# Food chains, environmental disruptions, and the role of early warning systems

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# My PhD ....

An early warning system for food supply chain resilience to environmental disruption

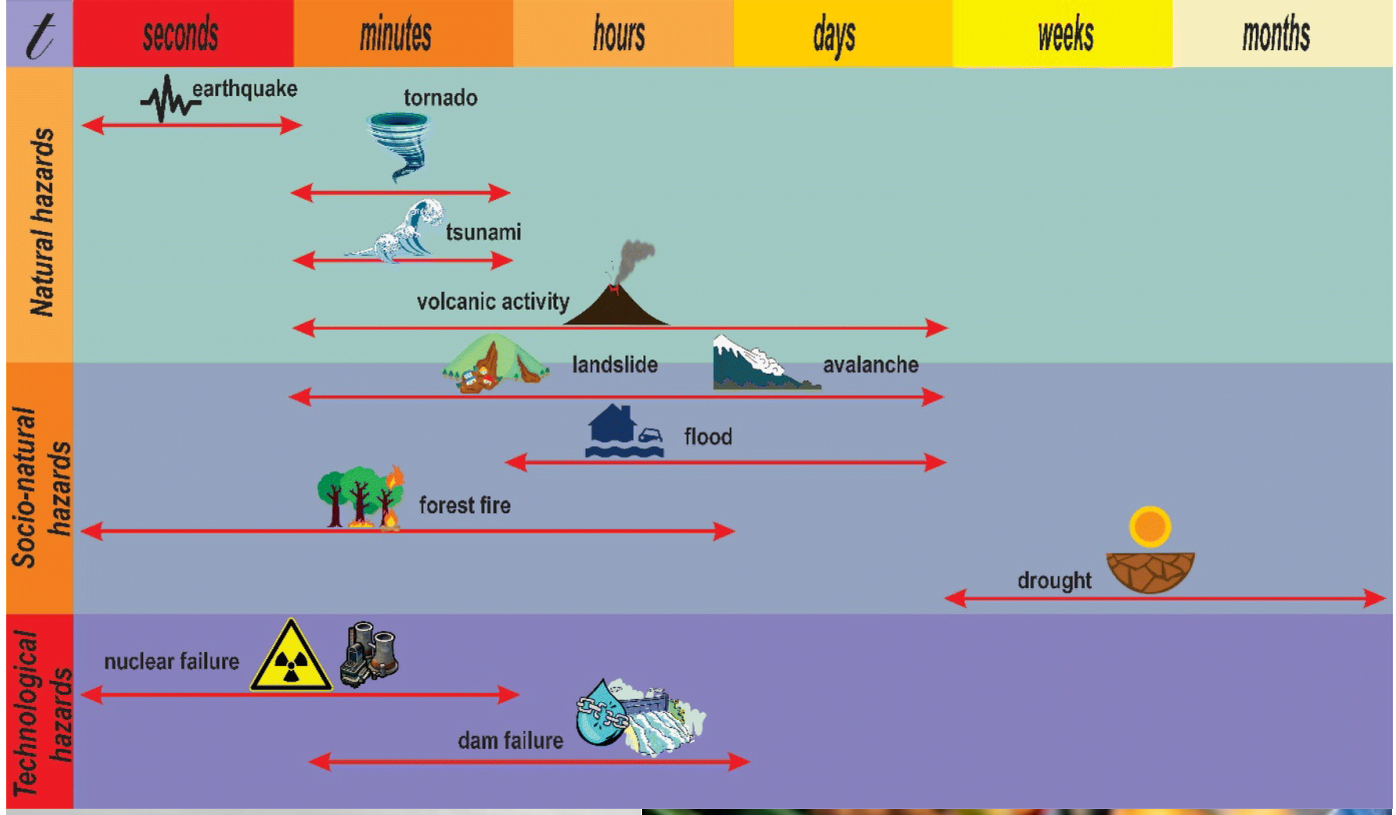


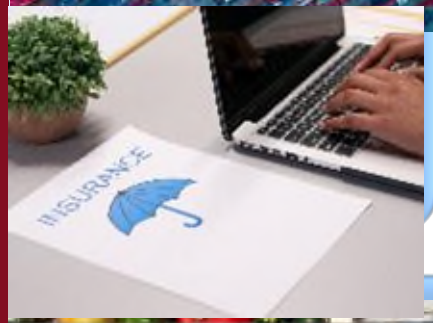

Diagram: Alcántara-Ayala and Oliver-Smith (2019)

# Food supply chains…

- Linear
- Clear boundaries
- Clear links

# What's it missed out?

- Complex
- Highly interconnected
- Highly globalised
- Highly homogenous (to some extent)
- Highly reliant on low number of exporting nodes




- Grows crops

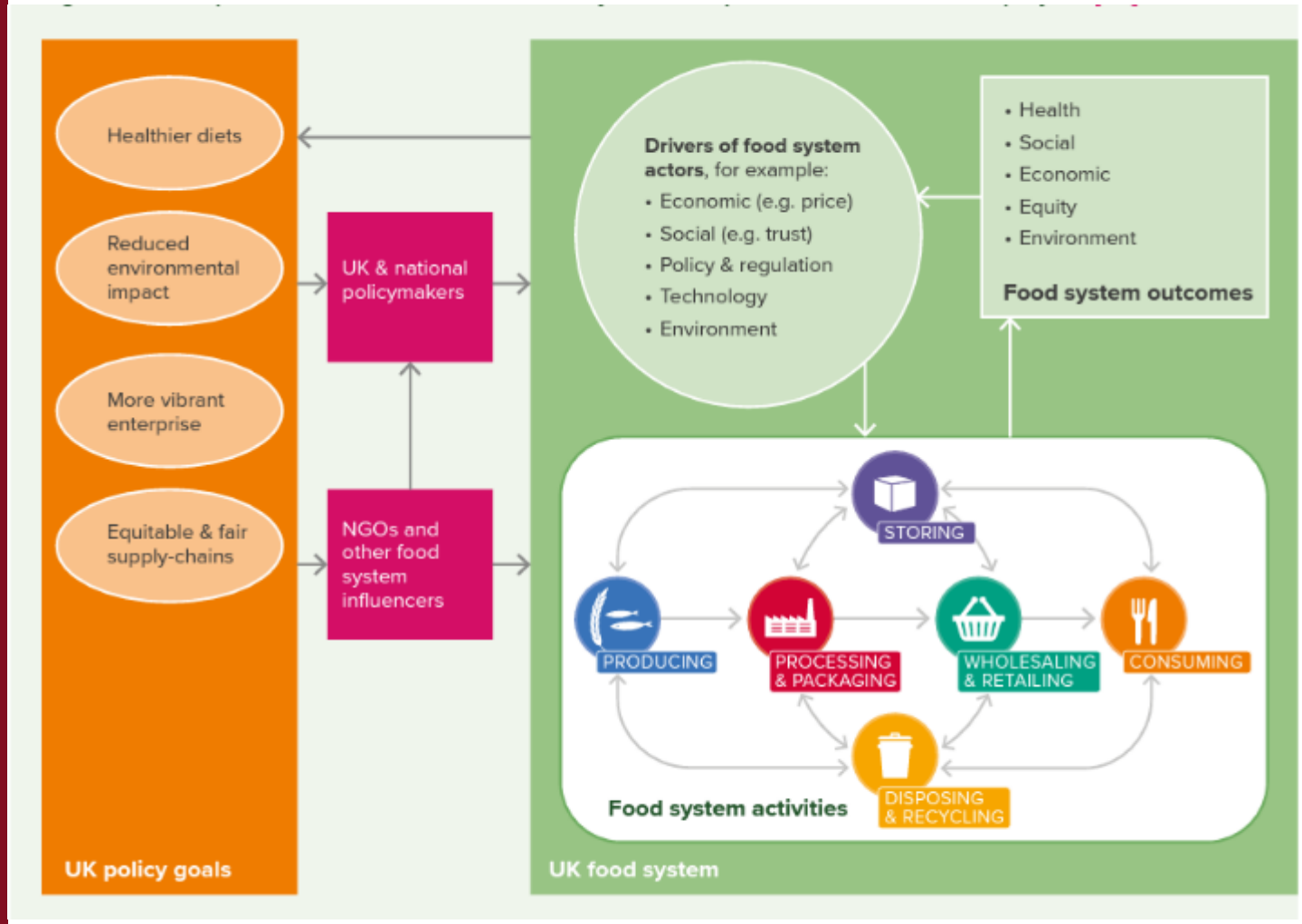
rocessor

ailer

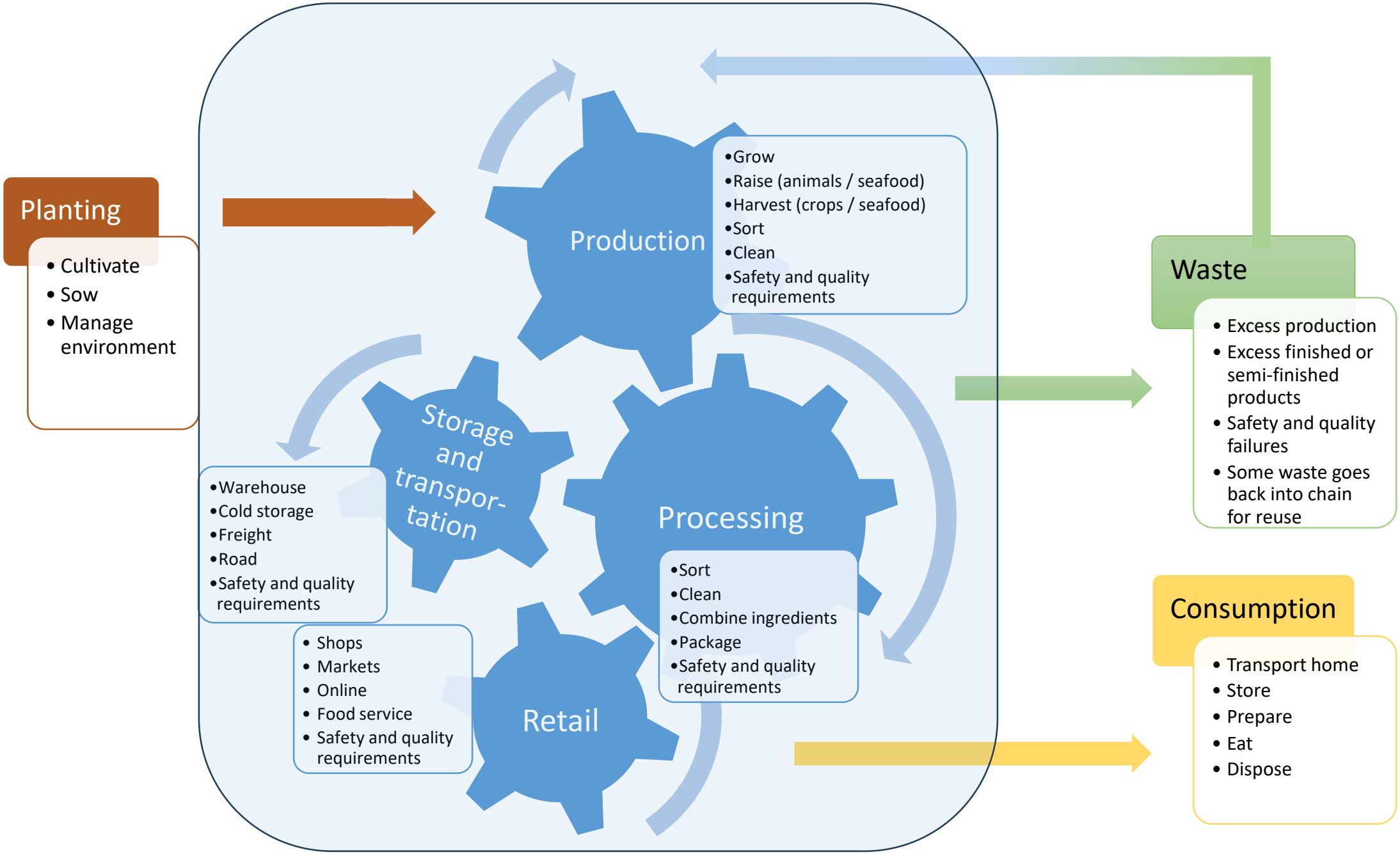
- Sells people food

## Food supply chains?

- Part of a wider socio-ecological ‘food system’
  - **Food and nutrition security**
  - Health
  - Livelihoods
  - Cultural and social aspects
- How can we conceptualise them?
  - People?
  - Activities?
  - Technologies?
  - Processes?
  - Flows?
  - Decision-making drivers?
  - Power structures?
- Wide range of scales
- Overlapping roles
- *Where do they start and end?*




Conceptual framework for the UK food system. (Hasnain et al, 2020)

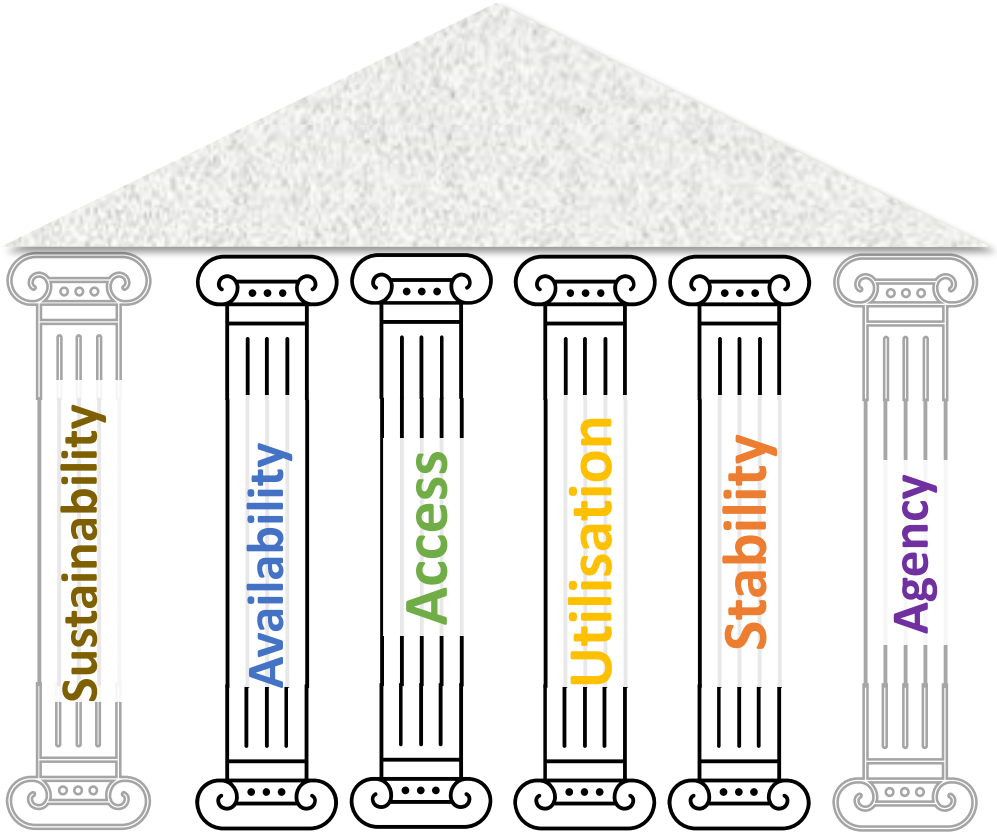

Planting
• Cultivate
• Sow
• Manage environment
Production
•Grow
•Raise (animals / seafood)
•Harvest (crops / seafood)
•Sort
•Clean
•Safety and quality requirements
Storage and transpor-tation
•Warehouse
•Cold storage
•Freight
•Road
•Safety and quality requirements
Processing
•Sort
•Clean
•Combine ingredients
•Package
•Safety and quality requirements
Retail
• Shops
• Markets
• Online
• Food service
• Safety and quality requirements
Waste
• Excess production
• Excess finished or semi-finished products
• Safety and quality failures
• Some waste goes back into chain for reuse
Consumption
• Transport home
• Store
• Prepare
• Eat
• Dispose

## UK food supply chains

- Global
  - 47% produced outside the UK
  - Fresh veg, beans, fruit
  - Negative trade balance
  - Few entry points
- Lean
  - High efficiency ‘just in time’
  - Low profit margins
  - Low stock in reserve
  - Low warehousing
  - Low adaptability
- Volatile
  - Production
  - Labour
  - Markets / trading
  - Dominance of few staples / varieties
- Asymmetrical
  - Few big players dominate
  - ‘Price setters’ and ‘price takers’
- Cheap
  - Prices may not reflect full cost

# Resilience?

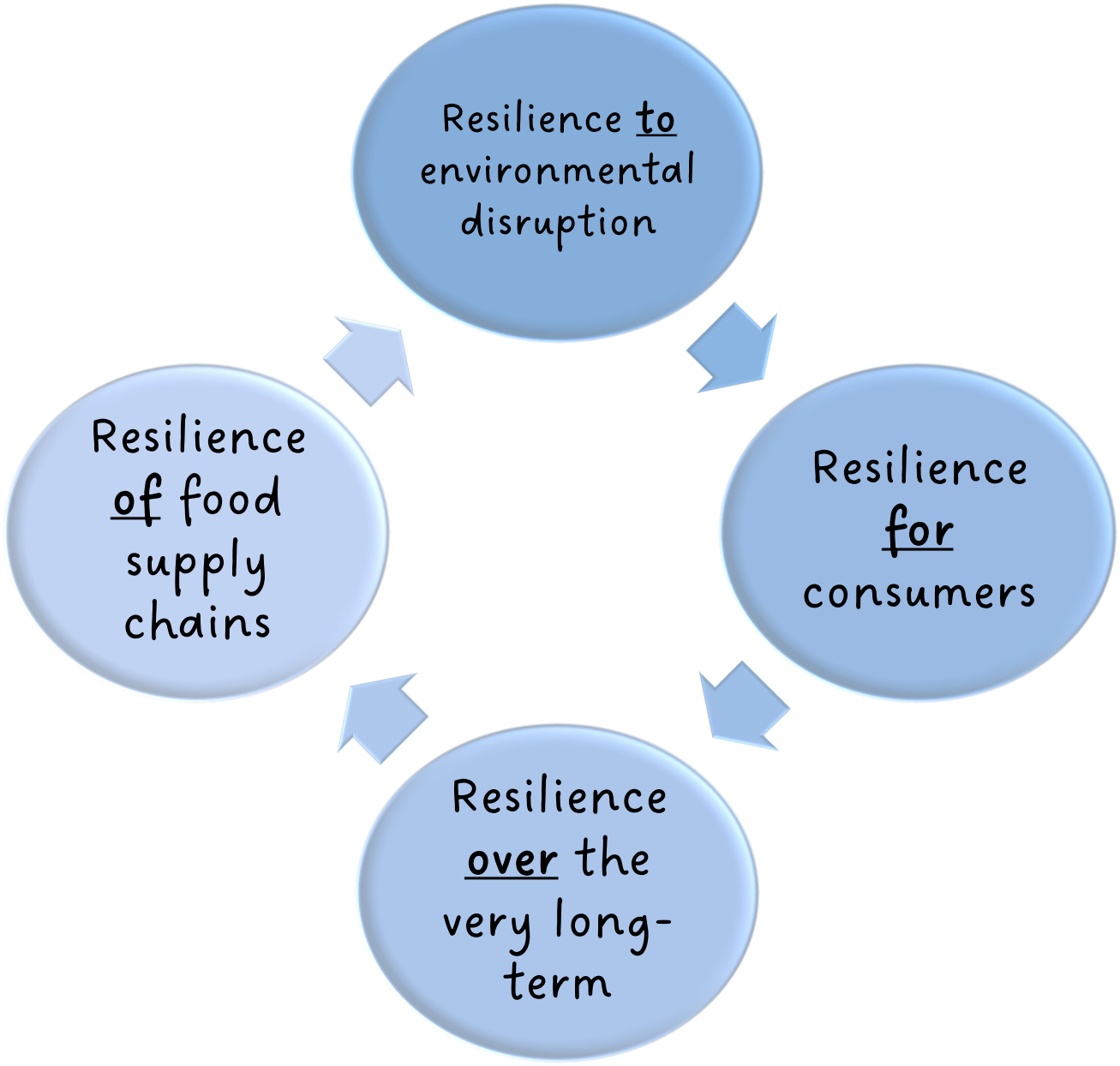
- Food security: pillars
- ‘Resilience’ and ‘vulnerability’
  - Coping? Recovering?
  - Going back to normal?
  - Adapting to a new normal?
  - Factor or exposure, sensitivity and adaptive capacity?
  - **Hasnain et al’s (2020) Three Rs**
    - Robustness
    - Recovery
    - Reorientation
    - *But are there 4? Response?*
- Six elements of systemic resilience? **Diversity, asynchonicity, redundancy, modularity, circuit breakers, back-up systems**
  - Tension between **resilience** and **efficiency** in commodified supply chains



# Guiding principles for resilience

- Resilience should be a *characteristic* of food supply chains
- Resilience requires *proactive & reactive action*
- Food supply chains require *adaptive capability* to re-order to a *new* status quo
- Food supply chain actors make decisions influenced by their *perception of risk*, which can improve or hinder resilience

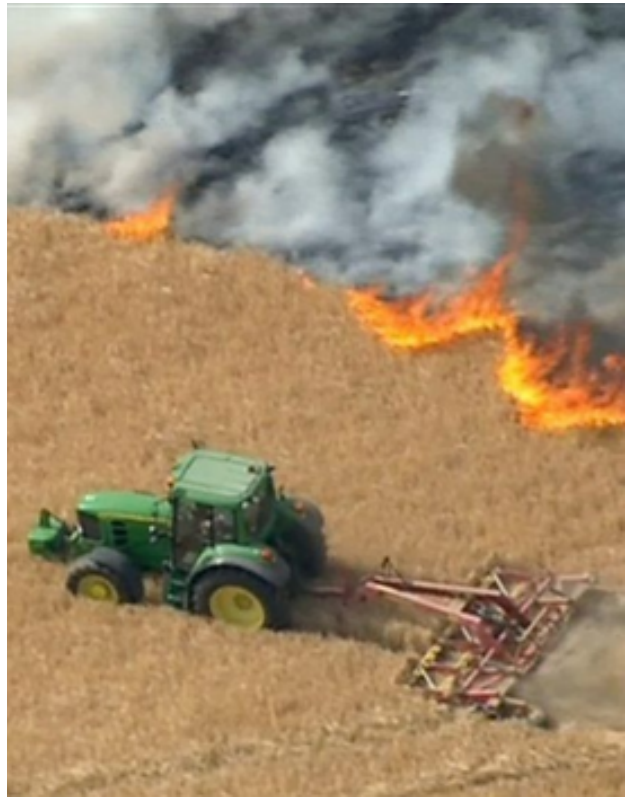
**Helfgott's (2018) Resilience Framing Cycle**



# ‘Environmental disruption’?

- **Break or interruption in the normal course of an activity**

- Environmental disruption as occurring **in and to the natural environment**
  - Physical
  - Non-human biological and chemical
  - Human-induced



# Many potential environmental impacts to food supply

| | | | | |
|---|---|---|---|---|
| Extreme temperature | Soil salinisation | Extreme precipitation | Drought | Cyclone, tornado, hurricane |
| Flood | Wildfires | Pests | Crop, animal, human diseases | Algal blooms |
| Ocean acidification | Aflatoxins | Endocrine disruptors | El Niño | Rising sea levels |
| Pollution and contamination | Infrastructure collapse | Marine heatwaves | Climate change | Biodiversity loss |
| Seismic activity | ? | | | |

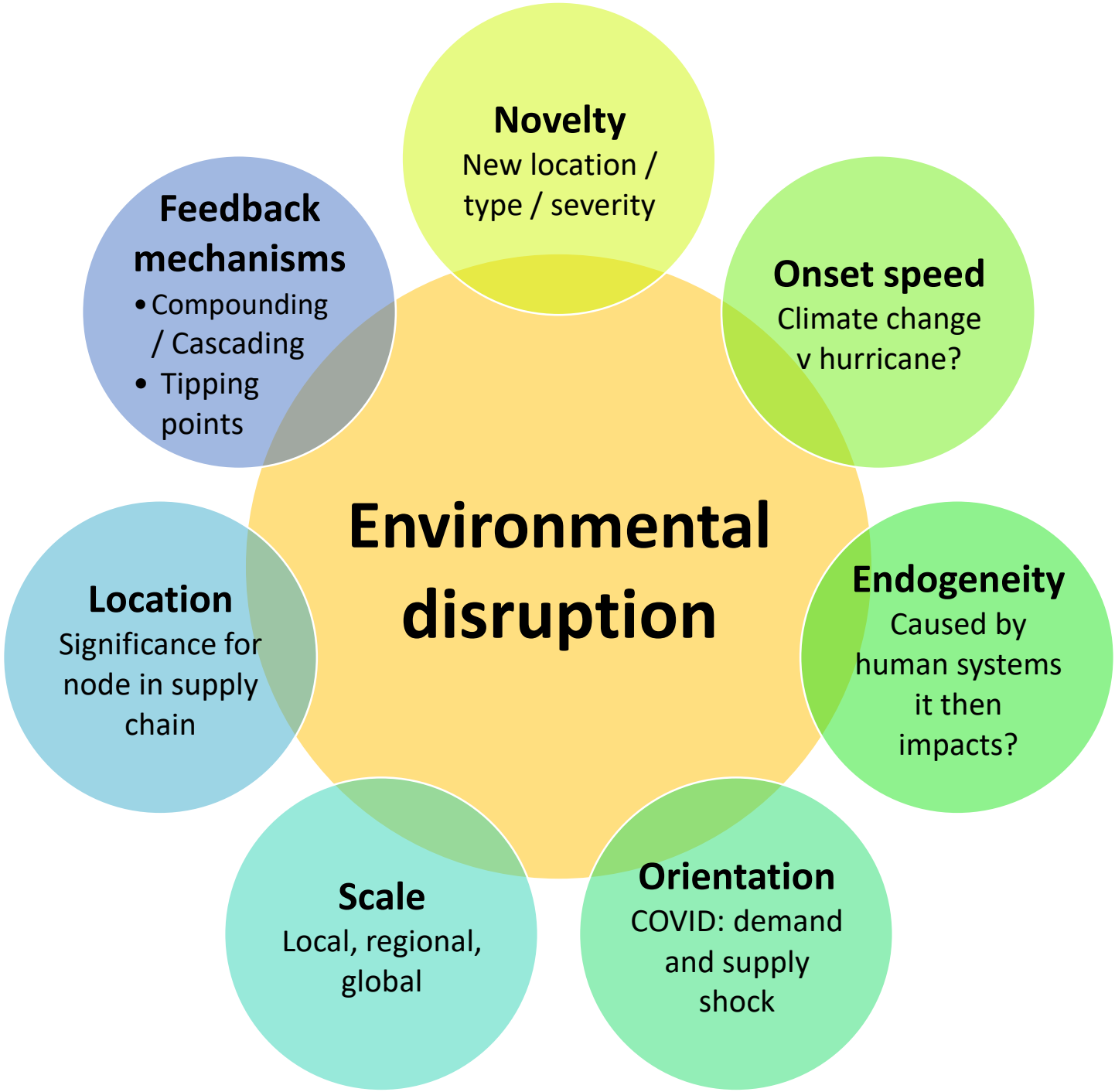
Exacerbated by…

- Blockades
- Economic impacts
- Trade patterns
- Conflict
- Labour shortages

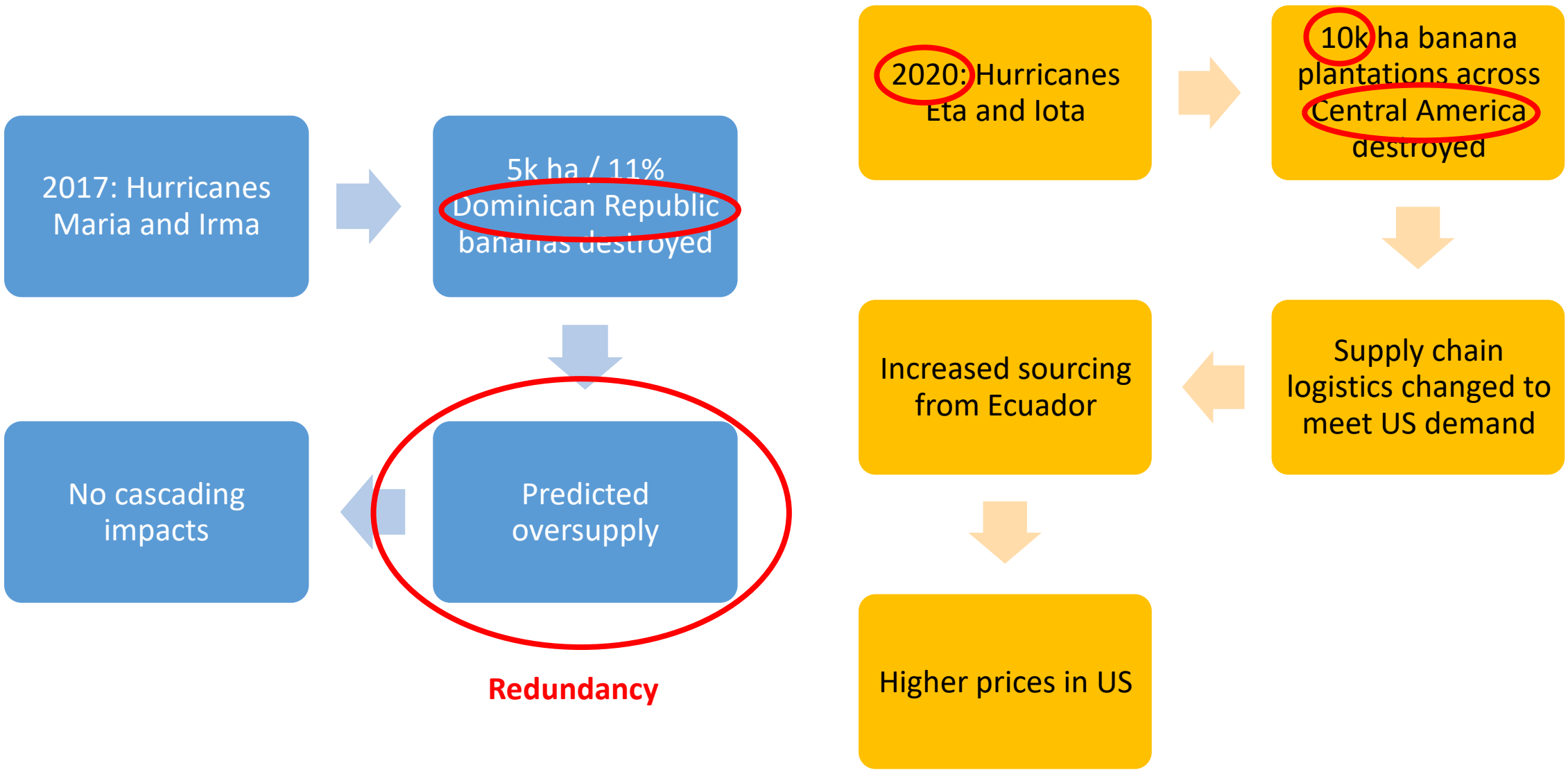
….

***Shock propagation: shortages, stoppages, price rises, safety and quality risks …***

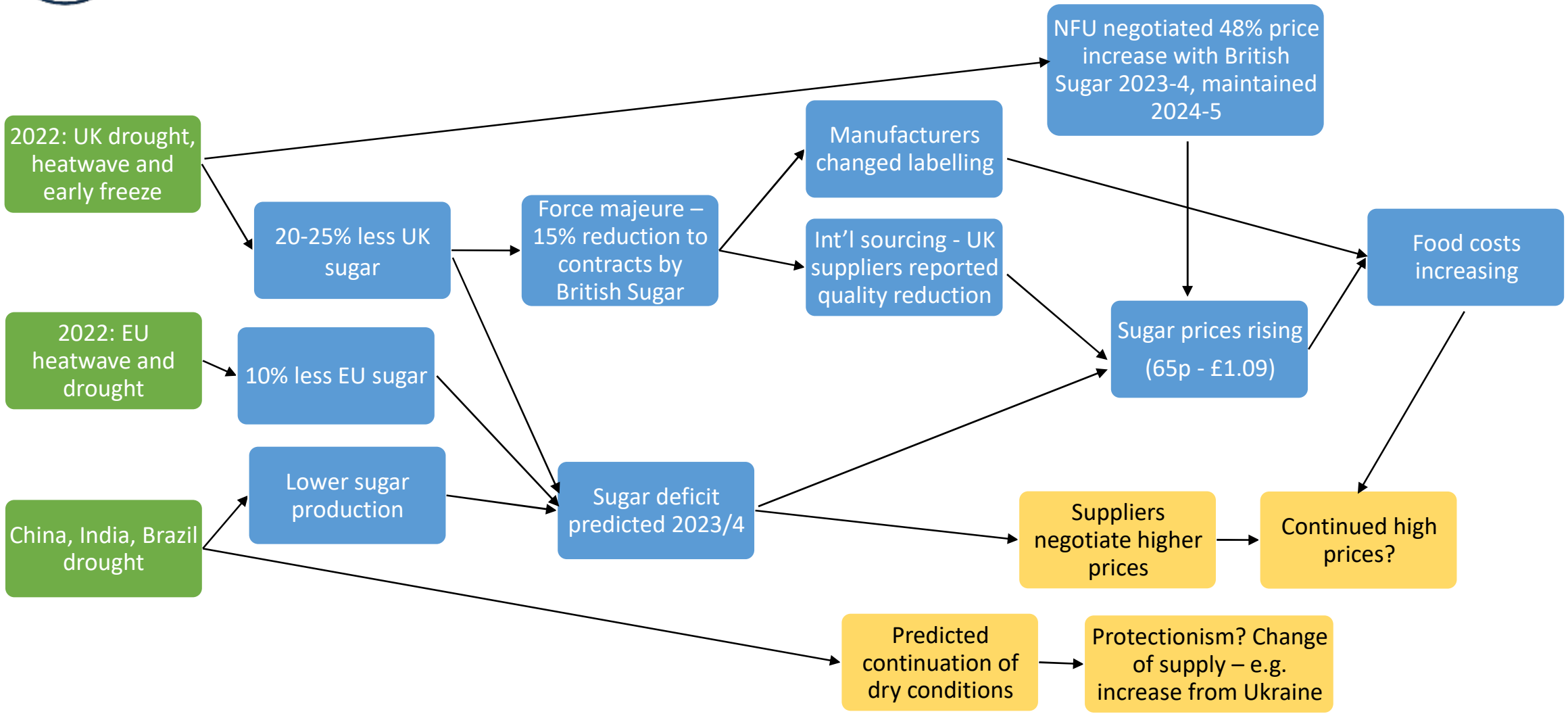
# Characteristics of environmental disruptions



# Environmental disruption may cascade – or not: Caribbean bananas



# Compounding environmental disruption: sugar 2022-3



# So, what is an early warning system?

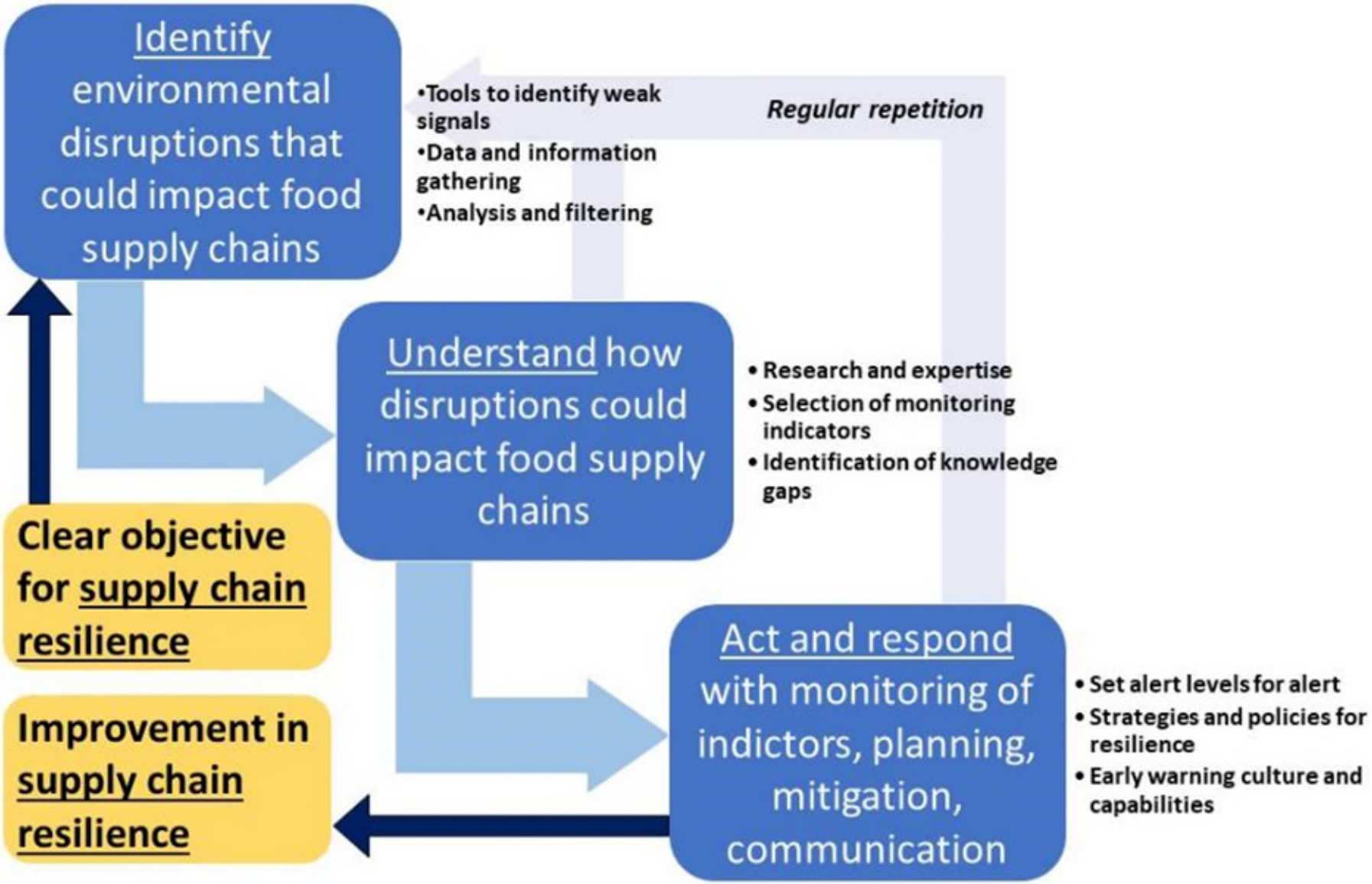
- Most existing early warning systems
  - **Monitor** signs
  - **Communicate risk**
  - Focus on **minimising impacts** of disruption
  - Success depends on **vulnerability**
- Food-focused EWS
  - Food safety, acute food security (Global South)
- Less focus on **how the disruption cascades**

**How about for food supply chain <u>resilience</u>?**

- Can assist policymakers and decision makers
  - **Identify**
  - **Understand**
  - **Respond**

  to emerging issues in the **medium- to long- term**
- Two roles?
  - **monitoring current and emerging risks** to inform what to take action on
  - **working with plausible future scenarios** to identify emerging risks, understand their consequences and decide what to monitor and take action on
- Success depends on **vulnerability of supply chains** and their **adaptive capacity** (balance efficiency and resilience)
- 'Holistic system' - **developments outside the food production chain** that may lead to emergence of risks
- Challenge of long-term horizon – **false sense of security** where risks are not imminent / clearly known

# Early framework for Early Warning System



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