

# INRAE

## ➤ Designing agroecological systems based on crop diversification in sheltered market-gardening: Combining plot and agrifood system studies

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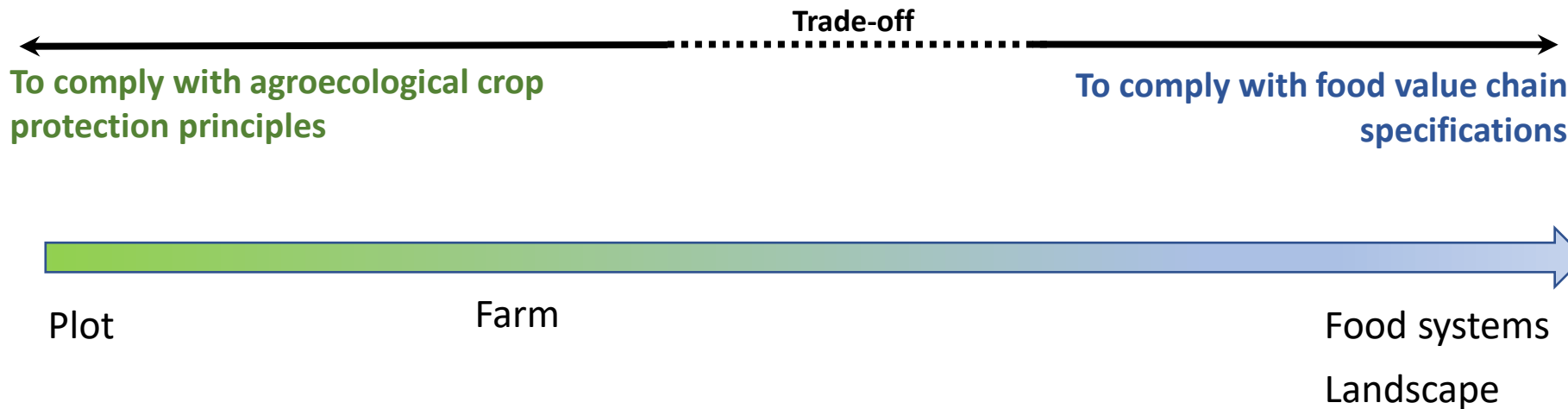
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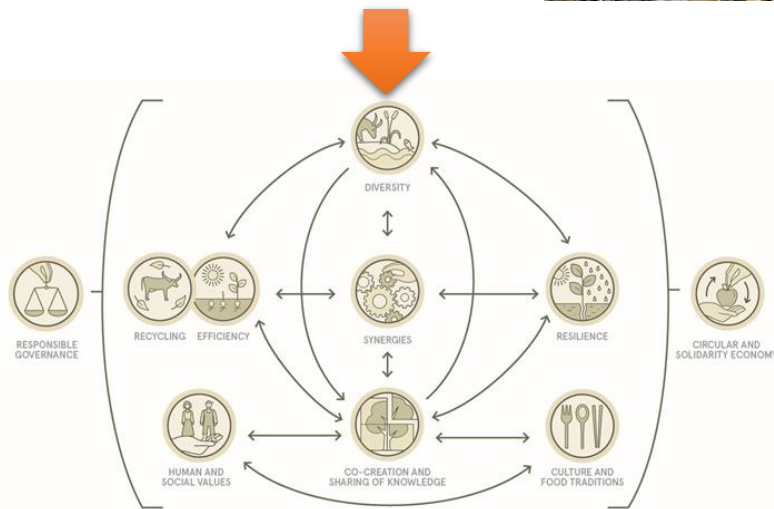
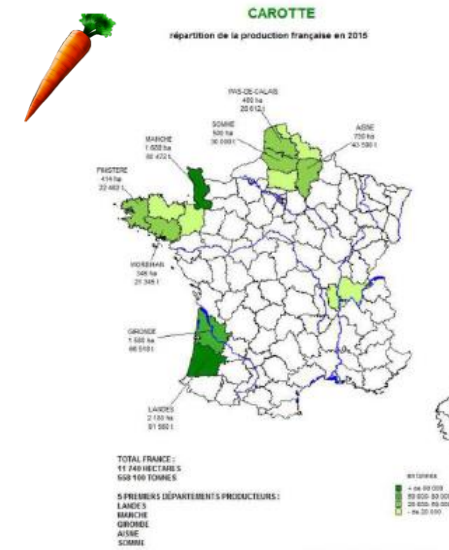
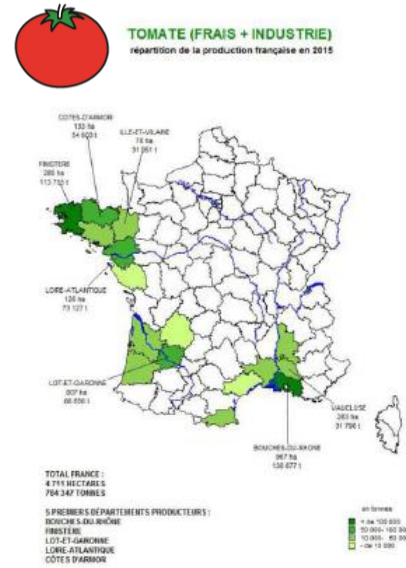


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Combining plot and agrifood system studies

How to crop fresh vegetables under shelters



# ➤ Agroecology based management in horticultural production systems : fostering crop diversity



Designing promising vegetable agroecological systems ?

Diversity is a key element interacting with many others, not only at field management levels but also at territorial and food system levels :

- manage day by day relevant and compatible agronomic practices at field and farm levels
- consider constraints and opportunities at the agrifood system level.

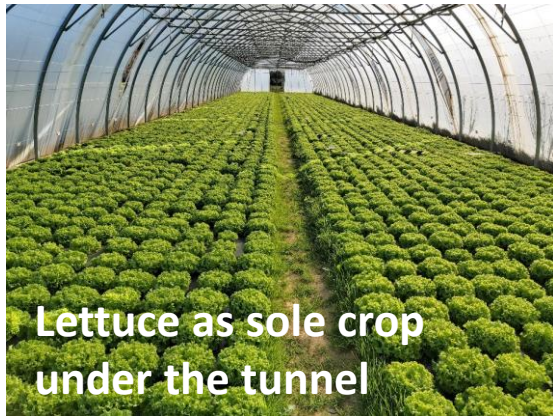
## ➤ Agronomy research to design higher crop diversified systems in market-gardening under shelter : from plot to agrifood scale



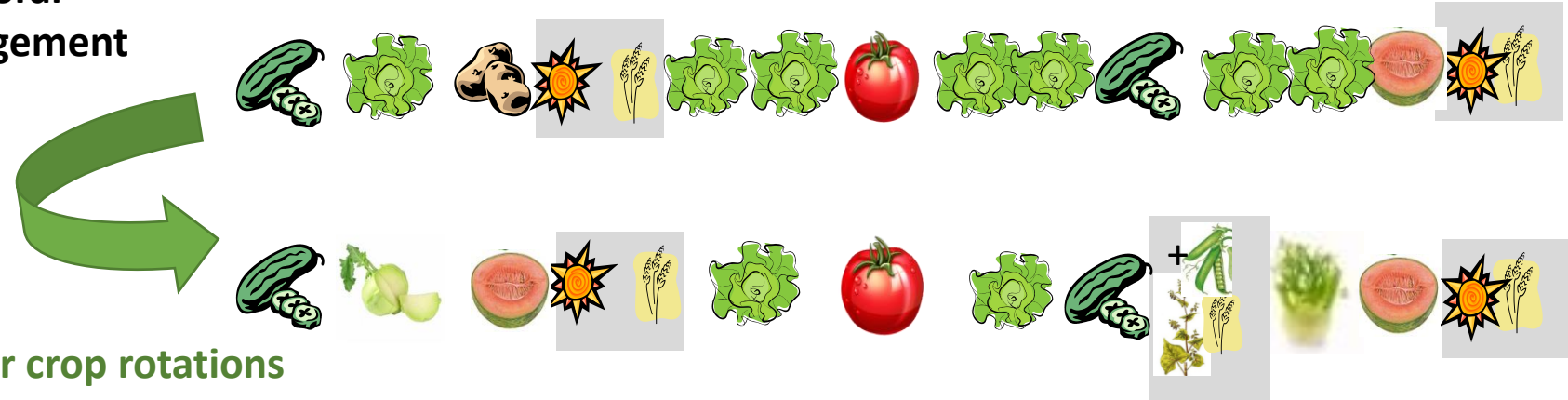
Cropping systems design  
Field experiments

- Inspiring resources for local stakeholders
- Lessons from design in action : How to diversify? Spatial and temporal arrangements under such shelter? Pathways? Drivers for design?
- Reports on multi-performances of cropping systems (or trade-offs)
- Understand biological process involved in such diversified systems at plot level

# ➤ At plot scale : multiple ways to organize crop diversity in time and space



Temporal arrangement



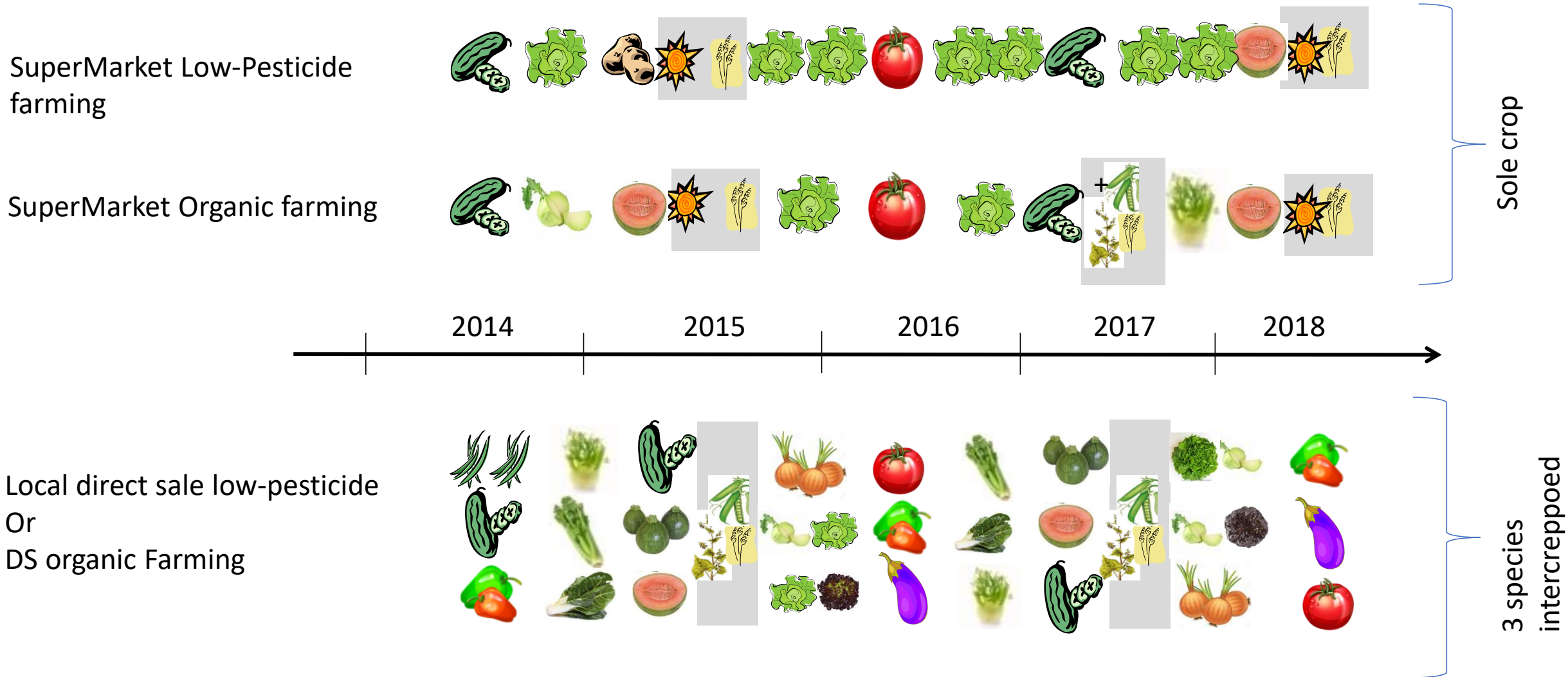
Longer crop rotations  
Multi-species cover crops

Several ways to **implement intercropping** under a shelter... In rows, strips, patches...

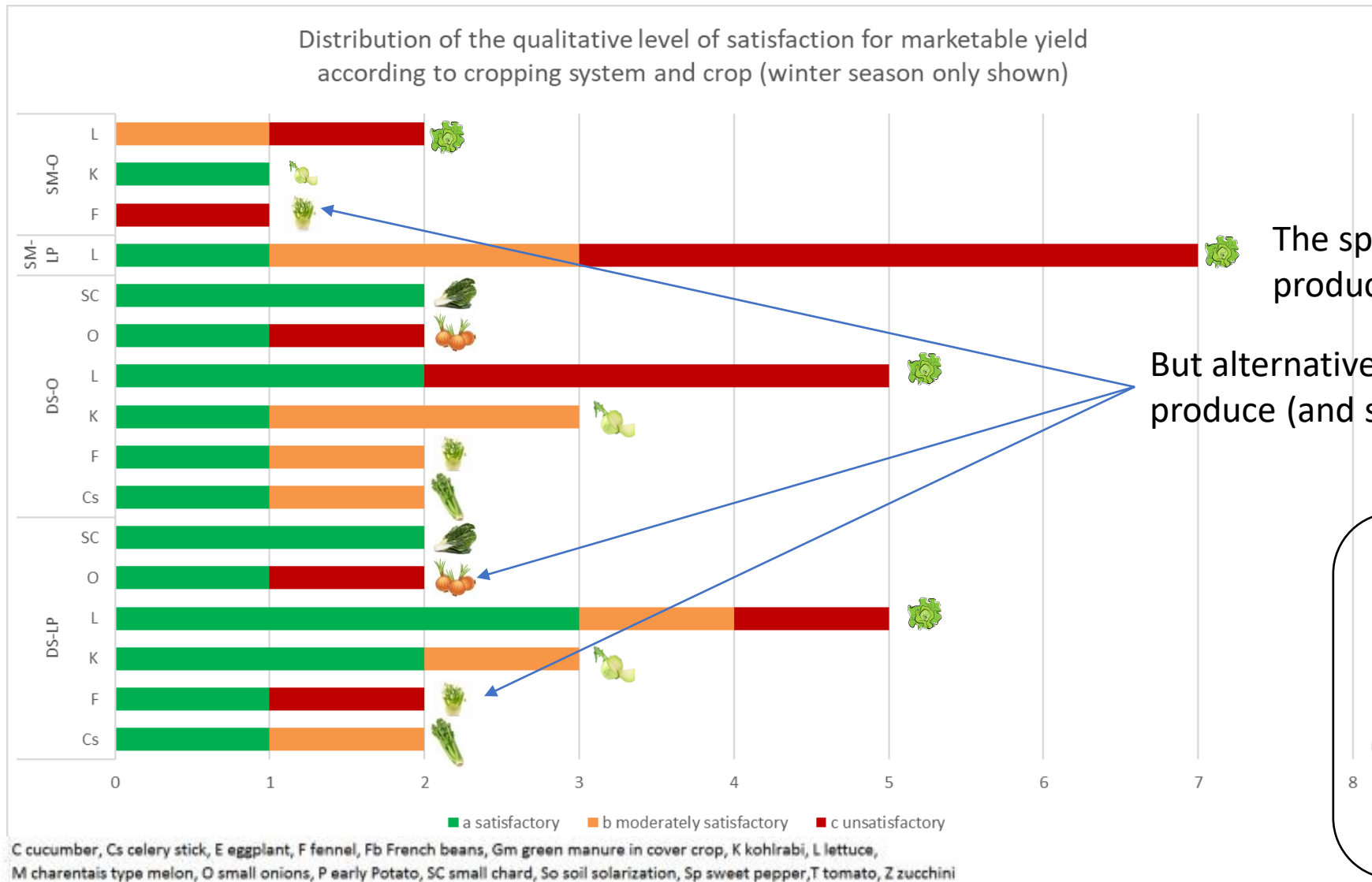
Spatial arrangement



# ➤ At plot scale : experimenting crop diversity in time and space



# ➤ At plot scale : are marketable yields satisfying?



The specialised system failed in high production standards for lettuce

But alternatives were not always a success to produce (and sell in their targeted value chain)

Less pests and diseases pressure, less pesticides requirements

Crop management organisation, workload Marketing yields...



## ➤ Co-design and co-assess diversified systems



Co-creation and sharing of knowledge: agricultural innovations respond better to local challenges when they are co-created through participatory processes

Open workshops → How to organize and implement diversity?

Local stakeholders (farmers, agricultural advisors, researchers, collect firms ...)

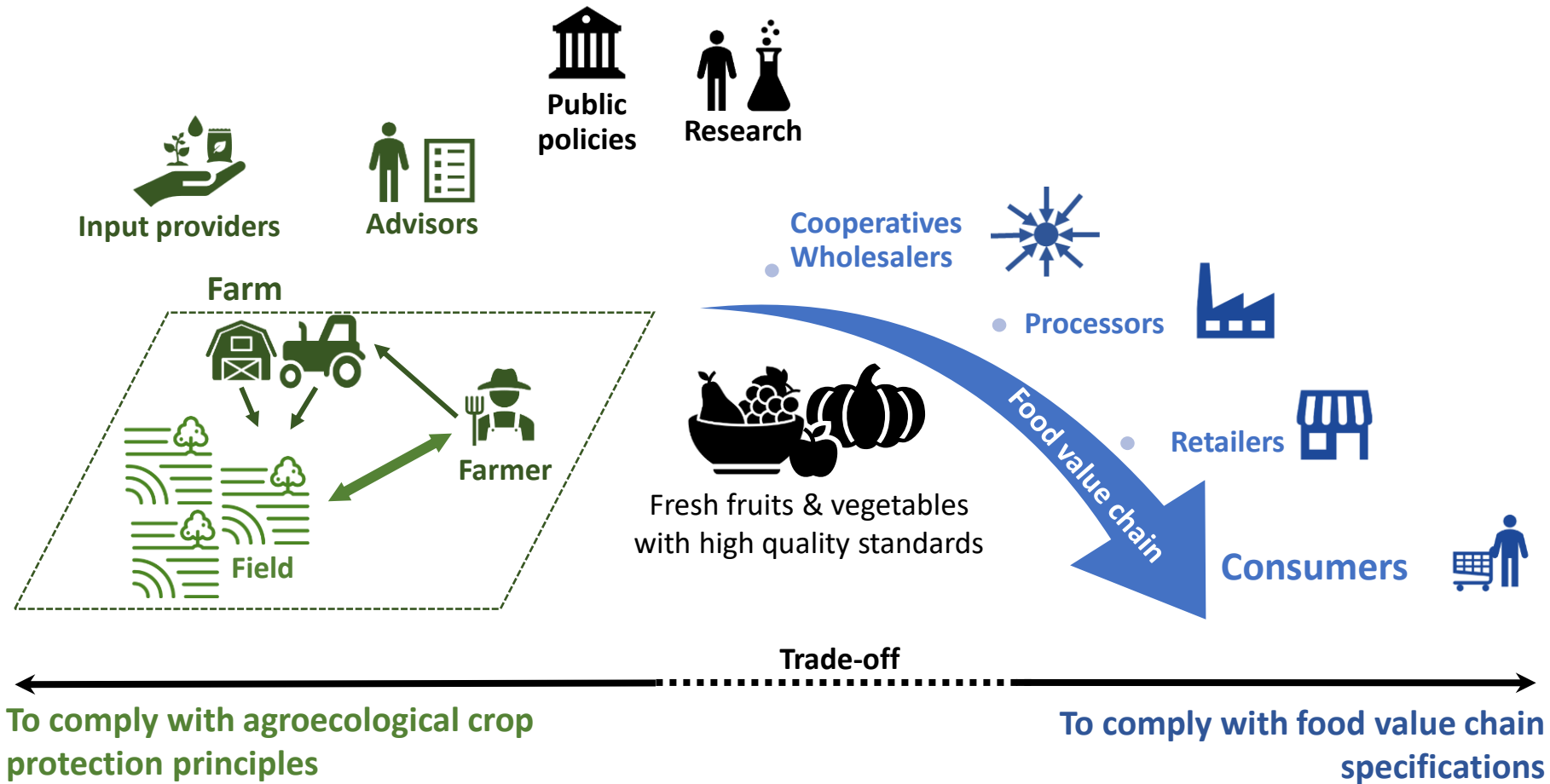
- discussed which level of diversity, which new crop would be relevant according to local food value chain specifications, farming system (organic or not?), etc.
- were inspired and interested in technical knowledge on low-referenced specie
- shared knowledge and know-how, contributed to identify relevant thresholds to assess those new crops and systems



# ➤ Developing diversified cropping systems requires studies at agri-food system level

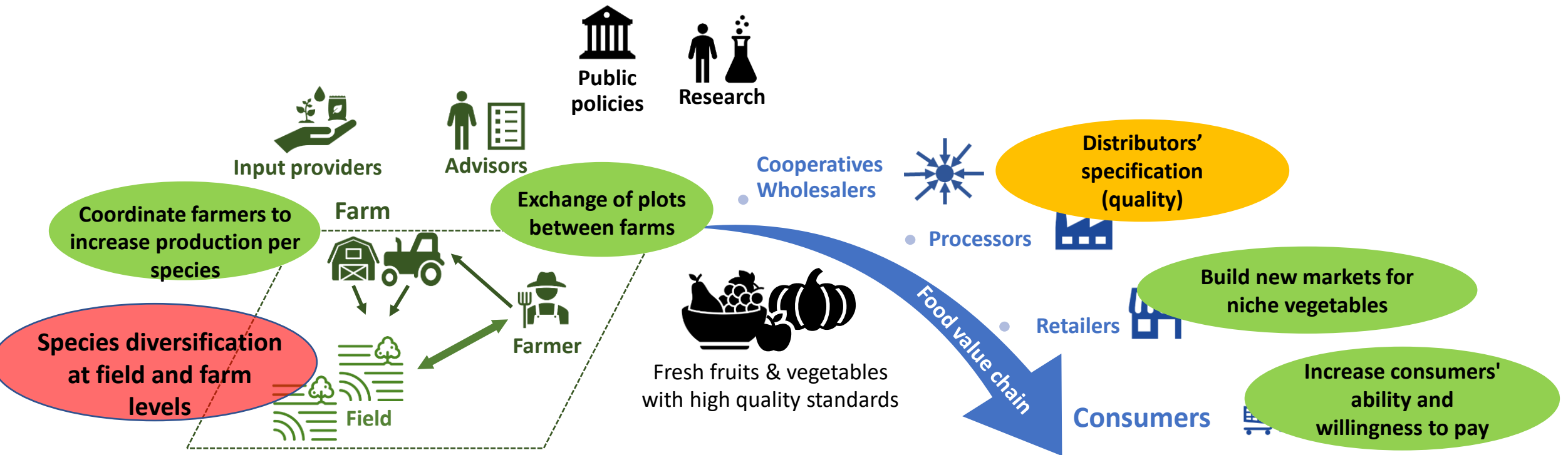
## Socio-technical lock-in at the agri-food system level

(Alaphilippe et al, in press ; Boulestreau et al 2021)



## ➤ Studies on crop diversification in Provence area (South-east France)

**Current sociotechnical problem:** a high level of crop specialisation on vegetable farms that fosters telluric pests and diseases



### Coupled innovations (Meynard et al. 2017)

involving several actors (input supply, production on farm, processing, distribution, and/or consumption) and considering various levels together

## ➤ To conclude

### Required steps to build coupled innovations :

- Identify stakeholders' strategies and sociotechnical lock-in in the territory
- Design and assess coupled innovations with stakeholders at various scales
- Fill in gaps of knowledge (multicriteria performances of the systems designed ; agroecological mechanisms)



### Discussing about coupled innovations with a range of stakeholders

- favors the design and adoption of innovations
- Enables to share individual knowledge from different persons

## > To go further...

- Alaphilippe A., Bussi C., Casagrande M., Dardouri T., Simon S., Lauri P.E., Lefèvre A., Navarrete M. (2021) The use of agronomic practices in IPM programmes in horticulture. In Improving integrated pest management (IPM) in horticulture , Editor Prof. Rosemary Collier, Warwick Univ., UK (in press)
- Boulestreau Y., Casagrande M., Navarrete M. (2021) Implementing a new sociotechnical framework in sheltered vegetable systems reveals lock-in and levers for farming practice change in root-knot nematode management, *Agronomy for Sustainable Development*, 41:44
- Lefèvre A., Perrin B., Lesur-Dumoulin C., Salembier C., Navarrete M. (2020) Challenges of complying with both food value chain specifications and agroecology principles in vegetable crop protection, *Agricultural systems*, 185: 102953, [doi.org/10.1016/j.agsy.2020.102953](https://doi.org/10.1016/j.agsy.2020.102953)
- Meynard J.M., Jeuffroy M.H., Le Bail M., Lefèvre A., Magrini M.B., Michon C. (2017) Designing coupled innovations for the sustainability transition of agrifood systems, *Agricultural Systems* 157 (2017) 330–339
- Meynard, Jean-Marc, François Charrier, M'hand Fares, Marianne Le Bail, Marie-Benoît Magrini, Aude Charlier, et Antoine Messéan (2018) Socio-Technical Lock-in Hinders Crop Diversification in France. *Agronomy for Sustainable Development* 38(5): 54. <https://doi.org/10.1007/s13593-018-0535-1>.
- Navarrete M., Brives H., Catalogna M., Lefevre A., Simon S. (2021) Intertwining deterministic and open-ended perspectives in the experimentation of agroecological production systems: a challenge for agronomy researchers. In “Agroecological transitions, between determinist and open-ended visions”, Magda D., Lamine C., Rivera-Ferre M., Marsden T. (Eds)
- INTERLUDE project: <https://www.picleg.fr/Projets/Les-projets-en-cours/INTERLUDE>

