



Institute
and Faculty
of Actuaries

The Economic and Environmental Benefits to Individuals and to Society from Investing in Forestry

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Outline

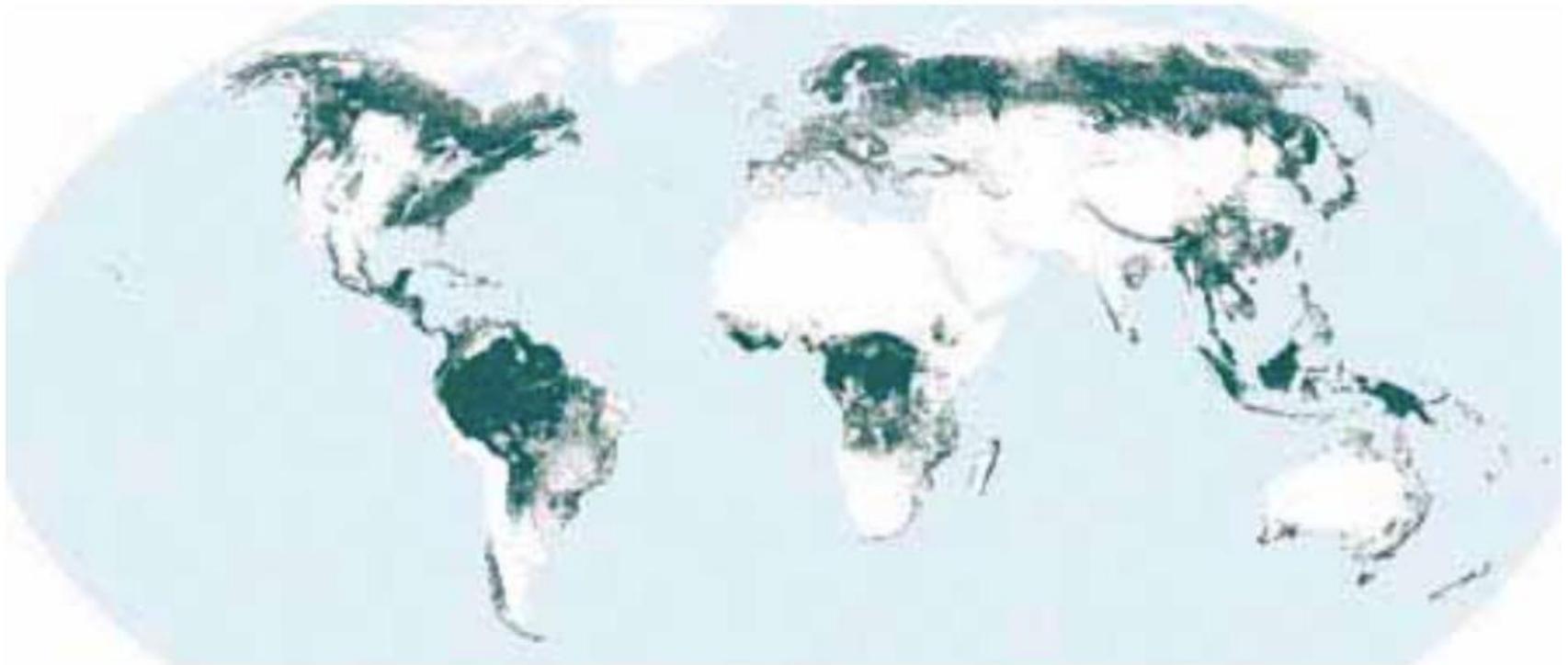
- Purpose
- Overview of forestry
- Forestry investment - how does it work?
- Forestry investment returns
- Managing risks and avoiding pitfalls
- Prudent forestry management
- Comparisons with other asset classes
- Forestry as a pension fund investment
- Benefits to society
- Recommendations

Purpose

- To show how prudential forestry investment can benefit both the individual investor and Irish society.
- To provide material to educate the potential investor to enable them to prudently invest in forestry and at the same time create environmental, economic and social benefits for Ireland.
- To make recommendations to Government to address obstacles hampering greater forestry investment.

Forestry Overview - Worldwide

The world's forests

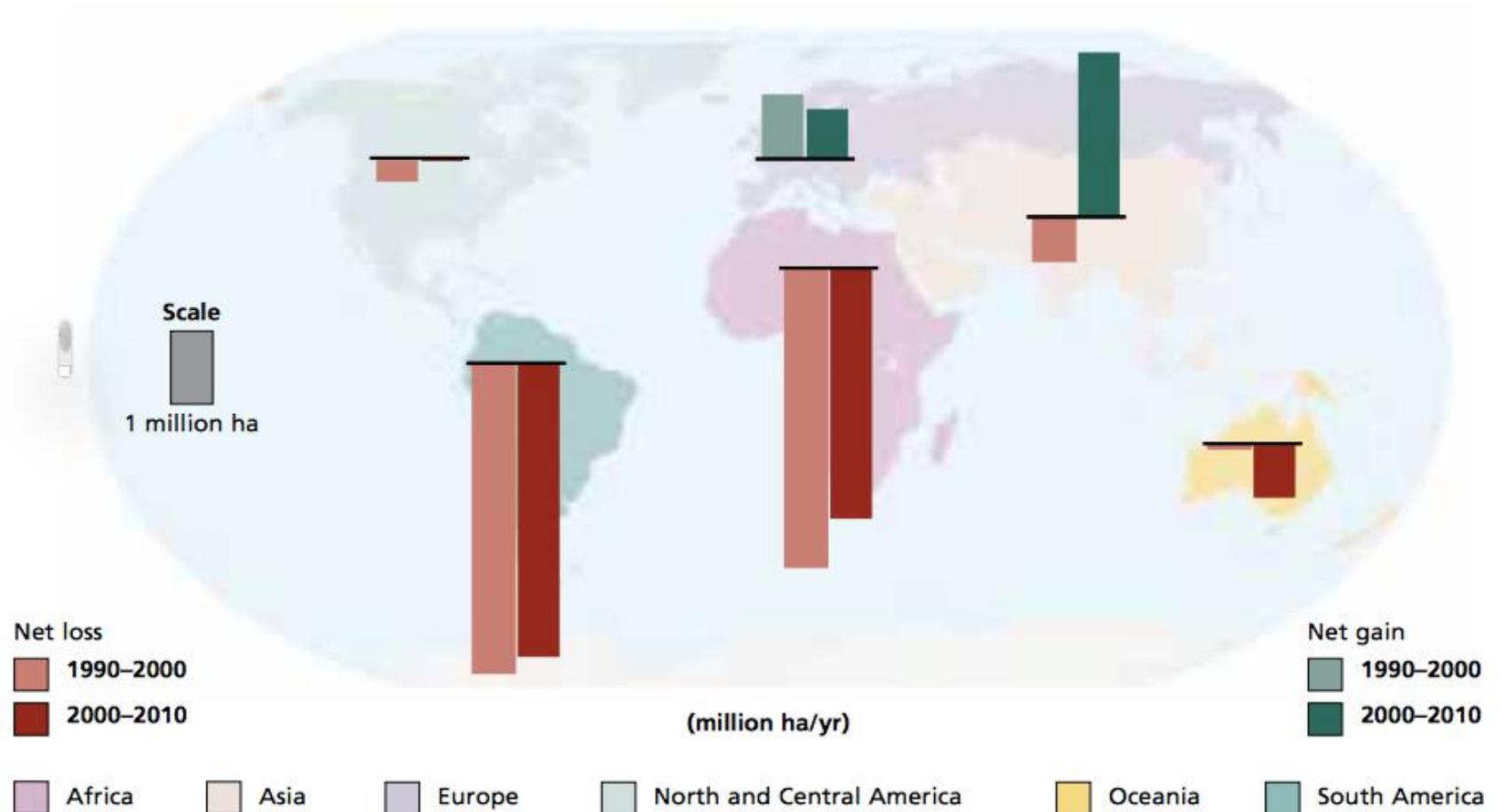


- Forest (> 10 percent tree cover)
- Other land
- Water

Source: UN FAO

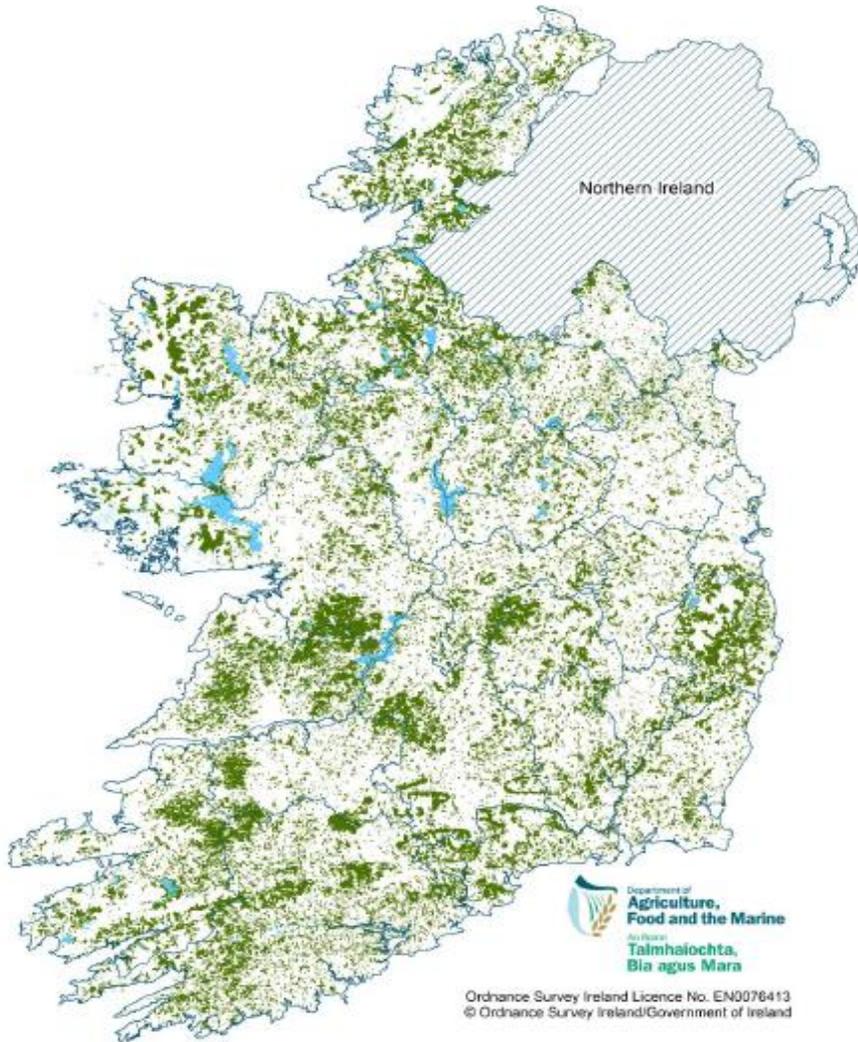
Forestry Overview - Worldwide

Annual change in forest area by region, 1990–2010

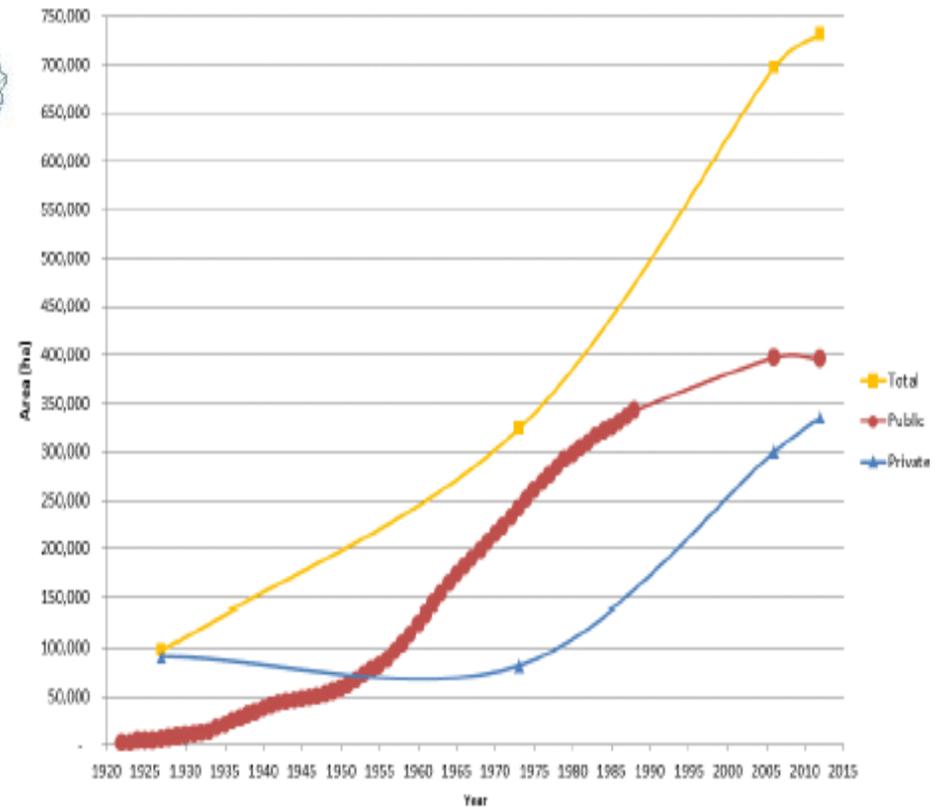


Source: UN FAO

Forestry Overview - Ireland

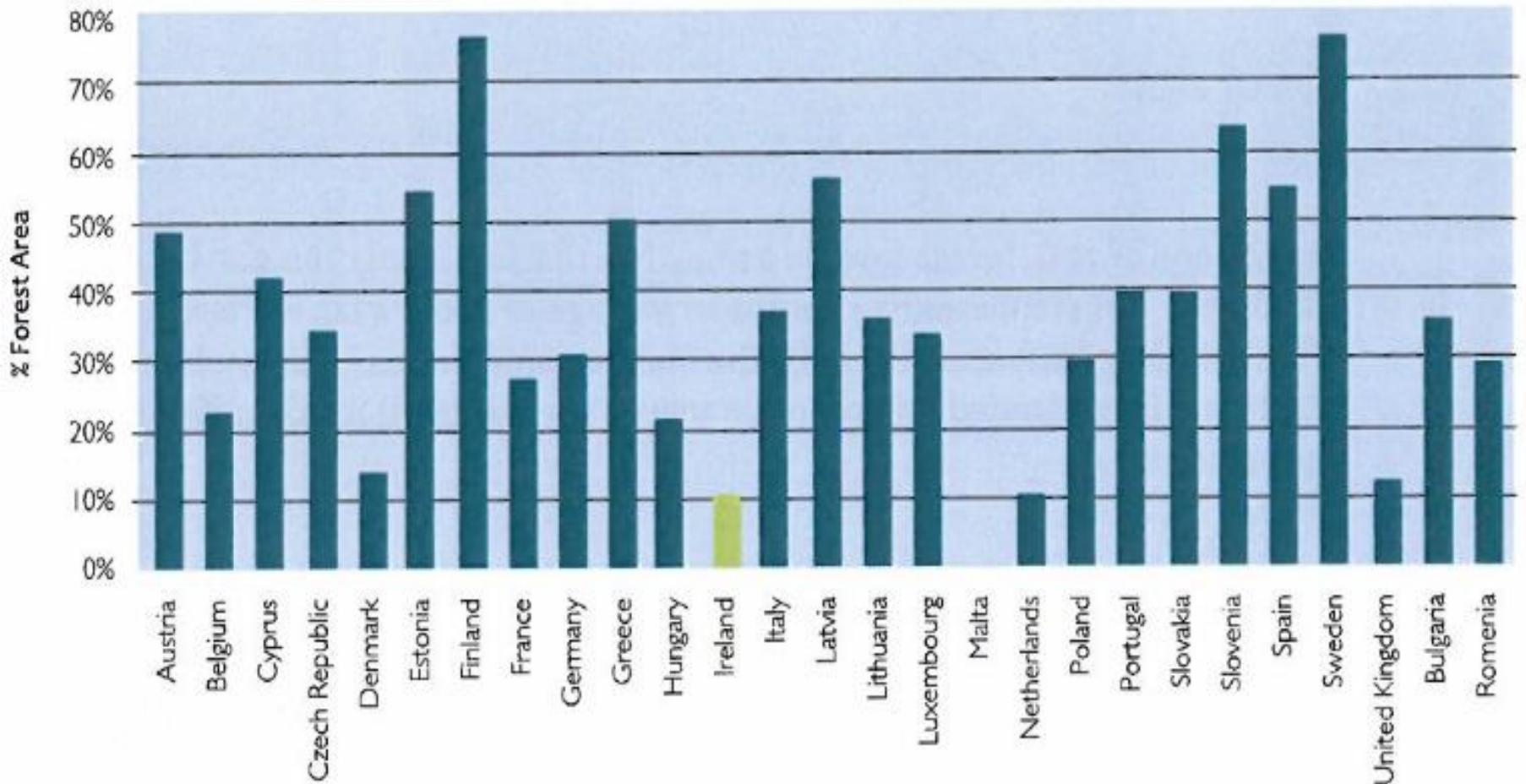


Forestry area in Ireland (hectares)



Source: www.agriculture.gov.ie/

Forestry Overview - Ireland



Source: Eurostat

Forestry Investment

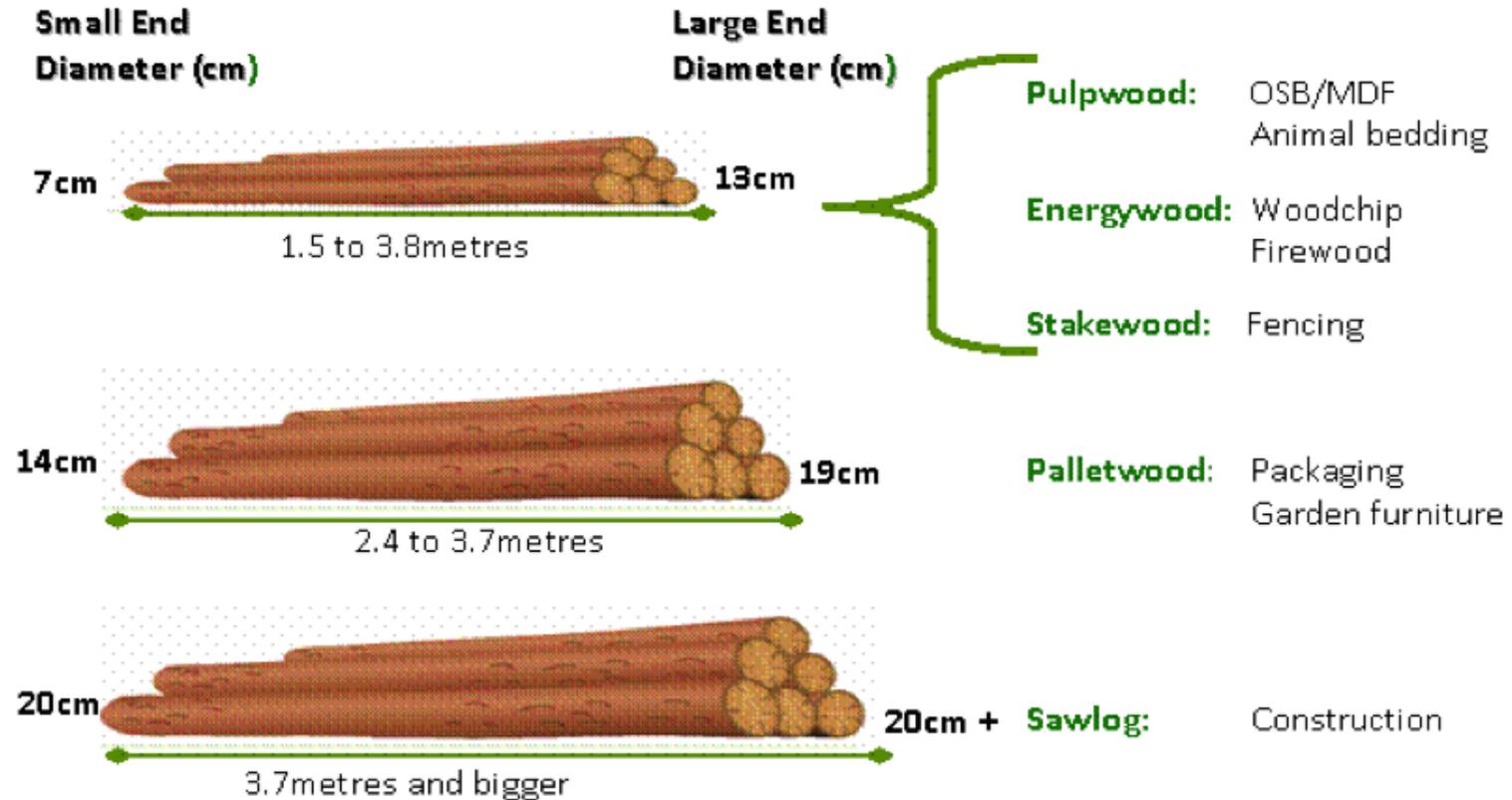
- How do you invest in forestry?
 - Directly – buying forestry land
 - Indirect – investing in a forestry fund
- How much money do you need to invest in forestry?
 - Directly – ~€50,000
- How much grants are available?
 - Approx €3,000 per hectare to plant and establish trees
 - €440 per hectare per annum for 15 years after planting
(subject to approval from the forest service)

Forestry – How does it work?



Photos from <http://www.roundwoodtimber.ie>

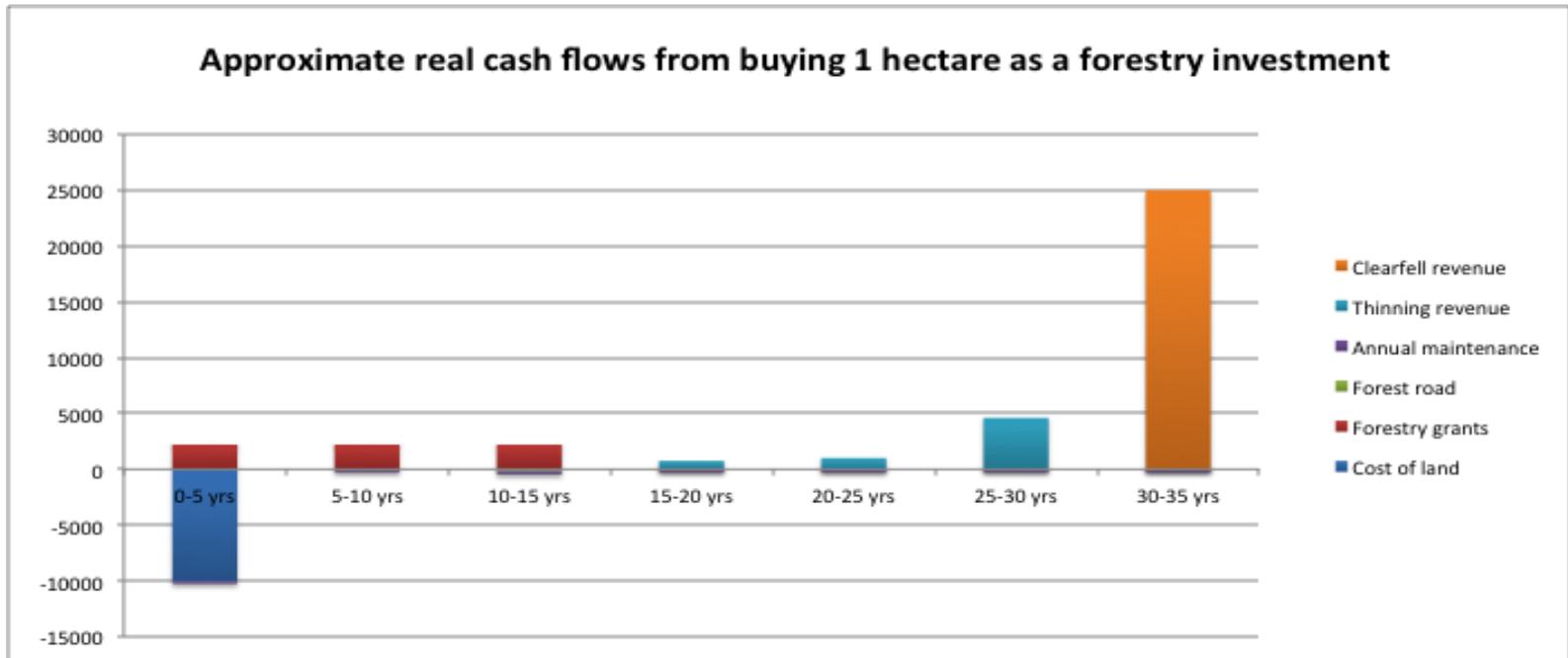
Forestry – How does it work?



The aim is to maximise the straight timber produced – which is much more valuable than crooked timber, in particular sawlog.

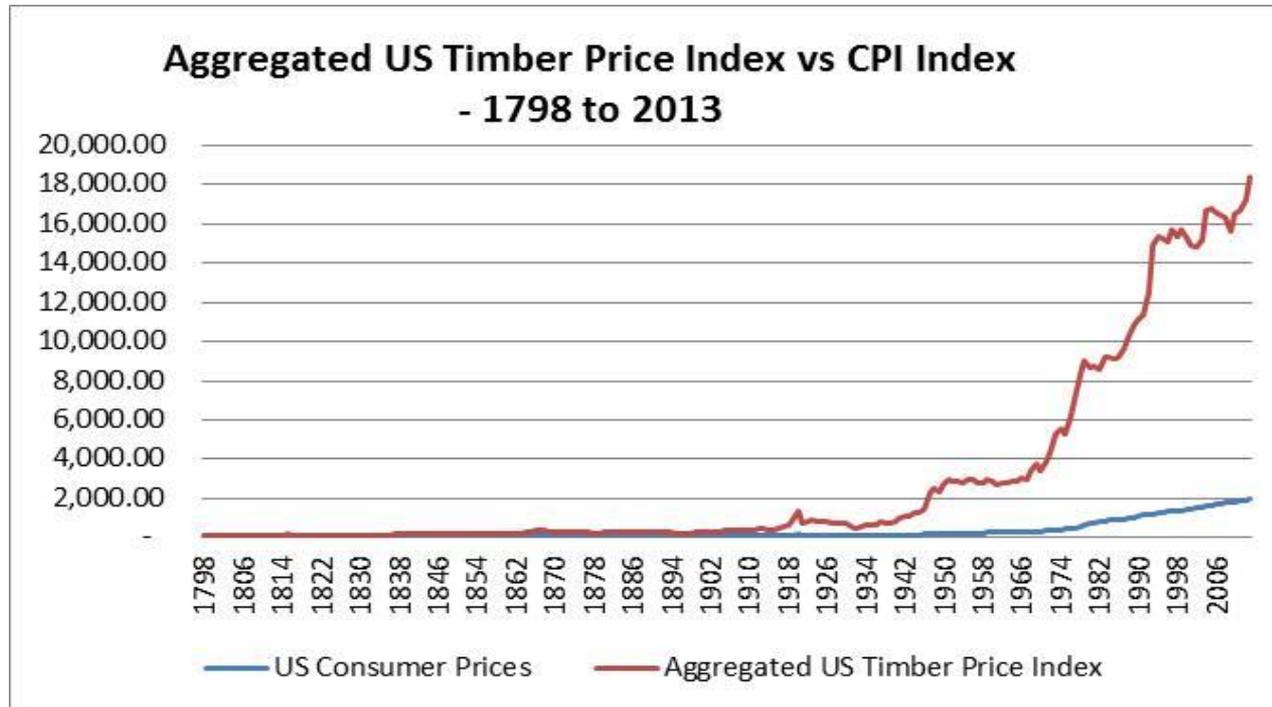
Investment returns

- What investment return are you likely to get from investing in forestry?



- The investment return largely depends on the price paid and the site productivity – this determines the real yield of the investment (it is important to pay the right price for forestry!)
- Return = Real yield plus change in timber prices
- Historical returns of 7-10% a year – assuming prudent management.

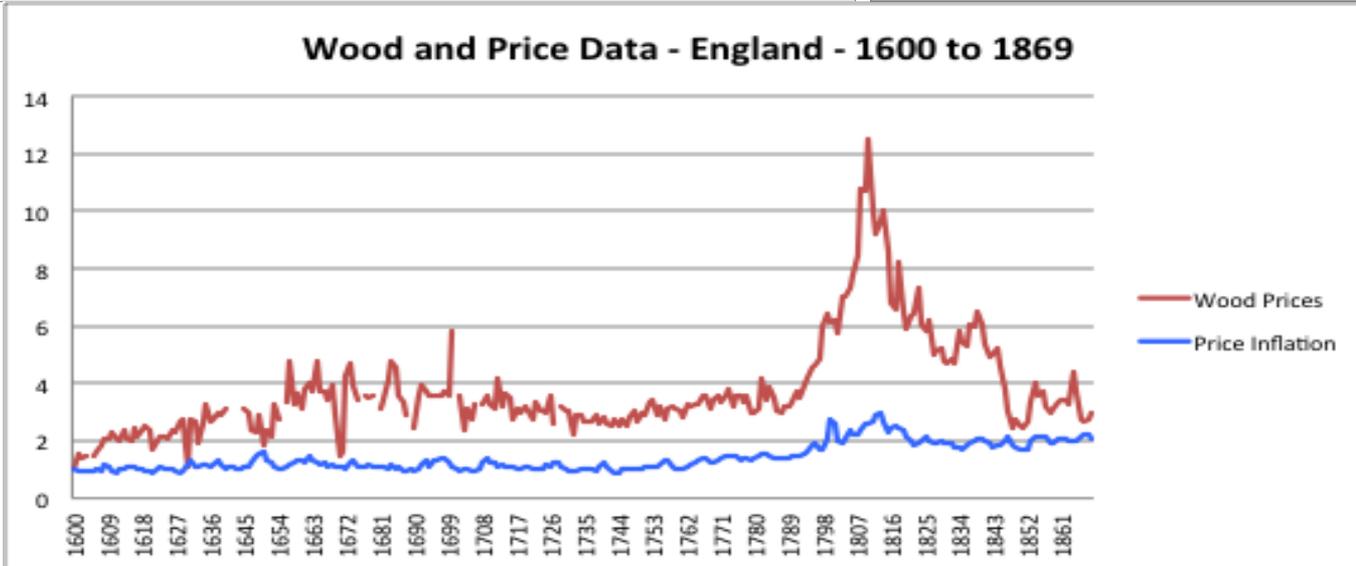
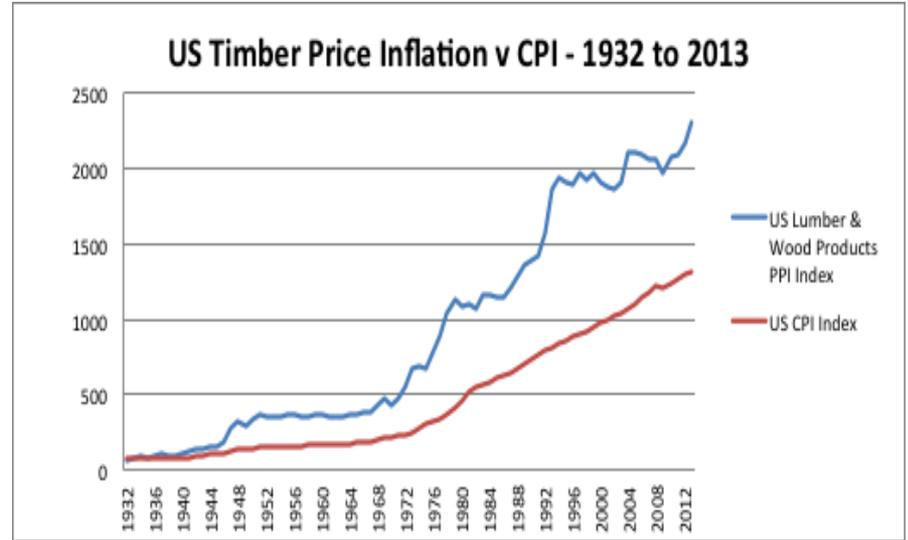
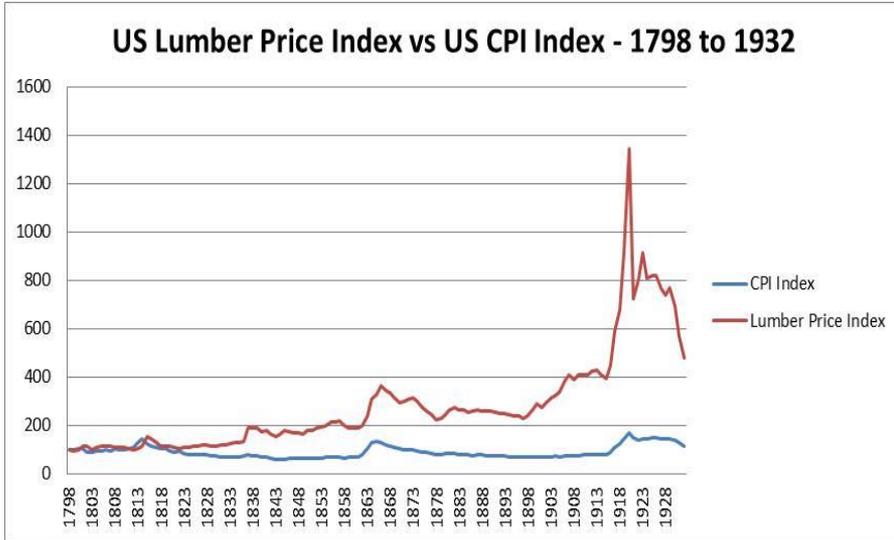
Historical analysis of timber prices (1)



Geometric average US Timber Price Change (1798 to 2013) = 2.45%
Geometric average US CPI Change (1798 to 2013) = 1.39%

Source: Cornell University Wholesale US Timber Price Series (1720-1932) data <http://krishikosh.egranth.ac.in/bitstream/1/2033061/1/19536.pdf>. From 1932 to 2013, US Lumber and Wood Products component of the US Producer Price Index www.bls.gov. The US CPI data was taken from the Finance, Economic and Investment Dataset of the Society of Actuaries in Ireland. www.actuaries.ie

Historical analysis of timber prices (2)



Source: "The Long March of History: Farm Wages, Population and Economic Growth, England 1209-1869" Gregory Clark Economic History Review, 60(1) (February, 2007): 97-136.

Historical analysis of timber prices (3)

Annual changes in US timber prices and CPI over time:

	CPI	Timber Price	Difference
1798-1848	-0.88%	1.08%	1.96%
1848-1898	0.10%	0.70%	0.60%
1898-1948	2.21%	4.80%	2.59%
1948-2013	3.55%	3.10%	-0.45%
1990-2013	2.54%	2.22%	-0.32%

Note: Construction of Aggregate US Timber Price Index

-The Cornell University Wholesale US Timber Price Series (1720-1932) data was used from 1798 to 1932.

-The Series was rebased to start at 100 in 1798.

-Price data was available from both the Cornell data and the US Bureau of Labor Statistics from 1926 to 1932. They showed similar price changes – differing by about 1-2% overall for the period. The Cornell data was chosen as this showed the most lower estimates.

-The Aggregate US Timber Price Index was then inflated by the US Lumber and Wood Products component of the US Producer Price Index from 1932 to 2013.

Historical analysis of timber prices (4)

Analysis of extreme timber price falls

US Timber prices have *fallen by more than 10% in 6 years since 1798*.

Worst price fall: 1921 – prices fell 46% as supply shortages from WWI faded - however, prices had risen by 14% in 1916, 31% in 1917, 16% in 1918, 26% in 1919 and 46% in 1920, a cumulative 340% in the previous 5 years.

Second and third worst price falls: 1931 & 1932 (during the Great Depression) - prices fell 19% in 1931 and by 15% in 1932. However, they then rose by 20% in 1933 and by 16% in 1934.

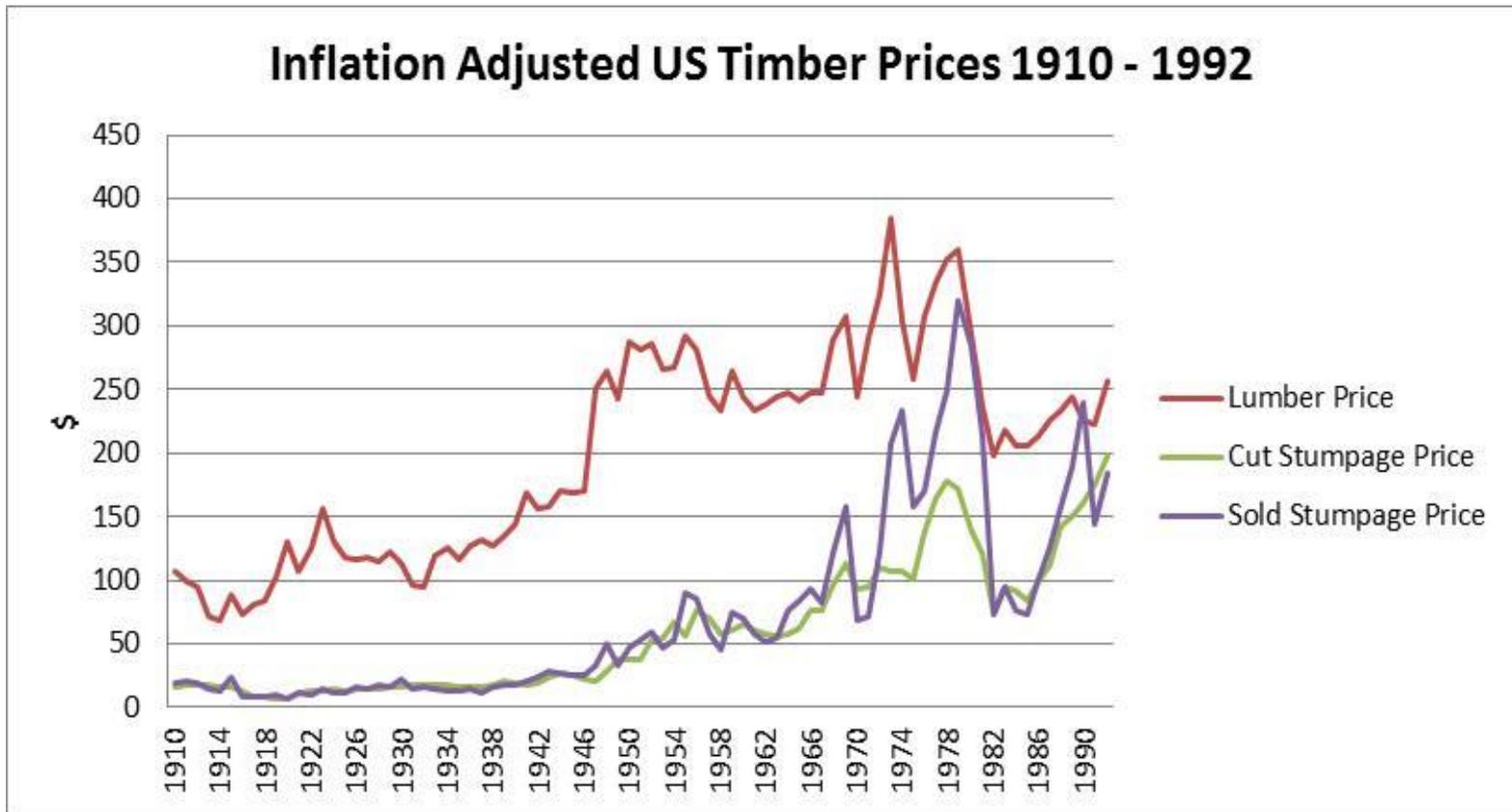
Fourth worst price fall: 1924 – prices fell 11.4% - however, they had risen by 11% in 1922 and 13% in 1923.

Analysis of extreme spikes in timber prices

US Timber prices have *spiked by more than 10% in 38 years since 1798*. They have spiked by more than 20% in 9 years since 1798 and by more than 30% in 6 years since 1798.

The six largest yearly increases were 55%, 46%, 41%, 37%, 36% and 31%.

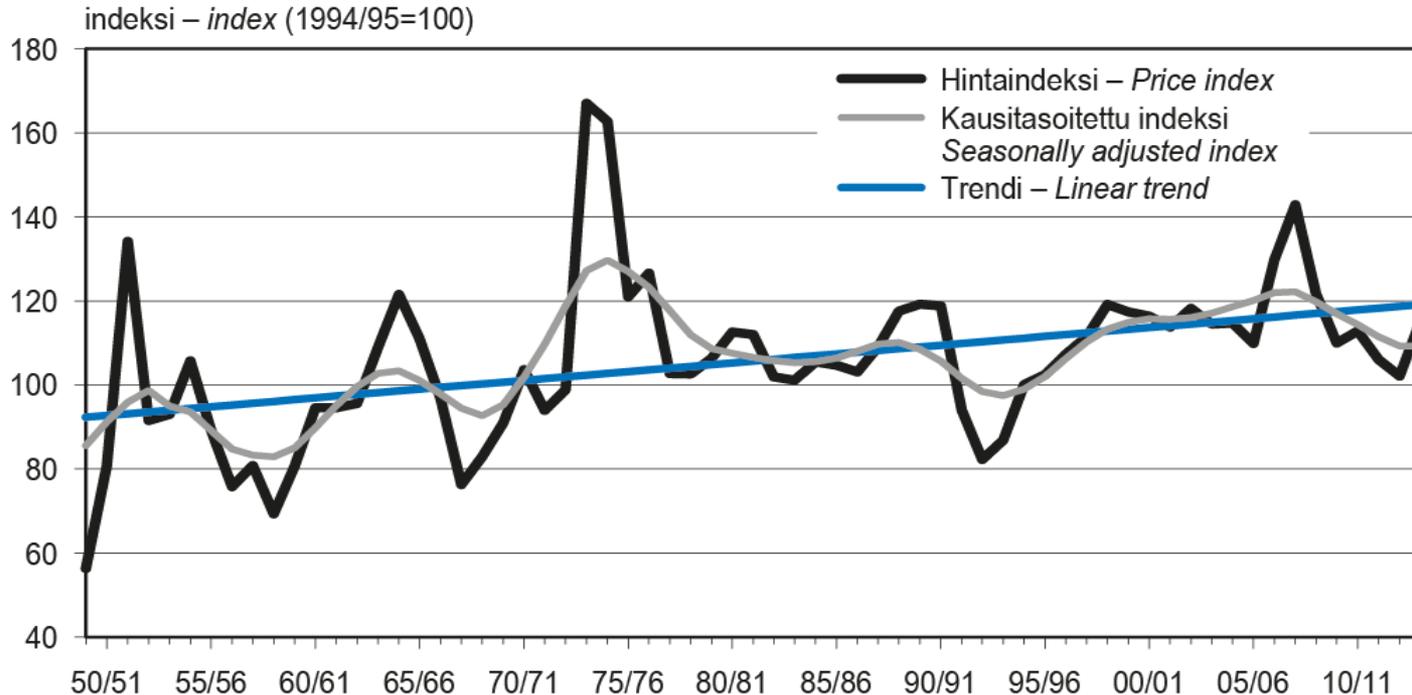
Cost of timber production



Between 1910 and 1992, the inflation adjusted timber price paid to the grower has increased by an inflation-adjusted 3% - compared to the inflation-adjusted lumber price increase of 0.4%

Source: USDA

Finnish roundwood timber prices



Hakkuuvuosi: 1.7.–30.6. – *Felling season: 1.7.–30.6.*

Hinnat on deflaoitu hakkuuvuoden 2013/14 rahanarvoon (tukkuhintaindeksi, 1949=100).

Kiinteinä painokertoimina kunkin puutavaralajin arvo-osuus, joka on puutavaralajin keskimääräinen osuus kantorahatuloista yksityismetsien pystykaupoissa vuosina 1987–2013. Kausitasoitettu indeksi: 9 vuoden painotettu tasoitus.

Prices are deflated to monetary value of felling season 2013/14 (wholesale price index, 1949=100).

The proportional values of the roundwood assortments as the share of the stumpage earnings between 1987–2013 are used as fixed weight coefficients. Seasonally adjusted index: 9 years' weighted adjustment.

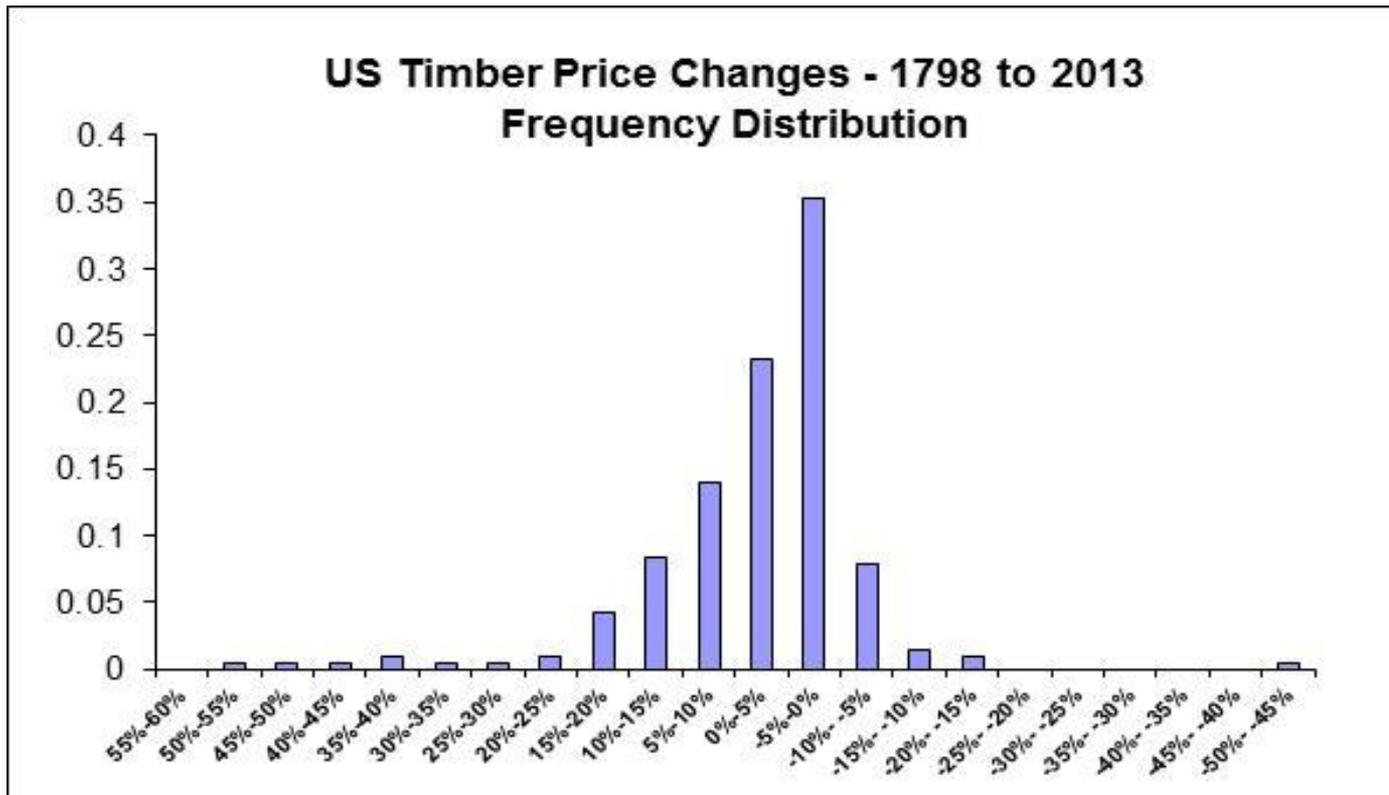
Lähde: SVT: Metsäntutkimuslaitos, metsätalastollinen tietopalvelu – *Source: OSF: Finnish Forest Research Institute*

Reaalinen kantohintaindeksi hakkuuvuosittain 1949/50–2013/14

Real stumpage price index by felling season, 1949/50–2012/14

Metsätalastollinen vuosikirja 2014

Potential to enhance returns



Positive Skew
Coefficient of
US Timber
Price Change
(1798 to 2013)

=

1.22%

- 1) Do not invest in forestry when it is based on timber prices that have spiked higher or timber prices that are overly elevated compared to long-term averages.
- 2) Aim to harvest and sell timber when timber prices are above their long-term averages.

Managing risks and avoiding pitfalls

Agent Risk

- Unscrupulous operators, conmen and cowboys.
- Breaking contracts, not paying for timber, fraud & other sharp practices.
- Misalignments of interest, a lack of transparency and difficult price discovery in the industry.

Mitigation: shop around when selling but only deal with individuals of appropriate character

Hazard Risk

- Wind, fire and frost.
- Pests, diseases.

Mitigation - buy insurance and use prudent forestry practices.

Regulation & taxation risk

- Regulatory and taxation changes.

Upsides risks

- Potential for higher growth rates due to more CO₂ in the atmosphere.
- Potential for subsidies for carbon sequestration.

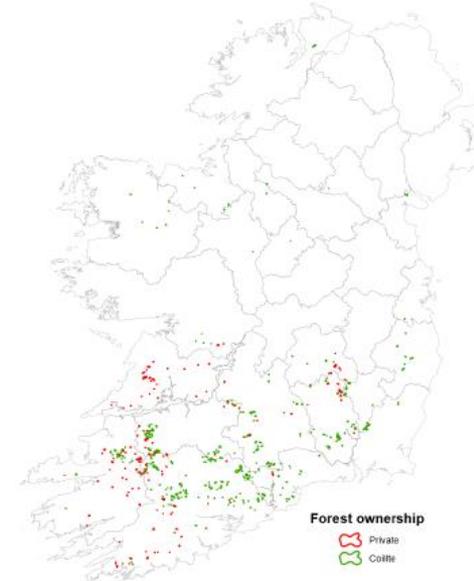
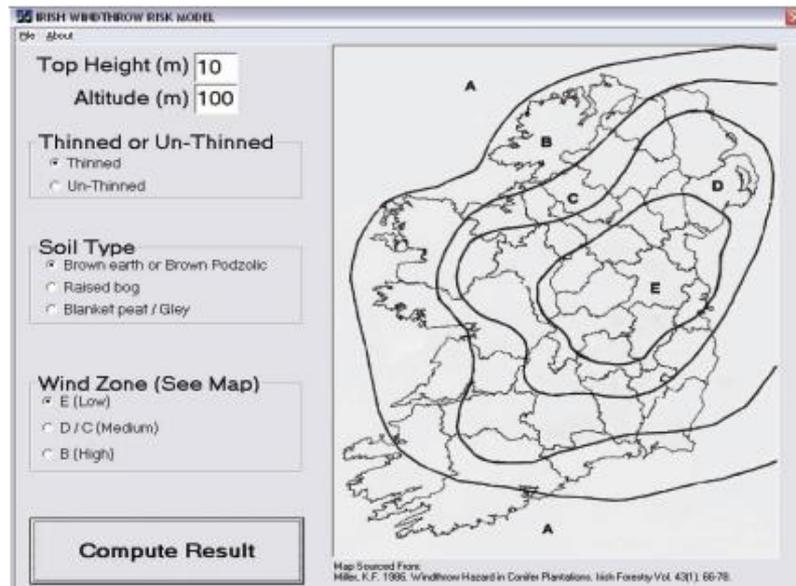
Hazard risk - wind

Windthrow risk is the risk that trees are uprooted or broken by wind before they are mature.

The factors that influence this risk are:

- Wetness of land – plantations with better drainage, e.g. on a hillside, should mean the roots of the trees are more secure, reducing the risk of wind/storm damage.
- Height/age – the higher the trees the greater the risk.
- Planting method – Crops established following ploughing on gley sites have a significantly higher windthrow risk than those established following hand-turfing (23-32% versus 0.4-1.1%).
- Thinning method – poor management of a thinning which opens up large gaps in the plantation can increase the risk.
- Location / wind zone / exposure of site

Hazard risk - wind



Source: Coford

The map above indicates the areas at greater or lesser risk from wind/storm damage (A = most exposed, E = least exposed). Local factors can also be relevant.

The different geographic exposures to wind / storm risk can be seen in the geographic distribution of damage resulting from Storm Darwin in 2014.

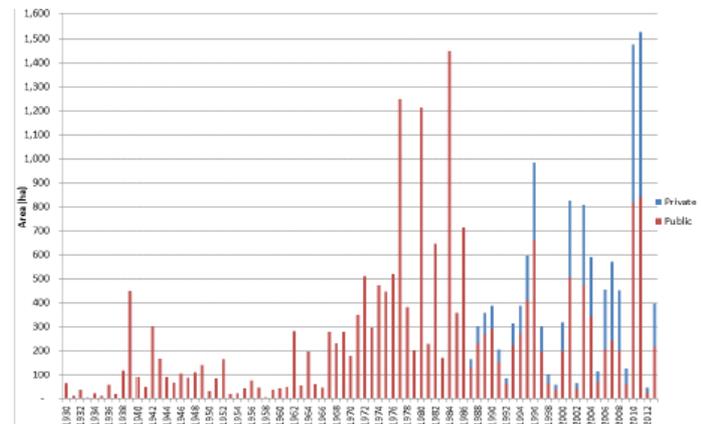
The main methods of mitigation for windthrow risk are insurance and using shorter rotation crops.

Hazard risk - fire

- The average percentage of forestry land experiencing forest fires per annum = $\sim 0.1\%$. The risk is mostly relevant during the months of spring.
- The number of months of exposure is somewhat lower than the rest of Europe due to our damp climate. The Irish Met Office has a forest fire warning index operating during these months.

<https://www.teagasc.ie/crops/forestry/fire-weather-index/>

- The factors that influence this risk are:
 - Age of plantation
 - Month of the year
 - Existence or otherwise of dry vegetation on site or nearby (e.g. gorse, purple moor grass and heather)



The main method of mitigation is insurance. The cost is typically about 0.3% of the value of the plantation. Firebreaks can be useful along with vigilance during dry periods (late spring)

Hazard risk - frost

The average percentage of forestry land experiencing frost damage is approximately 2% per annum.

The factors that influence this risk are:

- Age (0 to 5-7 yrs old)
- Height (up to 2m)

The main method of mitigation is to monitor and filling-in if need be, along with using frost hardy provenance.

Hazard risk – pests & disease

Animals, including deer, sheep, cattle, and squirrels can do very significant damage to a plantation particularly in the early stages.

The main method of mitigation is adequate deer fencing.

Disease risk also exists. To date there has been no significant disease risk to the main forestry crop in Ireland, namely Sitka Spruce.

However, this is no guarantee that it will not happen in the future. Getting insurance for such risks is very difficult and likely to be very expensive.

Prudent forestry management (1)

Free advice is available from Teagasc for anybody considering investing in forestry

Prudent management of a forest should both help to reduce risks and enhance returns.

Lifecycle of a forest

- Buying forestry land

- Planning, planting and establishing trees

- Managing the plantation

- Harvesting

- Replanting

Prudent forestry management (2)

Buying forestry land:

- Various websites with forest land for sale, e.g. www.forestsales.ie
- Paying the right price – forestry valuation
- Factors to consider:-
 - Can you get grant approval
 - Topography, vegetation and drainage
 - Soil type, soil testing and assessment
 - Accessibility and location (relative to markets etc)
 - Species suitability
 - Pests, flora and fauna
 - Environmental restrictions
 - Special requirements; fencing, drainage, road engineering (bridges etc.)

Prudent forestry management (3)

Planning, planting and establishing trees:

- Some planning essential – e.g. how will you extract the final crop
- Which planting method to choose – e.g. ploughing on gley sites has significantly higher windthrow risk than from hand-mounding.
- What planting density to choose
 - Trees should be competing with each other for the light, making them grow straight
 - The closer they are, the more they need to grow straight, and the less room they will have for branches. But you do not want them too close either or the trees will be too thin and not the final crop will not maximise the amount of sawlog produced (the most valuable timber).
 - Current consensus is that 2500 per hectare is optimal (Sitka).
- Monitoring for frost or animal damage in the first 4 years and rectify any problems.

Prudent forestry management (4)

Managing the plantation after establishment:

- Once the plantation is established, it mostly looks after itself and needs minimum maintenance.
- Adding a forestry road to the plantation will typically need to be considered before any harvesting. When considering the road, the cost of the road should be less than the reduction in cost from more efficient timber harvesting.
- Inspection paths will need to be established so that the optimal time for the first thinning can be established.

Prudent forestry management (5)

Harvesting :

- Hiring contractors of good character
- Shop around for the best price, especially for the clearfell:

Sawmill	Location	Website
Balcas Ltd	Co Fermanagh	www.balcas.com
ECC Timber Products Ltd	Co. Galway	www.ecc.ie
Glennon Brothers Ltd	Co. Longford & Co. Cork	www.glennonbrothers.ie
GPWood	Co. Cork	www.gpwood.com
Murray Timber Group Ltd	Co. Carlow & Co Cork	www.mtg.ie
Coolrain Sawmills	Co. Laois	www.gardendeckingfencing.ie
Woodfab Timber Ltd	Co. Wicklow	www.woodfabtimber.ie

- Smaller local sawmills near a plantation may offer better prices, e.g. due to the lower transport costs.

Prudent forestry management (6)

Harvesting :

Suggestions for when thinning the crop:

- Thin at roughly 4 year intervals beginning at approximately age 18
- When thinning try not to create significant holes in the forest canopy. The canopy is effectively the production factory of the forest – any holes in it let the productive light from the sun hit the forest floor rather than being used for photosynthesis.
- Avoid heavy or delayed thinnings that create large gaps – this can significantly increase windthrow risk
- Ideally thin during spring as it gives trees that get exposed more time to get used to the wind and it also gives the canopy the quickest recovery time.

Prudent forestry management (7)

Harvesting :

Suggestions for when thinning the crop (cont):

- Don't thin edge trees or create any openings into the forest from thinning. This reduces windthrow risk and makes the forest less accessible to unwanted visitors.
- Avoid thinning sales based on an average price – agree a separate price for the pulp, stakes, pallet and sawlog (if any)
- Monitor a section of the trees being thinned to check that the right ones are being cut rather than the more valuable ones – especially if the thinning sale is being carried out on an average price basis.
- Use the forestry tables to estimate the expected volume that the thinning should produce as a guide to the actual volume harvested.

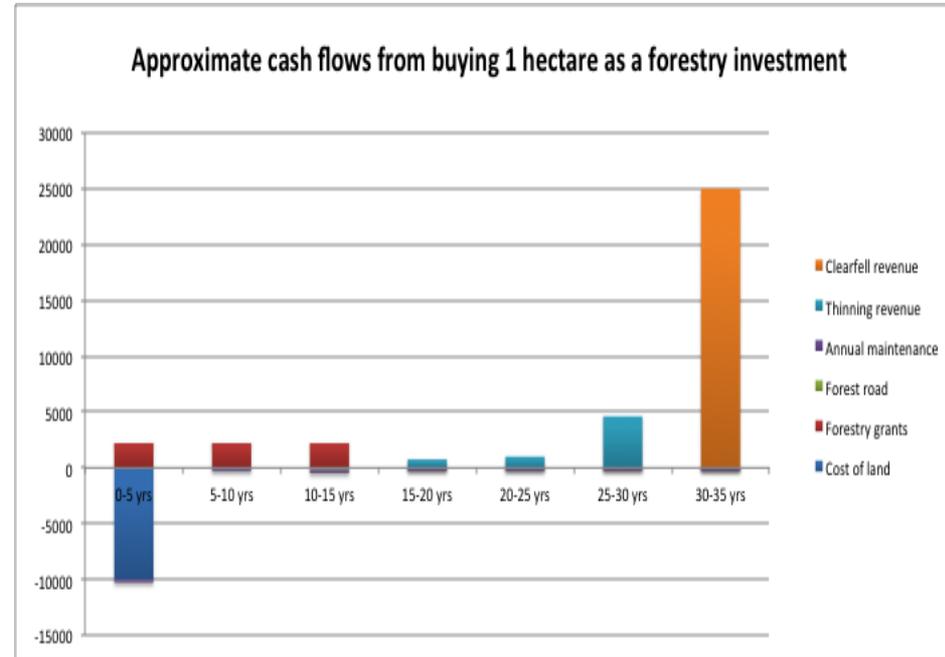
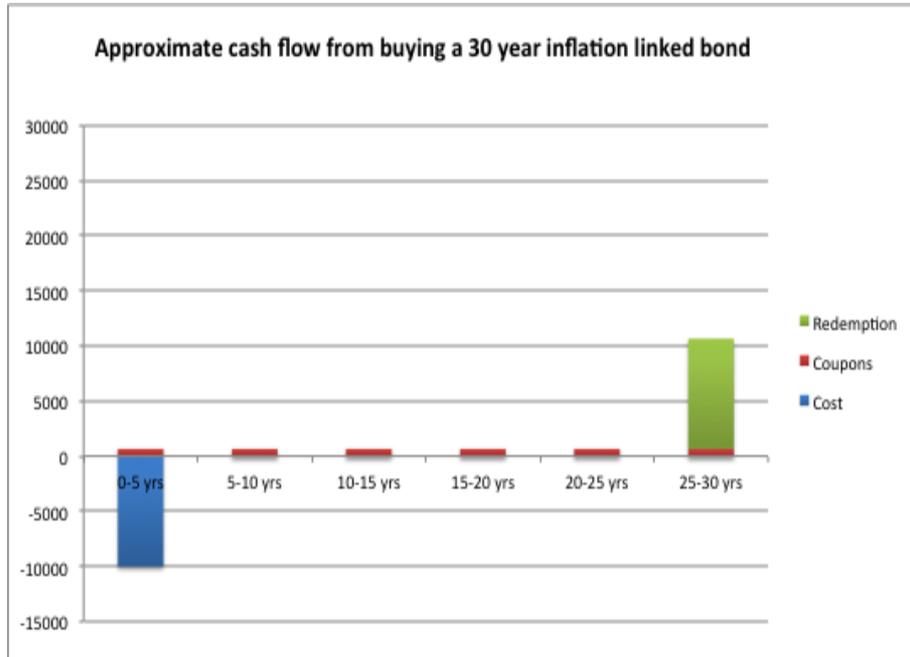
Prudent forestry management (8)

Replanting:

- Land can be sold after clearfell or replanted
- Mandatory to replant land. Unless you get agreement to plant other land instead.
- Replanting costs need to be paid out of revenue from clearfell.
- But also constitute an investment in the next crop.

Comparison with other investments (1)

Compared to Inflation-Linked Bonds

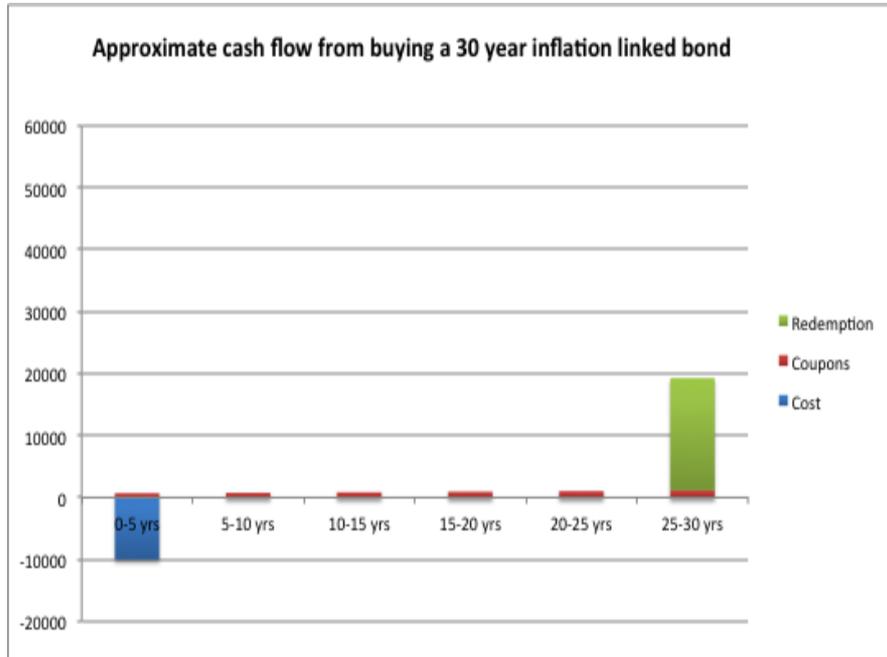


30 year US TIPS Bond (Inflation-linked) yields 1.32% (so 1.32% plus inflation)

Forestry yields ~ 5% plus timber price inflation (typically higher than inflation)

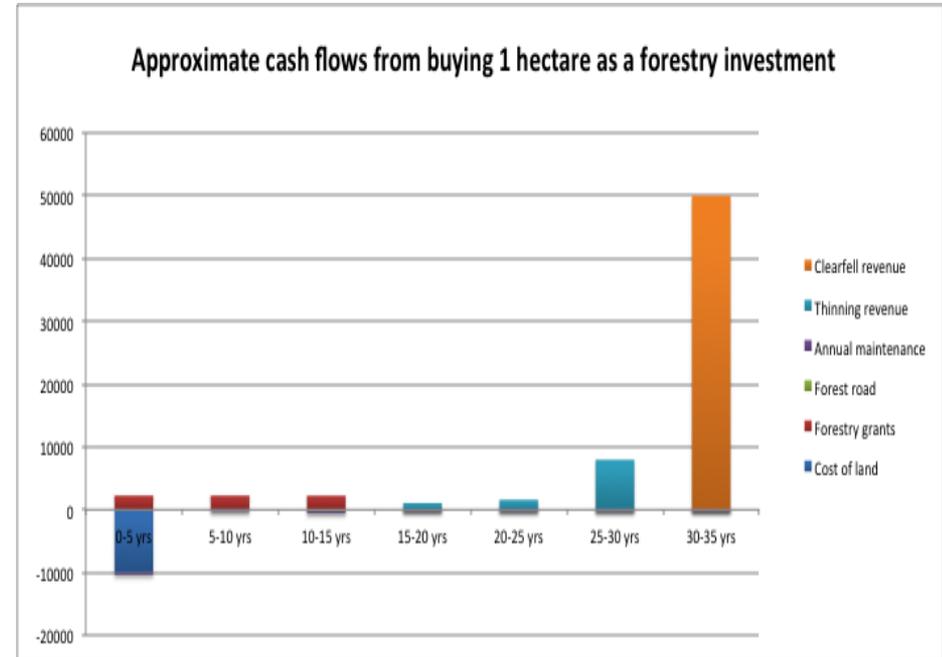
Comparison with other investments (2)

Compared to Inflation-Linked Bonds



30 year US TIPS Bond (Inflation-linked) yields 1.32% (so 1.32% plus inflation)

Expected nominal cashflows assuming 2% inflation



Forestry yields ~ 5% plus timber price inflation (typically higher than inflation)

Expected nominal cashflows assuming 2% inflation

Comparison with other investments (3)

Compared to Equities

Forestry Investment (1871-2013)

Historical forestry returns	=	7.94%+*
Standard deviation of timber prices	=	10.8%
Skew	=	+1.22%

*geometric average US timber price increase 1871-2013 = 2.94%

US Equity Investment (1871-2013)

Historical S&P returns	=	8.6%
Standard deviation of returns	=	~18.2%
Skew	=	-0.13%

Source: SAI Financial, Economic and Investment Dataset

Ideal pension investment?

- Excellent risk/return trade-off (as per last two slides)
- Forestry is a relatively long-term investment but similar to the time horizon of a pension fund investor.
- Forestry increases in value with timber price inflation – which is typically higher than inflation. This makes it useful to match increases in living standards – albeit with some basis / mismatch risk.
- The risk involved is more likely to produce much higher returns than much lower returns than expected (unlike financial market investments).
- For direct investment, the investor also gets amenity use of the forest – with associated healthy benefits.
- Feel good factor – making the world a better place, environmentally, economically and socially.
- Actuarial LDI: forestry has a number of advantages – a long discounted mean term, high real yield and infrequent reinvestment requirements.
- Correlation of US timber prices with US inflation = 0.5%. Correlation of S&P500 return with US inflation = 0.16% (better inflation matching asset). Correlation of US timber prices & S&P returns = 0.29% (good for portfolio diversification).

Benefits to Society

- Environmental
 - Carbon sequestration & oxygen production
 - Habitat for wildlife (density of bird populations etc)
 - Aesthetic and visual impact on the landscape
- Economic
 - Job creation
 - Sustaining and growing green industry – virtually no pollution
 - Recreation and tourism opportunities
- Social
 - Enabling greater social responsibility
 - Less fines from the EU

Sitka Spruce

On the merits of Sitka Spruce

- Growth rate ~ 4 times that in Scandinavia (Ireland's niche tree)
- Best tree species for carbon sequestration
- Produces quality straight timber with high strength to weight ratio
- Ideally suited to poor quality Irish soils and the Irish climate
- Shown to have highest density of bird populations (Batten 1976)
- When it was introduced, it was considered one of the most beautiful trees in Ireland, especially in mountain areas. It's image has suffered since then from misguided opinion formers.
- Along with Norway Spruce, it is the only commercial tree in Ireland. No other tree is likely to earn an investor a credible investment return.

Sitka Spruce, Bono and the old sow that eats her own farrow

Irish tendency to find fault with the best things about the country

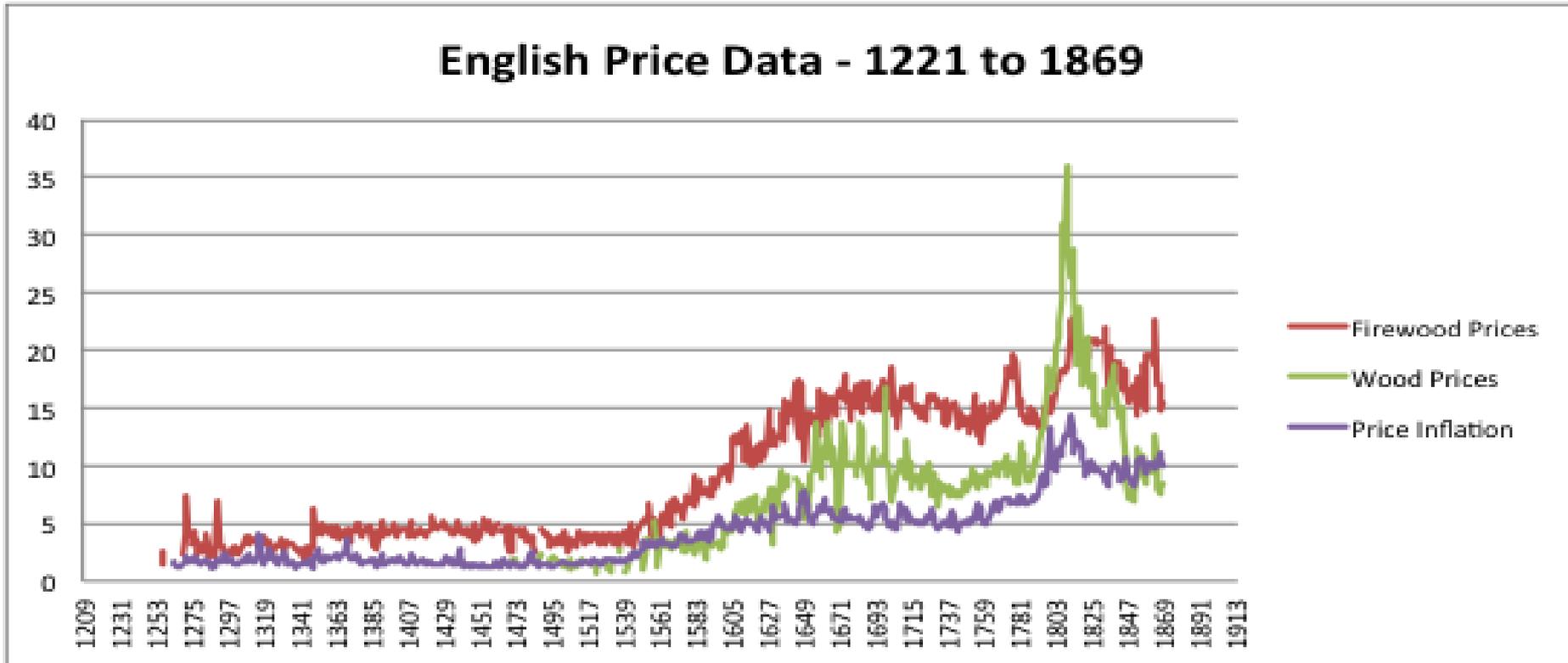
Recommendations

- 1) Advertising campaign to counter the erroneous and misguided image of Sitka Spruce.
- 2) Remove regulatory requirements necessitating arbitrary diversification of species requirements – equivalent to growing flowers in a wheat field, the flowers die and there's less wheat grown – which makes it less worthwhile growing wheat.
- 3) Introduce a policing body to clamp down on sharp practices in the industry (but don't do this unless it contains individuals with appropriate character, otherwise it will probably cement any bad practice).
- 4) Address the lack of transparency in the industry, e.g. enable better price discovery from Coillte.
- 5) Create a forward and futures marketplace for timber to improve price discovery and enable hedging for both forest owners and timber buyers.
- 6) Provide a form of disease insurance for Sitka Spruce.

Thank you for your attention

Any comments or questions are very welcome?

Historical analysis of timber prices (5)



Source

Gregory Clark "The Long March of History: Farm Wages, Population and Economic Growth, England 1209-1869" *Economic History Review*, 60(1) (February, 2007): 97-136.

http://www.econ.ucdavis.edu/faculty/gclark/papers/long_march_of_history.pdf