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Beyond farm income: True value accounting of ecosystem services from agroforestry

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A farm's sale receipts rarely show its full value. Ecosystem services such as carbon storage, soil protection, groundwater recharge, pollination, that trees generate on a farm typically go unrecorded, even though they are real and often substantial. True Value Accounting (TVA), developed under UNEP's TEEBAgriFood initiative, offers a disciplined way to bring these usually invisible contributions into view alongside market income, while also recognising any environmental or social costs a system creates. This article explains what TVA means for Indian agroforestry, which ecosystem services these systems generate, how they can be measured and valued without double counting, and why the distinction between economic value and cash income matters for farmers, researchers and policymakers alike.

Keywords: Carbon sequestration, Natural capital, TEEBAgriFood initiative

A FARM can generate far more value than what appears on its sales receipts. When a farmer in western Uttar Pradesh totals up a season's earnings from a poplar-boundary plot, the ledger usually stops at grain sold, timber marketed and wages paid. What it leaves out is harder to see but no less real. Carbon quietly locked into growing wood, soil held in place by tree roots during a heavy monsoon downpour, shade that spares a wheat crop during an unseasonal heat spell, bees moving between mustard flowers and a nearby jamun tree. These are ecosystem services with practical, physical benefits that natural processes provide to farming and to society.

Agroforestry, the deliberate combination of trees with crops, fodder or livestock on the same land, is unusually rich in such services. True Value Accounting (TVA), developed through the UNEP-led TEEBAgriFood initiative, offers a structured way to recognise these hidden contributions and hidden costs alongside market income.

Value of agroforestry in farm income

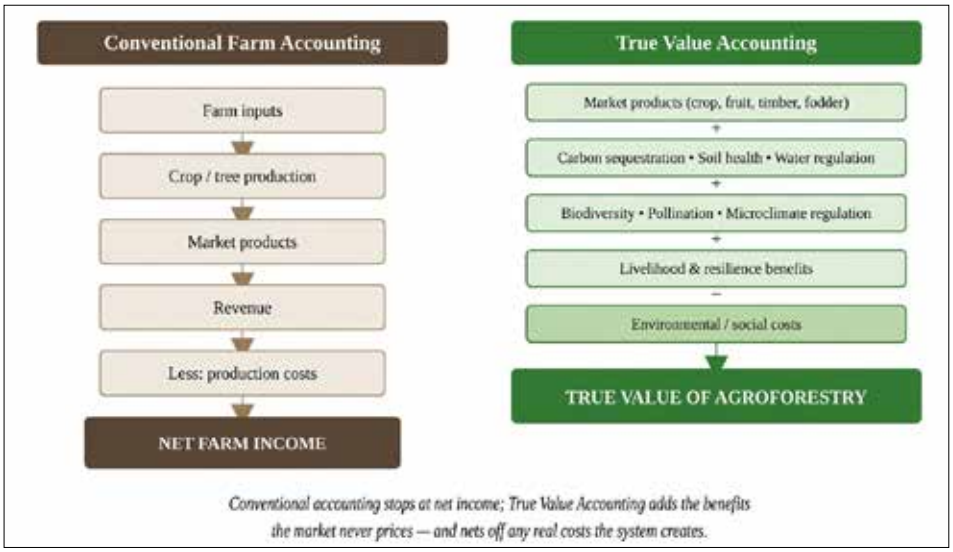
Conventional farm accounting follows a simple chain: what is produced, what it sells for, what it costs to produce, and what remains as net income. This works reasonably well for a single annual crop, but less well for agroforestry, where trees deliver benefits over years or decades, many of which never pass through a market. Consider a poplar-based boundary plantation, common across western Uttar Pradesh. Studies from Saharanpur and Yamunanagar districts report benefit-cost ratios for poplar agroforestry broadly in the range of 2.4–3.7. In addition, it sequesters 27–32 t carbon/ha in a boundary layout, and considerably more (66–83 t/ha) in a denser agrisilviculture arrangement, over a roughly seven-year rotation. Neither figure appears on a farm's income statement, yet both represent real value to the climate, and potentially to the farmer as carbon markets and payment schemes become more accessible.

Generating ecosystem services through agroforestry

Ecosystem services are conventionally grouped into four categories, each with a direct, farmer-relevant expression in an agroforestry system.

***Provisioning services*:** Timber, fuelwood, fruit, fodder, fibre and medicinal produce are what farm accounts already capture reasonably well. Trees on farms already supply roughly two-thirds of India's timber and close to half its fuelwood. TVA is concerned with everything provisioning services leave out.

Regulating services: These are less visible, but often more valuable over time such as erosion control, wind buffering, groundwater recharge, microclimate moderation, and carbon sequestration. Syntheses of



From conventional farm accounting to true value accounting

Indian agroforestry research report above-ground vegetation carbon capture ranging from under 1 to over 20 tonnes of carbon per hectare per year, with soil carbon stocks ranging from around 10 t/ha in arid boundary systems to well over 200 t/ha in Northeast India's multistrata homegardens – a reminder of how strongly this value depends on region, species and system design.

Supporting services: Soil formation, nutrient cycling between leaf litter and crop root zones, and habitat for the insects, birds and soil organisms that keep a farm ecosystem functioning.

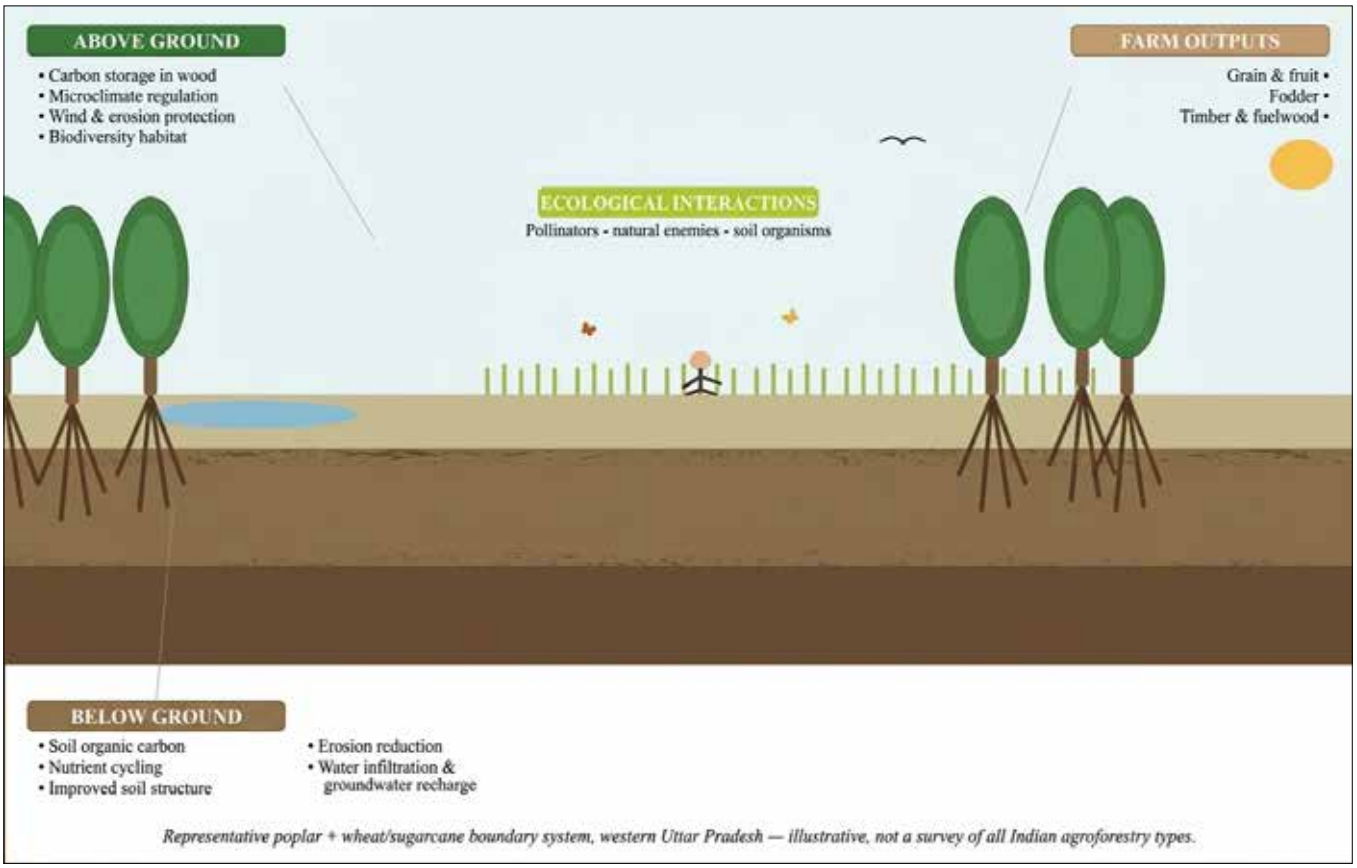
Cultural services: The shade tree under which a village meeting is held, the fruit tree that marks a family's land real value, even where it resists a rupee figure.

From conventional accounting to true value accounting

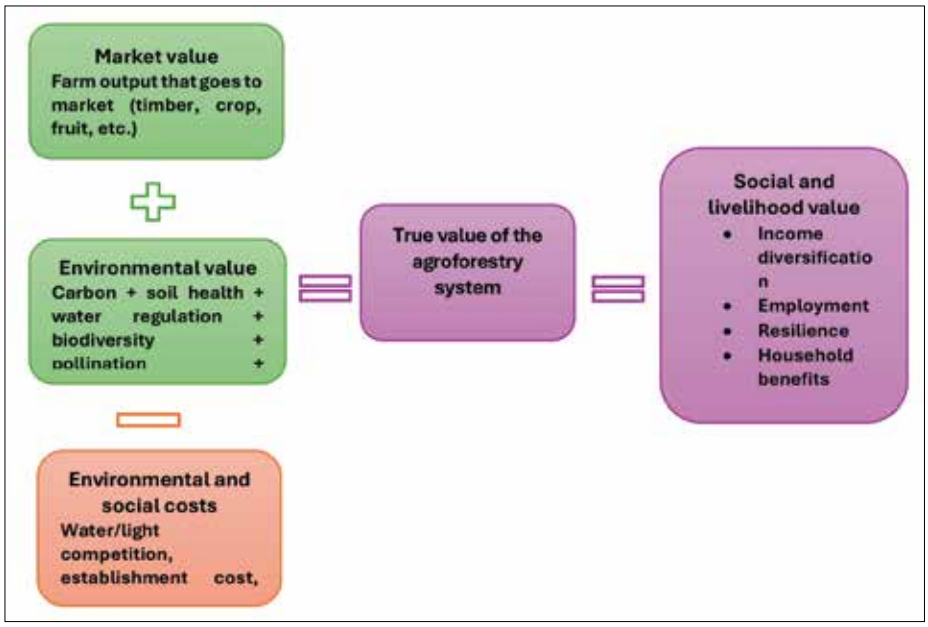
Conventional accounting is a single downward chain ending in net farm income. True Value Accounting widens this into a fuller stack. It starts from the same market benefits, adds environmental value and social/ livelihood value, and then subtracts any environmental or social costs the system generates, for instance competition for water in a dense plantation, or the labour cost of unpaid family time. This is not simply 'market income plus a carbon price; it is a broader accounting of the complete set of benefits, dependencies and costs a system produces, assessed together and transparently.

Value in ecosystem services

Not every service needs to be, or should be, converted into a rupee figure but several established methods exist for those that can be.



Agroforestry as an ecosystem service generating system



Framework of true value accounting

***Market price method*:** Uses the price of a comparable traded good, as when timber or fruit is valued at prevailing market rates.

***Avoided-cost method*:** Estimates what would otherwise have to be spent without the trees the cost of erosion-control structures partly replaced by tree cover.

***Replacement-cost method*:** Values a service by the cost of replacing it artificially, such as fertiliser saved through nutrient cycling from leaf litter.

***Change-in-productivity method*:** Links a service to its measurable yield effect. Shelterbelt trees valued by the wheat or mustard yield gain in the field they protect from wind.

***Carbon-pricing approaches*:** Value sequestered carbon using an agreed rate; domestic carbon-credit transactions in India have recently traded at roughly ₹1,500 per tonne of CO_2 equivalent, though prices vary and change over time.

***Contingent valuation, choice experiments and benefit transfer*:** Used where no market or avoided-cost proxy exists for cultural or biodiversity values but require careful, context-specific application by trained researchers.

Every method has limits. The right response to a service that resists confident monetisation is to record it qualitatively or biophysically (hectares protected, tonnes of soil retained, species recorded) so it still enters the decision, even without a price tag.

An illustrative TVA account for an agroforestry farm

To make this concrete, consider a hypothetical one-hectare poplar-boundary system in western Uttar Pradesh, combining a wheat–sugarcane rotation with poplar along field boundaries.

This is precisely the distinction that matters most for farmers. Economic value is not the same as cash income. A farmer cannot spend avoided soil erosion at the local mandi. But recognising this value has practical uses by comparing farming systems on a fairer basis, building the case for agroforestry-friendly credit and insurance products, and preparing farms to participate in carbon markets or ecosystem-service payments as these become more accessible in India.

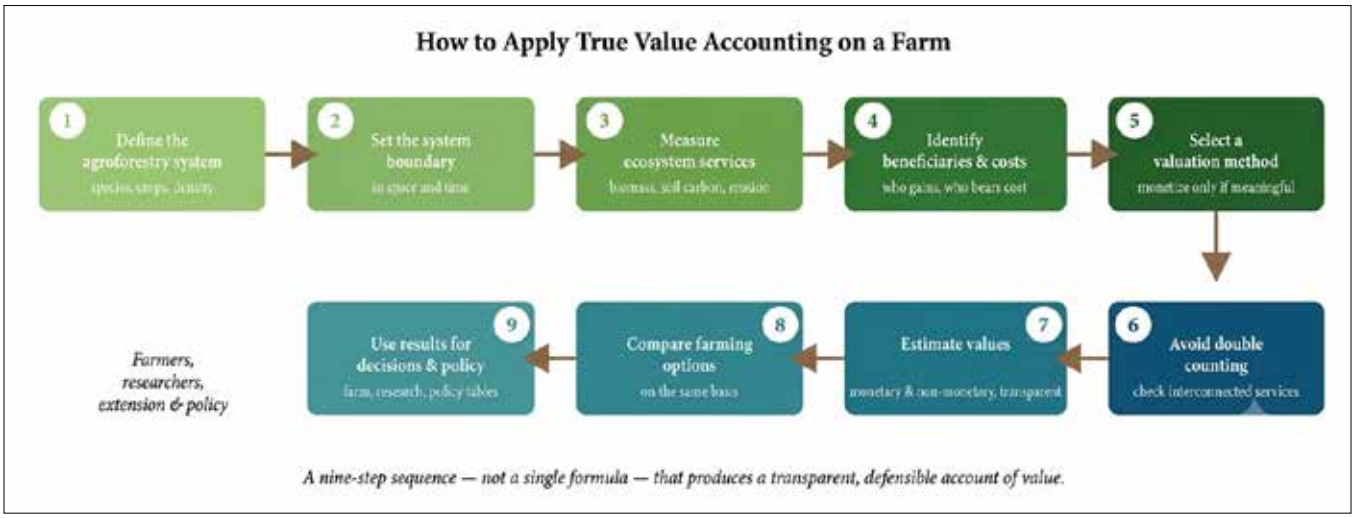
Avoiding double counting and misleading valuation

Ecosystem services are interconnected, not independent. Improved soil organic carbon tends to improve soil structure, which improves water retention, which in turn improves crop productivity. A TVA account that separately adds full monetary values for 'soil carbon,' 'water retention' and 'yield improvement' risks counting the same underlying benefit three times over.

Table 1. Illustrative true value accounting for a one-hectare poplar-boundary agroforestry system

Farm component / service	What the farmer gets	Visible in farm accounts	TVA perspective	Illustrative value (₹/ha/yr)
Wheat–sugarcane crop	Grain, cane sold at market	Yes	Included as-is	45,000
Poplar timber (annualised, 7-yr rotation)	Timber income at harvest	Yes	Included as-is	30,000
Production cost	- (cost, not income)	Yes	Deducted as-is	35,000
Net market income	Cash in hand	Yes	Base of the account	40,000
Carbon sequestration	No direct cash (yet)	No	Carbon-price method	12,000
Soil erosion avoided	Retained topsoil, fewer repairs	No	Avoided-cost method	4,000
Water regulation / recharge	More reliable groundwater	No	Avoided-cost method	3,000
Biodiversity and pollination	Better fruit/vegetable set nearby	No	Benefit transfer	2,000
Illustrative true value	Cash + recognised value	Partly	Full TVA stack	61,000

Note: Values are hypothetical and should not be interpreted as measured returns from a specific farm.



Sound TVA practice avoids this by defining clear accounting boundaries before valuation begins, tracing the causal pathway between a service and its ultimate benefit, applying methods consistently, and stating assumptions transparently. Where a pathway is uncertain, it is safer to value a service at its point of most direct benefit than at every downstream effect. This discipline is what separates credible TVA from an exercise in inflating agroforestry's numbers.

Trade-offs: Agroforestry is not automatically superior

True value accounting should not be read as a case for planting trees everywhere. Agroforestry also contains competition between trees and crops for light, water and nutrients; establishment costs and several years of delayed returns before a tree component matures; added management and labour requirements; species-selection and market-uncertainty risk for timber; and, in places, regulatory friction around tree harvesting and transport. Some of these are precisely the 'environmental/social costs'. The central argument of this article is not that agroforestry always wins - it is that any farming system, agroforestry included, should be judged on its complete set of benefits and costs, not on market income alone.

True value accounting for Indian farmers and decision-makers

For farmers, TVA offers a fairer basis for comparing systems over the multi-year horizon trees require, and helps make visible the resilience benefits of a diversified, tree-based system with shade during heat stress, fodder during a poor year, timber as a standing asset. It can also help farmers prepare for carbon-market or ecosystem-service payment opportunities as these mechanisms mature in India, though TVA itself does not create such payments; it only makes the underlying value visible.

For researchers, it provides a common framework for evaluating multifunctional systems on more than yield alone. For extension workers, it offers simple language to explain why a system that looks only moderately profitable this year may be building considerable value over its lifetime. For policymakers, TVA can help design better-targeted incentives, subsidies, credit terms or carbon-linked payments, in line with the National Agroforestry Policy and India's climate commitments. For financial institutions, it offers a way to factor climate resilience and long-term asset value into lending decisions. Throughout, one distinction must stay clear: economic value is not the same as cash income. TVA reveals value; it does not, by itself, convert that value into money in a farmer's hand.

From valuation to action: A practical roadmap

Applying TVA to a real agroforestry system, for research, extension or policy purposes, can follow the nine-step sequence. This sequence will not produce a single universal number for what agroforestry is worth. It will produce something more useful: a transparent, defensible account of value that can support better decisions at the farm and the policy table alike.

SUMMARY

Conventional farm accounting captures what agroforestry sells i.e. grain, fruit, timber, fodder but misses much of what it generates like carbon storage, soil protection, water regulation, biodiversity support and more. True value accounting, developed under UNEP's TEEBAgriFood initiative, offers a disciplined way to bring these usually invisible contributions into a farm's account alongside market income, while also recognising any environmental or social costs a system creates. Applied carefully with clear system boundaries, appropriate valuation methods and safeguards against double counting, TVA does not claim every agroforestry system is automatically superior; it claims that judging any system by market income alone tells an incomplete story. For Indian farmers already integrating trees into wheat, sugarcane and horticultural systems from Uttar Pradesh to the Northeast, making this hidden value visible is a first step toward decisions, incentives and markets that reward agroforestry for everything it truly provides.

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