

BIODIVERSITY CONSERVATION AND BASIC HUMAN NEEDS IN TANZANIA'S COTTON INDUSTRY: CAN WE HAVE IT ALL?



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August 2026

Main Messages

- Tanzania's cotton industry has a light footprint on the environment today, but it delivers little for industry stakeholders. Low-input farming and a small processing sector mean the industry meets on average about **8% of the basic needs** of Tanzanians involved in it.
- Every route to improvement carries an environmental cost, and **freshwater ecosystems are the most exposed**. Impacts concentrate sharply in the Lake Victoria, where 95% of the country's cotton is grown, and to a lesser extent in Lake Tanganyika.
- Expanding textile manufacturing offers the best balance between environmental impact and additional value provided. Raising farm yields delivers the largest social gains, but at roughly two and a half times today's environmental damage.

Context

The BAMBOO project examines how global supply chains for non-food biomass affect biodiversity, and where the leverage points lie to halt and reverse biodiversity loss. This brief applies that framework specifically to cotton in Tanzania. Cotton is important in Tanzania. Between 350,000 and 500,000 smallholder farmers grow it, and it

supports the livelihoods of roughly 40% of people in the main growing regions. It is the country's third-largest agricultural export and supplies a domestic textile industry that has struggled under competition from imported clothing. The government has named cotton a priority crop for investment, with targets to raise national output substantially.

Tanzania also holds exceptional biodiversity – two of the world's 36 biodiversity hotspots and about a fifth of Africa's large mammals. Critically for this industry, 95% of national cotton output comes from the Lake Victoria basin, one of the world's great centres of freshwater fish diversity. Growth in cotton and pressure on local ecosystems are therefore closely linked.

The commercial context is shifting. Voluntary standards, such as organic certification, Better Cotton, and corporate science-based targets, increasingly decide which suppliers reach premium markets. For Tanzanian ginners and exporters, **credible environmental data** is a reputational advantage.

Key results

We built a detailed model of Tanzania's entire cotton value chain for 2022, district by district, from farming through ginning, oil milling and

textile manufacturing. Adding environmental impact data, we can see not only how much damage occurs but where. Alongside the environment, we measured how well the industry meets basic human needs: food energy, protein, clothing, farm income, and rural employment. We then tested four realistic development paths against today's situation.

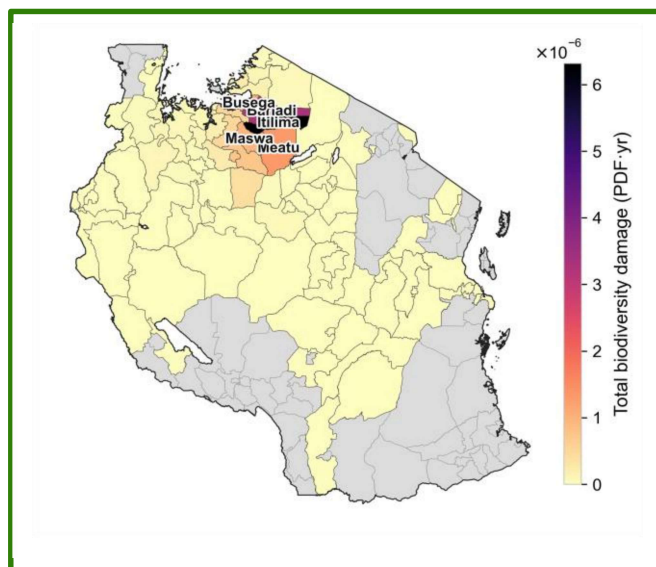


Figure 1: Where the cotton industry's environmental impact falls today. Damage concentrates in the cotton-growing districts of the Lake Victoria basin.

Today's industry is low-impact on the environment but delivers little social value. Cotton farming in Tanzania uses few purchased inputs by international standards, so its environmental footprint per hectare is modest. The flip side is that yields are low and the manufacturing industries are underinvested in. Farm income

reaches roughly a fifth of a living income; domestic fabric covers about a sixth of clothing needs; and the nutritional contribution of cotton by-products is negligible.

Impacts are highly concentrated. Environmental damage is not spread evenly across Tanzania. Just ten districts account for over 80% of the industry's biodiversity footprint, and a single district (Itilima) accounts for about a quarter of it (Figure 1). This concentration is an opportunity: targeted action in a handful of districts would reach most of the impact.

The four growth paths differ sharply in what they cost. Expanding domestic processing from 20% to 60% of lint nearly doubles the average share of basic needs met, from 8% to 15% (due to increased clothing supply for Tanzanians), while increasing environmental damage by only about 20% (mostly from increased water and energy used for textiles; Figure 2). Raising yields to the national target delivers more – 23% of needs met, on average – but comes with double biodiversity impacts across categories, because fertiliser and pesticide use rise with output. Irrigation is the least attractive option in this framework: it meets about the same share of needs as expanding processing, but with a dramatic increase in freshwater biodiversity loss. A shift to organic farming changes little either way – it delivers little additional benefit while modestly increasing nutrient loading to water from manure.

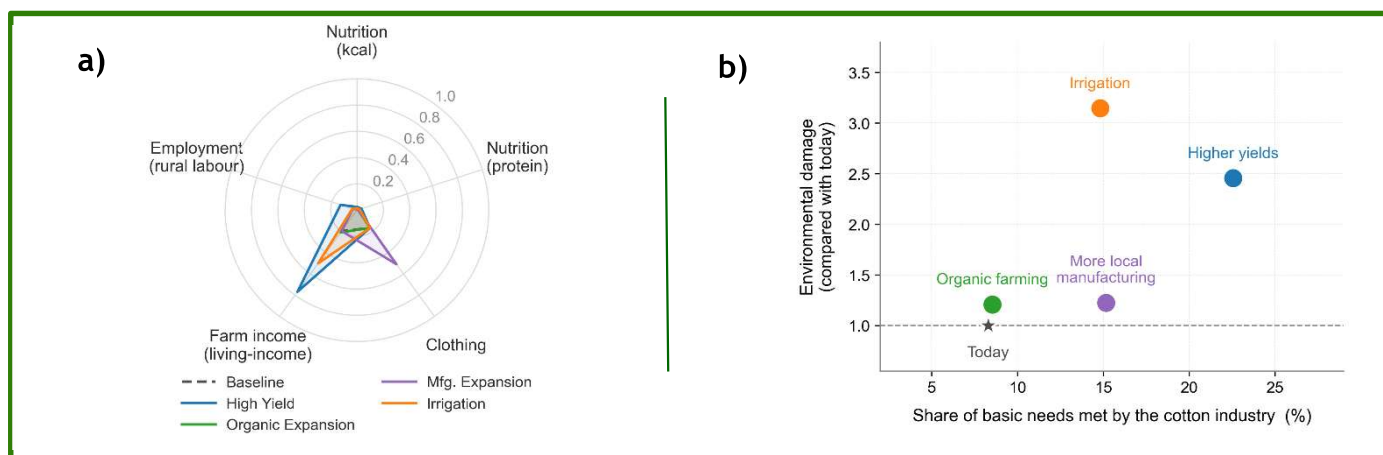


Figure 2: Plot a) shows the coverage of needs met across scenarios, as a share of the needs requirements for each. Plot b) shows what each growth path delivers, and what it costs. Moving right means meeting more of people's basic needs; moving up means greater environmental damage.

Recommendation

1. Put processing capacity first.

Of the options tested, expanding domestic ginning and textile manufacturing delivers the most human benefit for the least environmental cost. It also keeps more value in Tanzania and reduces reliance on imported fabric. Because mills sit away from the cotton-growing districts, their additional impact largely falls outside the existing impact zones. Practical steps include restoring capacity at existing under-used mills, investments in technology for more diverse fabric variants, and improving boiler efficiency – coal use at the textile stage is the single largest source of the industry's toxic emissions.

2. If yields are prioritised, manage the inputs.

Higher yields offer the biggest gains for farmers and should not be dismissed. But the environmental cost comes almost entirely from fertiliser and pesticides. This makes the damage manageable: precision application, soil testing, integrated pest management and buffer strips along watercourses would let the industry capture much of the yield benefit while limiting nutrient and pesticide losses to the Lake Victoria and Lake Tanganyika. Targeting these measures at the ten highest-impact districts would address most of the risk.

3. Treat irrigation as a last resort in times of need.

Irrigation raises yields, but not as much as increased plant spacing and nutrient management. Where irrigation is considered – for example as a buffer against increasingly erratic rainfall – it should be paired with water-efficient delivery, abstraction limits, and monitoring of local water availability. Rainwater harvesting and drought-tolerant varieties deserve assessment as lower-impact routes to the same resilience.

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Co-funded by
the European Union

Co-funded by the European Union and the Swiss Confederation. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Swiss Confederation. Neither the European Union nor the granting authority or the Swiss Confederation can be held responsible for them.

Project funded by



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