Faculty of Science
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Next Generation Plantation Investment Research Project

Benchmarking analysis: Part 2 An international perspective of the history of plantation development, policy and incentives.

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A brief description of the report

The aim of this analysis and report is to provide insights and guidance to the development of robust and evidence based mechanisms to support the expansion of the Australian plantation estate. While it is possible to present a simple list and limited narrative around incentives, it is only by a thorough analysis of a mechanism, consideration of the enabling and other factors in the operating environment and the outcomes, that it is possible to fully understand the purpose and utility of a tool. The analysis considered the United States of America and the European Union (taking The Republic of Ireland as an exemplar Member State) to understand the intent and mechanisms used: the intent was manipulation of agricultural production by semi and permanent land-use change by afforestation. A detailed analysis was undertaken of New Zealand and *República Oriental del Uruguay* (Uruguay). New Zealand was selected because their history and system of Government is similar to that of Australia, with a key difference in the level of involvement of the Government in the plantation estate by the use of a range of incentives. The New Zealand estate was initially based on the conversion of native forests to plantations and later focusing of cleared agricultural land. Uruguay was selected based on the experience of developing a world-scale plantation estate in close to 30 years. The land-base was natural grasslands used for agriculture and the Government's role was as facilitator. The Government developed and effectively implemented a series of incentive mechanism to stimulate afforestation.

The report is structured to present a synthesis of the analysis outcomes followed by details of the case studies:

- The attributes of plantation development programs with a focus on incentives
- European Union and the Republic of Ireland
- The United States of America experience
- Uruguay experience: a purpose built estate
- New Zealand experience: building on natural forest supply

The conclusions and recommendations

The following are the key conclusions of the analysis

1. A single 'magic lever' incentive does not exist to stimulate afforestation.
2. Effective incentives involve a broad range of considerations synchronized and in alignment.
3. Land-owners are key and their involvement will require compelling reasons to plant trees. A continued dialogue between AFPA and NFF is critical to reinforcing a link to have trees regarded as an option within agriculture. Trusted advisors must be convinced that planting trees is a 'wise and prudent' use of land.
4. Regional plans are required to align the interests of parties, focus tree regime design (species + silviculture + markets) and to assist with the fit of trees into agriculture. Plans must take account of the current status of trees within a region.
5. Mechanisms are required to join parties and it is suggested that well designed joint-ventures offer a robust mechanism to share the risks and returns in the absence of funds to support a lease arrangement. A motivated party is required to drive the process.

6. An intelligent and fit-for-purpose incentive package is required to help implement regional plans. The incentive used can help reduce the risk of adverse social and environmental outcomes by providing some influence over implementation (e.g. target land).

The key insights

The following are the key insights from analysis of policy measures to support afforestation by rural landowners in the European Union (The Republic of Ireland), New Zealand, Uruguayan and United States of America. These form the basis of specific recommendations of policy and incentive mechanism for Australian afforestation programs.

- *Trees into agriculture*
    - Across all jurisdictions, there has been limited investment in large-scale afforestation by rural landowners without support other motivated parties to drive the development.
    - Afforestation is a voluntary activity and even where tree planting is part of traditional farm practices, with a shift to larger-scale planting within farming enterprise activities there is a need to motivate farmer participation.
    - Larger-scale tree planting by rural landowners has often been stimulated by negative farming conditions. Trees provided an alternative income source under depressed agricultural conditions, and importantly are regarded as an alternative to agriculture rather than as an option within agriculture. Government financial support for tree planting was often provided as part of general support during rural downturns (e.g. Uruguay) or to encourage reduced production of agriculture commodities by taking land out of production (e.g. European Union; USA).
    - To promote tree planting, there is a need to focus on farmer needs and the fit of trees within agricultural systems (this is the current approach in Uruguay). The promotion should include a specific 'offer' and define the project details (e.g. the arrangements, markets, rotation lengths, species, silviculture and the target land).
    - Farmers will seek advice from their trusted advisors and historically farm advisors have had limited knowledge nor interest in afforestation (e.g. in New Zealand in the 1980s). This is a critical point that can be addressed as a part of a strategy to encourage trees into and as part of agriculture.
    - A key success factor in implementation of projects is a 'champion'. In the past Government has taken this role in the development of their own resources (e.g. New Zealand). In other cases it has been a party motivated by a need for a resource or a specific outcome (e.g. in Uruguay).
    - Farmers will select the land for afforestation within a farming unit that best meets their objectives. These may be direct income objectives, or those that aim to enhance the farm operations, for example through, spatial arrangement of management units, animal welfare, water quality or erosion control. A project design should help define appropriate land within farms based on farmer needs and the commercial requirements of the tree crop.
    - A barrier to larger scale tree planting is farmer to farmer peer pressure where larger scale tree planting is considered a sign of being a 'bad farmer' (e.g. in the Republic of Ireland). To address this pressure will require acceptance of larger scale tree planting as legitimate and part of agriculture.
- *Intent and supporting policy*

- Afforestation converts non-forested land to forests, and commences with cleared agricultural land. The decision making process of whether or not to provide land for afforestation rests with farmers or other land-owners. It is suggested that afforestation should be regarded as more an agricultural than forest policy issue. This is the current treatment in Uruguay.
- The policy and regulatory framework must reflect the needs of an afforestation project and these needs will evolve with time and the stages of development of a project. For example, the treatment of taxation in Uruguay and New Zealand has been dynamic and in some cases changes have had an adverse impact on rates of afforestation.
- There is a need for a clear intent statement supporting afforestation projects that is transparent as to the primary and any secondary goals. This will help frame the multiple benefits of afforestation. For example, in the EU, while tree planting is the outcome, the intent is manipulation of agricultural production. If this is made clear, then the financial support of tree planting is placed into the context of the EU agricultural subsidies framework.
- Afforestation with a primary intent of resource development will still result in other benefits. For example in New Zealand specific projects supported by grants seek to afforest erosion prone lands. There is specific evidence of a reduction in floods, sedimentation, erosion in areas afforested with commercial trees compared to grasslands.

- *Designing a project*
  - Regional plans prepared by Government have been successful in guiding afforestation and processing capacity development on a broad scale in New Zealand and Uruguay.
  - The development of a specific project by a party must be supported by a comprehensive project plan that fits within broader regional plans for plantations and processing. There is the option to disregard regional plans, but this places the onus on a project to reach critical mass of area established.
  - While it is appropriate to set afforestation targets, there is a danger in setting afforestation rates that may trigger concerns by agriculture (e.g. be regarded as a threat due to changing a locality). New Zealand's One Billion Trees Programme states that it does not intend to support whole farm afforestation to alleviate this issue.
  - Any target areas should carefully articulate the target land-base and the fit with exiting agriculture in a region. New Zealand has in the past set estate scale targets based on modelled wood demand, but did not specify the target land-base. Uruguay set estate scale targets and regulated which land could be planted at the individual property level based on farm productivity classification. A logical next step is to target specific land within individual properties by providing guidance to farmer's decision making process.
  - Evidence based species matching based on biophysical requirements (e.g. rainfall and soils) can support planting of the right trees in the right place for targeted markets and regional conditions. This was the approach taken in Uruguay and The Republic of Ireland.
  - Defining suitable land for afforestation (relative to its agricultural capacity to target marginal farmlands) was successful in gaining agriculture sector support for afforestation in Uruguay and in some cases in New Zealand. Afforestation in Australia could be supported by land classification (currently Australia does not have a uniform land classification system) to provide a clear definition of suitable land.

- Project and incentive system design can limit unintended negative consequences resulting from project implementation. This can include impacts to agriculture or land speculation distorting land values.

- *Investment mechanisms*
  - A range of investment vehicles are possible. A key success factor is participation of a motivated party to drive the uptake of an offer. Joint-ventures (not on a first right of refusal basis) are effective, as are pooled trust mechanisms (e.g. in the New Zealand context, limited partnerships).
  - Development of an out-grower scheme is a mechanism that links grower and processors while negating the need to purchase land (e.g. as implemented in Uruguay).
  - Motivated by land price barriers, processors seeking expanded resources by afforestation in Uruguay are now focussed on joint-venture arrangements to establish and manage trees on farmer's land and within (complementary to) agricultural systems.
- *The role of Government*
  - Government can have direct involvement in afforestation as the party undertaking the development. In New Zealand the Government was significantly involved in the development of the initial plantation estate until deregulation of the economy in 1984. After this time, the New Zealand Government maintained a support and facilitation role. With the One Billion Trees Programme, the New Zealand Government has recommenced funding and undertaking direct afforestation on other party's land.
  - Government can act solely as a facilitator of development as was the case in Uruguay and the Republic of Ireland.
  - Taxation arrangements have been a key factor of the scale and success of afforestation in Uruguay and New Zealand. In Uruguay eligibility for taxation mechanisms was linked to targeted land (marginal for agriculture) and supported specific species and silviculture. In New Zealand, taxation was an enabling mechanism in combination with other factors.
  - An expensing of plantation costs in the year of occurrence against any income is a strong stimulant of participation of parties with a taxation 'issue' or parties seeking to develop timber resources (the New Zealand treatment). A taxation treatment that delays expensing establishment costs until harvest is a disincentive to afforestation, as occurred in New Zealand.
  - An alternative and effective mechanism is to allow investment of tax liabilities back into afforestation (the treatment in Uruguay).
  - Under Uruguay's Forest Laws, the taxation treatments evolved with the state of development of the estate. Once the scale of the pulpwood estate reached a critical mass, there was a segmentation of taxation treatments to favour longer-rotation plantations for solidwood and veneer log outputs.
  - There is a need to design a taxation treatment that seek to maximise afforestation but with mechanisms to limit any adverse outcomes. This has been achieved in Uruguay by a combination of eligible land based on agricultural productivity and taxation treatments based on rotation lengths and target products. A complicating factors is that in Australia, taxation is a Federal Government issue, whereas land-use policy is a State based mechanism.
  - Income spreading mechanisms can assist with the 'lumpy nature' of plantation revenues and increase the attractiveness of afforestation. The treatment in New Zealand provided greater spreading for foresters compared to farmers growing trees.

- Climate change policies and associated mechanisms, including emissions trading, were previously an impediment to afforestation (e.g. in New Zealand the treatment of emissions liabilities resulted in accelerated harvest and conversion of plantations to farmland) or a stimulant where payments have been provided to landowners for this environmental service.
- The liability for future carbon emissions has been a compounding factor. The implementation of the New Zealand Emissions Trading Scheme (ETS) was an early announcement in 2002 of the segmentation of plantations based on Kyoto requirements into pre-1990 and post-1989 plantings and with differential treatment of each. This resulted in an unforeseen acceleration of harvest and deforestation to avoid emissions liability prior to the implementation of the ETS in 2008.

- *Government grants and loans*
  - Afforestation loan facilities provided to farmers, even with attractive terms and conditions generally failed stimulate afforestation in New Zealand.
  - Grant mechanisms have generally been more effective than loan facilities. For example in New Zealand after 7 years of offering afforestation loans with favourable terms, the result was a poor uptake and the facility was replaced by a grant mechanisms. Plantation development under grants in New Zealand supported 27.9% of the plantation established from 1971 to 1983.
  - Grant mechanisms have been more successful where they have targeted specific areas and land units for afforestation, specifying the species planted and any other attribute of a project.
  - Based on evidence from New Zealand and Uruguay, the duration of a grant programme must be consistent with the target timber resource expansion. For example, a short duration grant programme can support afforestation in a location with a current resource by planting the current species to augment resource supply. A longer duration grant programme is required where the goal is to develop a new estate to ensure sufficient resource for a viable new processing or export industry. While it is possible and appropriate to seek supplementary funding (e.g. an investor to continue funding of a programme), unless this is secured from commencement of the programme, the grant mechanism should commit to develop the whole the resource. After a period of time and successful implementation an investor may seeks to take-over the programme.
  - It is suggested that the up-take of grants could be facilitate by potential linkages to a specific project with a joint-venture linked to a highly motivated party with a longer-term focus to develop a commercial resource.
- *Processing capacity*
  - The presence of processing capacity provides confidence that a market exists. Where afforestation is occurring in a new region, a narrow species focus will assist in creating a critical mass of resource.
  - There is a need to consider both current and on the horizon existing and potential processing capacity options. In either case there is a need for complete disclosure as to the status of the target markets and processing capacity.

Introduction

An incentive seeks to stimulate a desired response by an intended recipient. Consideration of incentives can be simple and focus on the mechanisms that define the approach used. Based on experience there is a compelling requirement to not only understand the mechanisms of an incentive, but to understand the impacts of the operating environment and how this has impacted on the motivation to act. A further consideration is the unintended and collateral damage that can result from a poorly designed and/or implemented incentive (e.g. social and environmental impacts). Therefore the intent of this analysis was to seek to identify relevant country examples to explore in detail the history of plantation development with a focus on the actions of parties, the operating environments and the motivation of those involved. The incentive mechanisms also required documentation of on any mechanisms to limit collateral damaged. A narrow and detailed focus on four countries was undertaken and Table 1 presents details of the other countries considered based on previous studies.[1] The incentive systems in place and the operating environments in each country were reviewed at a high level based on the source report. This analysis considered New Zealand and Uruguay in detail, and the European Union (taking the Republic of Ireland as an example) and the United States of America.

New Zealand was considered as highly applicable to Australia given the long history of plantations, an initial conversion of natural forests to plantations, the significant role of Government in afforestation and the range of incentives utilised in the past. The role of agriculture and plantations in New Zealand was also considered relevant. Uruguay was selected as it is an example of a purpose built plantation estate focused on natural grasslands: while the land afforested is natural grasslands, these have been managed for agriculture. The Uruguayan example presented a case of highly focussed afforestation programme with the Government acting as a facilitator rather than as a direct investor, hence the incentive mechanisms are highly relevant to Australia. Uruguay also presents as an example of achieving a significant plantation estate in a relatively short period of time. The European Union (and the Republic of Ireland as an example) presents a case of afforestation driven by a motivation to control agricultural output by a permanent retirement of land. The mechanism of very generous 'aid' and that the farmers selected the land retired (established to woodlands) offered significant insights into non-regulatory mechanisms to encourage afforestation on marginal agricultural land. The United States of America was selected after consideration of the mechanisms driving land-use change: historically via control of agricultural out-puts and others have sought to retire marginal land for environmental reasons. The analysis included a dialog with a contact in New Zealand and parties with links to Uruguay and an interview with an Irish farmer (farming in Australia) with family in the Republic of Ireland with direct experience with woodlot development. Based on the information collected, the dialog was maintained and statements were used to direct seeking out specific information on the mechanisms and operating environment (a process of taking perception out of the description of the mechanisms). This resulted in a detailed understanding of the relationships between plantation outcomes, the drivers and the policy mechanisms used.

The following report provided the basis for evidence based recommendations for policy and incentive mechanisms to support the expansion of the Australian plantation estate.

[1] A summary of de Fegely et al (2011: p. 60-75).

Table 1: A summary of the attributes of plantation incentives in the countries listed[2].

Country	Natural forest concerns	Resource security	Market opportunities	Intent	Taxation			Grants	Subsides	Target zones	Land tenure	Area limits	Target species
					Income tax	Property	Inheritance						
Brazil	X	X	X	Resource development	X	X	X			X		X	X
Chile	X	X		Resource development	X		X		X	X	X		
India	X			Conservation & revegetate of wastelands & poverty alleviation				X	X				
Japan				A focus on domestic small forest owners				X					
Republic of Korea	X	X	X	Replant denuded forest for fuelwood and flood mitigation									X
South Africa		X		Use of out-grower schemes and environmental repairs		Increased rates		Nil		An issue			X
Turkey	X		No	Environmental driven e.g. erosion control									X
Viet Nam				Rural growth & poverty reduction. Reallocation or degraded or unused land to smallholders				X					

[2] A summary of de Fegely et al (2011: p. 60-75).

The attributes of plantation development programs with a focus on incentives

A high level summary of the key insights documented and collated by this analysis are presented in Table 2. The following is a discussion of the key points identified.

Normalisation of tree planting behaviours

Information collated defined the level of normalisation of tree planting in the European Union (EU with a focus on the Republic of Ireland), New Zealand, the United States of America and Uruguay. Uruguayan farmers have a long history of tree planting for on-farm needs (e.g. for animal shelter and wood resources) driven by a lack of natural forests. During 1907-1911, Uruguayan farmers began to plant eucalypt woodlots creating a landscape with '*islands'* of eucalypts in the grasslands. Tree planting by farmers for shade and shelter for livestock is normalised in Uruguay. Data for 2018 indicated that nationally 9.0% of the area of planted trees was as shelter belts and wind breaks. New Zealand farmers initially faced the task of clearing natural forests to create agricultural land but were encouraged from the mid-1800s to plant trees with a range of programs focused on on-farm use. An oscillation between agriculture and forest was a standard occurrence in the United States driven by agricultural depressions, disease and Government control of crop areas. The default outcome of idle farmland was a reversion to natural forests generally by natural processes. Farmers in EU Member States have made permanent land-use changes to woodlands but a stigma remains in regards to the conversion of agricultural land. A common theme has been the impact and 'dislike' of large-scale whole of farm planting. A segmentation of agriculture and plantations has reinforced this divide particularly in New Zealand. It was recognized in 1959 that it was necessary to secure the support of farmers to expand plantations, but farmers were in general wary of any further expansions. Increased plantation establishment rates in the 1970s resulted in a "farming versus forestry" debate. The arguments against plantations included disruption of existing rural communities, that large-scale plantations did not involve family ownership and land management, resulting in urban migration reducing education, health, transport and other social services in rural areas. Farmers were also concerned at becoming surrounded and isolated by plantations as they could not compete with company and Government purchase of land. In Uruguay change to traditional 'gaucho' (rancher) lifestyles and an impact on the landscape are concerns.

Intent of afforestation

The primary motivation for plantation development has varied. For example, woodland establishment in the EU and forests on idle agricultural land in the US are seek to manipulate agricultural production, whereas the plantation estates of Uruguay and New Zealand resulted from economic development objectives to secure forest resources. The intent of plantation development has also varied over time. Taking New Zealand as an example, while wood production remained as a primary goal, secondary or complimentary goals have evolved over time including social (e.g. employment during the Great Depression) and environmental (e.g. conservation of natural forests and repair of eroded landscapes in the East Coast Region) outcomes. Since the Kyoto Protocol, claiming biosequestration has been a by-product of plantations, with for example, New Zealand recently stated the pivotal role of the contribution of trees to meeting an objective of zero-emissions by 2050. Incentivised change of land-use away from agriculture to trees in the US has focussed on at risk land but lacks permanence (a maximum of 10 years) whereas the EU mechanism is a permanent land-use change with the farmers making the decision as to which land units within their farm are converted. Experience in New Zealand noted the impact of multiple objectives, the trade-offs required and a need for mechanisms to make decisions based on multiple objectives.

Table 2: A summary of the attributes of the plantation development in the four case studies listed based on this analysis.

	European Union	New Zealand	United States of America	Uruguay
Normalised tree planting behaviour	Tree planting was not a standard agricultural practice	A long history of attempted normalisation with success for not for harvest trees. Recent positive financial outcomes of commercial trees	Reversion to forest and conversion to agriculture was an accepted and normalised practice	A long history of woodlots for on-farm needs, including woodlots for fuelwood developed by industry but not involving 100% planting of land.
Primary intent	Manipulation of agricultural outputs to maintain price and reduce agricultural subsidies	Timber supply for economic development	Manipulation of agricultural outputs to meet domestic and export demands and to provide a buffer stock of commodities	Afforestation to develop a targeted (species and location) resource base for subsequent industry development
Other intents	Environmental repair, greenhouse house targets & wood resources	Environmental repair, greenhouse house targets and social issues	Environmental repair	Integration of trees & plantations within the agricultural landscape
External drivers of afforestation	The markets for agricultural crops	Domestic economic shocks (deregulation) and international market opportunities	Economic shocks and biological pests	Significant economic shocks: 1973 oil crisis & an EC ban on beef imports; 1981 recession and debt crisis; 1987 wool price collapse.
Treatment of afforestation	Under agriculture policy	Under forest policy	Under agriculture policy	Specific Forest Laws, but within the Ministry of Livestock, Agriculture and Fisheries
Mechanism	A subsidy system was in place for agriculture. For tree development, a grant (referred to as 'aid') with nil claim on the tree assets. The EU retains any carbon benefits.	National planning and estate targets, direct Government development, taxation, price controls, loans and grants. Taxation has had the greatest impact.	Historically via crop area quotas & payments for land retirement (under the Conservation Reserve Programme). Trees could be used to address delinquent farm loans	Taxation based incentives, debt facilities, creation of forest rights, an overall Forest Plan and limitation of afforestation to marginal agricultural land.
Permanence	A permanent land-use change referred to as retirement from agriculture	Nil official permanence requirements, but deforestation discouraged by ETS.	Out of crop production for at least a 10 year period	Only covers the current crop. Plantations can revert to agricultural at harvest.
Implementation	Payments to establish, maintain and support planted trees for woodland enhancement. An opportunity cost for lost agricultural production. This represented a minor net increase over the existing agricultural subsidy	Initially by setting estate targets, taxation law changes, grants on a successful establishment basis & limiting international units for surrender at deforestation.	Initially a quota system on crop area combined with payments to retire agricultural land.	An evolving mechanism matched to a staged development of the estate changing eligibility to encourage longer rotations for sawlog and veneer logs. All controlled by a five year rolling Forest Plan.
Outcomes	An 8.9 million ha increase for the EU and 286 540 ha increase for The Republic of Ireland from 1990 to 2015.	A 2017 plantation estate of 1.78 million ha & wood flows of 30.6 million m^3/y. 87.7% of plantation owners each hold < 40 ha.	Significant movement of land between agriculture and forests. Afforestation of 1.21 million ha of erodible and environmentally sensitive cropland under CRPs	An estate of 862 364 ha supplying c.17 million m^3/y by 2018. The plantations are on marginal agricultural land providing environmental and on-farm benefits.
Limitation of collateral damage	Differential treatment of farmer and non-farmer participants. In the Republic of Ireland, placing distance from home farm limitations of eligible land.	In some cases grants focus on specific environmental issues defined by region and land type. Grant mechanisms limit the area to limit whole farm planting. Buoyant agricultural land prices limits land purchase for plantations.	A focus on marginal farmland.	Mandated and legal use of 'marginal' agricultural land. Regardless of this mechanism, there are a range of concerns expressed including monocultures, landscape and social change.

External factors

The significance and impact of factors external to the plantation and processing sectors on the development of plantation estates, was considered.

Impacts on agriculture

The EUs narrow focus on markets for agricultural products and a balance between supply and demand for agricultural commodities was a key driver of the funding of permanent land-use conversion. US Federal Government policy combined with market pressures (e.g. commodity price) shifted land from crop production to forestry to reduce agricultural outputs and environmental impacts, but as soon as a commodity price threshold was reached, land was converted back to agriculture. The formal control of agricultural production ceased in 1996 in the US. A European Commission (EC) beef import ban in 1973 was followed in 1987 by a wool price crisis impacting Uruguayan rural communities. The impact was compounded by traditional sheep farmers operating on small farms (inheritance divisions over the generations) with tax burdens. A lack of financial viability of sheep enterprises motivated a search for alternative land-uses. Similarly, agricultural down-turns in New Zealand have stimulated farmers to seek alternatives to agriculture with plantations either self-funded or via arrangements with other parties. Historic experience suggests that significant land becomes available for afforestation when the current agricultural land-uses are depressed or in decline. This suggests that tree planting is regarded as an alternative to agriculture and not an option within agricultural systems.

Economic shocks

Economic shocks have played a significant role in plantation development. The oil crisis of the 1970s impacted the US and had a profound impact in Uruguay. Uruguay was 100% reliant on imported petroleum. To address energy costs, in the early 1980s some local industries converted their boilers to fuelwood from fuel oil, resulting in significant savings. In response fuelwood consumption increased by 5% annually from c.1.4 million m^3/y in the mid-1970s to 2.8 million m^3/y in the mid-1980s resulting in an organized market and establishment of woodlots for fuelwood by the consuming industries. By 2016, Uruguay's energy system was c.80% renewable installed capacity, with electricity close to 100% renewable, and of that 18% was sourced from biomass baseload generation. Economic reforms have stimulated interest by farmers in alternatives to agriculture. In Uruguay, deregulation of the economy occurred during the 1970s and for New Zealand, the economy was deregulated in 1985 resulting in agricultural down-turns leading, to land availability for plantations. Other agents such as pests, have caused significant shifts in agriculture resulting in increased forest areas (e.g. the spread of the boll weevil which feeds on cotton buds and flowers resulted in an agricultural depression in the early 1920s and large areas of cropland and pastureland became abandoned / idle).

Flow-on effects

A flow-on impact can result from events in other countries. In June 1990 the northern spotted owl was declared a threatened species in the Pacific Northwest resulting in at least 40% of the old-growth forests to be left intact within a 3.2 km radius of any spotted owl nest or activity site. This resulted in a search for replacement resources and New Zealand's plantation were targeted creating an enhanced market opportunity. A global log price spike resulted in some log grade prices more than doubling. This stimulated a significant increase on log exports and contributed to a spike in afforestation in New Zealand.

Policy framework

Agriculture as a policy focus, with afforestation as a tool

The policy framework surround plantation development can sit within agricultural portfolios (e.g. the EU, USA and Uruguay) or be outside of agriculture. Initially the New Zealand plantation policy sat within a dedicated Ministry of Forestry and in 1987 it was merged with the Ministry of Agriculture. An alignment of intent and interest can result from the Government department with a mandate over the land on which plantations are to be established having a significant role in policy. For example, initial establishment in New Zealand focussed on conversion of natural forests and in 1991 there was a switch to only afforest farmlands. In Uruguay, responsibility for plantations sits within the Ministerio de Ganaderia, Agricultura y Pesca (the Ministry of Livestock, Agriculture and Fisheries) and annual reporting includes all sectors on a side by side basis. The plantation sector is treated as part of agriculture. In the US, the Food Security Act of 1985 established a comprehensive framework within which the Secretary of Agriculture could administer agriculture and food programs from 1986 through 1990. The powers included the setting of crop area quotas which facilitated the oscillation of land into and out of agricultural production. The Federal Agricultural Improvement and Reform Act of 1996 shifted the Federal Government away from direct involvement in farm commodity markets, phasing in elimination of target price and land retirement programs, except for the Conservation Reserve Program (CRP). The CRP funded semi-permanent (no less than 10 years) land-use change out of agriculture. EU afforestation falls within the broader Common Agricultural Policy (CAP) framework which includes a range of subsidies for agriculture. The CAP includes EU regulation No 2080/92 of 30 June 1992(1) creating an aid scheme for forestry measures in agriculture provides a directive to Member States to develop specific mechanisms and 'aid' payments to make a permanent land-use change. It funds afforestation, tree maintenance and associated infrastructure costs, and an annual payment as an opportunity cost for lost net agricultural revenues. The Regulation does not include a claim on the trees grown. A key point is that the retirement of land from agriculture ceases the agricultural subsidy which is replaced by forestry related payments, while achieving reduced agricultural production. Afforestation also contribute to greenhouse gas offsets. The EU as a central body provided directives to Member States to implement the policy and similarly the US Federal Government could compel compliance with crop area quotas.

Resource development

The Uruguayan and New Zealand policy frameworks specifically sought to facilitate resource development. The Uruguayan frameworks (Forest Laws), were very specific and focussed providing clear directives reinforced by compliance resulting in access to the incentive framework. The framework had two versions commencing in 1968, 1987 and with amendments in 2005. Each version made incremental changes and enhancements building on the 1968 foundation. The evolution of the policy and legal framework complemented the stage of development of the plantation estate. The New Zealand policy framework was less prescriptive and prior to 1991 was mostly implemented by a Government agency. The framework was implemented by the preparation of plantation establishment plans but the plans did not compel compliance. This was of particular significance in 1960 when it was recognized that Government plantation establishment would not meet establishment targets (the Government could not purchase sufficient land) and there was nil mechanism to compel farmers to contribute equally, hence there was a need to secure the support of a wary and disinterested agricultural sector. The Government role post privatisation in the 1990s was to provide information and 'encourage' afforestation. New Zealand's One

Billion Trees Programme has empowered the Government to be directly involved in afforestation. The New Zealand ETS has a more direct influence over afforestation (financial rewards) and deforestation (financial penalties).

Implementation of afforestation programmes

Development of broad plans

The implementation of afforestation promotion mechanisms has varied. A common element to the EU, New Zealand and Uruguay was development of plans to guide afforestation. Each Member State of the EU developed a bespoke implementation of the Regulation. The process includes the formation of regionally specific plans detailing species to be planted and management inputs. The New Zealand planning was initially informed by inventory of the natural forests and plantations to determine supply, matched with demand projections to set estate targets. These plans were updated and informed by Forestry Development Conferences (1970s and 1980s) convened by Government to assess forest resources and associated industries, and to make recommendations for their expansion and by the preparation of a Wood Processing Strategy (in the year 2000). The Second Forest Law of Uruguay instituted a requirement to prepared Five Year Plans to guide afforestation.

Target estate

New Zealand's plantation establishment plans set estate and rates of plantation development goals. For example, current Government analysis has suggested afforestation of c.75 000 to 80 000 ha/y over the period of 2018 to 2050 to achieve net-zero emissions: increasing the 2017 estate of 1.71 million ha by 2.4 million ha to 2.6 million ha to 4.1 million to 4.3 million ha. The afforestation is to include production (for harvest trees) and the expansion of native forests providing additional biodiversity and cultural benefits to communities. It is expected that going forward, carbon revenues will be a significant contributor to afforestation. The Uruguayan Government set afforestation goals and adjusting the incentive mechanisms to achieve the targets.

Target land

The mechanisms to target specific land types vary between examples and mechanisms. The most prescriptive was in Uruguay. The First Forest Law directed the quality land to be afforested (Forest Priority Soils focused on marginal agricultural land) and defined the regions for afforestation (to create nodes of resources). Afforestation is regulated at the individual party level and a plan for a proposed plantation must be presented for approval by the National Forest Directorate and a copy of the Legal title proving the ownership of the land must be presented as well as information related to soils. It is at this point that eligibility based on soil type and location is verified and after approval, the plantations are registered and documented. The EU mechanisms allowed individual farmers to select the land 'retired' within a farming system which does not need to be a complete land title. Given a flat rate 'aid' payment and with an intent to maximise the financial outcome, farmers maintain the most productive land and seek aid for the least productive land. The US's CRP specifically targets removal highly erodible and environmentally sensitive land from crop production with resource conserving practices on a site for at least 10 years (if agriculture improves, the land is returned to production). The approach taken in New Zealand is a combination of approaches. Afforestation is not regulated and can occur on generally any land. The various grant mechanisms have in some cases targeted specific land for environmental repair and in one case, the grant formally defined land classes within a region to reduce soil erosion risks.

Species

A key attribute of the development of the New Zealand plantation estate has been a narrow focus on Radiata pine to create a significant single species resource. In Uruguay, the Second Forest Law defined a narrow range of suitable species to create a focussed critical mass. Under the EU mechanisms, each Member State defined target species as part of the individual Member State planning process.

Climate change and emissions trading

The implementation of the New Zealand ETS is a specific cases. The announcement in 2002 of the differential treatment of pre-1990 and post-1989 plantations to commence in 2008 resulted in an accelerated harvest, deforestation and conversion to agriculture of pre-1990 plantations to avoid impending liabilities and costs. With the commencement of the New Zealand Emissions Trading Scheme, participants and captured parties could meet their compliance obligations with eligible Kyoto-compliant units. Cheap units were secured from the old Eastern Block and surrendered as payment. This practice allowed continued conversion and in 2014, the New Zealand Government banned post-1989 plantation land-owners from surrendering international units.

Incentives mechanism

The role and intent of Government

The role of Government can be via direct participation or in an enabling role but the role should not be static and must reflect the situation. Uruguay's Second Forest Law assumed that the private sector would undertake afforestation, with the State as facilitator and coordinator. For example the role of the New Zealand Government commenced as a direct investor and facilitator, but this was changed by the 1985 deregulation of the economy and divestment of the Government plantation assets. They then provided free extension services, but in 1987 introduced 100% cost recovery and by 1989 ceased extension. The One Billion Trees Programme is a return to direct involvement in commercial afforestation. Commencing in 1918, the New Zealand Government had powers to set sawmill output allocations, require production reporting and impose export and domestic price controls which remained in place until 1985. A New Zealand Government focus was to ensure low-cost timber for housing and employment opportunities. This was a significant disincentive to plantation development which was reversed from 1959 by the log export trade to Japan with prices well in excess of the domestic market, making plantations a more competitive and profitable form of land-use.

The EU has a single focus mechanism with significant up-front and ongoing payments, whereas the US system relied initially on forestry as the natural default to reductions in allowed crop areas. The Uruguayan and New Zealand frameworks have taken a portfolio approach with a range of initiatives and treatments. The US (with a narrow focus on agricultural land), EU and Uruguay have relied on voluntary afforestation, whereas the New Zealand estate was commenced by direct Government involvement. In the absence of mechanisms to compel afforestation, Governments have encouraged afforestation.

Taxation

Taxation has been a cornerstone of influencing afforestation and the timing of taxation changes are clearly evident in the rates of afforestation. Uruguay's First Forest Law provided specific taxation treatments for compliant afforestation allowing investment of a percentage of an entities tax liability into afforestation on land owned by the party. The response was limited by an absence of commercial plantation experience, and it did not meet the needs of the farmers (with incomes generated by meat and wool production, who lacked information on international wood markets). The Second Forest Law expanded treatments to a broader range of parties with significant success. The Second Forest Law of Uruguay was amended in 2005 and revoked the taxation treatment of short rotation trees but it was maintained '*for production of* quality *wood'* in plantations targeting sawlogs and veneer logs on an at least a 15 year rotation. New Zealand's taxation treatment of plantation development has influenced new plantation establishment rates. The expensing of establishment costs in the year of incurring the costs against income in that year increased establishment, whereas a 'cost of bush' treatment depressed new establishment. A 'cost of bush' approach requires that plantation establishment expenses are held over until income generation by the plantation to reduce the taxable income. The taxation system allowed for income averaging (over five years for farmers and eight years for foresters). A favourable income taxation regime was implemented for post 2006 afforestation. Income spreading of lumpy plantation returns at harvest allows a party to reduce taxation liabilities in a single year. There are two types of taxation motivations. The first is to attract a new party with a taxation based motivation to afforestation and the second is that a party with ongoing afforestation objectives can be demotivated to plant with an adverse change in taxation treatments.

Loan facilities

Loans facilities for afforestation were developed in Uruguay under the First Forest Law and in New Zealand. Uruguay's First Forest Law created a Forest Fund with loans of up to 12 years with a grace period of 10 years but combined with taxation this did not result in significant afforestation by farmers. The Second Forest Law opened the facility to non-farmer parties and this was taken up by companies. In the 1960s a lack of interest by financial institutions to provide debt to forestry promoted the New Zealand Government to establish the Forestry Encouragement Loans offer but the take-up of the facility was very limited suggesting that other factors were in play. The US CRP system was linked to farm loans and The Food Security Act of 1985 created a mechanism to convert delinquent farm loans from the Federal Government into a plantation assets (of at least 20.2 ha to no more than 20 235 ha) on croplands as a green asset which on maturity, were used to repay the loans and amortized interest to the Government.

Grant mechanisms

The EU, US and New Zealand have made use of grant mechanism to encourage afforestation. The EU grants are referred to as 'aid' and are very generous but must be placed into perspective considering the net extra funding above agricultural subsidies: this was crudely estimated to be c.€97.50/ha/y for ongoing 'support' of the planted trees[3]. The US CRP mechanisms provide grants to shift highly erodible and environmentally sensitive land from crop production to grassland or forest cover. Land-owners offered land via a general sign-up on a competitive basis during selected times or via a continuous sign-up on a non-competitive and always open basis (with additional financial incentives to the general sign-up). The provision of annual

[3] It is recognised that the amounts are for different years – the aim was to demonstrate the net impact quantum.

payments under the CRP resulted a significant areas of afforestation. The CPR was combined with a crop area quota system applied at the Federal level down to an individual property basis. This resulted in land oscillating between under crop and 'idle', with idle land reverting to forests mostly via natural processes. New Zealand has maintained some form of financial assistance to tree growing since 1962. From 1962 to 1983, and despite ongoing changes and adjustments, grant schemes private sector afforestation remained relatively constant. The New Zealand grant programs ranged from a broad to specific intent focus (e.g. environmental repairs). The Kyoto Protocol stimulated grants focused on permanent forest sinks and other including carbon outcomes with trees for harvest. The New Zealand grants have had a clear distinction between intent of natural forest species and Radiata pine, with both types of trees encouraged. Another key attribute was intended long-term running of the programmes, and as a programme was terminated, it was replaced. The structure and nature of the current One Billion Trees Programme (initiated in 2018), suggests that the programme has taken stock of the lessons gained since 1962. The programme is a portfolio of initiatives providing broad access to support and the ability to seek a range of tree outcomes. The aim is to plant one billion trees from 2018 to 2028 (100 million/y but not whole farm planting) and the programme includes motivated parties (e.g. Crown Forests) to drive and facilitate afforestation. The outcome in less than 12 months has been 61 million trees planted. Grants in New Zealand have been successful is stimulating afforestation (see Table 3).

. A need to refresh grant mechanisms is driven by mechanism fatigue evidenced by a declining rate of uptake as latent demand is satisfied and the remaining farmers have less interest in afforestation. A key attribute of the New Zealand grants programme has been fit for purpose mechanisms matched to the state of development of the plantation estate, while achieving multiple benefits. The following are key attributes of a grant: a target is set; there is a focus; there are multiple benefits; and they are long-running.

Table 3: A summary of the past New Zealand grant mechanisms

Title	Duration	1^{O} intent	Other intent	Outcome (ha/y)
Forestry Encouragement Grants	1969 -1981	Wood		5170
Protection / Production Gants	1980 - 1991	Permanent revegetation		?
Forestry Encouragement Grants	1982 - 1984	Wood		?
East Coast Forestry Project	1992 - 2014	Environmental repair	Wood	1986
Afforestation Grant Scheme	2008 - 2013	Carbon	Wood	3725
Afforestation Grant Scheme	2015 - 2018	Carbon	Wood	3868

Investment mechanisms and vehicles

While direct investment by a single party in plantations is an option, investment mechanisms and vehicles have been developed allowing multiple parties to jointly invest. Afforestation in Uruguay focussed on purchased land and land access issues (e.g. price and concerns at the scale of development) resulted in use of lease mechanisms. In recent years most afforestation in Uruguay has been under out-growers schemes within farming systems spatially arranged as mosaics rather than large blocks providing farmer risk mitigation (diversification) and to capture synergies (e.g. livestock shelter and non-

timber forest products such as honey and mushroom collection). Uruguay's Second Forest Law included a forest right mechanism which allowed the land on which the trees were planted to be funded by debt with the land as security and development of joint-ventures on a first right of refusal and a crop share basis. Specific investment vehicles have been developed: Uruguay's Second Forest Law facilitated bearer share company involvement. Companies were formed by private individuals to provide investment scale. In other cases land was purchased, afforested and divided into 10 ha '*forested parcels*' to facilitate investment by parties outside of the agricultural sector. Afforestation in New Zealand has included land lease and joint-venture afforestation of less than 100% of a farmer's land. Limited partnerships (managed investment schemes) have facilitated multiple parties into a single plantation investment. A key supporting element has been the availability of investment facilitators since the early 1970s and parties willing to enter into joint-venture agreements and to form syndicates. The One Billion Trees Programme has Crown Forests as the developer and therefore facilitator of afforestation via leases and joint-ventures.

Development of processing

Processing can commence once a critical mass of resource provide the confidence to invest in capacity. The New Zealand Government maintained a direct investment approach and commissioned a large sawmill near Rotorua in 1939. A new Government in 1949 shifted policy to favour private over public ownership. In the case of Uruguay, processing capacity investment was by private companies with many small sawmills in operation and larger capacity investments occurred from 1992. The Second Forest Law allowed pulpwood exports commencing harvest and cash flows from the plantations which was then converted to domestic processing. Investment in processing capacity is an important signal for providing confidence to underpin afforestation in response to market signals (e.g. price and log requirements).

Climate change and emissions trading

In compliance with the requirements of the Kyoto Protocol, the New Zealand ETS segmented the plantation estate into pre-1990 and post-1989 trees with differential treatments and requirements. In 2002 the Government announced its preferred policy to implement the Kyoto Protocol included Government nationalisation of credits and liabilities associated with carbon stored in plantations established pre-1990 under the Climate Change Response Act 2002. Post-1989 plantations could claim New Zealand Units for the carbon bio-sequestered by the trees.

Outcomes

Area afforested

The EU mechanism has been successful in encouraging the retirement of marginal agricultural land with the area of forest and other woodlands increasing: between 1990-2000 in the EU an increase of 3.5% and The Republic of Ireland an increase of 44.7%; between 2000-2015 in the EU an increase of 1.6% and The Republic of Ireland and increase of 7.6%. This represents for the EU an 8.9 million ha and for The Republic of Ireland 286 540 ha increase in forests and other woodlands for 1990 to 2015. The EU farmers participating in the afforestation programs tended to plant only the poorer sections of farms. Farmers also staggered afforestation over a number of years. Arable crop land was least afforested and intensive livestock enterprises similarly had a low rate of afforestation. Most of the afforestation was on permanent grassland areas. The 2017 plantation estate in New Zealand was 1.78 million ha with 3.9% Government and 96.1% private ownership. Currently 87.7%

of the private owners of the estate each hold less than 40 ha of plantations, with 6.1% owning 40 to 99 ha, 0.5% owning 500 to 999 ha, 0.8% owning 1000 to 9999 ha and 0.3% owning greater than 10 000 ha. In 2014 in the US, 8.0 million ha were under the CRP was via general and 2.3 million ha was via continuous sign-ups. In Uruguay under the First Forest Law 12 000 ha were established by farmers. The Second Forest Law stimulated afforestation of 549 1530 ha mainly by groups of national investors stimulated by the policy to buy land to generate taxation benefits from investment in plantations. The differences between the First and the Second Forest Law are the freeing up to non-farmer participants and the development of investment vehicle options.

Processing

Afforestation in New Zealand and Uruguay has resulted in significant resource flows. In New Zealand, the 2018 plantation output was 30.6 million m^3 of logs supplying a wide range of processing. By 2005 Uruguay had created a critical mass of plantation and attracted world class industry with significant foreign investment in processing capacity. For 2018 the majority of the log outputs were eucalypts: a total of 16.93 million m^3; 10.20 million m^3 of pulpwood; 4.18 million m^3 of sawlogs and veneer logs; 2.60 million m^3 of fuelwood.

Reducing unintended impacts of afforestation

A specific concern of large-scale afforestation has been the impact on natural forests and agriculture. A range of strategies and method have been used to limit impacts.

- *Natural forests:* Conversion of natural forests to plantations resulted in conflict. Conversion ceased in 1991 in New Zealand with the New Zealand Forest Accord and this focussed plantation development on cleared land.
- *Marginal agricultural land:* The First Forest Law and subsequent forest laws in Uruguay limited plantation development to '*forest priority soils'* on marginal soils for agricultural-livestock production. This approach reduced displacement of agriculture by afforestation and fostered integration of trees into the agricultural land-scape. Some New Zealand grant mechanisms were specific as to the land types eligible focussing on marginal agricultural land.
- *Land limitations:* The Republic of Ireland limits 'aid' eligibility to land within 100 km of a farmer's home farm.
- *Region focus:* The First Forest Law and subsequent forest laws limit afforestation to specific Forestry Priority Areas. Some New Zealand grant mechanisms have been limited to specific regions in which land was eligible.
- *Limiting scale:* The scale of afforestation was limited in New Zealand by capping plantation expenditure taxation claims and the areas eligible under various grant mechanisms, both for an individual and within a single year.
- *Reducing speculation:* Across the EU the farm land opportunity cost paid to non-farmers was 25% of the payment to farmers to focus aid to farmers rather than other parties.

Regardless of this mechanism, there are a range of uniform concerns expressed including issues with monocultures, landscape and social change.

Designing a project

A range of incentive mechanisms are possible and the underlying considerations in designing a mechanism are presented in Table 4.

Table 4: A summary of the attributes to consider during the design of a mechanism in support afforestation.

Element		Narrative
The mechanism	Scope	A mechanism can be broad (e.g. national or state-wide) or very targeted (e.g. to address a specific issue)
	The project	The nature of the project should be defined (e.g. afforestation for harvest or permanent trees)
	Species	The target species should be defined
	Silviculture	The intended silviculture should be defined as this will set the duration of any mechanism
		There is a need to define the quality control measures for any works undertaken.
Outputs	Wood	There is a need to define who owns the wood resources
	Carbon	There is a need to define who owns the carbon benefits and liabilities
		A common feature of many mechanism is that the funding party takes ownership of the carbon
	Other	There is a need to define who owns the other outputs of a project
Intent	Primary intent	The main intended outcome should be defined
	Other intent	The other intended outcomes should be defined
	Moderation	A mechanism is required to balance any conflicts between the intents of the mechanisms
Parties	Parties	The target land base will help define the target eligible parties: the parties can be narrow or broad
	Arrangements	There are a number of mechanisms to join multiple parties into a project and whether these are compatible with a support mechanism needs to be determine
	Land lease	Land can be leased from a land-owner on an arms-length basis. The landowner is external to the arrangement
	Joint-ventures	Land-owners can join with other parties to undertake afforestation
		When a mechanism joins the parties with an interest in the trees it is a joint-venture
		A crop-share can be used to distribute the physical products and/or the net harvest proceeds
		A first right of refusal can be used but is most effective where there is competition for a resource.
Land	Eligibility	There is a need to define the eligible land based on the mechanism's intent
	Total area	A mechanism may include a stated total area objective based on the intent
	Annual area	A mechanism may define the maximum area included each year
	Minimum area	There is a need to define the minimum area included and whether this is a sum of a number of discrete plantings
	Maximum area	A mechanism may impose a maximum area supported per party
	Fit	A mechanism may seek to limit whole farm planting or allow whole of property afforestation
Funding	Total costs	There is a need to develop a robust budget for a project to understand the likely full costs as a basis for setting any mechanism's level of support
	Targets	Which activities are to be funded: establishment, maintenance or any element within
	Basis	Funding can be on a percentage of the target cost or as a flat rate per hectare
	Duration	Funding can be a once-off payment, and annual payment or payment over a number of years matching the target trees (e.g. the rotation length)
	Years	The number of year over which the mechanism is to work: is the aim an add-on resource or a new estate?
	Gap	Unless the mechanism provide 100% funding, there is a need to assess the recipient's ability to fund the gap
	Timing	There is a need to determine whether the payment is up-front of ex-post (once the works are completed)
	Assessment	There is a need for a mechanism to define compliance with the mechanism requirements
Mechanism	Sign-up	Is there to be a competitive tender process or a simple application process
	Assessment	An assessment process is required to rank and select participants unless it is on a first in basis
Other	Enabling	A wide range of enabling factors will contribute to the success of a mechanism and these must be determined
	Planning	The ability to conduct afforestation in the target areas under local planning requirements needs to be determined
	Taxation	Taxation treatment of afforestation expenses and harvest revenues is a specific consideration for all mechanism
	Carbon	The mechanisms of any emissions trading system needs to be considered.

European Union and the Republic of Ireland: retirement of agriculture

Summary and key lessons

The following are the key lessons from an analysis of the European Union and The Republic of Ireland:

- Permanent landuse change by afforestation has been embraced in the EU and in particular The Republic of Ireland stimulated by the EU funded payment structure: the cost of establishment, maintenance and an ongoing payment for lost agricultural income.
- The primary intent of EU policy was to retire land from agriculture by permanent afforestation with a by-product of the supply of timber and non-timber forest products and environmental benefits
- The retirement of marginal agricultural land and increasing the area of forest and other woodlands occurred on 8.9 million ha in the EU and 286 540 ha in The Republic of Ireland from 1990 to 2015
- A degree of farmer stigma remains associated with tree planting based on a perception of failing in agriculture.
- The programme sits within the EU's broader Common Agricultural Policy framework (CAP) which includes a range of subsidies for agriculture.
- The Regulation does not include a claim on the trees grown and funds for enhancement works of existing woodlands on farms.
- The mechanism is a direct grant (aid) payment for permanent afforestation with the ownership of the trees maintained by the farmer.
- The cost of the Regulation is a marginal increase in the existing farm based subsidies.
- Each Member State developed a bespoke implementation package including the formation of a plan which details to species to be planted and management inputs.
- The land retired is at the discretion of the farmer within a farming system at any scale.
- The EU system sought to reduce speculation on land and Member States could design their systems accordingly.

Introduction

The European Union (EU) was identified as a candidate for inclusion in this analysis based on the incentives systems documented by previous studies[4]. The EU compromises 28 member states across 4.4 million km^2 in area (see Table 5). The Republic of Ireland is a Member State with just under 0.7 million km^2 in area. Land-use in the EU is mostly rural and intermediate (between urban and rural) whereas the Republic of Ireland has rural over 90.2% of the country. The classification of land in the EU is 40% to agriculture and 81.5% as forests which indicates an overlap (e.g. some of the forest classed land is within agricultural systems). The land classification for the Republic of Ireland is 64.0% to agriculture and 23.0% to forests. The Republic of Ireland's agricultural land is dominated by permanent grasslands. The Republic of Ireland was included as an EU Member State with the largest positive change in the area of forest and other woodlands (FOWL) between 1990 and 2015.[5]

[4] de Fegely et al (2011).
[5] EC (2018a: p.124, Table 34) for 2015.

Table 5: A snapshot of the EU and the Republic of Ireland for 2015 and 2017 as indicated.

		EU			The Republic of Ireland		
		Area (ha)	Percent of total	Percent of land class	Area (ha)	Percent of total	Percent of land class
Area[6]	Total land mass	446,353,200	100.0%		6,979,700	100.0%	
	Rural	196,717,300	44.1%	44.0%	6,295,800	90.2%	90.0%
	Intermediate	197,834,000	44.3%	44.2%	606,200	8.7%	8.7%
	Urban	52,779,300	11.8%	11.8%	92,600	1.3%	1.3%
	Totals classification	447,330,600	100.2%	100.0%	6,994,600	100.2%	100.0%
Agriculture[7]	Arable land	105,165,096	23.6%	58.90%	438,084	6.3%	9.80%
	Permanent grasslands	60,527,958	13.6%	33.90%	4,027,686	57.7%	90.10%
	Permanent crops	11,962,753	2.7%	6.70%	0	0.0%	0.00%
	Total utilised agricultural area	178,548,550	40.0%	100.0%	4,470,240	64.0%	100.0%
Forests[8]	Forest	160,931,000	36.1%	44.2%	754,000	10.8%	94.1%
	Woodland	20,843,000	4.7%	5.7%	47,000	0.7%	5.9%
	FOWL	181,774,000	40.7%	100.0%	801,000	11.5%	100.0%

EU objectives

The EU via the European Commission (EC) has set 10 priorities as listed in Box 1. The treatment of agriculture is a specific focus under a Common Agricultural Policy (CAP) framework which sets the EC policy objectives. The CAP represents a significant but declining component of the EU budget accounting for 37.7 % of total EU expenditure planned for 2014–2020.[9] For 2014-2020, CAP2014–2020 (2) set three main long-term policy objectives in regards to food production, sustainable management and climate change, and equitable development (see Box 2).[10] In regards to viable food production there is a focus on agricultural income, agricultural productivity and price stability.[11] To achieve the CAP objectives, the EU has a three point approach (see Box 3). The first is farmer income support linked to sustainable agricultural practices (e.g. food safety, environmental protection and animal health and welfare) accounting for 70% of the CAP budget. This is an important point: the support is conditional rather than *as of right* and seeks to achieve broader outcomes. The second support mechanism addressed the market by providing an out-put price safety net to farmers. The third is a focus on rural development to modernise the sector while enhancing the environment.

[6] EC (2018a: p.12, Table 1) as an average for 2013-2015.
[7] EC (2018a: p.76, Table 21) for 2017.
[8] EC (2018a: p.122, Table 32) for 2015.
[9] EC (2015: p.4&5).
[10] EC (2015: p.3).
[11] EC (2018b: p.2).

Box 1: The ten European Commission priorities.[12]

1. *A new boost for jobs, growth and investment*
2. *A connected digital single market*
3. *A resilient Energy Union with a forward looking climate change policy*
4. *A deeper and fairer internal market with a strengthened industrial base*
5. *A deeper and fairer Economic and Monetary Union (EMU)*
6. *A balanced and progressive trade policy to harness globalisation*
7. *An area of Justice and Fundamental Rights based on mutual trust*
8. *Towards a new policy on migration*
9. *Europe as a stronger global actor*
10. *A Union of democratic change.*

Box 2: The CAP2014–2020 (2) set three main long-term policy objectives.[13]

1. *Viable food production: To contribute to food security by enhancing the competitiveness of EU agriculture while providing the means to address the challenges faced by the sector related to market disruptions and the functioning of the food chain;*
2. *Sustainable management of natural resources and climate action: to ensure the long-term sustainability and potential of EU agriculture by safeguarding the natural resources on which agricultural production depends;*
3. *Balanced territorial development: To contribute to the socioeconomic development of rural areas, while fostering the right conditions for safeguarding structural diversity throughout the EU.*

Box 3: The CAP2014–2020 (2) approach to achieving the policy.[14]

1. *Income support for farmers and assistance for complying with sustainable agricultural practices: Farmers receive direct payments, provided they live up to strict standards relating to food safety, environmental protection and animal health and welfare. These payments account for approximately 70% of the CAP budget. Under the 2013 reform, 30 % of direct payments will be linked to European farmers' compliance with sustainable agricultural practices which are beneficial to soil quality, biodiversity and the environment in general, such as crop diversification, the maintenance of permanent grassland or the preservation of ecological areas on farms.*
2. *Market-support measures: In the form of safety-net provisions, these measures come into play mainly when adverse conditions tend to destabilise markets. Payments for these measures account for approximately 5 % of the CAP budget.*
3. *Rural development programmes (RDPs): These measures are based on an in-depth analysis of the programming area and a selection of measures which are intended to help farmers modernise their farms and become more competitive, protect the environment and contribute to the diversification of farming and non-farming activities and the vitality of rural communities.*

The CAP includes three payments (subsidies) to farmers. The first is an 'operating subsidy' which covers direct payments (as an income support) and all rural development measures (but are not investments supports), as well as possible Member State aids and national top-ups.[15] For the period of 2013-2015 an operating subsidy of €368/ha/y was payed for eligible operations in the Republic of Ireland. [16] The second subsidy is a 'direct payment' consisting of a Complementary National Direct Payment, Transitional National Aids and payments under the Small Farmer Scheme. The area of land eligible for direct subsidy payments is presented in Table 6: of the utilised agricultural area, 86.2% of the EU and 98.7% of the Republic of Ireland are eligible for such payments. For 2016 the EU average direct payment was €259/ha/y (a range of €118 to €622 /ha/y) and in The Republic of Ireland farmers received €259/ha/y.[17] The third payment was a 'green direct payments' which accounted for

[12] EC (2018a: p.19).
[13] EC (2015: p.3).
[14] EC (2015: p.3).
[15] ARD (2018a: p.3).
[16] ARD (2018a: p.6; Figure 3).
[17] ARD (2018b: p.6; Figure 2).

approximately one third of EU Member State's direct payment budgets. Eligible farmers were required to diversify crops, maintain permanent grasslands and set aside around 5% of arable land as ecological areas.[18] The European Court of Auditors scrutinised the cost-effectiveness of EU law, and concluded that '*that greening, as currently implemented, is unlikely to significantly enhance the CAP's environmental and climate performance*.' [19]

Table 6: The agricultural area and the area receiving direct payments in 2016.[20]

	The EU 28 (ha)	Republic of Ireland (ha)
Utilisable area	178 566 050	4 446 840
Potentially Eligible Area	158 677 227	4 530 347
Determined Area	153 936 545	4 387 911

- Potentially Eligible Area: The total area declared by beneficiaries and potentially eligible for payment.
- Determined area: The total area declared by beneficiaries and for which all eligibility conditions are met. It takes into consideration the result of administrative and on-the-spot checks and for the Basic Payment Scheme the number of payment entitlements.

The European Union Council Regulation (EEC) No 2080/92

The Regulation

The treatment of forestry and afforestation of agricultural land is specifically addressed by EC regulations, but with multiple objectives: *'soil use and the environment and as a contribution to reducing the shortage of forestry products in the Community and as an accompaniment to the Community's policy for controlling agricultural production'*. [21] The temporary set-aside or (permanent) reallocating of farmland to afforestation or non-food production was reinforced by Council Regulation (EEC) No 2080/92 of 30 June 1992(1) which instituted a Community aid scheme for forestry measures in agriculture.[22] It is interesting to note the use of the term 'aid' to describe the measures. A snap-shot of the details of (EEC) No 2080/92 are presented in Box 4 and Box 5. The measures are part-financed by the Guarantee Section of the European Agricultural Guidance and Guarantee Fund (EAGGF) to '*promote afforestation as an alternative use of agricultural land and the development of forestry activities on farms'*.[23] The listed objectives (see Box 5) provide an insight to the focus of the measures. A key objective is to take agricultural land out of production, while achieving environmental objectives. This focus is supported by observations of the outcomes in Greece which note that the EU objective was *'withdrawal of a significant area of agricultural land from food production towards forestry.'*[24] It is further stated that the '*EEC Regulation 2080/92 institutes a scheme for forestry measures in agriculture that is primarily aimed at controlling agricultural production, encouraging development of forestry activities on farms and improving the incomes of persons employed in farming'*. [25]

[18] IUCN (2017).
[19] IUCN (2017).
[20] ARD (2018b) p.5; Table 1.
[21] EU (1992).
[22] CC & EP (1997: p.1).
[23] CC & EP (1997: p.1).
[24] Arabatzis et al (2005: p.96).
[25] Arabatzis et al (2005: p.97).

Box 4: The aim and basis of the EU Community aid scheme for forestry measures in agriculture.[26]

Article 1: Purpose of the aid scheme

A Community aid scheme part-financed by the Guarantee Section of the European Agricultural Guidance and Guarantee Fund (EAGGF) is hereby instituted in order to:

- *accompany the changes to be introduced under the market organization rules,*
- *contribute towards an eventual improvement in forest resources ,*
- *contribute towards forms of countryside management*
- *more compatible with environmental balance, — combat the greenhouse effect and absorb carbon dioxide.*

This Community aid scheme shall promote:

a) afforestation as an alternative use of agricultural land ;
b) the development of forestry activities on farms.

Article 2: Aid scheme

1. The aid scheme may comprise:
a) aid for afforestation costs ;
b) an annual premium per hectare afforested to cover maintenance cost in the first five years;
c) an annual premium per hectare to cover losses of income resulting from afforestation of agricultural land;
d) investment aid for the improvement of woodlands by the provision of shelterbelts, firebreaks, water-points and forest roads, and for the improvement of cork oak stands .

2.
a) Aid as referred to in paragraph 1 (a) and (b) may be granted to any natural or legal person undertaking afforestation of agricultural land.
b) Aid as referred to in paragraph 1 (c) shall be eligible only if it is granted to:
— farmers not participating in the early-retirement scheme introduced by Council Regulation (EEC) No 2079 / 92 of 30 June 1992 instituting a Community aid scheme for early retirement from farming (*),
— any other private-law , natural or legal person.

Box 5: The objectives of the EU Community aid scheme for forestry measures in agriculture.[27]

Article 4: Aid programmes

1. Member States shall implement the aid scheme referred to in Article 2 by means of national or regional multiannual programmes covering the objectives laid down in Article 1 and which set out in particular:

— the amounts and duration of the aid referred to in Article 2 on the basis of actual expenditure on afforestation and the maintenance of species or types of trees used for afforestation or on the basis of loss of income,

— the conditions for granting aid , in particular for afforestation ,

— the measures taken to evaluate and monitor environmental impact and compatibility with land use criteria ,

— the nature of any accompanying measures taken or planned,

— the measures taken to provide agricultural and rural operators with appropriate information.

2. Member States may also devise zonal afforestation plans reflecting the diversity of environmental situations, natural conditions and agricultural structures. Zonal afforestation plans shall be concerned in particular with:

— the setting of an afforestation objective,

— conditions in respect of the location and grouping of areas which may be afforested ,

— forestry practices to be complied with,

— selection of species of trees adapted to local conditions

The mechanisms

There are three elements to the aid framework: establishment, maintenance and payment of an opportunity cost for the foregone agricultural production (see Table 7). The mechanisms are segmented by crop, ownership type and includes provision for management of existing woodlands. The arrangement is made more attractive by the annual payment to

[26] EU (1992).
[27] EU (1992): Article 4.

addresses losses of farmers' or landowners' income after permanent conversion of agricultural land to FOWL. The attractiveness of this payment will depend on the amount paid compared to the actual net income foregone and loss of other EU aid, such as aid to set aside arable land.[28] An important point is that while there is an opportunity cost incurred, there is a freeing up of farm labour to either focus on the more productive areas of an individual farm, reduce wages by reducing the number of full time employees or allow off-farm income. A key outcome is that the farmer owns the resulting trees outright and does not need to make any repayments to the EU.

Table 7: A summary of the EU 'aid' of afforestation and maintenance of existing woodlands.[29]

Crop		Eucalypts	Conifers	Broadleaves or mixed species of >75% broadleaves	Existing woodlands
Afforestation		€2,415/ha (€2,000/ha)	€3,623/ha (€3,000/ha)	€4,830/ha (€4,000/ha)	
Maintenance			€301.90/ha/y yr 1-2, then €150/ha/y (€250/ha/y yr 1-2, then €150/ha/y)	€603.80/ha/y yr 1-2, then €362.30/ha/y (€500/ha/y yr 1-2, then €300/ha/y)	
Land opportunity cost	Previous agricultural land by farmers	€724.50/ha/y (€600/ha/y)			
	Non-farmers	€181.10/ha/y (€150/ha/y)			
Woodland improvements and provision of shelterbelts					€845.30/ha (€700/ha)
Renovation and improvement of cork oak stands					€1,691.00/ha (€1,400/ha)
Forest roads					€21,735/ha (€18,000/km)
Woodland provided with firebreaks					€181.10/ha (€150/ha)
Woodland provided with water-points					€181.10/ha (€150/ha)
Other					€845.30/ha (€700/ha)

Note: The amount in brackets was the aid levels listed in 1992 and the values in brackets are a revised values reported in 1997.

The outcomes

The outcome of implementation of EEC No 2080/92 by 1997 for the EU was €480 900 000 invested enhancing (e.g. afforestation and woodland management) 871 900 ha (a mean of €551.55 /ha) and for the Republic of Ireland, €94 200 000 resulting in 105 000 ha (a mean of €897.14 /ha).[30] As an example for Greece, EEC 2080/92 resulted in the establishment of 35,836 ha of poplar (*Populus spp*) plantations from 1994 to 2001.[31] The area of FOWL increased: for 1990-2000 for the EU by 6.05 million ha (an increase of 3.5%) and The Republic of Ireland by 229 9647 ha (an increase of 44.7%); for 2000-2015 for the EU by 2.9 million ha (an increase of 1.6%) and The Republic of Ireland by 56 567 ha (an increase of 7.6%).[32] Overall the following outcomes resulted as reported in 1997:

[28] CC & EP (1997: p.3).
[29] EU (1992): Article 3, CC & EP (1997: p.2, Table 1).
[30] CC & EP (1997: p.4; table 2).
[31] Arabatzis et al (2005: p.97).
[32] EC (2018a: p.124, Table 34) for 2017.

- Circa 500 000 ha of land was afforested;[33]
- The largest areas was in Spain with over 200 000 ha afforested;[34]
- The United Kingdom, Ireland and Portugal each afforested more than 50 000 ha;[35]
- 98% of the aid for afforestation was supplied to private individuals;[36]
- The afforestation was 40% conifers and 60% broadleaves and mixed plantations;[37]
- The land afforested was 61% permanent grassland and pasture, 36% arable land and 3% land under permanent crops (e.g. vines, orchards).[38]

A concluding comment in 1997 was that the scheme was largely applied in Member States or regions to expand their forest area on marginal and less productive agricultural land. This resulted in a concentration of agricultural production on the most productive cultivated land.[39]

The identified insights and issues

The money flows

The aid provided to farmers to afforest areas to achieve agricultural out-put objectives (retirement of agricultural land and reduced production) while providing environmental and resource development objectives was well funded (see Table 7). In 1997 the value of the aid was: establishment - €2,415/ha to €4,830/ha, maintenance - €301.90/ha/y to year for €603.80/ha/y for years 1 and 2 and then €362.30/ha/y. An ongoing agricultural opportunity cost payment of €724.50/ha/y for previous agricultural land owned by farmers or €181.10/ha/y for non-farmers was also paid. This must be placed in perspective of the savings by ceasing agricultural subsidies due to afforestation. For example for the Republic of Ireland in 2013-2015 an operating subsidy of €368/ha and a direct payment of as €259/ha/y was available totalling €627/ha/y. Based on the farm opportunity cost payment for afforestation, the net extra funding by the EU was €97.50/ha/y as an opportunity cost (it is recognised that the amounts are for different years – the aim was to demonstrate the net impact quantum).

Farmer strategies and the land retired

Implementation of EEC No 2080/92 provided the following insights of farmer strategies by 1997.[40] Farmers tended to take a strategic approach by only afforesting a small proportion of their land rather than making a total changeover. This would maintain some agricultural production onsite and subsidies. The land retired was the poor areas with lower productivity. To take account of limited resources farmers staggered afforestation in small stages over several years, improving the balance between the time required to establish forest plantations and residual funds from farming activities. In some cases the farmers sought to link islands of woodlands to extend the overall area of woodland on property. The following is a summary of the land retired from agriculture by afforestation: [41]

[33] CC & EP (1997: p.5).
[34] CC & EP (1997: p.5).
[35] CC & EP (1997: p.5).
[36] CC & EP (1997: p.5).
[37] CC & EP (1997: p.8).
[38] CC & EP (1997: p.8).
[39] CC & EP (1997: p.13).
[40] CC & EP (1997: p.14).
[41] CC & EP (1997: p.14&15).

- Arable crop areas where returns were high, had low rates of afforestation: the woodlands created were intended to combat wind or soil erosion or for game reserves;
- For intensive livestock farming areas where returns were moderately high, the afforested areas were fairly small.
- Permanent grassland areas where livestock breeding is less profitable, or unproductive arable land (with low per hectare agricultural value-added, low market values and low rents in general) were more attractive for afforestation. In such areas, the land-base is often extremely fragmented hindering both agriculture and afforestation.

Minimising collateral damage

The aim of the CAP and EEC No 2080/92 was to retire marginal farmland to reduce farm outputs while providing environmental benefits. The mechanisms developed sought to limit speculation by differential aid for farmers and non-farmer, particularly in the opportunity cost payments (see Table 7). Information from a participant in the Republic of Ireland implementation of EEC No 2080/92 stated that participation (retirement of land by afforestation) was limited to land within 100 km of the home farm. The farmer noted that they had afforested a small area on the home farm and purchased land within the 100 km limit the following year to participate. The land was purchased in another location due to land prices but also as it was not within observation of the farmer's peers.

Incentives and disincentives

An analysis of the outcomes and impacts of the implementation of EEC No 2080/92 was segmented into incentives and disincentives and this is presented in Table 8. The permanence of the landuse change was regarded as an incentive (e.g. the benefits would not be lost) and a disincentive (e.g. reversion to agriculture was not possible) and the perception of the individual farmer would balance these issues in the decision making process.

Table 8: A summary of the impacts under EEC No 2080/92.[42]

Area of interest	Incentives	Disincentives
Agriculture CAP	• Low-productivity agricultural land • Search for other production niches to bring in additional income	• Competes with aid awarded under other Regulations (2078/92, set-a-side) • Concern about Community, national or regional guarantees needed to continue premiums long-term • Irreversible nature of the measure (land cannot be returned to agricultural use)
Regional planning	• Development of the forest stand	
Employment	• Opportunity to employ the available workforce profitably in agriculture's low season	
Environment	• Improve the environmental and landscape quality of rural areas • Combat soil erosion and desertification	• Possible reduction of scenic value due to species choice
Statutory		• Conflict with the farm lease act
Socio-economic and financial	• Improvement in wildlife value • Increase in market value of marginal land areas (remote areas, land poorly suited to agricultural use, tiny plots of land on the edge of the forest, etc.) • Establish an area for leisure use • Diversification of financial investments • Promotes the regional heritage of large landowners in certain areas	• Farmers' descendants will not be able to revert to farming

[42] CC & EP (1997: p.17, Table 3).

The United States of America experience: forests as a land buffer

Summary and key insights

The following is a summary of the key points and attributes of the approach to land-use, agriculture and forestry in the United States of America (US).

- The historic intent of US Federal Government agricultural policy was to control agricultural out-puts to satisfy domestic and exports demands, and to maintain a strategic commodity reserve.
- The Secretary of Agriculture controlled the area planted to wheat, feed grains, cotton, and rice by setting area quotas, set-asides, or paid land diversions programs.
- Historically forests have been a buffer to US agricultural production: during periods of depressed agriculture, land reverts to forests by natural and/or human interventions: with idle farmland reverting to forests by natural processes.
- From 1957 to 1997, c.0.7 million ha/y of cropland and c.0.7 million ha/y of pastureland were converted either into or out of the agriculture land-base and a combined total of c.0.6 million ha/y moved into or out of forestry.
- The Government targeted semi-permanent land-use change for marginal and environmentally at risk land by a Conservation Reserve Programme (CRP) which made payments to farmers to remove highly erodible land and wetland cropland to grassland or forests (for no less than 10 years).
- In 2014, 8.0 million ha was under the CRP and it represented the US's largest tree planting program, planting 1.21 million ha of erodible and environmentally sensitive cropland, primarily in the US South.
- The expiration CRP areas after 10 years, and a reduced re-enrolment, prompted concerns that environmental benefits gained could be lost or reduced if land is returned to agriculture based on commodity price signals.

Introduction

A published in-depth study considered the factors influencing the allocation of land to forest land-use in the United States of America for the period of 1952 to 1997.[43] The study considered natural forests more broadly combined with planted trees. From 1957 to 1997, on average c.0.7 million ha/y of cropland and c.0.7 million ha/y of pastureland were converted either into or out of the agriculture land-base. Over the same period, a combined total of c.0.6 million ha/y moved into or out of forestry[44] with corn, soybeans, and wheat as competing crops.[45] A key conclusion was that where climate and site permits, forests, crops, pasture, or a range of rural land-uses can compete for the same unit of land with market forces often resulting in shifts between each. The following considers the US land-use systems and management in regards to the area forests.

Land use and land use controls

Land-use and the area of cropland, forestland, and grassland in the US during the 1950s to late 1990s have been driven by Governmental policies.[46] The Food Security Act of 1985 (P.L. 99-198) established a comprehensive framework within which the Secretary of Agriculture could administer agriculture and food programs from 1986 through 1990.[47] The Act provided the

[43] Alig et al (2003: p. 5).
[44] Alig et al (2003: p. 7) based on USDA ERS (2000).
[45] Alig et al (2003: p. 8).
[46] Alig et al (2003: p. 8).
[47] Glaser (1985: p.i).

Secretary with the power to use 'acreage reduction', set-asides, or paid land diversions programs to reduce the area planted to wheat, feed grains, cotton, and rice.[48] The 'National Program Acreage' (NPA) set the area planted to crops based on the weighted national average of farm programme payment yields to meet estimated domestic and export needs (less imports), with potential adjustments for target increases or decreases in carryover stocks.[49] This then set the allowed area at the farm level based on the Individual Farm Program determined by multiplying an allocation factor by the area planted on an individual farm.[50] The Act created programs to remove highly erodible land and wetland from crop production[51] supported by a prohibition on US Department of Agriculture (USDA) program benefits to farmers who impacted highly erodible soils ('sod-busters') or wetlands ('swamp-busters') by conversion to cropland.[52] The Act also provided provision for farm loans and allowed the 'Farmers Home Administration' to reschedule repayment of delinquent farm loans to expected future revenues from planting and harvesting of at least 20.2 ha to no more than 20 235 ha of softwood plantations on marginal lands that were previously used as cropland or pasture. A restriction was placed, that the land must not be subject to an existing mortgage, where the land was the security to the mortgage.[53] The passage of the Federal Agricultural Improvement and Reform Act of 1996 represented a substantial movement away from direct involvement in farm commodity markets. The Act phased in elimination of target price and land retirement programs (except for the Conservation Reserve Program - CRP). The absence of both mechanisms enabled farmers to choose among all potential agricultural enterprises in the South (except for fruits and vegetables). The expectation was that the link between land-use patterns and market price would be more dynamic; however, actions by Congress since the 1996 farm bill affected the initial objectives of that legislation.[54]

The Conservation Reserve Program

The CRPs of the 1956 Soil Bank legislation and the Food Security Act of 1985 were designed to shift cropland to grassland or forest cover.[55] The CRP initiated by the Food Security Act of 1985 provided payments to farmers to remove highly erodible and environmentally sensitive land from production and introduce resource conserving practices for 10 or more years.[56] Land-owners offered land via a general sign-up on a competitive basis during selected times or via a continuous sign-up on a non-competitive and always open basis (with additional financial incentives to the general sign-up). In 2014 the majority of the area 'enrolled' was under general sign-ups (8.0 million ha), with an increasing area enrolled under continuous sign-ups (2.3 million ha).[57] The continuous sign-ups targeted specific environmental and resource concerns via a range of initiatives (e.g. the largest initiative was the Conservation Reserve Enhancement Program - CREP), where the Federal Government partnered with States to address agricultural-related environmental concerns in specific geographic regions.[58] The CRP has resulted in environmental benefits (e.g. reduced soil erosion, improved water quality through wetlands and field-buffers, reduced fertilizer use, and increased wildlife habitat). From the late 1980s to early 1990s, about 90 % of the CRP tree planting occurred in the US South on private lands and resulted in more than 0.81 million ha of afforestation on former cropland.[59] Between 1987 and 1997, the net increase in US private timberland area was 1.58 million ha and the CRP represented the Nation's largest tree

[48] Glaser (1985: p.vii).
[49] Glaser (1985: p.8).
[50] Glaser (1985: p.8).
[51] Glaser (1985: p.vii).
[52] Glaser (1985: p.viii).
[53] Glaser (1985: p.49).
[54] Alig et al (2003: p. 43).
[55] Alig et al (2003: p.39-40).
[56] Stubbs (2014: p.1).
[57] Stubbs (2014: p.1).
[58] Stubbs (2014: p.1).
[59] Alig et al (2003: p. 43).

planting programme with trees planted on c.1.21 million ha of erodible and environmentally sensitive cropland, primarily in the US South.[60]

The expiration of a number of areas under the programme (after 10 years), and a reduced re-enrolment, prompted concerns that environmental benefits gained could be lost or reduced if land is returned to agriculture.[61] A number of factors have impacted CRP re-enrolment and initial uptake, and farmers seeking early release: high commodity crop prices have encouraged farmers to put CRP land (including marginal land) back into agricultural production. Another driver of reduced interest has been the low CRP annual rent-rate compared to the market rental rates. Regardless, enrolment increased under continuous sign-ups and demand for the program in general still exceeds the current enrolment level.[62]

Movement of land-use between agriculture and forestry

Land-use dynamics in the US include multiple pathways linked to changes in forest area, with two-way flows between forestry and agriculture.[63] Historic expansion of settlements and forest harvesting resulted in the area of cropland and pasture increasing, reaching a peak around 1920.[64] The spread of the boll weevil (*Anthonomous grandis grandis* Boheman which feeds on cotton buds and flowers[65]) and the agricultural depression of the early 1920s resulted in large areas of cropland and pastureland becoming idle and abandoned. During the same time, uncontrolled fires and a lack of forestry programs, resulted in only part of the harvested forests and the idle cropland and pasture to reverting back to trees. Trees did naturally regenerate in some areas (to pine, mixed pine-hardwood, and hardwood stands[66]) and the early 1900s was the beginning of what was referred to as the South's 'second forest'.[67] From 1930 until the early 1960s, the area of timberland increased by about 20.3 million ha as areas no longer suitable for cotton in the South, cleared areas on hill farms in the East, and marginal farms in other regions reverted back to forests. Agricultural policy contributed to the decline in cropland area during 1950 to 1972, the increase in cropland from 1973 to 1981, and again the decline of cropland area during 1982 to 1990. The downsizing periods recognized that resources had to be moved out of cropping to control production.[68] Fluctuations in agricultural markets due to droughts in the 1970s and 1980s led to world crop shortages, energy shocks (e.g. the 1973 oil crisis), and other factors have resulted in significant shifts in cropland area but also changes in national agricultural policy.[69] During the 1960s, the upward trend in timberland area was reversed, and by the 1970s, the rate of area loss began to accelerate, decreasing the timberland area by 4 % between 1962 and 1977 to 199.1 million ha, with a subsequent reduction to 196.3 million ha by 1987.[70]

During the 1970s and 1980s, forest clearing for cropland occurred throughout the coastal plains of the South[71] but considerable areas were marginal for agriculture or not well suited to the major US field (e.g. corn, soybeans, or wheat) and the region had only a slight drop in forest-land area during this period.[72] Later in the 1980s, crop prices declined as agricultural product stockpiles mounted due to falling crop exports. Land again moved out of cropland, resulting in a net increase in forest-land

[60] Alig et al (2003: p.23).
[61] Stubbs (2014: p.1).
[62] Stubbs (2014: p.1).
[63] Alig et al (2003: p.19).
[64] Alig et al (2003: p. 43) citing USDA Forest Service (1988).
[65] Ellis & Horton (2019) https://wiki.bugwood.org/Anthonomus_grandis_grandis
[66] Alig et al (2003: p. 43).
[67] Alig et al (2003: p. 43) citing USDA Forest Service (1988).
[68] Alig et al (2003: p.39-40).
[69] Alig et al (2003: p. 38-40).
[70] Alig et al (2003: p.22&23).
[71] Alig et al (2003: p. 38-40).
[72] Alig et al (2003: p. 38-40) citing Alig et al. (1998b)

area. By 1987, 32.4 million ha of cropland were held idle nationally under various farm programs, with a significant amount in the South. In the North during 1987 to 1997, excess agricultural capacity resulted in natural reversion of some former agriculture land to trees.[73] Changes in world supply and demand for agricultural products led to land used for crops returning to the pre-1973 level of circa 133.5 million ha nationally.[74] Movement of land between forestry and agriculture in the 1980s and 1990s has resulted in net gains from agriculture to forestry that have offset forest conversion to urban and developed uses.[75] The land-use dynamic can be both direct and indirect: a reduced supply of agricultural land due to urbanization can either result in indirect[76] or 'replacement' conversion of forest land to agricultural uses or direct conversion of forests to developed uses.[77]

Figure 1 presents a useful schematic of the dynamics of land-use in the US over the period of 1982 to 1997. The figure has forestry at the centre of the system acting as a land buffer to take account of the need for changes in the other land-uses. A key point is that Government policy combined with market pressures (e.g. price) shifted land from crop production to forestry to reduce agricultural outputs and environmental impacts, but as soon as a commodity price threshold was reached, land was converted back to agriculture. The change to trees was either via natural regeneration or by planting. An interesting strategy was to allow trees as a 'green' bank to restructure delinquent farm loans with repayment on harvest of the trees.

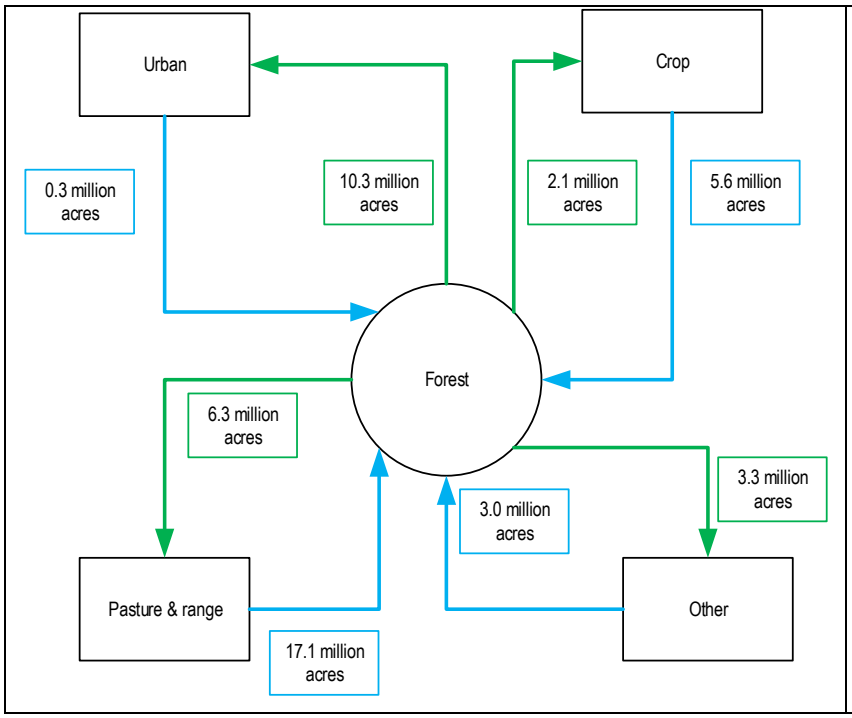

Figure 1: The area exchanged between the major land-uses in the US (1982 to 1997).[78]

[73] Alig et al (2003: p.23).
[74] Alig et al (2003: p. 38-40).
[75] Alig et al (2003: p.19).
[76] Alig et al (2003: p. 20) citing Alig et al. (1998a).
[77] Alig et al (2003: p. 20) citing Alig and Healy (1987)
[78] Alig et al (2003: p.21; Figure 13).

Uruguay experience: a purpose built estate

Summary and key insights

The following are the key insights gained by an analysis of the history of plantation development in *República Oriental del Uruguay* (Uruguay).

- There is a long history of woodlot planting by Uruguayan farmers to provide resources for on-farm use and shade and shelter.
- Responsibility for the plantation sector sits with the Ministerio de Ganaderia, Agricultura y Pesca (the Ministry of Livestock, Agriculture and Fisheries) and annual reporting includes all sectors on a side by side basis as part of agriculture.
- The Government policy intent was to develop a purpose built plantation based forest industry commencing with a plan to utilise marginal agricultural land to develop the plantation estate.
- A specific policy objective was to incorporate the plantation sector into traditional agricultural activities of Uruguay.
- Economic turmoil (deregulation and currency floats in the 1970s and a recession in 1981) depressed agriculture, stimulating agriculture to seek alternative land uses including plantations and woodlots.
- The oil price shock of the 1970s caused in a shift to fuelwood as an energy source for industry and resulted in woodlot planting by industry.
- Direct agricultural shocks have included a European Commission ban on beef imports (1973) and depressed wool markets (1987).
- The Government instigated two Forest Laws (1968 to 1979; 1987 to 2005) which guided development of a fit for purpose plantation estate on cleared agricultural land.
- The Forest Laws underpinned the programme and legally limited development to marginal agricultural land within set zones, defined species and silviculture, create investment mechanisms and used taxation as an incentive.
- The Forest Laws were amended to fine tune the outcomes relative to the state of plantation development.
- The Second Forest Law assumed that the private sector would undertake afforestation, with the Government as facilitator and coordinator.
- Initially the Forest Laws targeted famers but was expanded allow land purchased by companies. With land price increases (due to plantations), there was a shift to land leasing and joint-ventures.
- By 2018 there were 862 364 ha of plantations (68.6% eucalypts; 21.3% Pinus species; 9.0% shelter belts and windbreaks; 1.1% mixed species, *Salix* spp and *Poplus* spp). For 2018 the majority of the log outputs were predominantly eucalypts: 10.20 million m^3 of pulpwood; 4.18 million m^3 of sawlogs and veneer logs; 2.60 million m^3 of fuelwood.

Introduction: Natural landscape and early plantations

The historic natural forest cover of Uruguay was estimated to have been c.10% of the landmass[79] and in 2016 it was reported to be 3.5% of the landmass (c.667 000 ha)[80] located adjacent to water ways (see Figure 2).[81] Grassland ecosystems cover c.85% of the landmass[82] and the cause of the lack of natural forest and the traditional landscape of Uruguay in not known.[83] The grasslands of Uruguay have been managed under extensive grazing (e.g. beef and sheep production), covering c.14 million ha. A small area on the most fertile soils has been managed with semi-intensive beef and dairy production. Annual grain cropping (e.g. wheat, barley, rice, soybean, sunflower, corn, oats, sorghum) and annual forage crops (e.g. oats, rye grass, red clover, corn for silage, forage sorghum) has been undertaken on c.1.5 million ha.[84]

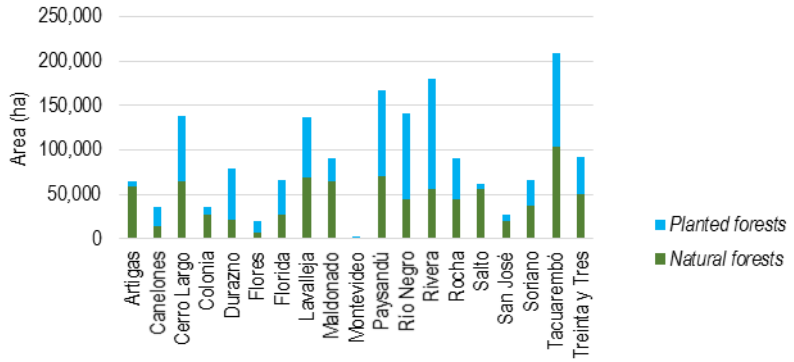

Figure 2: The area of natural forests (2016) and the area of plantation (2018).[85]

Over exploitation of Uruguay's limited natural forests resulted in a shortage of firewood and industrial roundwood in mid-1842 and the national Government sought to protect the natural forests from illegal logging by regulation. The mechanism was a levy charged on those involved in the harvest.[86] The first eucalypts were planted in Uruguay in c.1853 for medicinal properties.[87] Subsequent eucalypt plantations were developed to provide shade and shelter for cattle, to act as wind breaks and to provide fuelwood and fence posts.[88] During 1907-1911 farmers began to plant eucalypt woodlots creating a landscape with '*islands'* of eucalypts[89] in the grasslands.[90] To promote trees and the benefits of trees, "*The Annual Party of Tree Planting throughout the Republic",* commenced in 1900 resulting in the first nationwide afforestation programs. Throughout the country, schoolchildren, teachers, and the general public enjoyed activities in homage of the day of the tree, resulting in woodlots throughout the country.[91] In 1910, the Government rewarded a renowned tree planter of Punta Ballena, Mr. Antonio Dionisio Lussich, with the Uruguayan people a prize of $10,000 and a gold medal in recognition of '*painting the horizons with new colours and making the landscape flourish'*.[92] A 1935 Decree of the Executive Power created the '*Honorary Commission for*

[79] Delegation of Uruguay (1948: p.1)
[80] Ferrari (2016: p.17).
[81] Martino & del Castillo (2006: p.3).
[82] Martino & del Castillo (2006: p.8).
[83] Ferrari (2016: p.17).
[84] Martino & del Castillo (2006: p.8).
[85] MGAP (2019a); MGAP (2019b)
[86] Ferrari (2016: p.34).
[87] Ferrari (2016: p.17).
[88] Jacobs (1979: p. 139).
[89] Ferrari (2016: p.44).
[90] Ferrari (2016: p.17).
[91] Ferrari (2016: p.42&43).
[92] Ferrari (2016: p.44).

the Promotion of the Tree' to promote plantations and to formulate a *Forestry Law*.[93] Planting trees for shade and shelter for livestock was reported to be normalised in Uruguay.[94]

Economic drivers and shocks

Setting the scene

Uruguay's economy developed rapidly from 1900 to 1930 driven by exports of beef and wool. In the 1950s agricultural exports stabilised and manufacturing was limited due to small domestic markets and the role of Government expanded with the public sector as the source of most new employment. The economy was protected by high tariffs and the status quo was upheld by an alliance between the two major political parties through the 1960s, but lack of GDP growth and large public-sector deficits resulted. The military Government (1973-85) initiated major economic reforms during the 1970s, but operated with high deficits funded by debt. In an effort to reorient the stagnated economy toward external markets, the Government deregulated the economy by eliminating price controls, significantly reducing tariffs and providing subsidies to exporters. The results was increased exports, investment, and gross domestic product (GDP) improvement. A deregulation of the banking sector aimed to remove inflationary pressures, destabilised the economy sending the country into recession in 1981. One source of instability was the growing 'dollarization' of the banks. Deregulation of foreign-exchange resulted in United States dollars flowing into Uruguay, mostly from Argentine real estate investment. In response the local banking sector provided debt to domestic private companies and 'ranchers'. When the Government floated the Uruguayan currency in 1982, the peso value of much of the Uruguayan debt tripled. Uruguay faced both a recession and a domestic debt crisis in the early 1980s. In 1986-87 the economy recovered from recession as real GDP increased by 6.6 % in 1986 and 4.9 % in 1987. The fundamental problem of inflation (an average over 60 %/y in the 1980s) remained and domestic debt was largely absorbed by the public sector, increasing the deficit and foreign debt. During 1989-1990, the Government to abandon its growth-promotion strategy, and GDP did not increase.[95]

Specific shocks with plantations as a collateral product

During 1973, two international economic factors impacted Uruguay: the quadrupling of oil prices (Uruguay was 100% reliant on imported petroleum) and the closure of European Community (EC) markets to imported beef. These factors helped convince the military Government that a major economic restructure was required.[96] To address energy costs in the early 1980s, some local industries converted their boilers to fuelwood from fuel oil, resulting in significant savings.[97] A response was that engineering companies focussed on boiler designs to adapt oil units to fuelwood.[98] In response, fuelwood consumption increased 5% annually from c.1.4 million m^3/y in the mid-1970s to 2.8 million m^3/y in the mid-1980s. The increase in fuelwood use was prior to the stimulated expansion of the estate which commenced in 1990: in 1973 the estate was 111 123 ha and it was reported that 1 004 770 m^3 of logs were harvested of which 820 000 m^3 was fuelwood.[99] An increase in fuelwood consumption increased pressures on the natural forest. In 1987, harvest of natural forests was prohibited but allowed

[93] Ferrari (2016: p.45).
[94] Ferrari (2016: p.51).
[95] Hudson & Meditz eds (1990c: The economy).
[96] Hudson & Meditz eds (1990a: Stagnation).
[97] Hudson & Meditz eds (1990b: Forestry); Ferrari (2016: p.69).
[98] Ferrari (2016: p.69).
[99] Jacobs (1979: p.139).

firewood collection and wood for building cattle fences.[100] The area of natural forest has increased by 15%.[101] Demand for fuelwood included harvest of private woodlots providing commercial transaction experience for the farmers. This resulted in an organized market and establishment of woodlots for fuelwood by the consuming industries (e.g. *La Sierra*, *Metzen and Sena*).[102] The Government response included a National Energy Directorate study of fuelwood consumption. The closure of the EC markets to beef imports impacted the farming communities. A further shock to the agricultural sector (noted in Box 6) in 1987 was a down-turn in the wool markets, but the 'saviour' was investment in trees.

Box 6: A reflection of the state of agricultural in Uruguay in 1987.[103]

I remember 1987 in which the wool price crisis, determined that the traditional rural sheep farmer, with a property of little dimension resulting from of the natural division of the land by inheritance and the passage of generations, and cornered by the pressure of tax burdens, he did not find in the sheep the viability of his work and it was necessary to promote an opportunity.

And thanks to dynamic technicians and governors who know the countryside and the trees, they promoted the recycling of the Forestry Law with wise additions that quickly caught on in society, channeling domestic savings and fostering foreign direct investment.[104]

Ing. Lucio Cáceres Behrens *President of the National Academy of Engineering of Uruguay*

Energy supply

Biomass residues contributed 13% of industry's total energy consumption in 2007, and between 2003 and 2007, electricity was the most significant supply.[105] Biomass residues became the main energy source of the industrial sector in 2008, driven by the consumption of black liquor in pulpmills.[106] Over the period of 2007 to 2011 biomass contribution to the overall energy supply in Uruguay increased and in 2011 it supplied 30.7% of the energy needs as the second largest source of energy. The biomass consumed in 2011 was: fuelwood 40.0%; biomass residues 57.6%; 2.4% 'other primary sources'.[107] In 2016, Uruguay's power system was c.80% renewable installed capacity, with electricity close to 100% renewable, and of that 18% was sourced from a baseload of biomass.[108] A 2014 development was the Montes del Plata pulpmill delivering surplus energy (c. 500 GWh/y) to the national electricity grid (c.5% of the country's total energy needs).[109]

Development of Uruguay's Forest Laws

Development of Uruguay's Forest Laws

Uruguay is example of a purpose-built plantation based forest industry that commenced with a defined industry plan to utilise marginal agricultural land to develop a plantation estate.[110] This intent was facilitated by the Forest Laws and Nation Forest Plans. The first Uruguayan forest policy was created in the 1920s[111] and in 1948 stimulation of an afforestation programme was discussed. The 1948 approach considered that the first step to focus plantation development should be coordination by

[100] Martino & del Castillo (2006: p.10).
[101] Martino & del Castillo (2006: p.10).
[102] Ferrari (2016: p.70).
[103] Ferrari (2016: Foreword p.9).
[104] Translated from Spanish using https://translate.google.com/.
[105] DNETN (2008a) in Caldas (2011: p.18).
[106] DNETN (2008b) in Caldas (2011: p.18).
[107] IDB & UNDP (_____: p.9).
[108] Taibi et al (2018).
[109]Downloaded from https://www.storaenso.com/en/about-stora-enso/stora-enso-locations/montes-del-plata-mill on the 17/05/2019.
[110] de Fégely et al (2011: p.77).
[111] Ferrari (2016: p.53).

a single agency (rather than a fragmented approach) resulted suggested formation of a Forest Department, a Forestry Institute, or a Ministry of Waters, Forests, and Wildlife Resources.[112] Subsequently, the development of the Uruguay plantation estate was in an 'orderly and controlled' manner considering all aspects including an incentive framework and protection of the natural forest estate.[113] A specific objective of the National Forestry Policy was to incorporate the plantation sector into traditional agricultural activities in Uruguay.[114]

The first Forest law

The foundation of the expansion of the Uruguay plantation estate was the First Forest Law which ran from 1968 to 1979 (see Box 7). Between 1975 and 1979 a direct incentive (the *Minimum Required Productivity Tax*) allowed reinvestment of tax liabilities. The Law stimulated establishment of target species aimed at target processing markets on soils not suited to agriculture and with species adapted to the conditions of the country.[115] Over the period, 12,000 ha (32% pines; 54% eucalypts; 16% salicaceous) were established,[116] and is suggested that the scale of the response was limited by an absence of commercial plantation experience, and that it did not meet the needs of the farmers (who historically generated income from meat and wool production' and lacked information on international wood markets).[117] The mechanism was repealed in 1979 by the Law of Accountability.

Box 7: The First Forest Law of Uruguay: 1968 to 1979.[118]

The First Forestry Law 13.723 (1968) of December 1968 was the foundation for development of the plantation sector in Uruguay:

- *Basis:* The law declared a national interest *'defence, improvement, expansion and the creation of forest resources; and the development of forest industries and, in general, the forest economy'* supported by regulations.[119]
- *Target land:* The law classified '*forest priority soils'* as marginal soils for agricultural-livestock production. The Commission for Investment and Economic Development (CIDE) was an inter-ministerial public body of Uruguay that operated between 1960 and 1967 and it developed a soil classification system for the establishment of taxes according to the productivity of the land.
- *Attributes:* The law specifies plantations as protective, broad based and for production based on soils
- *Incentives to plant:* The law created incentives (tax exemptions and credits) and established a '*Forest Fund*' for farmers.
- *Incentives to process:* Tax exemptions were available for 25 years for the processing of wood or the use of other forest products.

The Second Forest law (1990 to 2005)

A revision of the First Forest Law was drafted (the Second Forest Law 15.695, 1984) but was not enacted.[120] For consistency this Second Forestry Law while described as such in some references[121], is not the Second Forest Law more usually described in most references. A Second Forest Law was developed based on the assumption that the private sector would develop the

[112] Delegation of Uruguay (1948: p.2).
[113] CAETS (2018).
[114] Martino & del Castillo (2006: p.10).
[115] Ferrari (2016: p.69).
[116] Ferrari (2016: p.69).
[117] Ferrari (2016: p.71).
[118] Ferrari (2016: p.68&69).
[119] Ferrari (2016: p.68&69).
[120] Ferrari (2016: p.71).
[121] Ferrari (2016) includes the drafted but never enacted Second Forest Law in the count of Forest Laws, while all other references refer to the 1987 law as the Second Forest Law.

new plantations, with the State as facilitator and coordinator. The development of the Second Forest Law included the public and private sectors, and non-government organisations (NGO's) in determining the instruments applied, hence, the law was approved by all political parties, and backed by society in general (see Box 8 for the related forest policy).[122] The Second Forest Law 15939 (1987) was enacted on December 28, 1987 and provided continuity of the First Forest Law regarding natural forest conservation, promotion of plantations and institutional structures, afforestation requirements and qualification of plantations and taxation treatments.[123] The law was not implemented until 1990.[124] The law required the preparation of a five year National Forestation Plan to set national targets (e.g. establishment rates) to be updated annually to reflect experience gathered in previous years. The law also established a 'Forest Right' mechanism separating the title to the land and planted trees[125] facilitated multi-party investments in plantations.[126] The law allowed companies with 'bearer shares' to purchase land for plantations.[127] The law recognised changes in the processing sector and enabled use of forest products as raw material by the chemical industry or power generation, and included ANCAP (Administración Nacional de Combustibles, Alcoholes y Portland – a state owned company) roles.[128] The law allowed eucalypt pulpwood exports to Europe[129] which commenced in 1988[130]. The law enhanced the attractiveness of Uruguay to foreign plantation investors building on: land at competitive prices in relation to neighbouring countries; a legal framework with fiscal and tax benefits; and good capacity for development of fast-growing plantations.[131] Voluntary third party certification and, technical advances and genetics resulting from research and development, assisted the growth of the industry from the 1990s onwards.[132]

Box 8: The aims of the National Forestry Policy of Uruguay.[133]

The specific objectives of this National Forestry Policy were:

- *Incorporate the sector into the traditional agricultural activities in Uruguay*
- *Establish a platform for the development of a new industrial sector*
- *Generate employment in depressed rural areas*
- *Restore degraded areas of low productivity*
- *Improve environmental conditions and assure bio diversity*
- *Improve the socio-economic conditions of the population in rural areas*
- *Creation of a sustainable energy resource*

Amendments to the Second Forest Law

Law 17905 of 2005 eliminated forestry subsidies and Law 18083 introduced income tax for plantations established since 2006, with an exemption for plantations *for production of* quality *wood*[134] (sawlogs on a 15 year rotation).[135] The associated forest policy maintained protection of natural forests.[136] It was suggested that the legislation discouraged genetic improvement by

[122] Martino & del Castillo (2006: p.10).
[123] Ferrari (2016: p.79).
[124] Pou (2011: sec. 1.2)
[125] Ferrari (2016: p.72).
[126] Pou (2011: sec. 1.2)
[127] Martino & del Castillo (2006: p.10).
[128] Ferrari (2016: p.72).
[129] Ferrari (2016: p.73).
[130] Martino & del Castillo (2006: p.10).
[131] Ferrari (2016: p.79).
[132] Ferrari (2016: p.79).
[133] Martino & del Castillo (2006: p.10).
[134] Ferrari (2016: p.139).
[135] Ferrari (2016: p.139).
[136] Ferrari (2016: p.139).

removing tax incentives for 'reforested' plantations.[137] In 2005, a requirement to conduct an *Environmental Impact Study* was regulated for plantation development (Decree 349/005)[138] was suggested to be a barrier to participation by small and medium investors in short (8 to 10 years) rotation plantations on their own land.[139] In response to Uruguay's emissions targets under the Paris Summit, the Government has set a plantation establishment target of 30,000 ha/y, towards 2 million ha by 2030.[140]

Specific incentives under the Forest Laws

Taxation

Taxation has been a long-term incentive mechanism for tree planting. An early example was during 1907-1911 when the planting of trees on farms and 'ranches' was encouraged and rewarded with a significant discount on land taxes.[141] Commencing in 1975 under the First Forest Law, between 1975 and 1979 a direct incentive (the *Minimum Required Productivity Tax*) allowed reinvested up to 100% of a standard plantation cost profile (based on a 10,000 ha plantation development to calculate a $/ha rate[142]). For example, a farmer could invest their tax liability, in plantations on their own land, if compliant with site, species and silviculture requirements.[143] The mechanism was repealed in 1979 (the Law of Accountability).[144] The Second Forest Law allowed reimbursement of up to 50% of the National Average Cost of Planting determined by the Government and paid one year after the completion of planting (20% for taxpayers of agricultural Income (IRA) or Commercial and Industrial Income (IRIC); 50% for other taxpayers).[145] The Law allowed equipment and inputs used for plantation development, harvesting and processing of wood to be imported tax free.[146] In 2005 the Second Forest Law was amended and the expense based taxation treatment was revoked (including for reforestation) and was replaced with income taxation on post-2006 plantations but with an exemption for longer rotation plantations targeting the production of quality wood (e.g. sawlogs[147] on a 15 year rotation).[148] Specifically, short-rotation plantations (less than 15 years) with nil pruning or thinning did not receive tax exemptions.[149] The evolution of the taxation treatment demonstrates a need for a dynamic approach: initially there was a need to encourage plantation establishment, which as the sector matured created an opportunity for income tax collection. In this case, the taxation treatment sought to encourage longer-rotation crops, rather than pulpwood production although export pulpwood was allowed under the Second Forest Law.

Loans

The First Forest Law of 1968 created a Forest Fund to channel capital into plantation development[150] with the pool of available funds set at 95% of the cost to establish a standard plantation of 10 000 ha.[151] The Second Forest Law created a line of credit granted by the *Banco de la Republica Oriental de Uruguay*.[152] The loans were for up to 12 years including a grace period of up

[137] Ferrari (2016: p.139).
[138] Ferrari (2016: p.139).
[139] Ferrari (2016: p.139&140).
[140] Ferrari (2016: p.140).
[141] Ferrari (2016: p.44).
[142] Ferrari (2016: p.73).
[143] Ferrari (2016: p.71).
[144] Ferrari (2016: p.71).
[145] de Fégely et al (2011: p.78).
[146] de Fégely et al (2011: p.78).
[147] Pou (2011: sec. 1.2).
[148] Ferrari (2016: p.139).
[149] Hopkins (2018).
[150] Ferrari (2016: p.68&69).
[151] Ferrari (2016: p.72).
[152] Ferrari (2016: p.80).

to 10 years and with interest rates equivalent to the Libor (official) rate + 1.5%.[153] The development of a Forest Right mechanism allowed the land on which the trees were planted and funded by debt, to be offered as securing for the loan to plant the trees.[154]

Land and land access

The plantation investment, development and ownership

Development of plantation silviculture and seeking domestic and international investors followed the development of the National Plan in 1990.[155] Afforestation from 1990 to 1998 was mainly by groups of national investors stimulated by the policy to buy land to generate taxation benefits from investment in plantations.[156] Companies were formed by private individuals to provide investment scale. In other cases land was purchased, established to trees and divided into 10 ha '*forested parcels*' to facilitate investment by parties outside of the agricultural sector (e.g. professionals, merchants and entrepreneurs).[157] During 1990-1995, domestic corporate investment in plantations occurred (e.g. CoFU-Sa and Fymnsa - Grupo Balerio) and institutional investors included: The Banking Retirement and Pension Fund, The Notarial Pensions and the Box Retirement and Pension Fund for University Professionals.[158] During the same period, investments included by companies based in Spain, Canada, the United States, Finland, the U.K. and Chile,[159] including EnceGroup, Shell and Weyerhaeuser.[160] A by-product of the development of the plantation sector has been significant foreign investment in processing capacity (e.g. foreign direct investment in the construction of a pulp mill[161]). In 2004-2005 a change of ownership of the plantations occurred stimulated by:[162]

- The economic crisis and bankruptcy of the companies Valleflor and Paso Alto.
- Commencement of pulp projects.
- Settlement of investment funds of different origins: in the case of Weyerhaeuser, retained 50% of land and forests with the remaining owned by Global Forest Partners (GFP).
- Timber Investment Management Organisations (TIMO's) investment (e.g. GFP; GMO, RMK, Harvard Securities - Forestal Atlántico Sur, Phaunos, COFUSA and Grupo Forestal) which stimulated creation of plantation management service providers.[163]

Target land for plantation development

A 1948 study of commencement of an afforestation programme suggested that the plantations should target specific land:[164]

1. The cost of the land is lower than elsewhere;

[153] de Fégely et al (2011: p.78).
[154] Martino & del Castillo (2006: p.10).
[155] Ferrari (2016: p.79).
[156] Ferrari (2016: p.82).
[157] Ferrari (2016: p.82).
[158] Ferrari (2016: p.82&83).
[159] Martino & del Castillo (2006: p.3).
[160] Ferrari (2016: p.82&83).
[161] Ferrari (2016: p.89).
[162] Ferrari (2016: p.86).
[163] de Fégely et al (2011: p.79).
[164] Delegation of Uruguay (1948: p.1&2).

2. The land is unsuitable for any other types of profitable exploitation;
3. These areas are particularly suited to the development of forests;
4. The land requires afforestation for soil conservation (following the deforested of mountain slopes by erosion or alluvial invasion) and for the elimination of swamps by land reclamation.

Based on these assumptions, the study estimated that the area considered as suitable land for plantations (based on climatic and ecological requirements) was 2.2 million ha to 2.7 million ha (12 to 15 % of the total land base).[165] The Commission for Investment and Economic Development (CIDE) was an inter-ministerial public body in Uruguay (1960 and 1967) which developed a soil classification system (CONEAT[166]) for differential taxation based on the productivity of the land.[167] Each title of land in Uruguay has the land classification recorded on the title. The First Forest Law of 1968 sought to limit plantation development to *'forest priority soils'* which were marginal soils for agricultural-livestock production (see Figure 3).[168] The mechanism was to only provide incentives to plantation located on *'forest priority soils'.* The qualifying land was only within Forestry Priority Areas set by the First Forest Law.[169] Subsequently the National Forest Plan defined priority areas and species for plantation development, largely on vacant or unused areas of poor agricultural land (approximately 2.5 million ha was identified for development in the zones[170]). These limitation have been maintained in each subsequent Forest Law. Taking a pragmatic approach, the Forestry Priority Areas have been amended to take account of changes in the operating environment. For example, in 1993 the boundary of Zone 2 was enlarged to take account of export pulpwood production: the original boundary was set assuming a maximum haulage of fuelwood to Montevideo.[171] It was reported that the definition of *'forest priority soils'* has been modified in 2006, 2007 and 2010.[172]

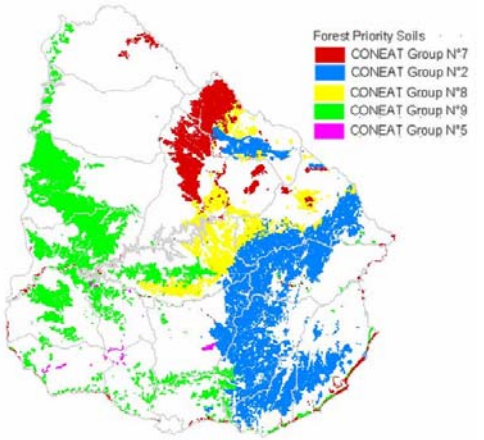

Figure 3: A map of the forest priority soils of Uruguay.[173]

Each CONEAT land unit is assigned a productivity index relative to the country's average productivity per unit land: a site index of 100 is average productivity, and most 'forest priority soils' have productivity indexes under 100. The most productive soils have indexes in the order of 200.[174]

Historically eucalypt plantations had been developed across most soil types but the main plantation zone was in the deep soils of the Rio Negro. The poorest tree growth occurs on poorly drained sites with shallow soils (particularly of basaltic origins).

[165] Delegation of Uruguay (1948: p.1).
[166] Martino & del Castillo (2006: p.10).
[167] Ferrari (2016: p.68&69).
[168] Ferrari (2016: p.68&69).
[169] Ferrari (2016: p.106).
[170] de Fégely et al (2011: p.77).
[171] Ferrari (2016: p.80).
[172] Ferrari (2016: p.173).
[173] Martino & del Castillo (2006: p.11).
[174] Martino & del Castillo (2006: p.10).

The plantations have been grown on a pulpwood rotation of 10 to 12 years as a planted crop or 5 to 7 years for coppice. Productivity data for 1973 suggested that for better sites: *E. globulus* (25 m^3/ha/y), *E. camaldulensis* / *E. tereticornis* (18 m^3/ha/y) and *E. saligna* / *E. grandis* (35 to 45 m^3/ha/y).[175]

Land use approvals

Since 1968 plantations in Uruguay have been regulated[176] and the plantation sector is regarded as the most regulated sector for primary production in the country.[177] Every proposed plantation project must be presented to the Dirección General Forestal following a set procedure.[178] Legal title proving the ownership of the land must be presented as well as information relating to the soils.[179] In 2005 a requirement to conduct an *Environmental Impact Study* was regulated for plantation developments greater than 100 ha (Decree 349/005).[180] An interested party must submit a detailed proposal to 'several' Government departments in two ministries and the relevant municipal administration.[181] After the plans are submitted and approved by the National Forest Directorate, the plantations are registered, and are 'traceable'.[182]

Land sales price

Plantation land values have appreciated considerably during the period of the Second Forest Law but values fell before trebling over the period 2002 to 2011 even though the incentive program had ceased.[183] Plantation development and associated processing have been linked to the increase in land price from 2004-2010. Further research suggested that the land price in 2002 was even lower c.USD100/ha.[184] There is an active market for agricultural and forestry land in Uruguay with 187 022 ha sold in 1139 transactions in 2017.[185] The impact of the mean area of the land sold and the mean price paid in 2017 is presented in Figure 4 for the 18 regions of Uruguay. A weak trend is evident where for smaller average land areas, the price realised in higher, stabilising at between 200 ha to 250 ha at USD3,000 to USD4,000 /ha (see Figure 4). The impact of a regions existing plantation estate area on the realised transaction price is presented in Figure 5 and the land price stabilises at c.USD3,000 to USD3,500 /ha for regions with greater than 40 000 ha of plantations (in 2018). There was a strong correlation between the area of plantations in a region (in 2018) and the 2017 land price realised (see Figure 6). The price of land in 2017 was reported based on full details of all transactions by land-use and that the average prices were: cattle land - USD2,000 to USD3,500 /ha; cropland - USD 6,000 to USD 9,000 /ha (75% or more suitable for cropping); mixed cropping, plantation and cattle land - USD4,000 to USD6,500 /ha; plantation land - USD3,000 /ha for non-planted area and c. USD4,000 /ha for planted sites.[186] It was reported that the construction of the UPM pulp mill in central Uruguay (near Paso de los Toros) is 'a reason for investors to consider properties in that area'.[187] In 2017 the largest land transaction in Uruguay's history was Weyerhauser's sale of 120 000 ha of plantations for USD402.5 million to an international consortium led by BTG Pactual (USD3,354/ha).[188]

[175] Jacobs (1979: p. 140).
[176] Ferrari (2016: p.106).
[177] CAETS (2018).
[178] Pou (2011: sec. 1.2).
[179] Pou (2011: sec. 1.2).
[180] Ferrari (2016: p.139).
[181] Ferrari (2016: p.137).
[182] Ferrari (2016: p.106).
[183] de Fégely et al (2011: p.78).
[184] de Fégely et al (2011: p.79).
[185] Based on data from MGAP (2019b: Table 5).
[186] Farmland Uruguay https://farmlanduruguay.com/farmland-prices-2017/ accessed on the 18/05/2019.
[187] Farmland Uruguay https://farmlanduruguay.com/farmland-prices-2017/ accessed on the 18/05/2019.
[188] Farmland Uruguay https://farmlanduruguay.com/farmland-prices-2017/ accessed on the 18/05/2019.

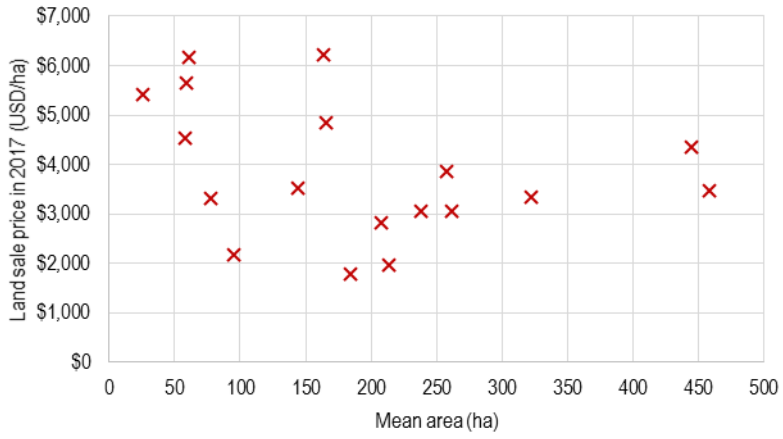

Figure 4: The value of land purchased in 2017 by Region and mean area of the transactions in each region.[189]

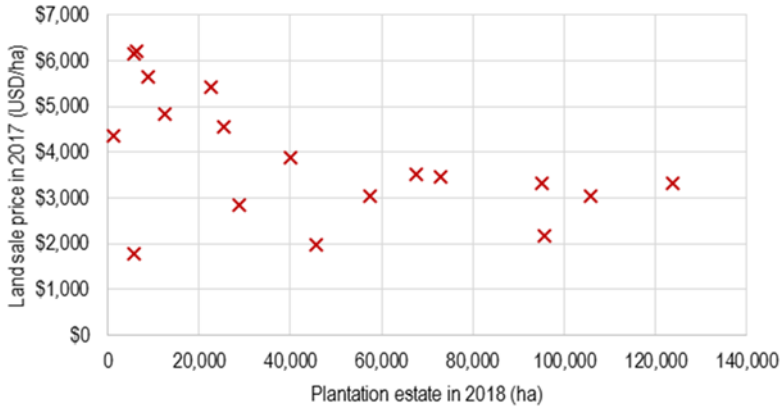

Figure 5: The value of land purchased in 2017[190] and the exisitng area of plantations in each region 2018.[191]

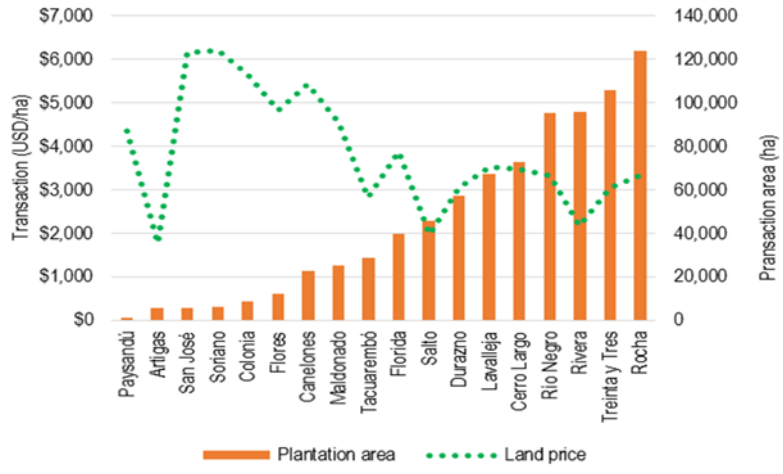

Figure 6: The value of land purchased in 2017 by Region[192] and the exisitng area of plantations in each region in 2018.[193]

[189] Based on data from MGAP (2019b: Table 5).
[190] Based on data from MGAP (2019b: Table 5).
[191] MGAP (2019a).
[192] Based on data from MGAP (2019b: Table 5).
[193] MGAP (2019c).

Out-growers and lease arrangements

Out-grower arrangements

A cattle breeder and farmer who had planted 150 ha of eucalypts on his farm since 2009 commented that the plantations were a great way to supplement income and diversify from traditional farming.[194] As an alternative to land purchase there are two arrangements to access land: a simple lease and joint-ventures. There are two types of joint-venture in Uruguay. The first is described as 'sharecropping' where a company enters into an arrangement with a land-owner to develop a plantation on the land-owners land and proportionally share the net returns. The second is described as '*promotions'* and involves an allocation of management between the company and the landowner, and the company supplying inputs such as 'forest genetics' (seedlings), technical assistance and site preparation for planting, and the land-owner commits to implement and manage the forest plantation until harvest, offering the wood to the company as the first purchase option (a first right of refusal).[195] In more recent years most new plantations have been established under out-growers schemes within farming systems spatially arranged as mosaics rather than large blocks providing farmer risk mitigation by diversification and to capture production synergies (e.g. with livestock shelter and non-timber forest products such as honey and mushroom collection). The plantation risk is reduced by grazing of green grass around the plantations.[196]

The current market and land lease costs

There is an active land leasing market in Uruguay and for 2017 there were 2768 contracts recorded covering 908 442 ha.[197] The areas involved varied for the different agricultural and plantation enterprises as indicated in Figure 7: land for beef cattle production was the largest area leased (461 573 ha) and there were 37 767 ha of forestry land leased under 91 contracts. The value of the leases on a per hectare basis varied (see Figure 8) with beef cattle land at the lowest rate (USD67/ha/y) and plantation land averaging at USD156/ha/y.

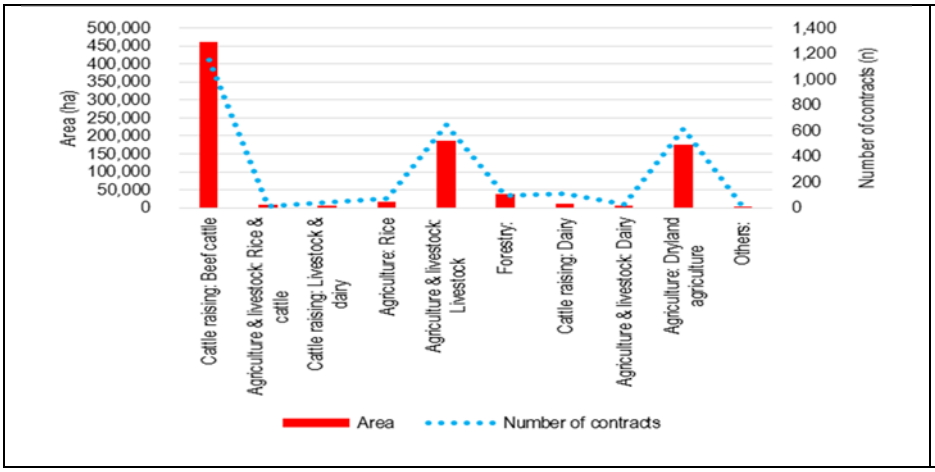

Figure 7: The number and area of land lease contracts formed in 2017 in Uruguay.[198]

[194] UPM (2016).
[195] Ferrari (2016: p.105).
[196] CAETS (2018).
[197] Based on data from MGAP (2019b: Table 9).
[198] Based on data from MGAP (2019b: Table 9).

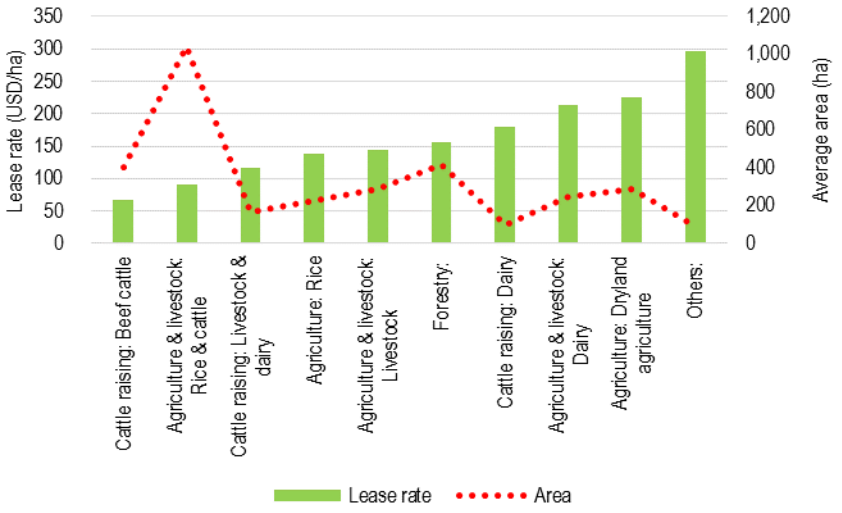

Figure 8: The average area leased and value of the land lease contracts formed in 2017 in Uruguay.[199]

The plantation estate

Development of the estate

The plantation estate of Uruguay developed in four broad phases:

- Phase 1: Prior to the 1990, a range of plantations, woodlots and shelter belts were established on farms for on-farm use. The oil shock in the 1970s and associated energy crisis resulted in an expansion of planting for fuelwood. Deregulation of the economy in the 1970s included floating the currency. Agriculture was impacted by a 1973 EC ban on beef imports from Uruguay and a wool price crash in 1987. The country was in recession in 1981. The First Forest Law was enacted and targeted assistance of farmers, by taxation measures and provision of loans.
- Phase 2: 1990-2001: The Second Forest Law was enacted. Plantation development by investors and start-up forestry multinationals were driven by fiscal incentives.[200] The Law included a forest right mechanism, a broadening of the loans based to non-farmers.
- Phase 3: 2002 to 2005: Plantation development reduced driven by the economic crisis, a lack of processing development and a reduction and removal of fiscal incentive.[201] A consolidation of the sector occurred with mergers and active sales and a change in the Second Forest Law restrictions on soils available for planting.[202]
- Phase 4: 2005 to 2018: The Second Forest Law was repealed and a requirement to submit an EIS is implemented for all plantations greater than 100 ha in size. The taxation treatment of less than 15 year rotation plantation was removed and replaced by an income tax regime for post 2006 establishment. Favourable taxation treatment was maintained for long- rotation for sawlog plantations. Post-land and forest sales and mergers, there was 862 364 ha of plantations in 2018, with 35% managed by Forestal Oriental (UPM) and Montes del Plata (Stora Enso & Arauco). During this period, lease arrangements developed (e.g. 18 000 ha on a 30 years lease between FOSA and Caja de

[199] Based on data from MGAP (2019b: Table 9).
[200] Pou (2011: sec. 1.2).
[201] Pou (2011: sec. 1.2).
[202] Pou (2011: sec. 1.2).

Jubilaciones y Pensiones de Profesionales Universitarios and 25 000 ha of land was purchased by FO, Cerro Largo in north east Uruguay).[203]

The Second Forest Law and incentive were amended in 2005 but by then it had created a critical mass of plantation and attracted world class industry: the incentive regime initiated the expansion of plantations, and industry and good plantation economics were the main drivers for consolidation.[204]

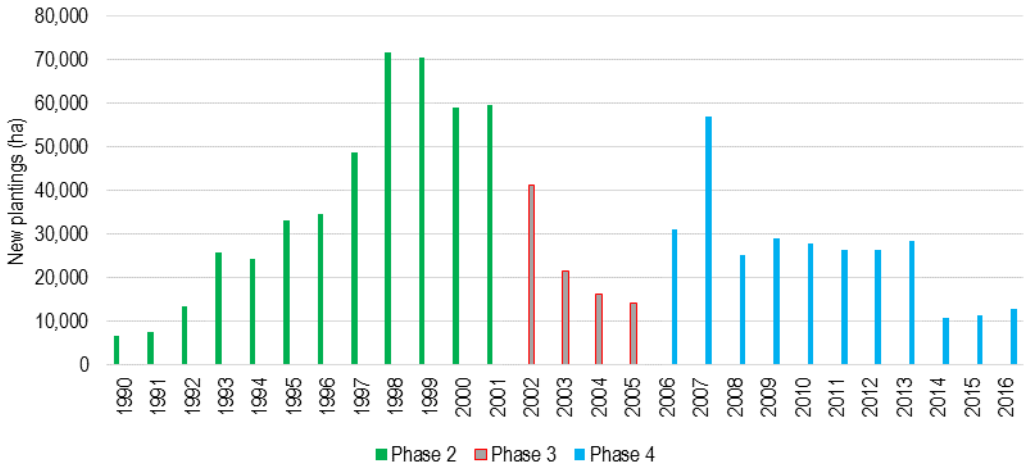

Figure 9: Annual establishment of new plantations in Uruguay.[205]

Area and species planted

Information on the history of the plantation estate pre-1990 was collated from a range of sources. The 1946 agricultural census indicated that there were 66 738 ha of non-indigenous plantation species.[206] By 1973 it was reported that there were 111 123 ha of plantations. The main species planted in 1973 were *E. globulus* (49.5%: 55 000 ha), *E. camaldulensis* / *E. tereticornis* (35.1%: 39 000ha) and *E. saligna* / *E. grandis* (9.0%: 10 000 ha). In the same year the estate produced 1 004 700 m^3 of wood products: fuelwood (81.6%: 820 000 m^3); sawnwood (7.9%: 79 000 m^3); pulpwood (7.0%: 70 000 m^3); posts (2.5%: 25 000 m^3); other products (1.1%: 10 700 m^3).[207] The plantations had been established in three regions: the pampas grasslands; Mesopotamia; the northwest. The main planted species are: *E. camaldulensis* - 28 000 to 33 000 ha (MAIs of 20 to 25 m^3/ha/y); c.15 000 ha of *E. tereticornis* plantations; *E. grandis* / E. saligna - 40 000 to 50 000 ha (MAIs of 25 to 50 m^3/ha/y); *E. globulus* - 2000 ha plus numerous private woodlots. *E. grandis* / *E. saligna* logs were processed into pulp, sawn timber and manufactured into fruit boxes.[208] In 1973, 15% of the estate was listed as line plantings compared to blocks of trees [209] and that *E. globulus* was planted in small woodlots used mainly as cattle shelter.[210] Close examination of the map presented in

[203] Pou (2011: sec. 3).
[204] de Fégely et al (2011: p.79).
[205] CAETS (2018).
[206] Delegation of Uruguay (1948: p.1).
[207] Jacobs (1979: p. 139).
[208] Jacobs (1979: p. 55&56).
[209] Jacobs (1979: p. 139).
[210] Martino & del Castillo (2006: p.16).

Figure 10 suggests a plethora of small plantings across the entire country. The historic species planted (*E. camaldulensis* / *E. tereticornis*) supports the significance of fuelwood at that time (81.6% of the harvest in 1973).[211]

The expansion of the plantation estate from 1990 (under the influence of the Second Forest Law) was 549 1530 ha of afforestation and post the amendments to the Second Forest Law in 2005, a further 286 780 ha of afforestation occurred. By 2018 the estate was 835 348 ha: 68.6% eucalypts; 21.3% Pinus species; 9.0% shelter belts and windbreaks; 1.1% mixed species, *Salix* spp and *Poplus* spp. The plantation estate is segmented into four major forestry regions (see Figure 10), each with different features regarding species, silvicultural management and development of associated industrial facilities:[212]

- *The west region:* This region was the first to develop, initially to produce saw-logs and pulpwood. The main species were *E. grandis*, *E. maidenii* and *Pinus sp*. Development of two large pulpmills resulted in a change of focus to pulpwood production, although potential for solid wood remained.
- *The North region:* This region has the largest area of plantations with the highest forest productivity. Most plantations target saw logs and veneer logs. Two large sawmills and two plywood mills operate in this area.
- *The Centre-East region:* This region has similar species and silviculture to the west region but with lower productivity.
- *The South-East region:* This region is dominated by short rotation *E. globulus* plantations for export pulpwood either as pulp logs or as chips produced in Montevideo.

The majority of the current plantations are planted with eucalypts for both pulpwood and solidwood production (including pruning and thinning, with 20 year rotations).[213] The species planted have varied with experience. For pulpwood production the initial species planted were *E. grandis* and *E. globulus*, and now *E. dunnii* is the dominant species. Species have changed for second rotations based on site-species matching experience, the use of clones and seeking to improve wood consumption rates (m^3/air dry tonne of pulp).[214] Solid-wood regimes focus on *E. grandis* and commenced with a focus on clear wood production which has since evolved to consider both pulp and solid wood production. Harvesting systems and management regimes have been developed for the first rotation and there is a shift into second rotation sites.[215] A 2011 report stated that domestic and foreign companies are now established and are managing significant areas of plantations for clear-wood production in the north.[216]

The Forest Laws and species planted

The species eligible for incentives were defined by the Second Forest Law and were limited to: hardwoods - *E. globulus; E. grandis; E. saligna; Populus deltoids;* hybrid 65/31; Salix hybrids 131-25 and 131-27 and softwoods - *Pinus pinaster; P. elliottii;* P. *taeda*).[217] Figure 10 presents a current map of the estate and the current plantation species mixture is presented in Figure 11 and Figure 12. An important point is the area of 'shade and shelter belts' identified in Figure 12.

[211] Jacobs (1979: p. 139).
[212] Martino & del Castillo (2006: p.12).
[213] Pou (2011: sec. 1.2).
[214] CAETS (2018).
[215] CAETS (2018).
[216] de Fégely et al (2011: p.80).
[217] de Fégely et al (2011: p.78).

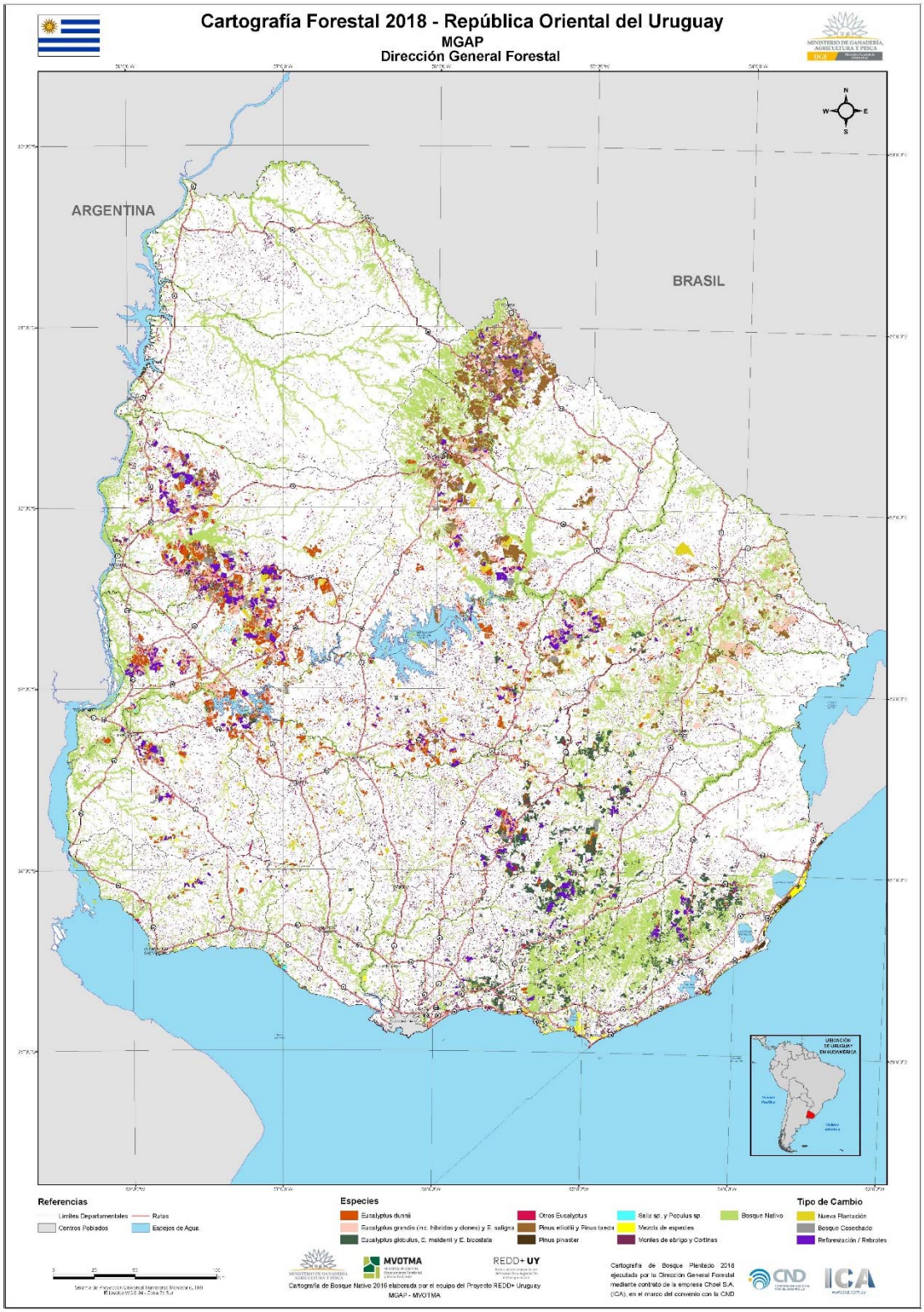

Figure 10: The plantation estate of Uruguay in 2018 and the natural forest cover in 2016.[218]

[218] MGAP (2018).

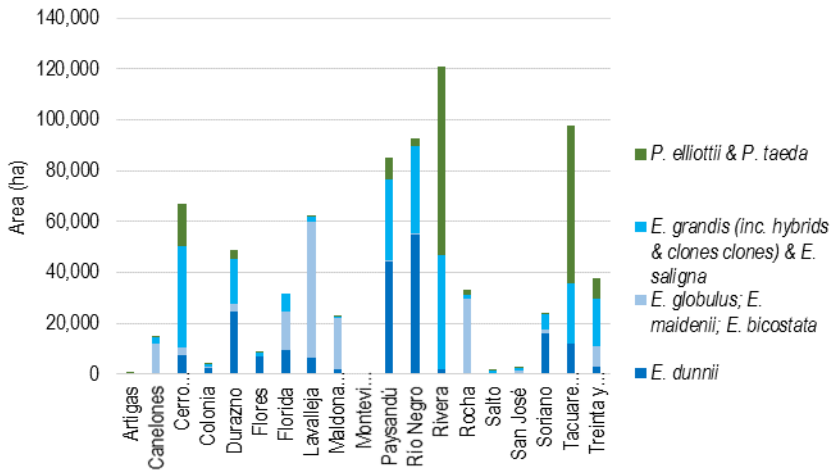

Figure 11: The area of plantation by Region for 2018 for the main plantation species.[219]

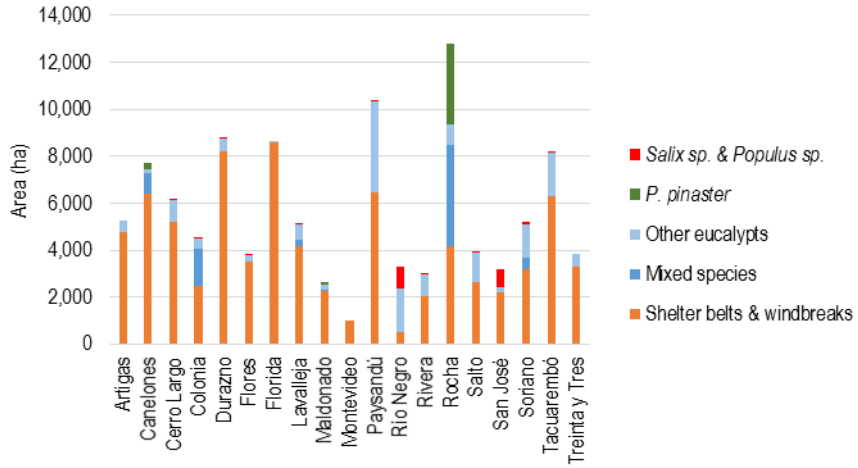

Figure 12: The area of plantation by Region for 2018 for the minor plantation species.[220]

Production and processing

Roundwood production

The majority of the log outputs are eucalypts (Figure 13) reflecting the plantation estate composition (see Figure 11). Uruguay commenced exporting *E. grandis* woodchips in 1988[221] and by 2000 it was producing 0.89 million m^3/y of pulpwood (logs and chip); 0.55 million m^3/y of sawlogs and plywood, and 1.99 million m^3/y of fuelwood. By 2018 Uruguay was producing 10.20 million m^3/y of pulpwood, 4.18 million m^3/y of sawlogs and veneer logs and 2.60 million m^3/y of fuelwood (Figure 14).

[219] MGAP (2019a).
[220] MGAP (2019a).
[221] Martino & del Castillo (2006: p.16).

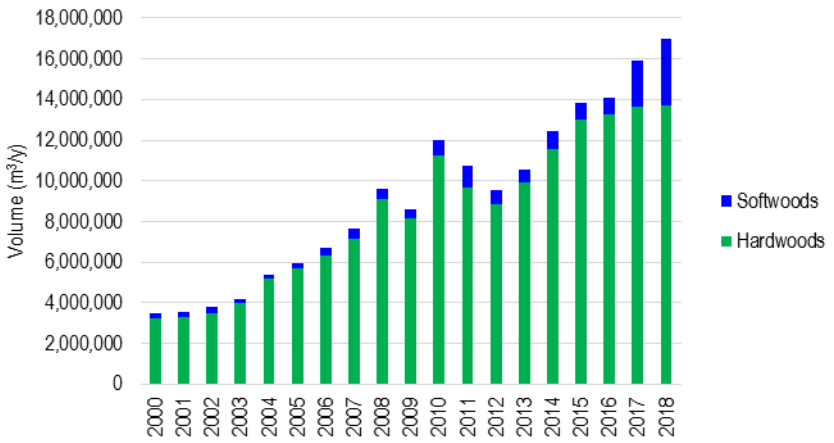

Figure 13: Roundwood production 2000 to 2018 segmented into softwood and hardwoods.[222]

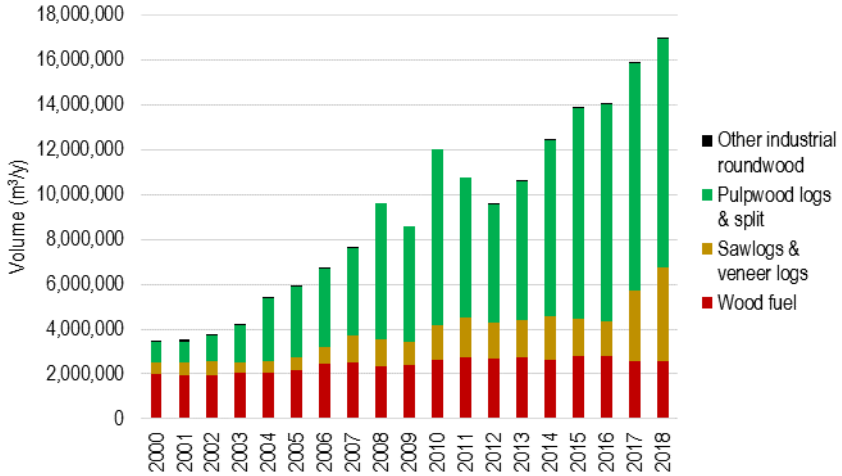

Figure 14: The outputs of Uruguay's plantation estate by product.[223]

Processing capacity

In 2011 it was observed that the *'forest industry in Uruguay, as with any developing industry, is experiencing problems with growth, infrastructure and government intervention. There are also some battles with neighbouring Argentina over processing development.'*[224] However, wood processing in Uruguay has a long history. Paper production commenced in Uruguay with the National Paper Factory (the project commenced in 1883) with eventual development of a plant in Puerto Sauce (Department of Colonia) in 1898. The installed capacity was 4 to 5 tons/day of paper employing 150 people.[225] During the 1980s, Uruguay imported 66 000 m³/y of sawn timber (30% of the total 220 000 m³/y required) and following recovery from the 1987 recession, sawn timber annual demand was increasing at c. 2.5 % in the late 1980s.[226] During that period, the country's sawmills were inefficient and small, many with a capacity of less than 30 m³/day.[227] Subsequent development of domestic processing capacity has been significant:[228]

- 1992: Urufor sawmill;
- 2004: Urupanel plywood and MDF mill 150 000 m³/y;

[222] MGAP (2019c).
[223] MGAP (2019c).
[224] de Fégely et al (2011: p.80).
[225] Ferrari (2016: p.36).
[226] Hudson & Meditz eds (1990c: Forestry).
[227] Hudson & Meditz eds (1990c: Forestry).
[228] CAETS (2018); Martino & Castillo (2016: p.18&19).

- 2006: Weyerhaeuser Plywood mill 150 000 m^3/y;
- 2007: UPM pulpmill opened their 1.2 million tonne/y Metsa Botnia (now UPM);
- 2009: Urufor sawmill expansion to 135 000 m^3/y;
- 2014: MDF pulpmill, Storaenso / Arauco pulpmill 1.4 million tonnes capacity;[229]
- 2016: Frutifor sawmill.

Other processing capacity developed includes:[230]

- *Pulpwood:* ENCE M'boplcua 800 000 m^3/y; Grupo Forestal (La Tablada) 800 000 m^3/y; ENCE (Penarol) 500 000 m^3/y (Stora / Arauco took over ENCE);[231]
- *Sawmills:* Fymnsa Sawmill 100 000 m^3/y; Caja Bancaria 45 000 m^3/y; Maserlit 100 000 m^3/y; Arazati 20 000 m^3/y
- *Treated timber plant*: Matra 15 000 m^3/y.

The increased processing capacity (pulpmills, sawmills, plymills and composite products manufacture) and a market for the plantation timbers has stimulated afforestation and reforestation.[232] This has shifted the focus of plantation establishment under the Second Forestry Law incentives to wood production for internal processing local mills.[233] For example, Stora / Arauco's Montes del Plata Mill in southwest Uruguay owns 190 000 ha of land and leases 56 500 ha for plantations.[234]

Plantation development and the community

Normalisation of trees into agriculture

It is recognised that there are differences between tree planting within farming systems and the development of large-scale industrial plantations. It was suggest that Uruguay does not have a history of plantation development[235], but there is a long history of trees planted within farming systems. In response to requirements for livestock shade and shelter, building materials requirements, agricultural materials and fuelwood, trees were established during the 20th century. The plantings occurred as woodlots (<0.5 ha reported in the 1970s[236] or 1 ha in area[237]), or as 2 to 4 rows of trees planted as windbreaks across the grasslands (Figure 10) which become an integral component of the landscape.[238] Data for 2018 suggested that nationally 9.0% of the area planted trees in Uruguay were as 'shelter belts and wind breaks' ranging between regions from 0.5% to 93% of the planted tree area (a mean of 23.4%). The area planted varied between regions from 503 ha to 8599 ha, with a mean of 4075 ha (see Figure 12). This is suggested to have been in response to a natural lack of trees in the landscape (recall the historic natural forest cover of Uruguay and in 2016 it was reported to be 3.5% of the landmass[239]). In more recent times there has been a focus on woodlot development rather than large projects[240] and that the plantation and processing industry via the Forest Products Society (SPF), has worked closely with the agricultural sector to define growth and synergies to develop both

[229] https://www.storaenso.com/en/about-stora-enso/stora-enso-locations/montes-del-plata-mill
[230] Martino & del Castillo (2006: p.17).
[231] de Fégely et al (2011: p.79).
[232] Pou (2011: sec. 1.2).
[233] de Fégely et al (2011: p.79).
[234] Downloaded from https://www.storaenso.com/en/about-stora-enso/stora-enso-locations/montes-del-plata-mill .
[235] Arrarte (2000).
[236] FAO (2007) cited in Pozo & Saumel (2018).
[237] Arrarte (2000).
[238] Arrarte (2000).
[239] Ferrari (2016: p.17).
[240] de Fégely et al (2011: p.78).

industries.[241] In other examples, plantation companies lease their plantations for grazing by local farmers forming silvopastoral systems.[242] A key point is that responsibility for the plantation sector sits with the Ministerio de Ganaderia, Agricultura y Pesca (the Ministry of Livestock, Agriculture and Fisheries) and annual reporting includes all sectors on a side by side basis (e.g. see the 2018 annual report[243]).

Collateral damage and plantation development

As the plantation estate matured and processing expanded, new challenges have evolved (e.g. concerns with monocultures, increasing environmental awareness, questioning the loss of biodiversity and pressure on water use).[244] The natural forests of Uruguay and they have a have high structural diversity, regeneration capacity, and species diversity. They harbor a distinctive species composition that is absent or rare in eucalypt plantations.[245] The use of exotic species has sparked controversy including consideration of the impacts on local landscapes (see Box 9). Current afforestation practices may reduce species richness and alter the composition of grassland vegetation in Uruguay.[246] Other issues include the impact on local ecosystems (e.g. whether plantations 'green deserts' or valuable habitats for indigenous flora and fauna?[247]), or whether eucalypts can be a useful tool for restoring degraded land.[248] The ongoing debate in regards monoculture plantations suggests a need for consideration of alternative approaches to achieve plantation productivity while conserving biodiversity.[249] Strategies include enhancement of species and structural diversity within plantations or establishment of mixed buffer strips containing natural species on the edge of plantations are potential measures to enhance biodiversity and foster the integration of plantations into the local landscape.[250] It is possible to develop plantation systems that realise the potential of plantations to enhance biodiversity[251], particularly where eucalypt plantations are replacing natural grasslands.[252]

Box 9: A statement of the impact of the change in the landscape due to plantation development.[253]
'The native rural inhabitant, with his or her roots in the gaucho culture of the pampas, has always appreciated being able to move freely across the territory, roaming on horseback with the sight of the distant horizon far ahead.'

There are a range of other concerns expressed in regards to the expansion of the plantation estate:[254]

- Social:
  - Loss of the traditional gaucho lifestyle.
  - Tree plantations are a permanent land-use change.
  - The development of the plantation estate has resulted in an increase in pests and dangerous wildlife.
  - Change in land-ownership.

[241] de Fégely et al (2011: p.79).
[242] Cubbage et at. (2012) cited in Pozo & Saumel (2018).
[243] MGAP (2019b).
[244] de Fégely et al (2011: p.80).
[245] Pozo & Säumel (2018: p.11).
[246] Six et al (2014) quoted in Pozo & Säumel (2018: Abstract).
[247] Bremer et al (2010) quoted in Pozo & Säumel (2018); Gautreau et al (2014) quoted in Pozo & Säumel (2018).
[248] Boulmane et al (2017) quoted in Pozo & Säumel (2018).
[249] Pozo & Säumel (2018: Abstract).
[250] Pozo & Säumel (2018: Abstract).
[251] Pozo & Säumel (2018: Abstract).
[252] MGAP (2016) quoted in Pozo & Säumel (2018).
[253] MGAP (2016) quoted in Pozo & Säumel (2018).
[254] Arrarte (2000).

  - Impacts on local roads by increased traffic.
  - Increased risk of fire and fire impacts.
- Financial:
  - Changes to rural livelihoods.
  - A lack of employment and where employment is offered, it is under harsh conditions
  - Land price have risen in the areas where plantations are developed.
  - Reduced to nil taxes paid to local municipal Governments by plantation companies.
- Environmental:
  - A reduction in biodiversity.
  - Changing from a prairie landscape and biodiversity, to plantation monocultures.
  - Increased water consumption by the planted trees compared to the original vegetation.
  - Depletion of the nutrients within soils and a lack of natural systems of replenishment.
- Aesthetics:
  - Visual pollution and changes to the landscape.

New Zealand experience: building on natural forest supply

Summary points and insights

The following documents an understanding of the history of plantation development in New Zealand and the insights relevant to the development of a package of actions and policy to stimulate afforestation.

- The 2017 plantation estate was 1.78 million ha (3.9% Government and 96.1% private) with 87.7% of the private owners each hold less than 40 ha of plantations, 6.1% owning 40 to 99 ha, 0.5% owning 500 to 999 ha, 0.8% owning 1000 to 9999 ha and 0.3% owning greater than 10 000 ha. The 2018 plantation log out-put was 30.6 million m^3 supplying a wide range of domestic processors and to exports.
- Observed trends in plantation expansion and deforestation in New Zealand have been stimulated by a complex set of factors.
    - Deregulation of the New Zealand economy in 1984 (a highly regulated economy to a market-led economy) and signing the Kyoto protocol were significant policy changes with direct effects on the plantation sector.
    - Economic shocks to the agricultural sector have stimulated farmers to seek alternatives to agricultural (e.g. afforestation) rather than considering afforestation as an option within their agricultural systems: deregulation resulted in c.1.5 million ha classed as marginal or uneconomic for agriculture.
    - The 1994 planting spike was enabled by depressed agricultural conditions.
    - The spotted owl impact on log supply in the Pacific Northwest resulted in log demand and a price spike.
    - The variable taxation treatment of plantation related expenses and incomes.
- The New Zealand agricultural land-base was mostly on converted natural forests, the 1840s to early 1900s view was of trees as an impediment to agricultural development.
    - It was recognized by the New Zealand Government that plantation establishment by farmers was required to meet national targets but agriculture had limited interest in large-scale plantings.
    - A divide between agriculture and forestry remained in the 1980s, institutionalized by a separation of tertiary education in agriculture and forestry and a farm adviser focus on livestock with limited knowledge nor interest in trees.
- The primary intent of New Zealand's forest policy until 1984 was setting of estate targets and rates of establishment to satisfy economic goals (based on inventory, demand projections and a coordinated approach) and price setting and market manipulation, in support of timber processing.
    - Secondary goals included social (e.g. employment) and environmental considerations (e.g. repair of eroded landscapes).
    - A key attribute of the development of the New Zealand plantation estate has been a narrow focus on Radiata pine creating a significant single species resource.
    - Policy measures have sought to limit adverse impacts (in some cases) by focusing plantation development on marginal agricultural land, capping plantation expenditure deductions (for farmers), and targeting areas by grants.
    - Government policy has evolved and adjusted over time from an initial very active role establishing the plantation estate through to a facilitation role and a now returning to active participation.

  - In general Government policy has been underpinned by Acts: of particular significance is the Resource Management Act 1991 setting the legislative framework for the sustainable use, development and protection of land, air and water resources. It is primarily implemented by Regional authorities via local plans containing policies, rules and performance standards associated with resource use.

- The New Zealand Government has used a range of incentive tools to stimulate plantation establishment, with the outcomes driven by the external framework within which the tools have been deployed. These have included Government as a direct investor in plantations and in processing capacity.
  - Government sawn-timber price controls were in place from 1918 to 1984 and discouraged plantation development.
  - Taxation treatments of plantation have stimulated and depressed plantation establishment: expensing of expenses against income in the same year increased establishment and holding expenses until harvest income generation has depressed new establishment.
  - The lumpy nature of plantation cashflows was addressed by income spreading: for farmers and foresters five years forward plus three years back for foresters.
  - Land-owner participation has been facilitated by direct investment and leases. Other parties can participate via limited partnerships, syndicates and joint-ventures. The One Billion Trees Programme includes lease and joint-venture projects on suitable land of 200 ha or larger (but not intending to plant whole farms).
  - A key element has been the availability of investment facilitators who organised plantation projects.
  - New Zealand has maintained direct financial assistance to tree growing since 1962.
  - Loans and grants were in some cases mutually exclusive to taxation mechanisms.
  - In 1962 the Government established a Forestry Encouragement Loans mechanism with limited up-take.
  - Government grant programmes have evolved from broad to specific focus (e.g. the Protection / Production Grants of 1980-1984 targeted environmental stabilization) or to meet climate needs.
  - A key attribute of the grants programmes has been the long-term duration of the offers and if one mechanism was terminated, it was replaced.
- The One Billion Trees Programme launched in 2018 is a multi-faceted policy tool in support of afforestation, including direct involvement by the Government.
  - The aim of the Programme is an additional 2.4 million ha afforested (19.8% of the current cleared non-plantation land) to result in 30.4% of cleared land planted to trees.
  - The One Billion Trees Programme aims to plant one billion trees from 2018 to 2028 and includes motivated parties (e.g. Crown Forests) to drive and facilitate afforestation.
  - The Programme is a portfolio of initiatives providing broad access to support and the ability to seek a range of tree outcomes: in less than 12 months, 61 million trees have been planted or are committed for planting.
- The New Zealand's Emissions Trading Scheme segmented the plantation estate into Kyoto compliant pre-1990 and post-1989 trees with different treatments and requirements. It is expected that going forward, carbon revenues will be a significant contributor to afforestation.

Introduction

The Treaty of Waitangi was signed in 1840 between the Mâori chiefs and the British Crown recording the consent of the Mâori to New Zealand becoming a British colony.[255] This is a fundamental point in regards to land-tenure and land-use in New Zealand. Commercial (pitsaw) utilisation of New Zealand's natural forests commenced in 1818 including a shipment of sawn timbers to Port Jackson (New South Wales).[256] The demand for exports continued, combined with increasing domestic demand.[257] *'From 1840 and the foundation of the colony there was a sudden dramatic rise in population which resulted in an enormously increased demand for timber. Between 1841 and 1843 the European population of New Zealand expanded from around 5,000 to 11 488. Auckland after its establishment as capital in September 1840 and Wellington became large timber consumers needing quantities of building materials to accommodate their rapidly increasing populations.'* [258] At this time natural forests covered c. 53% of the land area and Europeans regarded forests as an obstacle to agriculture and an inexhaustible source of timber.

Promotion of European settlement and rapid economic development remained a priority.[259] By 1870, depletion of the natural forests led to acknowledgement by some politicians, that in the future, demands for timber resources would require supplementation by imported timber or from plantations. The first forestry legislation passed in 1874 attempted to limit deforestation, but it did not address the prevailing view that forests impeded agriculture. Again in 1885 legislation set aside state forests, established a school of forestry, and appointed forestry staff, but did not endure.[260] The State Forests Act of 1885 allowed revenue from natural forest harvest to be placed in a dedicated "State Forests Account" to fund plantation development and offered subsidies to local government for establishing plantations. However, the brief interest in forestry did not endure and the State Forest Department was dismantled in 1887.[261] The natural forest timber industry reached a production peak in 1907 and declined as kauri (*Agathis australis*) forests were logged to near extinction.[262] A 1913 Royal Commission on Forestry recognized the limitations of the natural forest to meet New Zealand's future timber requirements, the fragmentation of forestry administration and a lack of interest in plantation development. It was noted that indigenous species and Larch (the most commonly planted exotic species at that time) were unsuitable, and that Radiata pine *(Pinus radiata)* was being raised in quite insufficient numbers. The strong performance of pine species was evident.[263]

The history of the New Zealand plantation estate is tied to development and agriculture. By 1920, c.11.9 million ha of agricultural land had been cleared, retaining the 6.3 million ha of natural forests (23 % the land area).[264] The area of land occupied by agriculture and plantations decreased from 15.5 million ha to 13.9 million ha between 2002 and 2016 (Figure 15). The plantation estate (1.78 million ha) was the third largest land-use after sheep and beef and dairying occupying (Figure 16). Returns from agriculture have varied over time and as an example, Figure 17 presents the farm-gate price for milk supplied by dairy farmers. Land-use has oscillated between different agricultural enterprises within agriculture and with plantation development. The current New Zealand plantation estate produced 30.6 million m^3 of logs in 2018 (an estate average

[255] Rhodes & Novis (2004).
[256] Fleet (1984: p.37).
[257] Fleet (1984: p.60).
[258] Fleet (1984: p.60).
[259] Rhodes & Novis (2004).
[260] Rhodes & Novis (2004).
[261] Rhodes & Novis (2004).
[262] Rhodes & Novis (2004).
[263] Rhodes & Novis (2004).
[264] Rhodes & Novis (2004) quoting the Ministry for the Environment, 1997.

production rate of 17.9 m³/ha). The plantation estate is dominated by Radiata pine (90% by area) with Douglas fir (*Pseudotsuga menziesii*) the next most dominant species (6.1% by area) (see Figure 18).

This section of the report reviews the New Zealand experience with the development of the country's plantation estate. The analysis considers the economic shocks and changes to the economy, the Government of New Zealand's policy and planning in support of plantation development, the development of the plantation estate, the role of agriculture, commercial tree growing arrangements and Government support and mechanisms. A detailed analysis is presented of the cause of the patterns of afforestation and deforestation from the early 1980s to better understand the mechanisms, interactions and results.

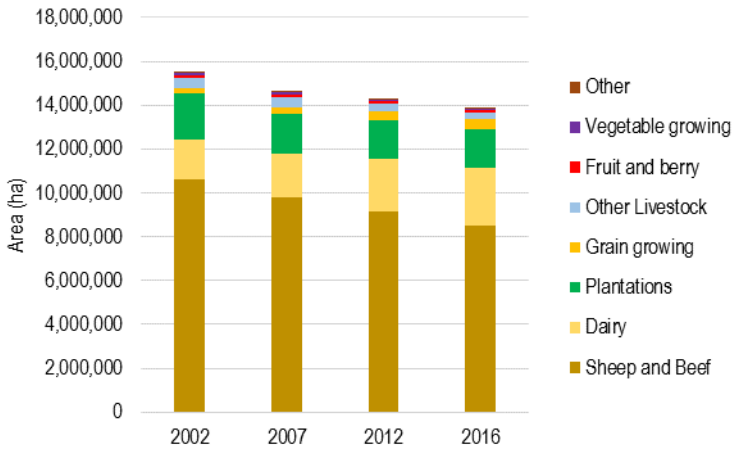

Figure 15: A breakdown of New Zealand's land-use (ha) by enterprise from 2002 to 2016.[265]

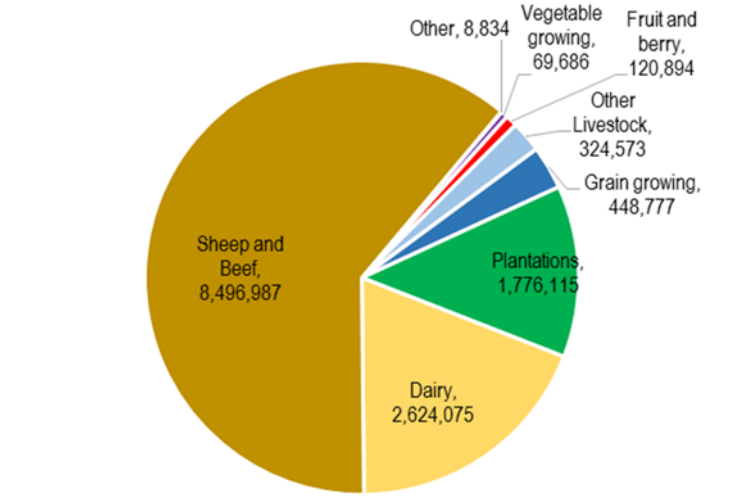

Figure 16: A breakdown of New Zealand's land-use (ha) by enterprise in 2016.[266]

[265] Data taken New Zealand's Environmental reporting Series: Environmental Indicators. http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Land/land-use.aspx s/.

[266] Data taken New Zealand's Environmental reporting Series: Environmental Indicators. http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Land/land-use.aspx s/

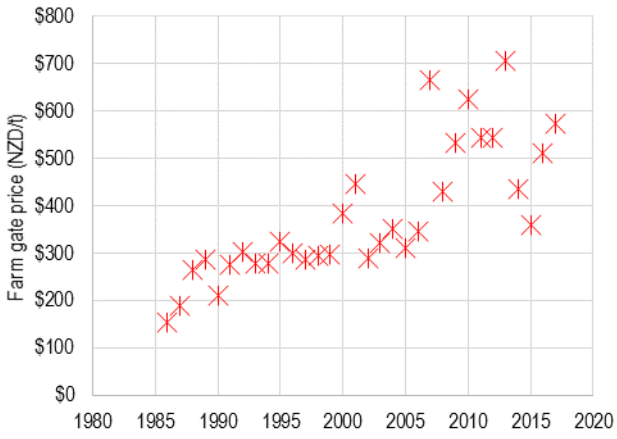

Figure 17: Data on New Zealand farm gate milk price.[267]

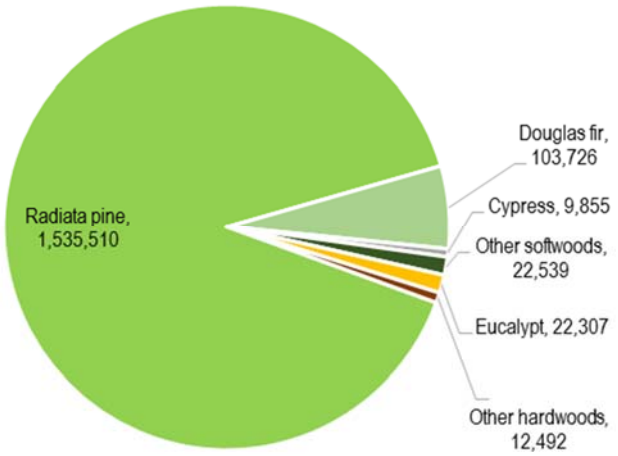

Figure 18: A breakdown of the 2017 New Zealand plantation estate area (ha) by species.[268]

Deregulation of the New Zealand economy

In 1984, a newly elected government was confronted with low economic growth, high inflation and an uncompetitive export sector and in response implemented a policy of deregulation.[269] In the next few months, and in the following years (to 1999), the newly elected and the replacement Government in 1990 '*introduced a series of economic liberalisation measures that showed a degree of comprehensiveness, theoretical purity and speed of introduction possibly unparalleled elsewhere in the world'* (see Box 10).[270] Changes included the floating of the exchange rate; extensive liberalisation of financial, capital and other markets; lowering of trade protection; fiscal restraint and monetary deflation ; changes to the machinery of government; corporatization and then sale of some Government assets; broadening of the tax base; and changes to industrial relations frameworks including a radical liberalisation of the labour market.[271] An initial 20% devaluation of the New Zealand dollar was

[267] Data sourced from http://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/ on the 03/05/2019.
[268] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017; Tables 13 to 18. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/.
[269] Rhodes & Novis (2004: p.23).
[270] Goldfinch (2004: p.80).
[271] Goldfinch (2004: p.75)

followed on the 4th of March 1985 by a float of the New Zealand dollar.[272] The New Zealand economy was in recessions in 1991 and 1998.[273]

Box 10: A summary of the key steps taken during the deregulation of the New Zealand economy from 1984 to 1999.[274]
1. The New Zealand dollar was floated, and capital and financial markets were deregulated within the first few months and over the following years and became amongst the freest in the world. 2. Fiscal policy was largely aimed at reducing the fiscal deficit with a commitment to fiscal disinflation with cuts to the fiscal deficit made during the severe recession of 1991. A broadening of the tax base introduced of a Goods and Services tax and lowering of marginal income and company taxes. 3. Monetary policy was aimed at deflation, with the independence of the Reserve Bank and a focus of monetary policy on inflation confirmed in the Reserve Bank Act 1989. 4. There was labour market deregulation. 5. New Zealand undertook an extensive programme of microeconomic reforms to increase efficiency in the economy, introducing a wide range of deregulatory measures and making large cuts to trade protection. Subsidies to agriculture and export incentives were removed: agricultural industries became amongst the least protected in the world, and possibly the least protected. Controls on foreign investment were considerably relaxed. 6. The New Zealand Government corporatized and then sold a number of government assets. The privatisation programme was the largest in the OECD in terms of revenue raised as percentage of GDP. 7. Significant cuts were made to some welfare benefits in the 1991 budget. 8. The public sector was comprehensively restructured alone new public management lines.

A national approach to forestry development

Surveys, inventory and national planning

The first national forest inventory (1921 and 1923) identified 5.0 million ha classified as forest land, of which 45% was merchantable and the Forest Service in 1925 estimated the total economically available natural forest softwood at c. 60 million m^3.[275] Based on population trends and expansion of industry (particularly agriculture), it was estimated that national sawn-timber demand would exhaust natural forest softwood supplies by 1970.[276] The New Zealand Government considered large-scale plantations as the only solution, and from 1925 onwards plantation development became a core forest policy: Government plantation establishment and incentives to encourage private companies, local authorities and private individuals to plant.[277] Government analysis suggested that c. 238 000 ha of Radiata pine planted over a 34-year period would be required to supply expected demand, assuming nil remaining natural forest resources. A plantation strategy was announced recommending that the 5200 ha of Government plantations (in 1925) be increased to 120 000 ha by 1935 to meet New Zealand's timber needs from 1965 onwards.[278] A key point was that previous plantation experience provided a basis that allowed planting on this scale to be contemplated.[279] New Zealand's plantation estate is segmented into public and private ownership (see Figure 19).

[272] Rhodes & Novis (2004: p.23).
[273] Goldfinch (2004: p.81&90).
[274] Goldfinch (2004: p.80&82).
[275] Rhodes & Novis (2004: p.10).
[276] Rhodes & Novis (2004: p.10).
[277] Rhodes & Novis (2004: p.10&11).
[278] Rhodes & Novis (2004: p.11).
[279] Rhodes & Novis (2004: p.11).

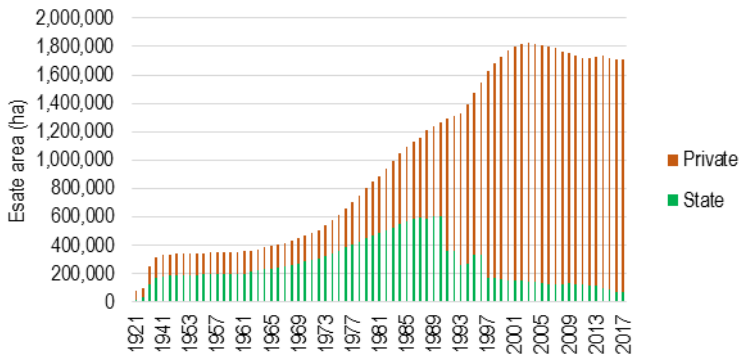

Figure 19: The scale and ownership of the New Zealand plantation estate over time.[280]

A national natural forest survey from 1946 to 1955 indicated that 0.8 million ha of the c. 5.8 million ha of natural forest were considered suitable for timber utilization and that timber supplies could only be sustained a few more decades. The Government consequently accepted that sales of timber from natural forests should be reduced. An analysis reported in 1959 of New Zealand's future wood demand predicted a deficit of 5.4 million m^3 in the year 2000. Around the same period as the analysis was undertaken, log exports to Japan increased significantly with prices well in excess of what was available in the domestic market. In response in 1960 the proposed plantation establishment rate was to treble and the Government approved a new target of 400 000 ha by the year 2000 with a focus on creating a major export industry. It was recognized that Government plantation establishment could only contribute to part of the target and that the farming community would need to contribute equally. Hence there was a requirement to secure the support of agriculture which was in general, wary of any further plantation expansion. The situation was that the Government could not purchase sufficient land and the interest by farmers' was limited. Exemption of plantation assets from estate duty in 1960 had little effect. At the same time financial institutions were reluctant to provide debt to forestry enterprises based on a lack of understanding of plantation investments. More direct incentives were considered necessary, and were implemented.[281]

A Forestry Development Conference was convened by the Government in 1969 to assess forest resources and associated industries, and to make recommendations for their expansion. It established a common commitment to and belief in forestry as a long-term contributor to the economy, and created a sense of partnership between the Government and the private sector, both large and small. Subsequent conferences were held in 1974/75 (addressing land-use policy, regional development, natural forest policy, forest legislation, forest industry, afforestation, short-term wood supply and recreational use of forests) and 1981 (addressing management practices, utilization, transport, landscape, social and environmental matters). In the year 2000, a Wood Processing Strategy had a broad goal to formulate and implement strategies targeting identified development barriers to boost investment in New Zealand's value-added wood processing.

The Resource Management Act (1991)

The enactment of the Resource Management Act 1991 (replacing the Town and Country Planning Act - 1977 and a range of resource management legislation) set the legislative framework for the sustainable use, development and protection of land, air and water resources. It provided for management of land, subdivisions, water, soil resources, the coast, and air and pollution control. The Act is primarily implemented by Regional Government authorities (rather than the National Government)

[280] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/.
[281] Rhodes & Novis (2004: p.23).

via local plans containing policies, rules and performance standards associated with resource use. The outcome was varying implementation, resulting in considerable criticisms from the forest industry and other resource managers. For example, plantations were subject to inconsistent forms of control, including consent requirements, resulting in a high cost and lengthy time incurred in seeking consents, particularly for wood-processing initiatives.[282]

Government objectives: plantations as a social tool

The Great Depression

At the time of commencement of the Great Depression in 1929, the New Zealand timber industry was already in recession. Pressure increased (1928 to 1934) as sawn timber prices fell due to natural forest oversupply and competition from imports (despite increasing import duties on timber) and regardless of the Government withholding sawn timber supply in support of private industry. During the Great Depression Government plantation establishment was enhanced by subsidized work relief programmes with a plantation development target of 120 000 ha by 1935 which was exceeded by 25% in 1934. The government also provided a subsidy for construction of houses equivalent to 33.3 % of wages, up to a maximum of the total construction cost, to provide a market for sawn timber.[283]

Labour

The early Government planting programs were limited by labour constraints, hence tree-planting prisons were established and prisoner labour was used until 1920.[284] A 2019 pilot programme of release to work for prisoner training and working in the forestry sector is part of New Zealand's One Billion Trees Programme (jointly developed by Te Uru Rākau and the Department of Corrections) will involve up to 15 prisoners from the Northland Regional Corrections Facility employed to plant seedlings in the 2019 season.[285]

The plantation estate

The development of the plantation estate

The Government intent was to develop a supply of wood resources. Figure 20 presents a summary of the history of the New Zealand plantation estate development segmented into eight phases and Box 11 presents an overview of each phase. Based on the data presented in Figure 19, Figure 21 was prepared indicating the contribution of private and Government development of the plantation estate. The New Zealand Government's 1988 budget (following deregulation in 1984) included corporatizing and privatizing (selling) its commercial plantation assets (maintaining the small area of natural forests). The plantation assets were intended to be sold (by open tender) in 90 units ranging from 51 to 132 112 ha in area, but some units were withheld from sale as a result of contractual, environmental and other concerns. Each unit was assigned tradable property rights (Crown Forestry Licences) containing individual terms and conditions of sale. Only the tree assets were sold, not the land upon which they stood. The plantations where sold in three tranches: 1990; 1992; 1996.[286] The divestment is evident in the estate

[282] Rhodes & Novis (2004: p.29).
[283] Rhodes and Novis (2004).
[284] Rhodes and Novis (2004).
[285] Friday Offcuts – 22 March 2019: Joint planting pilot launched in Northland
[286] Roche (2008: p.7).

ownership data and the change in estate area presented in Figure 21: 1991 (246 000 ha); 1993 (94 000 ha); 1997 (161 000 ha). The outcome was that the Government owned less than 7% of the national plantation estate. Subsequent settlements of claims under the Treaty of Waitangi have seen forest land, and some of the remaining forests and land, pass to Māori ownership.[287] Subsequent to a shift from public plantation development and ownership, to private corporate ownership and expansion, the majority of afforestation included small woodlots and plantations by private landowners and partnerships (to be defined in later sections).[288] The 2017 ownership of the plantation estate was 3.9% Government with 66 000 ha and 96.1% private with 1.64 million ha.

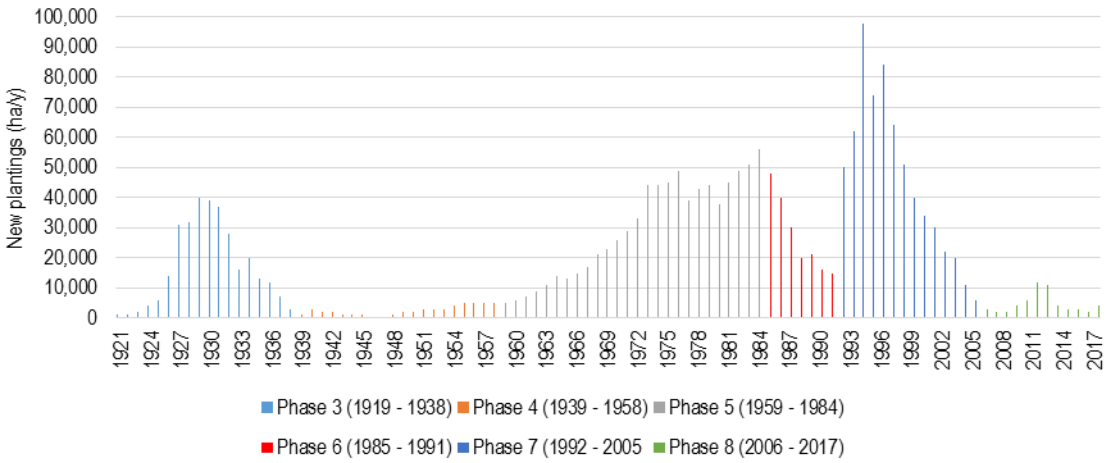

Figure 20: Data on the year to year change in plantation estate area in New Zealand.[289]

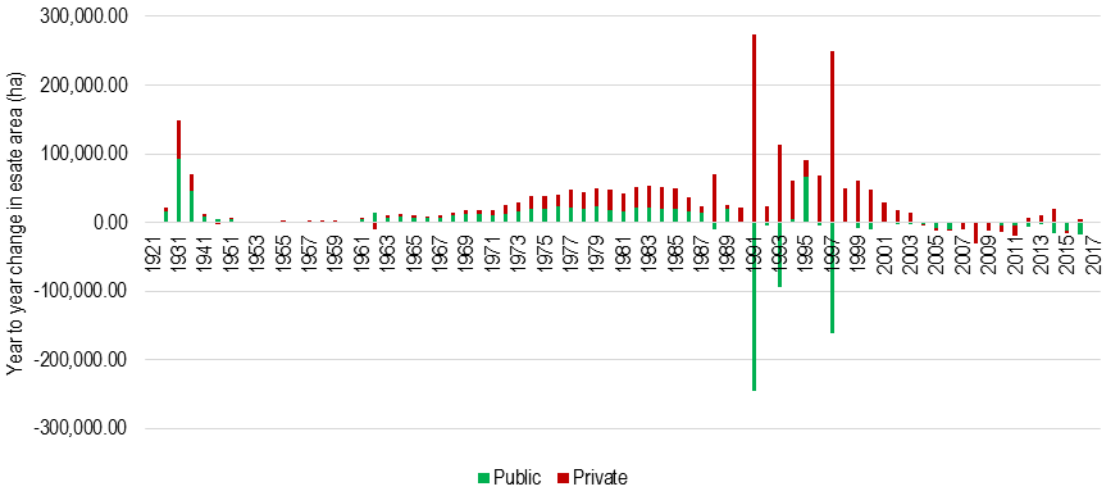

Figure 21: Plantation development in New Zealand over time by ownership: the Government divestments is shown.[290]

[287] Rhodes and Novis (2004).
[288] Rhodes & Novis (2004: p.23).
[289] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/
[290] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/.

Box 11: A snapshot of the details of the eight phases of development of New Zealand's plantation estate.

Phase 1: The period before 1870 focussed on economic development, natural forest harvest and development of agriculture.

Phase 2: In the period from 1870 to 1918 natural forest conversion to agriculture is almost complete. The Government seeks timber supply security by plantation development.

Phase 3: In the period from 1919 to 1938 the Government commenced the process of national resource inventory and national plantation development plans to match supply with demand. Plantation establishment is driven by the Great Depression.

Phase 4: The period from1939 to 1958 saw further national inventory and adjustments to the national plantation development plans. Taxation treatment of plantation development allowed immediate deductions and income spreading mechanisms for farmers in 1949. Timber price controls were considered by the Forest Service and private industry as a significant disincentive to plantation development extending into the 1940s and 1950s. Development of processing capacity commences.

Phase 5: During the period from 1959 to 1984 the national plantation development plan aimed at 400 000 ha by the year 2000. Plantation investment companies commenced operation in the 1970s. In 1984 a 'complete' deregulation of the New Zealand economy. Taxation treatment of plantation development allowed immediate deductions and income spreading mechanisms. Various grant mechanisms introduced but with limited impact. Loan mechanisms had even less of an impact in stimulating afforestation.

Phase 6: The period from 1985 to 1991 progression in the deregulation of the New Zealand economy. New Zealand was in recession in 1991. There was variable taxation treatment of plantations and the intent of divestment of the Government plantations. Immediate plantation development expensing ceased in 1987 back to a 'cost of bush' treatment. In 1991 taxation treatment was back to immediate expensing against any income. The 1991 New Zealand Forest Accord ceased natural forest conversion to plantations.

Phase 7: The period from 1992 to 2005 saw preparation of a Wood Processing Strategy. The era was a period of plantation development driven by a depressed rural economy, restricted supply in the Pacific north west resulting in an export driven log price spikes and investors seeking an alternative to a depressed stock market. Both unimproved and improved pasture was afforested. Investment mechanisms were available for non-farmers and plantation managers were in place. Government divestment of the plantation assets was been completed in 1997. The economy is again in recession in 1998. The New Zealand Emissions Trading Scheme treatment of plantations announced in 2002.

Phase 8: The period from 2006 to 2017 was a period of deforestation with plantations converted to dairy farms either before or after harvest. The provisions of the New Zealand Emissions Trading Scheme, including an announcement of the differential treatment of plantations as pre-1990 and post 1989 at implementation in 2007 stimulate deforestation facilitated by the utilisation of international units. Use of international units ceased in 2014. The New Zealand Emissions Trading Scheme announced commences in 2008. New Zealand farm gate milk price recovery stimulates deforestation and conversion to dairy farms.

Ownership and the current plantation estate

The majority of the 1990s afforestation was undertaken by small-scale investors, rather than the Government or major forestry companies and the estate can be segmented by the size of the parcels of plantations in the different Regions (see Figure 22). Today 87.7% of the owners of the estate each hold less than 40 ha of plantations, with 6.1% owning 40 to 99 ha, 0.5% owning 500 to 999 ha, 0.8% owning 1000 to 9999 ha and 0.3% owning greater than 10 000 ha (see Figure 23). The coordination of a large number of small plantations owned by a range of owners will require careful management.

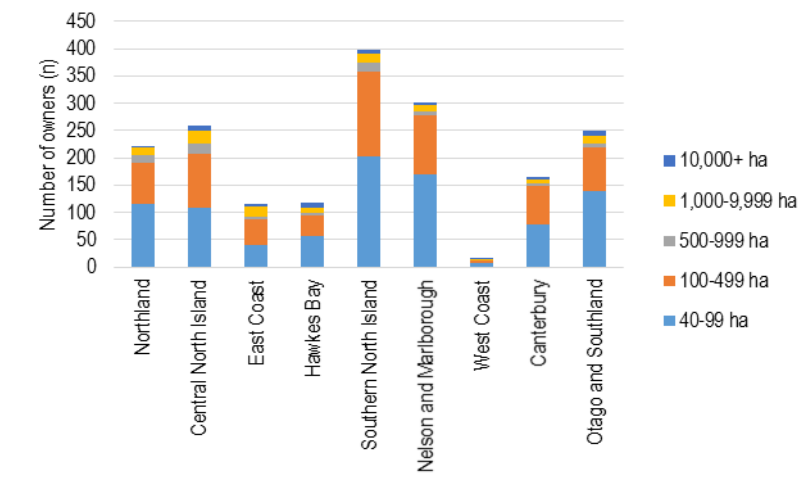

Figure 22: The structure of the New Zealand plantation estate by area held (> 40 ha) by Region.[291]

[291] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/.

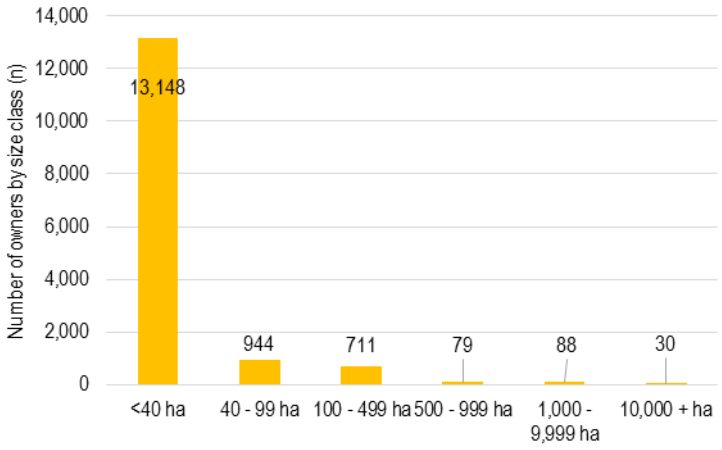

Figure 23: The structure of the New Zealand plantation estate by area held by individual plantation owners.[292]

Commencement, competition, conflict and fit with agriculture

Commencement of farmer planting in New Zealand

In 1858 a Planting of Trees Ordinance was passed by the Regional Government in the Canterbury region (a significant treeless area) of the South Island encouraging tree planting to develop on-farm wood resources on leased land.[293] In 1871 the Forest Trees Planting Encouragement Act 1871 was passed targeting the Canterbury Plains and the treeless Central Otago where resources were required for building materials, railway sleepers and firewood, and trees for shelter for stock and crops. For every acre of freehold land planted with suitable trees, farmers were entitled to a free land grant of two acres of 'wasteland'.[294] Tree planting on crown land was encouraged by reducing the rent paid by lessee who planted trees on their leaseholds. By 1877, 252 ha had been planted in Canterbury and in 1871, 526 ha had already been planted independent of the Act on private land. The provisions of the Act were not fully implemented, nor was it particularly popular with farmers. The first tree nurseries were established in 1896 by an afforestation branch within the Lands Department.[295] The supply of seedlings at cost-price by Government nurseries commenced in 1916 and was combined with extension to promote plantation establishment. This continued after the end of the First World War (1914-1918) with discharged soldiers eligible for grants of trees for farm purposes.[296] From 1921 to 1930, seedling sales from Government nurseries at cost price for private planting was a focus. It was reported that in 1927, 4.8 million seedlings were supplied to individual landowners and were mostly planted for shelter and on-farm uses, rather than for log production for sales. After 1930, the supply of at cost seedlings ceased due to unfair competition with commercial nurseries.[297] The farm forestry 'movement' of New Zealand commenced in the late 1950s with modest success in promoting small-scale plantations and a wider range of exotic species.[298] This was supported by Government but did not result in a great uptake by farmers. Courses in agroforestry were only introduced into the agricultural universities in the 1980s.[299]

[292] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/.
[293] Rhodes & Novis (2004: p.7).
[294] Rhodes & Novis (2004: p.7).
[295] Rhodes & Novis (2004: p.7).
[296] Rhodes & Novis (2004: p.9).
[297] Rhodes & Novis (2004: p.11).
[298] Rhodes & Novis (2004: p.18).
[299] Rhodes & Novis (2004: p.18).

Competition between agriculture and plantations

An afforestation branch within the Lands Department was established in 1896 to commence Government-organized plantation development by implementation of an annual planting programme. This was focused on land in the central North Island's volcanic plateau: the land was considered marginal for farming.[300] By the 1920s and 1930s afforestation was concentrated on land 'not suitable for agriculture' and, in a number of cases it was also poor for commercial forestry. In 1937 a cobalt deficiency was identified for the pumice soils allowing agriculture, but by that time, large-scale plantation development had severely restricted the development of agriculture. Addressing the micronutrient deficiency limited further expansion of the plantation estate.[301] In another case, private plantation development was limited in the 1940s and 1950s as meat and wool enterprises were very profitable. In the 1990s the opposite situation resulted due to deregulation of the New Zealand economy in 1984 and removal of subsidies and export incentives. At that time c.1.5 million ha was regarded as marginal (uneconomic) for agricultural production.[302] Box 12 presents the 2019 outlook for primary industries in New Zealand which is positive, hence the past afforestation enabled by depressed agriculture is unlikely.

Box 12: A snap-shot situation and outlook for primary Industries in New Zealand for 2019.[303]

- *Dairy:* New Zealand's dairy export revenue is forecast to rise 5.5 % to $17.6 billion for the year ending June 2019.
- *Meat and Wool:* Meat and Wool export revenues are forecast to increase to $10.1 billion for the year ending June 2019, up 6.0 % from last year.
- *Horticulture*: Horticulture revenue is forecast to rise 15.7 % for the year ending June 2019 to $6.2 billion driven by increases in kiwifruit, apple, and wine exports.
- *Arable:* Arable exports are expected to fall 3.2 % to $235 million for the year ending June 2019 as the impacts of the poor 2018 season are partially offset by an expected increase in export volumes from the 2019 harvest.
- *Other primary sector exports:* Export revenue from New Zealand's other primary sector exports and foods is expected to increase to $2.8 billion for 2019, up 3.5 % from 2018 due to small increases across most categories in this sector.
- *Forestry:* Forestry revenue is forecast to reach $6.8 billion for the year ending June 2019, an increase of 7.0 % from 2018, based on strong growth in log export volumes.

In the 1960s, the Government could not meet planting targets due to difficulties in purchasing land, and limited interest by farmers.[304] This created a need for the Forest Service to seek to win the support of the farming community who were wary of plantation expansions. Plantation establishment was actively promoted by the Forest Service in the 1970s (by devoting considerable resources) as a legitimate land-use in its own right, complementing agriculture supported by research of relative profitability and by providing technical advice.[305] This commenced competition by plantation developers with agriculture for more productive land. Increased plantation establishment rates in the 1970s resulted in a '*farming versus forestry versus the environment*' debate.[306] The arguments against plantation development included disruption of existing rural communities, that large-scale plantation forestry did not involve family ownership and land management, resulting in urban migration and reducing education, health, transport and other social services in rural areas. Farmers were concerned at becoming surrounded and isolated by plantations as they could not compete with company and Government purchase of land. Farmers who were able to sell were provided with an exit opportunity.[307] During the 1980s there was little interaction between forestry

[300] Rhodes & Novis (2004: p.9).
[301] Rhodes & Novis (2004: p.5).
[302] Rhodes & Novis (2004: p.33).
[303] Ministry for Primary Industries (2019: p.1).
[304] Rhodes & Novis (2004: p.17&18).
[305] Rhodes & Novis (2004: p.18).
[306] Rhodes & Novis (2004: p.18).
[307] Rhodes & Novis (2004: p.18).

and agricultural tertiary institutions, and farm advisers focused on livestock production techniques and had limited knowledge nor interest in promoting trees.[308]

The debate between agriculture and forestry included statutory planning issues under the Town and Country Planning Act (1977), polarizing parties. The Act listed the protection of *'land having actual or potential value for food production as a matter of national importance targeting control urban development on high-quality agricultural land*'.[309] This became a mechanism for local authorities to justify the control of plantation expansion. At that time plantation development was concentrated on conversion of natural forests and poorer quality farmland. The same restrictions were absent from agriculture and this remained throughout the 1980s.[310] These debates were a major disincentives and resulted in a poor public perception and constrained plantation development to some degree. In 1987 the Ministry of Forestry merged with the Ministry of Agriculture.[311] Initially Government forestry extension services were provided for free, but in 1987 the Ministry of Forestry (MoF) assumed this role (after deregulation in 1984) and introduced a 100% cost recovery system. By 1989 MoF ceased extension services as it was regarded as competing with private service providers. In the 1990s, MoF focused on raising the profile of plantations and facilitating investment by information brokerage producing a publications on plantations and investment opportunities.[312]

Impacts of a changing agricultural landscape due to deregulation

The deregulation of the New Zealand economy in 1984 eliminated subsidies for agriculture and changed the operating environment for afforestation.[313] Box 13 provides insights to the significant change and impacts that resulted from this policy shift. The result was a shift away from sheep and beef farming and the intensification of dairying, with real impacts for many rural communities.[314] There was a shift in rural employment: in 1986, 11% of the New Zealand workforce was employed in the primary sector which reduced to 7% by 2006.[315] Population decline resulted in some locations (particularly in remote areas) but gains in farming efficiency, stimulated by the Government's deregulation, resulted in increased incomes for farmers.[316] Linked to a reduction in farmland, major development of peri-urban areas and a "proliferation of lifestyle blocks" since the 1970s has also blurred the boundaries between rural and urban areas in many cases.[317]

Box 13: A snapshot of the impact of the Government's deregulation policy induced changes to farming communities.
'The removal of government subsidies for farming in the mid-1980s, including minimum prices, input subsidies, low-interest loans, and tax incentives, was influential in driving the initial move away from pastoral farming. Although some policies were introduced to assist farmers, the impact of the changes on commodity and land prices were damaging for some businesses and communities.'[318] *'While forced sales of farms and the exit of farmers out of the primary sector were smaller in number than anticipated, the social fabric of these rural communities changed as a result of the decrease in population, the shift in demographic profile and the subsequent downsizing of services in the rural areas. Government assistance in the form of debt restructuring, credit mediation, business planning, and transition funding, helped mitigate the impact. However, social pressures were immense with mental health issues coming to the fore for some, while many others drew on social assistance'*.[319]

[308] Rhodes & Novis (2004: p.18).
[309] Rhodes & Novis (2004: p.18).
[310] Rhodes & Novis (2004: p.18).
[311] Rhodes & Novis (2004: p.23).
[312] Rhodes & Novis (2004: p.30).
[313] Rhodes & Novis (2004: p.6).
[314] New Zealand Productivity Commission (2018: p.101).
[315] Callister & Didham (2010).
[316] Vitalis (2007: p.29).
[317] New Zealand Productivity Commission (2018: p.101).
[318] New Zealand Productivity Commission (2018: p.102&103).
[319] MPI (2017: p.6) cited in New Zealand Productivity Commission (2018: p.101&103).

Farmer motivations and aims

It is suggested that small-scale plantations are not simply a smaller version of industrial plantations: profit is suggested as the primary motive of industrial forestry, with environmental and social considerations acting as external constraints, whereas, small-scale forestry has multiple objectives bespoke to each small-scale grower, and in addition to external forces, there are internal forces associated with the beliefs, desires, personal circumstances and motivations of the small-scale growers.[320] While it is suggested that such a distinction applies in New Zealand, it is possible that a significant proportion of small to medium forest owners (SMFOs[321]) have a greater rather than lesser focus on short-term profit[322], because they are not constrained by strategic frameworks more associated with corporate operations.[323] A SMFO may have more flexibility to respond to current market conditions, without a requirement to report an ever-increasing asset valuation to shareholders.[324] The New Zealand Farm Forestry Association Inc. noted that: *'Several Branches have established a type of co-operative to help with sales and gain a higher stumpage. There was a strong feeling in this direction in the early years as many farm wood sales were made without adequate advice, and did not receive a good deal. Farm foresters are individuals, though, who tend to look for the best price for their wood as for their stock, and so often they were not loyal to these co-operatives. There is now a range of consultants and marketing companies, and some members can make an informed choice, with a good contract drawn up before selling logs.'*[325]

A wide range of studies have considered land-owner decision making and drivers for land-use change in New Zealand.[326] Past research has found that farmers are generally reluctant to afforest pasture and provide a variety of reasons for planting when it does take place. If the driver for afforestation by landowners is not purely economic, there is a need to understand what other factors are involved. A 1992 review[327] of nine New Zealand studies (published in 1974, 1983, 1984, 1986, 1988 and 1990) ranging from small-case studies to national random samples of land-owners indicated that direct financial benefit from timber ranked behind shelter, 'best land use', and aesthetic considerations. The author concluded that: [328] *'The literature tends to show that farmers in New Zealand plant trees for a variety of reasons including, in approximate order of priority, shelter, best land use, aesthetics and then for income. At the time of most of the research farming returns were better than they have been in recent times so that it is understandable that grazing returns were more important to farmers. This means that shelter was important because it was fairly quickly provided by trees and supported grazing activity.'* A 2008 study[329] based on 344 landholders in four regions of the South Island found that landowner's expectation of increasing log prices was one of the important determinant factors in landowners' planting decisions. The extent of land planted was related to forestry tax policy, expectations of increasing log prices, regional location of a property, owners' annual income and the area used in sheep and beef production.[330] A 2011 survey[331] of 188 landowners identified the main reasons for planting trees as economic return, value maintenance and conservation purposes with carbon sequestration as the least important consideration for tree

[320] Herbohn (2006: p.158).
[321] Wakelin et al (2014: p.1) small forest owners are owners with less than 40 ha and medium forest owners have 40 to 1000 ha of forests.
[322] Wakelin et al (2014: p.31 to 32).
[323] Wakelin et al (2014: p.31 to 32) noting as identified by Heine and West (2008).
[324] Wakelin et al (2014: p.31 to 32).
[325] Hosking (1999: p.5).
[326] Wakelin et al (2014: p.31 to 32).
[327] Fairweather (1992: p.5-12).
[328] Fairweather (1992: p. 12).
[329] Dhakal et al. (2008) cited in Wakelin et al (2014: p.31 to 32).
[330] Wakelin et al (2014: p.31 to 32).
[331] Bayne & Coker (2011) cited in Wakelin et al (2014: p.31 to 32).

planting.[332] A study[333] surveyed 728 land-owners (reported in 2013) from every region of New Zealand who owned 20 - 200 ha of forest as well as other unplanted land used for agriculture (the median farm size was 400 ha and the median forest plantation was 37 ha). The survey explored attributes of the forests, forest land-owner demographics, ownership objectives, silviculture and reservation prices for planting (the minimum payment a landowner must receive before converting land from agriculture to forest). The average once-off and annual payments (reservation price) to convert a hectare of land from agriculture to forestry were $3,554 and $360 respectively. The key factors were: whether or not the landowner lived on the property; if one of the ownership objectives was income from carbon; the primary agricultural enterprise and total household income. The survey indicated that their primary reason for owning plantations was income from timber (Figure 24). The survey did not consider 'shelter for livestock'.[334] A New Zealand study[335] of incentives noted that small-scale investors were motivated by a combination of factors listed in Table 9. This provides insights into the design of any arrangements to motivate participation and the alignment of interests between farmers and non-farmer investors. Overall New Zealand SMFO focus on financial returns is greater than for similar parties in Europe and North America: New Zealand plantations are introduced tree species, rather than harvesting of natural forest.[336]

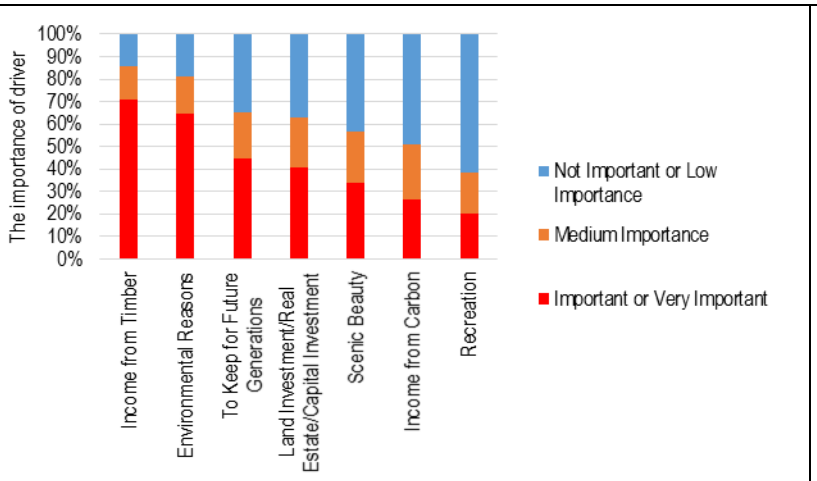

Figure 24: Importance of various reasons for owning plantations.[337]

Table 9: Motivations of small-scale parties to establish plantations.[338]

		Farmers' motivations:	Individual investors' motivations:
Monetary	Financial	Yes	Yes
	Diversification	Economic diversification	Diversification of their investment portfolios
	Taxation		Taxation advantages
	Superannuation		Yes
	Markets		A strong belief in the future market outlook for wood
Non-monetary	Personal interest	In trees and specialty timbers	In trees
	Environmental	Sustainable land use	
	Wood for own use	On-farm wood supply	
	Livestock shade & shelter	Shelter for livestock, crops and buildings	
	Aesthetics	Yes	

[332] Wakelin et al (2014: p.31 to 32).
[333] Rodenberg Ballweg (2013).
[334] Wakelin et al (2014: p.31 to 32).
[335] Rhodes & Novis (2004: Table 8).
[336] Wakelin et al (2014: p.31 to 32).
[337] Rodenberg (2013: table 20, p.75).
[338] Based on Rhodes & Novis (2004).

Commercial arrangements

Business arrangements

Direct investment in afforestation is an option and other options / business structures include: managed investment schemes (MIS), syndicates and joint-ventures.[339] Forestry investment via MIS was via a 'Limited Partnership' (see Box 14 and Box 15).

Box 14: A snap shot of the attributes of a Limited Partnership under the Limited Partnerships Act 2008.[340]

A limited partnership is a corporate structure with separate legal personality (similar to a company) which offers limited liability to investor partners. A limited partnership has full capacity to carry on or undertake any business or activity, do any act, or enter into any transaction, both within and outside New Zealand.

On the other hand a limited partnership has "pass-through" tax treatment in New Zealand, which means the tax consequences of the partnership's activities flow directly to the investor partners. There is no separate layer of corporate tax.

Limited partnerships are governed by the Limited Partnerships Act 2008 and must be registered with the New Zealand Companies Office. The name of a limited partnership must include the words "limited partnership" or the abbreviation "LP" or "L.P." at the end of the name. There are similar restrictions as for companies.

A limited partnership is formed on registration at the Companies Office and continues until it is deregistered.

A limited partnership must have at least one general partner and one limited partner. While they cannot be the same person, there is no restriction on them being related parties.

A general partner is responsible for the management and business of the partnership. Limited partners contribute capital to the partnership as investors but must not take part in the management of the business. While all partners' details must be registered, only details of the general partner will be made public thereby keeping the details of the underlying investors confidential.

A partner may transfer or assign their share in the partnership in the manner set out in the partnership agreement. The partnership agreement will generally provide for limited partners to leave the partnership by way of transfer, which may or may not be subject to pre-emptive rights. The partnership agreement may also deal with how partnership interests are valued on transfer. The general partner sometimes has a discretionary role in approving transfers.

Box 15: A licensing guide for MIS managers of forestry schemes.[341]

In general terms, an MIS pools money from investors who rely on the investment expertise of the scheme manager. The definition in the FMC Act (s 9) is broad, and will include most of the structures used in forestry schemes, including those that were participatory securities under the Securities Act 1978. A scheme is not an MIS if the investors principally produce the financial benefits or have day-to-day control of the operation of the scheme (ss9(1) (b) and (c) of the FMC Act). Ask the following questions to help decide whether you are an MIS:

- *What activities principally produce the financial benefits, and who performs them (s 9(1) (b)). For some forestry schemes, a forestry manager will exercise skill, and provide expertise and decision-making in managing the forest, while investors have an oversight role. In that situation, the forestry manager plays the principal role in producing the financial benefits. For other schemes, the investors manage the scheme and contract with different specialists for limited purposes.*
- *Who has day-to-day control (s 9(1) (c)). Investors may have this role or their input may be limited to more high-level control, leaving day-to-day control to a forestry manager. In some years, there will be little day-to-day activity by anyone, but in early years, and also as harvest approaches, there will be more activity. Identifying who exercises the day-to-day control will therefore involve looking at the forest's entire life.*

Small schemes are more likely than larger schemes to fall outside the statutory definition, as the investors are more likely to be actively involved in producing the financial benefits, and in day-to-day control. For efficiency reasons, larger schemes might need to devolve management responsibilities and day-to-day tasks, and they will generally be MISs.

MIS were attractive for urban investors (providing protection of limited liability, tax efficiency and a transferable asset[342]) but were not the focus of mass afforestation. An observation noted that they were well founded and resulted in very good returns

[339] *Pers. com.* Jeff Tombleson & Associates by email Wed 3/04/2019 8:47 AM
[340] Downloaded extracts from https://duncancotterill.com/publications/limited-partnerships-in-new-zealand
[341] Financial Markets Authority (2016).
[342] Information from https://www.forestenterprises.co.nz/our-investments/investment-structure/ downloaded on the 02/05/2019.

to investors driven by being 100% Radiata pine and almost all pruned (and not all initiated on tax concessions).[343] Examples of New Zealand MIS companies include:

- Roger Dickie New Zealand Ltd was established in 1971[344] and manages 89 plantations concentrated in the Hawkes Bay and Gisborne regions.[345] The Company promotes private investments (by an individual investor or a small consortium) and partnership investments in which partners own an undivided share of the forest and freehold land.[346]
- Forest Enterprises was established in 1972[347] and manages 60 plantation investments[348] located in the Wairarapa, Hawkes Bay and Gisborne regions.[349] The company uses Limited Partnership investment structures as registered MIS under the Financial Markets Conduct Act 2013.[350] At investment a party becomes a shareholder in a Limited Partnership owning a Radiata pine plantation.
- Greenplan offered its first prospectus in 1993[351] and all plantations are located in King Country[352]. Under a Greenplan investments each investment unit is equivalent to c.1ha of forest. Land is owned by an associated company (Greenplan Holdings) that grants partnerships a 40 year forestry right.[353]

Taxation as a lever: a roller-coaster ride

Taxation has been widely used by the New Zealand Government to stimulate afforestation (see Table 10 for a chronological summary).[354] The two main tools have been to allow the expensing of plantation development costs against revenues (income) at the time of costs occurrence (a stimulant) or requiring that the costs be held for deduction at the time of harvest revenues from that plantation referred to as a "cost of bush" (a depressant of afforestation). Other tools have included allowance of increased or accelerated depreciation, export based concessions and the use of income averaging over a number of years to allows for the 'lumpiness' of plantation revenue streams. A further attribute has been differential treatment of corporations, foresters, farmers and individuals. The impact of the different mechanisms depended on the circumstances. For example, deferred expensing against sales revenues (income) of establishment costs for a going concern plantation estate with ongoing sales revenues would be different to an investor or farmer with a once-off plantation investment. The benefit of allowing expensing of establishment costs at the time of incurring these costs would be greater for a once-off or new plantation development. The benefits would be amplified where the expenses were incurred during a period of employment and the revenues from the sales of the plantation wood occurred post retirement. For example, from 1949 farmers with plantations could expense planting, protecting and maintenance costs for shelterbelts and woodlots and spread income from the sale of farm trees over five years to mitigate the impact of higher marginal tax rates. Overall, taxation based incentives in isolation

[343] *Pers. com.* Jeff Tombleson & Associates by email Wed 3/04/2019 8:47 AM
[344] Manley (2002).
[345] Data from http://www.rogerdickie.co.nz/OurForestsFarms/ForestLocations.aspx accessed on the 02/05/2019.
[346] Manley (2002).
[347] Manley (2002).
[348] Information from https://www.forestenterprises.co.nz/our-investments/investment-structure/ downloaded on the 02/05/2019.
[349] Manley (2002).
[350] Information from https://www.forestenterprises.co.nz/our-investments/investment-structure/ downloaded on the 02/05/2019.
[351] Manley (2002).
[352] https://www.greenplan.co.nz/our-company/an-environmental-appraisal/
[353] Manley (2002).
[354] Rhodes & Novis (2004).

did not increase plantation establishment over the period of 1939 to 1958.[355] During the period of 1959-1984 incentives under the Income Tax Act were available for establishing plantations to offset long rotations:[356]

- *For individuals or farmers*:
    - Income spreading: Spreading timber sales revenues over a period of up to five years, including the year of sale was available only to farmers who planted trees for agricultural (pastoral purposes), or for a woodlot planted, or maintained, under a Forestry Encouragement Loan.
    - A reserve account: Individuals depositing forestry income into an 'equalization reserve account' where the funds earned interest at 3% and was only taxed when it was withdrawn from the account.
- *For companies*:
    - Carried forward: Companies deposited revenue from thinning operations into an account to be carried forward free of tax.

During other periods (e.g. the early 1960s) when Government did not regard forestry companies as significant contributors to afforestation, taxation deterred shareholders from re-investing their dividends and profits into second rotations.[357]

Table 10: A summary of the taxation treatment of plantations.[358]

	Stimulant	Depressant
1949	Taxation – expensing and income spreading by farmers	
1965	Taxation – expensing by companies allowed	Taxation – expensing by individuals not allowed "cost of bush'
1960s early	1960s early Taxation income: Exports Taxation Incentive	
1975	Taxation – Accelerated depreciation under a New Market Increased Export Taxation Incentive	
1980s early	Taxation– accelerated depreciation by companies allowed	
1982	Grants for plantations provided to farmers	Grants for plantations provided exclude larger companies
1984	De-regulation of the New Zealand economy	
1984	Taxation expensing allowed	
1987		Taxation expensing removed - back to "cost of bush
1991	Taxation expensing allowed	
2018	Taxation expensing allowed for foresters	Taxation expensing limitations for farmers

Historically the impact of the 'cost of bush' treatment can be observed in the new planting data (see Figure 20). In 1965 an immediate deduction tax regime made afforestation more attractive to companies. The treatment of individual (direct investors) was a 'cost of bush' treatment making plantation establishment less attractive.[359] The rate of afforestation accelerated from 1965 until 1983 (see Figure 20). The rate of afforestation declined on deregulation of the New Zealand economy in 1985 (see Figure 20). The 1987 Government budget changed taxation legislation by the imposition of a 'cost of bush' treatment[360] and the rate of afforestation continued to reduce (see Figure 20). A key issue identified was the treatment of inflation and whether the long-term nature of plantation investment should be taken into account in the tax regime. Industry was highly critical of the

[355] Rhodes & Novis (2004).
[356] Rhodes & Novis (2004).
[357] Rhodes & Novis (2004).
[358] Collated from Rhodes & Novis (2004).
[359] Rhodes & Novis (2004).
[360] Rhodes & Novis (2004).

"cost of bush" account and attributed much of the downturn in afforestation to this treatment.[361] The Government elected in late 1980 implemented a pre-election policy to remove the 'cost of bush' account and reintroduce immediate deduction of qualifying costs against income from any source in 1991.[362] The response was immediate with afforestation increasing from 15 000 ha/y in 1991 to 98 000 ha in 1993/1994. A 1999 analysis concluded that: *'in its current forestry tax legislation, the New Zealand government makes it financially less attractive for forest owners to sell immature forests than to sell forests at maturity. Similarly, it is less attractive to acquire immature forests than it is to plant new land'.*[363]

The 2018 taxation treatment of afforestation is outlined in Table 11 and highlights the differential treatment of afforestation for farmers and foresters. This difference commences with the assumed intent of the trees planted: for harvest or not. The farmer arrangement limits the scale of afforestation by placing a monetary limit on the deductable expenses (e.g. planting for timber is deductible up to $7,500 a year approximately 8 ha/y[364]). This treatment would limit the conversion of farmland to plantations. The treatment of plantation income by forward and back income spreading for foresters would allow an effective dilution of the lumpy nature of harvest revenues and reduce a taxation based incentive to re-afforest the harvested lands and/or to afforest new land. A primary consideration is eligibility to claim taxation treatments for afforestation. A specific case noted was for partnership investments were a taxpayer must '*carry on a forestry business*'.[365] The following are considerations in meeting the standards required by a partnership agreement to demonstrate this requirement: [366]

- A requirement that funds provided by the investor are used for the forestry activities;
- An investor should have a right to direct employment of forest advisers;
- An investor should receive regular management reports;
- An investor should have a right to be physically involved in the forestry activities (e.g. site visits, inspections and discussions);
- An investor should be entitled to the tree crop and not just the proceeds.

Other taxation tools

In the 1960s the exemption of the timber value of plantations from estate duty had little effect on tree planting. New Zealand does not have a capital gains tax[367]: that is land value appreciation is not taxed hence any negative impact on land value is a disincentive and a consideration in afforestation decisions. To encourage regional investment, forestry and sawmilling were eligible for up to 20 % depreciation on any plant and machinery used primarily and directly in these activities. The exact level of depreciation was dependent on the priority status of the region as determined by the Government in relation to the region's development needs.[368]

[361] Rhodes & Novis (2004).
[362] Rhodes & Novis (2004).
[363] Bilek (1999: p.19).
[364] Prepared based on Moore (2018).
[365] Prepared based on Moore (2018).
[366] Prepared based on Moore (2018).
[367] Downloaded from https://www.newzealandnow.govt.nz/living-in-nz/money-tax/nz-tax-system on the 02/05/2019.
[368] Rhodes & Novis (2004).

Table 11: A summary of the 2018 taxation treatment of plantations under the Income Act 2007.[369]

	For a forester	For a farmer
Crop and intent	Grows timber: live, harvestable wood.	Grows trees: are non-harvestable.
NZ ETS	Post-1989 forests: growing timber or trees and earning NZ Units are not taxable on issue or surrender, but create taxable income on sale.	
	Pre-1990 forests: If issued NZ Units they are capital and not taxable on issue, surrender or sale.	
Harvesting and marketing	Part of administration costs and fully deductible for foresters and farmers.	
Income	Harvests and timber sales, or selling standing timber or a cutting right, is liable for income tax on the proceeds.	
Land clearing	Depreciable at 5% DV	Fully deductible
Land preparation	A capital cost for famers or foresters, depreciable at 5% DV.	
Management, fertiliser, weed and pest control	All management is fully deductible.	Managing trees for erosion control, shelter or water quality is fully deductible. Managing for timber is deductible up to $7,500 a year.
Plant and machinery purchase	A capital cost depreciable according to the nature of the equipment.	
Planting	All planting is fully deductible.	For erosion control, shelter or water quality, planting and planting stock is fully deductible. For timber is deductible up to $7,500 a year. Regional Councils subsidies for erosion control planting do not affect deductibility.
Repairs & maintenance	Fully deductible.	
Selling standing timber	Income from the sale of standing timber is taxable. Sale of land with standing timber, the part of the sale income that's attributable to the timber is taxable. The Tax Administration Act 1994 presumes all trees are timber unless proven otherwise. Trees for shelter, erosion control or carbon are treated as timber, and taxable on their sale as standing trees.	
Buying standing timber	Nil claim of the purchase as an expense against other income. Must carry it forward until the timber is harvested or resold.	
Spreading of timber sales income	Spread income forward for up to 5 years, using an interest bearing income equalisation account held at IRD. Interest is paid at 3% pa with daily rests. Pay tax on the amount of income withdrawn from the account in any year.	
	Plus a spread income backwards for three years.	
Tracks, roads, culverts & bridges	Fully deductible if used for < 12 months but a capital expenditure with a longer design life, depreciable at: • 20% DV if they are partially or not metalled, • 5% DV if they are sealed or metalled	Capital costs depreciable at 5% DV

The following are other specific taxation tools applied by Government:[370]

- *Increased Exports Taxation Incentive:* The Government introduced an Exports Taxation Incentive under the Income Tax Act in the early 1960s. A reduction in assessable income (for taxation) from the increase in free-on-board (fob) value of exports over total sales based on the average of the first three of the last four years' trading figures. This measure was subject to change in 1966, 1972 and 1975.
- *A New Market Increased Export Taxation:* A New Market Increased Export Taxation Incentive was introduced in 1975 which allowed a further deduction of 15 % of the increase in f.o.b. value of export sales if these sales were to new markets (e.g. a new product into an existing market, or an existing product to a new market).
- *Export Manufacturing Investment Allowance:* An accelerated depreciation schedule provision was introduced in the early 1980s under the *Income Tax Act* as part of an Export Manufacturing Investment Allowance. Under the mechanism, up to a further 20% of the cost of investment in plant and machinery could to be deducted from assessable income in addition to the 25% first year depreciation allowance.

[369] Prepared based on Moore (2018).
[370] Collated from Rhodes & Novis (2004).

The Government's loans, grants and other initiatives

Prior to 1962, financial institutions were reluctant to provide loans to forestry enterprises because of their inexperience with such investments[371] and in response the Government developed a range of financial mechanisms (see Figure 25 and Figure 26 for the area planted). Table 12 presents a summary of the past grant mechanisms and the following section considers each in more detail.

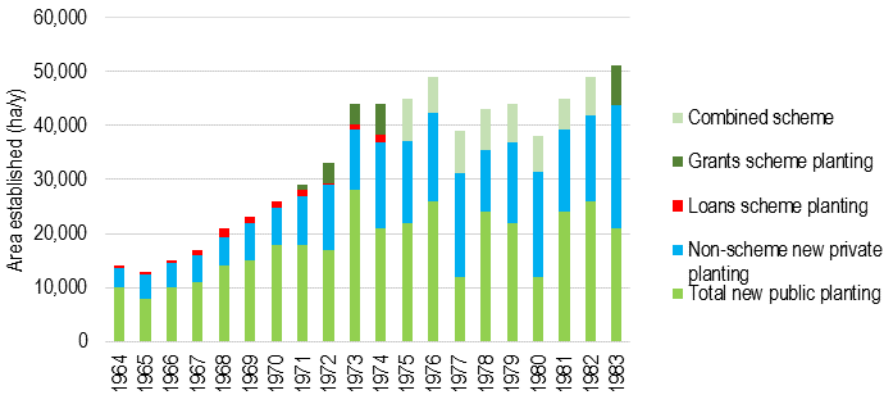

Figure 25: Plantation development 1964 to 1983.[372]

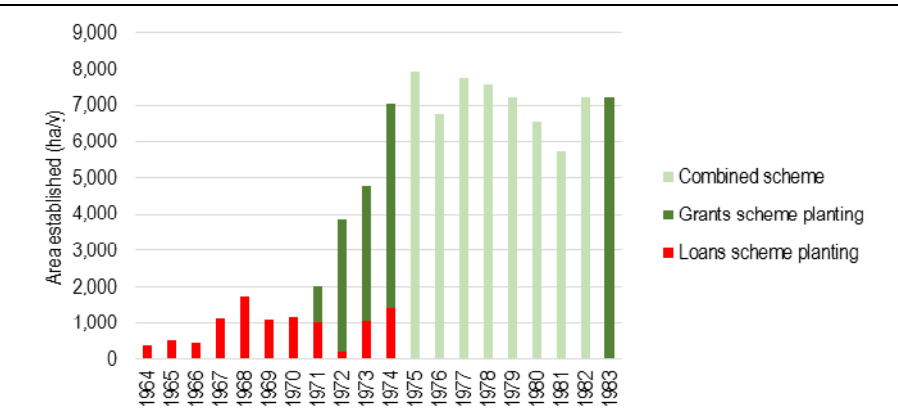

Figure 26: The planting outcomes attributed to Government grants and loan schemes.[373]

Table 12: A summary of the past New Zealand grant mechanisms

Title	Duration	1^{O} intent	Other intent	Outcome (ha/y)
Forestry Encouragement Grants	1969 -1981	Wood		5170
Protection / Production Gants	1980 - 1991	Permanent revegetation		?
Forestry Encouragement Grants	1982 - 1984	Wood		?
East Coast Forestry Project	1992 - 2014	Environmental repair	Wood	1986
Afforestation Grant Scheme	2008 - 2013	Carbon	Wood	3725
Afforestation Grant Scheme	2015 - 2018	Carbon	Wood	3868

[371] Rhodes & Novis (2004).
[372] Data taken from Forestry New Zealand dataset: MPI (2018a); combined with data from Rhodes & Novis (2004: p.18; Table 5).
[373] Data taken from Forestry New Zealand dataset: MPI (2018a); combined with data from Rhodes & Novis (2004: p.18; Table 5).

Permanent Forest Sinks Initiative (2006-2018)

The Permanent Forest Sinks Initiative was announced in August 2006[374] and initiated under the Forests (Permanent Forest Sink) Regulations 2007 and focused on land that was clear at midnight on the 31 December 1989 (Kyoto compliant land) and was or is to be established to permanent forests. The initiative delivered co-benefits (biodiversity, water, soil and carbon values) to the Crown, local authorities and landowners and contributed to sustainable land-use. [375] To be eligible the area must have been one hectare or greater and '*involve the conversion of un-forested land to an eligible forest through planting, seeding, or promotion of natural seed sources'*. The trees developed are to '*at maturity have, tree crown cover (or equivalent stocking level) of more than 30% in each hectare in which....trees have the potential to reach a minimum height of 5 metres at maturity in the place where they are located*'. The Government published the initiative mechanisms.[376] A forest sink plan was required to be submitted with a range of fees and charges for the Government to assess the plan. A forest sink covenant was entered into and was registered on the land title to plant and manage forests with a restricted period of 99 years from the date on which the covenant was registered. Landowners were allowed only limited harvesting on a continuous forest canopy cover basis. Landowners could earn New Zealand assigned amount units (New Zealand Units) for carbon sequestered between 2008 and 2012, which they were then able to sell in either the domestic or international carbon markets. The initiative was principally designed to improve returns from marginal land with little other economic use. The first covenants under the scheme were registered in August 2008 with 22 applications received, covering 5493 ha of forest land[377] and by 2013 it was reported that c. 20 000 ha had entered the scheme with c. 75 % as indigenous forest.[378] A 2011 review noted that, '*the PFSI has provided a small-scale, niche mechanism built around permanency of forests that is regarded as having less uncertainty than the ETS (Forestry), and has enabled landowners to access regulatory and voluntary markets for carbon.'*[379] While permanency is critical, it is reported that '*to Maori, a 50-year covenant is seen as land alienation and this hinders much potential Maori land from entering the'* Permanent Forest Sinks Initiative.'[380] The Permanent Forest Sinks Initiative was terminated in December 2018 with a plan for new permanent post-1989 forest activity into the NZ Emissions Trading Scheme.[381]

Forestry encouragement loans (1962 to 1983)

Figure 25 and Figure 26 present the outcome of the Government's Forestry Encouragement Loans introduced in 1962 under the Farm Forestry Act 1962. Loans could be made to '*any applicant for the purpose of establishing or managing a farm woodlot''*. Details of the mechanisms were presented in the Forestry Encouragement Loans Regulations 1967 and included providing funds for up to 20 years at an annual interest rate of 6.5% and included insurance for up to the amount borrowed. The minimum area was 2 ha which could be the sum of blocks of no less than 0.5 ha and the maximum area was 240 ha. Loans of $1,200/ha were to cover the full cost of establishment and maintenance, over a five-year period of establishment. The mechanism included a re-fund of 50% of the loan and 50% of the interest after 20 years if the plan was implemented satisfactorily. Priority was given to regions 1) with high timber demand; 2) close to population centres; 3) where forest industries were present or expected to develop. Despite these measures, the area planted remained significantly below target.[382] In

[374] See http://www.mfe.govt.nz/publications/climate/nz-fifth-national-communication/page5.html.
[375] Meister et al (2011: p.7).
[376] MPI (2015).
[377] See http://www.mfe.govt.nz/publications/climate/nz-fifth-national-communication/page5.html
[378] MPI (2013: p.2).
[379] Meister et al (2011: p.7).
[380] Meister et al (2011: p.8).
[381] https://www.teururakau.govt.nz/funding-and-programmes/forestry/permanent-forest-sink-initiative/ on the 30/05/2019.
[382] Rhodes & Novis (2004).

1965, the Farm Forestry Act 1962 was modified and renamed the Forestry Encouragement Act 1962 and local government could participate with loans for up to 40 years. New loans had an interest rate of 3% charged on the non-refundable half of the loan or by compounding interest up to the time where harvest revenues commenced. The limit of 40 ha planted over a five-year period was removed subject to approval of the Ministers of Forests and Finance.[383] Amendments to the facility were made virtually every three years, varying the maximum loan amount and interest rates to account for inflation.[384] In 1969, it was concluded that the planting rate was unlikely to reach the target[385] and the scheme was retained for local authorities only. In 1977, a single interest rate of 4.5 % was introduced for new loans and the 50% loan refund provision was revoked. Farmers with existing loans for plantations, could retain their loans, or cancel their existing debts fully and claim a proportion of their future qualifying costs under the new grant scheme. The facility ended in 1983 and loan holders could maintain their loans, or terminate them and receive grants for further expenditures: many farmers opted for grant payments, but most local authorities continued with their loans for cash-flow reasons.[386]

Forestry Encouragement Grants (1969 to 1981)

Regulations providing for Forestry Encouragement Grants were introduced in 1970 to gradually replace the unsuccessful loan scheme, allowing individuals, trusts, partnerships and smaller companies (with qualifying expenditures not exceeding NZ$200,000 per year) to receive annual cash grants equal to 50% of the qualifying establishment expenses for new plantations (a maximum of NZ$750 /ha) for a minimum eligible area of 2 ha.[387] In 1977 the maximum grant amount was increased in response to the Government Forest Service reporting new planting rates were falling as the grants covered only 1/3 of the establishment costs rather than the intended 50%. In 1980, the annual expenditure limits on under the grant scheme were removed.

Protection / Production grants (1980 to 1991)

In 1980 Protection / Production Grants were introduced targeting farmers with properties requiring environmental stabilization. The scheme provided grants of up to 2/3 of the establishment costs, and 50% of all future costs. As part of changes in 1984, Protection / Production Grant holders remained eligible for grants of up to 39.4 % of qualifying costs until 1990/1991.[388]

Forestry Encouragement Grants (1982 to 1984)

In 1982, the Forestry Encouragement Grants scheme was re-introduced by the Government to provide equitable assistance to all landowners. The grants were under the Forestry Encouragement Grants Regulations 1983 administered by the New Zealand Forest Service. From April 1st 1983, all previous incentives were withdrawn and replaced by a flat rate grant of 45% of qualifying plantation costs. The grants were extended to larger companies but the right to expense plantation expenditure (available since 1965 for taxation treatment) was removed: increased tax revenues were matched by a large new outflows of

[383] Rhodes & Novis (2004).
[384] Rhodes & Novis (2004).
[385] Rhodes & Novis (2004).
[386] Rhodes & Novis (2004).
[387] Rhodes & Novis (2004).
[388] Rhodes & Novis (2004).

grants. The scheme was terminated in the 1984 budget, and replaced by full expensing of plantation establishment costs for tax purposes. Transitional loans were available to previous grant holders for completion of existing plantation establishment.[389]

East Coast Forestry Project (1992-2014)

The New Zealand Government has instigated specific protects to address specific issues in specific regions in a targeted manner. The East Coast Forestry Project was introduced in 1992 under the Forestry (East Coast) Grants Regulations 1992 with the aim of '*promoting large-scale commercial forestry as a means of controlling soil erosion, providing employment and regional development and to recognize environmental needs on individual properties*'.[390] The 1992 regulations were revoked with the issuance of the Forestry (East Coast) Grants Regulations 2000.[391] The project targeted eroding and erodible land in the East Coast region of the North Island defined as '*the Gisborne region (as defined in the Gazette 1989, at page 2328)*' and *'includes every estate, right, title, or interest of any kind in or over any land within the boundaries of the East Coast region'*. The specific land targeted and therefore eligible, was at risk land units defined by specifying eligibility based on the *New Zealand Land Resource Inventory*, 2nd edition 1999. The eligible land classes were:

- Class VII, subclass "e" units 18, 19, 21, 22, 23, 24, and 25; or
- Class VIII, subclass "e" units 2, 3, 4, 5, 6, 7, 8, and 9 (as so defined).
- Land that does not meet the class VII and class VIII, subclass "e" units requirements, may be included in an approval certificate if, in the opinion of the Secretary, it is within the same
- Tributary watershed as land that does meet the requirements; and (b) it is based on practical and workable catchment or sub-catchment boundaries.

The grant mechanisms aimed to encourage 200 000 ha of afforestation by 2020[392] but this was reviewed to target 60 000 ha of most severely eroding land.[393] The grant mechanism was capped at a total of 7000 ha/y composed of upto 500 ha in a year as the sum of grants for land areas of five to 50 ha, and the balance as the sum of applications of greater than 50 ha. The grant was a competitive tender process for land-owners in the target areas, seeking funding of the cost of establishing and managing plantations. Options included commercial plantations, poplar and willow planting, and setting aside areas for natural forest regeneration. The area planted under the mechanism was 41 701 ha (1993 to 2013: see Figure 27). The rate of afforestation ranged from 376 to 4764 ha/y with an average rate of 1986 ha.[394] Over the period of 1993 to 2001, additional to the grant areas, 1915 ha was afforested fully-funded by the landowners who had received grants (see Figure 27).[395] Of the area afforested, 27 000 ha was on target land and 13 000 ha was included to address the whole or most of the watershed surrounding an erosion feature to achieve the greatest reduction in sediment run-off.[396]

[389] Rhodes & Novis (2004).
[390] Ministry of Forestry (1994) in Rhodes, D. (2001).
[391] Ministry of Agriculture & Forestry (2007: p.2).
[392] See http://www.mfe.govt.nz/publications/climate/nz-fifth-national-communication/page5.html
[393] Rhodes (2001).
[394] Data from Figure 27.
[395] Data from Phillips et al (2013: p.10; Table 3) 1993 to 2011.
[396] MPI (2014: p.3).

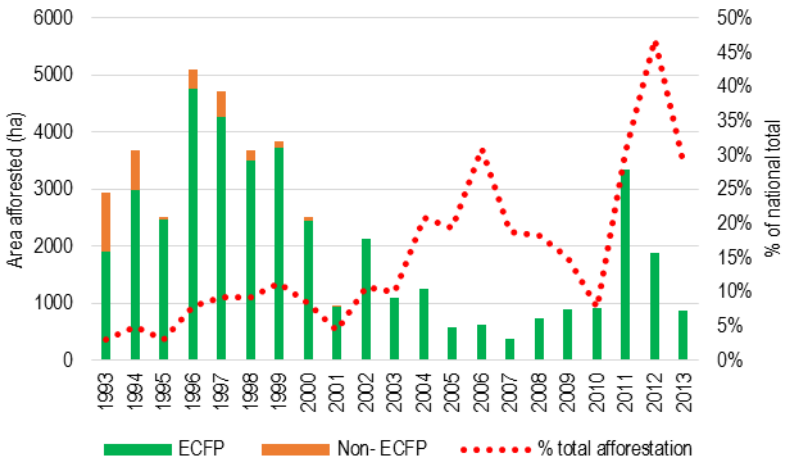

Figure 27: Outcomes of the East Coast Forestry Project 1993 to 2011.[397]

The % of total afforestation is relative to the national rate of afforestation presented in Figure 20.

The pattern of afforestation under the project broadly followed the national trends for the same period (see Figure 20) with the following noted: there was a time lag till peak afforestation in 1996 compared to the national peak in 1993 and that the contribution of the project to national afforestation rates increased during the period 2002 to 2008 (a period of national deforestation). This suggests that the project had a positive impact on famer's willingness to convert from pasture to tree cover, but overall the project was under-subscribed. The pattern of uptake may reflect the level of interest with the initial rate of uptake reflecting caution and after observations of the outcomes, more interested parties participate and with time the interested parties have afforested. The area planted was also less than that initially signed-up due to the c.60% drop-out rate of parties.[398] The reasons for with-drawl were suggested to include the *need for bridging finance, complications in achieving sign-off for multiply-owned Maori land, and a lack of genuine interest in undertaking land-use change.* [399] Other analysis[400] suggested that the reasons for the decline in uptake are: '*forestry profitability had declined compared with pastoral farming; the remaining land needing treatment was owned by people with less interest in retiring land from farming, or by Māori who are deterred by the covenant requirement; the complex administration with multiple signing stages for grant applications, grant certificates, covenants and payment claims; and the frequent need for bridging finance; and a requirement for 50-year replanting covenants'.* Other considerations include potential exclusion from the emissions trading scheme (announced in 2002) and restrictions on planting land with manuka / kanuka vegetation.[401] The grant mechanism was revoked in 2014 by the Forestry (East Coast) Grants Regulations Revocation Order 2014.

Afforestation Grant Scheme (2008-2013)

A new Afforestation Grant Scheme was launched in 2008 and was administered by the Ministry of Agriculture and Forestry. It operated as a contestable fund (parties submitted competitive tenders) to encourage increased areas of Kyoto- compliant forests to enable New Zealand to meet its Kyoto obligations at the lowest cost. It was also expected to boost afforestation for wood production and other environmental benefits (e.g. reducing erosion, nutrient leaching and flood peaks). Under the scheme, parties received a Government grant for Kyoto-compliant afforestation but retained ownership of the trees to receive income at harvest. The Crown retained the carbon credits and took responsibility for meeting all harvesting and deforestation

[397] Data from Phillips et al (2013: p.10; Table 3) 1993 to 2011; Data from MPI (2014: p.6)
[398] Meister et al (2011: p.14).
[399] Meister et al (2011: p.14).
[400] MPI (2014: p.5).
[401] Meister et al (2011: p.15).

liabilities. Priority was given to afforestation proposals that reduced the risk of soil erosion, improved water quality and biodiversity.[402] The scheme was designed to encourage more planting of trees in small forests and on farms. Regional Councils were allocated 50% of the scheme pool and 50% was available to the general public via a public tender pool. Of the public funding pool, 70% was allocated to species with high carbon sequestration rates (e.g. Radiata pine and Douglas fir). The remaining 30% was reserved for species with low carbon sequestration rates.[403] The outcome of the scheme for 2008 to 2013 was a total of 18 625 ha afforested (3725 ha/y): 6645 ha under the public pool and 11 980 ha under the Regional Council Pool.[404] The average grant rates were $1,700 /ha for the public pool, and $2,100 /ha for the Regional Council Pool by 2011[405] and for 2009 and 2010, the scheme was significantly oversubscribed.[406] It was suggested that that grant rates could have been lower in order to balance demand for grants with supply of funds.[407] A 2011 review noted that while a tender process promotes cost efficiency it also creates '*uncertainty and inconvenience for applicants that act as disincentives*'.[408] The scheme had multiple objectives resulting in a degrees of conflict, hence the scheme did not achieved optimisation of any objective noting in particular that '*maximising carbon sequestration and delivering carbon credits at least cost are not achieved by establishing forests on sites with severe soil erosion'*. [409]

Afforestation Grant Scheme (2015-2018)

The Afforestation Grant Scheme[410] launched in 2015 was designed to increase Kyoto-compliant[411] afforestation and had a target to deliver 15 000 ha over 2015-2020.[412] The scheme was a competitive tendering system, under which the Government offered cash grants to successful applicants for 5-300 hectares of afforestation. For 2018 the cash grant was set at $1,300/ha with a claim for payment made after successful establishment to the set minimum standard.[413] Any New Zealand-based individual or organisation could apply for a grant provided they owned the land, or had the legal right to use the land for forestry (for a minimum term of 10 years from the date the new forest was established).[414] Participants owned the resulting trees and could generate an income from the future harvest while the Crown retained all carbon credits (and liabilities) from the carbon sequestered by the plantation for the first 10 years after establishment. After 10 years, ownership of the carbon credits reverted to the land-owner, at which point the forest could be registered under either the New Zealand ETS or Permanent Forest Sinks Initiative. The scheme objectives included reducing erosion and improving soil quality, water quality and biodiversity and this test was applied to the Regional Council Pool.[415] This was supported by a formal process to assess and score the relative attributes of sites for soil erosion potential, impact on water quality, impact on flood risk, impact on biodiversity and the overall scale and impact of the potential afforestation.[416] The grant pool was 70% allocated to species with high sequestration rates (e.g. Radiata pine; Douglas fir) and 30% was for species with low carbon sequestration rates (e.g. natural species). It was recognised that although native species are slower growing, they promote greater biodiversity and provide habitats for

[402] NZ Farm Forestry Association (2008): https://www.nzffa.org.nz/farm-forestry-model/resource-centre/tree-grower-articles/tree-grower-august-2008/afforestation-grant-scheme-now-open-for-business/
[403] Anderton, J Forestry Minister, Tuesday, 22 April 2008, 2:39 pm. http://www.scoop.co.nz/stories/PA0804/S00527.htm
[404] MPI (_____) Afforestation Grant Scheme (AGS) 2008-2013 Forest Location. Downloaded on the 08/06/2019 from https://www.mpi.govt.nz/funding-and-programmes/forestry/afforestation-grant-scheme/
[405] Meister et al (2011: p.10).
[406] Meister et al (2011: p.10).
[407] Meister et al (2011: p.10).
[408] Meister et al (2011: p.10).
[409] Meister et al (2011: p.10).
[410] http://www.mfe.govt.nz/publications/climate/nz-fifth-national-communication/page5.html
[411] Kyoto-compliant forest refers to areas of forest planted after 1 January 1990 on to land which was non-forest land as at 31 December 1989.
[412] MPI (2018b: p.3).
[413] MPI (2018b: p.3).
[414] MPI (2018b: p.3).
[415] MAF (2008: p.4).
[416] MAF (2008: p.7&8).

threatened native birds and plants.[417] There are currently 96 participants in the scheme, with 29 participants in the public pool and 67 in the regional council pool.[418] The area afforested was 7736 ha (2016: 2918ha; 2017: 4818 ha) or .[419] The scheme was replaced by the One Billion Trees Fund in 2018.[420]

One Billion Trees Programme (2018-2028)

In a speech, the New Zealand Prime Minister (Jacinda Arderns) stated that:[421]

> *'We are setting up an Independent Climate Commission of experts who will develop carbon budgets right through to 2050. That means they'll set the amount of carbon we can afford to put into the atmosphere each year to get us to carbon neutrality, while ensuring we have enough energy available to run our economy and country.'*
>
> *'As part of our regional development work and under the leadership of New Zealand First Minister Shane Jones, we have started a programme to plant one billion trees in the next 10 years. This will contribute to reducing CO_2 emissions, both through C02 absorption and by reducing erosion.'*

In response the New Zealand Government has developed the One Billion Trees Programme to increase current rates of tree planting to reach at least one billion trees planted over the next decade (100 million trees/y). The One Billion Trees Programme is led by Te Uru Rākau (Forestry New Zealand within the Ministry for Primary Industries) to '*support landowners to grow both native and exotic trees to create employment and workforce development, optimise land use, mitigate climate change, support Māori values and aspirations, protect the environment and support New Zealand's transition to a low emissions economy'*. [422] The One Billion Tree Programme aims to provide a flexible system to help plant the right tree, in the right place, for the right purpose. [423] There are three elements to the One Billion Trees Programme: The One Billion Trees Fund (1BT), Matariki Tu Rākau (planting living memorials to honour our New Zealand Defence Force members, past and present) and Crown Forestry.

The New Zealand Government launched the $240 million 1BT Fund on 30 November 2018[424] funded by the Provincial Growth Fund.[425] There are two grants under the 1BT fund: Direct Landowner Grants and Partnership Grants. Direct landowner grants contribute to the cost of planting and establishing trees and fostering natural species regeneration (to encourage planting of native trees, trees for erosion control, and environment-focused planting). Of the fund, $120 million has been allocated to direct grants to landowners.[426] The Fund does not support whole-farm conversions and has a target of planting two-thirds native species. Grants are available for landowners or organisations who have the legal right to plant the land and can commit to maintaining the planting project for a minimum period (typically 10 years). The area planted to natural forests is to be a minimum of one ha with an aggregate area of up to 300 ha unless agreed to and for all other tree species the minimum area is 5 ha upto a total of 300ha. The land is not limited to the requirements of the New Zealand Emissions Trading System. The

[417] http://www.mfe.govt.nz/publications/climate/nz-fifth-national-communication/page5.html
[418] http://www.mfe.govt.nz/publications/climate/nz-fifth-national-communication/page5.html
[419] SMITH, S. (National—Kaikōura): https://www.parliament.nz/en/pb/hansard-debates/rhr/document/HansS_20161208_053850000/12-forestry-afforestation-grants-scheme-2016 accessed on the 07/06/2019.
[420] https://www.mpi.govt.nz/funding-and-programmes/forestry/afforestation-grant-scheme/ accessed on the 30/05/2019.
[421] https://www.stuff.co.nz/national/politics/107445802/prime-minister-jacinda-arderns-statement-to-the-united-nations-general-assembly
[422] Te Uru Rākau's (2018: p.1).
[423] Te Uru Rākau's (2018: p.1).
[424] https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/one-billion-tree-fund/ on the 30/05/2019
[425] Te Uru Rākau's (2018: p.1).
[426] https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/

fund is open to all Regions with a focus on Northland, Bay of Plenty, East Coast, Hawke's Bay, Manawatu-Whanganui, and the West Coast of the South Island.[427] The tree species to be planted:[428]

- Must be capable of growing to at least 5 m in height at maturity where they are located;
- Must not be grown or managed primarily for the production of fruit or nut crops.

Non-tree species (e.g. shrubs) are accepted as a component of mixed native plantings, where that is consistent with good planting practice.[429] Mānuka / kānuka can be funded to provide cover for erosion control or a nurse crop for a natural forests. Honey production can occur but the planted trees should be managed to reach 5 metres in height.[430] Table 13 presents details of the grant funding available.[431]

Table 13: A summary of the grant funds available under the 1BT Fund.

Type of planting	Size (ha)	Base (rate/ha)	Top-up available ($/ha)		
			Erosion prone land OR land in areas that support regional development goals	Fencing	Ecological restoration partnership projects
Indigenous mix (e.g. a mix of native trees and shrubs)	1–300	$4,000	$500	Up to $500	Up to $2,000
Mānuka / kānuka (particularly for erosion control or as a nurse crop for an indigenous forest)	5–300	$1,800	$500	N/A	N/A
Indigenous natural regeneration (e.g. retiring land and managing it to naturally return back to trees)	5–300	$1,000	$500	Up to $500	N/A
Exotic (e.g. planting eucalypts, redwoods or *Pinus radiata*)	5–300	$1,500	$500	N/A	N/A

Partnership grants aim to create closer working relationships between partners from Regional Councils, sector organisations, non-government organisations (NGOs), researchers, training organisations, Māori landowners, and community groups. To date the 1BT Fund has partnered with organisations to help reduce barriers to tree planting, making use of knowledge and experience from across the industry with grants totalling NZ$25.9 million: supporting training, nursery capacity and plans to establish of c.4.9 million seedlings.[432]

The Matariki Tu Rākau programme was announced on Anzac Day, 2018 and aims to plant trees to recognise the service of men and women of the New Zealand Defence Force, past and present. Te Uru Rākau will provide funding for trees (focussed

[427] Te Uru Rākau's (2018: p.6).
[428] Downloaded from https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/one-billion-tree-fund/direct-landowner-grants-from-the-one-billion-trees-fund/
[429] Downloaded from https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/one-billion-tree-fund/direct-landowner-grants-from-the-one-billion-trees-fund/
[430] Downloaded from https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/one-billion-tree-fund/direct-landowner-grants-from-the-one-billion-trees-fund/
[431] Downloaded from https://www.teururakau.govt.nz/te-uru-rakau-forestry-new-zealand/ on the 01/04/2019
[432] Downloaded from https://www.teururakau.govt.nz/dmsdocument/31767-forestry-partnership-projects on the 30/05/2019.

on native species) for planting on land accessible to the public. It is expected that c.350 000 trees are to be planted over the period of 2018 to 2020.[433]

Crown Forestry is a commercial trading organisation managing the Crown's commercial forestry assets.[434] The Crown Forestry programme targets afforestation of radiata pine plantations on sites with a minimum plantable areas of 200 ha that has not been previously plantation forests, with reasonable fertility and terrain suitable for current forest harvesting systems. The land must be suitable for production forestry in the relevant district council and regional council land-use and water plans and with the ability to control weeds by aerial spraying. The land must have good internal and external road access.[435] Crown Forestry can lease the land or enter into a forestry joint-venture for a one rotation (30-year) term. The Crown pays for all establishment and management costs over the lifetime of the crop and a negotiated land access charge. The arrangements on offer provide flexibility with the option of an annual rental (a lease), a share of the net profit at time of harvesting, or a mix of both. The landowner retain all rights to any carbon credits.[436] To date the 1BT Fund has initiated 21 Crown partnerships with a total value of NZ$145.7 million covering 13 462 ha (estimated 11.7 million trees) or a value of $10,823/ha (which includes land rent and forestry establishment, maintenance and harvest costs). The areas include planting radiata pine in 2018, 2019 and 2020+.[437] This has been achieved in less than 12 months. As at the 20th May, 2019, 61 million trees had been planted (13% as native species and 87% exotic species) under the One Billion Trees Programme.[438]

Analysis of past initiatives

The history of New Zealand's loan and grant incentives is presented in Table 14 and

Table 15 presents the current a summary of the elements of the One Billion Trees Programme. New Zealand has maintained some form of financial assistance to tree growing from 1962 to the present with the exception of the period around the deregulation of the economy in 1985 (1983 to 1992). From 1962 to 1983, and despite ongoing changes and adjustments, the contribution of the loan and then grant schemes to private sector afforestation remained relatively constant see (Figure 25 for all plantings indicating the relative contribution and Figure 26 presenting private afforestation and the loans and grants). In summary, loan supported plantations accounted for 9.2% of the private plantation development from 1964 to 1974 and for the period of 1971 to 1983, grants supported 27.9% of the private plantation development. The New Zealand Farm Forestry Association Inc. noted that '*during the years of the loan and grant schemes it was always a concern to Executive that many taking advantage of these schemes did not join the Association. Forest Service Extension Officers encouraged these people to join by giving them brochures, and subscriptions were made a qualifying expense. At one time in 1973, a complimentary copy of the Farm Forestry journal was given to each new grantee.*'[439] The deployment of loans and grants as incentives were in some cases mutually exclusive to taxation mechanisms (e.g. in 1965 companies unable to expense afforestation could receive a tax credit refund of 45 cents to the dollar but this was not available to companies that already had a Forest Encouragement Grant on the same lands).

[433] https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/matariki-tu-rakau/
[434] https://www.teururakau.govt.nz/about-us/crown-forestry/
[435] https://www.teururakau.govt.nz/about-us/crown-forestry/helping-achieve-one-billion-trees/
[436] https://www.teururakau.govt.nz/about-us/crown-forestry/helping-achieve-one-billion-trees/
[437] Crown Forestry 1BT downloaded from https://www.teururakau.govt.nz/dmsdocument/31764-crown-forestry-partnerships
[438] Downloaded from https://www.teururakau.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/tracking-progress-of-the-one-billion-trees-programme/ on the 30/05/2019.
[439] Hosking (1999: p.5).

Table 14: A summary of the past loans, grants and other mechanisms utilised in New Zealand.

		Basis	Objective			Eligibility	Targets	Narrative	Other comments
			Trees for harvest	Environmental repair	Other				
Forestry Encouragement Loans	1962-1983	A loan facility	Yes			Individuals and Local Councils	2 to 240 ha of plantations as the sum of at least 0.5 ha blocks, over a five-year period of establishment	Funds for up to 20 yrs at 6.5% interest to cover the full cost of establishment and maintenance and insurance	Significantly below target in 1969, unlikely to ever reach the target
Forestry Encouragement Grants	1969-1981	A grant	Yes			Individuals, trusts, partnerships & smaller companies	A minimum of 2 ha	Annual cash grants equal to 50% of the qualifying establishment expenses for afforestation (max of NZ$750 /ha)	Replace the unsuccessful loan scheme
Protection / Production grants	1980-1984	A grant	Yes	Environmental stabilization		Farmers		The scheme provided up to 2/3 of the establishment costs	
Forestry Encouragement Grants	1982-1984	A grant	Yes			All landowners & extended to larger companies	A minimum of 2 ha	A flat rate grant of 45% of qualifying plantation costs	Replaced in the 1984 budget by full expensing of plantation establishment costs for tax
Deregulation	1985								
East Coast Forestry Project	1992-2014	A grant	Yes	Reducing soil erosion	Employment and regional development	Specific at risk land classes in the East Coast region	A minimum of 5 ha 7000 ha/y up to 200 000 ha by 2020 but this was reviewed down to 60 000 ha	The cost of establishing and managing commercial plantations, poplar and willow planting, and natural forest regeneration.	Competitive tendering system. Replaced by the Afforestation Grant Scheme.
Permanent Forest Sinks Initiative	2006-2018	Facilitated access to ETS	Limited	Carbon	Improve returns from marginal land	Land-owners	Land 1 ha or greater. Cleared land at the 31 December 1989 & has been or is to be established to permanent forests.	Earn New Zealand assigned amount units for carbon sequestered between 2008 and 2012. A 99 year covenant with limited harvesting is allowed on a continuous forest canopy cover basis	Replaced by the 1BT Programme
Afforestation Grant Scheme	2008-2013	A grant	Yes	Reducing erosion & improving soil quality, water quality & biodiversity	Kyoto-compliant afforestation	Regional Councils & New Zealand-based individual or organisation	Priority was given to afforestation proposals that reduced the risk of soil erosion, improved water quality and biodiversity	Participants own the trees while the Government retains all carbon credits (and liabilities) Regional Councils received $2,100/ha and private participants $1,700/ha	Competitive tendering system.
Afforestation Grant Scheme	2015-2018	A grant	Yes	Reducing erosion & improving soil quality, water quality & biodiversity	Kyoto-compliant afforestation	Regional Councils & any New Zealand-based individual or organisation	15 000 ha by 2020, 3000 ha/y: 5-300 ha of previously un-forested land.	Participants own the trees while the Government retains all carbon credits (and liabilities) for the first ten years after establishment. 2018 $1,300/ha post establishment	Competitive tendering system. Replaced by the 1BT Programme

Table 15: A summary of the arrangements under the One Billion Trees Programme.

		Basis	Objective			Eligibility	Targets	Narrative	Outcome
			Trees for harvest	Environmental repair	Other				
One Billion Trees Fund	2018-2028	A grant	Yes	Yes	Social & community benefits	All land holders	Right tree, in the right place, for the right purpose	A $240 million fund aimed to provide a flexible system to help plant trees capable of growing to at least 5 m in height at maturity & not primarily for the production of fruit or nut crops	Aims to plant 1 billion trees by 2028 (100 million trees/y)
Direct landowner grants	2018-2028	A grant	Yes	For erosion control, and environment	Carbon Maori values	All land holders	Minimum of 1 ha upto a total of 300 ha: Regeneration to encourage planting of native trees, trees. 5 ha upto 300 ha for other afforestation. Priority regions: Northland, Bay of Plenty, East Coast, Hawke's Bay, Manawatu-Whanganui, and the West Coast of the South Island	A $120 million fund to contribute to the cost of planting & establishing trees and fostering natural regeneration	
Partnership grants	2018-2028	A grant	Yes	Yes	Social, capacity & information	Service providers & all land holders		Aim to create closer working relationship between partners from regional councils, sector organisations, non-government organisations (NGOs), researchers, training organisations, Māori landowners, and community groups	
Matariki Tu Rākau	2018-2020	A grant			Social benefits	Land with public access	Native species	To plant trees to recognise the service of men & women of the New Zealand Defence Force, past and present	c.350 000 trees are to be planted
Crown forestry	2018-2028	Lease / Joint-venture	Yes	Yes	Carbon	Min. of 200ha 'commercial afforestation' land	Radiata pine plantations	The Crown pays for all establishment & management costs over the lifetime of the crop & pays a negotiated rent to the landowner: an annual rental (a lease), a share of the net profit at time of harvesting, or a mix of both	

The grant programs evolved from broad to specific intent focusing on environmental repairs (e.g. the Protection / Production Grants of 1980-1984 targeted environmental stabilization). Based on experience, radiata pine provided soil conservation benefits for about 40 years and is easily managed on a commercial 30-year rotation[440] satisfying the environmental objectives. For example, in New Zealand ecosystem services of planted forests are recognised[441] and afforestation will reduce water yield[442] and flooding (in small-catchments)[443], sediment yields (mostly for geologically unstable land)[444] and erosion.[445] This was recognised by the East Coast Forestry Project (1992 to 2014) which encouraged commercial plantation development. The Kyoto Protocol and carbon added another layer of focus with some mechanisms focused on permanent forest sinks (e.g. the Permanent Forest Sinks Initiative 2006 to 2018) and other including carbon outcomes with trees for harvest objectives (e.g. the Afforestation Grant Scheme 2015 to 2018). There is a clear distinction between intent of natural forest species and radiata pine, with both types of trees encouraged. A key attribute of the grant programs was long-term running of the programmes, and where a programme was terminated, it was replaced. For example the Forestry Encouragement Loans failed to achieve the target plantings and was terminated and replaced by the Forestry Encouragement Grants programme. The structure and nature of the current One Billion Trees Programme initiated in 2018, suggests that the programme has taken stock of the lessons gained since 1962. The programme is a portfolio of initiatives providing maximum access and the ability to seek a range of tree outcomes. The programme includes motivated parties (e.g. Crown Forests) to drive and facilitate afforestation. The outcomes to date and in less than 12 months have been encouraging.

Development of a project and the underlying mechanisms

Design of a mechanism

New Zealand has made use of loans and grants and there is a strong preference to grant mechanisms based on the poor performance of loans. A key point is that there is a need for long-term approach (duration of mechanisms), or the ability to have overlapping mechanisms. Based on experience there is a need to have the ability to refine the mechanisms in place and this must be assessed as a trade-off between updates and providing certainty to participants. A grant mechanism must have a defined protocol for allocations including the sign-up and administration process of the sign-up. New Zealand experience suggests a high drop-out rate (60%) for some projects after initial sign-up. A range of reasons have been identified, but the key insight is to ensure that the mechanism itself is not a driver of failure to convert initial interest to afforestation. The One Billion Trees Programme has the options for Crown Forests to enter into joint-venture or leases with land-owners. In the design of a mechanisms, there is a need for a clear distinction between grants, joint-ventures and leases. To maximise potential up-take with multiple parties, there should be the ability to combine all three.

The scope and the intent

A grant program can be nation-wide or specific to defined area of land. New Zealand has made use of both options (e.g. the Afforestation Grant Scheme was national whereas the East Coast Forestry Project was very specific to a defined location). The East Coast Afforestation Project included every estate, right, title, or interest of any kind in or over any land within the

[440] Rhodes (2001).
[441] Yao et al. (2017: p.7).
[442] Blaschke et al (2008: p.9, Table 2).
[443] Blaschke et al (2008: p.8, Table 1).
[444] Blaschke et al (2008: p.21, Table 4; p.28).
[445] Blaschke et al (2008: p.34).

boundaries of the East Coast region. In other cases priority was given to regions 1) with high timber demand; 2) close to population centres; 3) where forest industries were present or expected to develop. This is a key point in the design of a grant programme. The trade-off is between the level of participation and the ability to secure maximum up-take in a target area. Options to address this could be either a roll-over available and unallocated fund or to have the ability to re-allocate un-used funds to more successful programmes. The advantage of a targeted afforestation project and mechanism is the ability to address a specific issue.

Multiple benefits has been a cornerstone of the New Zealand grant mechanisms: optimise land use, controlling soil erosion, providing employment with regional development, supporting Māori values and aspirations to protect the environment and to mitigate climate change and a transition to a low emissions economy. The One Billion Trees Programme has a mantra of: plant the right tree, in the right place, for the right purpose. A point of caution noted by New Zealand experience is a need to balance competing needs and potentially to set priorities from such a long list.

A programme can be defined based on an annual afforestation rate, a total target area after a set period of time or a combination of both. This is an important attribute of a programme as it provides a basis of assessing progress and allows a decision on continuance, modification or termination based on performance. This also provides signals to processors, land-owners and other interested parties. A point of caution is the signal sent to farmers so that a stated area intent is not regarded as a threat to farm and farming communities. This has been addressed by the One Billion Trees Programmes stated intent to not target planting of whole farms.

The project

An important point is to define the nature of the afforestation (the target silviculture) and in particular the rotation lengths. Where a project has a wood for harvest outcome, the markets for the trees grown and the transport routes should be defined (e.g. the Crown Forests joint-venture or lease programs targets commercial forestry sites with the ability to harvest with current harvest systems). Afforestation with radiata pine has been a foundation of most of the New Zealand grant programmes. In some cases where permanent afforestation (and carbon sinks) have been the objective, native species have been preferred. In other cases the grant mechanism allowed plantings with poplars and willows and setting aside areas for natural forest regeneration. The approach to species has been linked to the purpose of the afforestation.

The level of funding support

A grant must define the target eligible costs that it seeks to fund. There are two options to define the level of grant funding. The first is to set a percentage of the expected costs hence as the costs change so does the funds provided. From an administrative perspective this provides a degree of uncertainty as to the target area from a fixed allocation of funding. The second mechanism is a 'flat-rate' of dollars per hectare. This provides target area certainty but depending on the gap of the actual to grant level of funding, this could fail to attract interest. Therefore an important step in the design of a grant is to understand the likely costs to afforest and maintain an area of plantation. Where a grant mechanism does not fund all of the costs associated with afforestation, there will be a funding gap that must be addressed. From the grantor's perspective they will seek comfort and assurances that the grantee can fund that gap, otherwise it would be difficult to sign-up a party. A robust grant mechanism also is an ex-post payment based on the actual results. To support an assessment there is a need to define the target parameters (e.g. stocking and survival) and the mechanisms to assess success or not. This will address the question

of funding of the gap (the afforestation has been funded) but it will reduce the area afforested as not all signed-up grantees will achieve the required afforestation and may have displaced a party that would have planted trees.

The application, assessment and awarding process

A competitive tendering process is an efficient mechanism to secure participation at the least cost. However, given the need to secure funding for the gap between the grant funds provided and the true costs, plan site preparation and order seedlings, there is a need to assess the trade-off between certainty (a fixed grant) and grant fund allocation efficacy. New Zealand experience has noted that competitive tendering provides uncertainty and inconvenience for applicants that act as disincentive. In some cases a party may regard grant funding as the deciding point of whether or not to afforests, or for others they have a set programme that will proceed regardless. It is proposed that the target of grants should be a party requiring additional support to make a positive decision to afforest, rather than as a subsidy to a party who was already going to plant. This is a point that requires careful consideration in the design of a grant mechanism. Where a grant is on a relative benefits basis or a project must meet certain requirements, in the absence of unlimited funds there will be a need for a mechanism to allow a structured and objective decision making process of which land is in or out.

Eligible parties and land, and the treatment of land

Afforestation is a conscious choice by land-owners and experience has shown that it is relative to the profitability of the current land-use (agriculture). In other cases some land-owners simple do not have any interest in alternatives to the status quo agriculture as occurred with the East Coast Forestry Project with diminishing rates of afforestation as the project progressed. Therefore there in designing a mechanisms it would be prudent to consider all parties relative to the intent of the mechanism. Past experience with grants in New Zealand indicates that grant mechanism commence with a narrow focus on farmers, then expand to include a wide range individuals, trusts, partnerships and smaller companies (defined by some metric), then include Regional Councils and finally larger companies. A mechanism should reflect the intent of the project and this may be all inclusive or very targeted in the area of interest.

While afforestation of pasture lands has been a focus of grants, the One Billion Trees Programme has expanded eligible land to include establishing forests on land with manuka / kanuka vegetation. Past experience has observed tensions with whole farm afforestation. There is a need to determine whether a grant should facilitate whole of farm afforestation or not. The intent of the 1BT Fund is afforestation within agriculture hence the programme does not seek to support the planting of whole farms. In other cases such as the East Coast Forestry Project the focus was on landscape repair hence planting of whole farms was appropriate. A common element of all grant programmes has been to define the minimum eligible area of land which can participate. For example the Permanent Forest Sinks Initiative set the limit at one hectare or greater, but this area was to be permanent and not for clearfalling. Grant mechanisms usually set a maximum eligible area per landholder, but this could be the aggregate of a range of smaller units of planting on a property. For example the 1BT Fund sets a maximum area of 300 ha but this can be composed of 300 one hectare units of native species plantings or 60 X 5 ha units upto 300 ha of radiata pine. An overall grant project can set a maximum budget and/or area to be planted. This is important to ensure that the scale of the project meets the project objectives and to allow budgetary planning to ensure that the funds are available. The design of a grant must set the minimum, maximum and the composition of the maximum funded area based on the purpose of the

grant and find a trade-off with fixed costs and the scale of the planting. Where afforestation is for harvest, there is a need to address harvesting limitations.

To secure the interests of the funding party, grants have included the registering the interests in the land and the trees planted via a covenant. This is a reasonable requirement to ensure that the land-owner fulfils their obligations and/or to secure the interests of the grantor in the outcomes of the afforestation (e.g. carbon values). In some cases the requirement to have a covenant in place was regarded as a barrier to participation. For example, the Maori Land Court is unlikely to agree to Maori land alienation for this length of time. This must be accepted as a barrier to some party's involvement and be maintained to ensure the integrity of the grant mechanism unless an alternative mechanism can be developed and implemented.

Complementary treatments

A grant mechanism cannot operate in isolation. The New Zealand approach has been to link grants and taxation treatment of afforestation (in some cases and for some parties on an either/or basis). Under the New Zealand Income Tax Act 2004 (DF1), grants are tax neutral: that is a party cannot claim the expenditure funded by a grant as an expense, nor is it treated as income. The gap between the grant and the true costs is subject to usual taxation treatment, hence depending on the level of the grant relative to the total expenditure, within year or cost of bush expenditure treatment can impact the attractiveness of afforestation. In a similar manner the uptake of grants has affected the ability to participate by some land -owners in other programmes such as the New Zealand Emissions Trading (Forestry) programme. This has been the result in some cases of the crown retaining ownership of the carbon benefits and liabilities or by simple exclusion. This results in a policy conflicts between objectives and mechanisms. This also adds the complexity of any grant mechanism. There is a need to consider the complementary nature of policy objectives in the design (and exclusions within) a grant mechanism.

Where afforestation seeks to generate and claim (sell) carbon benefits, there is a need to ensure that the land afforested is Kyoto compliant and there is a mechanism to facilitate the sales of the units. A grant could include a mechanism to define and facilitate the sales of carbon benefits on behalf of the grantee. An alternative is that the Crown retains title to carbon benefit and claims this against the national carbon accounts. If this is the case, then the Crown has an interest in the afforestation outcomes and technically the grant is no longer a grant but consideration towards a joint-venture. This is a point that needs to be addressed, particularly from a taxation perspective.

Natural forest and land-use change

Concerns over resource supply from natural forests underpinned the development of the New Zealand plantation estate. In some areas the land developed for plantations had carried natural forests which were clear-fallen (see Figure 28 for the change in the level of natural forest harvest volume) and converted to plantations. By the 1970s, public concern over conversion increased, stimulating new environmental groups. Debates and acrimony between agriculture and forest industries, and the environmental movement and forest industries in the 1970s and 1980s, were the major disincentives resuling in statutory land-use controls, a poor public perception of the forest industry, and constrained development.[446] On July 4th, 1977 in the Maruia valley, the Maruia Declaration was signed[447] opposing natural forest utilization, and conversion, which was presented to parliament received little support. Natural forest management had become a major political issue. The issue received special

[446] Rhodes & Novis (2004).
[447] See a copy of the document on https://teara.govt.nz/en/document/13938/the-maruia-declaration-petition.

attention from the Government with the transfer of the majority of the crown natural forests to the new Department of Conservation in 1987, and conservation groups then shifted their focus to private natural forest management. The New Zealand Forest Owners' Association and the principal environmental groups in New Zealand (except Greenpeace) signed the New Zealand Forest Accord in 1991 under which forest owners agreed that they '*would not clear any land or disturb any area with naturally occurring indigenous vegetation in return for recognition by the environmental groups that commercial plantations were an essential source of perpetually renewable fibre and energy, offering an alternative to halt the depletion of indigenous forests*'.[448] The outcome was a shift of plantation development to afforestation of unimproved and improved pasture sites (see Figure 29).

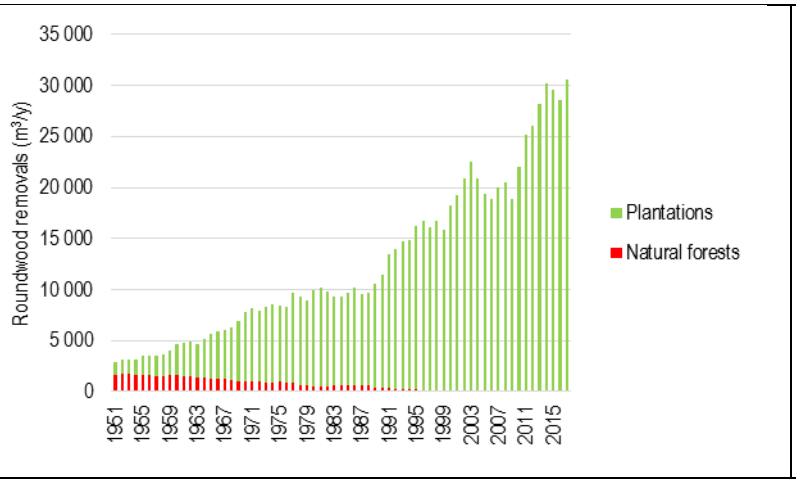

Figure 28: Log removals from New Zealand's natural forests and plantations (1951 to 2017).[449]

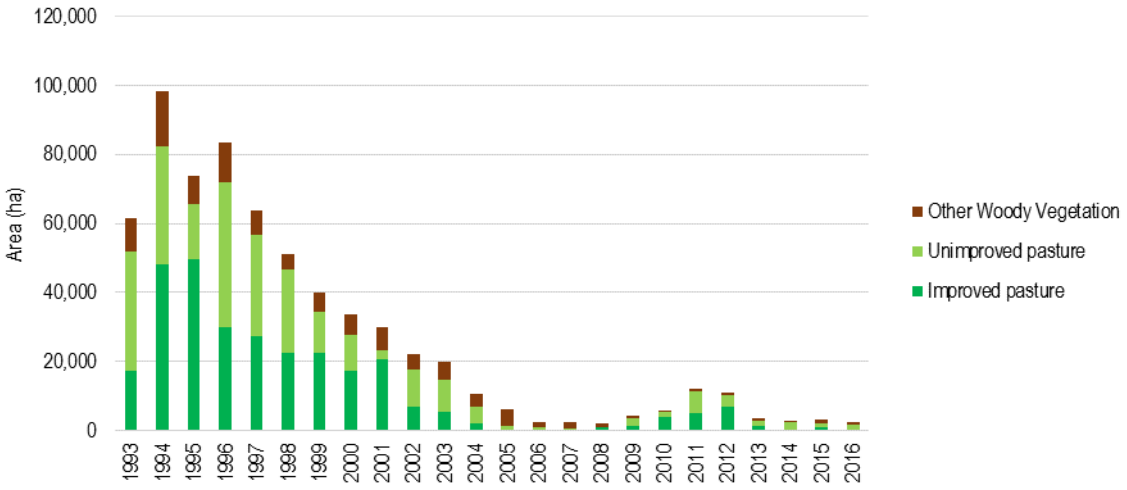

Figure 29: The previous land-use of sites afforested from 1993 to 2016.[450]

[448] Rhodes & Novis (2004).
[449] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/
[450] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/

Climate change and emission trading

2002 implementation of the Kyoto Protocol

Climate change policy has been a significant driver of the New Zealand plantation estate (both in increasing afforestation and deforestation) and climate change related issues formed part of the Wood Processing Strategy initiated in the year 2000.[451] In April 2002 the Government's policy package to implement the Kyoto Protocol included nationalisation of credits and liabilities associated with carbon stored in plantations established pre-1990 (see Box 16). The 2002 statement coincided with the release of the Climate Change Response Act 2002. The distinction between pre-1990 and post-1989 forests is compliant with New Zealand's Kyoto Protocol obligation and New Zealand must account for deforestation of pre-1990 forests (both natural and planted), but not all post-1989 forests (see Table 16).[452] By 2007 the Government had announced a new set of climate policies with the New Zealand's Emissions Trading Scheme (ETS) entering into force in 2008 (Climate Change Response (Emissions Trading) Amendment Act 2008) with subsequent amendments in 2013.[453]

Box 16: A summary of the 2002 actions taken by the New Zealand Government as part of the implementation of the Kyoto Protocol.[454]

In April 2002, New Zealand announced a preferred policy package for the domestic implementation of the Kyoto Protocol, which it ratified in December 2002, focusing on:

- *A price on carbon dioxide emissions, applied at first through an emission charge on carbon fuels. It will approximate the international price but will be capped at NZ$25 a tonne of carbon dioxide equivalent, to be effective from 2008;*
- *Provision of government incentives such as funds or the allocation of emission units for projects that deliver defined reductions in greenhouse gas emissions in any sector of the economy, and are additional to business-as-usual;*
- *Negotiated greenhouse agreements for sectors and industries that would have difficulty in adjusting to a full price on emissions in the first commitment period (2008-2012). This would involve a contractual commitment by the sector or industry to achieve international best practice in managing emissions in return for exemption from an emissions charge;*
- *Government retention of the sink credits and associated liabilities allocated to New Zealand under the Protocol in recognition of the carbon sink value of post-1990 forest plantings; and*
- *Exemption for the agricultural industry from any price measures in the first commitment period, provided the industry is willing to invest, in partnership with the government, in research to identify options for reducing agricultural emissions.*

Participants (and captured parties) could meet their compliance obligations with eligible Kyoto-compliant units (e.g. removal units – RMUs; emissions reduction units – ERUs; certified emissions reductions - CERs) until 1 June 2015.[455] For all sectors in New Zealand, the majority of units surrendered since 2008 have been international credits (ERUs and CERs) and in 2013, 99.5% of units were from overseas and primarily former Soviet countries (e.g. Ukraine and Russia).[456] In May 2014, the New Zealand Government banned post-1989 plantation landowners from the use of international credits after deregistration (due to deforestation) from the New Zealand ETS, required obligations to be met with emission units equivalent to those initially issued (the New Zealand Units).[457]

[451] Rhodes & Novis (2004).
[452] Afriat et al. (2015: p.6).
[453] Afriat et al. (2015: p.2).
[454] Rhodes & Novis (2004).
[455] Afriat et al. (2015: p.8).
[456] Afriat et al. (2015: p.12).
[457] Carbon Forest Services (2014).

Table 16: A summary of the treatment of plantations under the New Zealand ETS.[458]

Category	Pre-1990 forest land	Post-1989 forest land
Participation	Mandatorily – owners become participants when non-exempt pre-1990 forest land is deforested.	Voluntarily – owners can apply to register their post-1989 forest land into the ETS to earn New Zealand Units (NZU)s.
Treatment	They do not receive NZUs for increases in their forests carbon stock. Land-owners or liable parties must pay units for deforestation emissions if more than 2 ha of non-exempt forest is deforested in any five-year period from a minimum estate of 50ha.	They are entitled to receive NZUs for increases in carbon stocks and must pay units for decreases.
Status	• Where forest land was first established before 1 January 1990, it is pre-1990 forest land. • Land that was forest land on 31 December 1989; • Land that remained as forest land on 31 December 2007; and • Land that contained predominantly exotic forest species on 31 December 2007.	• Land that was not forest land on 31 December 1989 • Land that was forest land on 31 December 1989 but was deforested between 1 January 1990 and 31 December 2007; or • Land that was pre-1990 forest land that was deforested on or after 1 January 2008, and any ETS liability has been paid.
Deforestation	Where pre-1990 forest land is deforested, the landowner (or a third party in certain situations) becomes a mandatory participant in the ETS and must pay units for the carbon emitted, unless the deforestation occurs on exempt land, or is offset. Offsetting means that owners of pre-1990 forest land (or a third party if applicable) can deforest pre-1990 forest without incurring obligations to pay units, as long as a new carbon equivalence forest is created. The new forest must be at least the same area and achieve the same carbon stocks as the pre-1990 forest land that is to be deforested, within a specified timeframe.	When post-1989 forest land registered in the ETS is deforested, it is subject to obligations in the ETS including paying back the unit balance of the deforested land. If post-1989 forest land is cleared, but not deforested, due to a natural event or harvesting, participants will be required to account for carbon emissions when they submit an emissions return.

Current policy objectives

The New Zealand Productivity Commission conducted a Commission of Enquiry into the opportunities and challenges of a transition to a lower net emissions economy for New Zealand and prepared a comprehensive report. The report foreword states that: *'Being asked to advise on how New Zealand can best make the transition to a low emissions economy, while at the same time continuing to grow incomes and wellbeing, is perhaps the most profound and far-reaching mandate the Commission could be tasked with'*.[459] The enquiry considered six key questions including: '*e. how to encourage efficient land-use decisions that take into account the costs and benefits of greenhouse gas emissions and abatement (including how costs and benefits may be affected by applying carbon prices or other interventions to different activities) and concerns about international competitiveness.*'[460] The analysis concluded that *'...transition towards a low-emissions land sector over the next 30 years will also likely involve transformative land-use change'*. And *'The biggest driver of change is likely to be rising emissions prices.'*[461] The analysis suggested a rate of afforestation of c.75 000 to 80 000 ha/y over the period of 2018 to 2050 is required to achieve net-zero emissions[462]: increasing the 2017 estate 1.71 million ha (see Figure 16) by 2.4 million ha to

[458] Te Uru Rākau (2015); Te Uru Rākau (2017); Afriat et al. (2015: p.5).
[459] New Zealand Productivity Commission (2018: p.i).
[460] New Zealand Productivity Commission (2018: p.iii).
[461] New Zealand Productivity Commission (2018: p.103).
[462] New Zealand Productivity Commission (2018: Figure 4-15; p104).

2.6 million ha.[463] The afforestation is to include production (for harvest trees) and the expansion of natural forests providing additional biodiversity and cultural benefits to communities.[464]

Implications of afforestation and deforestation to agriculture

The results of a 1990s surveys dismissed an impact of carbon as a driver of the rise and fall in the area planted in the 1990s suggesting there was limited knowledge of the carbon markets at that time[465] and a 2011 survey identified carbon as the least important consideration for tree planting[466] and income from carbon was lowly ranked as an objective by owners with plantations.[467] The significance of carbon has changed (see Table 16). The New Zealand Productivity Commission enquiry concluded that land-use change would have variable regional impacts from modest to dramatic: Canterbury, Otago and Manawatu-Wanganui with the greatest absolute land-use change, driven by conversions of sheep and beef farms; afforestation may include 20% of the Gisborne region; Taranaki's dairy land could reduce by close to 60% as horticultural and plantations expands.[468] There remains a tension between a need to increase the afforestation and the intent to deforest. The implications of deforestation to New Zealand's ability to meet emissions obligations are also significant, requiring information on future rates of deforestation to project New Zealand's likely emissions over the second Kyoto Protocol commitment period and beyond to inform future policy development.[469] A survey of the intent to deforest is conducted annually and the results are modelled under the New Zealand ETS scenarios. Deforestation is estimated to be 44 000 ha between 2017 and 2030: large-scale owners envisage 12 000 ha and small-scale owners 32 000 ha.[470] The conversion is intended to be 47% to dairy; 40% to sheep and beef; 6% to lifestyle / residential; 7% to other land-uses including infrastructure and mining.[471]

Processing, production, price and price controls

Plantations and processing: a strategy of new trees in a new region

The radiata pine established during the 1920s and 1930s in concentrated areas resulted in large quantities of relatively uniform raw materials (with poor wood quality due to a lack of thinning) with low harvest and haulage costs, and bulk marketing by the late 1940s. These were important to the development of a processing industry. A significant step towards processing was that the new Director of the Forest Service was a forest products engineer, and that the Government commissioned a large sawmill near Rotorua in 1939. Industry followed in 1941 with NZ Forest Products Ltd commissioning an integrated sawmill-structural board plant to process radiata pine logs. The first commercial pulping of radiata pine commenced in 1939. During the 1940s and 1950s the Government's focus shifted from plantation development to processing including approval of the establishment of a newsprint and pulp and paper mill in 1943 as part of a "National Pulp and Paper Scheme" and in 1948 Conical Hill sawmill began operating in the South Island.

A new Government in 1949 shifted policy to favour private over public ownership. A 1952 agreement between the Tasman Pulp and Paper Company and the Government resulted in the development of a pulp and paper mill at Kawerau in the central

[463] New Zealand Productivity Commission (2018: p.103).
[464] New Zealand Productivity Commission (2018: p.103).
[465] Maclaren (2007).
[466] Bayne and Coker (2011).
[467] Rodenberg Ballweg (2013).
[468] New Zealand Productivity Commission (2018: p.104).
[469] Manley (2018: p.1).
[470] Manley (2018: p.2).
[471] Manley (2018: p.2).

North Island.[472] While Government sought to provide leadership, in 1952 processing appeared attractive by the Government (as the resource owner) selling logs at low stumpage prices, effectively subsidizing the mill's profits. The building of additional radiata pine processing capacity combined with a re-assessment of future demand and targeting exports in the early 1960s, stimulated a renaissance of Government planting underpinned by political support and financial incentives. In the early 2000s, plantation forestry remained subject to inconsistent forms of control under the Resource Management Act 1991 included consent requirements over much of New Zealand's rural land. The main impact on the forest industry was increased cost and lengthy delays in seeking consents, particularly for wood-processing initiatives.[473]

The Government elected in 1999 softened the free market approach and the plantation industry was again identified as a key contributor to economic development and identified that planning and infrastructure development had not been undertaken in crucial plantation growth regions. A Wood Processing Strategy was initiated in 2000 as a joint whole-of-government and industry approach to biosecurity, climate change, investment promotion, labour/skills/safety, national certification, research / science / technology, the Resource Management Act, trade access, trade enhancement and transport. The broad goal was to formulate and implement strategies targeting identified development barriers to boost investment in New Zealand's value-added wood processing. Funding targeted research and road construction as an incentive, but re-assurance by the Government that it placed a high value on the forest industry was also an incentive, particularly for companies with foreign ownership.[474]

Production quotas and sawn price controls

Growing concerns over New Zealand's natural forests resulted in regulations in 1918 empowering the Minister of Forestry to regulate production at each sawmill: requiring sawmills to report their activities and impose a system of export and domestic price sawn timber controls which remained in place until deregulation 1984. Export quotas followed and timber exports permits were required to control domestic prices under the adage of '*conserving New Zealand timbers for New Zealand use*' to maintain local timber supplies for post-World War 1 construction. The intent of the policy was achieved in maintaining local supply but provided a disincentive to private plantation development.[475] Price controls were maintained in the 1920s and 1930s, but from 1928 to 1934, timber prices fell driven by oversupply from natural forests, competition from imports and regardless of the Governments withholding of supply to support the private industry. An industry rationalisation resulted with the surviving companies less inclined to develop plantations. A Timber Price Committee was established by the Government in 1936 to set standard timber prices (through negotiations with sawmill representatives) due to demand exceeding supply with the end of the Great Depression. Under the Timber Price Committee, natural forest sawn timbers were at the same price as radiata pine, with minimal price differences across timber grades. The Government, however, remained focussed on ensuring low-cost timber for housing and employment opportunities.[476] Price controls were considered by the Forest Service and private industry as a significant disincentive to plantation development extending into the 1940s and 1950s.[477] Depending on the perspective taken, the Government (as resource owner), made processing ventures as attractive as possible by selling

[472] Rhodes & Novis (2004).
[473] Rhodes & Novis (2004).
[474] Rhodes & Novis (2004).
[475] Rhodes & Novis (2004).
[476] Rhodes & Novis (2004).
[477] Rhodes & Novis (2004).

a very large volume of logs at low stumpage prices. The significance of the Japanese log trade increased from 1959 with prices well in excess of the domestic market, which made plantations a more competitive and profitable form of land use.

Overall, price controls inevitably depressed plantation expansions, and highlights a requirement to implement a combined portfolio other policies and incentives.

A price spike

In 1986, the U.S. Fish and Wildlife Service was petitioned to list the northern spotted owl as an "endangered species" and in June 1990 it was declared a threatened species. Under this provision, at least 40% of old-growth forests was required to be left intact within a 3.2 km radius of any spotted owl nest or activity site.[478] This resulted in a search for replacement resources and New Zealand's plantation resource was targeted: the resource included Douglas fir and radiata pine. This resulted in a log price spike[479] with some log-grade prices more than doubling, stimulating increased log exports (see Box 17) leading to calls for a return to Government to intervention to secure supply to domestic processors, increase domestic employment opportunities and prevent a perceived overcutting of the estate. The Government did not intervene.[480]

Box 17: An observations of the situation during the 1990s log price spike.[481]
The 1990s log price boom was akin a gold rush: if a tree could produce one or more logs it was worth considerable money. This resulted in conservation poplar plantings and most of the minor species previously regarded as merchantable to be. It was reported 'that while driving around the rural area, harvesting was happening everywhere'.[482] Farmers with mature stands of trees sold the trees at record high prices allowing retirement of inter-generational debt. However, there were very few small-scale forest owners with little or nil plantations to sell and take advantage.[483] The entities who had recently purchased the state forest assets had a windfall and accelerated the payback of debt.[484] The forest owners over-cut their forests during this brief period and potentially replanting rates did not match the rate of harvest. This experience resulted in price and market signals to the farmers, resulting in the small-scale growers planted up to 100 000 ha annually (the nurseries must have been able to secure seed and ramp up production).

The current industry and the business case for new trees and new processing

The presence of professional organizations and sector associations (processing and marketing), and a constructive working relationships with key stakeholders (e.g. the Government, research organizations, civil society and environmental groups) is a signal of maturation of the industry.[485] Sawmilling in New Zealand continues to struggle economically: around the year 2000 there were 130 sawmills and today there are less than 50. New Zealand sawmills have nil competitive advantage over countries such as China, hence log exports are attractive.[486] New Zealand has four sawmills producing structural sawn timber with the Australian market as significant component. The remaining sawmills process unpruned logs. Until 2030, annual pruned log production has been modelled to reduce by 375 000 m^3 (a reduction of 30%). Furthermore, in 2037 pruned log supply from Kaingaroa Timberlands will cease resulting in a loss of more than 450 000 m^3/y or a total reduction of 70% relative to the current Central North Island domestic consumption. These reductions of pruned log supply will commercially compromise most, if not all, of the pruned log mills. Future processing of a much-reduced volume of pruned logs will most

[478] Andre & Velasquez (2015).
[479] Rhodes & Novis (2004).
[480] Rhodes & Novis (2004).
[481] *Pers. com.* Tombleson & Associates by email Tue 16/04/2019 12:43 PM
[482] *Pers. com.* Jeff Tombleson & Associates by email Wed 3/04/2019 8:47 AM
[483] *Pers. com.* Tombleson & Associates by email Tue 16/04/2019 12:43 PM
[484] *Pers. com.* Tombleson & Associates by email Wed 3/04/2019 8:47 AM
[485] Rhodes and Novis (2004).
[486] *Pers. com.* Jeff Tombleson & Associates by email Tue 19/03/2019 6:14 PM

likely be carried out by the few sawmills processing structural logs, and pruned logs will continue to be exported.[487] New Zealand requires a market for knotty sawn timbers that can justify construction of large sawmills located within the forest resources and reduce prohibitive haulage costs to the port. Such demand would result in a very attractive business case for growing radiata pine on farms and associated new plantings.[488]

Recent dynamics in the New Zealand forestry sector

The 1990s planting spike

The data presented in Figure 19 suggests plantation development in a relatively controlled manner, while the new planting data (Figure 20) indicates turbulence in the development of the New Zealand plantation estate. A more in-depth of understanding can be gained by considering the harvest and replanting of the existing estate by backing-out the new planting areas. The total estate data (Figure 19) was used to calculate the year to year change in the estate as reported as at March 31st each year. The new planting data (Figure 20) reports on the area planted up to the December 31 each year. The afforestation area was subtracted from the year to year area change to indicate the fate of the harvested existing estate and this analysis is presented in Figure 30. The analysis provides the following insights:

1. The area of existing plantations remaining fallow after harvest has varied greatly since 1952 (the red bars below the x-axis).
2. The rate of fallow land compared to new plantations could reflect the different ownership and the maturity of the estate with harvest and replanting (at the most basic level the public compared to private estate noted in Figure 19).
3. The spike in fallow land in the period 199 to 1994 reflects the rate of harvest of standing plantations stimulated by the export induced price-spike compared to the capacity to replant. This followed the sale of Government plantations to private interests and an increased rate of harvest which would have contributed to 'funding' the purchases.
4. This may reflect the change in ownership from public (with associated restrictions) to private with greater agility to react to market signals.
5. The rate of afforestation increased from an average of 4000 ha/y in the 1950s to a maximum of 98 000 ha in 1994 and an average of 55 400 ha/y for the 1990s.
6. The increased planting beyond the year to year change less new plantings would reflect the catch-up planting of fallow land from previous harvests.
7. The scale of afforestation suggests an adequate nursery production ramp-up. Given that opened-rooted plants are planted, limited infrastructure would be required and seed would have been the limiting factor.
8. The fate of the fallow land post 1999 is reported to be deforestation and conversion to agriculture.

[487] Tombleson (2018).
[488] *Pers. com.* Jeff Tombleson & Associates by email Tue 19/03/2019 6:14 PM

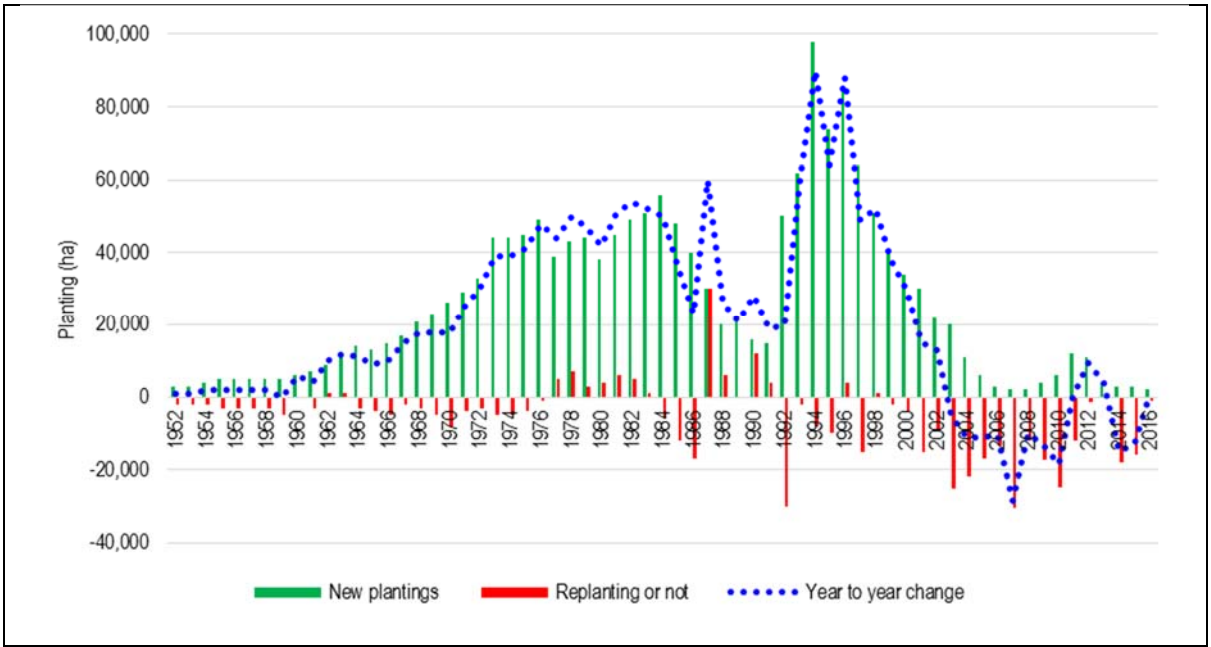

Figure 30: An analysis of the dynamics of the New Zealand plantation estate from 1952 to 2016 considering the area afforestation, the year to year change in total area of the estate and the net of afforestation.[489]

A definitive assessment of what stimulated the 1990s planting boom on farm sites has not been undertaken.[490] The following explores the factors at play at that time to better understand the phenomenon indicated in in Figure 30. Some parties considered that the global price spike for wood in 1993/1994 drove the unprecedented interest in plantation forestry in the mid-1990s despite the fact that the new plantings would be dependent on a price some 30 years into the future. Other parties[491] have considered the impact of log price in combination with other factors. The ability of the New Zealand asset managers to react to the opportunity and the physical ability to handle the logs to export resulted in the log price spike.[492] Log price indexes and afforestation rates are presented in Figure 31. Further analysis considered whether there was a correlation between log price and the area planted (see Figure 32). Both charts indicate a degree relationship between high log prices and the rate of afforestation but the relationship ceases in c.1997. In recent years, New Zealand has had 5 years of the highest log prices since the 1993/94 price spike and yet there is little interest by farmers in planting trees.[493] This supports the premise that a wider range of factors beyond log price drove the afforestation spike.

The 1984 deregulation of the New Zealand economy from one of the most controlled to perhaps the most open economy in the world impacted all sectors.[494] The subsequent recessions in 1991 and 1998 created increased economic pressure. Removals of subsidies and export incentives resulted in c.1.5 million ha of agricultural land to be regarded as marginal or uneconomic, hence new enterprises were required. It was reported that afforestation was often one of the favoured options as woodlots and plantations became more generally part of sustainable farm management.[495] As noted in Figure 24, income generation was a high priority of farmers owning trees. The land afforested included mostly improved and unimproved pasture (see Figure 29). The removal of subsidies resulted in depressed rural land prices which raised the profitability of afforestation

[489] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/
[490] *Pers. com.* Jeff Tombleson & Associates by email Wed 3/04/2019 8:47 AM.
[491] New Zealand Productivity Commission (2018: p.101).
[492] Rhodes & Novis (2004) quoting Ministry for the Environment (1997).
[493] *Pers. com.* Jeff Tombleson & Associates by email Wed 10/04/2019 5:39 AM.
[494] Rhodes & Novis (2004).
[495] Rhodes & Novis (2004: p.27&28) & New Zealand Productivity Commission (2018: p.101).

based on purchased land.[496] The depressed rural economy provided a pivotal component with farmers willing to offer land for afforestation while retaining ownership or willingness to sell land.

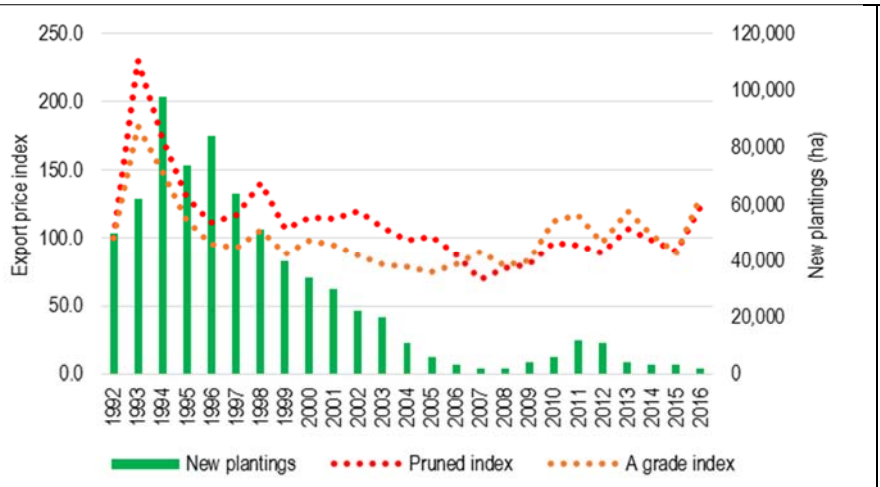

Figure 31: Afforestation and New Zealand's log price index.[497]

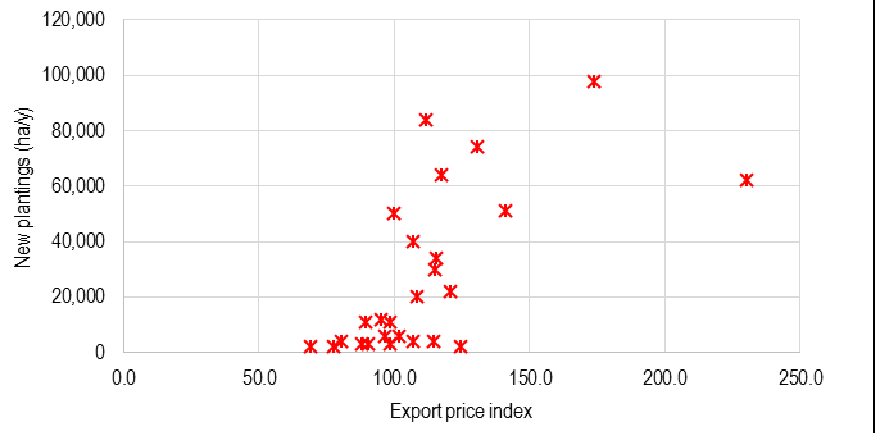

Figure 32: An analysis of afforestation and export log price index.[498]

The majority of the 1990s afforestation was undertaken by small-scale investors[499] and was superannuation focussed.[500] At that time a generally weak equity market in New Zealand (and internationally) prompted private investors to seek alternative investments.[501] Investment in plantations was facilitated via direct investment (trees and land were owned outright by individuals), partnerships (as discussed partnerships were a MIS structure) and the purchasing of shares in a company developing the tree assets.[502] The nature of the parties investing must be considered within the taxation framework: note previous discussions of the impact of a 'cost of bush' treatment under taxation laws (see Table 10 and Table 11). The Government removed the 'cost of bush' treatment and reintroduced immediate deduction of qualifying costs against income

[496] Rhodes & Novis (2004: p.28).
[497] Data presented in Figure 30 taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/
[498] Data taken from Forestry New Zealand dataset: National Exotic Forest Descriptions 2017. Downloaded from https://www.teururakau.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests/
[499] Rhodes & Novis (2004: p.28).
[500] Rhodes & Novis (2004: p.25) & New Zealand Productivity Commission (2018: p.101).
[501] Rhodes & Novis (2004: p.27).
[502] Rhodes & Novis (2004).

from any source in 1991.[503] The liberalisation to any income allowed non-farm related income generated by any person to be offset by an investment in trees.

The 1994 planting spike resulted from an alignment of factors, hence the event cannot be attributed to 'one stimulus' but is the outcome of a crescendo of multiple factors. The fundamental enabler was the motivation of farmers to be involved, not as a positive decision based on the attributes of plantations, but rather as a response to a severely depressed agriculture sector resulting from the 1984 Government policy of deregulation of the New Zealand economy and resulting recessions in 1991. In the absence of land, it is suggested that the planting spike would have been much more subdued. The log price spike resulted from factors in the northern hemisphere and were completely out of the control of New Zealand. However the standing resources, forest manager mandates to export and export infrastructure allowed capture of the opportunity. Regardless, the log price spike added to the attractiveness of plantations. The depressed equity market motivated non-farm individuals to seek alternative investments and available investment structures promoted by plantation developers operating investment products (in operation since the 1970s) facilitated indirect investments. Investment by non-farm individuals was made more attractive by the immediate deduction of plantation development expenses under the New Zealand taxation framework. Carbon has been reported as a nil-contributor to the 1994 planting spike. The factors can be segmented into:

- *Out of left field*: The spotted owl, log prices and log demand;
- *Indirect* : Economic recession, depressed farming driven by Government policy and the depressed equity market;
- *Direct:* Motivated log sellers with available resource and the ability to export, available investment structures, parties facilitating investment and Government taxation policy.

Therefore, the only available options to stimulate afforestation are a positive motivation of farmers, available investment structures promoted by parties with an interest in the resulting resources and taxation treatments.

Deforestation, agriculture and the New Zealand ETS

The previous analysis considered the drivers of afforestation and as noted in Figure 30 post the 1994 planting boom there was a sharp reduction in the rate of afforestation and Figure 33 focuses of the period from 1980 to 2016. Afforestation peaked at 98 000 ha in 1994 and by 2007 and 2008 it had bottomed out at 2000 ha/y with the year to year change in the estate at 1000 ha in 1998. The difference in timing and the scale is due to the net effect of harvest and re-plant or not, and the rate of afforestation. An important point is that the land under the ex-Government plantation assets remained owned by the Crown (see Table 17). Post 1998 there was an increase in the rate of deforestation (nil-replanting after harvest) to a peak of 25 000 ha in 2003. By 2012 deforestation reduced and ceased in 2013, only to recommence in 2014 with 18 000 ha deforested.

Table 17: A summary the ownership of New Zealand's plantation estate in 1990 (see Figure 19).

	Area (ha)	Proportion of the total estate
Private plantations	654 000	52%
Public plantations	607 000	48%

Published information states that deforestation was to create dairy farms (Box 18). The scale of the land-use change is significant with 283 700 ha converted between 1996 and 2008, with a projection of a further 370 300 ha by 2020. The cost of

[503] Rhodes & Novis (2004).

conversion was calculated to be NZD19,655/ha and environmental concerns have prompted some re-assessment of the programme (Box 19). Given the past and actual deforestation and conversion to dairy farms, the average farm gate milk price for New Zealand is presented (see Figure 17)[504] with the analysis of afforestation presented in Figure 33. Average milk price was mostly stable for 1988 to 1998 and then steadily increased. The attractiveness of dairy farming post recovery from deregulation of the economy in 1984 is evident by a steady increase in price. While the rate of milk price increase has fluctuated, there is a linkage to the pattern of deforestation and the reducing rate of afforestation.

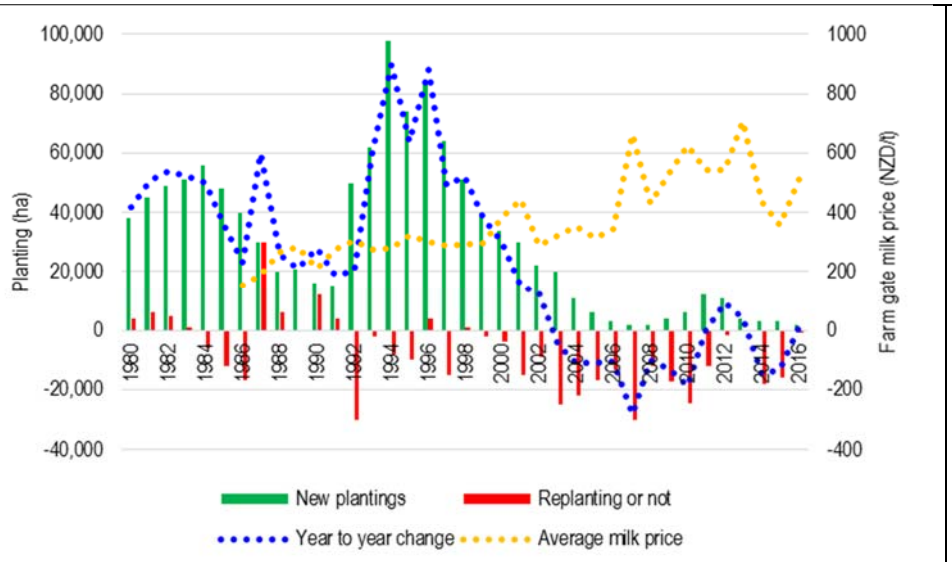

Figure 33: The rate of afforestation and deforestation and farm gate milk price in New Zealand.

Box 18: Examples of conversion of plantations to a higher and best use – dairy.

About 283,700ha of land were converted to dairy between 1996 and 2008, an increase of 23 per cent. It projects that by 2020 another 370,300ha will be added to the dairy estate, another 25 per cent increase. Canterbury has had the highest conversion rate with 122,500ha, an increase of 170 per cent, with another 100,000ha likely to convert to dairying between 2008 and 2020.[505] Three new dairy farms that have been converted from forestry will begin milking for the first time in the new season as part of Landcorp's large-scale dairy development near Taupo. The state-owned enterprise has converted nine farms from forestry in partnership with landowner Wairakei Pastoral. In total, the nine dairy units encompassed 5300ha and milked 13,000 cows, chief executive Steven Carden said. Based on its current timetable, Landcorp hoped to have everything completed by 2020. To date, the project has cost $87 million. "We have four this year, four the next year and four the year after. When the whole thing is finished we are looking at 24 farms and around about 30,000 cows across 25,700ha of land."[506]

Box 19: A more detailed account of deforestation for dairy farming.

New Zealand's largest corporate farmer has announced it will sharply scale back its plans to convert thousands of hectares of forest near Taupo into dairy farms because of financial and environmental concerns. State-owned Landcorp formally launched a review of its plans for leased forestry land at Wairakei Estate last year, citing the low dairy payout, the heavy capital requirements for the conversions and environmental concerns about nitrate leaching into the Waikato River catchment. Chief Executive Steve Carden said Landcorp would now only increase its dairy herds on the Wairakei Estate from around 17,000 cows currently to between 22,000 to 23,000, rather than the originally planned increase to 38,000 to 40,000. He said Landcorp has originally planned to invest a total of up to NZ$285 million in converting the 14,500 hectare Wairakei Estate, but would now invest closer to NZ$255 million. It has already invested around NZ$120 million and the new plans to invest a further NZ$135 million over the next four to five years would be funded from existing cashflow and by increasing bank debt.[507]

[504] Milk farm gate price taken from Organisation for Economic Co-operation and Development data https://data.oecd.org/new-zealand.htm.
[505] Morgan, G. & Simmons, G. (2014) Dairy doing dirty on our environment. 15 Jan, 2014 5:30amhttps://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11186378
[506] Piddock, G. (2014) Landcorp's huge dairy plans start to take shape. 08:25, Jul 15 2014: http://www.stuff.co.nz/business/farming/dairy/10267167/Landcorps-huge-dairy-plans-start-to-take-shape
[507] Hickey (2016).

While the intent to deforest has been driven by conversion of plantations to agriculture (e.g. dairy farms), the pattern of deforestation presented in Figure 33 has been shaped by the New Zealand ETS. The New Zealand ETS entered into force in 2008 but the intent and treatment of plantations was announced in 2002. The two treatments of plantations are outlined in

Table 16: pre-1990 and post-1989 forests. If a pre-1990 plantation is deforested, the landowner must pay for the carbon stored in the plantation and emitted. If a post-1989 plantation is deforested and site has claimed carbon benefits by registration in the New Zealand ETS, the claimed carbon must be re-paid and if the plantation has not been registered, nil liability results. The impending obligation to account for the carbon emitted in pre-1990 plantations announced in 2002 stimulated deforestation of pre-1990 plantations to avoid the obligation set for to commence 2007 (30 259 ha deforested), with the largest area of land-use change occurring in 2008. On commencement in 2008, the New Zealand ETS allowed repayment with international credits and deforestation continued with the surrender of purchased international carbon units available at a much lower price than the New Zealand Units. In 2014, the New Zealand Government banned post-1989 plantation landowners from surrendering international credits and the only allowed unit for repayment was a New Zealand Units.

Current policy and going forward

It is possible to gain significant insights into motivations and responses of the parties involved in the New Zealand plantation sector over the last 30 years to inform future policy and expectations. Table 18 presents a summary of the attributes of New Zealand during periods of afforestation (1984 to 1995) and deforestation (1996 to 2016). Going forward, the current New Zealand Government objective of afforestation towards an additional 2.4 million ha by 2050 will require annual afforestation at close the peak rate experience in 1994 (c.75 000 to 80 000 ha/y). This is a significant challenge. Building on a lack of interest in carbon identified in 2011 (see Figure 24), it has been observed that a high price for carbon generated by growers with plantations established after 1989 is motivating a resurgence of afforestation on farm land.[508] The One Billion Trees Programme is offering a range of grants to land-owners and organisations to plant trees as an incentive (see Table 15). The target trees are not required to be compliant with Kyoto requirements but the compliant areas will add to New Zealand's carbon accounts. The area to be afforested (2.4 million ha) represents 19.8% of the current cleared non-plantation land and will result in 30.4% of cleared land planted to trees (see Figure 15). If dairy remains a higher and best use, current sheep and beef land would be afforested: this would require 28.2% of this land-use to be converted. It is possible that afforestation would be on marginal land within current farming operations. As indicated in Figure 15, the area of sheep and beef land has already reduced from 2002 to 2016 (see Figure 15). Overall there has been a reduction in the area of agricultural and plantation land of 1.6 million between 2002 and 2016: depending on compliance with the New Zealand ETS, this land could be afforested.

[508] *Pers. com.* Jeff Tombleson & Associates by email Wed 17/04/2019 9:54 AM.

Table 18: A summary of the internal and external conditions during afforestation and deforestation in New Zealand (1984-2016).

Factor	Afforestation	Deforestation
Period	1984 - 1995	1996 - 2016
NZ Government policy	The deregulation of the New Zealand economy in 19845 with the removal of agricultural subsidies, changes to exports and floating of the New Zealand dollar result in significant structural adjustment. Divestment of the Government plantation assets (excluding the land).	The segmentation of pre-1990 and post-1989 plantations with different treatments and introduction strategy (with 5 years advanced warning) of the New Zealand ETS prompts reaction from plantation owners.
Agriculture	Agriculture depressed due to deregulation of the New Zealand economy commencing in 19845.	The dairy sector is buoyant driven by increasing milk farm gate price.
Land access	Land values are depressed and land purchase is an option. Land leasing an option.	Land values, particularly for dairy country escalating. Land leasing an option.
External factors	A buoyant log export market and log price spike driven by loss of resources in the Pacific north west following 'spotted owl' focused resource with-drawl.	A buoyant log market driven by exports to China.
Markets	A significant spike in log price driven by exports.	While log prices have decreased from the price spike, they remain high.
Current plantations	New Zealand had a significant and mature plantation asset of suitable species able to be harvested for log exports.	The plantations deforested ranged from immature to mature pre-1990 trees.
Export capacity	New Zealand was able to ramp up export infrastructure and harvest and haulage capacity to capture the export opportunity.	From the initial beginnings (in 1920s) New Zealand has evolved export infrastructure and harvest and haulage capacity to capture the export opportunity.
Owner's motivation	The new owners of the ex-Government assets were able to maximise harvest and log sales to capture the benefits of the log price spike.	Plantation asset managers with control and ownership of the underlying land seek to realise the appreciation in land value. This excludes the ex-Government estate.
Owner's actions	The majority of afforestation funded by small-scale and individual investors.	The majority of deforestation undertaken by large scale corporate investors seeking returns from land conversion to dairy.
Investment vehicles	Direct independent, joint-ventures and shares in MIS vehicles are investment options.	Direct independent, joint-ventures and shares in MIS vehicles are investment options.
Investment promotion	A range of companies have been operating since the 1970s offering direct and indirect investment in plantation assets	A range of companies have been operating since the 1970s offering direct and indirect investment in plantation assets.
Investment returns	Equities are depressed and returns are poor motivating investors (including for superannuation) to seek alternatives.	Equities and other asset classes have recovered.
Taxation	Differential treatment of farmers and foresters on some matters. Specific plantation related expenses are able to be used against any source of income for tax liability calculations in the year of occurrence.	

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