East of England – UK – Potatoes

Potato farmers in the East of England are facing concerning trends due to extreme weather and labor shortages

- The region accounts for one-third of England's potato outputs, despite the crop occupying only a modest portion of the land.

Landscape information

- Geographical Area: 1.9M ha
- Farmed Area: 1.4M ha (30% rented)
- Arable Area: 1.1M ha
- Potatoes Crop Area: 30K ha
- Population: 6.3 million (21% rural)
- Land holdings: 11.300
- Average farm size: 127 ha

Current Challenges (potatoes focus)

Agronomic & Environmental:

- Shifting rainfall patterns and temperature variability due to climate change.
- Overcropping and high input use with long term negative effects on soil health.
- Dependence on land with limited history of field use, exacerbating difficulties in managing rotation and pest control.

Economic:

- Considerable part of farming area is under short-term land stewardship/tenure agreements.
- Market fluctuations, rising input costs and uncertain over trade policies.

Social:

- Labor shortages during key seeding/harvesting periods exacerbated by post Brexit rules, which restricted the flow of seasonal workers.
- Farm consolidations[1] and a steady reduction in the number of small and medium-sized growers.

Soil preparation for potato seeding

Figure: Steve Parsons. Extracted from The Standard

Herbicide spraying for weed control

Figure: Tim Scrivener. Extracted from Farmersguide

Sources: UK Department for Environment, Food & Rural Affairs, UK Office for National Statistics, Eurostat, AHDB 2021, Expert interviews
Notes: [1]When large farms or commercial groups acquire land previously belonging to small ones

UK

A regenerative approach for potato fields involves extended crop rotations and soil-enhancing practices

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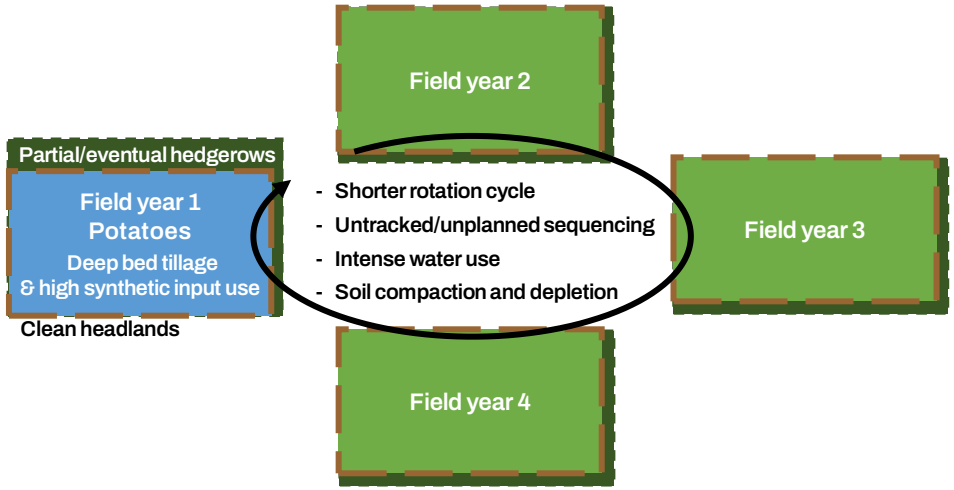
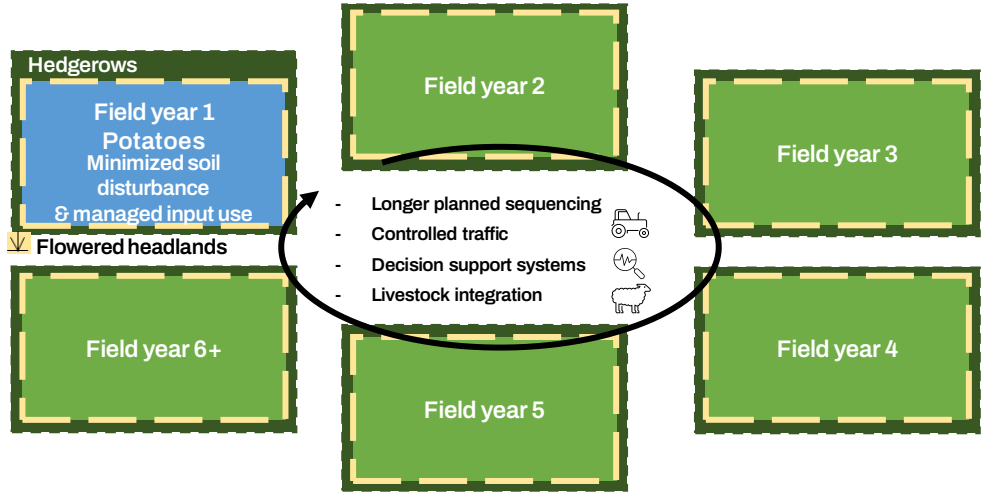
Current land-use scheme for potato fields[2]



Alternative land-use scheme for potato fields



Transition pathway hypothesis

- Broaden potato field rotations to six or more years with context appropriate and no-till crops e.g. cereals, oil seeds, grass, vegetables, flowers, etc., to allow soil to recover, prevent potato cyst nematode[1] and permit more nutrients to cycle with less chemical additives.
- Introduce a mix of cover crops ahead of potatoes to build organic matter reserves, improve water retention and reduce the amount and frequency of irrigation.
- Control farm traffic and keep tillage to a minimum on the fields e.g., fall bedding[3], to prevent compaction (soil compression) and further soil damaging, preserving microorganisms and keeping carbon locked in the soil.
- Integrate livestock grazing into the rotation where feasible and introduce pest and nutrient management systems to reduce synthetic inputs and runoff.
- Implement longer-term land rent agreements and data-driven decision support systems.

Set of changes used

- Crop diversification: 6+ years field rotations to heal and prepare soil.
- Cover crops: mix ahead of potatoes to build organic matter and improve water retention.
- Edge of the field: introduce/expand hedgerows and flowered headlands.
- Grazing: livestock integration when feasible.
- Growing Practices: minimum soil disturbance, input management system, traffic control systems, tramline disruption.

Notes: [1]Nematode pests cause crop damage in potatoes. [2] Since potatoes cover less than 5% of the landscape, the analysis focuses on crop fields to isolate the economic impacts of other, more prevalent crops. [3] Fall bedding in potato fields allows for soil preparation work to be done when growers typically have more time and labor available to them: https://spudsmart.com/fall-bedding

UK

Modeling indicates a break-even point after the first full rotation and a payback period of nine years in cash terms

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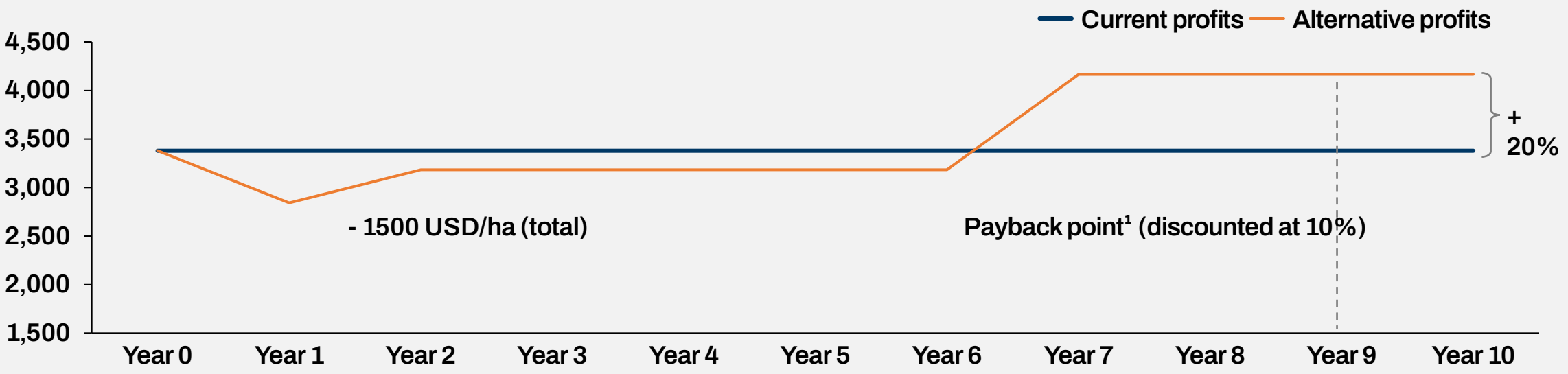
Comparison between yearly net income: current vs alternative state, undiscounted cash (USD/ha)

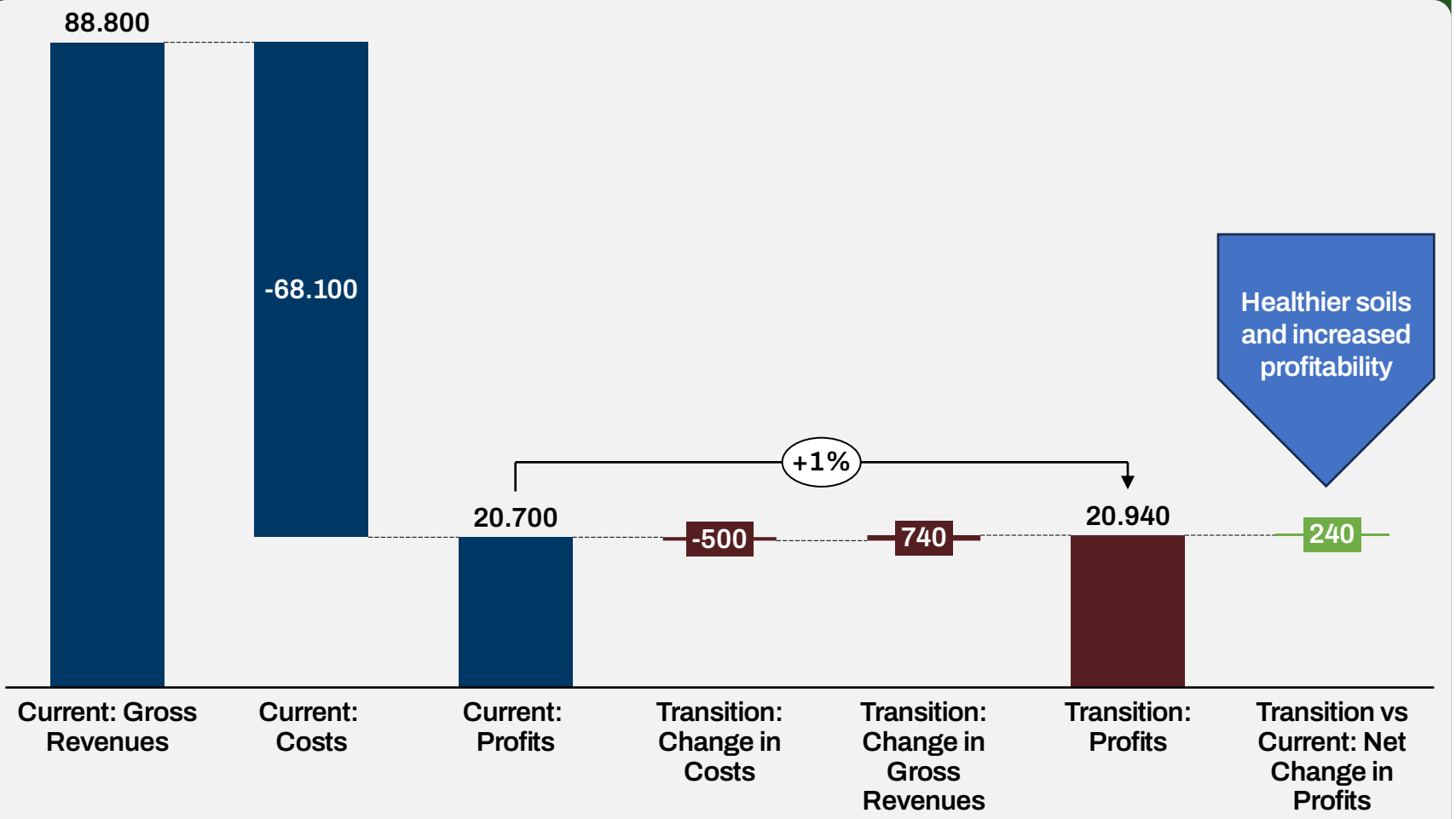


- Farm profitability decreases during the interim transition but reaches a 20% higher equilibrium after six years, once full field rotation, agronomic improvements, and soil benefits are realized for the next potato harvest.
- The drop in profitability is primarily due to increased overhead costs from new machinery, traffic and nutrient management systems, and professional services, as well as operational costs from cover crops and field edge protection investments.
- Higher profitability after transition is linked to reduced fertilizer and fuel inputs, and labor savings from decreased tillage.
- Farmers would forgo ~1500 USD/ha in cumulative profits before profitability returns to current state levels (undiscounted cash).
- For an average 127ha farm divided in six fields a short-term cost of ~$32k (profits lost in years 1-6) is offset by expected additional profit of ~$66K in years 7-10, resulting in a net gain of ~$34K over the 10-year period (undiscounted cash).[3]

Note: [1]When accumulated profits from alternative state surpasses those from current state. The model compares profitability per hectare for potato crops alone, excluding opportunity costs from longer rotation periods and expenses/revenues from other crops in the sequence, which will also need to be grown regeneratively for full economic/environmental benefits to be realized. Conservatively assumes no extra subsidies, carbon revenues, green premiums, or increase in land value. [3] Costs and returns will vary based on the farm's size and portfolio.
Source: Systemiq analysis

Over 10 years, the net present value of the transition is marginally positive despite initial overheads and investment costs

10-year CUMULATIVE income and expenditures – NPV[1] discounted with 10% rate (USD/ha)



- The adoption of combined regenerative agricultural practices represents a profitable transition, yielding approximately $240 USD/ha in NPV over 10 years for the potato farmers.
- The alternative model (see pg 3) results in cumulative profitability that is marginally higher and less prone to market fluctuations, as soil becomes more resilient due to rotations and less dependent on synthetic inputs.
- Higher overhead costs and investments, including machinery, are the main profitability detractors while inputs savings on chemicals and labor are the main contributors to positive change in profits.
- The positive change in gross revenues from the transition is smoothed in NPV terms by the delayed revenues from the longer rotation schemes.

Notes: [1]Net Present Value.
Source: Systemiq analysis

Transitioning to regenerative potato farming will also provide environmental benefits to the landscape

Regen10 Framework landscape level outcomes[1]	Indicative impact from transition[2]
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 the well-being of local communities	
Increase employment, knowledge and education	
Optimize access to safe and nutritious food	

Key implications and recommendations

- Extended and planned crop rotations, combined with soil and biodiversity restoration, can increase farmers' income by 20% post-transition (in nominal terms).
- Farmers can improve resilience to weather and market fluctuations through stable yields, reduced irrigation, and fewer synthetic inputs.
- Introducing regenerative practices in potato fields will benefit other crops and the broader landscape.

For transition to be possible, farmers need:

- Practical, trustworthy, context-specific knowledge programs that help farmers adopt new practices and make informed decisions tailored to their goals.
- Longer-term tenures and joint soil fertility investment by tenants and landlords.
- Easily available financial incentives and value chain facilitation to allow initial farm investments and secure margins during the transition.
- Developed data ecosystem with clear protocols for sharing information like field history and supporting data-driven decisions.

Notes: [1]Regen10 Outcome Framework Indicators for Landscapes from zero-draft version. Qualitative base analysis. [2]Significant positive outcomes on potato farms are less noticeable at the landscape level because the crop makes up a small proportion of the total planted area. Source: Systemiq analysis

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Summary

A regenerative approach for potato fields will lead to higher and more resilient profits for East of England growers

United Kingdom
East of England

The initial investments to enhance soil health and crop management are offset by an average 20% increase in farm profitability after the first longer rotation cycle.

Current state of agricultural land-use

Agronomic & Environmental

- Climate-driven rainfall shifts, intense input and water use, limited data on field history, degraded soil health and complicated crop management.

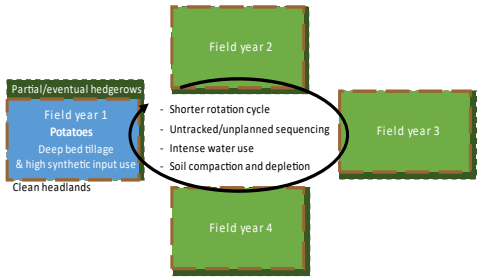
Economic

- Short-term land stewardship agreements, market fluctuations, rising input costs, and uncertainty over trade policies.

Social

- Labor shortages during critical seeding and harvesting periods, exacerbated by new immigration rules, along with farm consolidations (large farms acquiring land belonging to small ones) and a steady reduction in the number of small and medium-sized growers.

Current land-use scheme for potato fields



Transition pathway hypothesis

Extended and planned crop rotations

- Broaden potato field rotations to 6+ years with context appropriate and no-till crops for soil recovery, pest prevention and natural nutrient cycling.

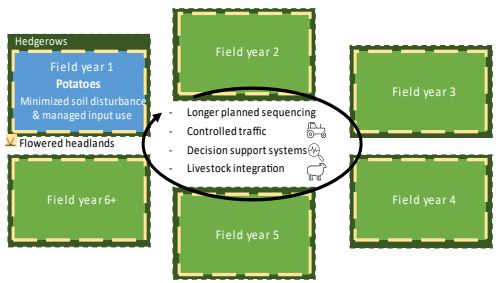
Minimized soil disturbance

- Control farm traffic and keep tillage to a minimum to prevent soil compaction and damage, preserving microorganisms and keeping carbon locked-in.

Farm and input management

- Introduce data-driven decision-aid systems to reduce use of synthetic inputs and runoff, and longer-term rental agreements for joint soil fertility investments.

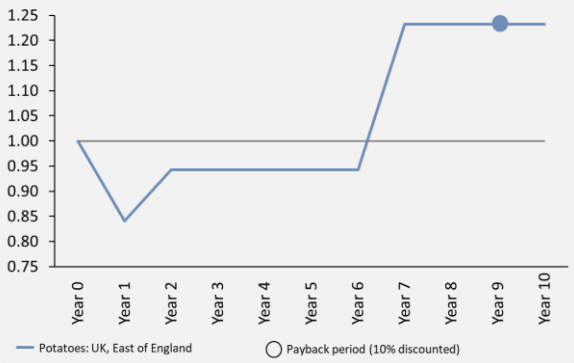
Alternative land-use scheme for potato fields



Results of economic modeling

- Over 10 years, the cumulative effect of a transition to regenerative agriculture is positive with an average net added value of 240 USD/ha and a payback[3] by year 9 (10% discounted).
- Profitability lowers during an interim period and reaches a point of equilibrium 20% higher after the first full 6 years rotation.
- Higher overhead costs and investments, including machinery, are the main profitability detractors while savings on chemicals and labor are the main contributors to positive change in profits.

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



Implications and recommendations

- Regenerative systems can increase farmers' income post-transition.
- Farmers can improve resilience to weather and market fluctuations through stable yields, reduced irrigation, and fewer synthetic inputs.
- Introducing regenerative practices in potato fields will benefit other crops and the broader landscape.

For transition to be possible, we need:

- Practical, trustworthy, context-specific knowledge programs that help farmers adopt new practices and make informed decisions tailored to their goals.
- Longer-term tenures and joint soil fertility investment by tenants and landlords.
- Easily available financial incentives and value chain facilitation to allow initial farm investments and secure margins during the transition.
- Developed data ecosystem with clear protocols for sharing information like field history and supporting data-driven decisions.

Note: [1]Net Present Value 10% discounted. [2]Costs and returns will vary significantly based on the farm's portfolio. The model compares profitability per hectare for potato crops alone, excluding opportunity costs from longer rotation periods and revenue from other crops in the sequence. Conservatively assumes no extra subsidies, carbon revenues, green premiums, or increase in land value. Landscape transition happens all at once .[3] When accumulated profits from alternative state surpasses those from current state. Systemiq analysis for Regen10.org

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