Regen10 – Landscape Transition Pathways - Overview

- Regen10 has developed landscape-level transition pathways across five significant agricultural regions.
- A transition pathway represents a switch from the conventional agricultural practices common in the landscape to regenerative ones, that helps restore and rebuild natural systems.
- A key element of this process is understanding the economics of transitioning to regenerative agricultural practices as well as the potential environmental and social outcomes of such transitions at landscape level.
- The combination between countries and agricultural products was made based on geographical representation, impacts of production, data availability, and applicability of results. The choice of landscapes was primarily driven by their national-level importance in the production and export of the specific products.
- Regen10 recognizes that there is more than one way to create a regenerative food system. The proposed approaches are not prescriptive, and practices were selected after careful contextual analysis of their relevance and evidence of their intended outcomes.
- Broader evidence linking practices and outcomes is still greatly needed and highlights the importance of developing an outcomes-based framework, which Regen10 is currently doing.

Selected Landscapes

Country	Landscape	Focus Ag Product
Brazil	Querência City	Soy & Beef
India	Punjab State	Rice
United States	North Dakota	Wheat & Maize
United Kingdom	East England	Potato
New Zealand	Waikato Region	Dairy

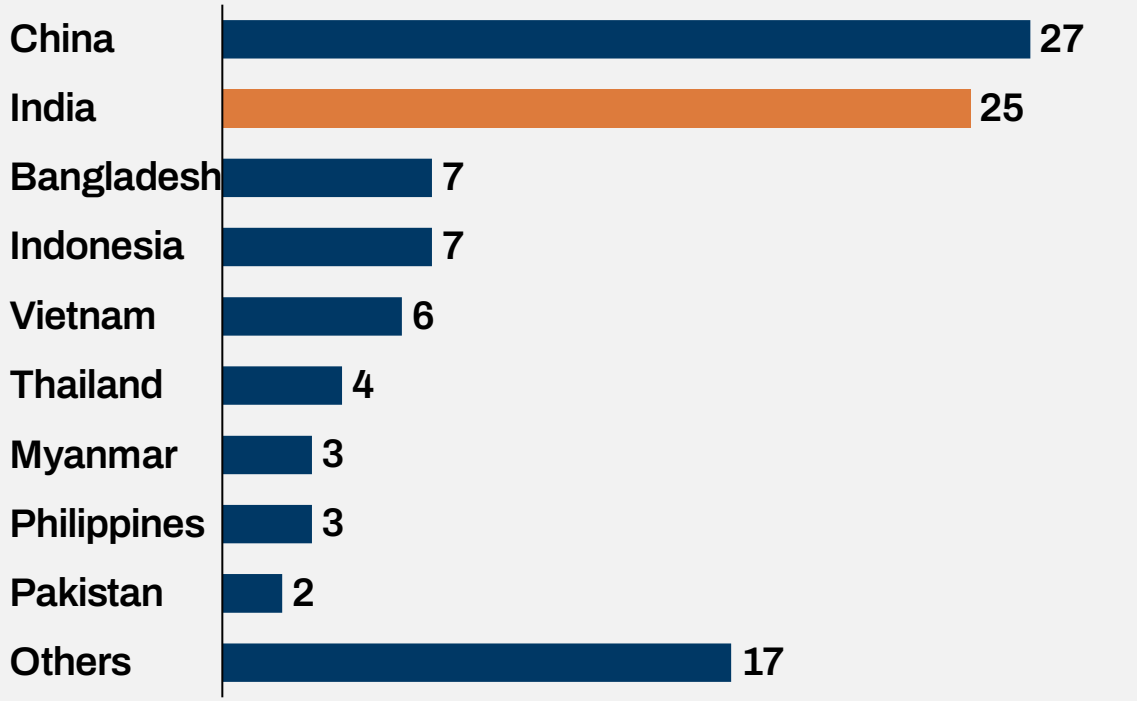
Source: Systemiq analysis.

Punjab – India – Rice

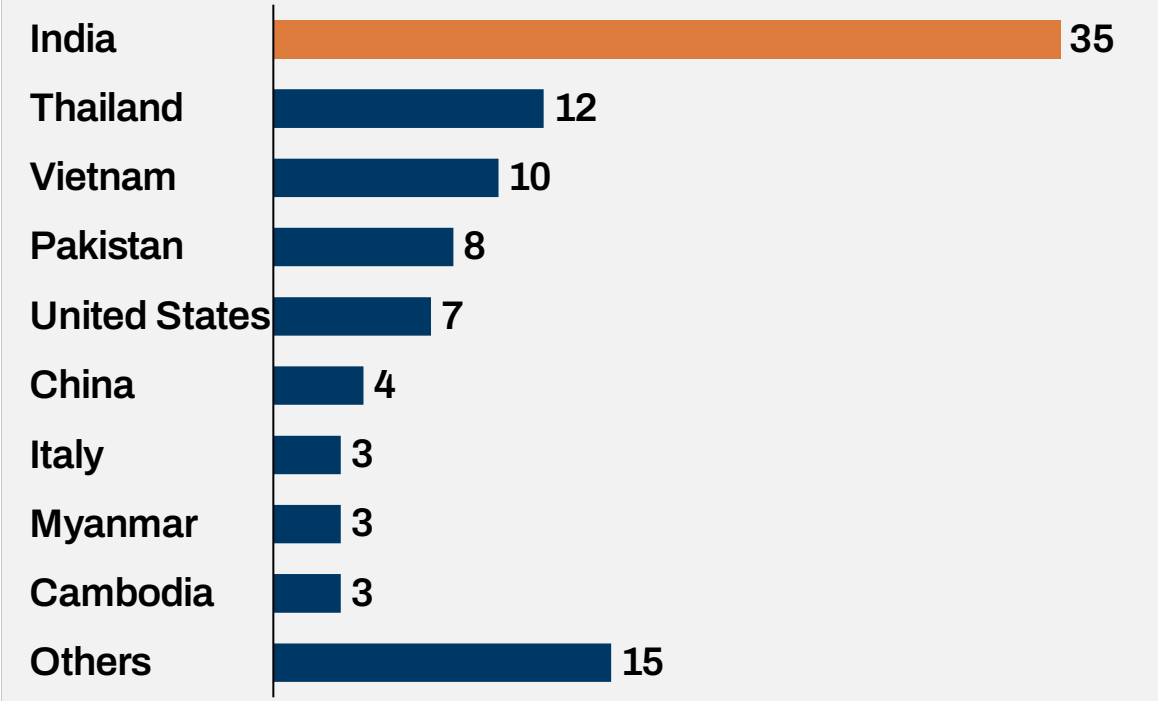
India is a prominent global producer, consumer and exporter of rice

- Rice is central to India's food security and heritage, serving as a primary dietary source for many. As a prominent global producer, consumer, and exporter, India's reliance on rice is crucial for both global nutrition and livelihoods.
- India contributes 25% of global rice production and 35% of rice exports.

Rice Production (%)



Rice Exports (%)



Source: FAOStat 21, OEC
Note: Rice production measured in metric tonnes, Rice exports in USD

Punjab state, one of the largest rice producers in India, is facing significant challenges relating to agriculture

- Punjab's 4.2M hectares of farming landscapes yields 10% of the rice and 15% of the wheat produced in the country

Landscape information

- Geographical Area: 5.0M ha
- Agricultural Area: 4.2M ha
- Population: 30.5M (62% rural)
- Land holdings: 1.1M
- Average farm size: 4 ha

Current Challenges

Agronomic & Environmental:

- Land use dominated by high input rice-wheat double crop system
- Ground water levels reducing and quality declining
- Intense air pollution as a consequence of slash-and-burn practices

Economic:

- Volatile and concentrated revenues from few agricultural products
- More than 85% of Punjab farmers are indebted
- High dependency on public subsidies and government procurement programs

Social:

- Political tensions with neighbouring states over water rights
- Hidden health costs, including stress and mental illness
- Younger generations shifting to non-farm employment

Water intensive paddy cultivation

Narinder Nanu/AFP/Getty Images

Slash and burn technique for field cleaning

Saagnik Paul/Greenpeace

Source: Systemiq analysis; Punjab Gov; Gov of India; Experts interviews

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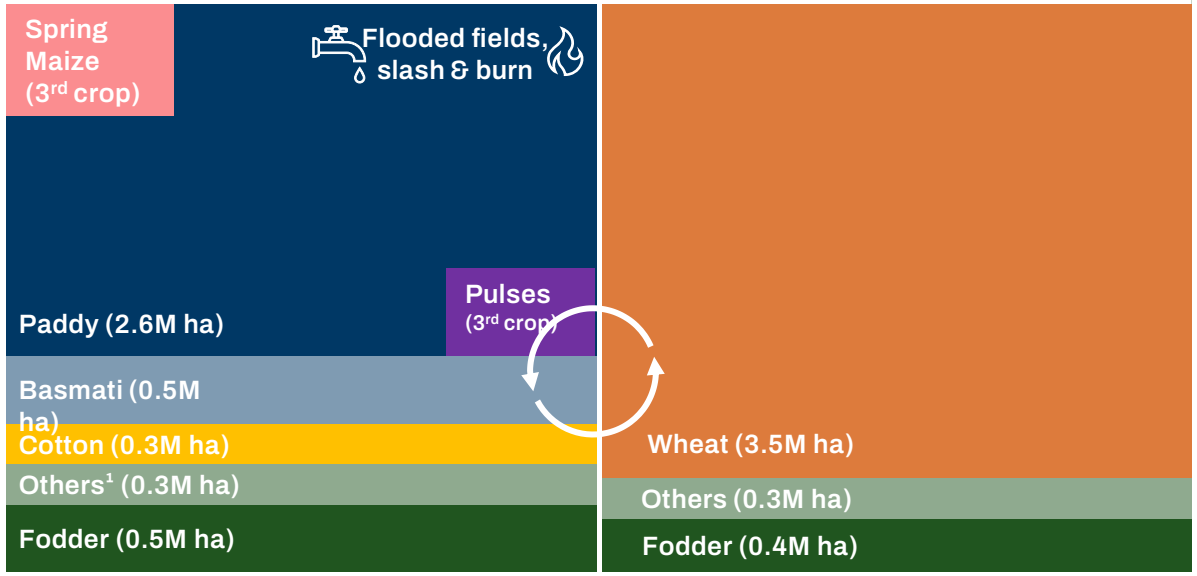
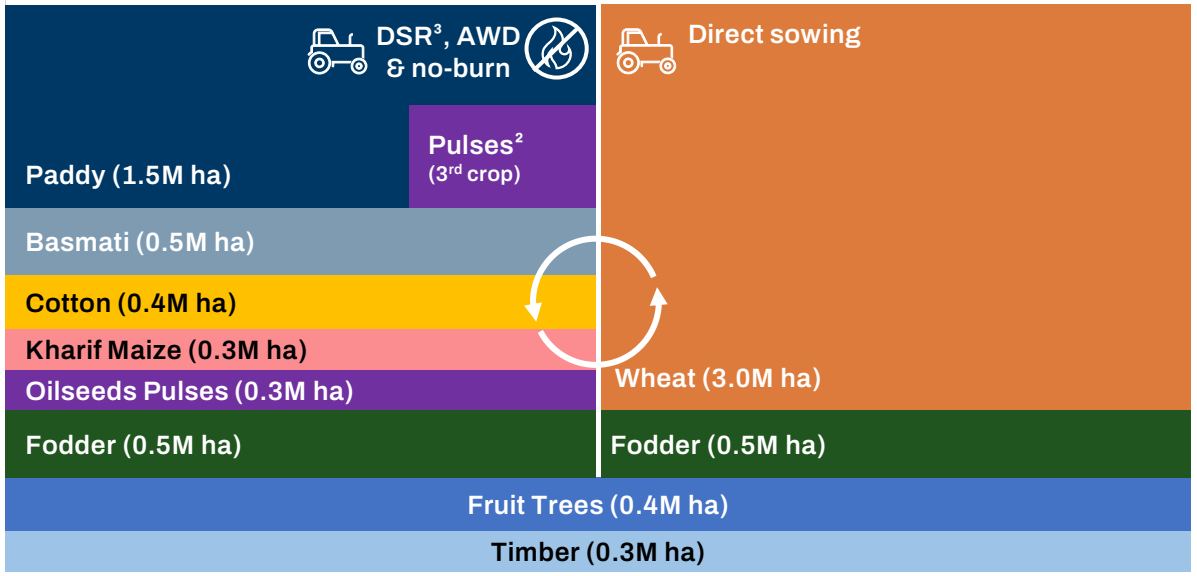
An alternative to Punjab's landscapes involves diversifying from rice and adopting water and GHG-saving practices

Current land use at agricultural landscape level



Alternative land use at agricultural landscape level



Transition pathway hypothesis

- Diversifying the agricultural components within Punjab's landscape and increasing the adoption of regenerative agricultural practices, such as direct rice and wheat seeding, alternate wetting drying, and stubble management, can alleviate some of the challenges for the landscape pertaining to issues such as underground water depletion, poor air quality and soil health, and revenue concentration.
- Introducing perennials on cropland can increase carbon sequestration and air cleaning, prevent water run-off, increase biodiversity and become a new resilient income stream to support India's growing need for timber.

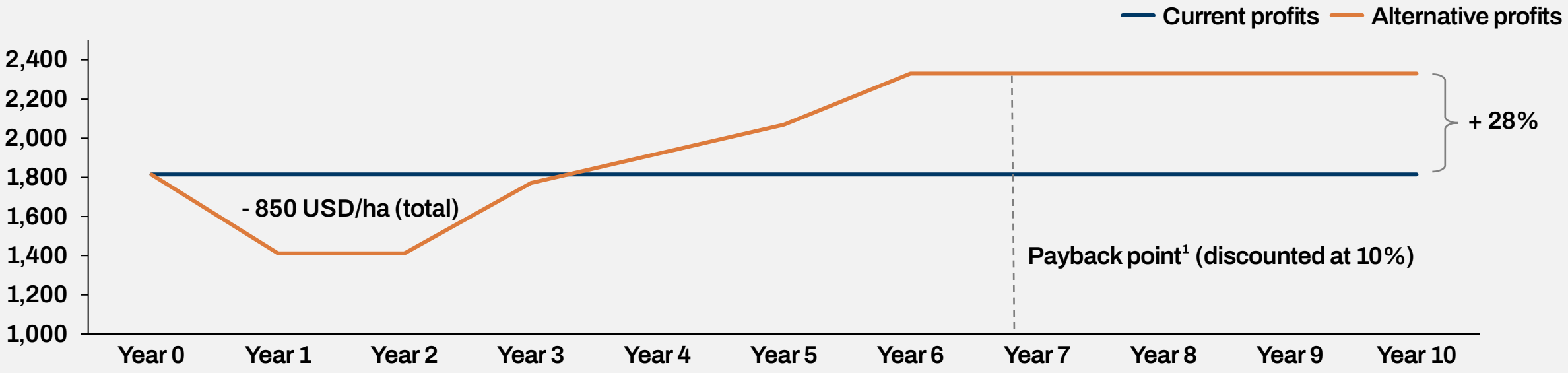
Main set of changes

- Crop diversification: decrease paddy area and increase traditionally cultivated crops.
- Forestry/trees: Integrate fruit and native trees for timber
- Growing practices: Increase direct sowing and crop residue management

Note: [1]Sugarcane and Guara Kharif Crops and Barley, Oilseeds, Pulses Rabi Crops were omitted due to low representativity. [2]Assumes the inclusion of a third crop entails no straw-burning. [3]Salt affected areas might not be well suited for DSR- Direct Seeded Rice before soil is adequately restored. [4] Kharif season refers to the monsoon crop cycle and Rabi denotes the winter crop cycle.
Sources: Systemiq analysis; Punjab Agricultural University; Gov of Punjab; International Rice Research Institute, Experts interviews

Modelling the transition suggests positive results after year 4 and payback by year 7 in cash terms

Comparison between annual net income: current vs alternative state, undiscounted cash (USD/ha)



- Farms' profitability decreases during an interim transition period and reaches a point of equilibrium that is approximately 30% higher in the alternative state after year 6 of the transition.
- The initial drop in profitability relates mainly to investments in and delayed revenues from the introduction of perennials (fruits and timber).
- The drop in profitability is partly offset by cost savings from mechanization and slightly higher wheat yields from an increase in direct seeding practices.
- Farmers would forgo 850 USD/ha in cumulative profits before profitability returns to current state levels (undiscounted cash).
- For an average 4 ha farm, a short-term cost of ~$3.5k (profit lost in years 1-3) is offset by expected additional profits of ~$12K in years 4-10, resulting in a net gain of ~$8.5K over the 10-year period (undiscounted cash).[3]

Note: [1]When accumulated profits from alternative state surpasses those from current state. [2]Model focuses solely on the agricultural landscape (aggregation of farms) and does not contemplate costs for eventual new landscape level infrastructure or market channels. Conservatively assumes no carbon revenues, green premiums, or increase in land value and a cyclic approach for earlier timber harvesting. Landscape transition happens all at once. [3] Costs and returns will vary significantly based on the farm's portfolio. Source: Systemiq analysis

Regenerative interventions could return USD 3 billion to Punjab's agricultural landscape in 10 years

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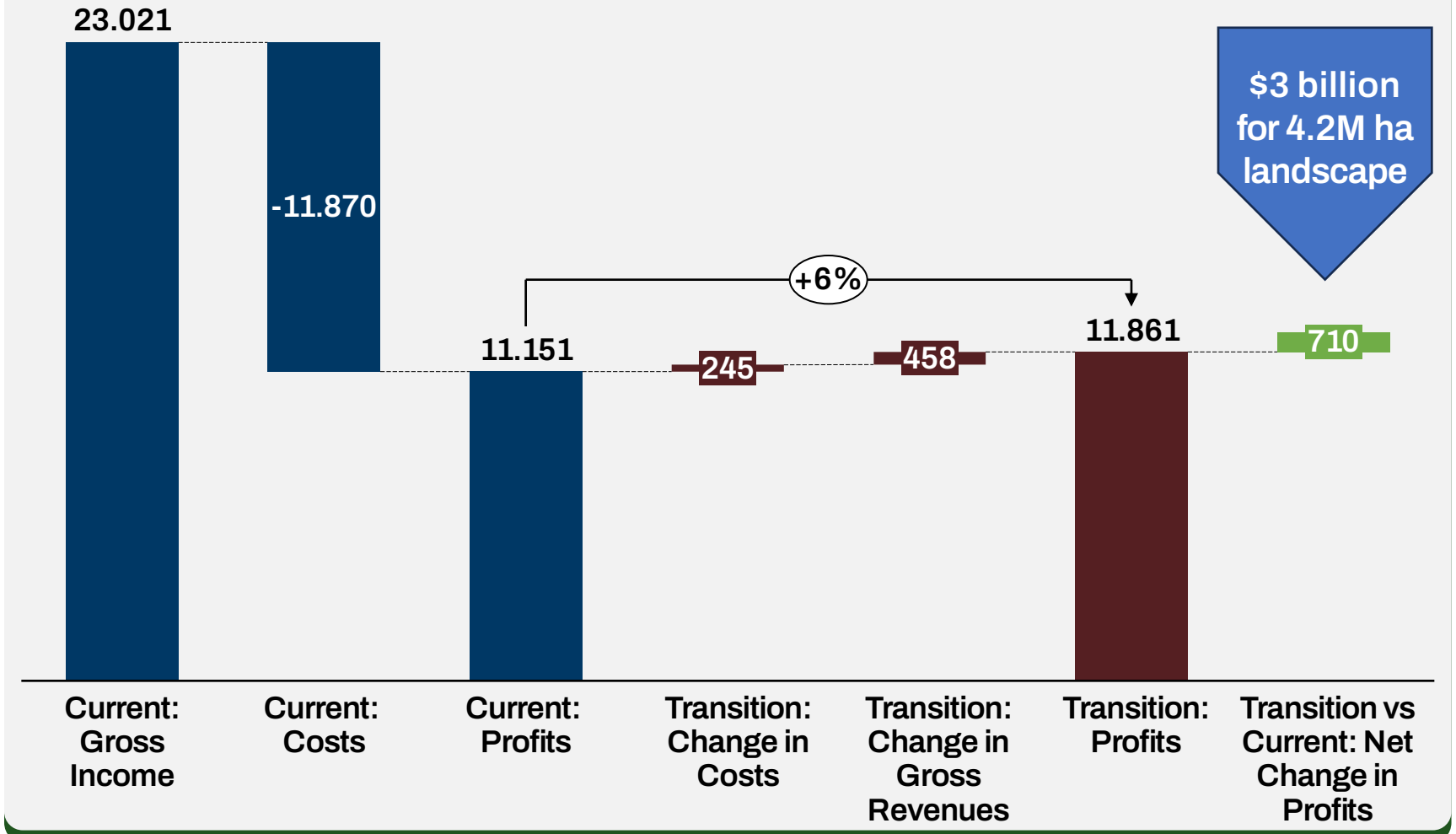
10-year Cumulative income and expenditures – Net Present Value[1] discounted with 10% rate (USD/ ha)



- Increasing crop diversification with oilseeds, pulses, fruit trees and others is a profitable transition with 710 USD/ha or 3 billion USD for landscape in Net Present Value.
- Cost savings on cash crops and higher revenues from perennials are the main drivers of increased revenues during the transition period.
- Post- Transition cumulative profitability is 6% higher in NPV terms, more diversified and less prone to market fluctuations.
- Further economic benefits should be expected from electricity savings[2].

Notes: [1] Net Present Value, [2] In 2024 70% of Punjab`s 1.65B USD agricultural budget was allocated to provide free electricity to farmers, most of which is used to pump ground water to flood rice fields.
Source: Systemiq analysis

Positive environmental outcomes can follow if enabling conditions for transition are met

Regen10 Framework landscape level outcomes[2]	Indicative impact from transition
Economic / Environmental / Social	Negative — Neutral — Positive
Increase economic diversification and resilience	
Increase landscape value creation	
Optimize landscape biodiversity & habitat functionality	
Minimize water, soil and air pollution	
Improve water availability	
GHG emissions minimization	
Optimize carbon sequestration and storage	
Enhance inclusivity and empowerment of local communities	
Enhance well-being of the local communities	
Increase employment, knowledge and education	
Optimize access to safe and nutritious food[3]	

Key implications and recommendations

- Transition increases value to the agricultural landscape by USD $3 billion in NPV terms and benefits the environment over the next decade
- Overall, farmers' income is more diversified and less prone to market shifts
- Regenerative interventions reduces social tensions over water and enhances community health

For transition to be possible, we need:

- Public support, including MSP[1], to help alternative crops be competitive along rice/paddy
- Public and private players to develop infrastructure and demand signals for sustainably produced rice and other diversified agricultural products
- Farmers to be provided with affordable technical aid and appropriate financial support, on top of current public incentives, during first years of transition
- Longer land tenure and legal certainty for perennials

Notes: [1]Minimum Support Price. [2]Regen10 Outcome Framework Indicators for Landscapes from zero-draft version. [3] Nutritional diversity is higher but food loss increases due to perishable nature of fruits
Source: Systemiq analysis

Further considerations for Punjab's landscape agricultural transition

Punjab has been a focus of numerous studies and initiatives addressing agricultural challenges. The Regen10 analysis contributes by highlighting potential economic benefits of adopting one set of regenerative agricultural practices. The proposed approach is not prescriptive but represents one potential pathway for agricultural transition. It demonstrates tangible gains from a transition, both economically and environmentally, reframing the issue as an opportunity to implement necessary changes on the ground, with the recognition that:

Farmer-Driven Transition:

Punjab farmers are aware of the ecological degradation caused by current cropping system and seek improved solutions to preserve natural resources; ultimately, a transition is only possible if driven by them, with governments and other stakeholders providing the enabling conditions for their success.

Need for Concrete Evidence and Economic Viability:

Farmers will need to see clear benefits from transitioning through evidence of linkages and economic feasibility, ensuring livelihoods can be maintained and improved before risking a move from an already delicate financial position.

Critical Linkages In Place:

Any implementation of diversification strategies will need upstream and downstream linkages within agricultural value chains. Institutional arrangements such as public-private partnerships are necessary to provide the required market infrastructure and the scaling up of new and alternative crop choices.

District-Level Diversification Plans:

Tailored district-level diversification plans for Punjab must be developed through grassroots participation, considering specific agro-ecological, economic, geographic, and socioeconomic factors within each part of the state.

Overcoming Implementation Challenges:

Widespread dissemination of practices like DSR[1], AWD[2] or crop diversification will encounter implementation challenges that can hamper steady and cost-efficient progress. Technical and financial support from government and businesses must be designed and adapted to favour and sustain change.

Notes: [1] Direct Seeded Rice, [2]Alternate Wetting Drying
Sources: Systemic; FOLU – The Food and Land Use Coalition India; TERI - The Energy and Resources Institute; WBCSD – World Business Council For Sustainable Development

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Summary

Diversifying Punjab's agricultural landscape could add USD 3 billion to farmers' incomes while improving environmental outcomes

The short-term costs of a transition to regenerative practices are offset by an average 30% increase in long-term farm profitability[4]

Current state of agricultural landscape

Agronomic & Environmental

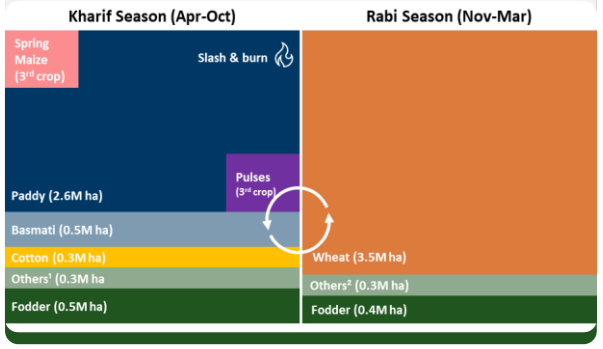
- Land use is dominated by a mono-crop rice-wheat system known for intensive underground water usage, high inputs and burning practices.

Economic

- Punjab's farmers face high debt with volatile revenues from few crops, reliant on subsidies and government purchases.

Social

- Political tensions over water rights persist with neighboring states; hidden health costs; Younger generations favor non-farm jobs.



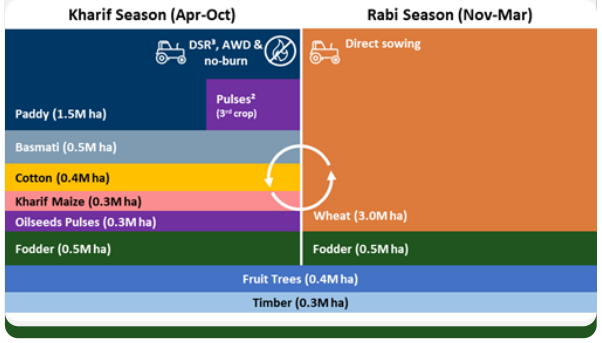
Transition pathway hypothesis

Crop diversification

- Decrease area for water intensive paddy and diversify landscape with cotton, maize and oilseeds pulses.
- Widespread adoption of direct rice and wheat sowing, alternate wetting drying, and stubble management for better water usage and lower air pollution.

Forestry/trees

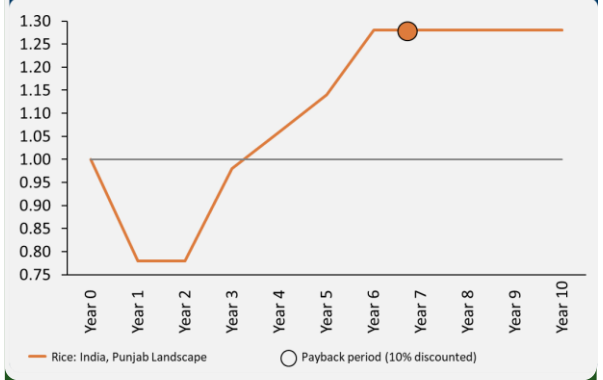
- Implement perennials (fruit and native trees for timber) to increase carbon sequestration, increase biodiversity and further income diversification.



Results of economic modeling

- $3 billion Net Present Value (NPV – 10% discount) could be generated in the landscape with payback in year 7.
- Over 10 years, the cumulative effect of transition is positive with an average added NPV of 710 USD/ha.[2]
- Average farm profitability lowers during an interim period and reaches a point of equilibrium ~30% higher after year 6.
- Cost savings on cash crops and higher revenues from perennials are the main contributors to the positive net change.

Change in net profitability over a 10 years period for proposed transition pathway (alternative state/current state) Indicated in relative terms



Implications and recommendations

- Transition lifts farmer income by 6% in NPV and benefits the environment over the next decade.
- Diversification makes revenues more resilient and less affected by economic and climate market shifts.
- Regenerative agricultural practices reduce social tensions over water and enhance community health.

For transition to be possible, we need:

- Public procurement, including MSP[1], to help alternative crops be competitive with paddy.
- Public and private players to develop infrastructure and demand signals for sustainably produced rice and diversified agricultural products.
- Farmers to be provided with affordable technical aid and appropriate financial support, on top of current public incentives, during first years of transition.
- Longer-term land agreements for perennials.

Note: [1]Undiscounted cash. [2]Model focuses solely on the agricultural landscape (aggregation of farms) and does not contemplate investments in technical assistance, new landscape level infrastructure and market channels. Conservatively assumes no carbon revenues or price premiums, high fruit spoilage rates and a cyclic approach for earlier timber harvesting. Landscape transition happens all at once. [3]Minimum Support Price. [4]Costs and returns will vary significantly based on the farm's portfolio. Systemiq analysis for Regen10.org