Paulownia: The Wonder Tree That Sequesters 22 Tonnes of CO2 per Hectare

By Dirk Roethig | CEO, VERDANTIS Impact Capital | March 3, 2026

Paulownia grows five times faster than oak, re-sprouts from its root stock after harvest, and sequesters amounts of CO2 that native tree species cannot come close to matching. But do the promises hold up? And how do we solve the invasiveness problem? A sober look at the data.

Tags: Paulownia, CO2 Sequestration, Agroforestry, Impact Investing, Climate Action

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What Sets Paulownia Apart

When people first hear about Paulownia, they are sceptical. A tree that grows up to three metres per year, re-sprouts from its root stock after felling, tolerates storms and drought, and sequesters quantities of carbon dioxide that make European mixed forest species look modest? It sounds like marketing, not botany.

But the data is robust. Paulownia elongata and its hybrid forms cultivated in Europe today achieve growth rates of two to three metres in height per year under optimal conditions (Pude, 2023). Prof. Dr. Ralf Pude of the Institute of Crop Science and Resource Conservation (INRES) at the University of Bonn has been conducting systematic research on this tree species since 2008 at Campus Klein-Altendorf, building one of the most reliable scientific databases in Europe. His experiments demonstrate that under Central European conditions, Paulownia is not only cultivable, but performs significantly better than originally expected.

Campus Klein-Altendorf, the University of Bonn's external research facility between Meckenheim and Rheinbach, is today home to the bio innovation Park Rheinland (Bio IP) — one of Germany's leading competence centres for bioeconomy. Since summer 2024, Bio IP has been officially recognised as a certification service provider for Paulownia in the voluntary carbon market (Bio IP, 2024). This has strategic significance: it creates a scientific foundation for monetising the CO2 storage potential.

The CO2 Balance: What the Numbers Really Say

The often-cited figure of 22 tonnes of CO2 per hectare per year requires careful contextualisation. Comparing various measurements:

• **Paulownia (hybrid forms, Europe, plantation)**: 10–22 t CO2/ha/year, depending on location, water availability and management intensity (Pude, 2023; MDPI Forests, 2022)

• **German mixed forest**: 8–13 t CO2/ha/year (Thünen Institute, 2023)

• **European spruce**: 6–10 t CO2/ha/year (EFI, 2023)

• **Short-rotation coppice poplar**: 4–8 t CO2/ha/year (FNR, 2022)

Under good conditions, Paulownia genuinely sequesters roughly double that of German mixed forest. This superiority is explained not only by rapid growth, but also by the exceptionally large leaves of the species: a mature Paulownia leaf can reach 80 centimetres in diameter. The associated high photosynthetic activity is the key to the disproportionate CO2 uptake.

An additional factor, often overlooked: Paulownia trees re-sprout from the existing root stock after harvest. This coppicing effect means that the extensive root structure — and thus the carbon mass bound in the soil — is preserved between harvest rotations. The net CO2 balance across multiple rotation cycles is therefore more favourable than the isolated view of a single rotation.

Timber Properties: Lighter Than Poplar, Stronger Than Balsa

Paulownia timber has a density of approximately 260 kg/m³ — making it up to 60 percent lighter than many other woods, yet remarkably load-bearing (Holztools.de, 2024). This combination makes it a sought-after material for:

Furniture and interior construction: Particularly in Japan and Korea, Paulownia wood has been prized as a premium timber for centuries. Its low thermal conductivity makes it an ideal insulating wood.

Structural lightweight construction: Surfboards, skateboards, sports equipment, and increasingly structural elements in construction utilise the strength-to-weight ratio of the timber. Prof. Pude is explicitly researching its suitability as a building material for the construction industry and sees significant potential (Gebäudeforum, 2024).

Energy use: The biomass yield of a Paulownia plantation is up to 30 percent higher than comparable poplar plantations (Cathaia International, 2023). This also makes Paulownia interesting for bioenergy applications, though material use under the cascade utilisation principle is ecologically more sensible.

Paper production: High cellulose content and short fibres make Paulownia a potential raw material for the paper industry, particularly specialty papers.

The Invasiveness Problem and Its Solution

Anyone writing honestly about Paulownia must address the invasiveness issue. Without embellishment.

Paulownia tomentosa, the so-called foxglove tree, is classified as potentially invasive in Germany and is monitored by the Federal Agency for Nature Conservation (BfN, 2023). In the USA, P. tomentosa is classified as moderately invasive. In Austria, the species is already on the invasive list. The risk: Paulownia produces millions of seeds per tree, is light-demanding, and can colonise gaps in near-natural vegetation.

The decisive scientific answer to this problem is sterilised hybrid varieties. Modern Paulownia cultivation is dominated by in vitro-propagated hybrids such as Cotevisa 2 and Shan Tong, which are either sterile or have a de facto germination rate of nearly zero (World Tree, 2024; MDPI Forests, 2022). These hybrids cannot naturally reproduce — the invasiveness risk is thereby biologically eliminated.

The consequence: a Paulownia plantation with certified, sterilised hybrid varieties is comparable to an apple orchard in terms of invasiveness. The trees grow where they are planted. They do not spread uncontrolled.

Prof. Pude underlines this distinction: it is crucial to differentiate between wild types such as P. tomentosa and modern in vitro hybrids. The blanket warning against Paulownia cultivation does not reflect the state of breeding research (Pude, 2023).

Site Requirements and Cultivation in Central Europe

Paulownia cannot be planted everywhere without consideration. The species requires:

• **Frost sensitivity awareness**: Young shoots can be damaged at -15°C. Established trees survive low temperatures as they re-sprout from root stock.

• **Deep, well-drained soils**: Waterlogging is the greatest enemy. Loamy sandy soils up to pH 8 are tolerated.

• **Sunny exposure**: As a pronounced light-demanding species, Paulownia requires full sunlight.

• **Irrigation during dry periods**: Particularly in the first growing year, regular water supply is critical for optimal growth.

Under Central European climate conditions — with milder winters due to climate change — growing conditions are improving in the long term. Bavarian cultivation trials show: Paulownia is competitive, but not necessarily self-managing under forestry conditions (LWF Bayern, 2024). As an agricultural plantation or in an agroforestry setting, however, the species is well manageable.

Economics and Investment Potential

The economics of a Paulownia plantation depend strongly on the utilisation strategy. First harvests are possible after 8–10 years; subsequent rotations arrive faster through coppicing (Pude, 2023).

Timber prices for quality Paulownia currently stand at €300–600 per cubic metre for processed timber — considerably above the level for poplar or spruce. The market for Paulownia timber in Europe is still underdeveloped, representing both risk and opportunity.

The material utilisation is overlaid by the emerging CO2 certificate market. Since summer 2024, Paulownia can be certified in the voluntary market, with Bio IP as the recognised certifier. At current prices of €4–15 per tonne CO2 in the voluntary market and annual sequestration of 10–22 tonnes per hectare, an additional income of €40–330 per hectare per year results (Cervicorn Consulting, 2025). This is not a primary income source, but a substantial contribution to overall returns.

Larger operations in Romania and Hungary, where land is cheaper and the climate more favourable, project total returns of 6–9 percent per annum over a 20-year period with combined timber and CO2 revenues (Prosperise Capital, 2025).

VERDANTIS Impact Capital: Paulownia in Portfolio Context

As an impact investor, we view Paulownia not in isolation, but as a building block in a broader agroforestry system. The combination of:

1. **Rapid CO2 sequestration** through Paulownia as the primary species

2. **Biodiversity enhancement** through margin strips with native shrubs and wildflower areas

3. **Timber revenues** as stable cash flow anchor

4. **CO2 certificates** as growing additional yield

...creates an investment vehicle that links ecological and economic value creation.

The work of Prof. Pude and Campus Klein-Altendorf provides the scientific credibility that institutional investors require. It is no coincidence that Bio IP became the first German actor recognised in the voluntary Paulownia certificate market — this was the result of years of methodical research work.

Conclusion: Potential with Measured Perspective

Paulownia is not a wonder tree that solves all climate problems. But it is an exceptional species that, under the right conditions, delivers CO2 sequestration performance that clearly exceeds native tree species — while being economically utilisable within a single decade.

The most important message: the invasiveness debate is already resolved with certified, sterilised hybrid varieties. Anyone today blanketly advising against Paulownia cultivation is ignoring the state of breeding science.

What is still lacking is scale. 4,000 hectares in Romania, trial plots in Bavaria, demonstration plantations in the Rhineland — that is a beginning. For a tree species with this climate potential, it remains far from the scale the situation demands.

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