Potential application of the modeling: serious games

The Cega Catchment in Spain

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Location

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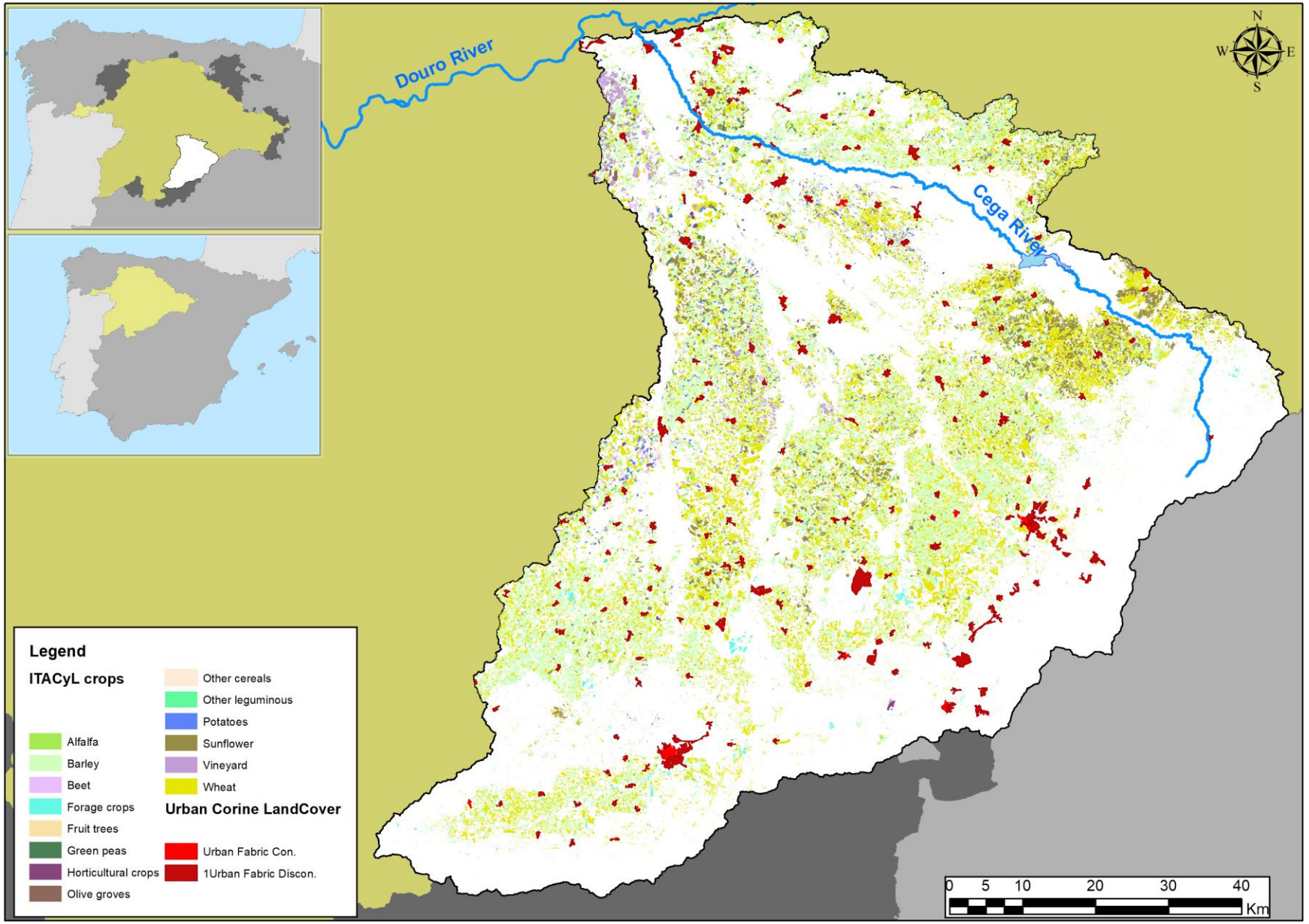
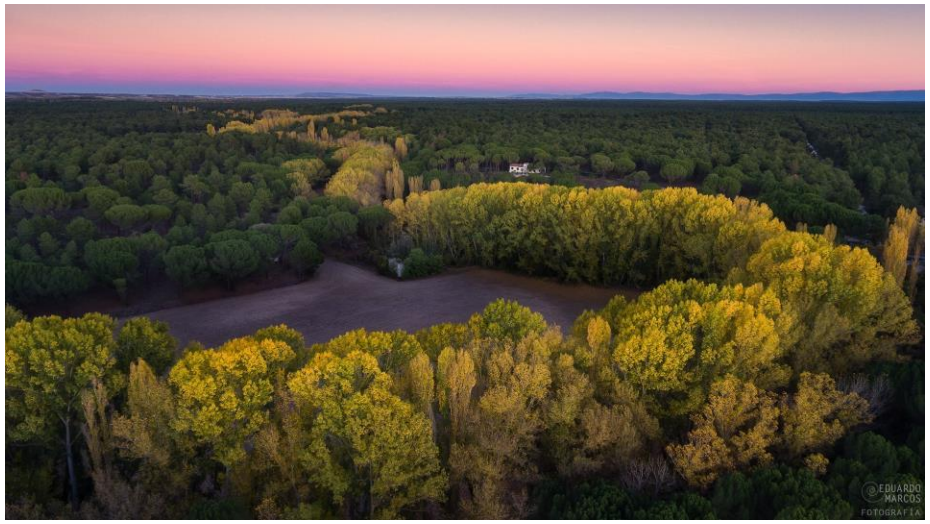


The challenges

1) One of the few non-regulated catchments in Spain



But also…

The challenges

2) Expanding groundwater-fed horticulture

The challenges

3) Existing water retention areas for aquifer recharge cannot meet growing demand

The challenges

4) Deep aquifer overexploited

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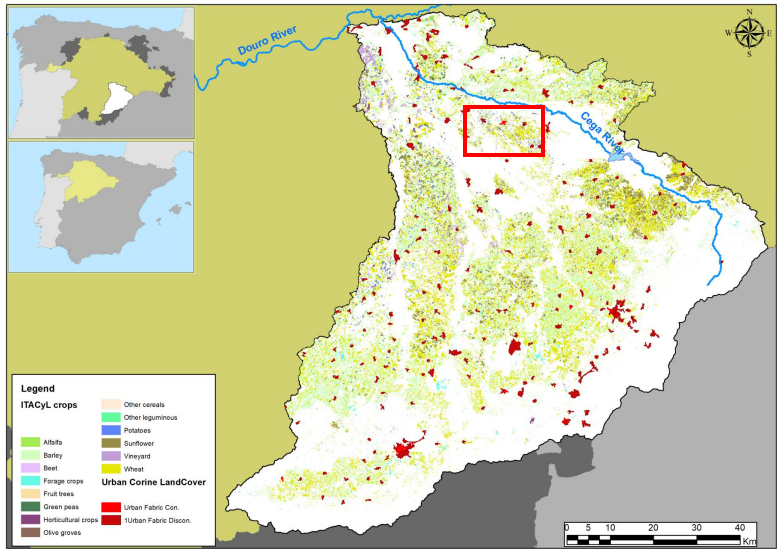
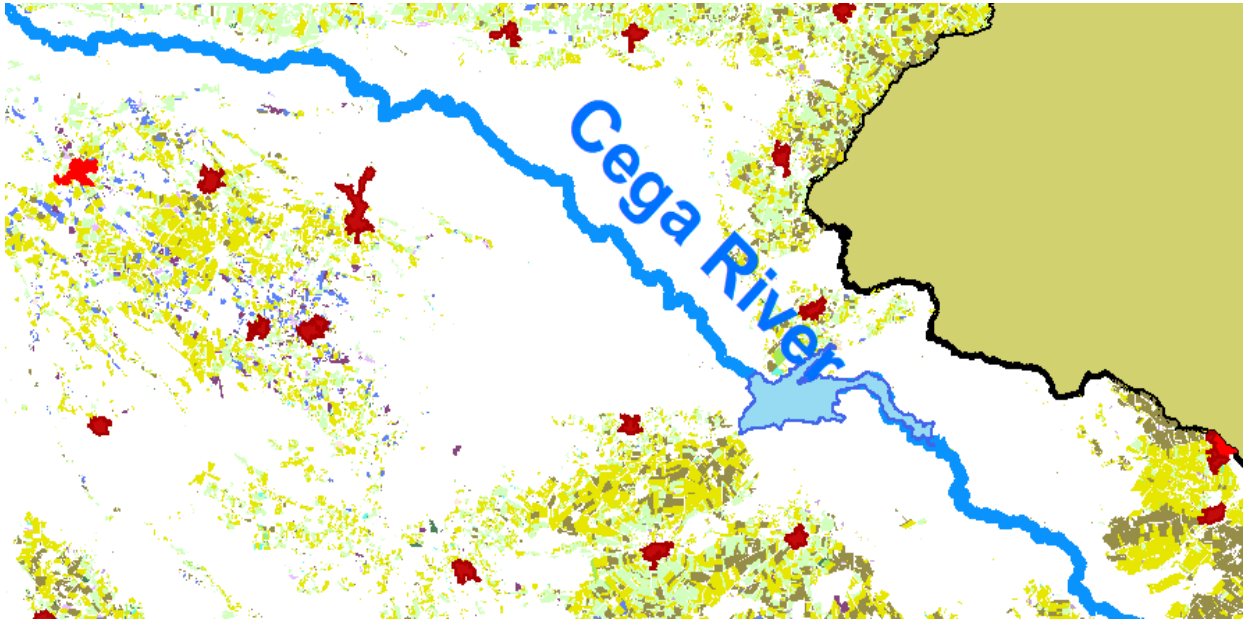
The challenges

5) Dam construction under assessment

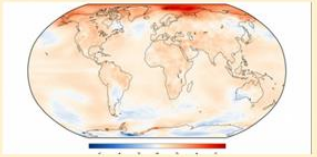




Our approach: a modular hierarchy

4 CLIMATE MODELS

- GFDL-ESM2M
- HadGEM2-ES
- IPSL-CM5A-LR
- MIROC5



3 CLIMATE CHANGE SCENARIOS

- RCP 2.6
- RCP 6.0
- RCP 8.5

8 HYDROLOGICAL MODELS

- CLM45
- H08
- LPJmL
- MATSIRO
- MPI-HM
- PCR-GLOBWB
- WaterGAP2
- WaterGAP2-C

WATER MANAGEMENT MODEL

- AQUATOOL (DSS of Spanish river basins)

SOCIOECOMIC MODEL

- PMAUP (Mathematical programming model)

3 MANAGEMENT SCENARIOS

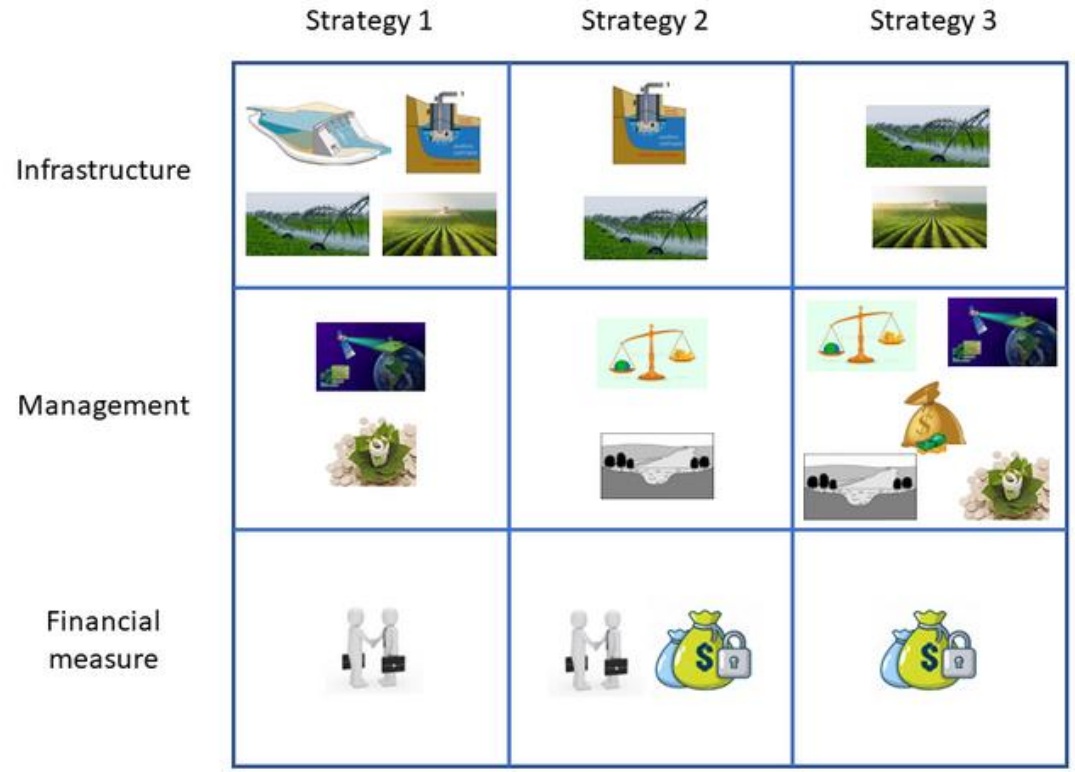
- All additional infrastructures considered in the river basin management plan
- All additional infrastructures, excluding irrigation expansion
- All additional infrastructures, excluding irrigation expansion and irrigation modernization

Serious game?

A serious game is an interactive, digital game designed primarily for **educational or training purposes**, rather than solely for entertainment. It applies gaming principles to achieve specific learning outcomes or solve real-world problems.

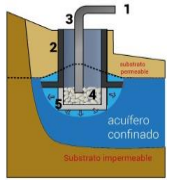
Now, let's play…

Select one of the following strategies: *



Now, let's play…

Dam



Aquifer Recharge

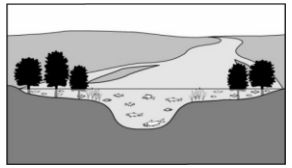
Irrigation modernization

Irrigation area expansion

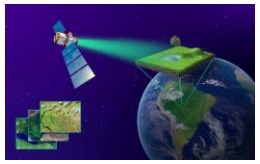
Financial cost

Resource cost

Environmental cost



Environmental Flow



Remote Sensing

Buyback

Insurance

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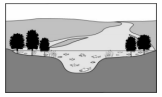
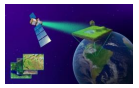
	Environment	Economy	Cost
 Dam	− −	+ +	+10
 Aquifer Recharge	+	+	+9
 Irrigation modernization	− −	+ +	+9
 Irrigation area expansion	− −	+ +	+3
 Financial cost	+	−	-5
 Resource cost	+	−	-3
 Environmental cost	+	−	-2
 Environmental Flow	+	−	0
 Remote Sensing	+	−	+2
 Buyback	+	−	+9
 Insurance	0	+	+1

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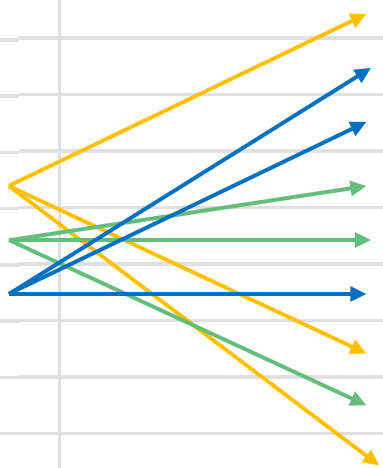
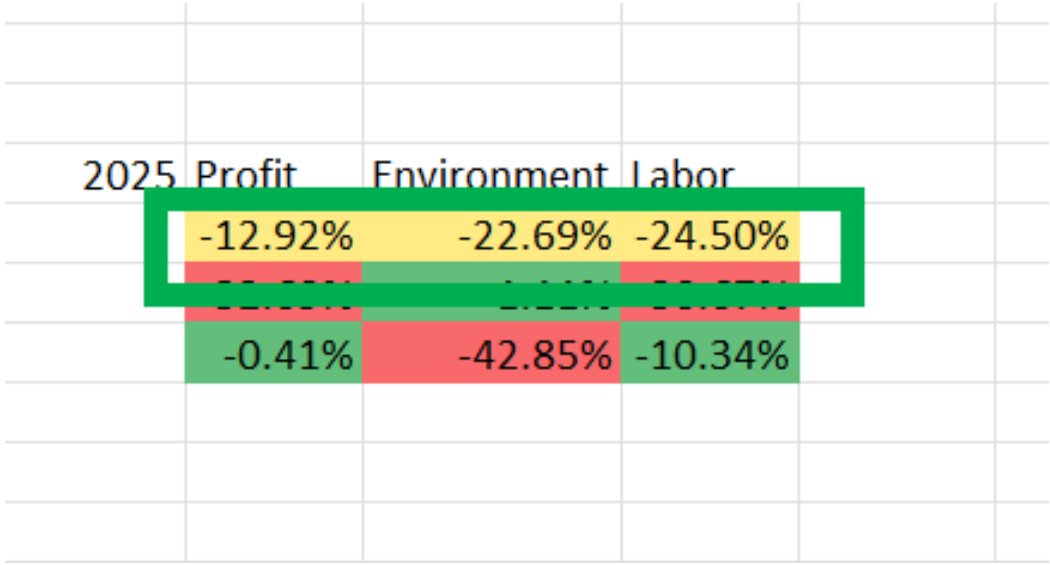
Results…

Respuestas 2025	Profit	Environment	Labor
	-12.92%	-22.69%	-24.50%
	-32.69%	1.11%	-30.67%
	-0.41%	-42.85%	-10.34%



Respuestas 2035	Profit	Environment	Labor
	-15.21%	-43.16%	-20.24%
	-8.46%	-72.18%	-10.87%
	0.09%	-87.64%	0.00%
	-39.97%	-1.69%	-29.92%
	-57.92%	13.08%	-56.17%
	-3.04%	-74.65%	-3.52%
	-10.16%	-54.18%	-16.67%
	-49.43%	8.46%	-48.95%
	-18.80%	-33.49%	-29.42%

Result Scenario 1



2025	Profit	Environment	Labor
	-12.92%	-22.69%	-24.50%
	-0.41%	-42.85%	-10.34%

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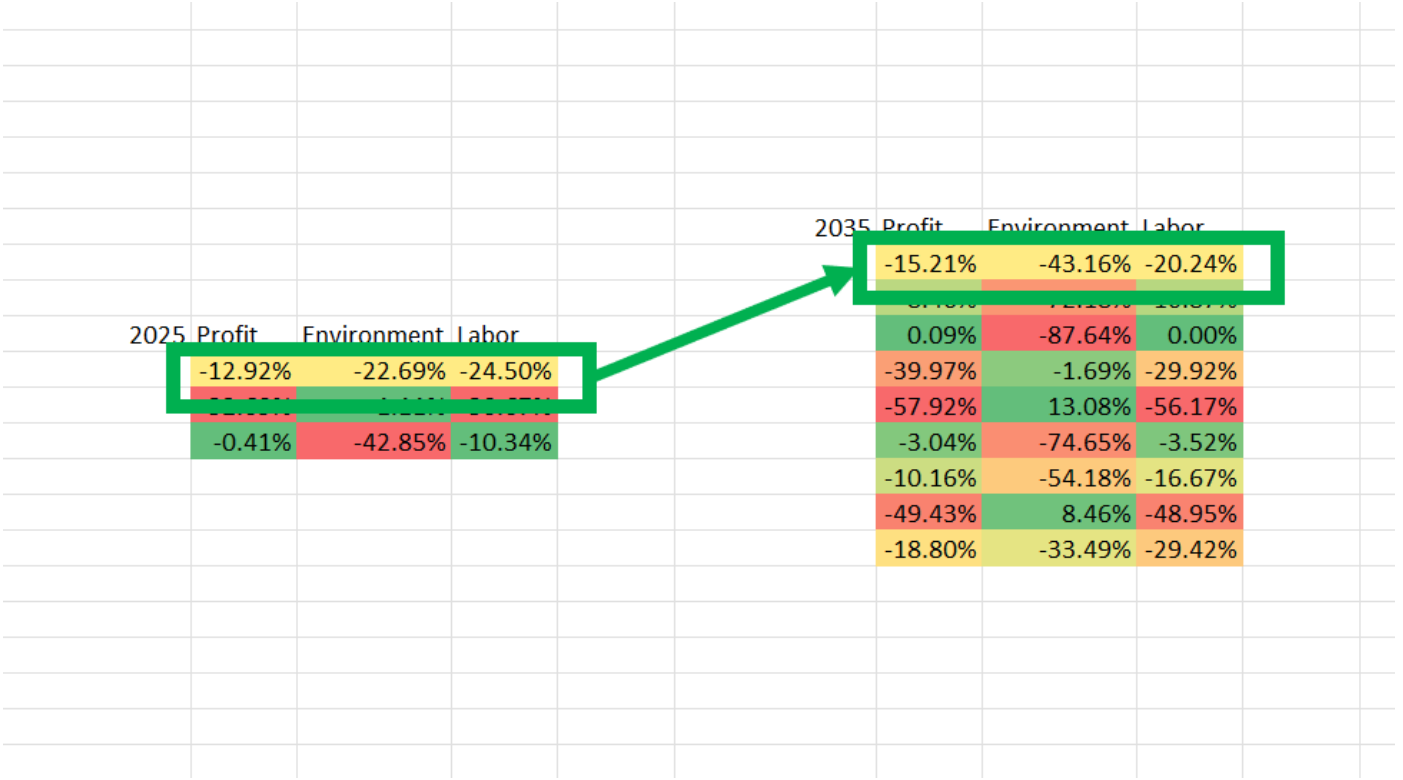
Result Scenario 2



2025 Profit	Environment	Labor
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2035 Profit	Environment	Labor
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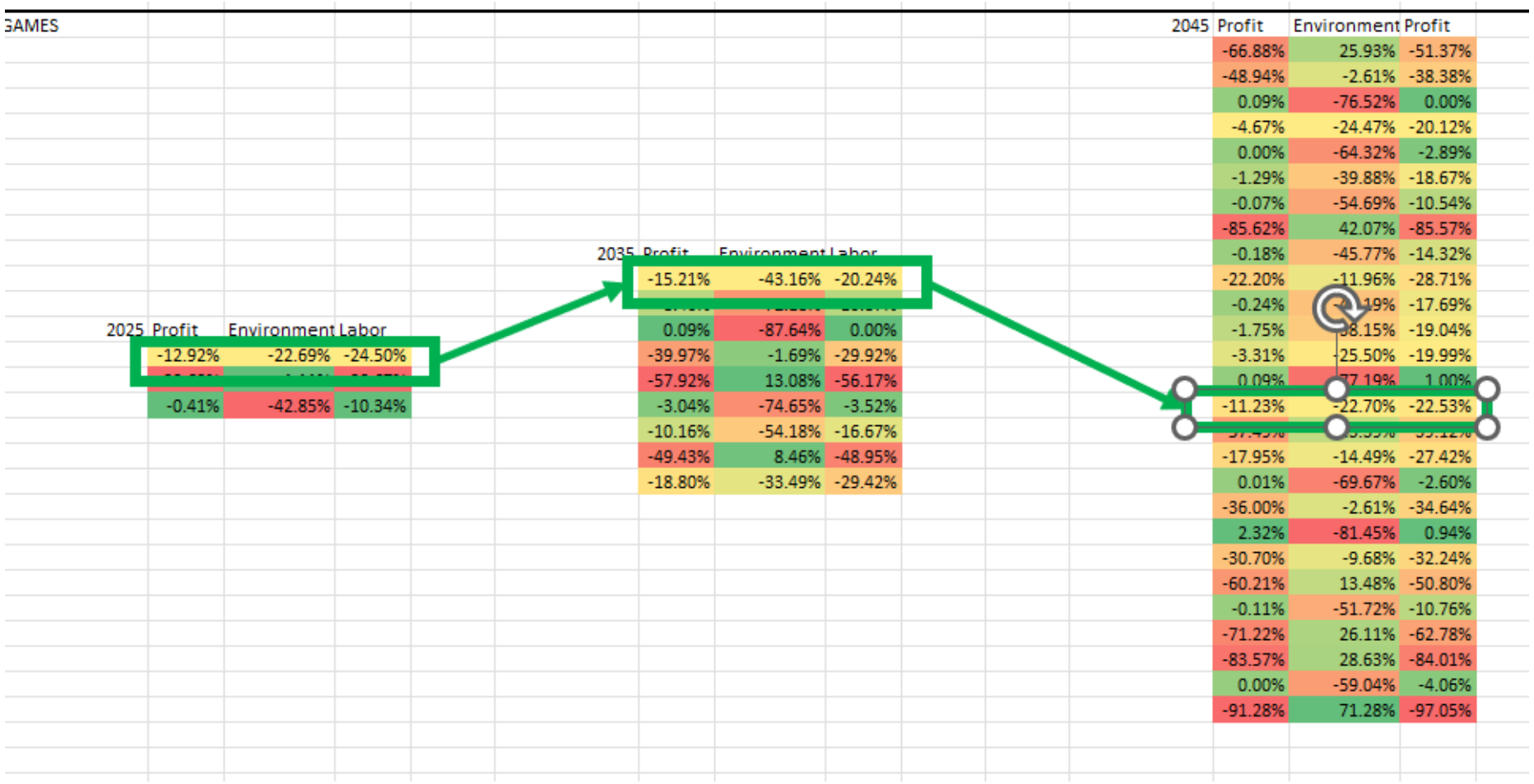
-10.16%	-54.18%	-16.67%
-49.43%	8.46%	-48.95%
-18.80%	-33.49%	-29.42%

Result Scenario 3



GAMES

2025 Profit Environment Labor

-12.92%	-22.69%	-24.50%
-0.41%	-42.85%	-10.34%

2035 Profit Environment Labor

-15.21%	-43.16%	-20.24%
0.09%	-87.64%	0.00%
-39.97%	-1.69%	-29.92%
-57.92%	13.08%	-56.17%
-3.04%	-74.65%	-3.52%
-10.16%	-54.18%	-16.67%
-49.43%	8.46%	-48.95%
-18.80%	-33.49%	-29.42%

2045 Profit Environment Profit

-66.88%	25.93%	-51.37%
-48.94%	-2.61%	-38.38%
0.09%	-76.52%	0.00%
-4.67%	-24.47%	-20.12%
0.00%	-64.32%	-2.89%
-1.29%	-39.88%	-18.67%
-0.07%	-54.69%	-10.54%
-85.62%	42.07%	-85.57%
-0.18%	-45.77%	-14.32%
-22.20%	-11.96%	-28.71%
-0.24%	[illegible]19%	-17.69%
-1.75%	[illegible]8.15%	-19.04%
-3.31%	-25.50%	-19.99%
0.09%	[illegible]7.19%	1.00%
-11.23%	-22.70%	-22.53%
[illegible]	[illegible]	[illegible]
-17.95%	-14.49%	-27.42%
0.01%	-69.67%	-2.60%
-36.00%	-2.61%	-34.64%
2.32%	-81.45%	0.94%
-30.70%	-9.68%	-32.24%
-60.21%	13.48%	-50.80%
-0.11%	-51.72%	-10.76%
-71.22%	26.11%	-62.78%
-83.57%	28.63%	-84.01%
0.00%	-59.04%	-4.06%
-91.28%	71.28%	-97.05%

Thank you for the attention

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