4

Agroforestry Update

Department of Agriculture and Rural Affairs

Department of Conservation, Forests and Lands

Victoria

4

February 1986

Agroforestry Update - *an occasional newsletter for agroforestry practitioners, research workers and extension specialists*

Number 4 *February 1986*

Editors: *Ian Hamer, Department of Agriculture and Rural Affairs, 166 Wellington Parade, East Melbourne 3002*
Telephone (03) 651 7712

Rob Youl and Brad Lynch, Land Protection Service, Department of Conservation, Forests and Lands, 378 Cotham Road, Kew 3101
Telephone (03) 817 1381

Typist: *Jenny Mason, Land Protection Service*

Printer: *David Rooke, Land Protection Service*

EDITORIAL

The recent and continuing amalgamation of the Victorian land management agencies to form the Department of Conservation, Forests and Lands has deflected one of the editors (RY) from his task, for which he sincerely apologises to our readership. The revised agroforestry directory will be published next issue, which we expect to be out in June 1986.

The year 1985 saw the publication of a major book on agroforestry, increased experimental work, successes on the ground with the Potter Project in Victoria, much more use of direct seeding, alterations to the taxation system, better co-ordination between the Federal and State governments on land reclamation, more and more changes foreshadowed, and greatly increased public interest in trees.

To our contributors and helpers - thank you very very much.

*THE LATEST FROM AOTEAROA **

Gavin McKenzie reports from Wellington (October 1985):

*In the 1984 New Zealand Budget, the Government revoked the Forestry Encouragement Grant Scheme and made all forestry costs tax deductible from income from any source in the year of expenditure. This move was made to equate forestry with other forms of land use and leave market forces to decide the position of forestry. ***

The effect of this change on extension services has been substantial, resulting in a dropping of one-to-one advice in favour of group education and promotion. Also with reduced farm incomes giving less benefit under tax deduction, we have seen a decrease in new planting and tending by the small farmer/ forest grower.

The Forestry Rights Registration Act enacted in 1983 has proved an acceptable vehicle for joint venture formation and has therefore provided an avenue of financial relief to growers affected by the change mentioned above. To date most of the financial investment has been offered by the major company growers who see joint ventures as a means of establishing and acquiring forest without purchasing the land but this means that forest ownership and control is being lost by the small grower. This negative aspect is however balanced to some extent by the fact that forest values are being maintained through on-time tending.

The announcement by Government last month that the NZ Forest Service, as a department, is to be broken down into a corporation and a department of conservation, also indicates considerable changes for advisory services and private-sector forestry promotion. The immediate effects of this decision are unknown but obviously matters such as "charging for services", "research funding", and "forestry promotion" will all be subtantially affected.

In view of these changes agroforestry has not been able to escape the ups and downs inflicted by policy decisions. Some progress has however been made and is worth mentioning.

---

* *Maori for 'the long white peeler log' or 'the long white protein molecule'*

** *We understand from John Mortimer that, since Gavin wrote this letter, the range of tax-deductible costs has been heavily reduced.*

Research

The monitoring of trials established to study the effects of trees on pasture and grazing livestock amongst trees continues. A technical workshop held in mid 1984 to collate and assess research findings from around the country found:

> *"That agroforestry could prove a useful diversification and wise land-use option for some farmers over a wide range of environments, but it did not warrant national emphasis nor additional incentives. Economically, agroforestry could provide an IRR of around 10 percent nationally but it remained to be demonstrated over the full life of the crops involved. It could help individual farmers increase their profitability compared to traditional agriculture but could be expected to reduce annual farm earnings in intermediate years."*

Additional matters receiving attention from researchers are the collection of site-specific data for inclusion in the computer package SILMOD, used to evaluate quantity and quality factors in growing and processing radiata pine, and consideration of special-purpose species for incorporation into agroforestry, including the eucalypts, cypresses, Acacia melanoxylon and Juglans nigra.

Policy

The Departments of Forests, Agriculture and Lands promoted a joint Agroforestry Policy in March 1985 that provided a base from which to launch agroforestry promotion to the private sector. This policy places emphasis upon various departmental activities and includes:

- *Active promotion through demonstration units, extension programmes and computer modelling*
- *Encouragement of integrated land use by establishing Crown land demonstration units*
- *Ensuring constraints are not present through legislation, statistical needs and State marketing activities*
- *Continuing research into clients' needs covering shelter, species, animal performance and financial returns*
- *Ensuring equal opportunity for agroforestry under land-use planning procedures*

Within this framework several interesting developments have taken place recently:

- *A series of agroforestry demonstration areas has been established in Northland on private land by the local United Council and Departments of Forestry and Agriculture. Using the Forestry Rights Registration Act to protect the demonstrations over their rotation length, such areas are*

expected to promote the benefits and options available to landowners under agroforestry regimes

- *Combined courses have been held for officers of the Departments of Forestry and Agriculture to provide each with a knowledge of the other's specialised land-use interests. We hope that advice will be provided on the basis of the total-farm concept and the aggravation between forestry and farming apparent in some areas will to some extent be overcome*

- *The Co-operative Forestry Companies Act 1978 is currently under review with the aim of simplification and allowing market forces to dictate the need for and the formation of such collectives. The grouping of private owners together, particularly for marketing purposes, is still considered important but regulatory controls should not be used to influence formation*

- *Government consideration continues to be given to the equality of taxation treatment between land-based industries and the removal of anomalies that disadvantage forestry under current tax laws*

Agroforestry as a Land Use

The current downturn in farming profitability, particularly on New Zealand hill country, has focused attention on the need for diversification. Agroforestry provides such an option for change with several important benefits:

- *Reducing the number of trees planted (around 600 stems/ha) and the number receiving tending treatment and finally occupying the site, to around 100-200 stems/ha; agroforestry regimes are considerably cheaper than past traditional forestry regimes*

- *Reduced tree numbers allow owners to undertake the management of larger areas, which means that the owners' labour and time can be used to better advantage before outside contract labour must be considered*

- *The grazing of forest sites provides income during the intermediate years, which overcomes to some extent the problem of time between planting (costs) and felling (returns)*

- *Diversification into agroforestry could mean the difference between retaining land under family ownership and selling to larger corporate buyers*

- *Joint venture investment can be considered for agroforestry establishment and tending as a means of lessening financial inputs but still retaining land and percentage return from the forest crop*

In conclusion, agroforestry is a land-use system which is suited to some sites and some landowners. It is not a panacea for all ills and it still requires an ongoing commitment of finance over at least the first 8-10 years of the crop's life. It is a system that requires pruning and thinning to be carried out on time if a profitable crop is to result and it will place a heavy emphasis on personal supervision in the early establishment years. On weed-free, accessible, and suitable growing sites, it can provide a satisfactory financial return on the investment made, and therefore warrants careful consideration as a means of diversifying land use by those landowners desirous of variety and change.

FEDERAL - STATE SUPPORT

In May 1985, Hugh Stewart, Victoria, received a letter from Lionel Wood, Secretary, Australian Standing Committee on Forestry. It is reproduced in essence below:

> *The Standing Committee on Agriculture and the Standing Committee on Forestry have considered the recommendations contained in the report on the National Agroforestry meeting at Canberra on 6-7 June 1984.*
>
> *It was felt that for the most part the recommendations concerning research and extension from the National meeting could be best dealt with individually by the States and Territories according to their own circumstances. As a result, the Standing Committees only examined those recommendations dealing with co-ordination of State and Commonwealth activities.*
>
> *The Standing Committees:*
>
> - *agreed to the formation of a national corresponding working group comprising representatives of the Department of Primary Industry, CSIRO, and one representative from each of the State Departments of Agriculture and Forestry, with representatives holding office for a two-year term*
> - *did not agree to the holding of workshops on specific issues on an ad-hoc basis but agreed that any workshop should be evaluated by the SCA Advisory Committee on Priorities in Rural Research and Extension and approved by the Standing Committee on Agriculture*
> - *agreed to the continuation of the agroforestry working group in each State/Territory and requested each group to identify a contact person*
> - *agreed to the twice-yearly publication of Agroforestry Update with responsibility for the issuing of the publication to lie with the State that was responsible for convening the national corresponding working group*

- *endorsed a recommendation that CSIRO Division of Forest Research be requested to:*

  - *maintain and periodically publish a list of agroforestry projects*

  - *develop a computer model to integrate information not accumulating on alternative agroforestry systems*

  - *define and model the effects of various factors, such as soil type, climate, tree species, density, arrangement, silviculture, and type of agricultural system, on the production and profitability of agroforestry enterprises*

MEMBERS OF THE NATIONAL CORRESPONDING WORKING GROUP ON AGROFORESTRY - NOVEMBER 1985

A Hincks
District Agronomist
Department of Agriculture
PO Box 124
MT GAMBIER SA 5290

I McArthur
ACT Forests Branch
Department of Territories
PO Box 158
CANBERRA CITY ACT 2601

B Drinan
Land Management Branch
Department of Territories
PO Box 158
CANBERRA CITY ACT 2601

P Lock
Woods and Forests Department
Regional Office
PO Box 162
MOUNT GAMBIER SA 5290

B W Hawkins
Forester-Extension Services
Forestry Commission of NSW
GPO Box 2667
SYDNEY NSW 2001

Dr J Davies
Department of Agriculture
Jarrah Rd
SOUTH PERTH WA 6151

G Morvell
National Tree Program
Department of Arts, Heritage and Environment
GPO Box 122
CANBERRA ACT 2601

R Moore
Research Branch
Department of Conservation and Land Management
14 Queen St
BUSSELTON WA 6280

Dr J K Leslie
Deputy Director Division of Plant Industry
GPO Box 46
BRISBANE QLD 4001

Dr R J Thistlethwaite
Assistant Secretary
Division of Technical Services
Department of Primary Production
GPO Box 4160
DARWIN NT 5794

Assistant Secretary
Forestry Branch
Department of Primary Industry
CANBERRA ACT 2600

J Walsh
Chief, Private Forestry Division
PO Box 180
SOUTH LAUNCESTON TAS 7250

S Wakefield
Department of Agriculture
NSW Government Offices
140 William St
BATHURST NSW 2795

P Paul
Principal Research Officer
Forestry Economic Research Station
Bureau of Agricultural Economics
GPO Box 1563
CANBERRA ACT 2601

J Kellas *
Victorian School of Forestry and
Land Management
CRESWICK VIC 3363

S W Margetts
Extension Director
Department of Agriculture and Rural Affairs
PO Box 500
EAST MELBOURNE VIC 3002

A Brown
Assistant Chief, Division
of Forest Research
PO Box 4008
QUEEN VICTORIA TERRACE ACT 2600

Dr G Bacon
Manager, Forest Research Branch
Department of Forestry
GPO Box 944
BRISBANE QLD 4001

J G Stephens
Chief, Pastures and Field
Crops Branch
Mt Pleasant Laboratories
LAUNCESTON TAS 7250

* John Kellas replaces Hugh Stewart who is off to Zimbabwe to work on the Zimbabwe Rural Afforestation Program for ADAB. Agroforesty is part of the program and we can expect an article or two from Hugh in future editions. (See later for additional information on Hugh's new job.)

ANZAC AGROFORESTY : A SANDGROPER'S VIEW

David Bicknell of Manjimup wrote an account of his recent trip to eastern Australia and to New Zealand for Alcoa 'Leaflets" (July-August 1985). He would have written the story differently for 'Agroforestry Update' had we commissioned him to do a piece, but was happy for us to publish his original article:

The tour was a whirlwind affair to check on agroforestry research and farmer practice in Victoria, Tasmania, ACT, and New Zealand. My own department is involved in several tree trials as well as joint agroforestry research and demonstration areas with CALM; Manjimup is to be the site of one such joint investigation. This project will, we hope, give answers to farmers about the potential profitability and management requirements of agroforestry in the high-rainfall South-West.

Other States are also in the early stages of agroforestry planning, however, New Zealand is reported to have extensive and longer experience in wide-spaced tree planting and agroforestry systems. The aim was to learn from the experience of these other groups and refine the information for West Australian use.

Victoria

The Victorian government has recently committed $210,000 to agroforestry research. I visited the two most advanced sites at Carngham near Ballarat, and Hamilton's Pastoral Research Institute.

Pinus radiata has been used at several spacings at Carngham with sheep grazing permanent pasture under the trees. Several problems mar the future extension value of the site. Unselected seed was used to produce the trial trees and early thinning has left a lot of trees with poor form. Corellas had chosen to land on the soft growing points, which broke on some of the trees. Pasture had not been fertilized during establishment or for some years before; as a result the pastures were very poor. Only a few trees had been damaged by sheep, and the sheep concerned appeared to be from one group only. Results from grazing measurements should be available in a few years.

At the Pastoral Research Institute there were agroforestry species evaluations, tree lucerne research, honey locust trials, windbreak evaluations, and extensive windbreak species observations.

The Institute has fairly flat, heavy soil that is subject to waterlogging in some years, to which lucerne trees are particularly susceptible. Honey locust selections that were being tested appeared to be very slow-growing. This was thought to be due to dry summer conditions and the occasional depredations of hares!

Much of western Victoria is flat and exposed to cold winter winds. Old sugar gum windbreaks are common along the main roads, as are huge windbreaks of Monterey cypress. In the light of current knowledge, these trees are not the best available, and the planting design is not recommended now.

There is a strong move in Victoria to replant indigenous species in the rural landscape. Windbreaks are often designed as wildlife corridors, using four rows of plants to produce the desired effect. Financial backing for this move comes from the Victorian Garden State Committee and the Potter Foundation, as well as other government bodies. There appeared to be some problems selling the idea of wide windbreak/fauna corridors to farmers. Experience in New Zealand, in contrast, favours the establishment of single-or double-row shelter belts that can also be managed to produce an income.

Tasmania

One description I heard of Tasmania was 'New Zealand's windbreak'. The climate is mild to cool and most of the country on which trees are being planted is steep. The conditions are similar to those found in New Zealand, so it is not surprising that NZ experience is being used here. Wide-spaced radiata pine with electric fencing is starting to find a place on the hillslopes unsuitable for potatoes or intensive agriculture.

Single-wire electric fences stop sheep eating the establishing pines. Heavy stocking for short rotations (called mob grazing) was effective in handling severe weed problems on this non-arable country.

The Forestry Commission of Tasmania has several schemes operating to encourage pine and eucalypt planting by private individuals. The Private Forestry Division administers grants and loans to substantially reduce the cost of establishment of plantations.

Australian Capital Territory

The CSIRO was active in agroforestry research and the development of radiata clones for particular uses, but unfortunately is no longer involved in this research, and the farmer who was co-operating is carrying on by himself. Francis Clarke of Tarago, NSW, is producing pine clones for sale. His farm would normally be considered marginal for radiata, but agroforestry and the use of selected seed stock and clones are showing that commercial growth rates are possible.

Across the Tasman

Luckily, my plans to visit New Zealand and inspect agroforestry sites coincided with a tour organized for the Australian Forests Development Institute.

Neil Barr - agroforestry

Our first trip was to Neil Barr's farm at Kaukapakapa, north-west of Auckland. Neil conceived and did much to set up the New Zealand Farm Forestry Association about 30 years ago. He is also recognized as one of the prime movers for agroforestry with a properly designed pruning program. On his own property, I saw 30-year-old southern mahogany that Neil had planted and is now cutting for timber. Nine-year-old Sydney blue gum trees were being thinned during our visit and sawn in the paddock to produce small planks (about 50mm square and 450mm long) for the furniture trade in the USA. In the climate at Kaukapakapa, these wide-spaced Sydney blue gums were about the same size as 40-year-old conventionally grown karri. As an example, Neil Barr is able to grow a 50cm butt log of Sydney blue gum ('Bartlett' strain) in 20 years. Neil is probably known most widely however, for his pruning regime for radiata pine, designed to produce high-value, knot-free timber.

Another important concept that Neil practises and encourages is 'added value'; that is, if the tree grower can harvest the timber and do the basic milling and air drying, returns from each tree are considerably higher. Even with on-farm milling Neil said the important thing to do was to negotiate the sale before cutting the trees.

Dick Endt - horticultural production

New Zealand has a well deserved reputation for progress with new horticultural crops. One of the innovators is Dick Endt, who has introduced many exotic, semi-tropical tree fruits to New Zealand (and then to Australia), including the babaco and evergreen black walnut. Most of these imports are due to Dick's regular visits to suitable countries (especially South America) to evaluate and collect specimens. Bamboo windbreaks were used extensively around this farm.

NZFFA conference - Hamilton

The first field trip was to McLaren Falls Arboretum. This 60-ha arboretum was organized by the enthusiastic Tauranga Tree Society. (It is improtant to recognize the energy that New Zealanders put into farm forestry and scenic tree planting; the NZFFA has 4000 very active members.)

David and Chris McNeil's farm

This covers 330 ha on the western slopes of the Kaimai Range, of which 83 ha remain in native bush (at a premium in New Zealand), and carries about 500 Romney ewes, 270 dairy cows, and two deer herds (fallow and red).

Woodlots covered about 20 ha; these were mostly radiata pine with some blackwood, Monterey cypress (the 'macrocarpa' of Footrot Flats fame), various eucalypts and black walnut.

Windbreaks were important to slow down the 'freakish gales' that came off the adjacent hills. Around the house, bamboo (Phyllostachys spp) had been used in hedges. In one paddock, a single row of radiata with every second tree high-pruned and every other tree fan-pruned, was providing shelter and potentially valuable timber trees.

The Mortimers - landscape planting

If you can't get to this 20 ha property, you can at least see 'Trees for the New Zealand Countryside' jointly written by John and Bunny. More than 300 species of trees have been planted, well identified and are growing well.

Particular plantings include a Sydney blue gum fuelwood block (planted on a 2m x 2m grid); a mixed woodlot of eucalypts and pines, and a mixed planting of black walnut, paulownia, catalpa and black locust.

Later in the day we visited the Mortimer's radiata pine plantation on a separate area of 112 ha. Tree growth was good but planting was on a very close spacing; late thinning and inadequate pruning had reduced the yield of logs. Management had been according to the best advice of the time from the Forest Research Institute.

Tikitere

By reputation, New Zealand has the most advanced and widespread radiata pine agroforests. The Tikitere trial was planted in 1973, which makes it the first properly planned one in New Zealand. Other agroforestry plantings in New Zealand are older, but not designed for research.

The management regimes used in the trial were termed '1970s agroforestry'. Recent plantings will use earlier thinning, and pruning - this is '1980s agroforestry'.

Agroforestry research at Tikitere is conducted jointly by the Ministry of Agriculture and Fisheries and the Forests Research Institute, Rotorua.

Kaharoa shelterbelt demonstrations

We saw THE shining example of a managed single-row shelterbelt at this property. A 22-year-old demonstration belt of radiata, planted in 1961 and harvested in 1983, yielded the equivalent of $30,000 NETT per km of shelterbelt. It is estimated that if all trees in the row had been high pruned on time, the single row would have been worth $50,000 nett per km. This is probably a New Zealand situation only, because sales to competing buyers for peeler logs, sawlogs and pulpwood maximised returns, however the potential was demonstrated compellingly.

Shelterbelts on the property included mountain ash as the main species with Cryptomeria japonica as an understorey, and radiata with cryptomeria. One 'unfortunate' shelterbelt on the property, planted by the owner, was a mix of radiata as the high species and larch as the low tree. The belt was planted on a high ridge, where it was obvious that larches are one of the few deciduous conifers.

John Aitken - joint venture agroforestry

This is HILL country - Tuki Tuki Valley near Havelock North. Much of the country is unsuited to intensive grazing because of the poor soils, problems of access, erosion and land slips. However, pines grow well and are a hope for the private landholders joining the venture.

Farmers provide land and practical growing skills, the government and private enterprise provide finance (by taxation incentives and investment), and the joint venture partner provides the marketing skills.

John Aitken's aim is to have up to 4000 ha of agroforestry pines on adjacent farms on a 25 - 30 year rotation. Details of the venture were carefully considered, and are not rigidly binding on parties involved.

John Aitken and John Groome (a professional forester in the venture) believe that several points are important in their area:

- Stock grazing foliage on trees less than four years old will reduce profitability, therefore stock are excluded for the first three years
- This means that only poor sites are worth planting, otherwise lost income from excluding stock is too high
- Weed control at planting and growth to 12 months old is critical
- Pruning should not start before year four (compared with Neil Barr's pruning system)
- There is no place for form or corrective pruning in this scheme

Plant materials

Aokautere Soil Conservation Centre is the centre for all the North Island research to "... evaluate, develop and release improved plant materials for land stabilisation, erosion control, river control and shelter". It also carries out research into multiplication, establishment, management techniques and diseases of soil conservation plants.

The National Plant Materials Centre near Palmerston North is a good example of how to fit a lot into a little. Total area is 32 ha - besides the offices and laboratories, there are a propagation building, services building, automated glasshouses, shadehouses and coldframes, a coolstore, 10,000m of shelterbelts (about 230 species and clones) and 76 nursery blocks. All the hybrid willows and poplars used as horticultural windbreaks are tested here. One of the interesting developments is the use of alders for horticultural windbreaks because of their restricted root spread and ability to fix nitrogen.

One radiata clone (Teredale) was being tested for its narrow, upright growth.

Jim Pottinger, Tinui

More HILL country - this is very rugged terrain with volcanic soils (pumice and ash) over rock. Land slips are common on these mostly over-cleared hills. Jim has extensive windbreak plantings and woodlots to help stabilize the soil. Pampas grass and New Zealand flax are used as the low shelter and several eucalypts and pines are used as the tall break.

Even the airstrip on this property was steep!

Overall impressions

Anyone contemplating a trip to New Zealand to inspect trees on farms should contact the New Zealand Farm Forestry Association. Contrary to much of Western Australia, NOT planting trees is the unusual thing. Even so, management of trees on farms in New Zealand has no recipe for success. New Zealand is already ahead of Australia in the use of planted, managed eucalypts on farms. This is mostly because New Zealand is so short of hardwoods that they attract a premium.

CALLING ALL COCKIES - THE VFGA FARM TREES PROGRAM

Victorian primary producers have realised that trees are an essential part of the productive farm.

Farm trees can indirectly provide income through shade, shelter, soil conservation and biological pest control. In addition, they offer a range of supplementary investment to conventional on-farm investments. The gap between horticulture, forestry and agriculture is beginning to be bridged through this and other related farm trees programs

An annual deficit of 5 million farm trees in Victoria is being rectified by planting of individual trees, direct seeding of tree seeds and the encouragement of natural regeneration.

In a co-operative effort by farmers; Federal, State and local government bodies, and community groups, the VFGA Farm Trees Program began with and continues to harness local farmers' initiative and leadership by assisting the formation of farm trees groups and developing their activities.

Currently, there are 24 Victorian Farmers and Graziers Association Farm Trees Groups. The VFGA has financed the overall program in conjunction with the Victorian Government and the Federal Government's National Tree Program. The results are achievements towards Greening Australia, in the Garden State.

The local groups set their own aims and priorities, and find funds to carry out their everyday activities. Large projects are co-ordinated through the VFGA Executive Officer, Farm Trees Program, who will identify the best arrangements for effective projects and the appropriate assisting organisations.

The emphasis on farm trees has been integrated with the whole spectrum of land degradation and the need to sustain land productivity. Officers of the State Government's Department of Conservation, Forests and Lands; Department of Agriculture and Rural Affairs; Ministry for Environment and Planning and others, all assist in many ways.

Land degradation, identified as a serious threat to primary production in Australia, can be reversed. The possibilities for a more diverse agriculture and better use of the indigenous plants of Australia may eventually remove some of the pressures of world competition from our primary producers.

For further information: Ed Adamson
Farm Trees Program Executive Officer
VFGA
24 Collins Street
MELBOURNE VIC 3000

Telephone (03) 639 261

BARK BEYOND BANGKOK - FODDER TREES IN NORTH EAST THAILAND

R Gutteridge and L Humphreys of the Agriculture Department, Queensland University, St Lucia 4067, are working with A Topark - Ngarm of Khon Kaen University, Khon Kaen 40002, Thailand on an agroforestry project, supported by a grant from the Australian Centre for International Agricultural Research, to promote the use of legumes in village farming systems in northeast Thailand:

This region of Thailand lies between latitude 14-19°N and experiences a tropical climate with pronounced seasonal rainfall. At Khon Kaen (central northeast Thailand) more than 85 percent of the annual total of 1250 mm falls in a six-month period, mid April to mid October. Soils in the region are characterised by sandy texture, acid reaction (pH 5.5-6.5), low organic matter (0.58%), low CEC, (3-5 m equiv/100g), a low level of plant nutrients (particularly N, P and S) and high susceptibility to erosion.

An important aspect of the overall program is the collection and evaluation of leguminous shrubs and trees as sources of fodder, fuelwood and green manure. A shortage of high quality forage over the dry season is one of the major constraints to livestock production in the region and fodder trees are seen as a possible solution to overcoming this problem. Their deep-rooted nature enables them to exploit moisture at depth and thus maintain green leaf for a longer period than other fodder species such as grasses and herbaceous legumes. It is envisaged that green material from the trees will be cut and fed directly to livestock or mixed as a supplement, with rice straw the main dry-season fodder source.

Currently *Leucaena leucocephala* is used to some extent in this context but its slow establishment and poor growth on the more acidic soils have limited its widespread use. Thus a range of possible alternative species has been collected and is currently being evaluated. Forty-eight provenances from a wide range of tropical genera have been sown at Khon Kaen and early growth of the four *Sesbania* spp, *Calliandra calothrysus* and some of the *Albizia* spp has been exceptional. Dry matter yields of edible material of up to 1.5 kg per tree have been recorded in the first 6 months since planting. Green leaf retention and regrowth after cutting will be monitored during the dry season each year and assessment of the nutritive value of each species using *in vitro* and *in vivo* techniques will be made.

In addition to fodder, these fast growing trees can also be utilized for fuelwood, a scarce commodity in many village communities in the region. Thus wood production of all species is also being recorded in the evaluation program. Leucaena and some of the other fast-growing tree legumes are also being tested for use in alley cropping systems. In this system, the trees are grown in widely spaced rows, 3-8m apart, with a crop such as maize, kenaf or cassava between the rows of trees. Material from the trees is harvested at regular intervals and is used as a mulch to "fertilize" the crop in the alleys. Cutting frequencies, height of cutting, productivity of different species and effectiveness as a fertilizer are some of the parameters that are currently being assessed. This system is seen as important in maintaining crop yields on the poor soils of the region without large inputs of chemical fertilizers and also in helping to prevent soil erosion by placing the tree rows on the contours. A tertiary benefit is the extra material from the trees that could be used to feed livestock.

THE ALL BLACKS AGROFORESTRY PROJECT TEAM

From the annual report of the Forest Research Institute, Rotorua, 1984:

In 1983, a group of about 12 staff was set the task of providing mechanisms for evaluating combinations of forestry and agriculture. The impetus has arisen from the results of the Radiata Pine Task Force, which have shown:

- *farm sites can produce considerably more basal area increment than forest sites*
- *optimum first-crop tree stockings for sawlogs can be as low as 100 stems/ha*
- *topography, location, and overhead costs have a major impact on logging, transport, and total costs*

Taken together, these factors indicate that agroforestry on farm sites has great potential.

The group has initiated several new projects, mainly dealing with radiata pine, which include:

- *Checking existing predictive models (such as SILMOD) for low tree stocking and shelterbelts, and developing new sub-models where appropriate*
- *Defining relationships between trees, understorey pasture, and livestock. This project involves close collaboration with researchers from the Ministry of Agriculture and Fisheries*
- *Developing appropriate techniques for oversowing forage legumes and grazing livestock in forests, particularly as a means of increasing tree growth and improving access*

- Testing various silvicultural techniques (such as variable pruning and internode pruning) on low tree stockings and shelterbelts

- Collaborating with other groups in the testing on farmland of vegetativelygrown clones showing characteristics which should improve sawlog values and timber grades

It is expected the group will work closely with existing agroforesry practitioners.

CUTTINGS FOR AGROFORESTRY IN WESTERN AUSTRALIA

Richard Moore, a research forester with the Department of Conservation and Land Management, Busselton, Western Australia, has contributed this piece on propagation:

Some fifteen years can be saved by growing radiata pine from cuttings instead of from seed.

To be useful for agroforestry, radiata pine needs special features such as straight stems, fine branches and wood of comparatively high density. Pine families with these characteristics have been identified in progeny trials. Improved techniques for raising cuttings now enable identical trees to be produced in large numbers at reasonable cost.

Eminent New Zealand farm forester, Neil Barr, suggests that even though cuttings cost much more than seedlings, they would save $1200 a ha, within six years of establishment, through reduced planting, culling and pruning work.

The amount of debris from culling and pruning would also be less because three trees only need to be planted (instead of the normal seven) to produce one crop tree.

There would be big gains in timber production too. Superior trees from cuttings will be more valuable because they are straighter, have smaller knots and produce a greater volume of wood than today's seedlings.

These improvements are being introduced to West Australian agroforestry now. Interest is high (one hundred people attended a field day at Mundaring recently), and several operational agroforests are being planned by my department in the Donnybrook Sunkland near Busselton and on recently purchased farmland near Balingup.

The Government also seems likely to encourage farmers around Manjimup to try agroforestry. A 'farm' trial, run jointly with the Department of Agriculture, is being planned.

There are two main reasons why CALM is involved with the new propagating techniques. Firstly, CSIRO Division of Forest Research (Canberra) is terminating its work in this field, and secondly, cuttings cannot be imported from eastern Australia (because of the risk of introducing Dothistroma) unless stringent quarantine procedures are followed.

To start the program we needed suitable material from selected families and a practical technique for striking cuttings. We now have both.

Trevor Butcher (Research Section, Como) has progeny trials covering about 20 families of radiata with agroforestry potential and has access to seed of selected families in eastern Australia. Gordon Chester (Research Section, Wanneroo) has developed a successful technique for raising cuttings and is confident that it will work on a large scale. The first 'commercial' cuttings will be available for planting in 1986.

Two methods will be used for raising the cuttings, one using stem shoots and a second using fascicle shoots. In the first year or two of operation, however, only the stem-shoot method will be used. The fascicle-shoot method will be used once the clonal hedges are ready - probably in 1987.

The CALM nursery at Manjimup has been chosen to raise the new trees. The climate is cool, the equipment is modern and it is fairly central to where agroforestry is likely to be practised. The number of cuttings required initially is 30,000 per year but it seems likely that the demand will increase.

THIS MEAT NEEDN'T BE MARINATED IN RETSINA!

Peter Bray, a forester with DCFL at Casterton, south-western Victoria, wrote these notes after the 1983 drought:

Jim Cleary owns two properties west of Casterton; both are typical of the land south-west of the Kanawinka Fault with swamps and red-gum flats, some drained, interspersed with sandy ridges. Radiata pine plantations of various ages up to 12 years have been planted on some of these ridges.

During the drought of 1982-83 he started pruning his plantations and using the foliage as fodder for lambs, ewes, wethers, vealers and cows, and carried 50% more stock in fat condition on his property than in normal years.

Jim reports that no abortions occurred as a result of feeding out; in fact his records show that ewes returned 105% lambs, which was higher than any other property in the area.

Prunings were also used as stockfeed during the winter flood of 1983 when grain could not be fed out.

Jim operates this way:

- He allows stock to feed on prunings within the plantation
- He limits access of stock to areas outside the plantation - his property is well subdivided and this is obviously important
- He commences pruning where the stock camp or congregate and then continues from there
- Pruning should advance gradually into bracken areas as stock do not willingly feed in bracken
- Two hours pruning with a Stihl 015L chainsaw is sufficient for 250 lambs, but the operation is better done in two stages each week

For example 500 lambs were fed on 3 ha of turnips and a few hectares of pasture. They ate turnip tops initially and then moved onto the prunings when the tops were finished. They fattened on the turnips and used the foliage for green feed.

Jim also found that lambs don't utilize as much of the foliage as older sheep and twelve-month-old lambs in store condition can be fattened in one month on turnips and prunings. He further believes that lambs can be fattened this way throughout the year, bringing the benefit of staggered income and better prices when supply is normally low.

There is also a fire protection advantage. As well as removing lower limbs from the trees, the undergrowth is considerably reduced or mulched, although this occurs over a small area. The mulching effect would however probably speed up the nutrient cycle.

Rams did considerable damage to young thin-barked pine trees by stripping bark off.

INFORMATION NETWORKS IN AGROFORESTRY

This article by Peter Huxley and Anthony Young of the International Council for Research in Agroforestry was accompanied by a set of data sheets for the worldwide gathering of standard agroforestry information. For further details or for copies of these sheets please contact ICRAF at PO Box 30677, Nairobi, Kenya. The article describes what we are trying to do with 'Agroforestry Update':

Networking in international agricultural research is now a normal practice (see the recent interesting paper on this subject in Science, 225, 989-993 by Donald L. Plucknett and Nigel J.H. Smith). Some of these networks are informal, exchanging just ideas and information; others work through more formal links in which programs of work are conducted in an interactive way. The latter usually require some additional resource inputs (for example, the projects being undertaken in different regions by ICRAF's Collaborative and Special Projects Program - see Newsletter No 12).

A considerable amount of information about every aspect of agroforestry flows into (and out of!) ICRAF through many visitors as well as through the correspondence that reaches us from all over the world. In addition we retain many close links with those who have attended Workshops and Training Courses, who have joined in various ICRAF activities, or have met our staff in different parts of the world.

Among these contacts there is a growing number of researchers who have become involved in field investigations in agroforestry (including various kinds of laboratory back-up), or who see the need to undertake this activity in the near future. ICRAF's Technology Program is compiling information about such investigations with the aim of exchanging information about field research methods aimed at technology generation. This is linked, on the one hand, with the production of a set of source documents on 'Research Methodology for the Exploration and Assessment of Multipurpose Trees' and, on the other, by establishment at ICRAF of a computerized Environmental Data Base.

To quote Plucknett and Smith: 'A network usually reduces costs, minimizes duplication and boosts efficiency'. We could add, in a developing situation such as we have in agroforestry research, where we are all testing the quickest and most efficient ways of carrying out field investigations in a new subject area, that an informal information-exchange network is essential if we are to move ahead as fast as national governments and development agencies are urging. The problem we are addressing is" 'How can we best (that is, most cost-effectively and speedily) carry out field research in agroforestry?'

The first objective of our network is to compile information and to disseminate an awareness of the kinds of investigations in agroforestry that are being undertaken or planned; for example, for field research, we need to know the objectives, experimental layouts, and methods for assessment, including appropriate statistical analysis. We should also like to know what use is expected to be made of the results.

A second objective is to link the results obtained from field experiments with climatic, soil and other environmental conditions at the sites on which the work is being carried out. This will enable research workers and, perhaps more importantly, those involved in development projects in other countries, to know how closely the trial sites match their local environmental conditions, and so how applicable are the results from this aspect.

At this stage, all we are asking is that you devote a small amount of time to correspond with us. We shall be writing to some people and institutions with which we already have contacts, but would greatly welcome anyone else with an agroforestry field research program to write and ask to join the network. If you would like to participate, please write to Peter Huxley (Research Methodology) or Anthony Young (Environmental Data Base) at ICRAF.

DEAR JOAN LETTER: MINISTER-TO-MINISTER ON TAX

On 29 November 1985, John Kerin, the Federal Minister for Primary Industry, wrote this letter to Joan Kirner, the Victorian Minister for Conservation, Forests and Lands:

Prior to debate on the Government's draft White Paper, "Reform of the Australian Tax System", I received a number of representations requesting that there be no changes to the provisions of the Income Tax Assessment Act which enable certain expenditure. By now you are no doubt aware that the Government has decided to maintain these provisions in recognition of the extent of land degradation in Australia.

You may not be aware however, that the Treasurer has agreed to certain changes within section 75(d)(1) of the Income Tax Assessment Act to include capital expenditure on measures to combat other forms of land degradation such as salinity and landslip. As the Act presently stands deductibility for expenditure on such measures is questionable because of the use of the term "soil erosion". The new wording, refers to "an operation primarily and principally for the purpose of preventing or combating land degradation, otherwise than by the erosion of fences" and "an operation consisting of the erection of fences (including any extension, alteration or addition) primarily and principally for the purpose of excluding livestock or vermin from areas affected by land degradation in order to prevent or limit any extension of aggravation of that degradation and to assist in reclaiming those areas".

These amendments were recently introduced by the Treasurer in the House of Representatives and an extract from the Second Reading Speech on the Taxation Laws Amendment Bill (No. 4) is as follows:

> *"As announced in the 19 September 1985 statement, the Government has decided against changing the immediate deduction available for capital expenditure on soil conservation after taking account of concerns over land degradation problems. In recognition of those problems the capacity to write-off expenditure on arresting or preventing soil erosion or soil salinity is, by the Bill, to be extended to expenditure on arresting land degradation generally. Capital expenditure incurred after 19 September 1985 in overcoming land degradation in the form of soil infertility and structure decline, to give but two examples, will thus be subject to immediate write-off."*

I am aware of strong support by some States for the introduction of a third component, assistance to individuals under the National Soil Conservation Program (NSCP).

While I appreciate that the Program was introduced with the intention of developing a third component, I am now of the view that the most effective way that the Commonwealth can assist landholders in the foreseeable future is through the provisions of the Income Tax Assessment Act as previously outlined. Deductions of $30 million to $40 million are claimed annually by landholders and I understand there

has been a strong growth in the use of these provisions. I recognise that the tax concessions do not cover all situations but I trust they complement the measures offered by your Government. I believe that the taxation concessions are a very real incentive to many farmers who have been encouraged to undertake greater soil conservation activity by your district officers.

You have my assurance that I will continue to press for increased funding of the NSCP to enable the achievement of the program's stated objectives, and I trust that I can continue to look forward to a similar commitment in respect of your own responsibilities in the soil conservation area.

THE WORLD'S FIRST BOOK ON AGROFORESTRY - WELL THE SOUTHERN HEMISPHERE ANYWAY!

Rowan Reid and Geoff Wilson published a major book on agroforestry in 1985 that sold 2000 copies. A new edition is being prepared. At the time of the books launching, the Victorian Farmers and Graziers Assocation put out this review of the book:

"The farmer has not been shown how to make a dollar out of farm tree planting" say Rowan Reid and Geoff Wilson, authors of "Agroforestry in Australia and New Zealand", a new book just issued in Victoria.

Reid and Wilson say that most farmers are unaware that agroforestry can mean big revenue increases for them, not just at the end of rotation of trees, but also in the integration with livestock and cropping enterprises to produce significant productivity gains.

They report some successful agroforesters have the view that the conservation movement has instilled a sense of guilt in farmers if they should consider making money from farm trees. The authors believe making money from farm trees is probably the most important reason a farmer can be given for planting them, especially now that farmers in both countries are experiencing an excruciating cost-price squeeze that gives them little or no spare money for the philanthropic tree planting both Government and "greenies" would like to see.

They stress that no farmer can accept the productivity loss that poorly planned tree planting can give, even though it might have community benefits and be supported by community funds.

"He or she must also be able to see a financial benefit in wood, fodder, seed, food or other advantages such as shade and shelter", they assert. Reid and Wilson stress the keyword "integration" to obtain the full synergistic effect of trees in agriculture, through which agroforestry as a whole becomes much greater in its beneficial effects than the sum of the tree growing and farming enterprise parts.

The authors state that the slow adoption of agroforestry so far is because good information has been dificult to obtain. The agroforestry innovators in farming and scientific research have not yet been fully accepted by their peers. What appears to be needed is

the passing of time for the policymakers with blinkers on to be superseded by people with vision. This has happened in both New Zealand and Western Australia, and is advancing well in Victoria.

Commenting on species for use in agroforestry, the authors state that the Victorian program has the promise of eventually advancing beyond the others because it is taking in a range of tree species other than pines. Eighteen months ago, Victoria's 150th Anniversary Board recognised the importance of agroforestry to our State, and allocated $210,000 of Commonwealth funds towards the development of six agroforestry sites around Victoria for further research into this system of land management. This practical project is run by the State Forests and Lands Division of the Department of Conservation Forests and Lands and Victoria's Department of Agriculture and Rural Affairs. It demonstrates the benefits of reafforestation and planned planting to our rural community.

However, the official attitude to agroforestry in Australia is patchy. In the opinion of the authors a national thrust from Canberra, perhaps some seed money, is required. Reid and Wilson make the point that Government supported agroforestry is needed at the farm level - not as handouts from the public purse, but in a tax structure that recognises the quite different time-scale trees have in the revenue-earning process, and they advocate financial support in education at all levels and in research and extension.

Recognising the tough days ahead for beef, dairy, grains, sugar and some other primary industries in our region (because of the Euroglut), the agroforestry development will, they believe, be seen as a much more profitable land use than monocultural systems which have little resiliency in bad economic times.

The authors say that education and farm extension is probably the cheapest investment the community can make in protecting the soil resource, but that politicans and bureaucrats are reactive rather than being active in taking new initiatives.

They respond to pressures rather than generally anticipating what the community wants, so the implication is that much pressure must be brought to bear on government if agroforestry and similar innovations are to take place.

Reid and Wilson point out that we are the generation that has become fully aware of the destruction that has been done in ignorance of our planet's resources of soil, water and air, but to recognise a problem is to be only half way towards its solution.

The book is both practical and hard hitting, and is available at $28, posted from Goddard and Dobson, Box 148, Box Hill, Victoria, 3128 (Telephone: (03) 890 4618).

THE POTTER FARMLAND PLAN

Andrew Campbell, Project Manager of the PFF at Hamilton, Victoria reports on the first year's operations:

Funded by the Ian Potter Foundation, the Potter Farmland Plan brings together a unique blend of private enterprise, community and government to tackle land degradation. Its aim is to establish practical demonstrations on real farms of measures that address long-term degradation of the land, and to show how these measures can be best planned to complement farm management.

The project began in Hamilton, western Victoria in November 1984. Three demonstration areas were defined at Wando Vale, Melville Forest and Glenthompson, and landowners were invited to meetings in each area in early January 1985, at which they were asked to volunteer their farms for participation in the project. The response was encouraging, with 48 landowners coming forward. After two rounds of inspections, fifteen properties were selected.

A hectic first year saw 55 km of fencing constructed, 27 ha seeded with trees, 13 ha seeded wtih deep-rooted, salt-tolerant pasture, and 30,000 trees planted in shelterbelts, woodlots, clumps and wildlife corridors. Wet weather in late spring and early summer has been good for trees if nothing else - survival rates average 98% and summer growth rates should be high.

Whole Farm Planning is the key feature of the Potter Farmland Plan approach to tackling land degradation. It involves a critical analysis of the existing layout of the farm in relation to such things as erosion, salinity, water supply, wildlife habitat, shelter and uses to which various soil types are put, with a view to making changes to enhance the long-term productivity and economic viability of the farm.

In practice the planning steps are as follows:

- farm layout is examined in the light of natural boundaries and particular management or degradation problems, and inappropriate subdivisions are modified to create a new layout which also takes into account access, land capability and fire protection

- land use constraints are identified for each management unit, and a water supply strategy is prepared to complement the new layout

- a revegetation plan is devised. Erosion-prone, saline or discharge areas are excluded from stock and revegetated where appropriate, as are primary recharge zones where they can be identified, using various combinations of trees and deep-rooted pastures. Shelterbelts, woodlots, clumps, natural regeneration and individual trees are located and linked to provide shade and shelter, wildlife habitat and

farm wood supply in a pattern which is in harmony with the landscape. The plan consists of an overlay over a large-scale aerial photograph

Indigenous species grown from local seed are used wherever possible on demonstration properties, but in areas where the natural environment has altered (such as salty gullies) or in situations where local species cannot fulfill a desired role, the best species for the job will be used. Tagasaste and casuarina hedgerows have been established around holding paddocks at Wando Vale, and woodlots of durable hardwoods for supply of farm timbers and fuelwood have been established at Glenthompson.

Participating landowners contribute at least one-third of on-ground costs and must be prepared for field days, "sticky beaks" and monitoring long after the three year implementation phase of the project is complete. Above all, the Potter Farmland Plan is a demonstration project. Its demonstration value will be enhanced by field days and farm walks at a local level and production of printed information and audio-visuals for wider circulation, to ensure that the lessons learned during the project are available to interested people throughout the community.

FOR YOUR LIBRARY - BUY NOW BEFORE THEY ARE REMAINDERED

- See elsewhere for notes on 'Agroforestry in Australia and New Zealand' by Rowan Reid and Geoff Wilson - soon to be republished by Nelson.

- 'Trees for the New Zealand Countryside - A Planter's Guide'. John and Bunny Mortimer. (Silverfish : Auckland 1984.) NZ $37 to Taitua Books, RD9, Frankton NZ.

- 'Tree Crops - 84 : Growing Up'. Proceedings of the Second Australasian Conference on Tree and Nut Crops. (Natural Resources Conservation League : Melbourne 1985.) $15 plus postage.

- 'Let the Earth Live'. Verne McLaren. (BAC Squatter Publications : Wartook 1982.) Contact Brian Carter, Wartook 3381.

PAMPHLETS AND PAPERS

- The impact of Government policy on land degradation in the rural sector. Michael J Blyth and Michael G Kirby, Bureau of Agricultural Economics 1984.

- Trees and Timber Series, NZFS, Private Bag, Wellington, NZ:

  - Portable debarkers for posts and poles

  - A guide to the successful seasoning of roundwood

  - Forestry joint ventures

- *Farm forestry : a landscape guideline*
- *Forestry finance and taxation*
- *Pine plantation nutrition and fertilisers*
- *Woodlot record systems*

Guidelines for participants in joint venture forestry. Information Paper No. 1. New Zealand Forestry Council 1985.

UP THE RESOLUTION!

AUSTRALIAN FORESTRY COUNCIL	MEETING NO 22
	PLACE: ADELAIDE
RESOLUTION	DATE: 29 AUGUST 1985

TREES ON FARMS

Council DISCUSSED tree plantings on farms. It recognised that trees have many values to farms, the ecological and aesthetic values, the increased productivity via shade and shelter and a long term commercial value. Council RECOGNISED that many States have programs directed at raising the consciousness of farmers to the importance of trees. Council AGREED that it should formally contact the Australian Agricultural Council in order that both Councils can effectively work together to encourage farmers to plant more trees on their farms. Council WAS INFORMED that a recent delegation from the National Farmers Federation had made representations to the Chairman about extending the planned use of trees on farms for all purposes.

Council REQUESTED its Standing Committee look at ways and means of promoting the integration of trees within traditional agricultural environments to assist agricultural diversity.

DAGS AND SCRAGS

* Hugh Stewart, a forester at the Research Laboratory of the Department of Conservation, Forests and Lands in Macarthur Street, Melbourne has been seconded to the Department of Foreign Affairs to take up a two-year appointment as Forestry Reserch Scientist, Zimbabwe.

Hugh will be working on a rural afforestation project financed by the Australian Development Assistance Bureau. The aim is to test the performance of a wide range of indigenous and exotic species for their suitability for firewood, posts and poles on the communal lands in Zimbabwe, where wood provides over four-fifths of the fuel for cooking and heating. The project will emphasis the sociological effects of afforestation.

Hugh's experience in eucalypt silviculture and nutrition, and his involvement in agroforestry research in Victoria, will be invaluable to this project in which eucalypts are expected to play an important role. He and his family - wife Glenda, Andrew (5) and Duncan (3) - depart on 20 February for Harare (formerly Salisbury) where they will live. Zimbabwe (formerly Southern Rhodesia) has some magnificent tourist attractions, and Hugh and Glenda offer a cordial invitation to anyone travelling through Harare to come and stay. They can be contacted c/o Australian High Commission, Box 4541, Harare, Zimbabwe.

* Interest in direct seeding for rural revegetation is mounting, especially in Western Australia, South Australia and Victoria.

* FIME, the Forest Industries Machinery Exposition, will be held at Myrtleford, Victoria from 14-17 April 1986 (Monday - Thursday). For further information contact Australian Forest Industries Journal, 203 Castlereagh Street, Sydney NSW 2001 (Telephone (02) 2646273).

* Joanne Millar of Department of Agriculture and Rural Affairs, Wodonga 3690 Victoria (Telephone (060) 241 811) is keen to help organise a field day or seminar on agroforestry. Please contact Joanne today.

* Dr C Hackett of Division of Water and Land Resources, CSIRO, Canberra ACT 2600 (Telephone (062) 465842) is surveying Papua New Guinea's potential for subsistence agriculture and smallholder cashcropping. Plant description methods have been designed, and descriptions are being prepared by Australian and foreign authors; their use for field assessment is being tested. The system is intended to apply to any higher plant species and should be helpful for agroforestry.

* Alan Brown of Division of Forest Research, CSIRO, Canberra ACT 2600 (Telephone (062) 818 351) advises that his group, and Queensland's Department of Forests, are developing a database within which the success of species (or seedlots or clones) can be recorded. Suitable environmental conditions can be matched

with species. Copies of data will be shortly available. Terry Johnston of Brisbane is collaborating with Alan.

* Ed Adamson (see earlier) is now President of the Australian Branch of the International Tree Crops Institute. He replaces Geoff Wilson, who advises that ITCI is arranging a tour of China to study paulownias - Geoff was in China in September to plan the trip.

* Alcoa publishes 'Leaflet' monthly - it is an excellent newsletter available free from PO Box 172, Pinjarra WA 6208 (Telephone (095) 311 611).

* John Fargher of PO Box 329, Balhannah SA 5242 (Telephone (08) 391 0647) suggests that readers might like to assist him to collate a simple handbook for low-technology agroforestry in arid zones in developing communities (both with Aboriginals in Australia, and overseas) that emphasises fuel and fodder production and can be integrated with existing farming.

BACH: WHERE SHEEP MAY SAFELY GRAZE

Aust. J. Exp. Agric., 1985, 25, 524–8

Green *Pinus radiata* needles as a feed for sheep

G. W. Anderson

Division of Animal Production, CSIRO, P.O. Wembley, W.A. 6014.

Summary. Various combinations of cereal chaff and *Pinus radiata* needles were fed to penned sheep in three experiments. The *in vivo* digestibility of green needles was estimated to be 36%. Intakes of needles were variable and increased to more than 50% of the total dry matter intake if the chaff component of the diet was restricted to 25% of normal intake. Under these conditions, the needles made a useful contribution to the diet and reduced rates of liveweight loss.

The feeding value of pine needles may decrease by about 30% as they age but that of fresh young needles can be greater than those of late summer pasture residues. Therefore, if kept ungrazed for *in situ* consumption in summer or during drought, when pasture residues are not able to maintain sheep, green pine needles can be valuable either as a substitute for pasture or as a partial supplement.