Understanding and Integrating Local Knowledge to build human-centred climate services

I-CISK MOOC

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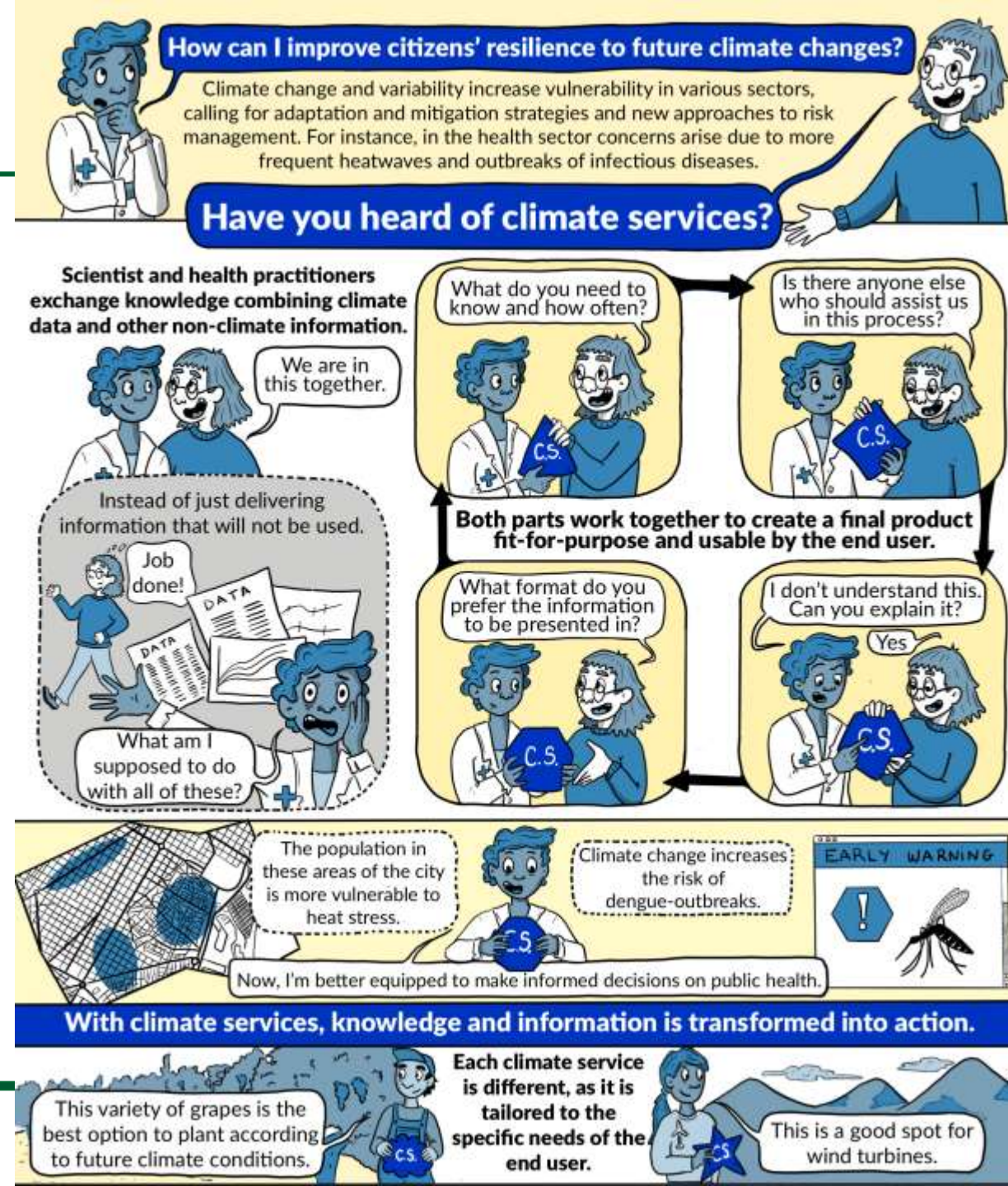IHE Delft Institute for Water Education

Recap – What are Climate Services (CS)?

*"The transformation of **climate-related data** — together with other relevant information into **customised products** such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate **that may be of use for society at large**.*

*These services include **data**, **information** and **knowledge** that support adaptation, mitigation and disaster risk management (DRM)"*
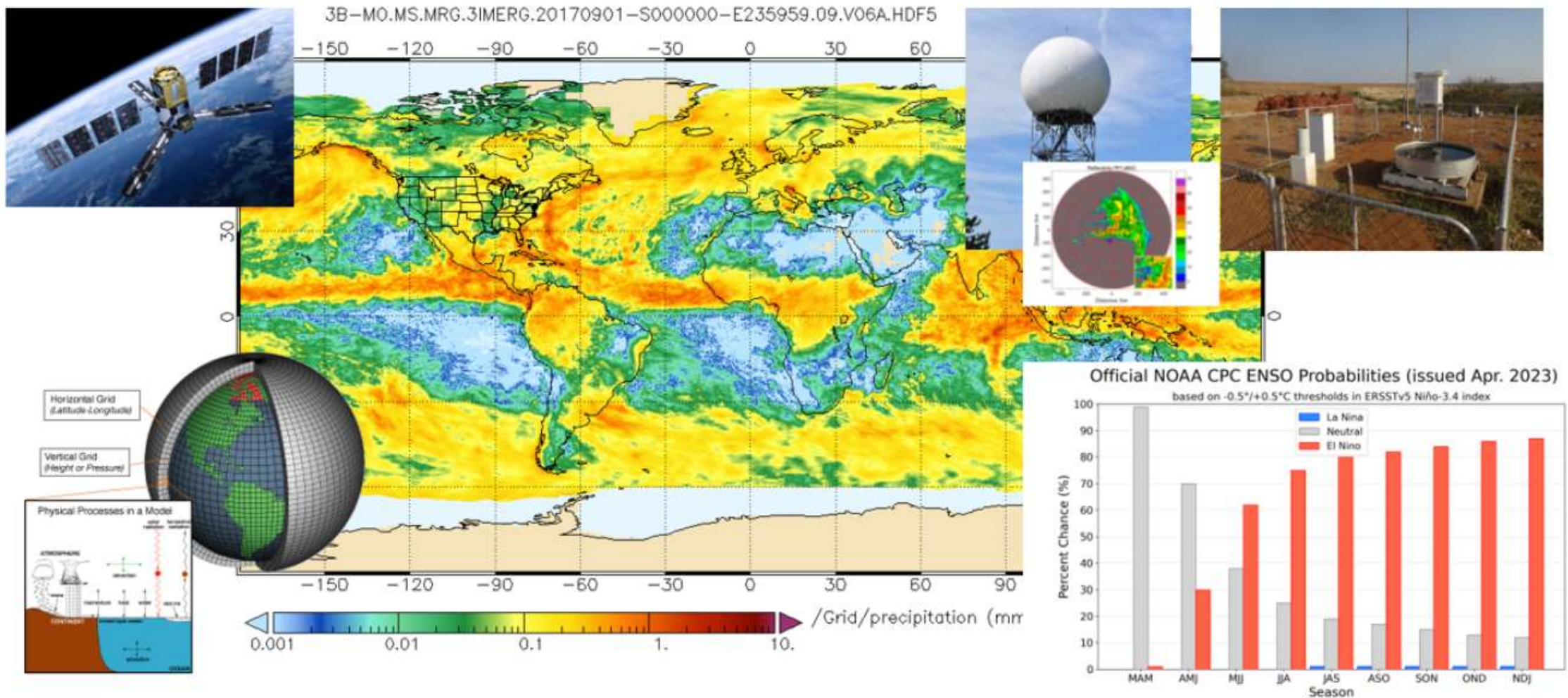
Recap - How are climate services produced?

Co-creation of knowledges

Producing decision-oriented information

Working across science-society boundaries

DATA PROVIDERS
- Copernicus (CDS)
- EO Data GEOSS Data Hubs
- Socio-Economic Datasets
- In-Situ & Citizen Data

DATA INTEGRATORS & DEVELOPERS
- Modellers, Researchers

SERVICE PROVIDERS
- Sectoral Information Provider

SERVICE PURVEYORS
- Private Services Businesses
- Public Services Purveyors

USERS
- Government Agencies
- Private Sector
- Citizens
- User Communities, NGO's

Increasing value-add

Local Knowledge and Needs integration

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Significant advances in climate prediction science – from sub-seasonal to climate scale

DOES BETTER DATA AND INFORMATION LEAD TO GREATER USE OF CLIMATE SERVICES IN DECISION MAKING?

Intended for use

More physical science expertise
Focused on products
Relevant to demand
Valuated

Focus on better data

Climate science

Climate services

Designed for use

More social science expertise
Focused on process
Driven by demand
Evaluated

Focus on better decisions
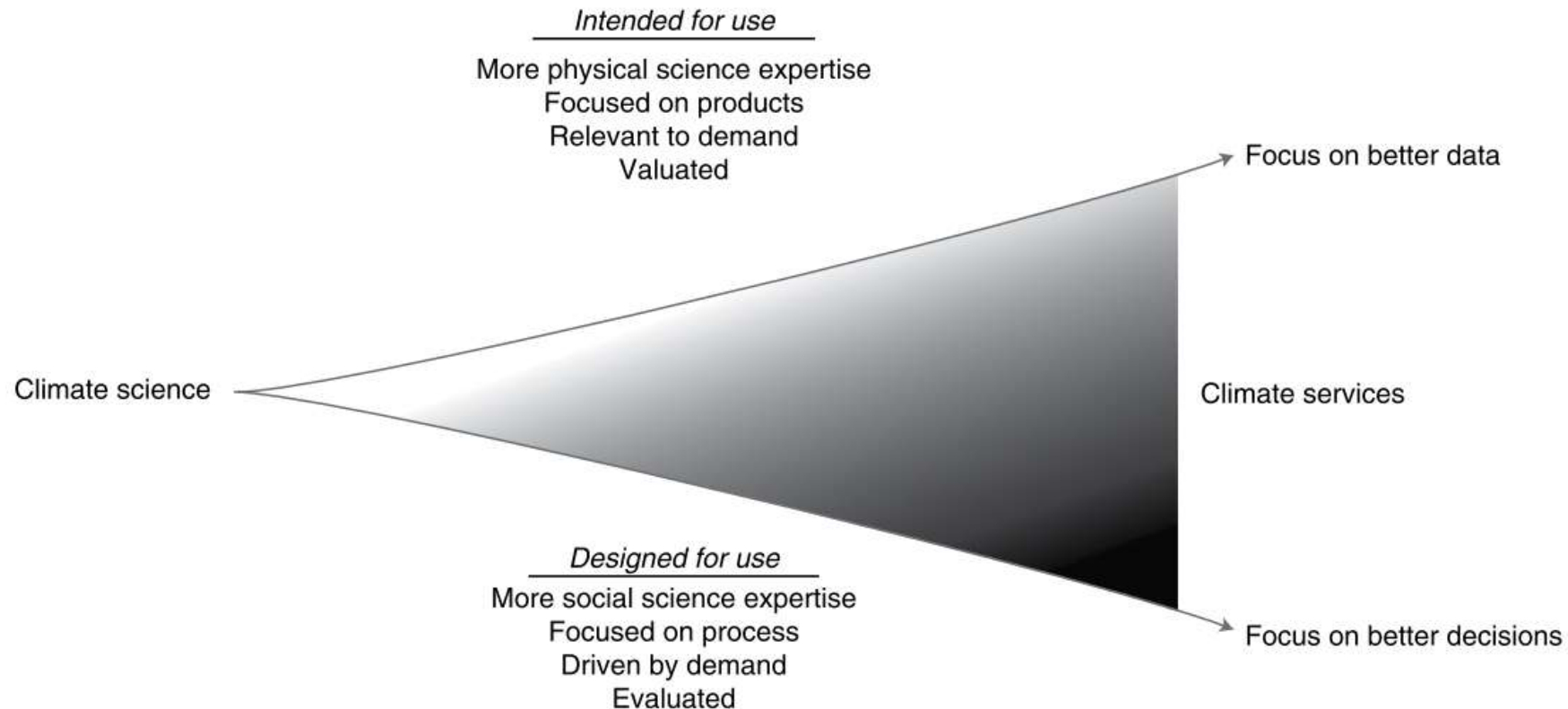
CS products suffer from Usability Gaps

Source: Findlater et al. (2021)

Improving uptake of CS requires…

Understanding of multi-temporal and multi-scalar dimensions of climate impacts & feedback loops

Better understanding of decision-making processes of users.

Incorporation of social, cultural and behavioural factors & local knowledge and customs of users

Transdisciplinary approaches across the full climate services value chain

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Recognising that multiple knowledges are consulted when taking a decision

"Climate services require more than just climate science"
(Goddard, 2017)

- Scientific knowledge by itself is not enough: Users rely on their own local knowledge for risk appraisal and implementing coping strategies and may inform their decisions with other (scientific) knowledges.

- Barriers that impede the uptake of climate services that include primarily on scientific data, including lack of understanding of:
  - the needs of end users
  - their decision-making processes, and
  - poor recognition of the knowledge of the users

- Integrating local knowledge, including traditional and indigenous knowledges, through a co-creation process can help build services and smart tools that are *credible*, *salient* and *legitimate*.
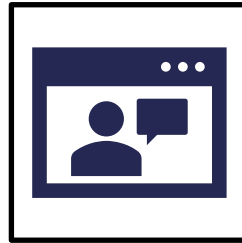

A seasoned professional! Irrigation canal headworks operator for 42 years, Alazani Basin, Georgia

What makes climate information useful?
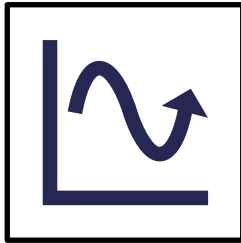
Credibility

Scientific integrity and adequacy of data or technical advice.

Salience

Relevance of the information to the needs of the decision makers.

Legitimacy

Perception that the information has been produced justly and accounts for diverse perspectives.
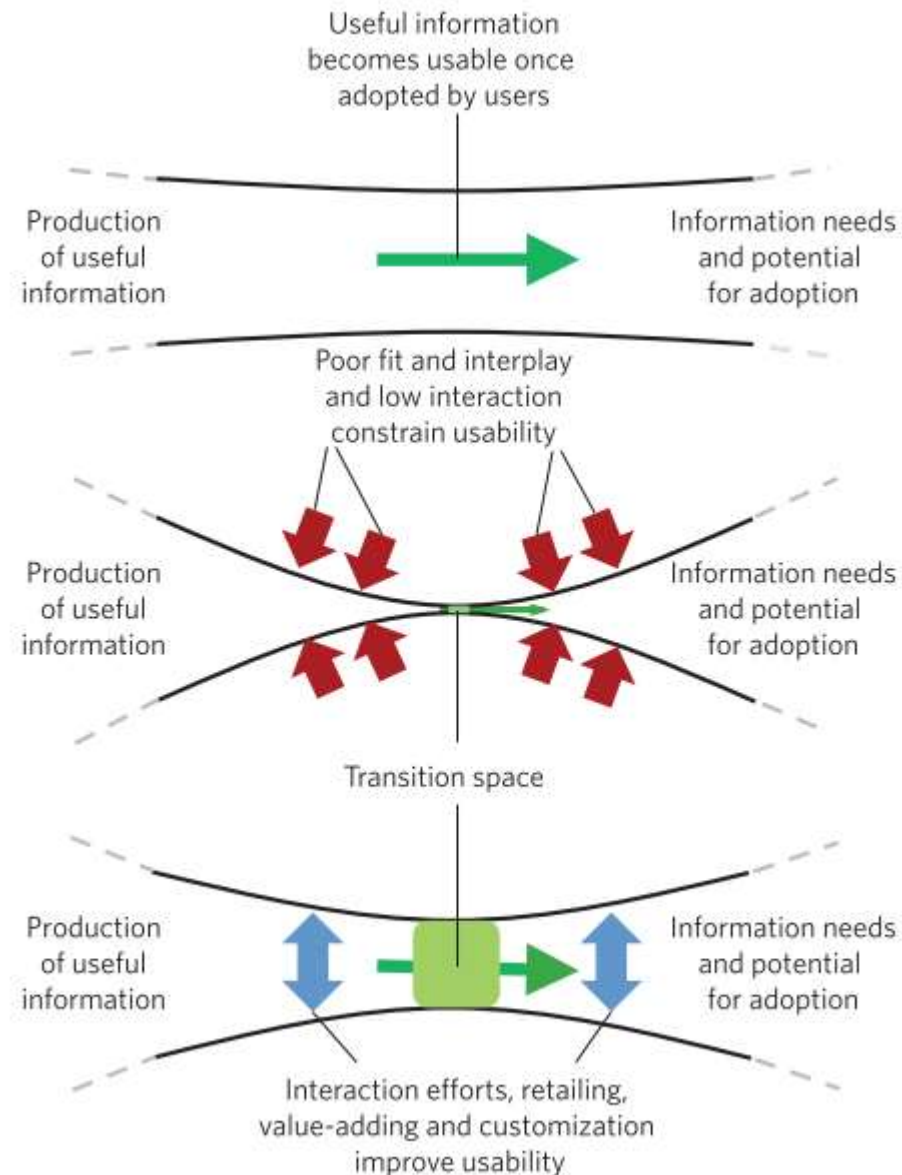
Cash et al. (2003)

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What makes climate information useful?

Fit
When users perceive the information as useful to their decision-making needs.

Interplay
The extent to which climate information aligns with existing rules, current information use or organisational culture.
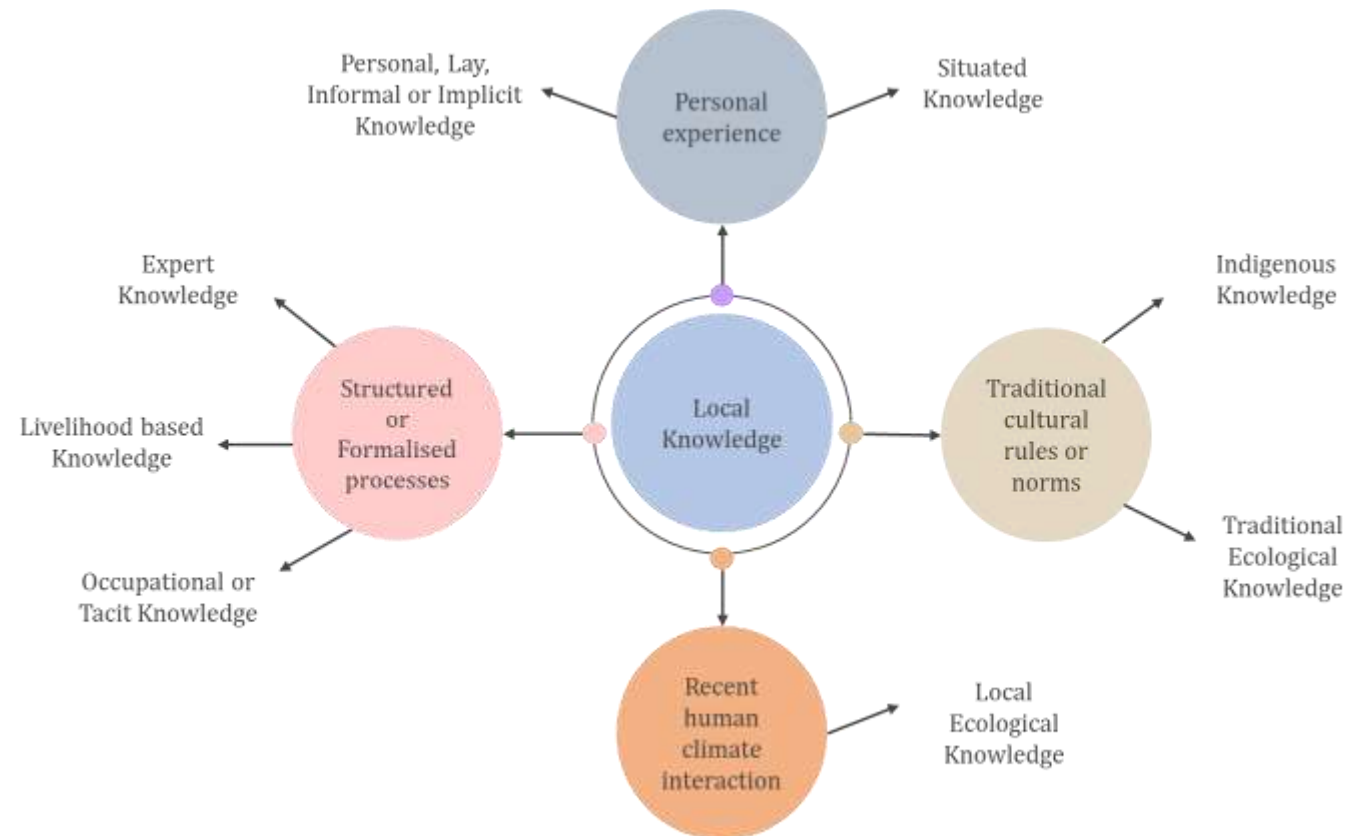
Interaction
Establishment of long-term trust building relationships underpinning how users obtain, receive and participate in the production of climate information.

Useful information becomes usable once adopted by users

Production of useful information → Information needs and potential for adoption

Poor fit and interplay and low interaction constrain usability

Production of useful information — Information needs and potential for adoption

Transition space

Production of useful information → Information needs and potential for adoption

Interaction efforts, retailing, value-adding and customization improve usability

Lemos et al. (2012)

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Role of local knowledge in making climate information useful and usable

- The FAO defines local knowledge as "a collection of facts and relates to the entire system of concepts, beliefs and perceptions that people hold about the world around them."

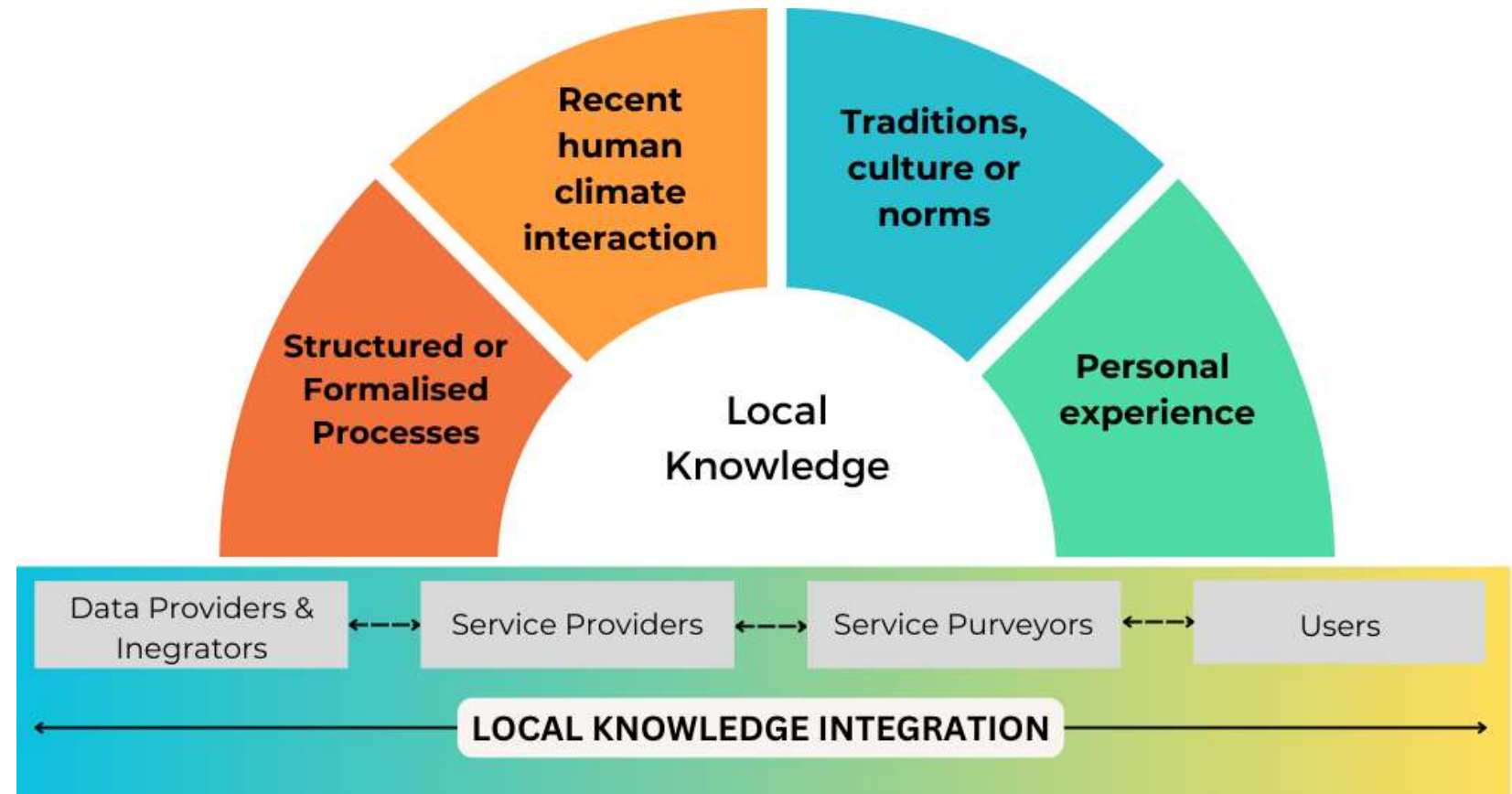- Other disciplines have also defined local knowledge in similar terms…

Within I-CISK, we reframe local knowledge. We propose local knowledge as an **all-encompassing** term that includes a range of different knowledges signifying how individuals how perceive their surroundings, validate new information and solve problems.

Personal, Lay, Informal or Implicit Knowledge

Personal experience

Situated Knowledge

Expert Knowledge

Indigenous Knowledge

Livelihood based Knowledge

Structured or Formalised processes

Local Knowledge

Traditional cultural rules or norms

Traditional Ecological Knowledge

Occupational or Tacit Knowledge

Recent human climate interaction
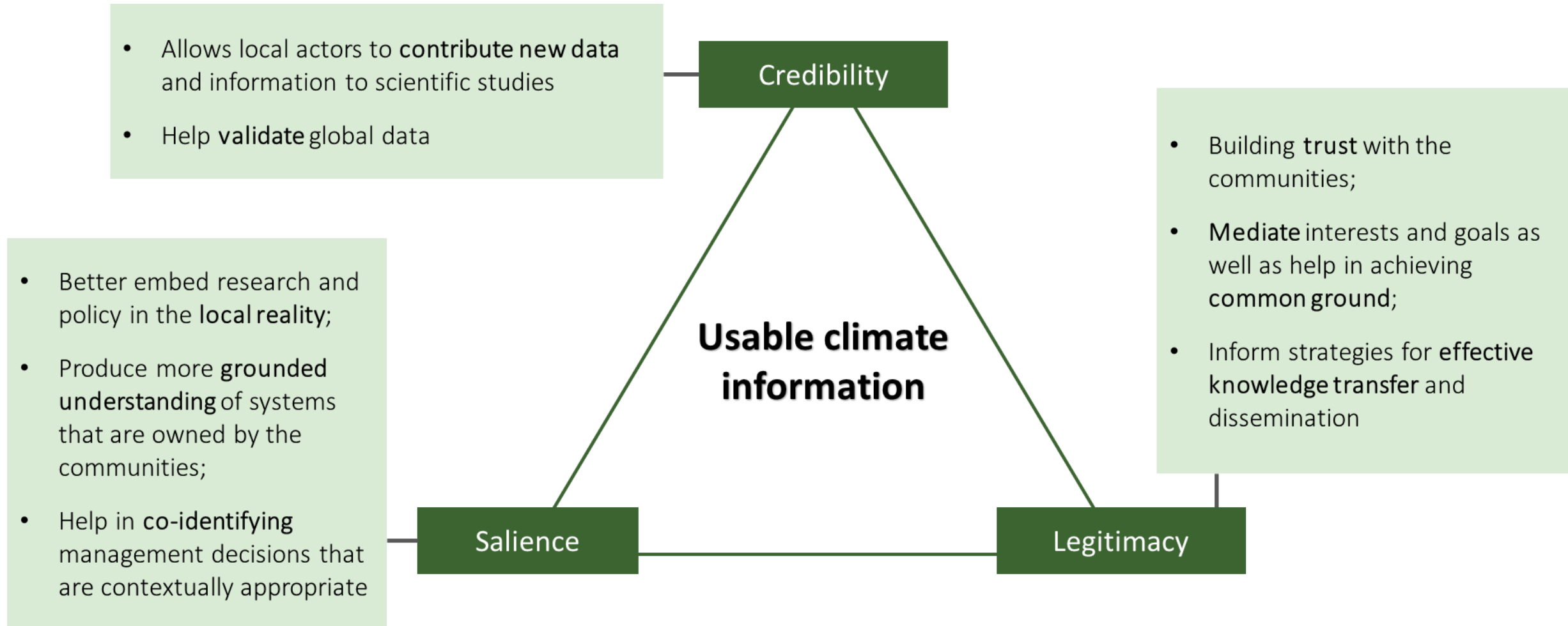
Local Ecological Knowledge

Reframing local knowledge for climate services

Local knowledge holders can range from indigenous, rural or urban communities to professionals working at various levels of governance and boundary organizations.
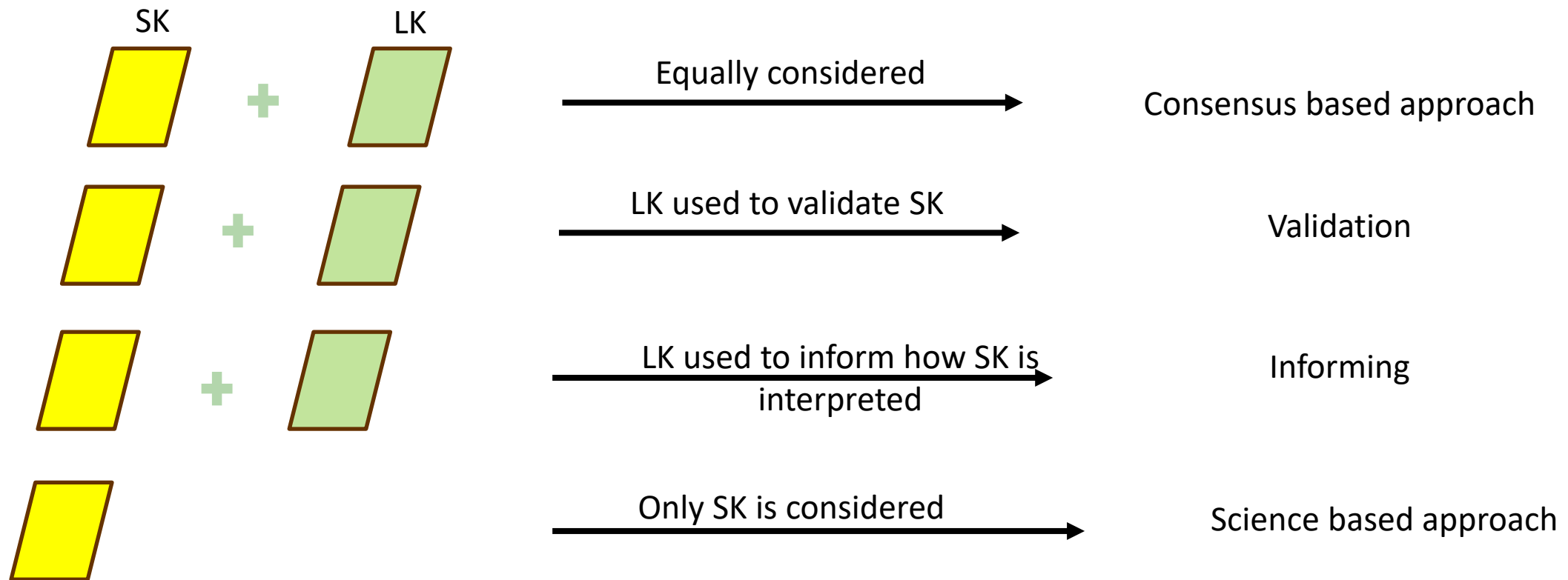
Value of Local Knowledge for Climate Services

- Allows local actors to **contribute new data** and information to scientific studies

- Help **validate** global data

Credibility

- Building **trust** with the communities;

- **Mediate** interests and goals as well as help in achieving **common ground**;

- Inform strategies for **effective knowledge transfer** and dissemination

- Better embed research and policy in the **local reality**;

- Produce more **grounded understanding** of systems that are owned by the communities;

- Help in **co-identifying** management decisions that are contextually appropriate

Usable climate information

Salience

Legitimacy

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Local knowledge integration

SK		LK	Equally considered →		Consensus based approach
	+		LK used to validate SK →		Validation
	+		LK used to inform how SK is interpreted →		Informing
			Only SK is considered →		Science based approach

Source: Plotz et al. (2021)

It is not enough to just consider local knowledge, but also understand it in the context of its use

Examples

- Prediction indicators associated with rainfall cessation directly inform farmer decisions regarding planting and pre- and post-harvest operations in East Africa (Radeny et al. 2019).

- Smallholder farmers in Southern Africa rely on LK-based indicators to predict a poor growing season, thereby triggering protective decisions such as food gathering and selling of assets (Mapfumo et al. 2016).

- Cereal farmers in Ethiopia choose between growing an early or late-maturing (traditional) variety of crops based on the timing of rainfall (Kassie et al. 2013).

- Herding communities in northern Pakistan not only to forecast grazing conditions and plan their short-term strategies like seasonal migration, location of campsites and collection of winter feed, but also longer-term coping strategies like forming committees for livestock and feed management, using glacier melt for irrigation and diversifying income sources (Joshi et al. 2013)

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Importance of participatory methods in exploring and understanding local knowledge

Participatory Methods have been defined as "a purposeful learning process for action that engages the implicit and explicit knowledge of stakeholders to create formalised and shared representations of reality" (Voinov et al., 2018).

Source: icisk.eu

- Participatory methods engage community members as active contributors rather than passive subjects, drawing on their daily experiences, practices and cultural context.

- Help in building trust and long-term collaboration with communities.

- Promotes co-learning and ownership of the research process.

Importance of participatory methods in exploring and understanding local knowledge

Surveys	Interviews	Serious Games
Focus Group Discussion	Transect Walk	Rich Pictures
Cognitive Mapping	Problem Tree	Social Network Analysis
Decision Timelines / Seasonal Calendars	Agent Based Modelling	Participatory GIS

- There are a host of participatory methods (few are listed alongside)…

Depending on the level of engagement with the end users, methods can range from being unilateral to joint action oriented.

Source: Basco-Carrera et al. (2017)
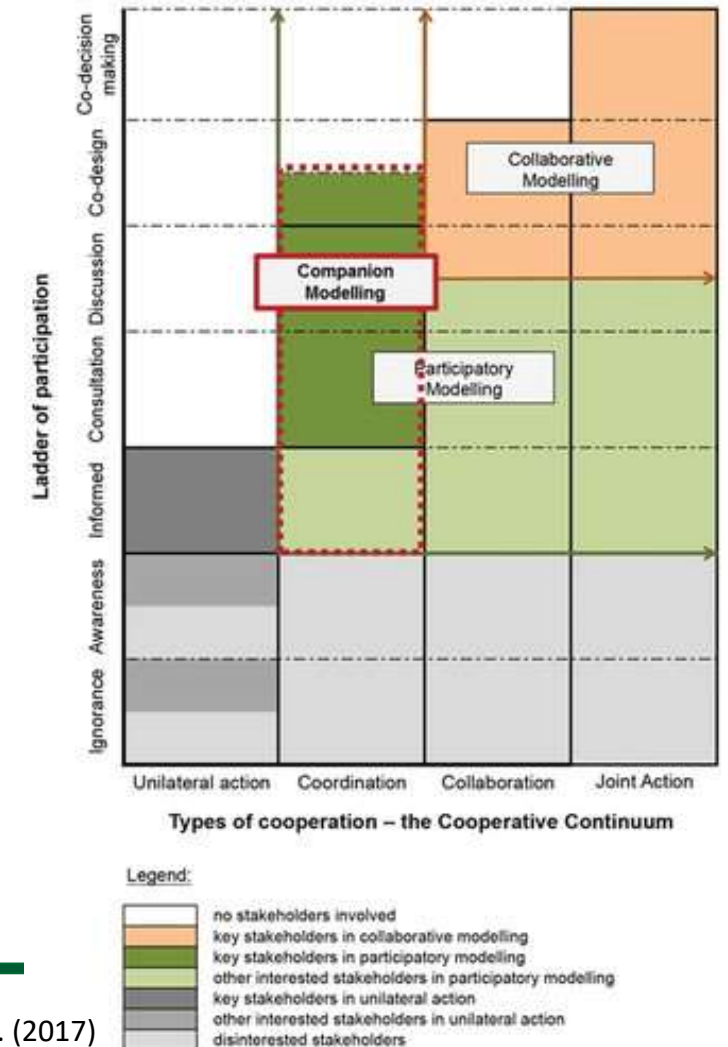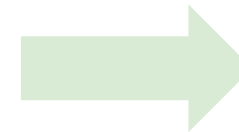
Decision Timelines

- Decision timelines (or seasonal calendars) are a commonly used methodology to conduct rural appraisals with an aim to encourage participation of local communities (Chambers, 1994).

- Decision timelines serve as a boundary tool linking knowledge systems (Ray and Webb, 2016).

- These tools have been used across disciplines like development, forestry, agriculture etc. to understand patterns and long-term changes in the local environment.

Source: Ray & Webb (2016)

Depending on the purpose, Decision Timelines can be set up to answer different questions. However, the central idea remains that decision timelines provide "a framework for organising information about a user context and related climate knowledge" (Ray and Webb, 2016).

Understanding Local Knowledge use within Decision-making: using decision timelines framework
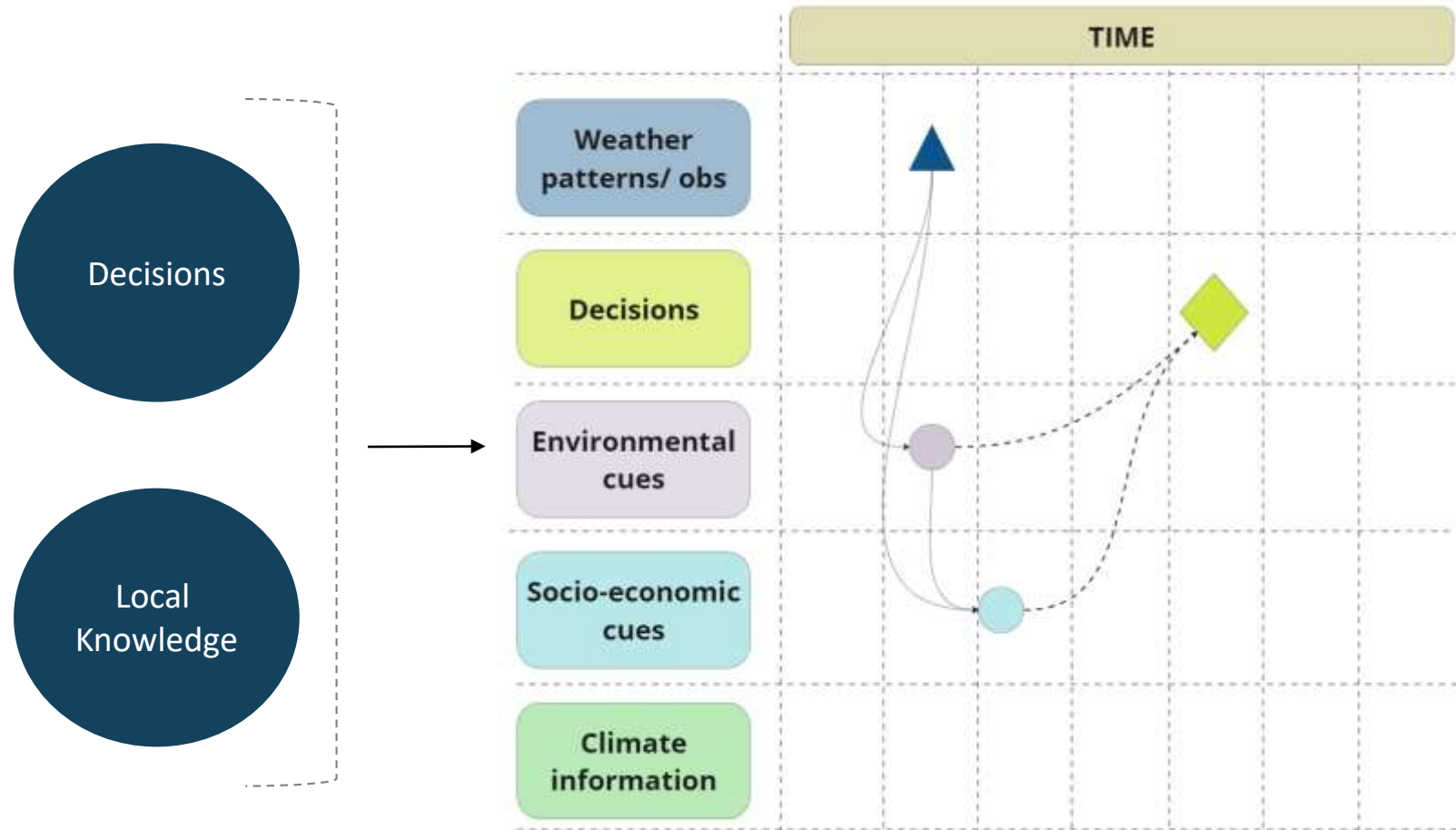
- Understanding of the local environment.

- Cues are long-term observations or evidence that individuals or organizations rely on to trigger decision making.

- In some cases, cues can be linked to "thresholds".

- Individuals triangulate between different sources of information.

Source: Van den Homberg et al 2024

Understanding Local Knowledge use within Decision-making: using timelines framework

Decisions

Local Knowledge

Climate Services
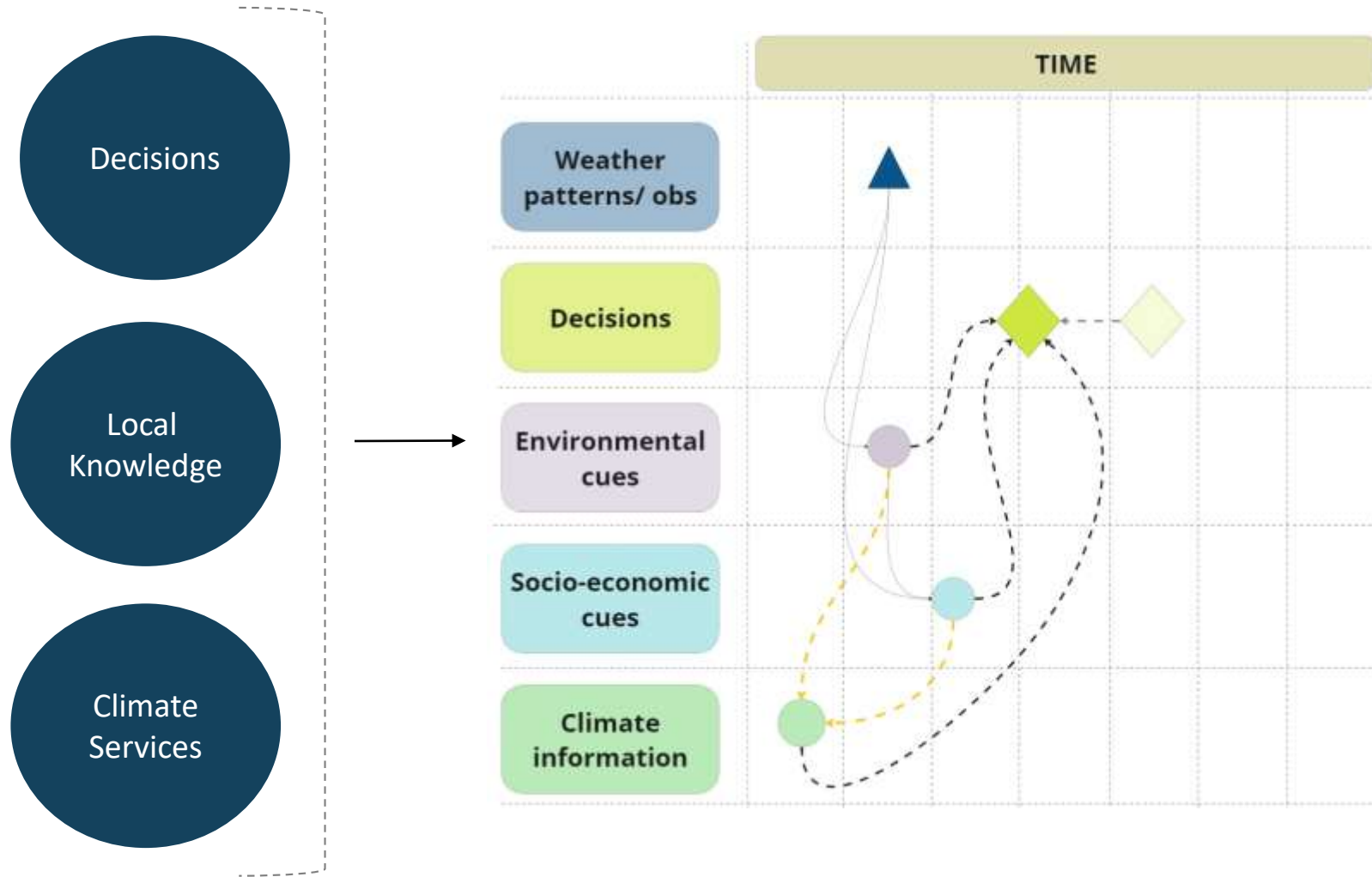
- With decision-oriented CS individuals can make decisions preemptively. Potentially have more options to mitigate risk.

- But also, CS can incorporate these cues to provide information that is more salient to the needs of the user and is perceived as more trustworthy.

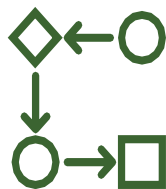- Thus, *improving last mile access*.

Source: Van den Homberg et al 2024

Decision Timelines

Decision Timelines

ACTORS
Who is the timeline developed for?

PROCESS
What livelihood or organizational processes do you want represent?

TIMELINE
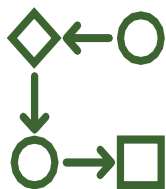What timescale makes sense for the decision process?

	JAN	APR	JUN	AUG	OCT	DEC
OPERATIONAL STEPS						
KNOWLEDGE AND INFORMATION USED — ENVIRONMENTAL CUES						
KNOWLEDGE AND INFORMATION USED — SOCIO ECONOMIC CUES						
KNOWLEDGE AND INFORMATION USED — CS USED						
WEATHER PATTERNS						
CLIMATE RISKS/ EXTREME EVENTS						
COPING OR ADAPTATION PROTOCOLS AND STRATEGIES						

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Using Decision Timelines – Alazani-Iori Living Lab, Georgia

Timeline shows the farming cycle of a winemaker for 12 months.

- Uses decisions as a starting point to discuss needs.
- Provides an understanding of climate information needs, including the spatial and temporal dimensions.
- Provides an overview of currently used sources of information.
- Also helps articulate coping/adaptation decision climate service is meant to support.

Source: Van den Homberg et al 2024
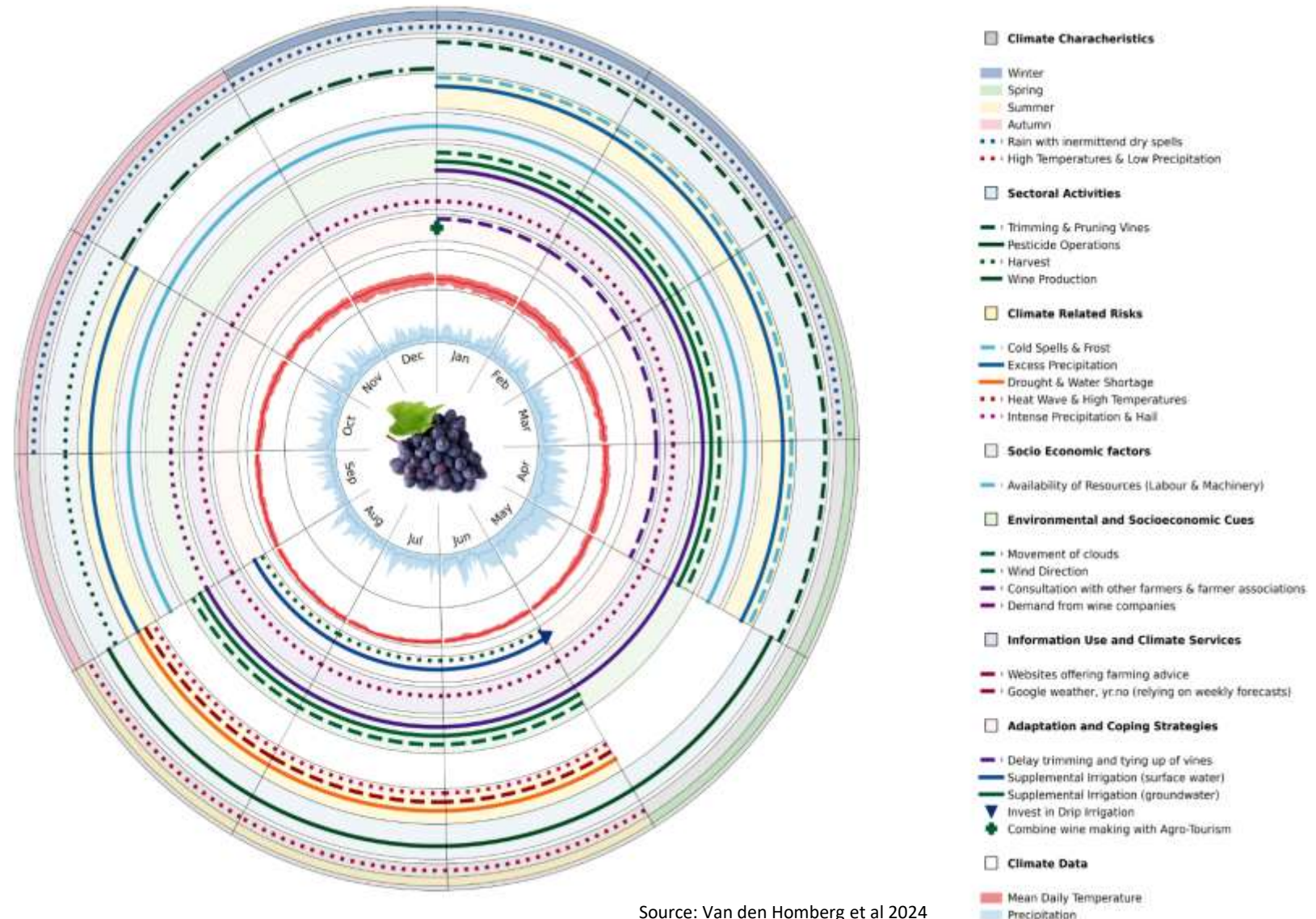
Decision Timelines: tool for CS co-creation

Tool for ideation of CS	Easily understood by CS community and end users alike	Support user-centered evaluation of climate information	Puts decisions at the center of CS development
Co-exploration and Co-design		Co-evaluation	Co-delivery

Conclusion

Climate services must go beyond climate science.
Scientific data alone is insufficient—effective services must integrate **local knowledge** to be credible, salient, legitimate and usable.

Focusing on fit, interaction, and interplay enhances usability.
Climate information becomes more effective when it aligns with users' contexts, fosters long-term engagement, and integrates seamlessly with existing practices.

Local knowledge is diverse and contextual.
It encompasses the observations, practices, and decision-making processes of communities—rural, urban, and professional—at various governance levels.

Integration through co-creation is critical.
Participatory approaches foster mutual learning, build trust, and ensure that climate services are responsive to users' needs and realities.

Decision timelines serve as powerful boundary tools.
They organize information around real user decisions and help identify when and how climate knowledge is most impactful.

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