts, 1991, 014-00253)** Trials were carried out during 1967-70 to identify felling and drying methods of *E. globulus*, *E. camaldulensis* and *E. umbellata*, to produce girders.
- Uchimura-E. 1986. Green shelterbelts and afforestation in semiarid zones: a case study of Nigeria. *Tropical Forestry*. No.5.** Species recommended for shelterbelts include *Acacia albida*, *A.nilotica*, *A.senegal*, *Azadirachta indica*, *Cassia siamea* and *Eucalyptus camaldulensis*. For each of these species the conditions required and notes on their cultivation in shelterbelts are given. The wider range of species available for use in less arid areas is also discussed.

- Uhart.E. 1975. *Charcoal in the Sahelian zone. 13 pp. Addis Ababa, Ethiopia; United Nations Economic Commission for Africa.*** Suggestion is made to increase plantations with fast-growing species such as *Eucalyptus* spp. for meeting the fuelwood needs in the Sahel, where natural forest areas have been drastically reduced due to fuelwood cutting for charcoal making.
- Ubrig-H. 1990. *Yield expectation of Eucalyptus saligna in the Hararghe Highlands, Ethiopia. Beitrage zur Tropischen Landwirtschaft und Veterinarmedizin. 28:4.*** Ball-rooted *Eucalyptus saligna* was planted at 1 x 1 m spacing on a fluvisol, and on a badly degraded regosol for production of building poles. The results showed that on good fluvisol site, building poles can be obtained with a systematic thinning after 1 1/2 years. The rotation for this assortment would be 4 years. Annual increment was more than 60 m<sup>3</sup>/ha wood. Production was poorer on the regosol and the rotation must be extended to 6 or 7 years.
- Valeri,-SV; Corradini,-L; De-Aguiar,-IBTI. 1991. (Effects of NPK and dolomitic lime levels on Eucalyptus grandis wood volume production). Efeitos de niveis de NPK e calcario dolomítico na producao volumetrica de madeira de Eucalyptus grandis Hill ex Maiden. Cientifica-Jaboticabal. 1991, 19: 1, 63-70; 13 ref.** The effects of ammonium sulphate, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and dolomitic lime were studied on 4-yr old *Eucalyptus grandis*. Application of N and P did not significantly affect volume production. Application of K<sub>2</sub>O increased volume production, as did application of lime. (In Portuguese).
- Valeri,-SV; Aguiar,-IB; Corradini,-L; Alvarenga,-SF. 1993. The effects of phosphorus and dolomitic lime on the production and volumetric conversion factors of Eucalyptus grandis wood. South African Forestry Journal. No. 164, 55-57; 4 ref.** Stacked wood volume, dry wood weight, stem form, bark thickness and stacking factors of 8-yr old *E. grandis* were measured. There was a linear effect of increasing lime on the volume of stacked wood and wood weight. Application of 400 kg P<sub>2</sub>O<sub>5</sub>/ha resulted in a smaller bark percentage than no fertilizer application. There were no significant effects of P or lime on stem form or stacking factors.
- Vales, C. 1989. Política forestal e conservación dos recursos biolóxicos. V Xornadas Agrarias Galegas, 1987, 335-353. Xunta de Galicia. España.** The main concern expressed by the author is focused on plant and animal species conservation, while production remains in subordinate position.
- Valette, J.C. Inflammabilités des espèces forestières méditerranéennes. Conséquences sur la combustibilité des formations forestières. Revue Forestière Française 1990. (No spécial):76-92 (13 ref.)** In order to assess fire risks in Mediterranean forests, laboratory tests on flammability of leaves at different ages and development stages were carried out. Results are given for graminaceae, shrubs (*Calluna*, *Cistus* spp..) and 15 tree species (including *Quercus*, *Pinus*, *Acacia*, *Cupressus* and *Eucalyptus* spp.). Both *Eucalyptus* spp. tested: *Eucalyptus dalrympeana* and *E. macarthurii* present a degree of flammability ranging from high to very high.
- Vandana Shiva, Bandopadhyay-J. 1987. Ecological data of Eucalyptus cultivation. Research Foundation for Science and Technology, Dehradun.** The paper states that fall in production of Ragi due to *Eucalyptus* spp. planting has been detrimental to the poor rural people in Kolar. *Eucalyptus* spp. is unsuited for areas receiving less than 700

mm rainfall and, being an ecological destabilizer it causes desertification in arid areas.

- Vandana Shiva, Bandyopadhyay-J, and Jayal ND. 1985. *Afforestation in India: problems and strategies. Ambio. 14:6.*** A discussion covering current practices, the potential for afforestation of wastelands and social forestry including the example of Karnataka. Authors feel that free distribution of seedlings led to the extension of *Eucalyptus* spp. plantations on private land previously used for food crops.
- Vandana Shiva, Sharatchandra and Bandyopdyay-J. 1981. *Social, Economic and Ecological impact of social forestry in Kolar. Indian Institute of Management, Bangalore.*** The authors consider that by promoting eucalypts, social forestry has only benefited the rich and the industries at the cost of the poor, because *Eucalyptus* spp. are useless except as industrial raw material. Tree planting in ragi fields has reduced the yield of ragi, increasing its price. This, coupled with resultant unemployment has led to distress and social unrest.
- Vandana Shiva, Somashekar Reddy ST, Bandopadhyay-J. 1984. *Ecology of Eucalyptus and farm-forestry policy in rainfed areas. Indian Statistical Institute, Bangalore - 1.*** The paper argues against use of exotics and states that *Eucalyptus* spp. cultivation is ecologically destructive.
- Vandana Shiva. 1991. *Afforestation programmes and landuse conflicts. Conflicts over natural resources in India. Sage Publications, New Delhi.*** The author suggests that Social Forestry should promote indigenous fruits, fodder and fuel species and not exotic *Eucalyptus* spp. which has negative ecological impacts.
- Vandana Shiva; Bandyopadhyay-J. 1985. *Ecological audit of Eucalyptus cultivation. v + 80 pp; Dehra Dun, India; the English Book Depot.*** A work-in-progress report of a long-term research programme aimed at monitoring the introduction, expansion and effects of *Eucalyptus* spp. cultivation in croplands. There are 2 main parts: Social forestry and the spread of eucalypts cultivation; Ecological audit of *Eucalyptus* spp. cultivation in rainfed regions. Aspects discussed in Part 2 include; eucalypts and the myth of high biomass productivity; the water economy of *Eucalyptus* spp. and its impact on hydrological stability in arid regions; the soil economy of *Eucalyptus* spp. (nutrient deficits and allelopathy) and eucalypts in relation to desertification and rural economy.
- Varela Díaz, R. 1990. *Eucaliptos, celulosas e o forestal galego. Edita ADEGA- Concello de Noia. 178 pp. Galicia. España.*** While strongly criticizing *Eucalyptus* spp., this paper does not provide primary data, or bibliographic references where data were partially extracted from, and focuses only on its negative aspects.
- Vásquez, W. 1990. *Efecto del fertilizante y el espaciamiento en el crecimiento inicial de Eucalyptus grandis en Turrialba, Costa Rica. En Manejo y aprovechamiento de plantaciones forestales de uso múltiple. Actas de la reunión IUFRO, Guatemala, 1989. Centro Agronóm. Trop. de Inv. y Enseñanza. CATIE. Turrialba, Costa Rica.*** Trials using 4 different spacings and 4 fertilization levels were made. The results show that *E. grandis* grows 6,6 m in height and 5,1 cm in diameter (1,30m), per year. Fertilizer has an impact on these parameters, while its effect decreases after

12 months, regardless of the spacing. The highest yields are obtained from fertilized plots.

**Auron P. Dossier Burundi : des projets forestiers. Bois et Forêts des Tropiques 1992. (No 233):21-34.** The author presents a historical background and draws a balance of achievements reached in large industrial reforestation schemes (65 000 ha, of which, one third is planted to *Eucalyptus* spp.) as well as in smaller communal afforestation schemes (12 900 ha) and private ones (20 to 25 000 ha) during the last decade. Small private afforestation schemes are in general small *Eucalyptus* spp. woodlots, fences delimitating private property and disperse trees in plots (*Laucaena*, *Grevillea* spp. etc.). The main constraints to private afforestation is land scarcity and funding availability.

**Velasquez-Jimenez,-M.O.; Robles-Molano,-H. 1991. [Model of agroforestral system of lulo (*Solanum quitoense*) associated with *Pinus patula*, *Eucalyptus globulus* under various shading nets]. Modelo de sistema agroforestral de Lulo asociado con pinus patula y *Eucalyptus globulus* bajo malla polisombra. Universidad Distrital Francisco Jose de Caldas, Santafe de Bogota (Colombia). Programa de Ingenieria Forestal. 170 p. (In Spanish).**

**Venkataramanan,-C (Editor). 1987. Effect of bluegum plantation on water yield in Nilgiri Hills. India, Central Soil & Water Conservation Research & Training Institute. Bulletin Central Soil and Water Conservation Research and Training Institute. No. T-18/0-3, vii + 109 pp.; 19 ref. Dehra Dun, India.** The effect of planting the natural grasslands with bluegum (*Eucalyptus globulus*) on watershed hydrology were studied at two sites at Glenmorgan, Ootacamund, Tamil Nadu. Preliminary studies in 1968-72 showed that there were negligible differences in monthly discharge from the watersheds. One of the watersheds was planted with bluegum in 1972. Hydrological measurements made after 10 years from planting bluegum, showed a reduction of 16 percent (an average of 87 mm/yr) in the expected water yield compared with the control grassland watershed.

**Venugopal.S. 1988. Impact of eucalypts plantations on the industrial climate, Malur Taluk. My Forest. December 1988.** Increased area under plantations have promoted the establishment of numerous new forest-based industries. *Eucalyptus* spp. plantations presently meet both firewood needs of the people and industries inside and outside the Taluk. 42 tile factories, some of which also manufacture bricks, are now functioning in the Taluk.

**Verma-DPS. 1990. Agroforestry practices of Gujarat State. International Tree Crops Journal., 6:1.** Apart from farm forestry, the most important types of agroforestry practised in Gujarat are peripheral planting and inter-cropping. The author reports the results of a survey on these two types of agroforestry. This revealed that peripheral planting is more popular than mixed planting except under irrigated conditions when both are equally popular. Agroforestry has been adopted by large, marginal and small farmers all over the state, but is most prevalent in the moderate rainfall zone (800-1000 mm). *Eucalyptus* spp. are planted by 90 percent of farmers in agroforestry systems. Farmers had a different view on the effect of trees on annual crops. 51 percent of them reported there was no effect, 34 percent a decrease, and 15 percent an increase.

- Verma-DPS. 1991. Evaluation of agroforestry practices in Gujarat State, India. Special issue. Agroforestry + principles and practices. Proceedings of an international conference 23-38 July 1989 at the University of Edinburgh, Edinburgh, UK Forest Ecology and Management. 45: 1-4.** Another paper on the peripheral planting of *Eucalyptus* spp. in Gujarat.
- Vigneron, P. Création et amélioration de variétés hybrides d'Eucalyptus au Congo. Bois et Forêts des Tropiques 1992. (No 234): 29-42 (11 ref).** Mastering of ancient techniques such as controlled pollination and herbaceous propagation enabled to consider the implementation of a breeding programme to obtain performing hybrids to establish industrial plantations in Congo. A Reciprocal Recurrent Selection model was adopted. The hybrids involved are *Eucalyptus urophylla* x *E. grandis* et *E. urophylla* x *E. pellita*. The resulting variety will be constituted by hybrid individuals of the first generation. Arguments in favour of a R.R.S. concerning the differences the variety may show, are analysed.
- Vila Lobos Santos, A. J. Eucalyptus, bois et huiles. Séminaire sur les produits de la forêt méditerranéenne. Florence sept. 1988. Ed Collona verde 1990. 609 p.** The main characteristics of *Eucalyptus* spp. in Portugal are described (particularly *Eucalyptus Globulus* and *E. camaldulensis*), including the economic importance of paper pulp and oil sectors.
- Vimal-Op, Tyagi-PD. 1986. Fuelwood from wastelands. OQEH. New Delhi India: Yatan Publishers.** Wood is the dominating domestic fuel in India. The question of development of plantations is governed by the diversity of agroclimatic conditions and hence the problems are therefore location specific. The book examines the issues.
- Vital, BR; Almeida de, J; Valente Ferreira, O; Pires I.E. 1994. (Growth characteristics and wood quality of Eucalyptus camaldulensis for charcoal production.) Características de crescimento das árvores e de qualidade da madeira de Eucalyptus camaldulensis para a produção de carvão. IPEF Piracicaba (47): 22-28.** This research aimed at evaluating the genetic variability between growth characteristics, wood density, wood chemical composition and wood charcoal characteristics for 33 month old progenies of *E. camaldulensis* Dehn. It was concluded that except for growth characteristics, the perspective for genetic improvement is very small among progenies. (In Portuguese).
- Vivekanandan.K. 1989. Problems and potentials of reforestation of salt affected soils, Sri Lanka. FAO, Bangkok.** The world-wide situation regarding salt affected soils is discussed. In Sri Lanka considering the requirements of firewood, use of salt affected soils through tree planting is stressed. Some of the *Eucalyptus* spp. suitable for the purpose are indicated.
- Walker-D. 1990. The state of tree cover in Dalocha 1990, ii+27 pp; 4 ref., Addis Ababa, Ethiopia, Action-Aid-Ethiopia.** Tree cover in Dalocha, Ethiopia, has been under pressure for the past 3 generations as people's livelihood has changed from pastoralism to sedentary life. This change has produced land clearing and wood requirements for building and fuel. *Eucalyptus* spp. were introduced to the area about 50 years ago and is now the most common species planted. All farmers

wanted to plant and coppice eucalypts although they realised that it had various disadvantages.

**Wang,-HR. 1991. A review of introduction, improvement, silviculture and utilization of eucalypts in China. in Development of forestry science and technology in China [edited by Shi, K. S.; Deng, J. F.; Ding, Y. Y.; Li, W. C.; Chen, Z. D.]. 144-153; 36 ref. Beijing, China; China Science and Technology Press.** It is estimated that there are more than 600 000 ha of *Eucalyptus* spp. plantations in China, with a production capacity of 2 million m<sup>3</sup>/yr. The total area of eucalypt plantations is expected to reach 1.3 million ha by the year 2000. The production of wood and other forest products is increasing rapidly. The capacity of wood chip industry is 500 000 t/yr of eucalypt chips; in 1989, some 110 000 t were exported to Japan, Korea Republic and Taiwan. Eucalypt oils are produced mainly from the leaves of *E. globulus* subsp. *globulus* and *E. citriodora*; 1500 t of eucalypt oils were exported in 1989. Community or household based oil production provides very good income to farmers in rural areas in SW China.

**Wen Maoyuan et al. 1990. A study of Eucalyptus 12 ABL as windbelt trees for rubber plantations. Royal Forest Department, Thailand.** Success of *Eucalyptus* 12 ABL as windbelt, is indicated. The species earlier used did not provide the advantages noticed with eucalypts.

**White-EH, Pou-R. 1980. Overview of forestry in Uruguay. Journal of Forestry. 78:12.** A description of the efforts being made to develop forestry in Uruguay in order to reduce imports of wood. About 130 000 ha of plantations of exotics have been established recently, most of them are *Eucalyptus* spp (75 percent), although *Pinus pinaster* has been widely planted (15 000 ha) to stabilize coastal sand dunes. Private landowners are encouraged to establish plantations through tax incentives.

**White-KJ. 1988. Eucalypts on small farms. (in: Multipurpose tree species for small-farm use. Proceedings of an international workshop held November 2-5, 1987 in Pattaya, Thailand 1988,) 86-96; 8 ref. Co-published with the International Development Research Centre, Canada, Arlington, Virginia, USA: Winrock International Institute for Agricultural Development.** The use of eucalypts in the farmland sector on small or large holdings is in its infancy. With increasing privatisation and diminishing regional forest land resources, it is logical to expect and to promote the transfer of responsibility for wood production to farmers. Eucalypt, with its wide range of end uses and present and future yield potential will play a major role in this process. This paper discusses species and provenance selection, seedling production, field establishment, spacing, rotation length, inter-cropping, growth, yield and utilization particularly in Asia. Certain problem areas, including the effects of eucalypts on the environment, water supply, and fertility, are cited. To increase wood yield, capital investment for clonal stock production is urgently needed. There is also need of support for extension services in both training and field operations.

**Whitesell, C.D; DeBell, D. Schubert, T.H., Strand, R.F., Crabb, T.B. 1992. Short rotation management of Eucalyptus: guidelines for plantations in Hawaii. USDA Forest Service Pacific Southwest Research Station. General Technical Report 137.** A 10-year research and development programme was conducted on the island of Hawaii, where 230 000 acres are suitable for growing biomass in short-rotation *Eucalyptus* spp. plantations. Successful techniques are described for seedling

production, plantation establishment, maintenance, biomass yield estimation, and harvest. Environmental issues are discussed, including soil erosion, nutrient depletion and monocultures. Production costs for biomass yield are estimated for three promising management regimes, representing pure eucalypt plantings at dense and wide spacings and a mixed species plantation where *Albizia* spp. is used as a nurse crop to provide nitrogen needed for optimum eucalypt growth.

**Willis-RJ. 1991. *Research on allelopathy of eucalypts in India and Pakistan. Commonwealth Forestry Review. 70:4.*** A review of studies carried out in India and Pakistan on the allelopathic effects of *Eucalyptus* spp., especially *E.tereticornis* and *E.globulus*. Although there is evidence to support an allelopathic effect of eucalypts on crops and undergrowth under certain conditions, the extrapolation of bioassay results on the effect of leachates and extracts should be taken with caution since the concentrations used may differ from field conditions. Six criteria are listed which need to be established to suggest that allelopathy is operative; in many cases, these have not been addressed in studies on *Eucalyptus* spp.

**Wrann H., J.; Arriaga B., M. 1988a. *Plantaciones experimentales con especies de interés tánico en la zona semiárida de Chile. Ciencia e Inv. Forest., 2 (3): 51-66. Santiago. Chile.*** In the arid and semi-arid areas in the interior of the country, where annual precipitations range from 215 to 360 mm, two trials were carried out with five species producing tannins, among them, *Eucalyptus astringens* and *E. sideroxylon*. Each species was tested with and without initial fertilization (NPK). In the most arid zone, the species that could be considered as an alternative are those used in the trials.

**Wrann H., J.; Infante L., P. 1988. *Métodos para el establecimiento de plantaciones de Eucalyptus camaldulensis y Quillaja saponaria en la zona árida de Chile. Ciencia e Inv. Forest., Vol. 2 (3): 13-25. Santiago. Chile.*** In an arid zone of Chile, where annual precipitation reaches 215 mm, trials were carried out to assess different soil preparation methods, with and without fertilizers and herbicides, in order to establish the species. The most important factor became shrub control. Fertilization is effective if herbicides are applied first.

**Wyk-G-van, Sijde-HA-Vander. 1983. *The economic benefits of forest tree breeding. South African Forestry Journal No. 126.*** In the light of results from a wide variety of research trials it can be assumed that genetic improvement would result in a volume production increase. In case of *E. grandis* this can be 20 percent to 40 percent. The cost of research is less than 1 percent of the industry's annual turnover.

**Yantasath-K. 1988. *The role of nitrogen-fixing trees as MPTS for small farms. Multipurpose tree species for small-farm use, Proceedings of an international workshop held November 2-5, 1987 in Pattaya, Thailand, 1988. Co-published with the International Development Research Centre, Canada, Arlington, Virginia, USA: Winrock International Institute for Agricultural Development.*** A summary of research on nitrogen fixing tree species on acid and non-acid soils is given. *Acacia mangium*, *Acacia auriculiformis*, *Albizia Falcataria*, *Casuarina equisetifolia* and *Eucalyptus camaldulensis* adapted well in both acid and non-acid soils and are considered to have exceptional potential for fuelwood, charcoal and other wood users.

**Yasin-SM, Raza-SM. 1992. Improving the quality of wood produced from eucalypts trees. Pakistan Forest Institute, Peshawar.** *E.camaldulensis* trees are grown in Pakistan on a large scale. Requirements of special processing for improving wood quality and recoveries are discussed.

**Zech W.; Kaupenjohann, M. Carences en potassium et en phosphore chez *Casuarina equisetifolia*, *Eucalyptus* spp., *Acacia auriculiformis* et *Tectona grandis* au Sud-Bénin (Afrique occidentale). Bois et Forêts des Tropiques 1990. (No. 226): 29-36 (13 ref.)**

This article provides information on the lack of potassium and phosphorus in *Casuarina equisetifolia*, *Eucalyptus* spp., *Acacia auriculiformis* and *Tectona grandis* in plantations located in southern Benin, where these were established for firewood production, with the financial support of BAD. The species planted have adapted more or less to soils and site conditions, which imply disturbances in mineral nutrition, decrease in productivity and low profitability. Continuous production of firewood without fertilizers (K,P) appears to be difficult.

**Zheng-HS. 1988. The role of eucalypts plantations in southern China. Multipurpose tree species for small-farm use. Proceedings of an international workshop held November 2-5, 1987 in Pattaya, Thailand, 1988. Co-published with the International Development Research Centre, Canada, Arlington, Virginia, USA : Winrock International Institute for Agricultural Development.** Large scale *Eucalyptus* spp. plantations are raised in China since the 1960s for timber and other products. Farmers have also planted eucalypts on a large scale beside houses, on waste land, and along roads and waterways. In coastal areas the plantings serve as shelterbelts and provide timber and fuelwood as well as they increase crop yields. In southern China eucalypt wood is used for pillars, furniture, farm tools and pulpwood. Leaves are used to produce tannin extract and oils. Flowers help support apiculture. However, some problems with declining soil fertility and yields have occurred.

**Zohar-Y, Aronson-JA, Loventien-H. 1988. Cultivation of multipurpose trees in rain water harvesting systems in the arid zone of Israel. Commonwealth Forestry Review, 67:4.** Biomass yields, energy production and fodder characteristics of *E. occidentalis* and *Acacia salicina* grown over 2 or 4 years rotations in rainfall water harvesting basins are discussed. Potential was promising for sustained productive fuelwood plantations relying entirely on runoff.

**Zohar-Y. 1989. Biomass production of short rotation *Eucalyptus camaldulensis* Dehn. stands growing on peat soil under a high water table in Israel. South African Forestry Journal. 2989., No. 149, Contribution from the Agricultural Research Organization, Israel 1988 No. 2385-E.** Biomass of *Eucalyptus camaldulensis* was studied under a four-year rotation from February 1976 in the Hula Valley, Israel. The water table at the site was controlled and kept at 1 and 2 m for most of the year. Seedlings were planted at a stocking density of 1 670 trees per hectare, on acid peat soil and at 1 100, 1 670 or 3 300 trees per hectare, on neutral peat soil.

**Zrira, S.; Benjilali, B.; Fechtal, M. Les huiles essentielles de 27 espèces d'*Eucalyptus* acclimatées au Maroc. Actes de l'Institut Agronomique et vétérinaire Hassan II. Revue scientifique et technique multidisciplinaire. 1992. 12 (2) p 15-21.**

**Zrira, S. Benjilali, B. Fechtal, M. 1992. (Los óleos esenciales de 27 especies de Eucalyptus aclimatadas en Marruecos). Les huiles essentielles de 27 espèces d'Eucalyptus acclimatées au Maroc Actes de l'Institut Agonomique et Vétérinaire Hassan II. Revue Scientifique et Technique Multidisciplinaire. v.12(2) p 15-21.**

## FAO - Forestry Department

### List of Working Papers on Forest Plantation

- FP/1 *Mean Annual Volume Increment of Selected Industrial Species.* Ugalde L. and Perez O. April 2001.
- FP/2 *Biological Sustainability of Productivity in Successive Rotations.* Evans J. March 2001.
- FP/3 *Plantation Productivity.* Libby W.J. March 2001.
- FP/4 *Promotion of Valuable Hardwood Plantations in the Tropics. A Global Overview.* Odoom F.K. March 2001.
- FP/5 *Plantations and Wood Energy.* Mead D.J. March 2001.
- FP/6 *Non-Forest Tree Plantations.* Killmann W. March 2001.
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