Tree plantations: the green tide that threatens Aysén?

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This article addresses a number of urgent questions about Chile's forestry model and its future in the Aysén region. How many hectares of pine trees are there at present? Will this increase in the short or medium term? Will climate change provide an incentive to set up large-scale pulp plants?

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First-time visitors to the Aysén region in Chilean Patagonia are often surprised by the exotic vegetation which appears alongside the road between the Balmaceda airport and the regional capital Coyhaique. This fifty-kilometer stretch of meadows and native forests is periodically interrupted by organized green pine plantations. However, this genus does not occur naturally in southern Chile, or indeed in the rest of Chile and the southern part of the planet: *Pinus* originates in the northern hemisphere.

This situation is surprising because the large-scale monoculture of non-native species is seen as inconsistent with a territory which has acquired nationwide prestige as a reserve of life. The fights against the Alumysa aluminium plant and the HidroAysén and Energía Austral dams, as well as the region's natural wealth, have added to this overall impression.

Large-scale plantations are now being questioned not only for visual reasons, but primarily because of their impact on the ecosystem, and especially the problems they cause for natural water provision. Not for nothing have they come to be dubbed *"green deserts"* [1].

Hundreds of hectares of plantations can be found in Mañihuales, El Blanco, the Coyhaique and Cerro Castillo national reserves, on the slopes of El Divisadero, in the area around the zone devastated by the Hudson volcano, and on the banks of Lake General Carrera. Because of pine's bad reputation among the population and rumors that in the coming years climate change will lead to temperature "improvements" in Aysén, with the resultant impact on the region's ecosystems, it made sense to ask: could a "green tsunami" be coming to Patagonia, similar to the one that came with the salmon boom?

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Measuring the scope of the problem

A first hard fact is that, in perspective, the pine plantations in Aysén cover a much smaller surface area than they occupy (alongside eucalyptus trees) in central-southern Chile. The 43,000 hectares of this tree in Aysén (primarily the ponderosa pine, and to a lesser extent the lodgepole pine and Douglas fir) are significant, but small in comparison with the 4.4 million hectares of native forest in the region and with the 2.5 million hectares of pine and eucalyptus plantations in the country as a whole [2]. In fact, it constitutes only 1 and 1.7%, respectively, of these figures.

Moreover, “this is absolutely nothing compared with the more than 2 million hectares burnt in the middle of the last century,” explains Alex Fajardo, doctor of forestry science at the University of Montana and a researcher at the Coyhaique-based think tank Centro de Investigación en Ecosistemas de la Patagonia (CIEP). This refers to the political decision taken in the first half of the 20th century to sacrifice biodiversity in this area for tradable livestock on a massive scale.

According to Leonardo Yáñez, the Aysén regional director at Chile’s national forest service (CONAF), one of the main problems today has more to do with perception, pointing out that “if you go to Villa Cerro Castillo or Villa Ortega, all of the pine trees are at the side of the road.”

For sure, although it is not disastrous in terms of number of hectares, the presence of pine trees generates mistrust, mainly as a result of the way that the industry has developed. The species has gotten reams of bad press, despite that poplars, sweet acacias, birch trees, cork oaks and willows are also introduced species to Aysén and Chile as a whole. Moreover, the musk rose, like the lodgepole pine, is already considered an exotic, invasive species, according to the environmental ministry.

“Whether or not it is exotic is not the problem; the problem is the abuse of an overly aggressive plantation model,”explains René Reyes, former president of the national assocation for native forest engineers. Reyes, who is a PhD candidate in energy and forestry resources at the University of British Columbia, Canada, states that the planting of pine trees should not necessarily be seen as negative. He gives the example of a farmer who owns 50 hectares of land (20 hectares of native forest, plus some meadow and agricultural land), who could plant half a hectare of eucalyptus in order to be self-sufficient with regard to firewood and even to sell the excess. In such a case, there would be no reason to see planting as unsuitable.

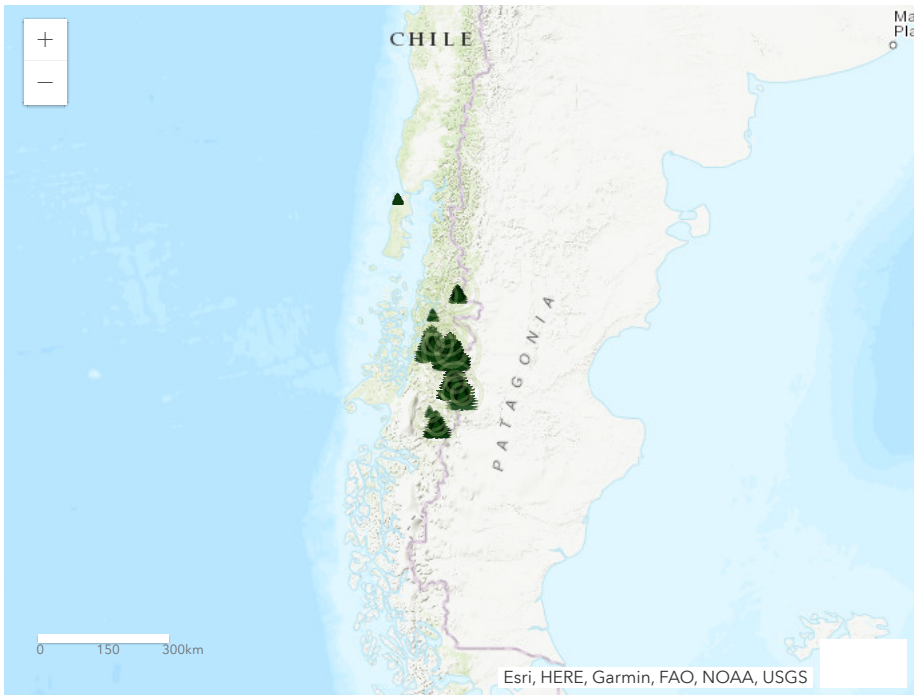
The problem is the model.

There is a key date in the expansion of the forestry industry in Chile: 1974. That year, at the start of Augusto Pinochet’s neoliberal dictatorship, the forestry development law (Law 701) was passed [3]. It provided for a special 75% subsidy toward planting costs, which was taken advantage of mainly by large companies, especially the pulp and paper company CMPC, owned by the Matte family through Forestal Mininco and the Angelini family through Forestal Arauco. In four decades the government gave out $875 million [4] and 1.3 million hectares of land were planted [5], primarily with the fast-growing pine species *pinus radiata/insignis* and the eucalyptus species*globulus* and *nitens*. In 1998, the law was adjusted to facilitate the inclusion of small landholders [6], who could now receive 90% of planting costs (meanwhile, the amount given to large landowners was reduced to half the investment). What was attractive about the new law in many cases, more than the future harvest, was the opportunity to retain a profit margin after forestation. What was good about this, recalls José Urruti, head of the forestry development department of CONAF, is that settlers could use it to recover the most eroded parts of their land.

Over the course of these forty years, a vast green tide which would provide cellulose pulp and sawn lumber took over a large section of the land from the O’Higgins region to Aysén, and was particularly concentrated in Maule, Bío Bío and Araucanía (around 75% of the total amount planted) [7]. As José Antonio Prado, the former director of the Forestry Institute (Instituto Forestal, INFOR) and CONAF, points out, “without taking away from the efforts of the State and individuals to establish

plantations from 1975 onwards, it is impossible not to connect the drastic increase in the surface planted with the adoption of Law 701"[8].

INTERACTIVE MAP: Pine plantations in the Aysen region



This "successful" production model (which, in a mining country, made up 2.7% of GDP in 2013), has had major socio-environmental consequences.

The first of these consequences is the destruction of native plants. Prior to the modifications made to Law 701 in 1998, thousands of hectares of native forest were replaced by plantations, covering the land with densely planted pine and eucalyptus trees which were grown for economic purposes. For example, between 1978 and 1987 around 50,000 hectares of native forest were eliminated from the forest areas of Maule and Bío Bío, while in 1998 one-third of the forests on the Bío Bío coast were replaced by pine plantations [9], according the book *La tragedia del bosque chileno* (The Tragedy of the Chilean Forest).Indeed, Chile's Central Bank and CONAF have acknowledged that between 1985 and 1996 160,000 hectares were replaced [10].

Although the effect on soil acidity is not significant ("forest soils in the south of the country already have a fairly acidic pH,"says Luis Otero of Chile's Universidad Austral [11]), it is clear that the way that forest plantations have developed, transforming the soil by eliminating native tree and shrub species, has had a considerable impact on water availability over the long term, as evidenced by the decline in water yield in forest basins in southern Chile [12], explain Cristian Frene and Mariela Núñez in the article "*Hacia un nuevo modelo forestal en Chile"* ("Toward a new forestry model in Chile").Even the Chilean government has acknowledged that when plantations take up over 20% of a basin, there have been major effects on water resources [13].

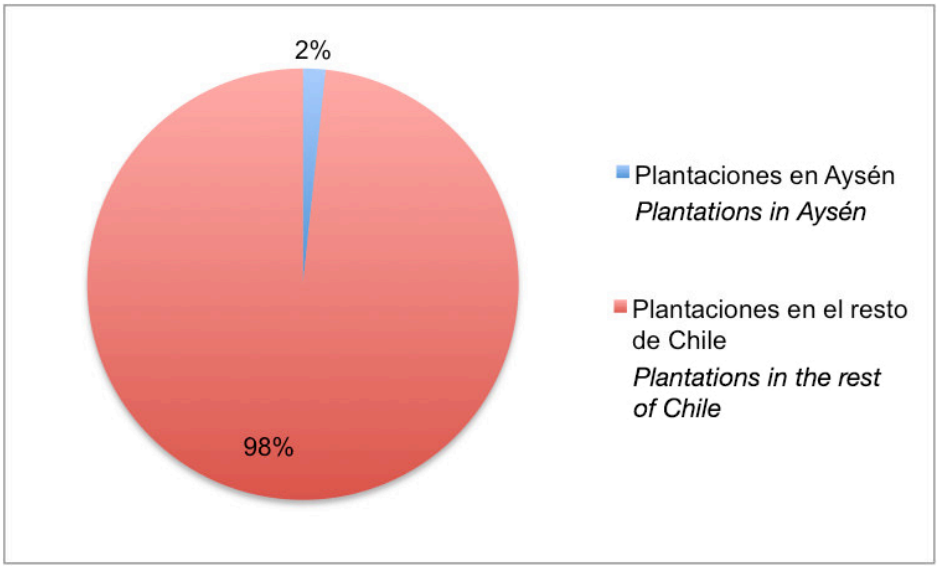
There are multiple reasons for this: pine trees (but to a greater extent eucalyptus trees) consume more water than native species [14]; in forest systems with a high density of individual trees the process of evapotranspiration increases [15]; and trees need more water in their first years of growth [16].

Urritia further explains why monocultures are not recommended: they present significant health risks and increase the risk of forest fires by forming a continuous, homogeneous mass; they cause imbalances in the water regime; and they damage biodiversity and the landscape.

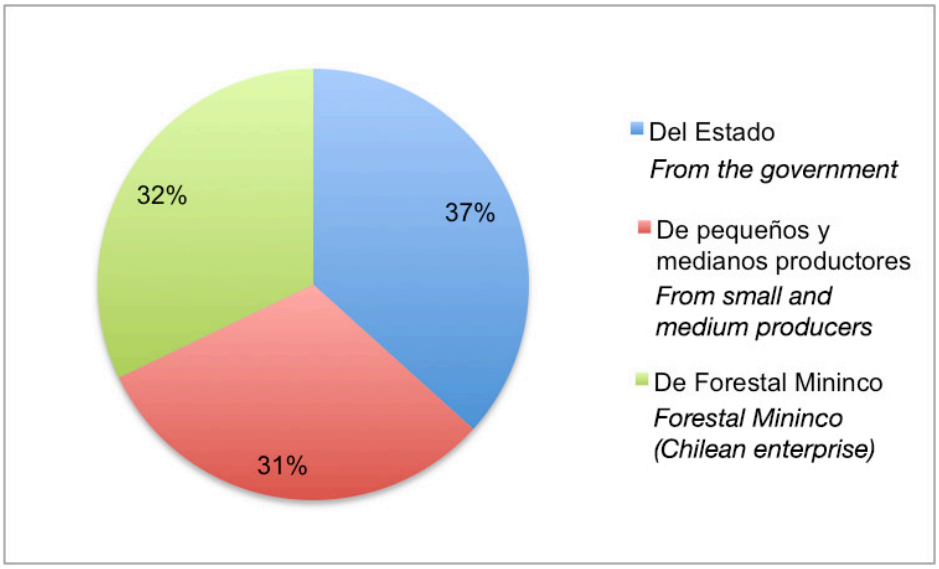
Moreover, numerous social effects have been identified, particularly between Puerto Montt and northern Chile. These include conflicts over land ownership, the loss of cultural and economic diversity, a lack of water for human consumption, the use of herbicides and pesticides, damage to rural roads, and impact on the landscape. Urrutia recalls that during his time at university the comparative advantages of this industry were already being discussed, but in his opinion these so-called advantages were nothing more than "the looting of Araucanian territories, low land values and, most importantly, a cheap workforce."

Overall, in spite of the positive results of this forestry model in macroeconomic terms (around 65,000 jobs in the industry and an average annual export value of $5.5 billion [17]), once the social and environmental effects are taken into account, the overall situation is negative. At the very least, it is not what would be expected from sustainable development in the case of large-scale plantations. The basic reason for this is that the degradation of ecosystems will never be sustainable.

GRAPHICS: Tree plantations in Aysen



Pine tree plantations n the Aysen region represent a minor surface area compared to the tree farms of central and southern Chile. The 43,000 hectares in Aysen are significant, but small in contrast with the 2.5 million hectares in the rest of the country.



The percentages according to type of property.

Are tree plantations a threat to Patagonia?

Pine plantations are not an unusual sight in Aysén. They are so common that, although this may not seem to be the case, they have been growing alongside native trees and in soils eroded by cattle grazing for over half a century. This also thanks in part to major fires in the region [18].

In summary, there are three main elements that have come together, in almost identical proportions, in the more than 43,000 hectares of pine plantation in existence today.

The first of these is the Chilean government's work toward conservation and restoration. In 1948, the Coyhaique National Reserve was created "to protect and recover the soils exposed to erosion following the major fires that affected the region at the start of the 20th century, during the period of colonisation"[19]. In 1956, exotic conifers (ponderosa pine, lodgepole pine and Scots pine, among others) were successfully planted in this protected area, and were then planted in the Cerro Castillo, Cochrane and Jeinimeni reserves, as well as in other state-owned areas. For example, José Urritia states that the pine trees in the Mañihuales Reserve were planted after the 1966 floods. There are now around 16,000 hectares of pine trees [20] on state-owned land.

Secondly, Law 701 encouraged private planting in Aysén (as in the rest of the country), and this was mainly carried out by large companies such as Mininco, which has 13,600 hectares.

Thirdly, small and medium-sized landowners account for 14,000 hectares. The incentive of a 75% subsidy for the planting of fast-growing (and therefore, according to the model, profitable) trees was difficult to turn down, and proved even more tempting when it increased to 90% in 1998. However, according to the experts, in many cases plantations or forests were not established, as in practice the initiative became a system of bonuses which allowed producers to remain on the land through the transference of fresh money.

The first major difference between what has been done in Puerto Montt and Aysén's experience is that the pine planted in Patagonia is not the same kind. The Chilean forestry model is based on the insignis or radiata pine, while the pine trees planted in Aysén were mainly ponderosa pine, followed by lodgepole pines and Douglas firs.

For this reason, there have been concerns in recent years that climate change will alter conditions and massive pine plantations will have better business prospects, leading to a significant increase in tree farms.

There are a number of reasons why the insignis or radiata pine, which had performed so well in the north of the country, was not planted in Patagonia. A report produced by Cristian Rodríguez, assistant director of Mininco's Heritage Centre, and Roderick Jara, Mininco's property administrator for southern Chile, explains that tests carried out by INFOR from the 1960s to 1985 "clearly established that ponderosa pine, Douglas fir and lodgepole pine demonstrated the best results in terms of adaptation, growth, survival and resistance to the cold, and that they were in general better suited to Aysén's soil conditions and cold, harsh climate."Rodríguez and Jara further stated that their business in Aysén was always intended for a market of "wood for construction and external use,"meaning that the trees were intended to be used as sawn lumber rather than pulp.

Ultimately, Aysén's soil was not suitable for the insignis or radiata pine, which is harvested after 12 to 22 years (17 years on average, depending on the aim) [21], while those grown in the region have a planting to harvest time of between 35 and 40 years.

One concrete reason why this industry has not developed to the same extent as in other parts of the country is that in terms of growth, the performance of the ponderosa pine in Aysén is worse than that of the insignis or radiata pine in Concepción or Araucanía.

Photo: CONAF

"After 10 years the insignis pine is at least 8 metres tall and has a diameter of 10 to 12 centimetres, whereas the ponderosa pine will be a metre and a half tall, two metres at most, and have a diameter of about 5 centimetres after 10 years,"explains Víctor Barrera, regional assistant director for the Patagonia office of INFOR.

It is true that there is uncertainty as to whether this characteristic will change, at least in the medium term, as a result of climate change.
"It could go either way. It is possible that with fluctuating temperatures in terms of cold, or with higher temperatures, there will be no further change," says Barrera. The Mininco report adds that, "from the point of view of tree growth and wood quality things could become more complicated than the scenarios we are used to."

This is confirmed by Fajardo, who observes a tendency to believe that global warming would encourage – or incentivise – the planting of pine trees in Aysén because they would grow better without the low temperatures (which are the limiting factor in their growth) or more restrictive conditions in the region.

"However, the outlook is not that clear, since climate change is also leading to droughts, and in particular to dry periods at the end of the growing season, as happened this year, which also restricts the growth of the pine trees,"he adds.
Perceptions of pine plantations must also be considered. José Urrutia thinks that it will be hard to establish new monocultures of exotic species in Aysén because citizens of the region area critical of this kind of production system; in his view, "this is very positive and should be encouraged."

This complex circle closes with the lack of road, energy and transport infrastructure which, according to Fajardo, "are things which can be overcome when the plantation business is doing well, which it isn't in the region."

This state of affairs means that climate change will not necessarily prove to be an incentive to increase the number of pine plantations in Patagonia, and is even less likely to lead to the replacement of native forests. The Chilean forestry boom reached its peak during the 1970s and 1980s, when the forest could be replaced by plantations. Now, following the promulgation of the native forest law in 2008, this is no longer legally viable (although it remains possible through irregular

practices). However, planting trees in eroded soil is still an alternative option. Ideally, these trees will be native varieties, although some suggest that pine can be used as a first step to help the soil recover so that it can then be reforested with endemic species. “Plantations are being managed and in some of them lenga beech is being planted, because this needs a coverage period, especially at the start. And if it doesn’t have this coverage, recovery is very difficult. Now, if you go to Cerro Castillo you can see that in some places pine trees are taking over,” Yáñez explains.

And that’s not all.

In 2015 there arose an important discussion about whether or not to renew Law 701 until 2018, after 40 years of its application, given that it was no longer in effect as of 2013. In addition to questions about the setting up of an unsustainable forestry model, one of the main companies involved in the “cartel del confort”price-fixing scandal was CMPC. Through Mininco, CMPC produces pine and eucalyptus pulp which allows toilet paper to be made.

Since then, the project has stalled in Congress. Ultimately, at present there are no subsidies to support the continued expansion of the green tide.

Pine plantations along the edges of Cerro Castillo National Reserve. Photo: Patricio Segura

Biomass as an energy source: threat or opportunity?
However, climate change presents another possible threat for Aysén’s soil, although, depending on your point of view, it is not necessarily a threat.

A global energy debate has arisen now that the use of fossil fuels is discouraged. In this debate, biomass as an energy source has had a significant role.

Biomass has already been considered by INFOR. “I see development here as more linked to wood fuel,”explains Barrera. The organization has carried out multiple tests with poplars, which is expected to be useful for heating, having already classified the varieties in terms of performance depending on soil depth, temperature and local climate. Poplars also originate in the northern hemisphere and grow rapidly (trees for fuel are grown in two-year rotations). Consequently, when rural landowners come looking for wood for sawmills, this tree is recommended as the best option.

Leonardo Yáñez from CONAF agrees: “Thirty years ago the topic of energy was not a key consideration. However, now the situation has changed and in future lots of plantations will have this aim.”

Some people have now begun to focus on this sector in Aysén, where climate change could be both an opportunity and a threat. It allows us to reflect on the pressure we are putting on the native forest, with 200 or 300 year-old species which end up being slowly burnt or used for cooking. The cultivation of plantations for energy in a cold area like Patagonia could be one route, in tandem with a reduction in consumption, toward energy efficiency and the incorporation of unconventional renewable energy sources.

And of course there are also extensive efforts to recover the native forest.

One example of this is the environmental group Tompkins Conservation, which, according to its website, has “created a thriving nursery of native species to supply reforestation projects” [22]. The foundation’s work in the future Patagonia National Park seeks to restore the environment to its natural state, with particular focus on meadows, while in the Pumalín Park it does the same with native forest.

The Reforestemos Patagonia foundation, linked to the real estate firm Patagonia Sur [23], has planted over 120,000 native trees since 2012 [24]. Paradoxically, this initiative’s list of founders includes Thomas Kimber, the son of Charles Kimber, Arauco’s corporate affairs and marketing director. This forestry company, alongside CMPC, has been responsible for transforming the landscape of southern Chile into an unbroken sheet of green. Furthermore, Kimber Sr. is one of the investors in Patagonia Sur [25].

The discussion on the future of Aysén’s forests and soils is yet to be defined. It depends on the public policies implemented

and on citizens' and inhabitants' convictions on the type of development to promote.

What is clear is that the extractivist model will always be a possibility. Chile's abundant natural resources are a privilege, but they bring with them great responsibility. They are the sword of Damocles which will always hang over Aysén, the reserve of life.

The author, Patricio Segura, has written about science, tourism, corruption, and socio-environmental conflicts for publications in Chile such as Le Monde Diplomatique Chile, CIPER Chile, El Mostrador, La Nación, and El Ciudadano. His work has also been published internationally in Science and Nature. He is president of the Corporation of Development in Aysén, and is currently vice-president of Chile's national journalism association.

FOOTNOTES:

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