Development of holistic metrics of agricultural and food system performance

https://glfx.globallandscapesforum.org/topics/21467/page/TPP-home

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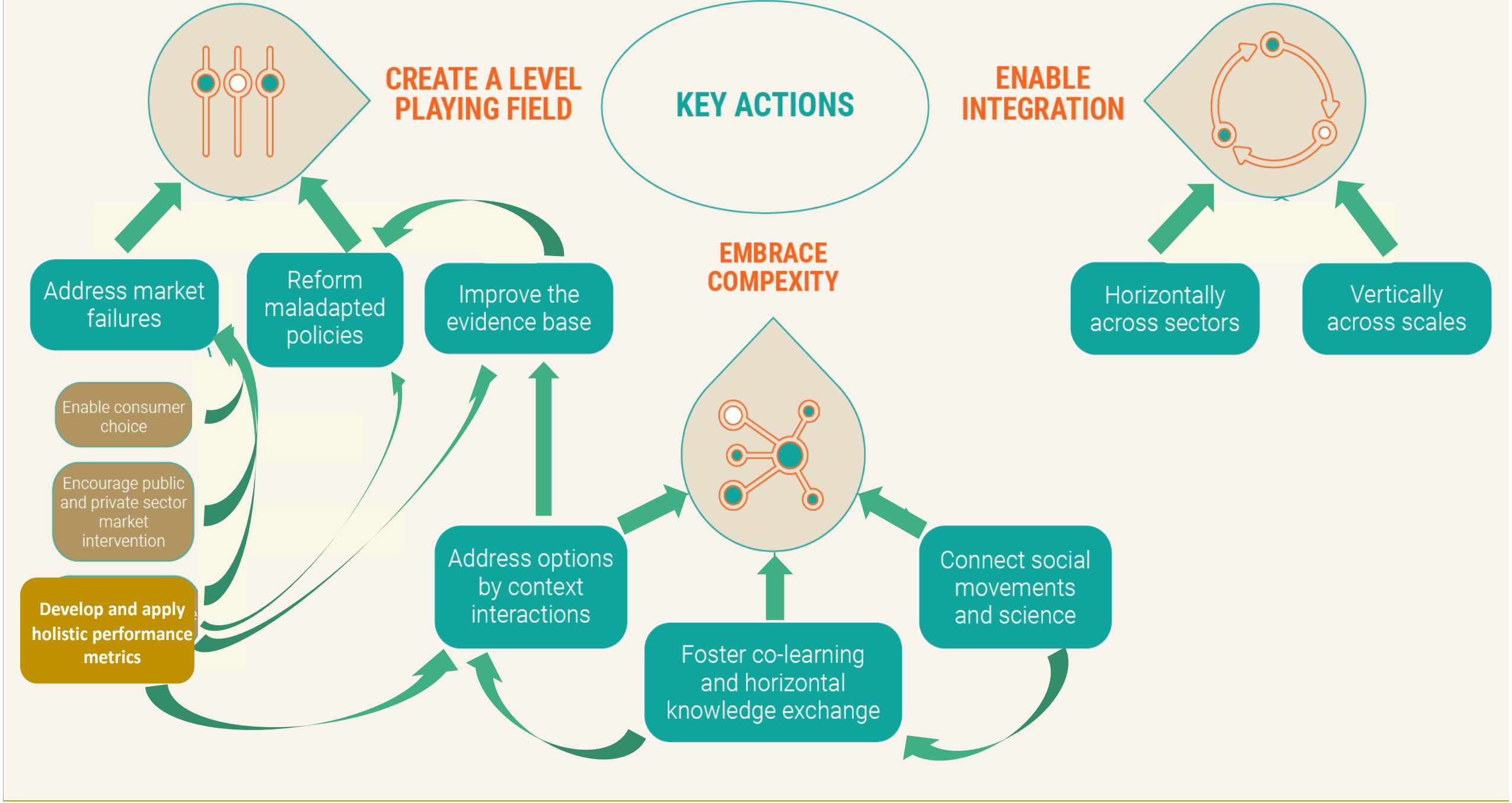
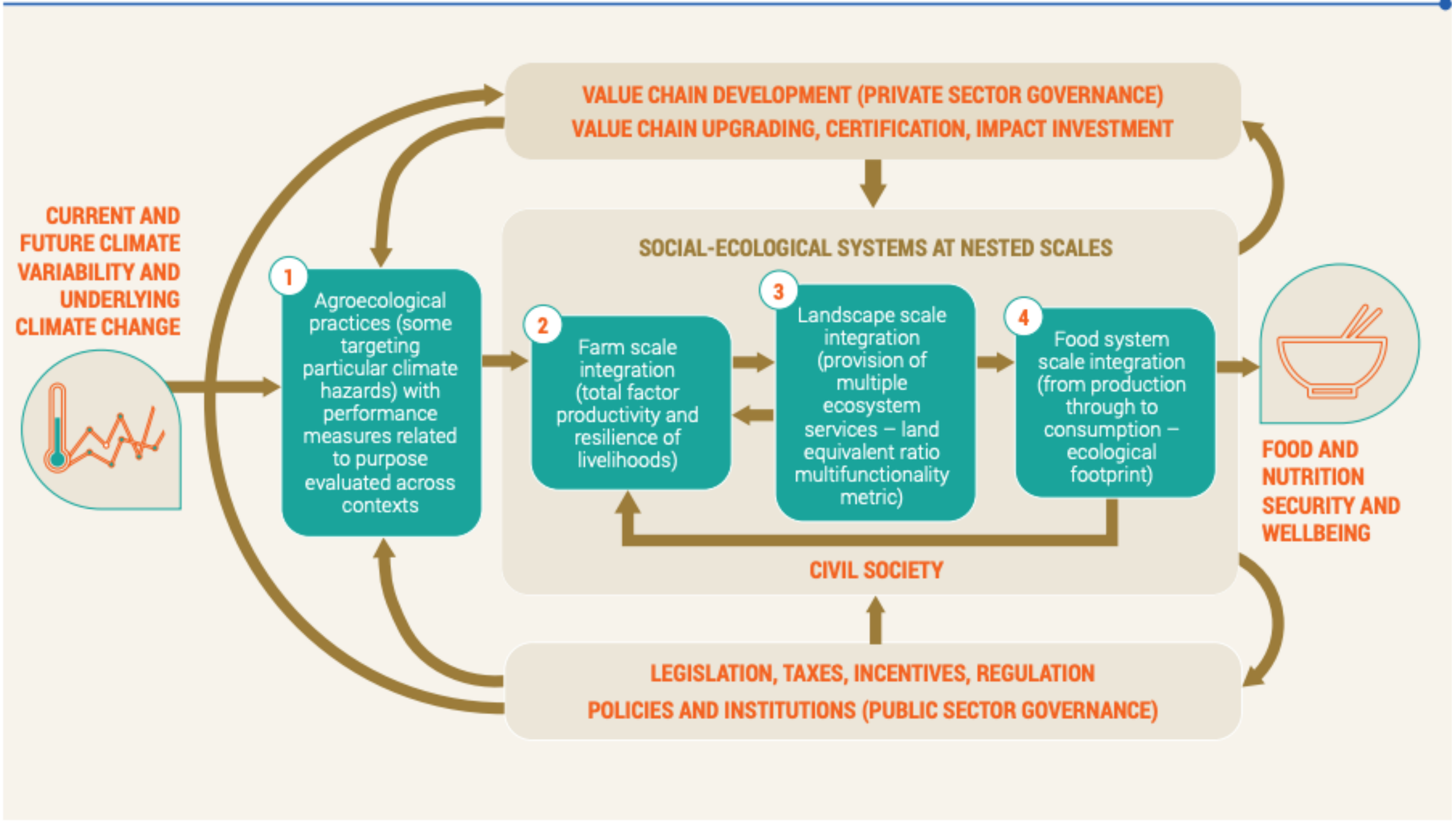
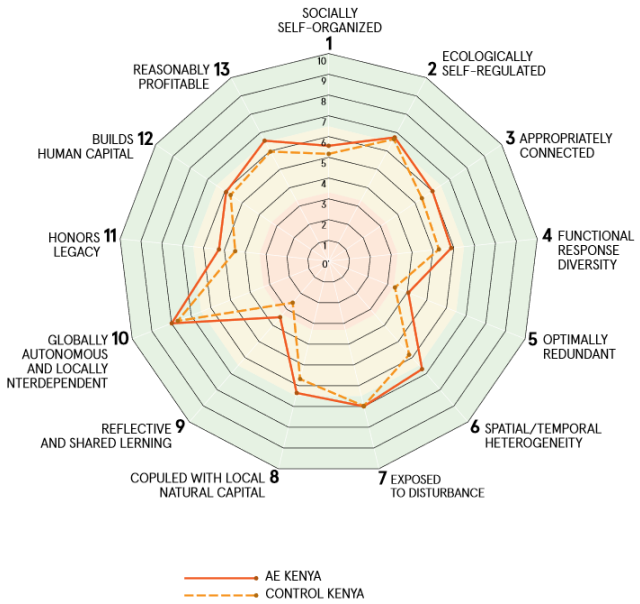


Sinclair, F., Wezel, A., Mbow, C., Chomba, C., Robiglio, V., and Harrison, R. (2019). The contribution of agroecological approaches to realizing climate-resilient agriculture. Background Paper. Global Commission on Adaptation. Rotterdam. https://gca.org/reports/the-contributions-of-agroecological-approaches-to-realizing-climate-resilient-agriculture/



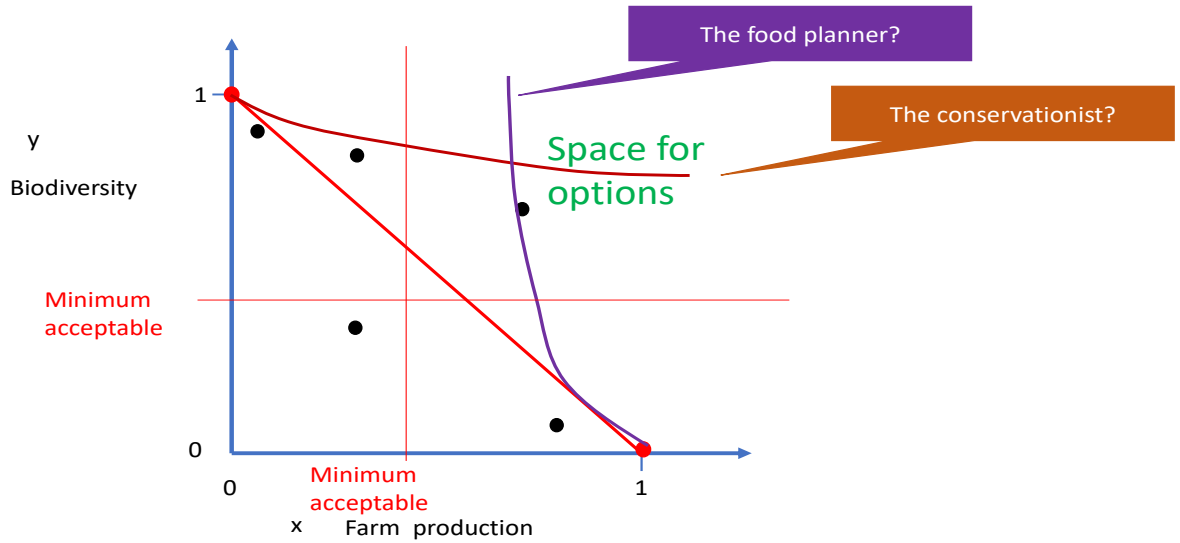
HLPE 2019. Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome http://www.fao.org/3/ca5602en/ca5602en.pdf

Caution – principles for overcoming dangers with metrics



1. **Context specificity**
   local relevance *versus* global comparison
2. **Quantitative and qualitative information**
   triangulation,
   explanation.
3. **Multidimensionality**
   tryany of the one number index / monetisation,
   differential weighting,
   non-linearality,
   thresholds,
   limits to trade-offs (compensation).

Indifference = equal value/utility



Protocols for using and interpreting metrics as important as the metrics themselves

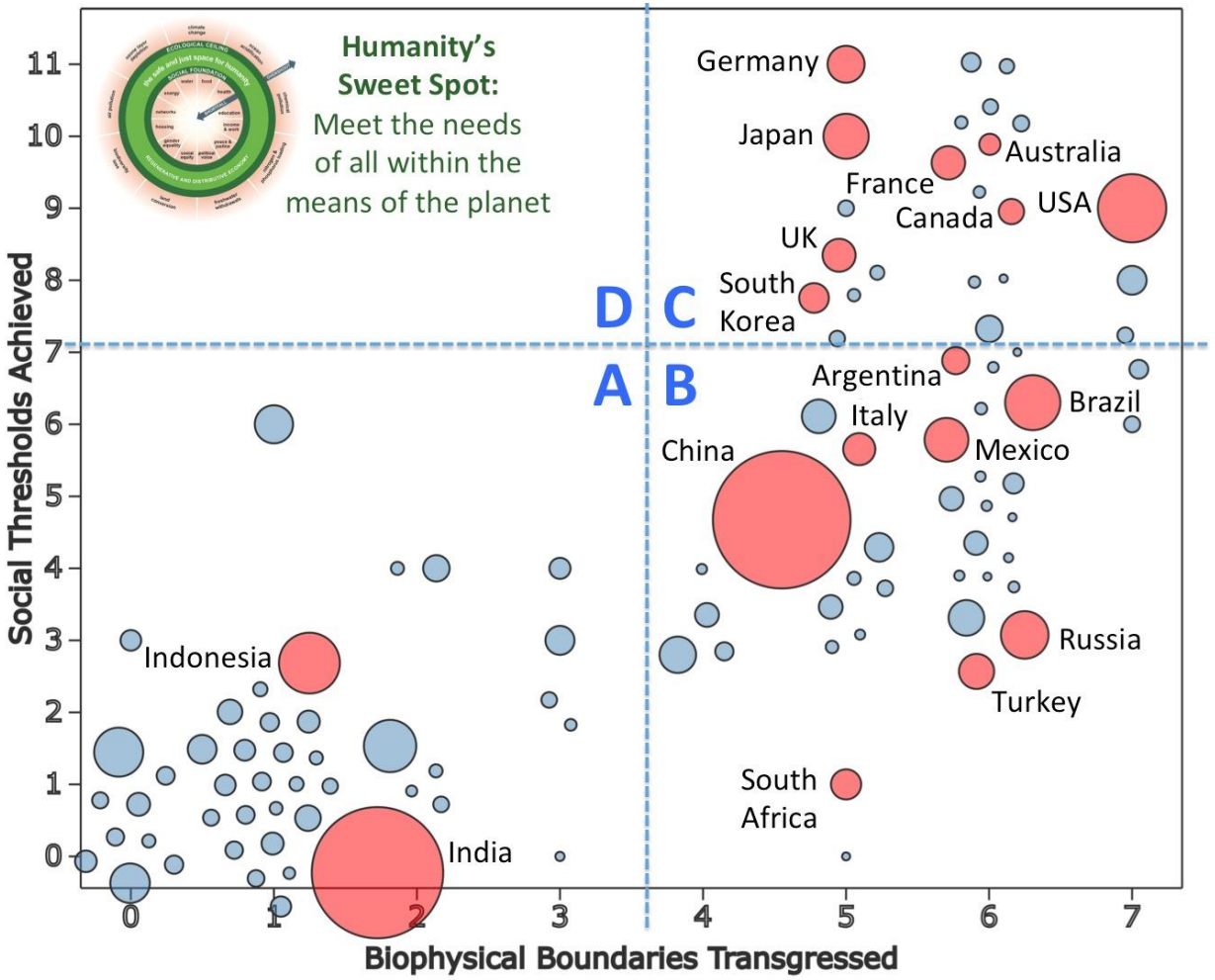
Need comprehensive **assessment frameworks** AND **common databases** from which users can operate syntheses relevent to their purpose, rather than just a few iconic indices

Immediate traction from combining SDG indicators

SDG 2.1 prevelance of undernourishment (PoU) - percentage of total population

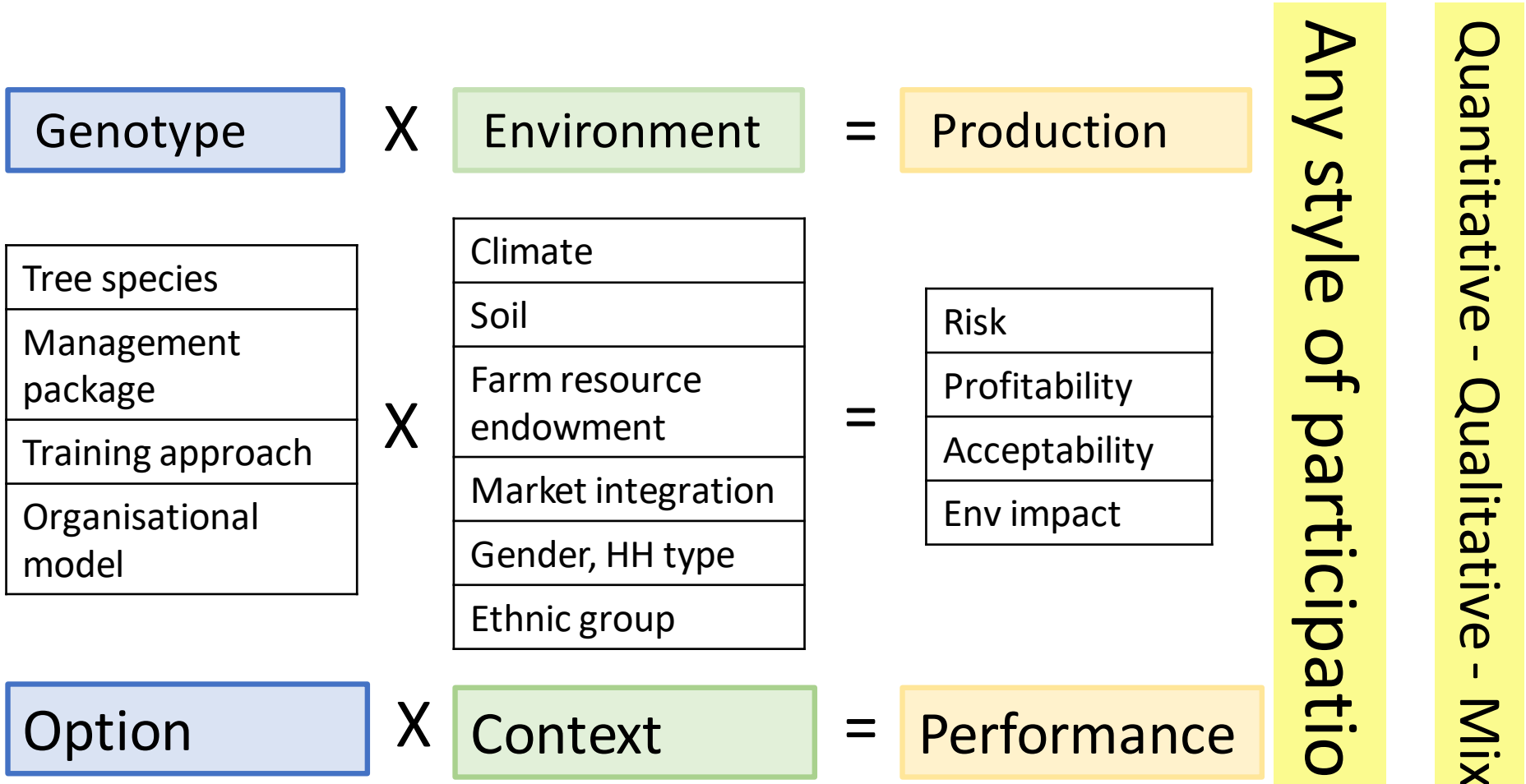
SDG 15.3 proportion of land that is degraded (PD) - percentage of total land area

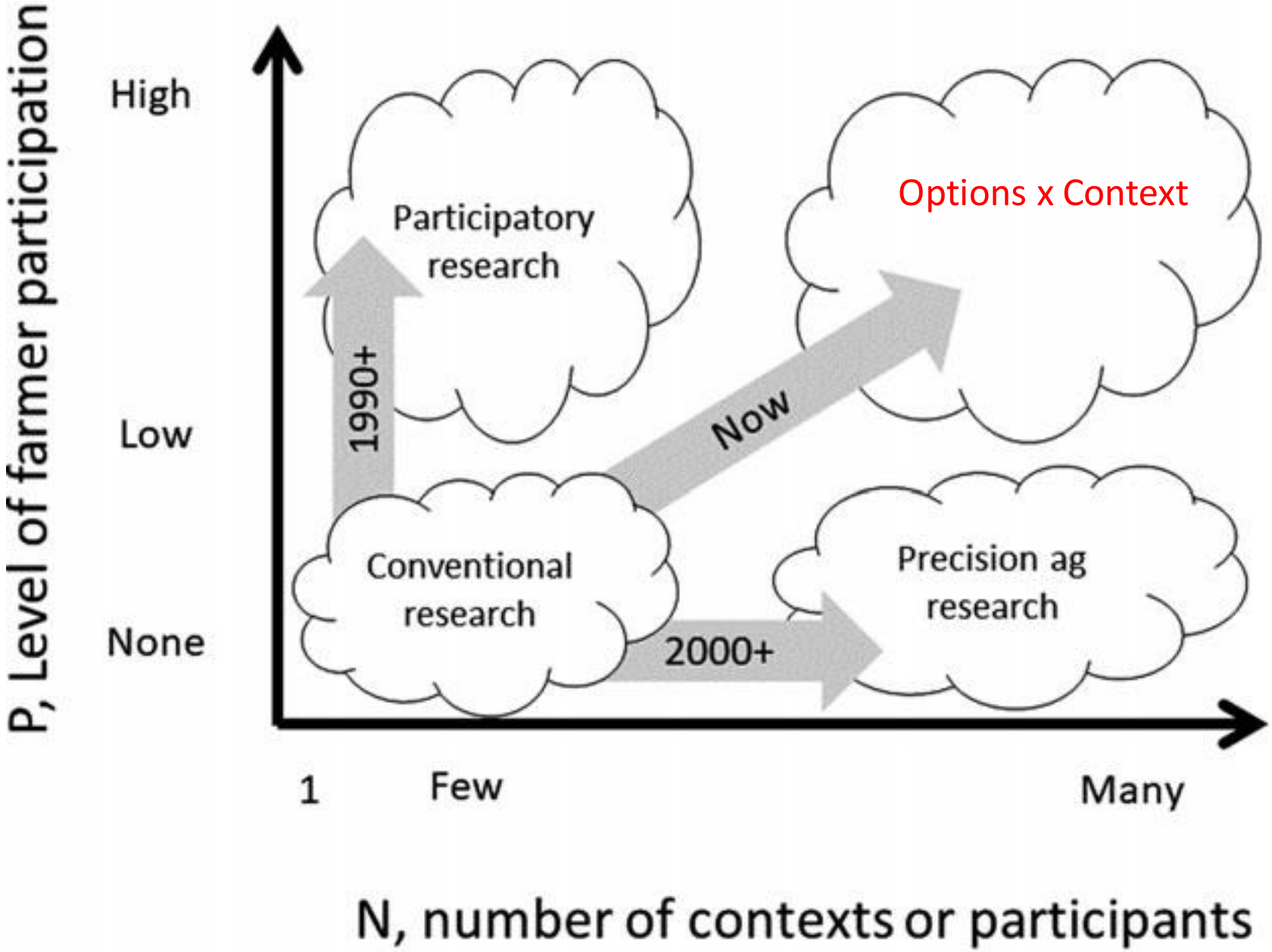
Δ PoU / Δ PD



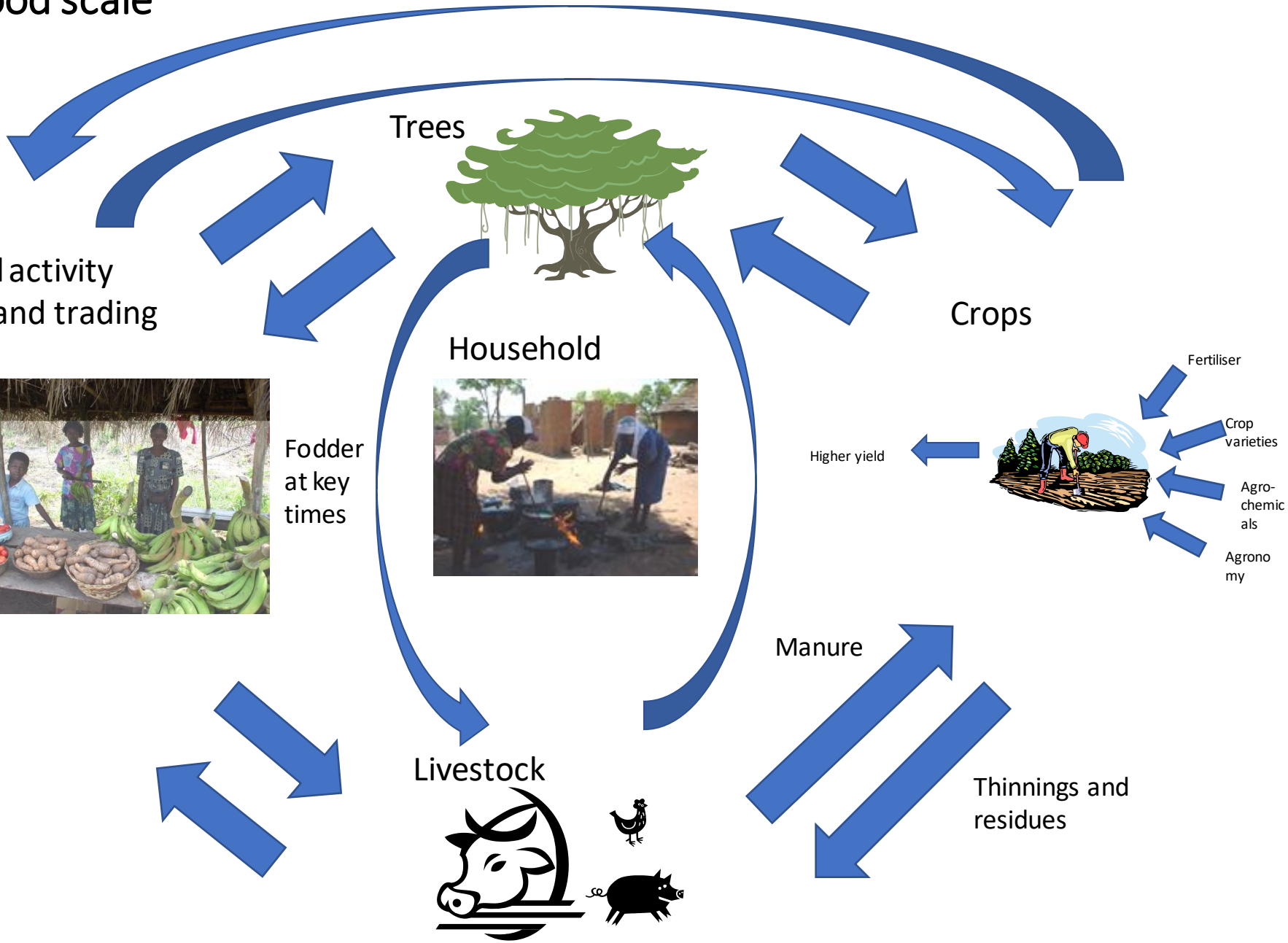
O'Neill, D.W., Fanning, A.L., Lamb, W.F. *et al.* A good life for all within planetary boundaries. *Nat Sustain* **1,** 88–95 (2018). https://doi.org/10.1038/s41893-018-0021-4

Field scale: from GxE → OxC

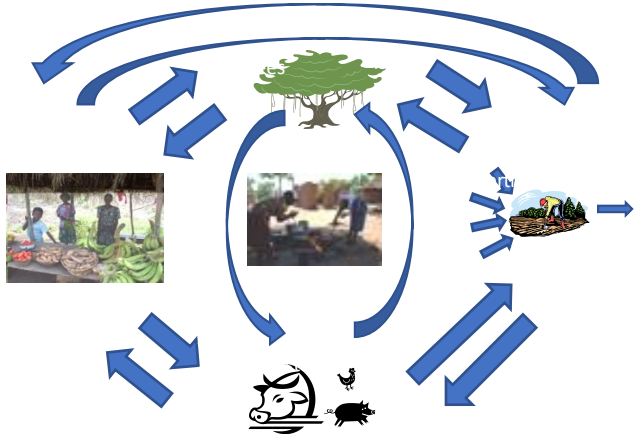



P, Level of farmer participation
High
Low
None
Participatory research
1990+
Now
Options x Context
Conventional research
2000+
Precision ag research
1
Few
Many
N, number of contexts or participants

Farm / Livelihood scale



Farmer decisions take whole livelihood into account: maize in the mid hills of Nepal



- Farmers don't follow agronomic recommendations
  - plant at high population density, use thinnings for fodder end up with lower than recommended densities
  - intercrop – including with tree cover (globally almost half agricultural land has >10% tree cover)
  - apply fertiliser purposively (precision farming?)
  - **30% increase in maize yield** through participatory varietal selection in Nepal (Tiwari et al., 2009)

Total factor productivity and resilience of whole livelihood rather than yeild of one component

Tiwari, T.P., Brook, R.M. and Sinclair, F.L. (2004) Implications of hill farmers' agronomic practices in Nepal for crop improvement in maize. *Experimental Agriculture* 40: 1-21

Tiwari, T.P, Virk, D.S. and Sinclair, F.L. (2009). Rapid gains in yield and adoption of new maize varieties for complex hillside environments through farmer participation. I. Improving options through participatory varietal selection (PVS). *Field Crops Research* 111: 137–14-21

Tiwari, T.P., Brook, R.M., Wagstaff, P. and Sinclair, F.L. (2012) Effects of light environment on maize in hillside agroforestry systems of Nepal. *Food Security* 4: 103-114

DOCUMENTING AND EVALUATING THE SOCIO-ECONOMIC VIABILITY OF AGROECOLOGICAL PRACTICES ACROSS AFRICA

RESEARCH PROGRAM ON Forests, Trees and Agroforestry

CGIAR

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE


SAT - Agroecology Center Tanzania


CIRAD-ILRI - Agropastoral and pastoral systems in Senegal


CIRAD - Agro-sylvo-pastoral systems in Burkina Faso


CIRAD-ICARDA - Compost, livestock, and crop production in Tunisia


CIRAD-IRD - Agroecology comparisons in Madagascar


CIMMYT - Farm mechanization in Ethiopia and Zimbabwe


ICARDA - Legumes and agroecology in Ethiopia

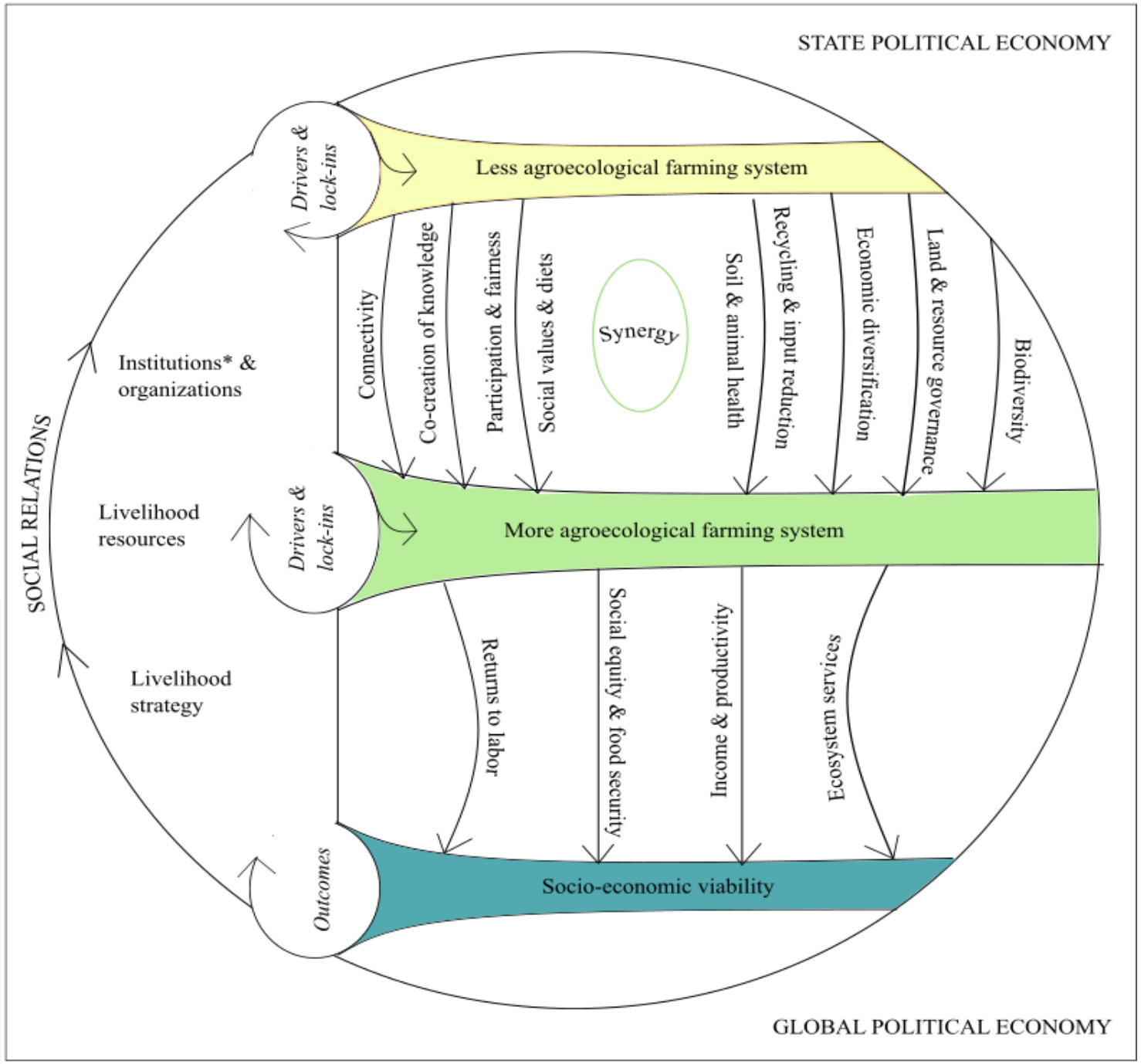

ICRAF - Tree-crop associations and biomass in Burkina Faso


ICRAF - Agroforestry and soil and water conservation in Kenya


IWMI - Exclosures in Ethiopia


Cornell University - Agroecology in Malawi


The Alliance of Bioversity and CIAT - Agroecology in Kenya



*Institutions performing agroecological interventions will be of particular interest

Planning, data analysis, reflection

Data collection

Step 1: Delineate case study.

Aim: Ensure common understanding of geographical and contextual boundaries of investigation.

Described the farming context of the study area

Step 2: Expert / key informant data collection

Aims:

1. Elicit information on the farming systems, heterogeneity of farms and farm households, levels of agroecological integration and their trajectories, the interventions made.
2. Explore the objectives and hypotheses using expert, qualitative information.

Step 3: Assess information needs and design Step 4

Aims:

1. Compile existing information (published or not) and so no unnecessary collection of further primary data is done.
2. Localise design for Step 4

Step 4: Farm characterisation survey

Aim: Collect data to allow typologies of farms to be generated in terms of structural variables and agroecological

Step 5: Analysis of Step

Aims:

1. Generate typologies
2. Explore relationships between structural and agroecological indicators.
3. Identify themes for Step 6

Step 6: Participatory group-level data collection

Aims:

1. Explore the objectives and hypotheses using participatory methods in a focus group discussions
2. Explore and explain heterogeneity revealed in Step 4.

Step7: Analysis of Steps 1-6 and plan Step 8

Aims:

1. Assemble and interpret all information in terms of objectives and hypotheses.
2. Detailed design of Step 9

Step 9: Synthesis of situation

Aim: Assemble and integrate all information so far available. Identify further investigations or analyses needed to interpret the data and plan those that are feasible as a possible Step 10.

Step 8 : In-depth understanding of mechanisms

Aim: HH surveys essentially qualitative, using or not the HH sample produced in the step 4b and the description of changes highlighted in step 4a to understand and analyse specific results including capture perceptions on changes and their effects.

Step 8a: Drivers and lockins

Aim: Understand factors that facilitated and blocked making changes in agroecological practice

Step 8b: Labour

Aim: Understand and measure implications of AE practice for labour quality, quality, allocation,...

Step 8c: Income, food security and nutrition (farm and regional scale)

Aim: Understand and measure implications of AE practice on income, food security and nutrition.

Step 8d: Environmental services

Aim: Understand and measure implications of AE practice changes on environmental services and their values

Step 10: Possible and/or optional additional studies such as:

1. Understand potential for ES payments shifting viability
2. Model systems to understand tradeoff and evaluate other options for shifting the viability (eg subsidies)
3. Explore/test other options for shifting the viability

Step 11: Overall synthesis and reporting

BOX 4 Landscape Scale Metric for Multifunctional Land Use

PLOT-TO-LANDSCAPE SCALE METRIC FOR MULTIFUNCTIONAL LAND USE ($LERM_s$)

$$LERM_s = \gamma_{P,s} \sum_i P_i / P_{i,ref} + \gamma_{R,s} \sum_j R_j / R_{j,ref} + \gamma_{C,s} \sum_k C_k / C_{k,ref}$$

- $\gamma_{P,s}$: Societal weighting of provisioning (P) services
- $P_i / P_{i,ref}$: Current vs reference services per unit land
- $\gamma_{R,s}$: Societal weighting of regulating (R) services
- $R_j / R_{j,ref}$: Current vs reference services per unit land
- $\gamma_{C,s}$: Societal weighting of cultural (C) services
- $C_k / C_{k,ref}$: Current vs reference services per unit land

Source: van Noordwijk et al. 2018.[72]

The Ecological Footprint

MEASURES

how fast we consume resources and generate waste

Energy

Settlement

Timber & Paper

Food & Fiber

Seafood

COMPARED TO

how fast nature can absorb our waste and generate new resources.

Carbon Footprint

Built-up land

Forest

Cropland & Pasture

Fisheries