



Radiata pine in Galicia

John Purey-Cust

Introduction

Galicia, in north-west Spain, grows a third of Spain's wood production and contains much of its forest-based industry. Plantation production is dominated by *Eucalyptus globulus* (mostly for pulp) and *Pinus pinaster* (sawn timber and panel boards).

Radiata pine has been quite widely planted. In some places its productivity approaches that found in New Zealand, but in most places it does much less well.

Wood supplies, particularly of softwood (which is not available to be imported), are getting short and there is a strong move to increase both the plantation estate and its productivity.

Radiata pine is seen to offer the best softwood prospect and in 1989 Groome Poyry (New Zealand) was contracted to introduce New Zealand nursery and establishment methods. Work began early that year, using John Purey-Cust (establishment and silviculture), Bill Lawrence (nurseries) and Dr Graeme Will (soils and nutrition). Dr Mike Wilcox will look into tree breeding later this year and has also been asked to comment on eucalypts, where there are equally large opportunities for productivity increases and extension of range.

Work so far has indicated that New Zealand techniques produce very similar results in Galicia, and that the reasons for poor performance are a variable mix of climate, soil nutrient deficiencies and poor establishment methods.

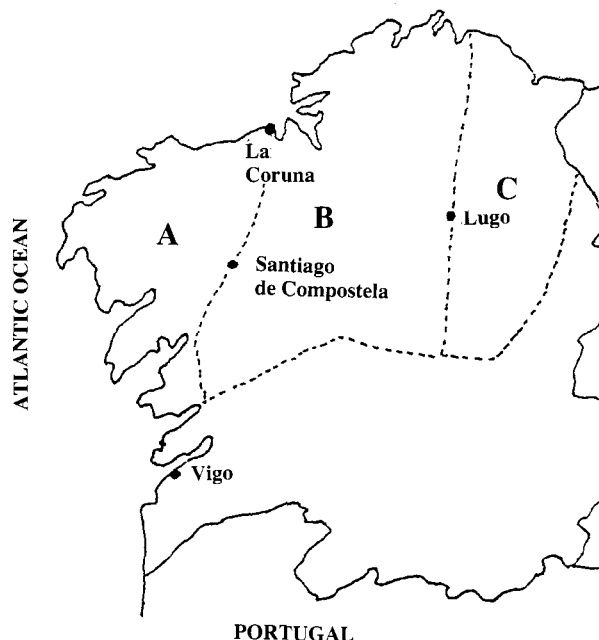
However, in the end the most important problems are not technical, but the lack of any marketing cooperation amongst the many small forest owners and poor liaison between the forest grower and research.



The Land

Galicia is one of the 19 autonomous regions which make up Spain. It sits in the north-west corner of the Iberian Peninsula and has two frontiers with the Atlantic Ocean, one with Portugal, and only one border shared with Spain. It grows 30% of Spain's domestic wood production, catches much of its fish, and exports building stone all over the world. Apart from its coastal cities it is one of the poorest parts of Spain.

PREFERRED AREAS FOR RADIATA PINE IN GALICIA



- A only if strong soil nutritional deficiencies are corrected
- B moderate soil deficiencies
- C slight soil deficiencies

There are small suitable areas in the southern half of Galicia, but in general the hot dry summer climate poses big problems.

Its customs and language are distinctive and it looks to the sea. The Romans came there and left bridges and town walls, but it was only briefly occupied by the Moors. Spanish ships were (and still are) sailed by Galician seamen to all corners of the world and the Pinta returned there from the New World. It is a country of the coast, with a poor harsh granite hinterland and little obvious interest in the rest of Spain.

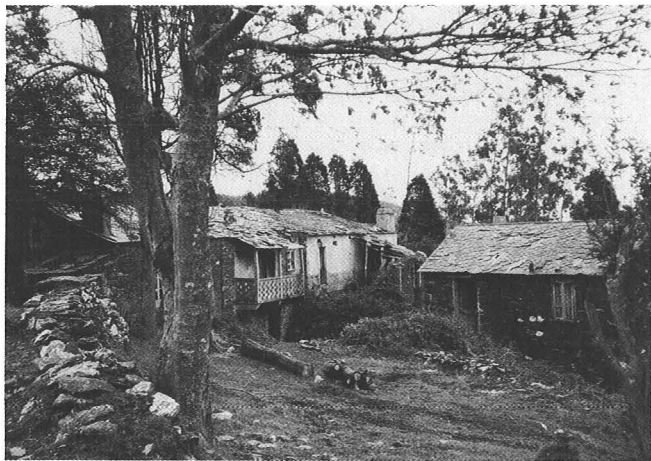
Its capital, Santiago de Compostela, contains the grave of the Apostle James, and pilgrimage has been a most important industry for 1500 years.

Galicia lies in the latitudes of 42 to 44 degrees north – approximately Otago in the southern hemisphere. The climate is oceanic, with long cool wet winters and a pronounced summer drought from June/July until August/September. Severe frosts and snow are rare, and wind, except for occasional Atlantic gales, is not a big problem.

The author, John Purey-Cust is an international forestry consultant.

It is a good tree-planting climate, but the dry summer and fire give problems when the job is poorly done.

Apart from occasional steep rises from the coast, Galicia is a country of wide agricultural plains and broad rolling now treeless hills. Fire is the main shaper of the landscape and the hills are clothed in gorse and heather and often burnt plantations. Natural forest of oak, chestnut and birch is confined to mountain valleys and other secluded places.



Abandoned farmhouse. All over Galicia hill farmers are walking off their land, defeated by poor soils, fragmented tenure and EEC attacks on subsidies.

Land tenure is very complicated, with inheritance to all children equally, bit by bit, with the result that the freehold landscape is a patchwork of tiny fields divided by stone walls.

Private land holdings are therefore very small (most would be no more than 10 hectares and 200 hectares is said to be very large), and there is no aristocratic landholding tradition as there is in Portugal. Perhaps a corollary, there is also very little tradition of interest in trees and forest management.

In the hill country only the lower more fertile land is freehold and the hills are the common land of the village. There is a committee responsible and specific individual rights, but mostly the land is only roughly grazed, and most years it burns.

Sometimes this common land is used for tree planting joint ventures between the Xunta and the community, but fire is always a problem.

The villages of solid stone houses are now often empty of anyone under 50. A life of unremitting toil no longer has attractions and youth has long since fled to the coastal towns and to the car factories of northern Europe.

The European Economic Community is accelerating this tendency by its war on excessive production ("market" prices and death to subsidies). This is further upsetting the hill-country rural economy, where people often live off four or five cows and a few sheep.

Work is still done by hand, and the cows provide the transport system. Land reform is hindered by an often strong family attachment to the ancestral hearth and there is great reluctance to sell rural land, even at very high prices. Amalgamation into economic holdings is difficult, and despite the very large areas of neglected land it is not easy for new uses or owners to obtain a foothold.

Much now reverts to gorse and bracken, and in many places the rural landscape moves either towards complete emptiness or weekend habitation only.

The Forests

Much of the land has good potential for trees, and indeed in the past was forested. Chestnut (*Castanea sativa*) was the mainstay of many rural economies, providing both food, building mate-



Misdirected effort. Traditional establishment techniques are intensive, but often the effort is misdirected. Here, the site was 100% cultivated before planting and is rotovated annually between rows to reduce fire risk. The radiata pine trees (five years old and much blanked) are unweeded and have nutrient problems.

rial and tools. It was displaced by maize and potatoes from the New World and further discomforted by the Chestnut blight. The groves are neglected and the nuts lie in droves, uncollected.

The interest now is in plantations. Along the coast and up to about 400 metres *Eucalyptus globulus* flourishes, rudely healthy, seeding and coppicing where it will. Fire only encourages it, and needing no helping, caring, sharing hand it is the bane of the green movement. It was introduced about 80 years ago, from Portugal.

There is potential to greatly improve the productivity of *E. globulus* in country suited to it, and also to try out others of the genus elsewhere.

Pinus pinaster, another Portuguese introduction but native there, also does well along the coast and in the drier and hotter inland valleys of the south. It also stands fire well, regenerating vigorously, and tolerates shallow dry soils. Its form is poor and its productivity very low but it is a robust species in tune with its surroundings, and so is favoured.

Radiata pine is a distant third favourite. It has a wider range than either of the others, but needs a great deal more attention to fulfil its potential.

The comparative productivity of these three is approximately:

P. pinaster – 5-7 m³/ha/year – mean 6 m³

P. radiata – 5-25 m³/ha/year – mean 10 m³

E. globulus – 10-40 m³/ha/year – mean 15 m³

The only other plantation species of any extent is *Pinus sylvestris*, planted on the highest ground and usually very slow growing and of poor form.

Acacia melanoxylon regenerates vigorously along the coast, with a form much better than in New Zealand. It is treated as a weed and not used. Small stands of 30-year-old kauri, rimu

and totara flourish in the grounds of the Lourizan Forest Research Station.

The one million hectare plantation resource is spread amongst 300,000 owners. There are no large owners, nor any cooperation in either growing or marketing wood.

Plantation soils are predominantly shallow and infertile, much degraded by pastoralism and continual burning. The vegetation is familiar to New Zealand foresters – gorse and heather, with broom, blackberry and bracken coming in on the better sites. In corners protected from fire there is colonisation by birch and alder.

In general, weeds lack the explosive vigour of gorse and bracken in New Zealand and do not require such drastic control measures.

For radiata pine potassium deficiency is likely everywhere, and a lack of phosphate also causes problems in places. These deficiencies are seldom obvious in the other plantation species.

Mostly the plantation estate is unmanaged. *Eucalyptus Globulus* and *Pinus pinaster* are often left to regenerate themselves, and nursery and the standard of plantation establishment is not high.

Seedlings are grown in bush nurseries often in the plantation. They are small and unsuited to mechanisation, and all work is done in a traditional manner, by hand. Seed is sown in rows on raised beds, with a good strike. Weed control (by hand) is good but there is no use of fertiliser, nor any conditioning of seedlings.

After one growing season in the nursery radiata pine seedlings are 10–15 cm tall, with a weak stem and very poorly developed roots. Sometimes they are left in the nursery for another growing season and planted out when about 25 cm tall.

Success is judged solely by survival after planting, and strong growth in the first year is neither expected nor achieved.

Plantation establishment practice is often expensive, with total cultivation (including often use of a rotovator) before planting. Herbicides and fertilisers are rarely used. As described, seedling quality is very poor and poor survival and the threat of fire reinforce a perceived need for close spacings (less than 2 metres) and, occasionally, the planting of two trees in one planting spot. Blanking often continues for several years after planting.

Weeding is mostly aimed at fire control, with inter-row cultivation and only slashing round the tree. The negative emphasis on prevention of risk rather than encouragement of tree growth leads directly to uneven, poorly stocked and unhealthy stands. 100% pruning to 2 metres is often done as a fire prevention measure, where it is largely ineffective as nutrient-deficient canopy development is insufficient to control gorse regrowth. Pruning is never done for silvicultural reasons.

Thinning is rarely done, and then for production only, and many stands are grossly overstocked, with much ill health and loss of volume.

There is very little analysis of whether current practice achieves management objectives, and, if not (usually the case) what to do about it.

Fire is an ever-present threat, but a vigorous control campaign has considerably reduced the area burnt, though not the number of fires. Arson and casual agricultural burning are important causes.

Pines suffer from a number of insect pests not present in New Zealand. Plantings in fresh pine cutovers or burnt sites seem to be invariably attacked by shoot borers and bark-eating beetles.

The needle fungus *Dothistroma pini* is claimed to be common and a serious hazard of radiata pine, but so far all demonstrated attacks have been either other fungi or nutrient deficiencies and only a token presence of dothistroma has been detected. The disease was apparently a problem some years ago, but now seems to be quiescent.



Seedling quality matters. Seedlings of poor (left), medium (centre) and good (right) quality compared 12 months after planting in a disced site.

The green attitude to plantation forestry varies. There is a very vocal opposition to the planting of more eucalypts, focusing on their perceived exclusion of all else and water consumption in a country of dry summers, and possibly the age and odour of some of the industry.

Pines so far are not very controversial, though Greenpeace is occasionally recorded as muttering that Galicia should not become the forestry capital of Spain.

There is claimed support for the planting of native species, but no strong case for how this is to be done and no apparent concern for the pressures of Spain's wood deficiency on other people's forests. As in Britain, there is a tendency to see the present landscape as a natural climax situation, but unlike Britain there is not yet alarm when the forest naturally re-asserts itself.

Opposition seems generally to come from urban intellectual groups. Support for more plantations comes from industry and landowners, many of them peasants who otherwise have no economic crop.

The Industry

Spain builds in stone and concrete. Wood is little used in buildings except for shuttering and internal work, but despite this, a population of 40 million uses quite a lot of wood, and Spain imports about 50% of its demand.

The sawn timber industry is made up of many small mills, mostly cutting short length (2.5 metres) pine logs into boards for use in fish boxes and pallets, with a small proportion cut for panelling and furniture (some exported). Pinaster saws cleanly with tight knots, but its form does not allow the cutting of longer lengths, and this is claimed to be one of the reasons for favouring the growth of radiata.

The mills also cut a little chestnut for window frames and doors, for which there appears to be a strong traditional demand, but log quality is very low. Globulus (also in very small quantities) is sawn for flooring of good appearance.

There is some use of eucalypts and pine for veneer.

The pulp industry depends on eucalypt, importing any extra raw material from South America and Africa. There are seen to be ample potential sources of supply in the cash-strapped developing world, and so there is less interest in expanding the domestic eucalypt resource.

Pine is mostly used for panel boards, both particle board and MDF. There is concern over future supplies as the domestic resource is short and imports at a reasonable price are not available.

Wood prices are quite uniform, varying little from about 5000 pesetas/tonne for eucalypts and pine 3500 pesetas, delivered to the mill (\$NZ1 = 57 pesetas), with little increase for quality.

On both price and productivity eucalypts beat pine on most sites – a problem if the area of radiata pine plantations is to be increased in any area where eucalypts are an alternative.

The quandary for both grower and user is the organisation of the forest industry in Galicia, which is either a strongly organised cartel of a few very big firms or some 600 small sawmills, all getting wood from a multitude of very small and disunited forest owners.

Like the world over, the big industrial wood users have little interest in the raw material except that it be cheap and uniform. Market diversity, other than as a result of engineering wizardry, frightens them and silvicultural curiosity is not their strong point. They add to Spain's wealth and provide for much of its wood requirement, but they do not do as much as they should to make the grower of trees rich.

But potentially rich growers are important, because in Galicia they, not industry, own the forest. Some carrot has to be found if productivity is to be increased, and the most obvious is a diversity of wood prices, based on quality.

The most obvious candidate for this is *Eucalyptus globulus*, which is regarded solely as a low value industrial wood. Yet Spain sits on the edge of one of the biggest and most sophisticated markets in the world, with a large demand for good-quality sawn timber, and in *E. globulus* it has a tree to supply it. So far that opportunity has been ignored, but if taken up it would offer a potential for better prices for selected logs and an incentive for good management.

Administration

Government in Spain is now very decentralised in many respects, and Galicia controls most of its own affairs. This includes forestry which under the present administration is highly favoured both as a source of raw material for local industry and as a part of the solution to rural depopulation.

There is a regional or Xunta (pronounced "shunta") forestry organisation which administers any funds set aside for forestry. It is responsible for fire control, and administers joint venture planting on communal land. It runs nurseries, but these are to supply joint venture programmes and seedlings are not generally available to the private landowner (who has no other serious source of supply).

The Xunta has a forestry research and training centre under its control at Lourizan and there is another university forestry school at Santiago de Compostela.

Senior appointments in the bureaucracy are political, and run within the four-year term of the presidency. This has the effect of exaggerating changes in policy, beneficial to forestry when it is in favour, but destructive of morale and continuity when it is not.

The national Forest Service in Galicia is essentially Xunta controlled, flourishing when, as now, there is local political interest in forestry and pining when there is not. It is an effective organiser of fire control, but has no state forest under its direct control, as by and large there is no public land. Where it plants, it is either as an agent or in partnership with someone else, usually a village on its common land.

Professionally trained foresters are mostly in the higher levels of administration, with field duties being performed by rangers who have taught themselves on the job. Their quality varies considerably, but as some have spent their whole career in one district, there is in places a great fund of local knowledge and experience.

The main defect of the system is that it offers no channel for querying the success of traditional practice nor any opportunity and liaison for the introduction of change. There is no liaison with research, either to point it at problems to be solved or to take up its findings. The best example of this has been the failure of field practice to recognise soil nutrient deficiencies even when these have been clearly identified by research as a major problem.

This has led to a tendency to concentrate on species such as *Eucalyptus globulus* and *Pinus pinaster* which are naturally healthy and have strong powers of recovery from logging and fire.



Good seedlings, good site preparation (discing), good weed control = no maintenance costs. 12 months after planting. Before discing the site was in a dense tight gorses sward, but regrowth has been much less vigorous than it would be in New Zealand.

While in many respects sensible, this attitude has had the effect of playing down the importance of the resource and of any need to improve its productivity. As a result, there is no history of interest in good nursery techniques or other silvicultural matters, nor is it easy for the private forest owner to get seedlings for planting, regardless of quality.

There is no pressure for change from forest owners because of their individual small size and lack of any cooperative organisation. AFRIFOGA represents a changing industry attitude, albeit in a narrow field, but for some time to come the responsibility for change will rest with the Forest Service.

The Project

The initiative for improving this situation has been taken by an industry association. AFRIFOGA (Asociación para el Fomento de la Riqueza Forestal de Galicia) whose members are concerned above all by the shortage of good pine sawlogs.

They prefer radiata pine to pinaster because of its greater productivity. They are aware of its growth rates in other parts of the world as well as in the Basque Country in Spain itself, and aware also that Galician plantations have not so far come up to expectations.

They see the solution lying in easy access to good quality seedlings and the development of better plantation management practice.

Hence the introduction of New Zealand foresters to Galicia.

A universal problem in such situations is the local belief that solutions cannot be simple (otherwise they would have been found long ago). There is invariably a pressure for complicated solutions involving high technology, and the news that New Zealand plantation establishment techniques are simple is not always well received.

The first phase therefore had to be a trial, to see what applied in Galicia, for there are obvious differences as well as similarities. Soils are less fertile, the summer climate more extreme, and plantation performance not at all what it ought to be. How far does this show up poor practice, and how far does it reflect real difference?

The first step therefore was to test out New Zealand techniques and see how they performed. There was confidence in the philosophy that strong seedlings in a well prepared environment will always do well, but what variation was necessary to produce strong seedlings and to establish healthy and fast-growing plantations?

A small nursery was put in and managed as it would be here. Not everything went right, but when there were problems, seedling reaction was as expected. So too when things went well. Strong seedlings were grown.

Five small sites were set aside for trial plantations, being prepared and planted in January 1990. Three were on shallow degraded pastoral soils under stunted gorse and heather, and two had been in pinaster, recently felled.

Seedlings were lifted, trimmed, topped where necessary, packed in boxes and transferred to the site in best Trewin tradition. The three pastoral sites were cultivated in continuous rain just before planting, using rippers and giant discs, turning the sites into a condition that made planting both difficult and unpleasant.

Planters had been found locally-short, solid, rather dour men armed with mattocks and an air of invincible resistance to change. This looked to be a problem because a part of the deal was spade planting.

However, it turned out that the problem was over estimated. Yes, they would try the spades and the planting boxes in their wire frames, and after a short trial this was pronounced a good system and never looked back.

A series of trials were put on each site, to give pointers to where the important problems lay. Various grades of seedling were compared, and planting into untouched ground compared with the results from varying intensities of cultivation or weed control with herbicide.

Two growing seasons later, there is good survival and vigour on all save one site. First growing season survivals exceeded 90% and seedlings still grow strongly, being now between one and two metres tall, according to site.

Locally, blame for the one poor result has been ascribed to a high summer temperature, often over 40 degrees C, and certainly there is no other radiata for many miles around. There has been poor survival there and very variable growth.

In April 1991 trial measurements showed only the advantage of good large seedlings and of any method of weed control (by herbicide or cultivation) over none. By October good seedlings still hold the lead, but the beneficial effect of cultivation above weed control alone is beginning to show up.

The seedling result is important because it is a strong local belief that on any exposed site (and most in Galicia are exposed) the best seedling is small and not above 15 cm tall. The "good" trial seedlings were 35-40 cm tall with a root collar diameter greater than 5 mm. The trial difference between good and poor seedlings favours the good ones most on hard sites: on good sites the advantage has been less.

But though the trial plantations have grown strongly from the start, they have all in some degree shown signs of nutrient deficiency.

Dr Graeme Will visited Galicia in April 1991 to assess the nutrient status of radiata pine and the soils where it is grown.

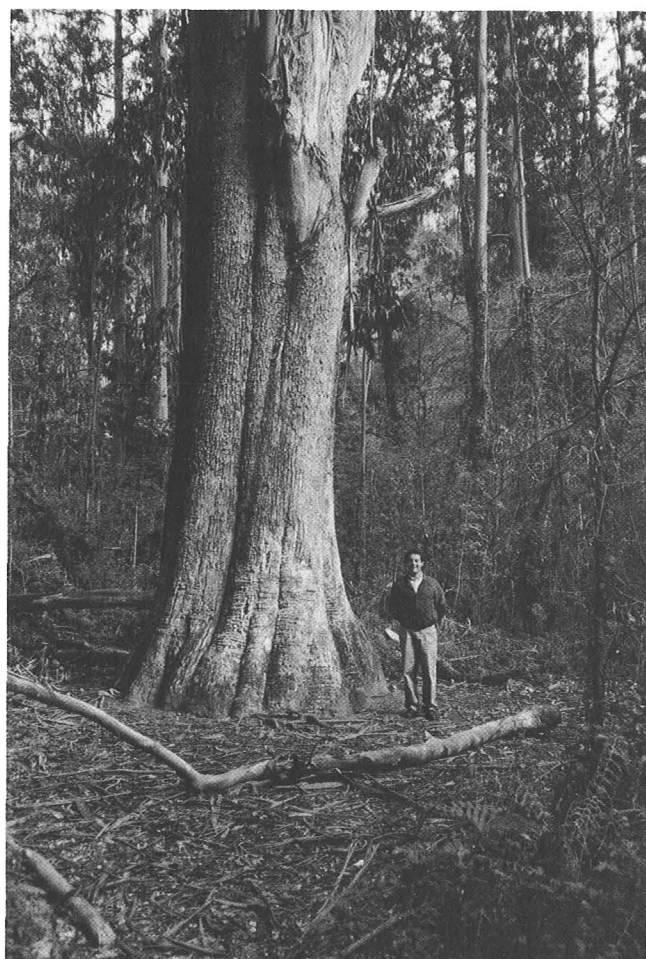
His investigations gave order to casual observation of a great deal of highly variable ill health in radiata plantations. With much local variation there is in general a gradation from extreme distress in the west, through an acceptable poverty, to good health and colour in the east. But everywhere foliage is thin, and despite close spacing, weeds are not suppressed even after the canopy closes.

Soil and foliage analysis confirmed potassium deficiency almost everywhere, with phosphate also low in the west. A wide range of trials was put in, to better define the range of response to fertiliser.

Ironically these findings only confirmed work already done at the Forest Research Centre at Lourizan, but not taken up into field practice.

Overall, the plantation establishment trials had been too crude and beset by variables to give subtle answers, but they did give some clear and basic messages. Discounting the hot inland site, they say that:

- Good strong seedlings will always do much the best, in both growth and survival, with quality being more important on harder sites.



Not all the best trees are radiata. This 80-year-old *Eucalyptus globulus* was one of the first to be planted in Galicia. Better establishment practice is likely to yield at least as good a return for eucalyptus as it has for radiata pine.

- Weed control before planting is essential, and cultivation, probably the more the better, adds to the advantage.

Given fulfilment of these conditions, it is possible to establish healthy and fast-growing plantations of radiata pine in Galicia without a need for blanking or weeding after planting.

In other words, thus far the same rules apply in Galicia as they do in New Zealand:

- good seedlings + good planting in a well prepared site = a good plantation.

There are necessary differences of technique, notably the much greater universal need for fertiliser, but the philosophy is the same.

A standard prescription has been defined for the meantime:

- Slash vegetation to a close sward.
- Single tine rip the planting line.
- Spot or line spray the planting line with herbicide, using glyphosate, one metre wide.
- Plant in the rip when the herbicide effect is clear.

Ripping for deep soil cultivation is probably not necessary in the prevailing stony soils. Its prime purpose is to cut the tight surface turf and to mark the planting line.

But with experience the advantages of a combination of good seedlings and total cultivation become more and more apparent, and that, plus fertiliser, is likely to be the next recommendation.

What Next?

The techniques for the successful establishment of radiata pine are all but resolved, and the main difficulty now is to translate them into routine practice. Silvicultural choices then becomes

possible – where to plant, for what purpose, and how to manage the crop to attain reasonable objectives.

But technique is not in the end the most important constraint on forestry in Galicia. There is as yet no framework within which the threads of any common purpose may be drawn together. The local Forest Service is not strong and the only organised body is of industrial wood users whose interests generally lie, as they do in New Zealand, outside the forest.

There is no farm forestry or grower interest, and very little knowledge or apparent curiosity in that sector.

The Forest Service, having no land of its own to manage, has not been in a strong position to test new ideas or to play any obvious part in defining a framework of change for the better.

The greens have so far been a negative voice, concerned only with protest and holding the moral high ground. They have not yet shown any sign that they want to be a part of a solution which does not ultimately lead to exploitation elsewhere.

Thus there is still a vacuum, though the formation of AFRI-FOGA has changed this a little. Industry is now aware that it has some responsibility for the resources on which it depends and the Xunta of Galicia supports the need for a more positive attitude to be taken to the forest resource.

However industry has still to work out what it wants, and what it is prepared to do, in research and in encouragement of growers, to get it.

At the same time the industry interest has to be counter-balanced by the viewpoint of the grower, and so far there is no voice. There are no cooperatives or associations of forest owners.

It is unlikely that the prospects of cooperatives will find favour with industry, but in the end it is the best assurance of long-term supply and the only way to move forestry down off

TABLE 1: A COMPARISON OF SEEDLING QUALITY

(measured 12 months after planting)

Site	Seedling Quality				poor	
	good		medium		M.ht Survival	
	M.ht	Survival	M.ht	Survival	M.ht	Survival
		%		%		%
Torres de Arcos	69	100	55	80	34	49
Trasmonte	62	100	46	95	35	92
Vilasantar	62	100	43	90	31	97
Xove	90	87	74	65	65	67
Vilamarin	58	97	47	80	34	72

M.ht – mean height (cm) of surviving trees

Survival % – % of trees alive and healthy

The following seedling quality classes were used:

	root collar diameter	stem height
Good	5 mm	30-40 cm
Medium	4-5 mm	30-40 cm
Poor	below 3 mm	20-30 cm

Xove is both a sea-level site and on good forest soil. The others are between 400 and 500 m above sea level. Vilamarin is the site with very hot summers.

the barren uplands and onto the better-quality abandoned low-land soils.

But as yet no solution to this problem has been found.

ADDENDUM

‘From Beech to Coal, and Back’

G. Mew and C.W. Ross

NZ Forestry, August 1992

The concluding section of Messrs Mew and Ross’s article, published in the August 1992 issue of NZ Forestry, was not printed in its entirety. The final two paragraphs are reprinted below. We apologise to the authors for the inconvenience.

Some Philosophical Questions

The purpose of the major trials at Giles Creek is to find satisfactory ways of restoring indigenous vegetation to mined sites with similar characteristics. Eventually it is hoped that the methods will be documented in the form of prescriptions that can be followed by miners. They may also become part of the conditions under which licences are issued to mine in indigenous forests. However there are a number of uncertainties about what will happen, and what we as foresters and/or conservationists want to happen.

Full-size beech trees like those at Giles Creek take at least 60 years to develop. While canopy closure will be at a much younger age, we are not sure when the beech forest will achieve comparable diversity, or even become a “stable ecosystem”, if such a thing exists. Should we try to hasten the stages to maturity as much as possible? Or should we push the clock back for the site and let natural colonisation (by similar or the same species) take its natural course? It is far easier for the miners not to have to worry about soil survey, segregation, stockpiling, stumping, weed control and restoration. But in these days, a sea of gorse, steep-sided, water-filled pits, and rusting heaps of machinery are not acceptable environmental outcomes when judged against surrounding native forest. The best we can do is set the scene so that the options of future generations are not compromised. Both forests and soils have taken a very long time to develop. We are attempting to return our mined sites to a state as close to that before mining as we possibly can.



Good site preparation and weed control, good seedlings, good foresters (Dr Graeme Will and Manolo Miguez). 12 months after planting. Traditionally, seedlings in Galicia make very little growth in the year after planting.