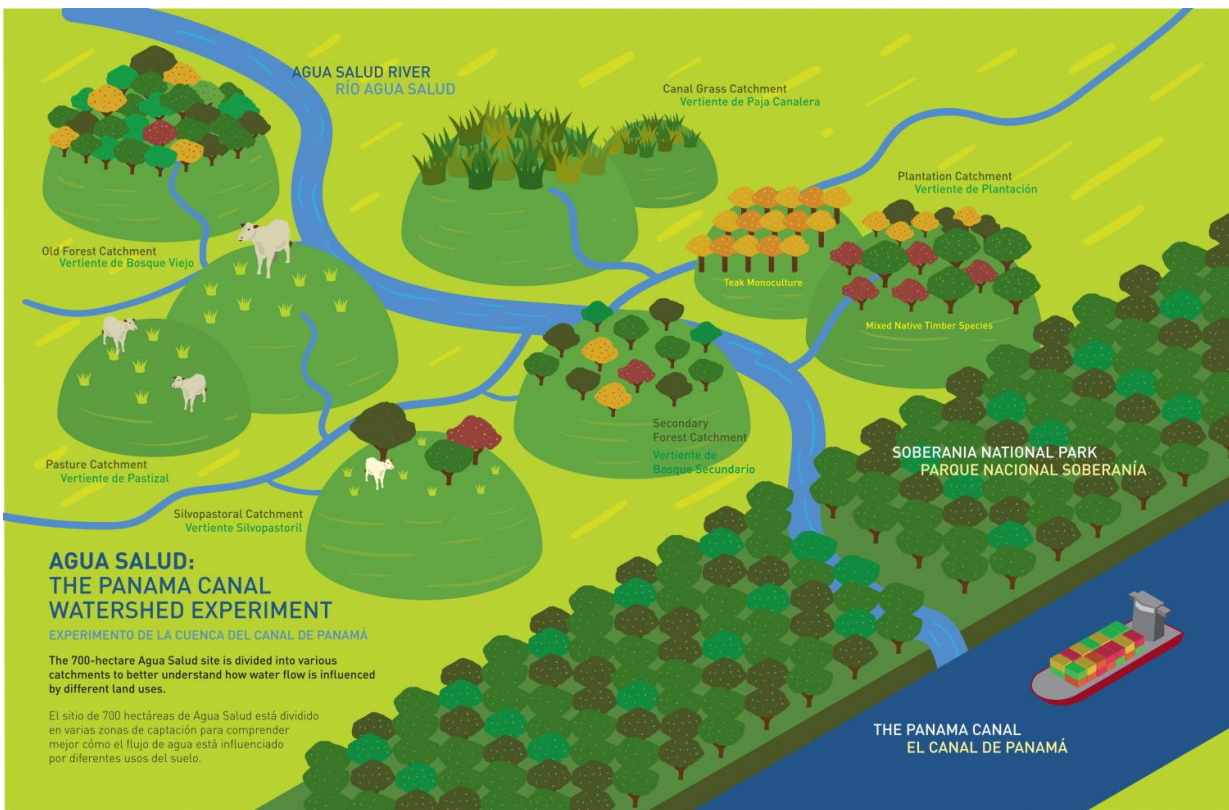


Panama's native tree species excel in infertile tropical soils

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What is the best way to use land to prevent flooding, maximize water storage during dry periods, store carbon, protect tropical diversity and maximize timber value? The Agua Salud project evaluates these options in a 700-hectare experiment in the Panama Canal watershed. Credit: Jorge Aleman_STRI

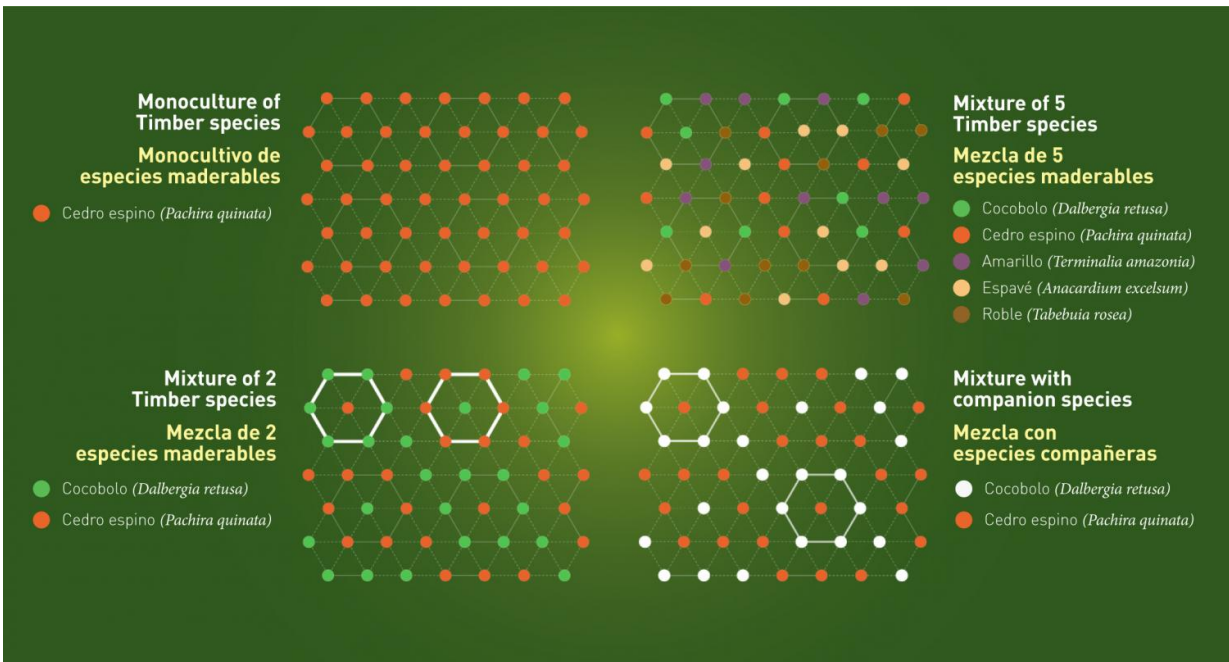
Teak, the most valuable species for tropical reforestation, often

performs poorly in the acid soils of steeply sloping land in the tropics. As human population skyrockets and land becomes a scarce resource, balancing tradeoffs between reforestation, conservation, water availability and carbon storage becomes paramount. In a recent publication from the Smart Reforestation Program, Smithsonian scientists and collaborators including the Panama Canal Authority confirm that native tree species performed very well in field trials and would be preferable to teak in this situation.

"The take-home message of this experiment is that if you want to reforest to maximize timber harvest on poor, [acidic soils](#) in the Panama Canal watershed, plant Amarillo (*Terminalia amazonia*)," said Carolina Mayoral, post-doctoral fellow at the Smithsonian Tropical Research Institute (STRI) in Panama and first author of the paper. "It's spectacular. It grows amazingly fast and the trunks are straight and have excellent timber value. It accumulates biomass much faster than teak in these soils."

In 2008, scientists planted five [native species](#), *Anacardium excelsum*, *Dalbergia retusa*, *Pachira quinata*, *Tabebuia rosea* and *T. amazonia*, in single-[species](#) plots and also in mixtures with each other and with companion species. In all, they tested 21 different land-use options. For the next seven years, they measured the height and basal diameter of more than 22,000 trees each year and calculated the biomass of the trees in each of the treatments.

The companion species, *Erythrina fusca*, *Gliricidia sepium*, *Inga punctate*, *Luehea speciose* and *Ochroma pyramidale*, were chosen because they contribute nutrients, provide shade or otherwise improve growth in combination with timber species. By planting a fast-growing timber species with a species that provides nitrogen that it captures from the air (a nitrogen-fixing species), for example, this natural fertilization effect may result in greater growth.



To find out if there is a diversity effect, scientists planted mixtures of trees as well as monoculture plantations. Credit: Jorge Aleman, STRI

"The first major result of this experiment was that the trees survived: on average, about 95 percent of the seedlings we planted were still there seven years later," Mayoral said.

Amarillo outperformed all of the other species in growth trials. After only seven years, *Amarillo* trees were more than 9 meters tall and 14 centimeters in diameter at the base and had a biomass of 47.1 tons per hectare when grown in monoculture, compared to 14.9 tons for *Dalbergia*, 14.2 tons for *Anacardium* (Espave) and 4.4 tons for *Pachira* and 3.6 tons for *Tabebuia* (Roble). From a scientific point of view, it was also interesting that *Dalbergia*, which fixes nitrogen, and *Pachira* grown together performed much better than either when grown alone.

Currently, the area planted in teak, *Tectona grandis*, in Central America is estimated to be almost 133,000 hectares of which 55,000 are planted in Panama. Teak represents 76 percent of the plantations established in Panama between 1992 and 2000, according to the Food and Agriculture Organization (FAO). It does not perform well in infertile, acidic soils.

"We're very pleased to see that native species are a viable alternative to teak for reforestation in these poor soils," said Jefferson Hall, STRI scientist and director of the Agua Salud project. "The unknown is still the pricing structure for these native hardwoods."

"*Amarillo* has excellent timber quality," Hall said. "It may not be quite as pretty as teak, but it can be painted and it very long-lasting. Cocobolo [*D. retusa*] is perhaps even more beautiful than teak and is traditionally used for decorative woodwork and rosewood sculptures. High demand has caused the price to double, and there are reports that *Dalbergia* can be sold for more than \$5,000 per cubic meter, almost 10 times the market price of the highest quality teak."

More information: Carolina Mayoral et al, Survival and growth of five Neotropical timber species in monocultures and mixtures, *Forest Ecology and Management* (2017). [DOI: 10.1016/j.foreco.2017.08.002](https://doi.org/10.1016/j.foreco.2017.08.002)

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