The impact of Social Forestry zoning governance and coffee management on farmers' livelihoods and ecosystem services

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SUSTAINABLE UPLAND PRODUCTION LANDSCAPE, BANDUNG – 26 JANUARY 2023

BACKGROUND

- Pagar Alam City is a peri-urban upland area, producer of coffee, rubber and horticultural crops.
- It is in the upstream part of Musi Watershed, the largest watershed in South Sumatra that provide enormous ecological and economic resources
- With the boom of coffee local market, improving the coffee supply chain can benefit farmers.
- The social forestry scheme is an opportunity for coffee farmers to improve the quality of coffee and access to land

RESEARCH QUESTIONS

- How are the existing policy influence economic well-being and environmental outcomes?

- How do alternative policy perform compare to existing policies on long-term economic well-being and environmental outcomes?

- Is there trade-offs? How can the alternative policy provide synergistic economic well-being and environmental outcomes?

To answer the above RQ, we will conduct an ex-ante analysis using a spatially explicit simulation model - FALLOW

FALLOW Model

- FALLOW is a semi agent-based model, where farmers, as actors, make decision on what to farm, transforming the landscape.

- FALLLOW considers changes in the landscape will have consequences on landscape & household economy and provisioning of ecosystems services

- It is a spatially explicit model that can be applied at any scale.

- It runs on annual time step.

Model representation of a landscape

FALLOW model simulates the landscape under three main units:

- **Plot** as a unit that is managed by farmers. The size of the plot equals the size of the pixel of the maps used as input parameters. The default is 1 ha.

- **Livelihood options -** activities performed by farmers
  i.   In single land use system e.g. cropping systems and agroforestry systems
  ii. In multiple types of land use systems e.g. cattle rearing, rattan or firewood harvesting
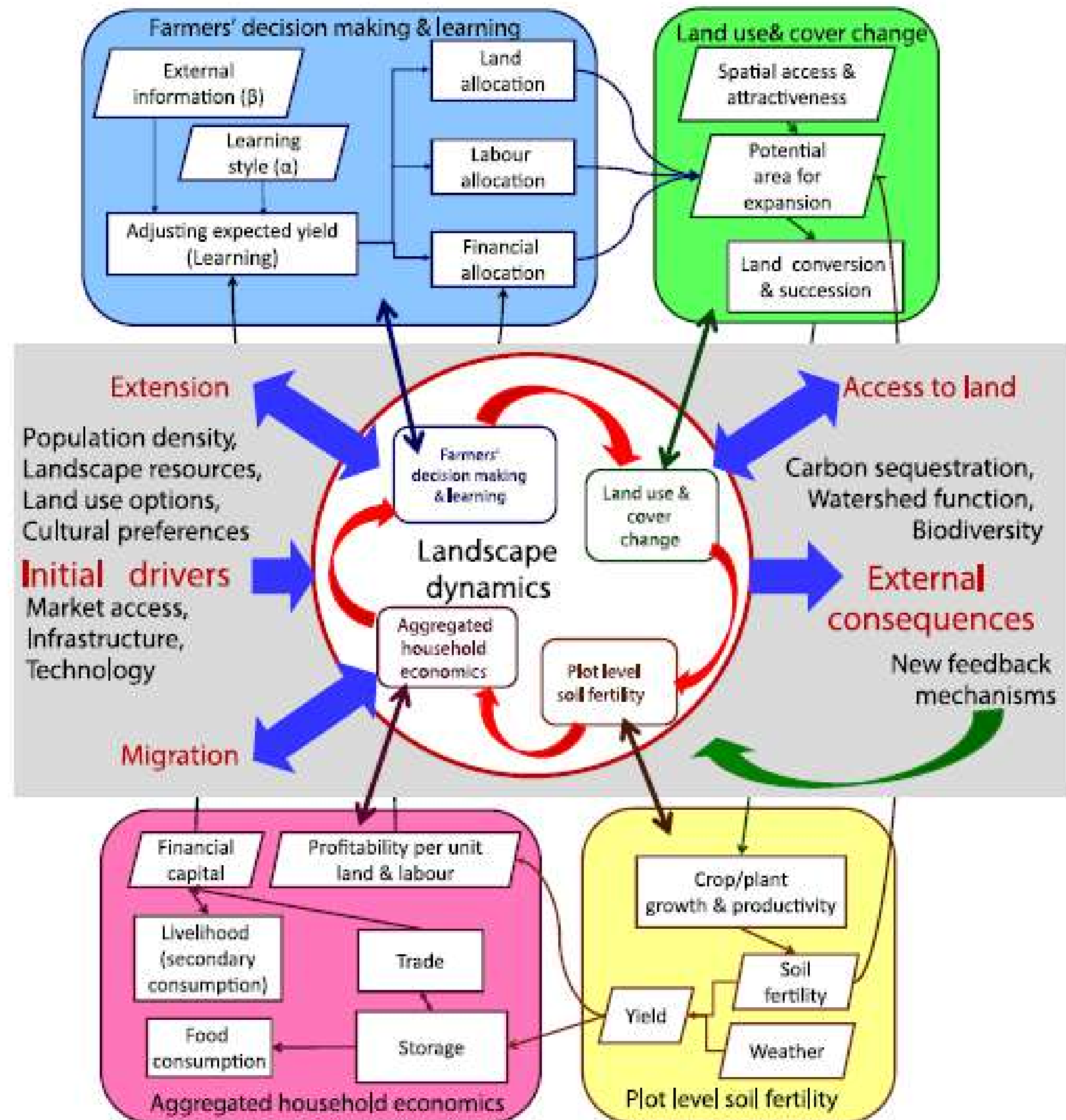 iii. Activities that are not associated with land-use systems e.g. off-farm activities

Photo: World Agroforestry/Isnurdiansyah

- **Aggregated farmers** as the main agents of land-use change. An aggregated farmer is an average farmer that represents a group of farmers with similar livelihood options

Model representation of a landscape
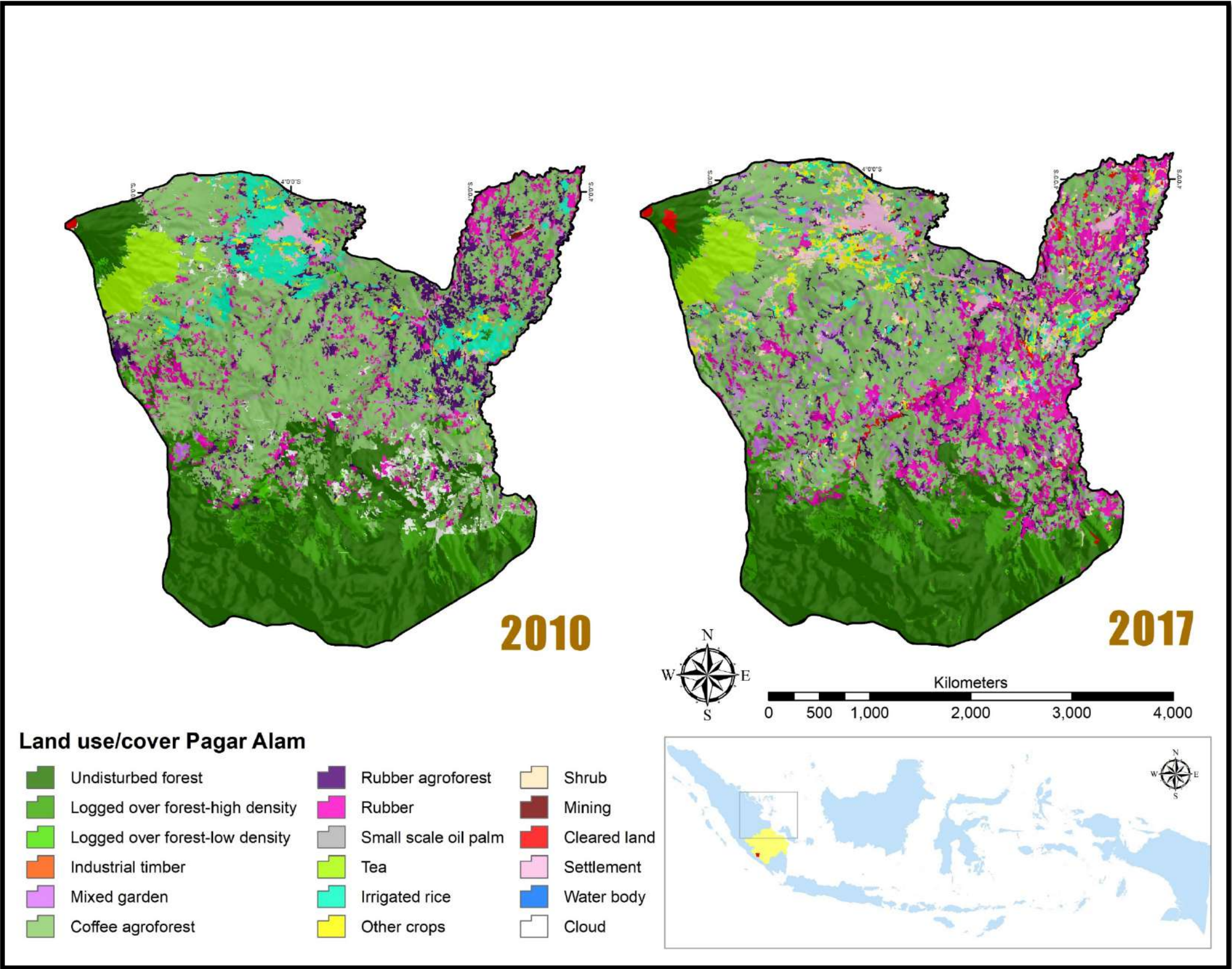
4 MAIN MODULES in continuous loop

- **Plot Level Soil fertility**
- **Aggregated household economics**
- **Farmers decision making and learning**
- **Land use land cover change**

INPUT PARAMETER

Land Cover Change (2010 – 2017)

Land use/cover Pagar Alam

- Undisturbed forest
- Logged over forest-high density
- Logged over forest-low density
- Industrial timber
- Mixed garden
- Coffee agroforest
- Rubber agroforest
- Rubber
- Small scale oil palm
- Tea
- Irrigated rice
- Other crops
- Shrub
- Mining
- Cleared land
- Settlement
- Water body
- Cloud

Area of the main farming systems (% total landscape)

Farming systems	2010	2017
Tree Based systems	55.4	53.8
Coffee	42.7	49.4
Karet	10.1	2.0
Annual Crop		
Rice	4.0	4.8
Other crop/ Horticulture	0.9	2.5

Productivity, profitability, and plot-level carbon stocks of the major land cover/land use systems in Pagar Alam

Land cover/ land use systems	Yield ton/ha/yr	Price USD/ton	Return to land USD/ha	Return to labour USD/day	Establishment labour (day/ha)	Establishment cost USD/ha	Carbon stocks ton/ha
Forest	-	-	-	-	-	-	145.9
Rice	8.5	407.4	732.6	5.2	178.5	222.5	4.0
Vegetables	47.7	274.6	3,592.6	7.4	337.1	1,315.3	3.0
Potatoes	22.2	709.6	6,690.3	12.4	281.7	2,865.6	3.0
Coffee AF	1.1	1,611.7	446.0	6.7	37.9	46.1	66.3
Rubber AF	1.3	600.2	254.1	7.1	9.9	132.5	71.6
Rubber mono	1.7	467.8	62.0	4.4	18.2	102.5	63.2
Oil Palm	24.2	62.4	194.1	5.5	18.9	134.7	36.2
Mixed Systems	0.9	185.2	178.4	5.8	13.3	23.1	67.7

SCENARIOS

Indonesia's Formal Social Forestry Schemes

The target area and scheme of this study

Social Forestry Schemes	Hutan Desa (HD)	Hutan Kemasyarakatan (HKm)	Hu... Ra...
English name	Village Forests	Community Forestry	Co... Fo...
Main entities	Village institutions; village farmers group	Farmers groups; local cooperatives	Ind... gro...
Forest tenure		State ore...	
Allocated State-Forest		Production and protection forests	
Contract duration		35 years maximum, with evaluation eve...	
Management practices	Collecting non-timber forest products; timber extraction... services use		

Approx 30% of forest area

|			
Non-forest		Indicative area for social forestry	
Social forestry permit		Protection forest	

Scenario	Accessibility for coffee in forest area	Access knowledge, facilitation, technology *improved coffee systems*	Harvesting practice *premium coffee*
BAU	✓	X	Stripped (ST)
1A	✓ in SF ✓ existing coffee	✓ in SF	Selective (SL) in SF area, ST elsewhere
1B		✓	SL and ST everywhere
2A	✓ in SF	✓ in SF	SL in SF, ST elsewhere
2B		✓	SL and S everywhere
3A	✓	✓	S everywhere
3B		✓	SL and ST everywhere

SIMULATION RESULTS
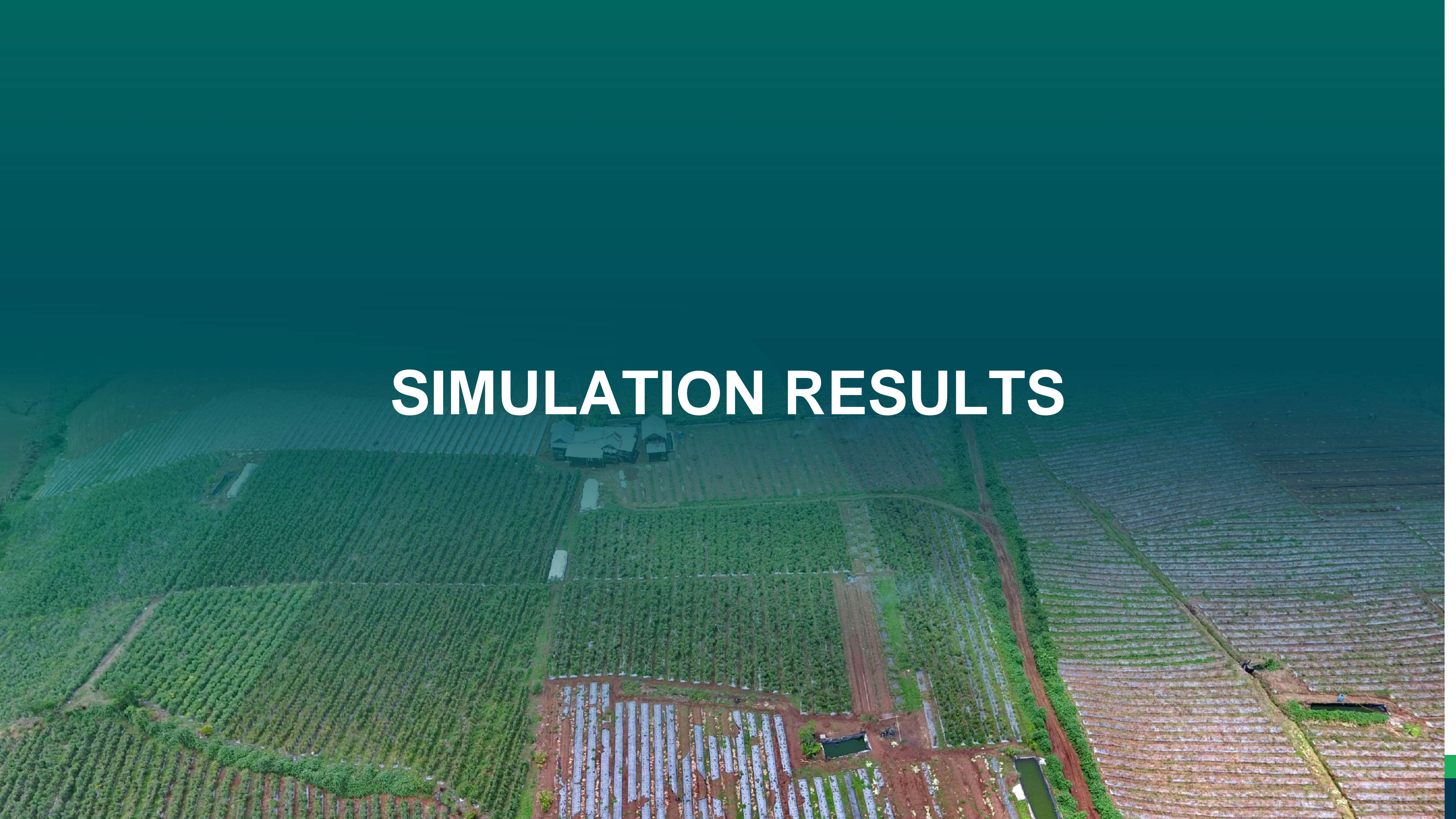
Distribution of land use systems at the end of 30-year simulation (2047)
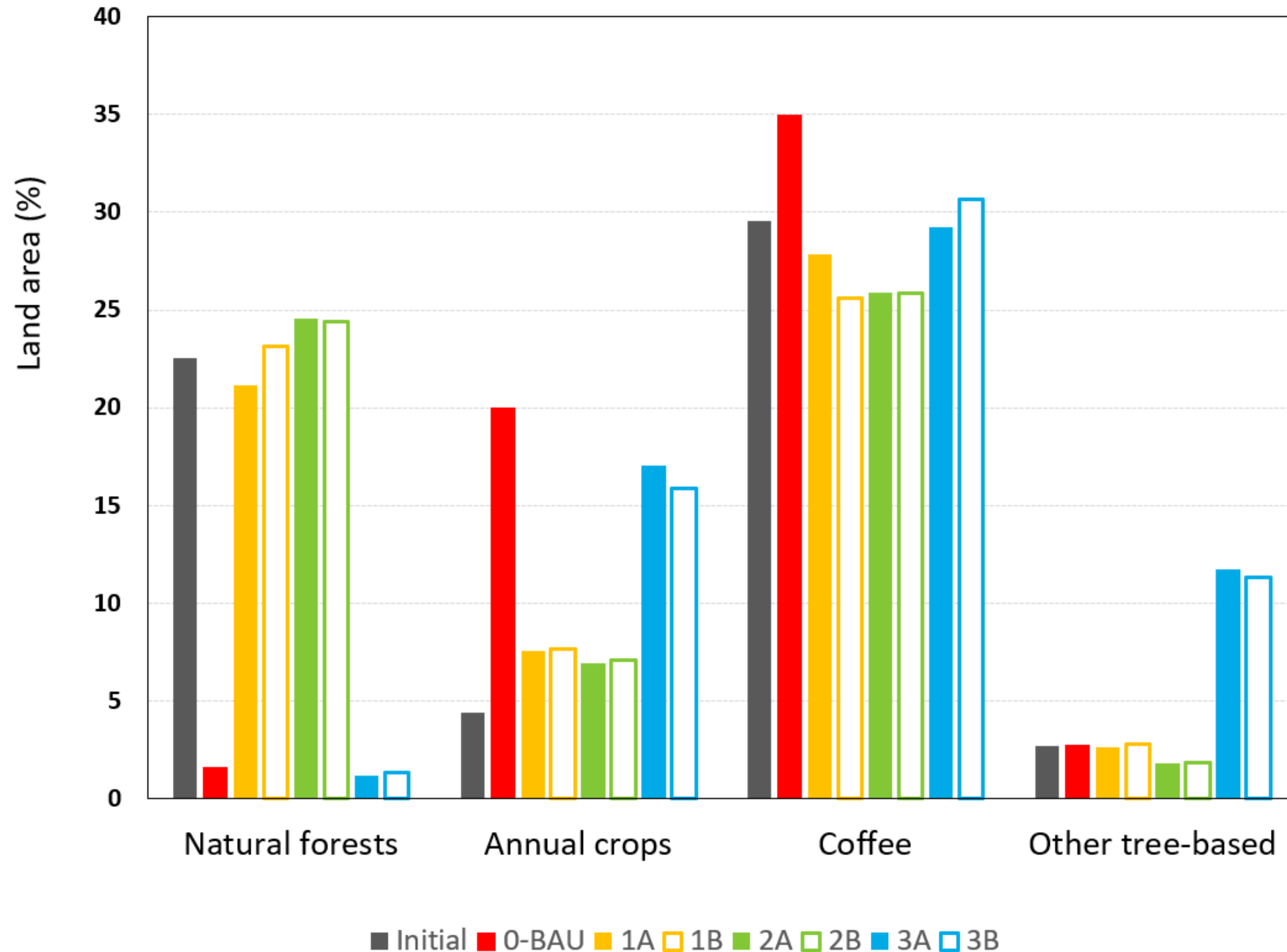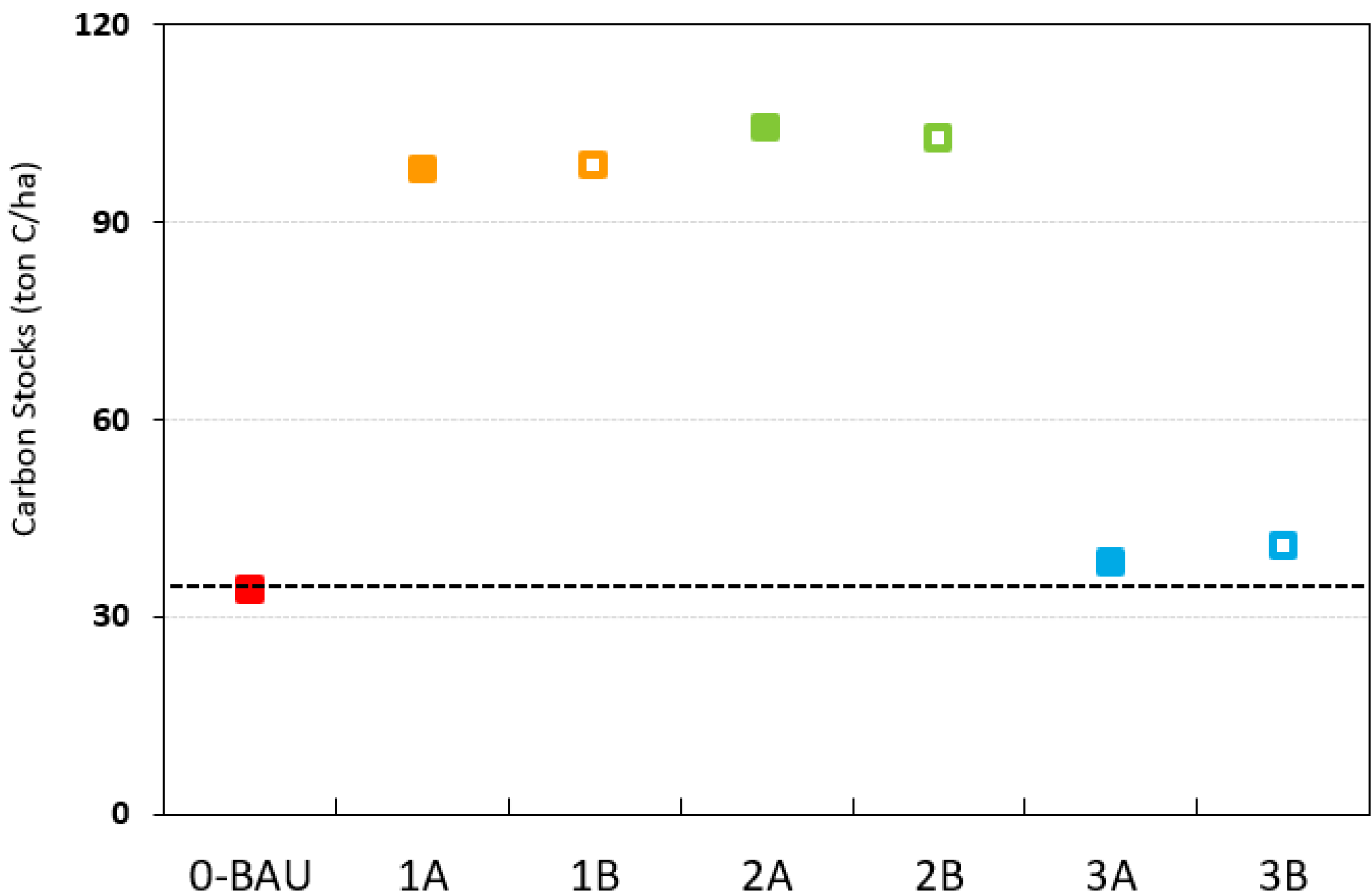

- Forest loss and coffee area is the highest in BAU scenario, followed by the *Social Forestry scenario.*

- Coffee area is high in *Open Access Scenario* and reduced in the *Social Forestry scenario*

Average revenue derived from agriculture (USD/year over 30-years period
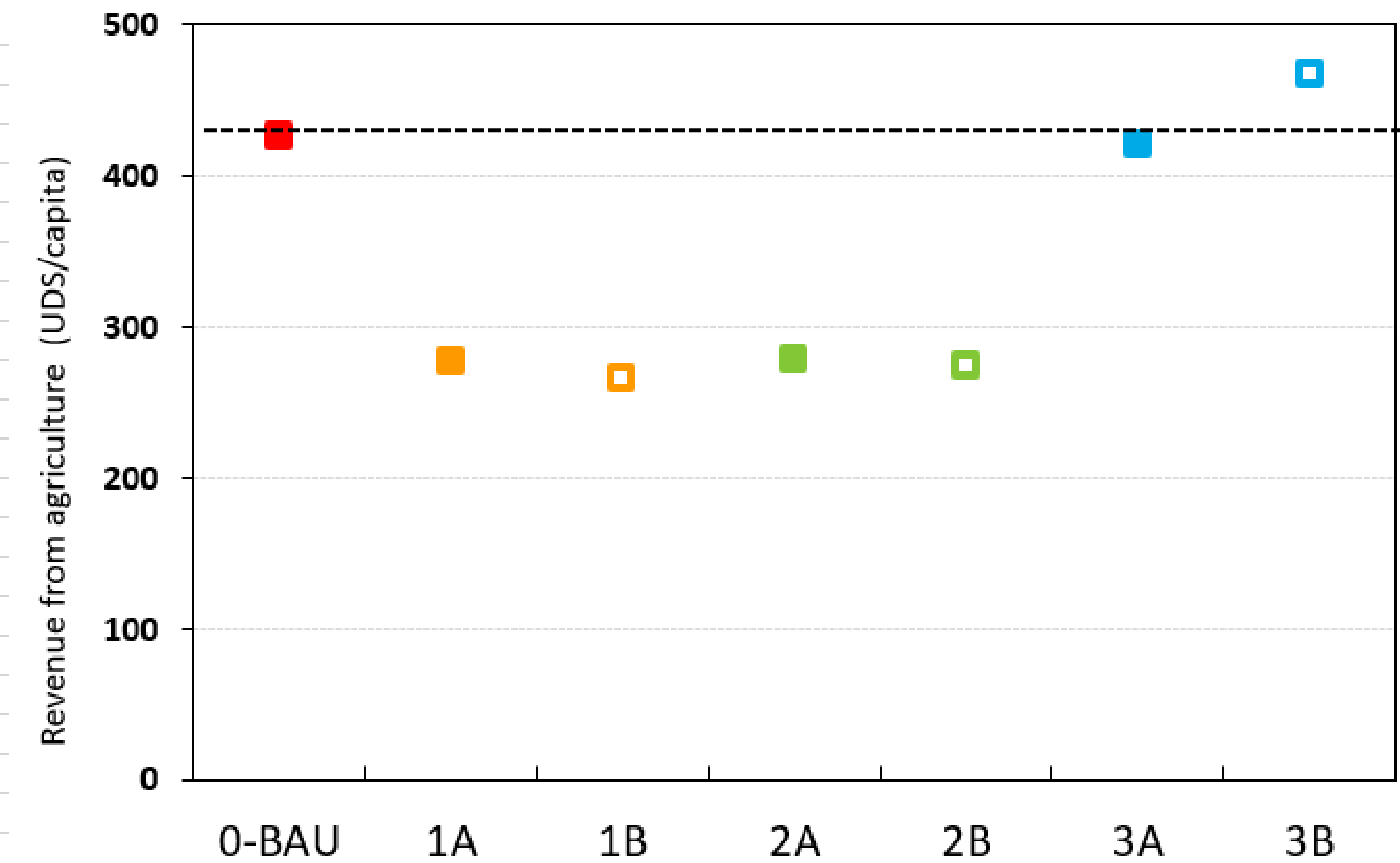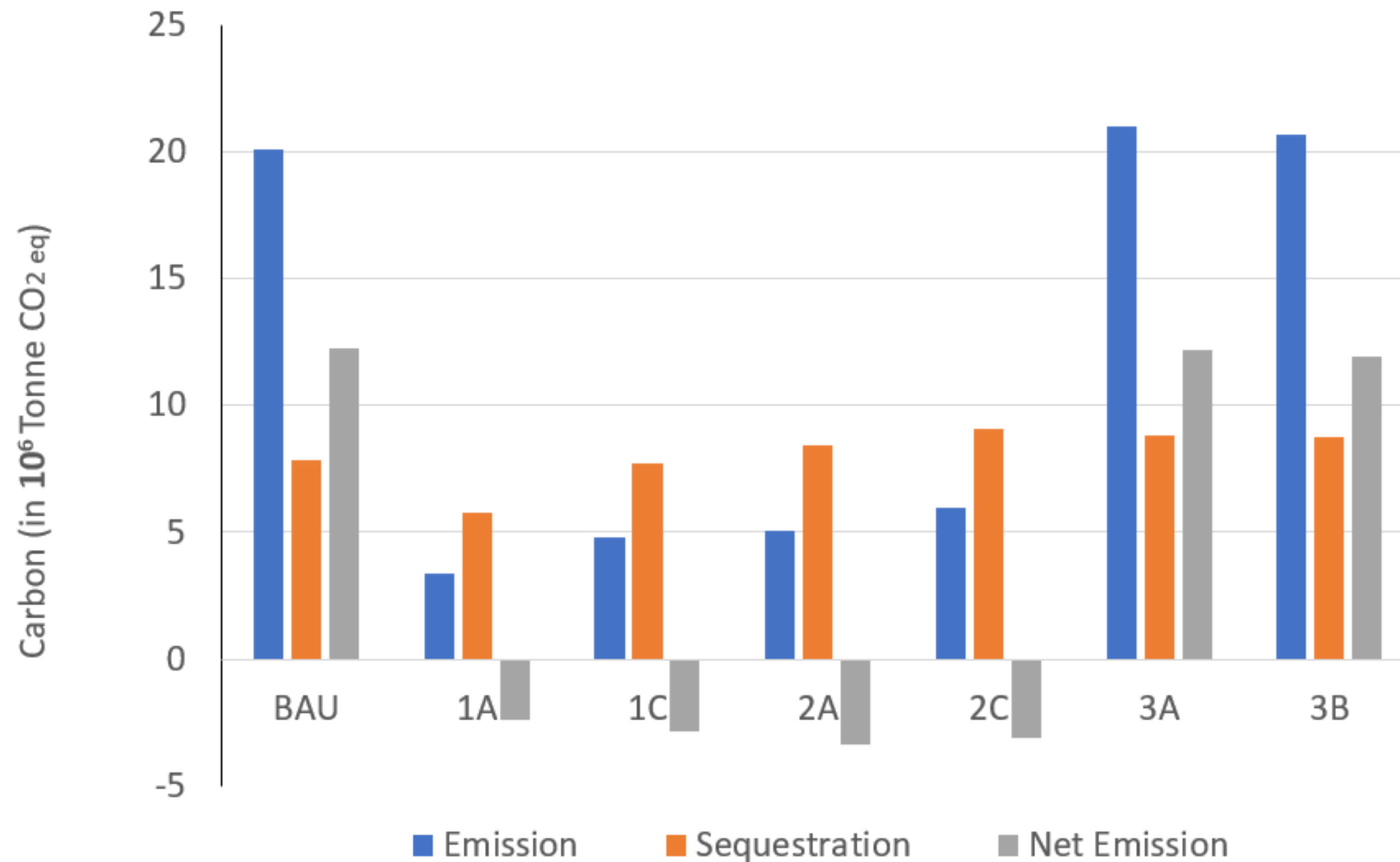
**Average carbon stocks (ton/ha over 30-years period)**

- High revenue obtained in BAU and Open Access scenarios.
- High carbon stocks in Social Forestry scenarios

Estimated carbon emission & sequestration over 30 years period (2017-2047)

- The open access scenarios emitted carbon with net emission of approximately 12 Million CO_2 equivalent.
- The Social Forestry scenarios have negative net emission – sequestering carbon.

Erosion risk at the end of simulation run
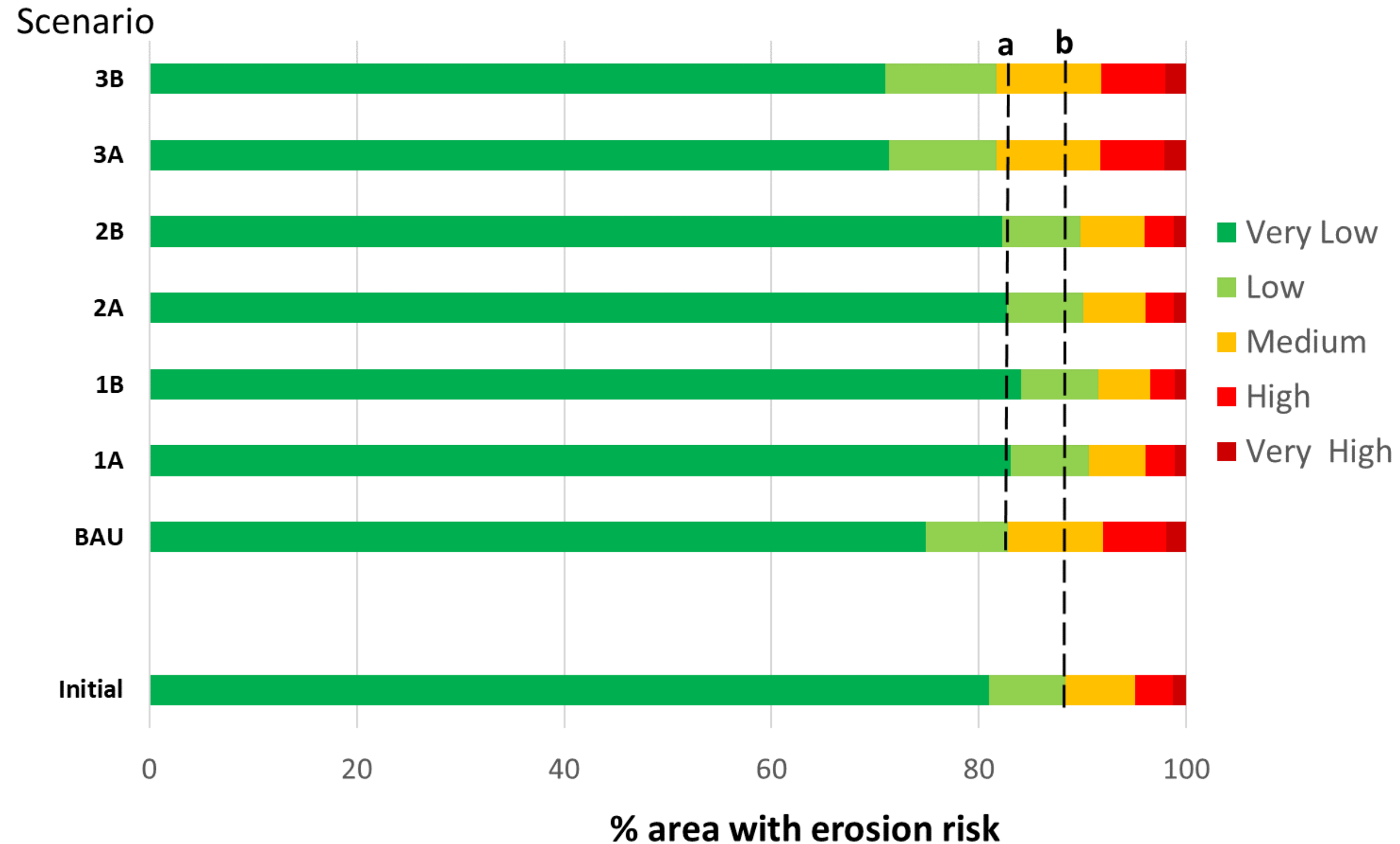
Line b. medium and high soil risk erosion at the start of simulation - 2017 (11.6%)

*Line a.* medium and high soil risk erosion at the end of BAU simulation (17.1%)

- In BAU and open access scenarios the medium and high-risk erosion area increase, 47.4%, 8.3%, and 15.1%
- Social Forestry reduce the risk of soil erosion ranging from 12.7 – 27.2%.

TRADE-OFF ANALYSIS
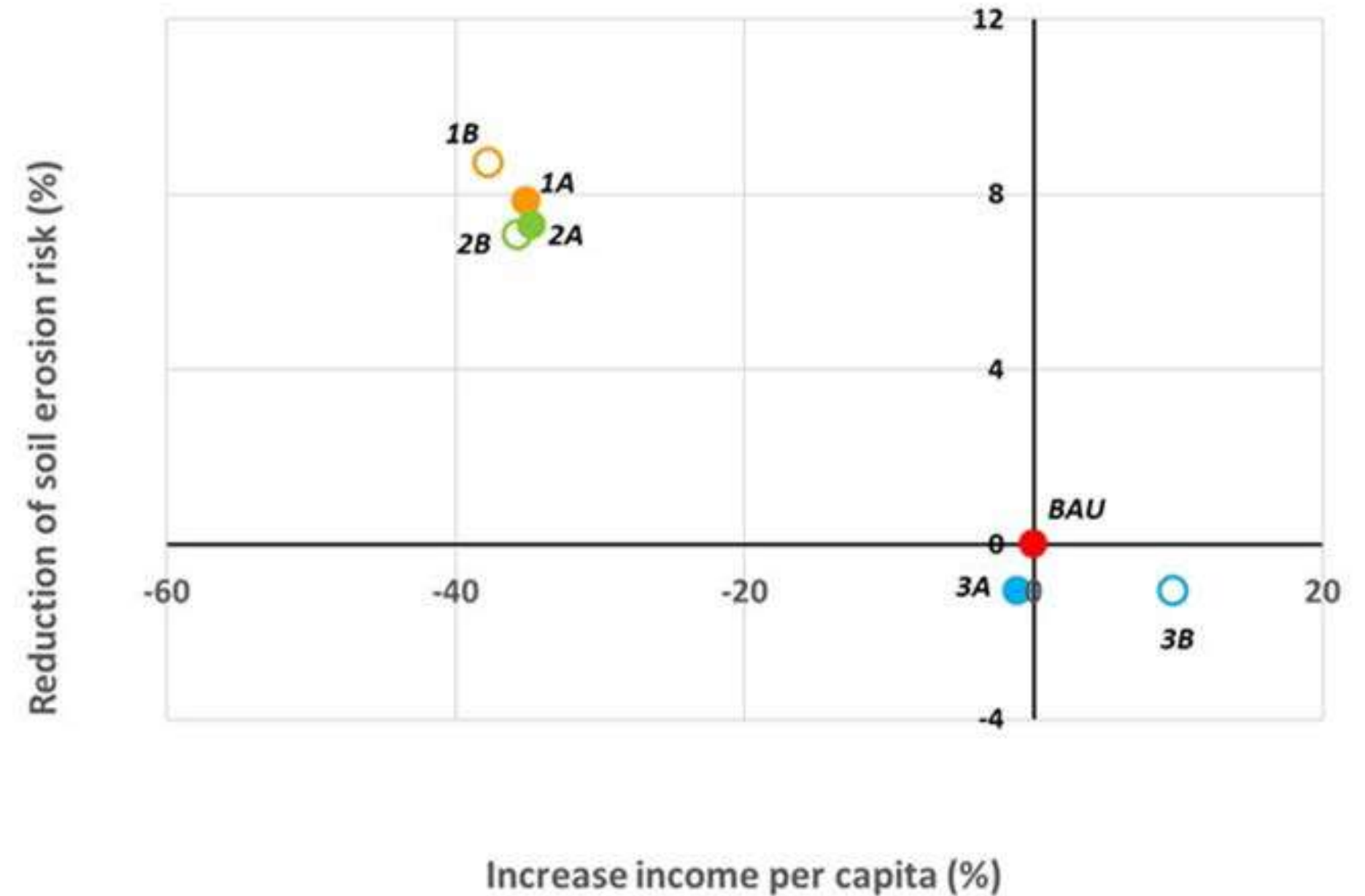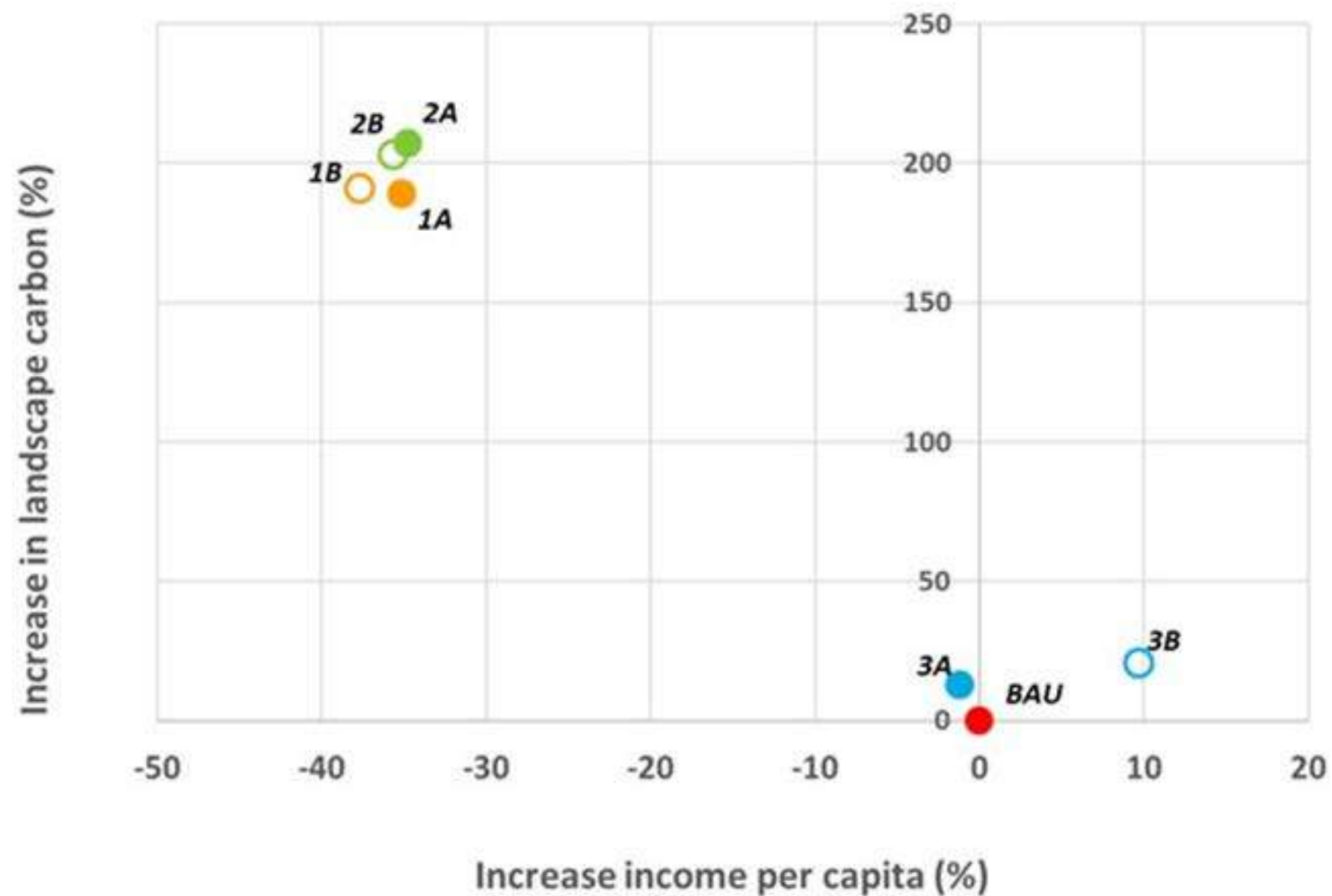
- *Y-axis.* Landscape carbon and % soil erosion risk estimated in each scenario is compared to BAU
- *X-axis.* Income per capita estimated in each scenario is compared to BAU
- **Social Forestry scenario has not been able to maintain income at BAU, although it is able to improve ecosystem services**
- **Changes in harvesting techniques has not improved farmers income – not many farmers interested to participate**

Potential incentive scheme
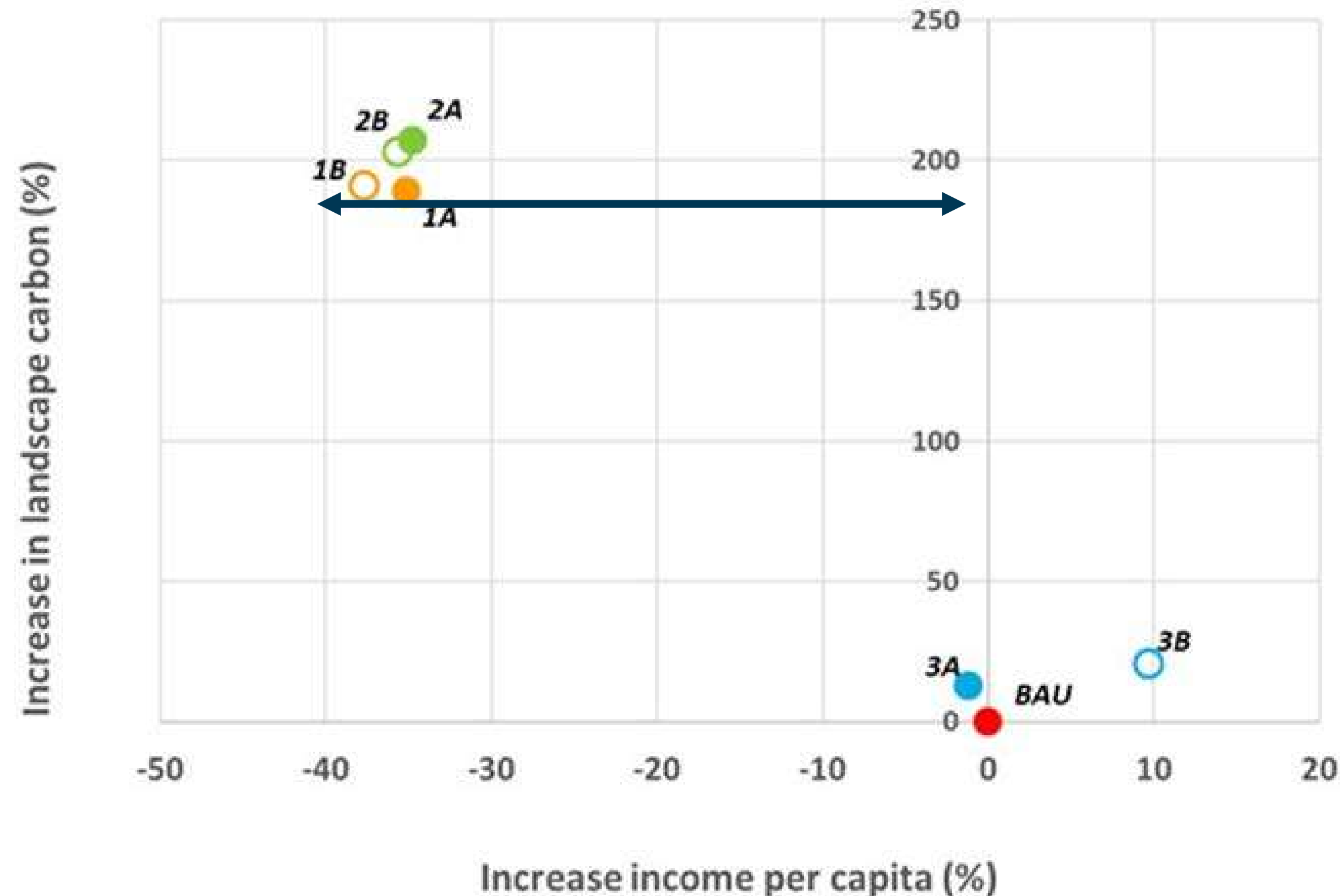
- Carbon incentive scheme that can increase income per capita by 38 – 34 % in Social Forestry Scenario
- The incentive scheme is essential to ensure landscape carbon is maintained/increased.

RECOMMENDED ACTION

1. The sub-national government focuses on more policies and programs that improve coffee farmers' knowledge of harvest, post-harvest and entrepreneurship.

2. The farmer extensionist programs facilitate knowledge on financial literacy and establish more effective business units at the landscape/village/sub-district level (beyond increasing productivity at the farms' level).

3. National and sub-national policies and programs to develop further coffee premium market providing linkage between farmers/farmers group with 'green' off-takers that practice ESG approach and connect to impact investors (beyond conventional financial investors).

4. Intermediary organisations (NGOs, cooperatives) and sub-national governments to pilot ecosystem-service incentive schemes that can fill the gap in income between Social Forestry scenarios and the Business as Usual scenario.
   - Law No. 32 Year 2009 and Government Regulation No. 46 Year 2017 on environmental economics instruments – compensation, reward and payment for ecosystem services,
   - Presidential Regulation No. 98 Year 2021 on carbon value.