RESEARCH ARTICLE

ScienceAdvances

ENVIRONMENTAL ENGINEERING

Assessing the land resource–food price nexus of the Sustainable Development Goals

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Michael Obersteiner,[1]*† Brian Walsh,[1]*‡ Stefan Frank,[1] Petr Havlík,[1] Matthew Cantele,[1] Junguo Liu,[1,2] Amanda Palazzo,[1] Mario Herrero,[3] Yonglong Lu,[4,5] Aline Mosnier,[1] Hugo Valin,[1] Keywan Riahi,[1] Florian Kraxner,[1] Steffen Fritz,[1] Detlef van Vuuren[6,7]

Brian Walsh (Research Scholar)
International Institute for Applied Systems Analysis
Ecosystems Services & Management
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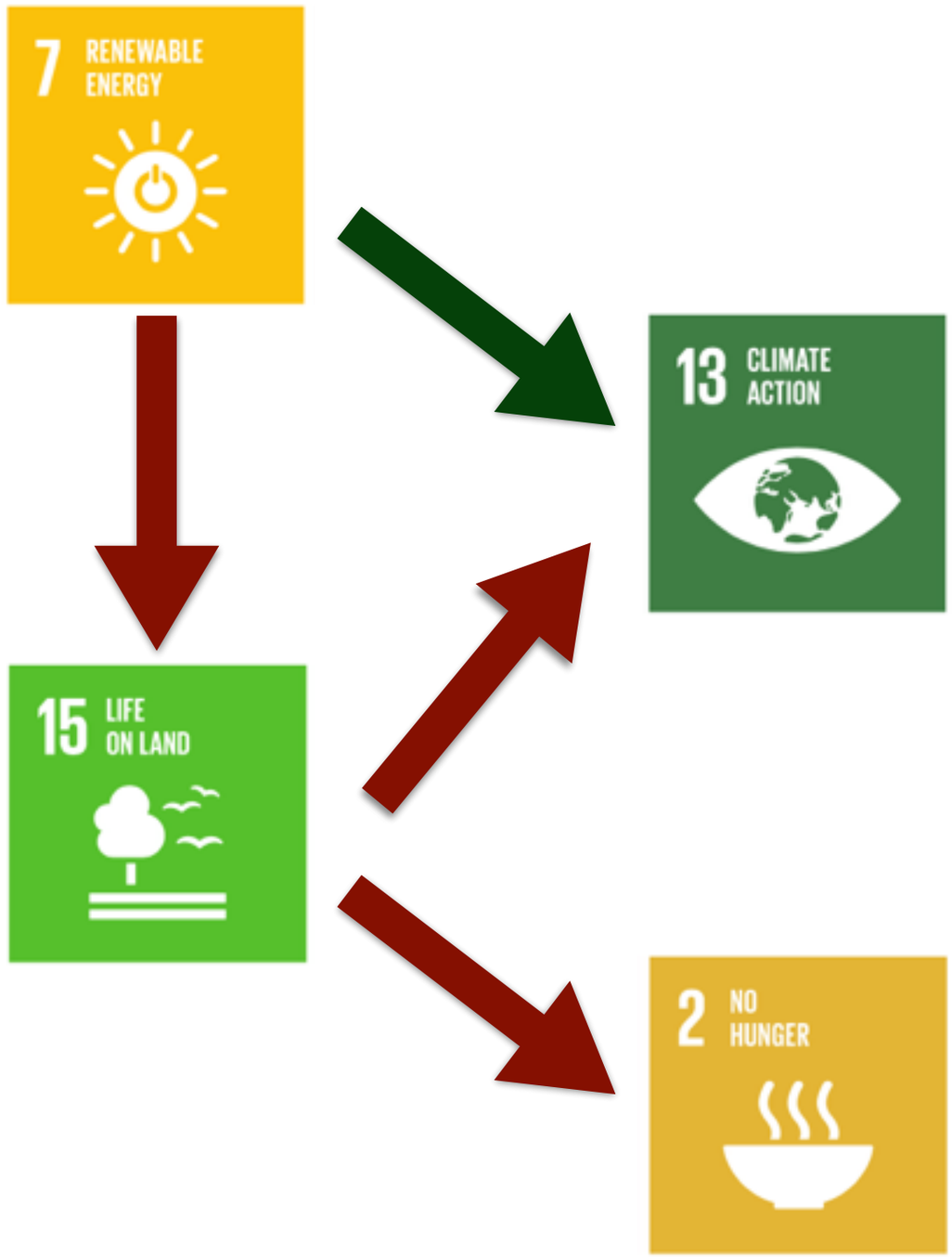
The fundamental question:

How do we **manage trade-offs** among 17 goals to make progress on the **complete agenda?**

Tradeoffs

Sustainability is not pursued in a vacuum:

Ambitious conservation policies will lead to food price increases.

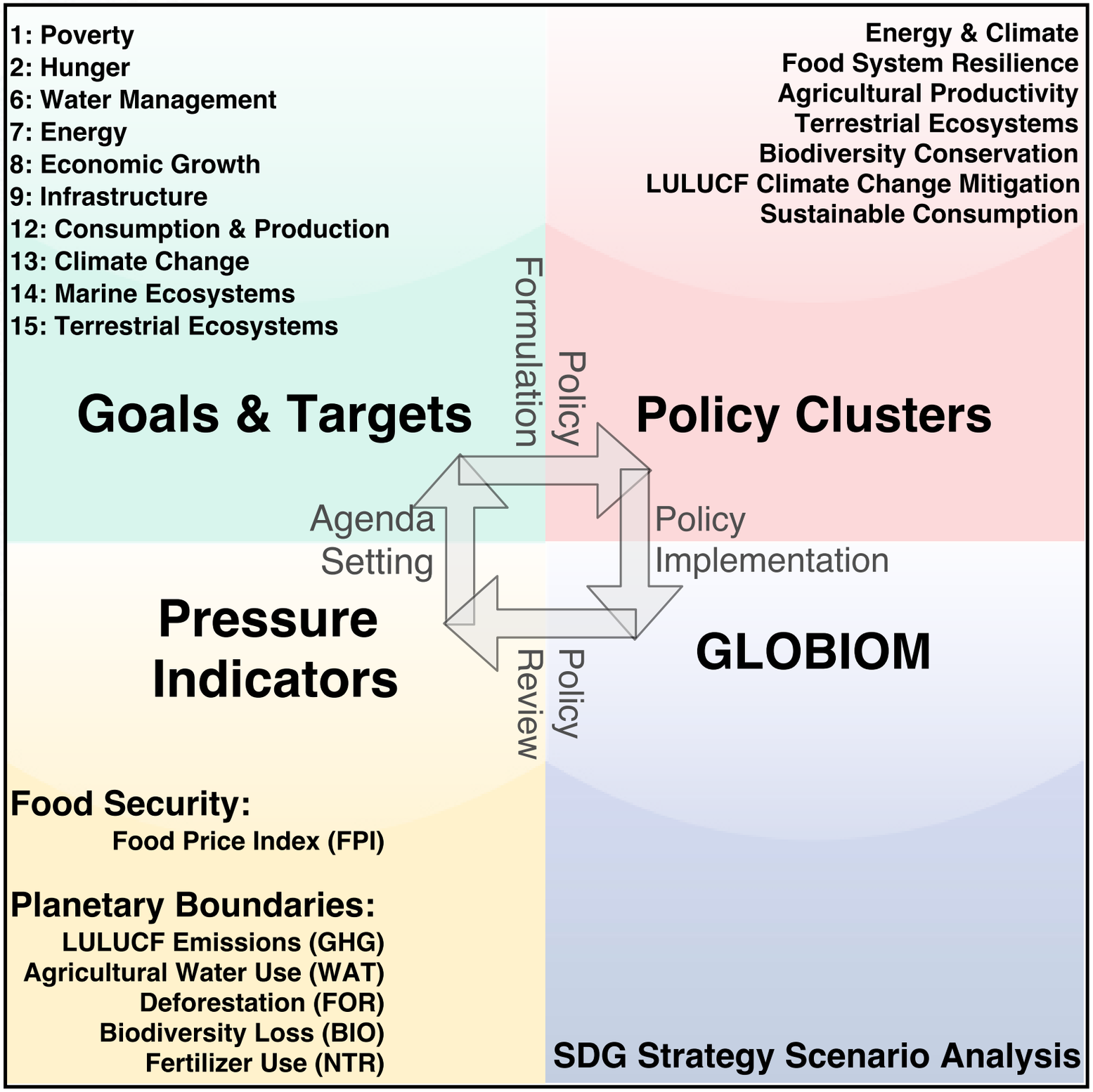


Ex: 1st generation biofuels

The question is how to manage tradeoffs to live within resource budgets.

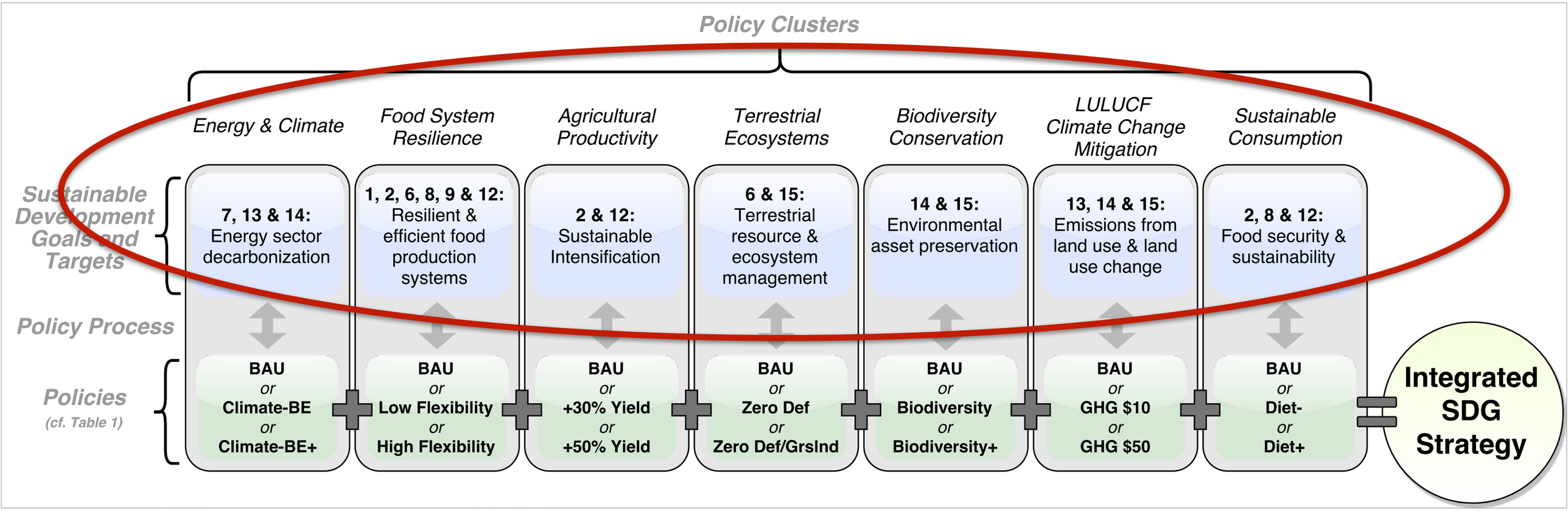
Analysis framework:

- Looking at land system-related SDGs
- Based on the policy process
- Not trying to identify the "best" policy directly
- Can we see tradeoffs using a model like GLOBIOM?
- Can these be independent of scenario construction?



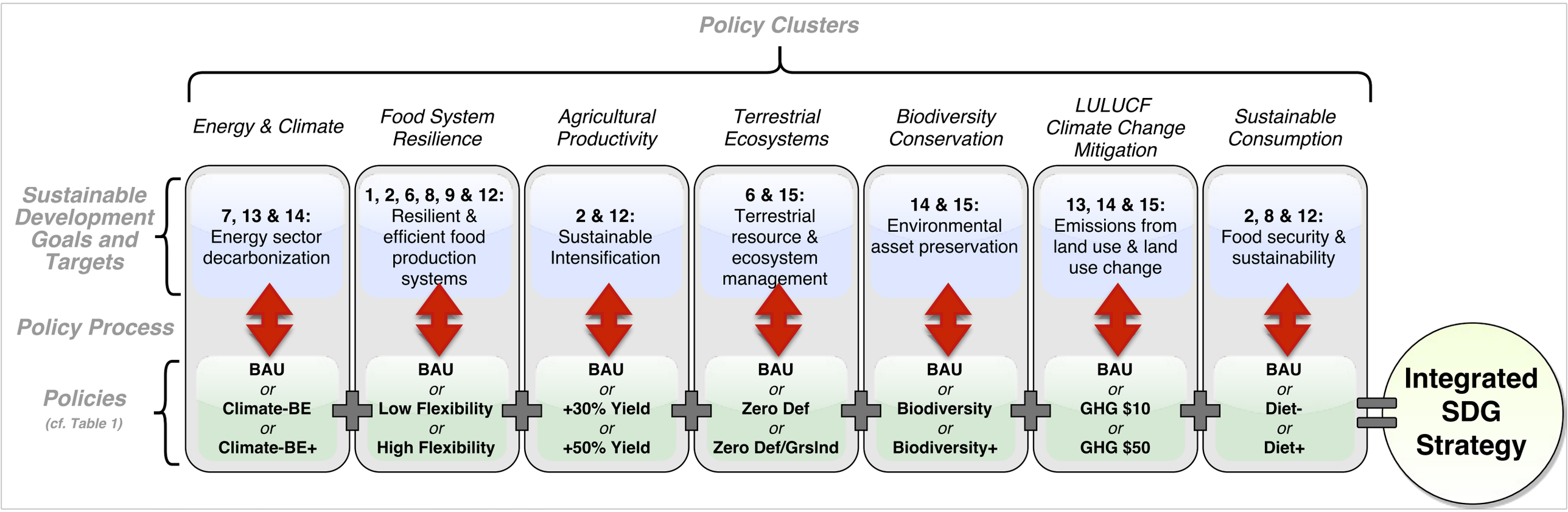
Goals

- Identify thematic clusters of goals



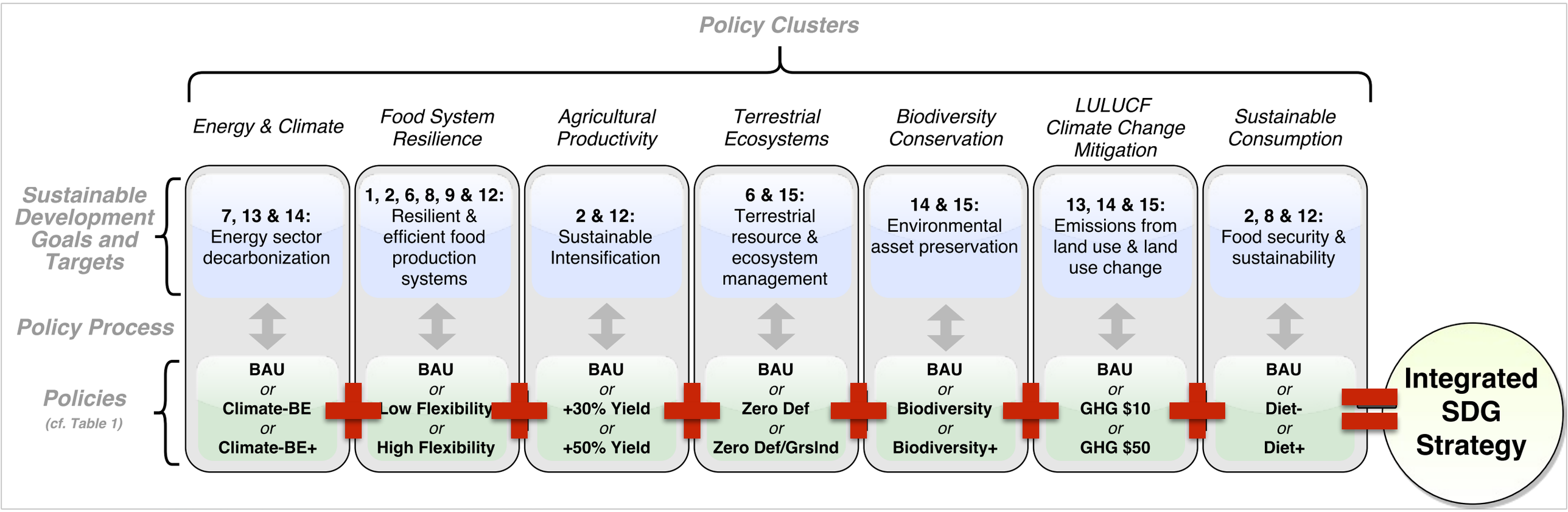
Goals into **Policy**

- Identify thematic clusters of goals
- Pair each cluster with a range of policy options (global implementation)



Goals into **Policy** into **GLOBIOM**

- Identify thematic clusters of goals
- Pair each cluster with a range of policy options

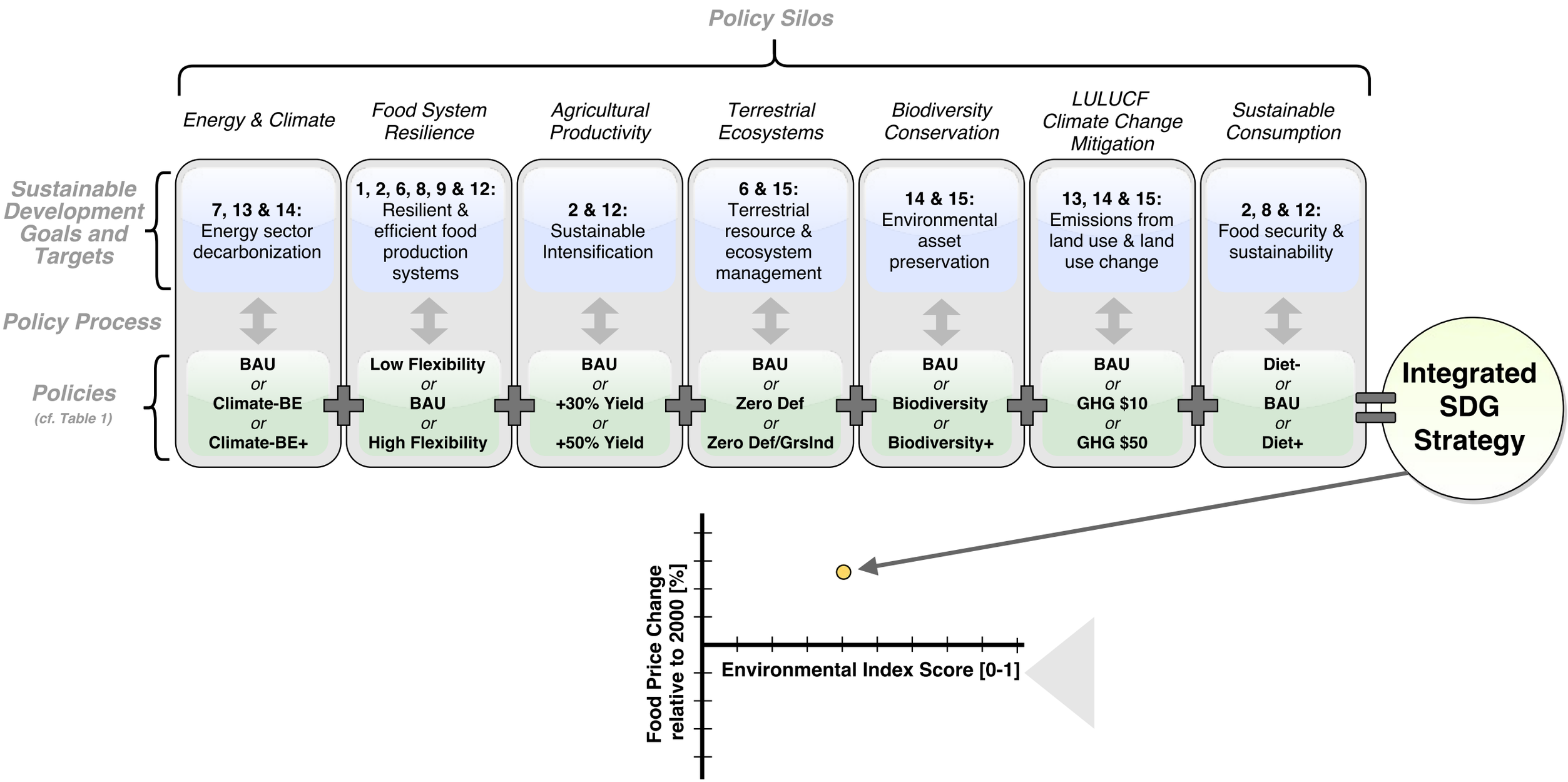


- Construct scenarios from unique combinations of policies

GLOBIOM into **indicators**

- Planetary boundaries define the solution space for environmental SDGs.
- Fertile soil, stable growing conditions, clean water for drinking and agriculture are foundational to other goals.
- Indicators & benchmarks for many targets.
- Good place to start looking for co-benefits and tradeoffs.

GLOBIOM -> Indicators -> Goals

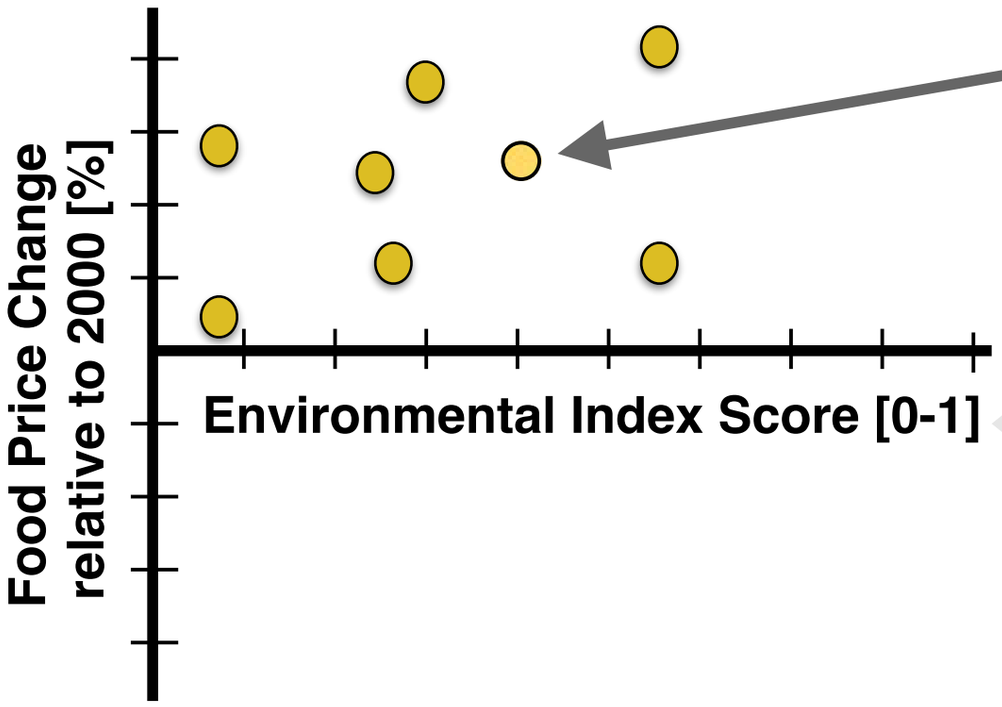


Each scenario is assessed on **food prices** & **environmental outcomes** decadally through 2050.

management

AU *or* **Yield** *or* **Yield**	**BAU** *or* **Zero Def** *or* **Zero Def/GrsInd**	**BAU** *or* **Biodiversity** *or* **Biodiversity+**	**BAU** *or* **GHG $10** *or* **GHG $50**	**Diet-** *or* **BAU** *or* **Diet+**

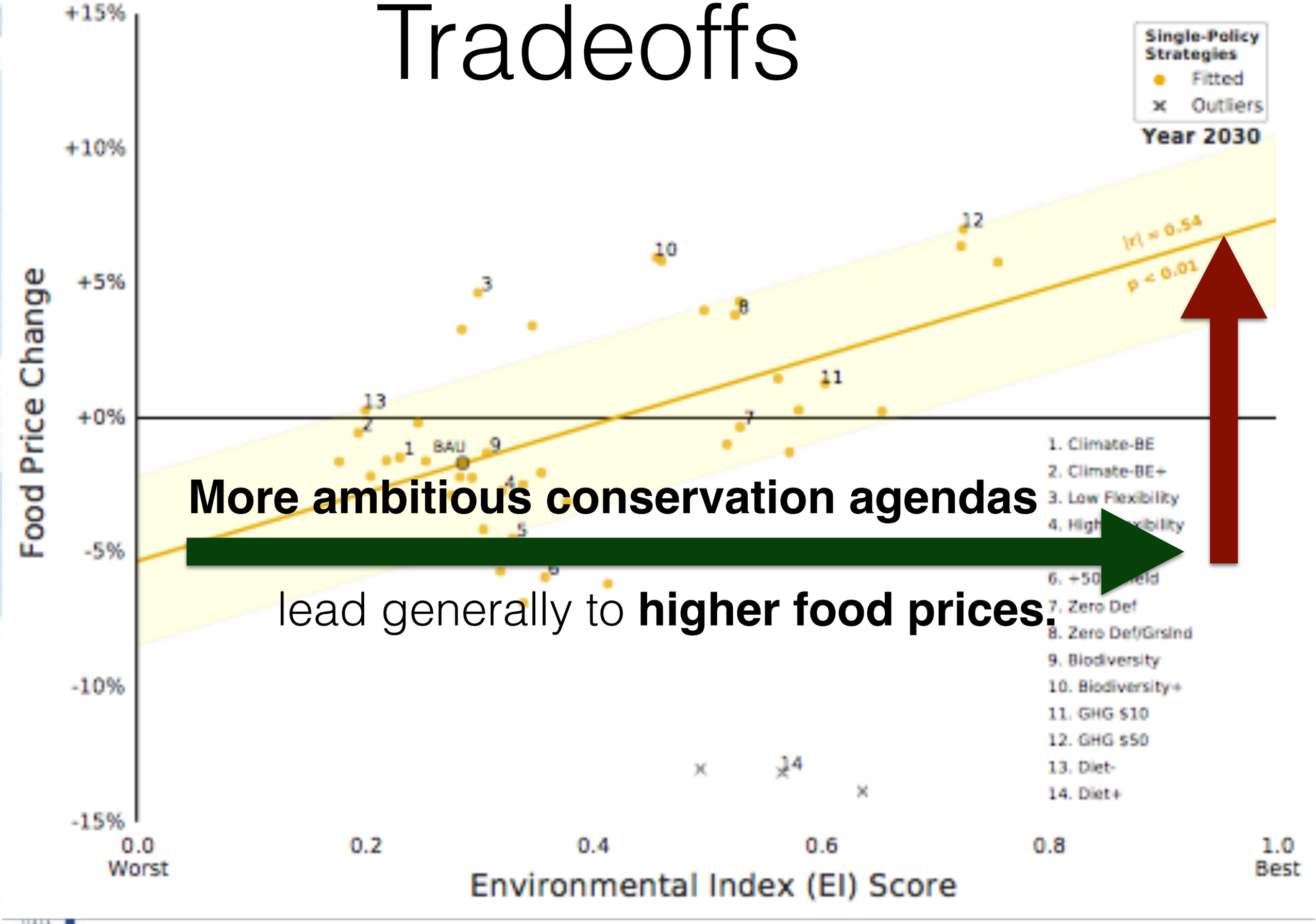
Integrated SDG Strategy



X-axis:
environmental "score"
LULUCF emissions,
agricultural water use,
deforestation,
biodiversity loss
fertilizer use

Y-axis:
GLOBIOM food price index

Tradeoffs



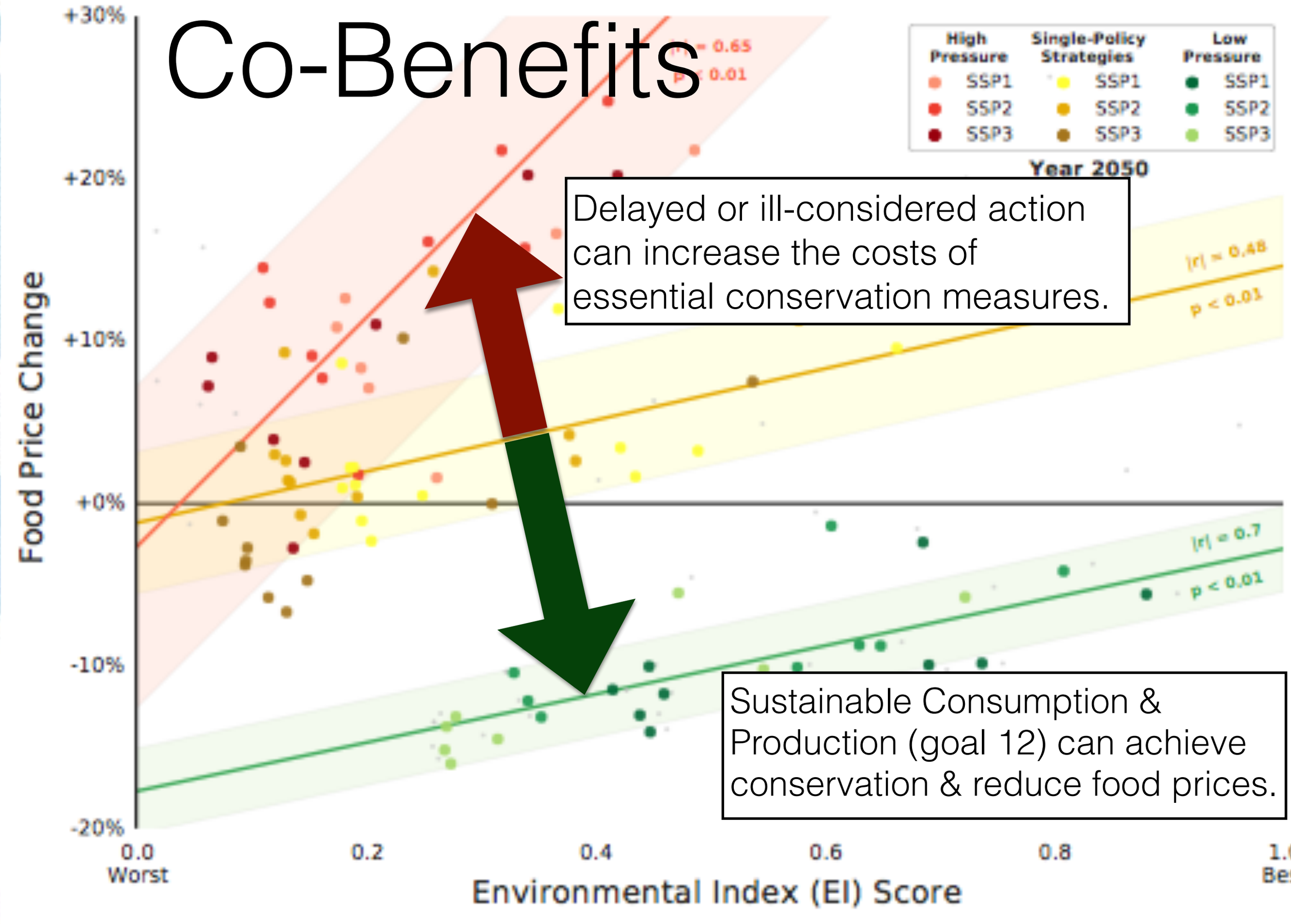
More ambitious conservation agendas

lead generally to **higher food prices.**

Tradeoffs

- We can use GLOBIOM to see tradeoffs
- Conservation policies included here can increase food prices by up to 20% in 2030
- There is a tradeoff efficiency frontier that limits joint food price—environmental outcomes.
- So the questions become:
  - What are we willing to pay or give up?
  - Can we move the tradeoff frontier?

Co-Benefits


High Pressure
SSP1
SSP2
SSP3
Single-Policy Strategies
SSP1
SSP2
SSP3
Low Pressure
SSP1
SSP2
SSP3
Year 2050
|r| = 0.65
p < 0.01
|r| = 0.48
p < 0.01
|r| = 0.7
p < 0.01
Delayed or ill-considered action can increase the costs of essential conservation measures.
Sustainable Consumption & Production (goal 12) can achieve conservation & reduce food prices.
+30%
+20%
+10%
+0%
-10%
-20%
Food Price Change
0.0
Worst
0.2
0.4
0.6
0.8
1.0
Best
Environmental Index (EI) Score

Co-Benefits

Sustainable
Consumption
& Production
radiate co-benefits
and create opportunities
to **achieve multiple goals.**

Energy storage
Fertilizer & water efficiency
Climate-resilient agricultural infrastructure
Waste & overconsumption reduction

Silos vs. Systems

- Healthy ecosystems are essential to development, but entail trade-offs.

- Conservation measures affect food prices, but delayed action on climate will lead to even deeper food insecurity.

- Sustainable Consumption & Production are key to achieving both environmental and food security targets simultaneously

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Alternative Slides

Trade-offs

Sustainability, equity, and inclusivity cannot be pursued independently:

New IIASA research shows that **conservation policies** lead to **food price increases.**

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