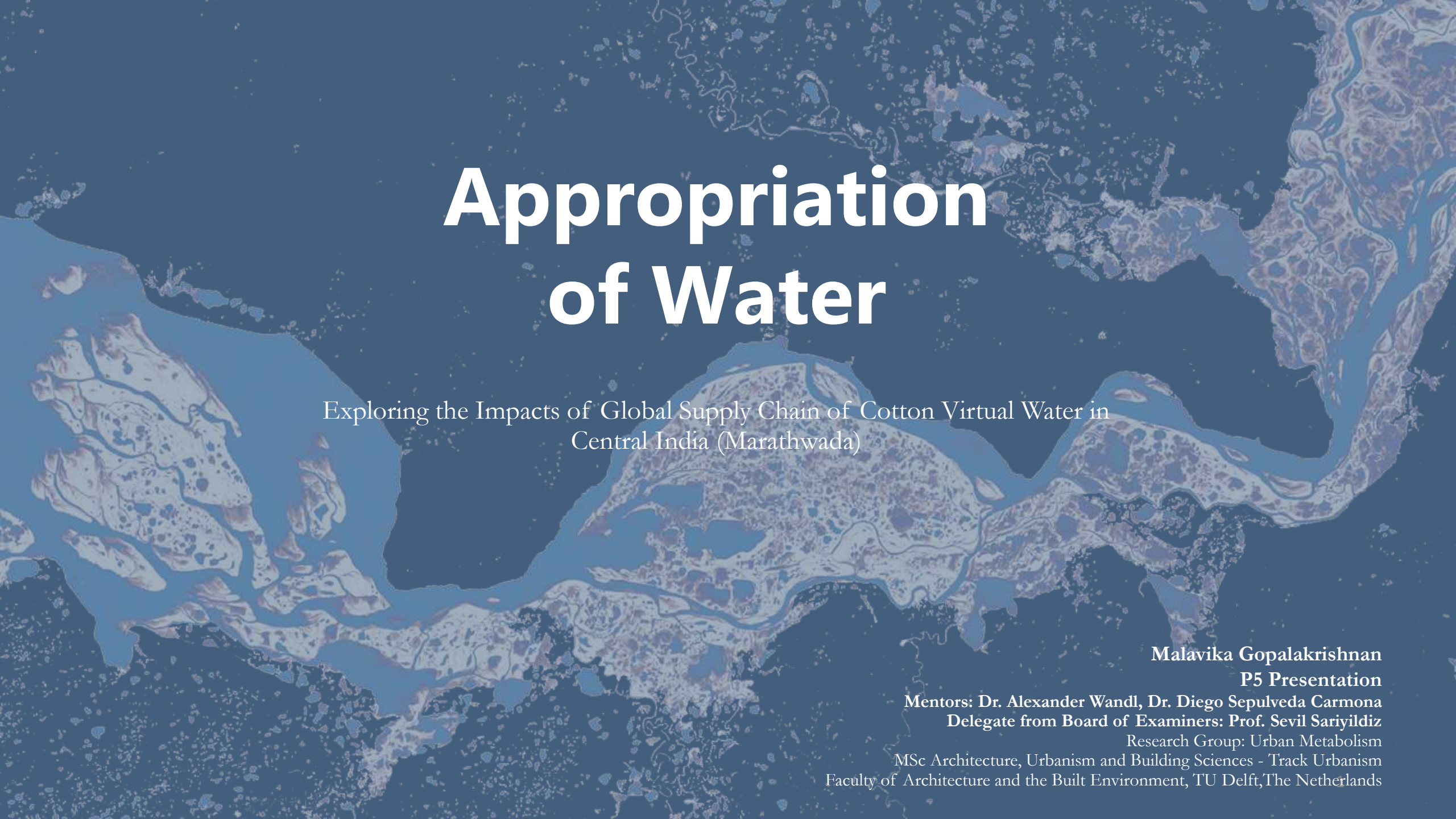


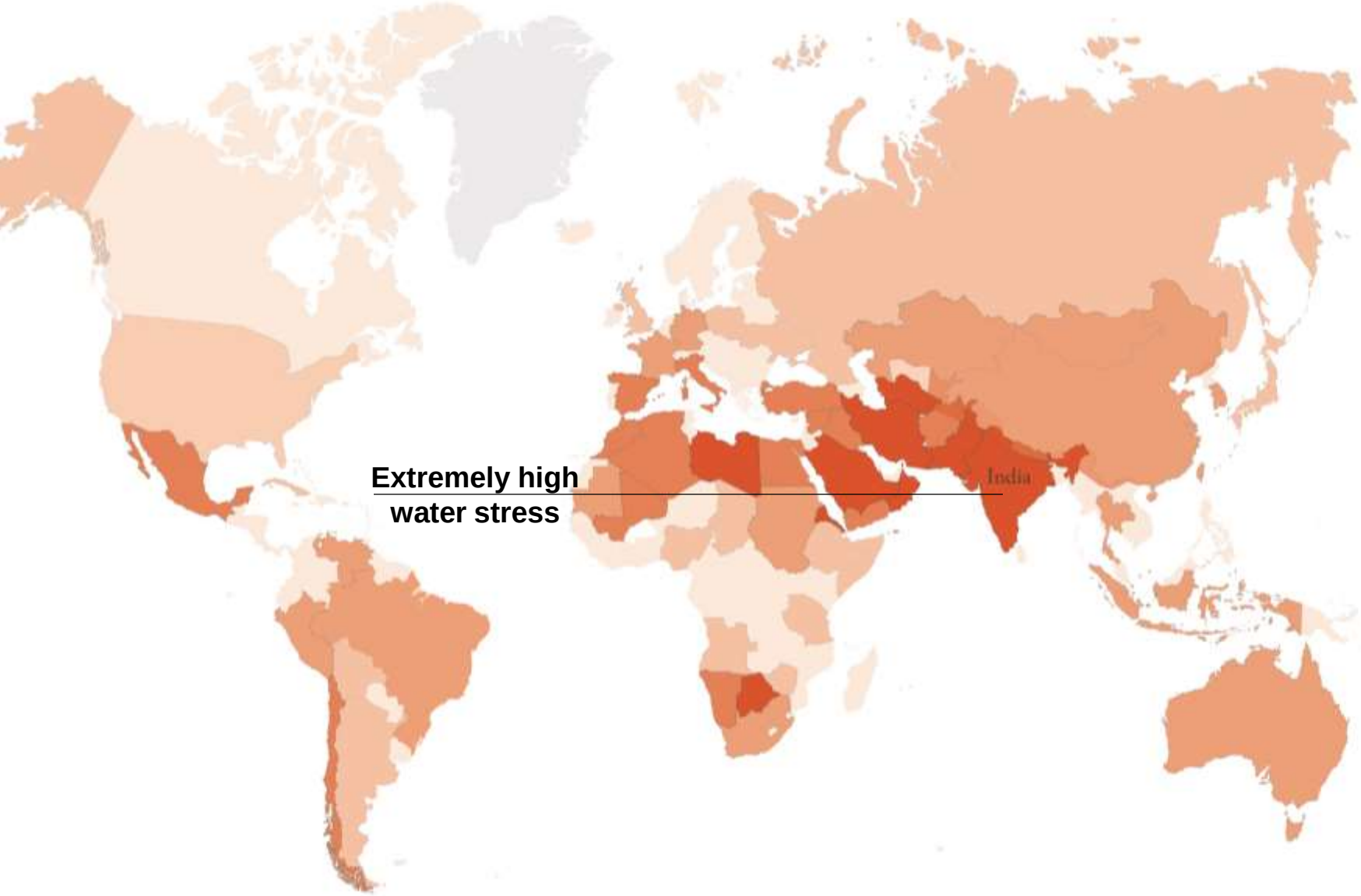
Appropriation of Water

Exploring the Impacts of Global Supply Chain of Cotton Virtual Water in Central India (Marathwada)

Malavika Gopalakrishnan
P5 Presentation
Mentors: Dr. Alexander Wandl, Dr. Diego Sepulveda Carmona
Delegate from Board of Examiners: Prof. Sevil Sariyildiz
Research Group: Urban Metabolism
MSc Architecture, Urbanism and Building Sciences - Track Urbanism
Faculty of Architecture and the Built Environment, TU Delft,The Netherlands

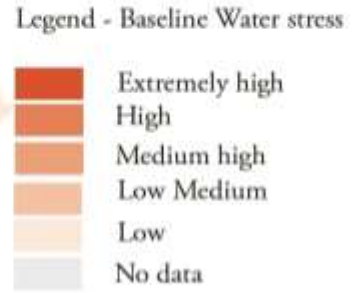
Access to clean affordable water

The right to ‘clean water and sanitation’ is a basic human right
(United Nations sustainable developmental goals)



"An estimate of **5 out of 8** people will be living in conditions of water stress or scarcity by **2025**"

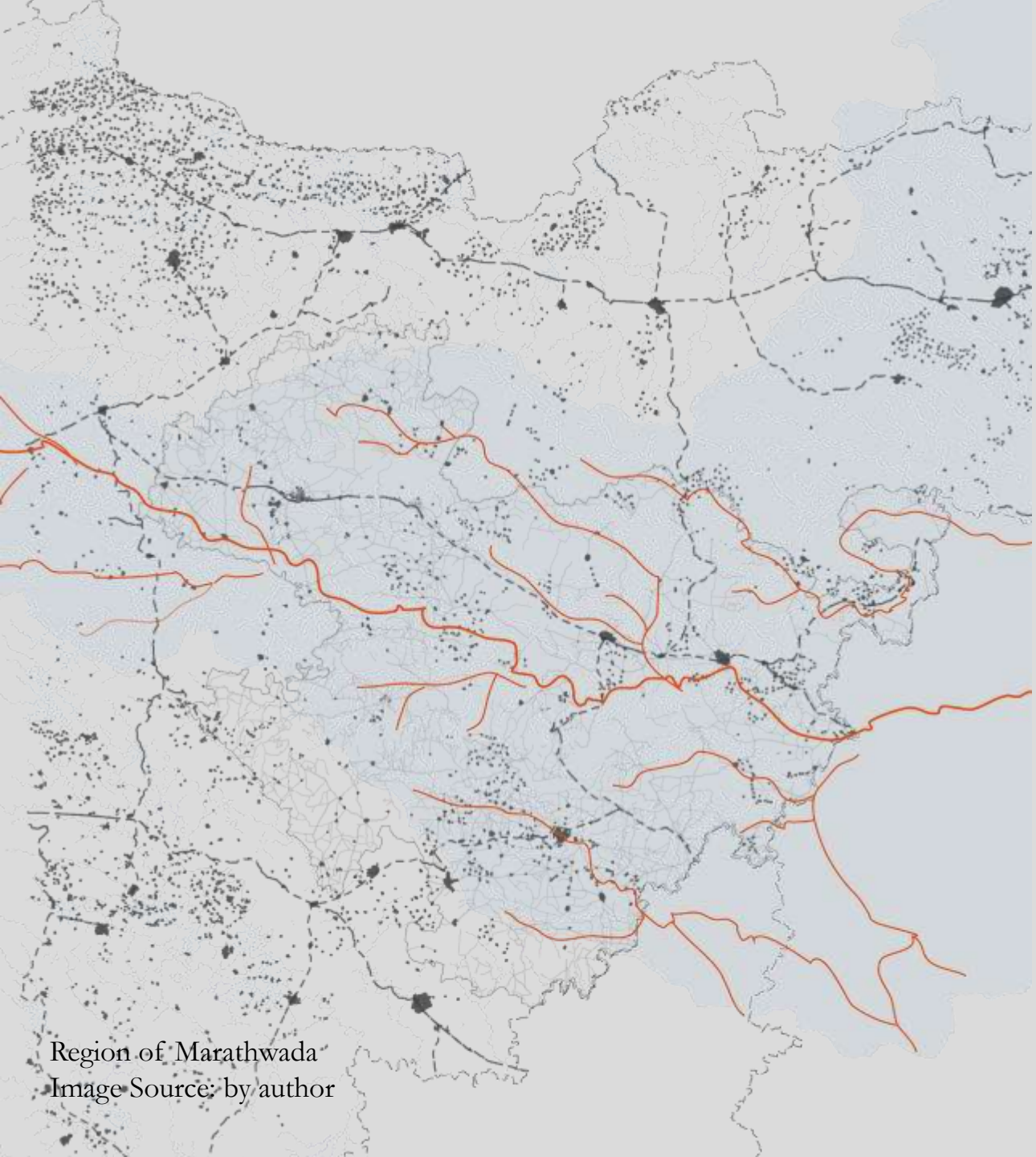
(Arnell, 1999)



Source : World Resource institute aqueduct water risk atlas 2019

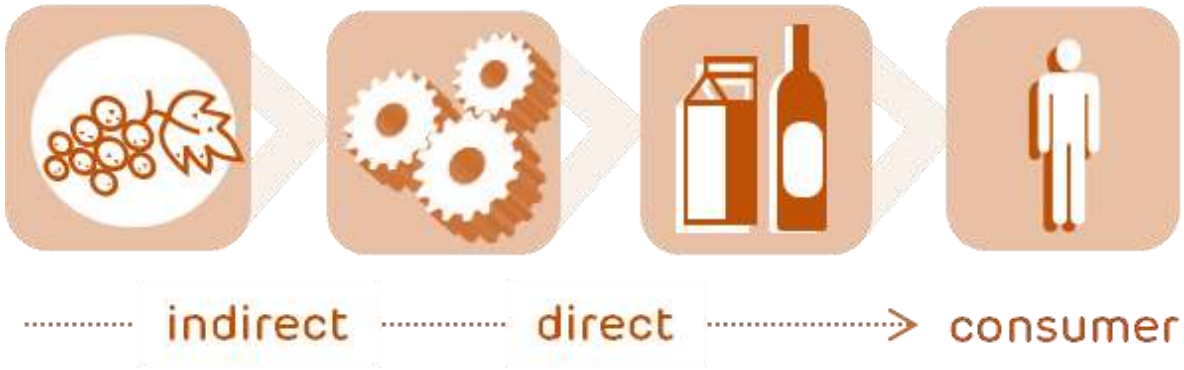
"Almost 70% of the available fresh water is currently used for agricultural purposes"

(Darrel Jenerette & Larsen, 2006)



Region of Marathwada
Image Source: by author

PROBLEM FIELD



“The **water footprint** is a measure of humanity’s appropriation of fresh water in volumes of water consumed and/or polluted”.

(water footprint network)

“India exports **95.4 billion** cubic metres a year of virtual water through the production of goods”

(Water footprint network)

Politics & Policy

How India's Water Ends Up Everywhere But India

The country is the world's biggest exporter through its crops, shortages in urban areas.

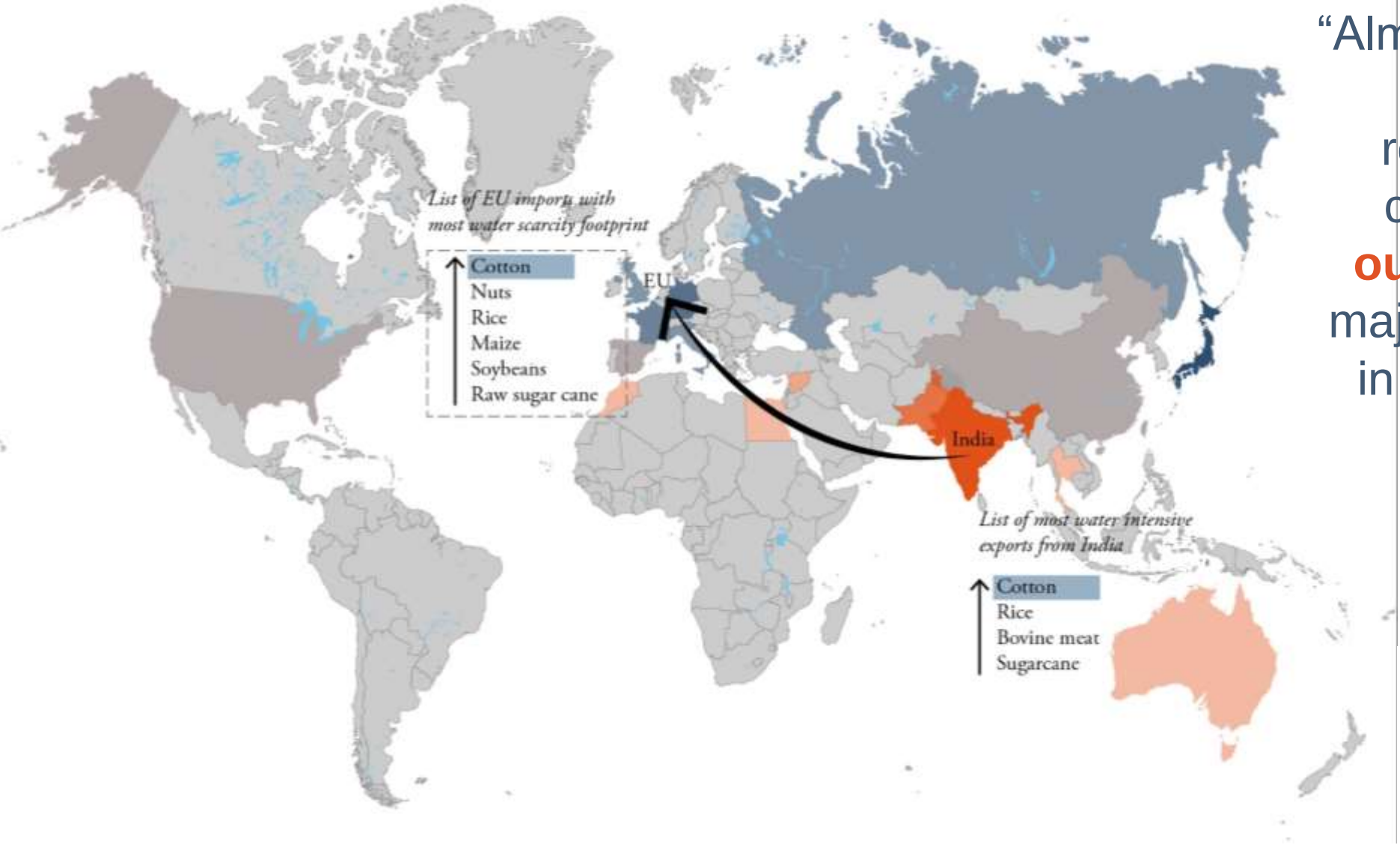
By David Fickling
July 6, 2019, 2:00 AM GMT+2

The last drop. *Photographer: ARUN SANKAR/AFP*

"The trade of scarce water through **water intensive products** lead to water stress in exporting regions"

(Lenzen et al., 2013)

Indian farmers during a protest in Mumbai in March.
Thousands of them walked more than 100 miles to protest the country’s agrarian crisis.
(Image: Getty Images)



Source : Feng et.al, 2015, Lenzen et.al, 2013, Dolgonova et.al, 2019, https://economictimes.indiatimes.com

"Almost **84% of the water footprint** of the EU25 region related to cotton consumption is located **outside of Europe**, with major impacts particularly in India and Uzbekistan"

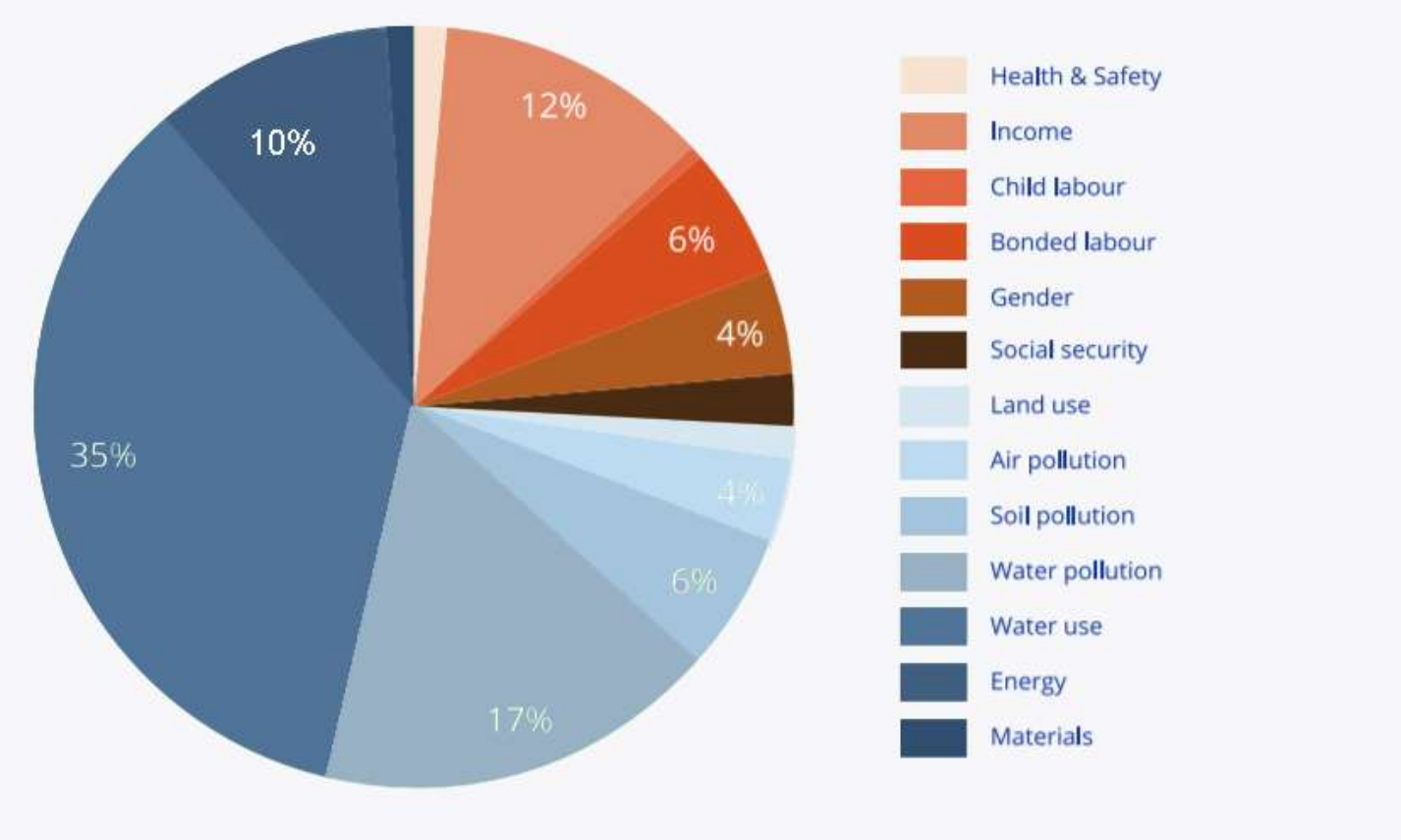
(Chapagain et, al. 2006).

Cotton is a "thirsty" crop!

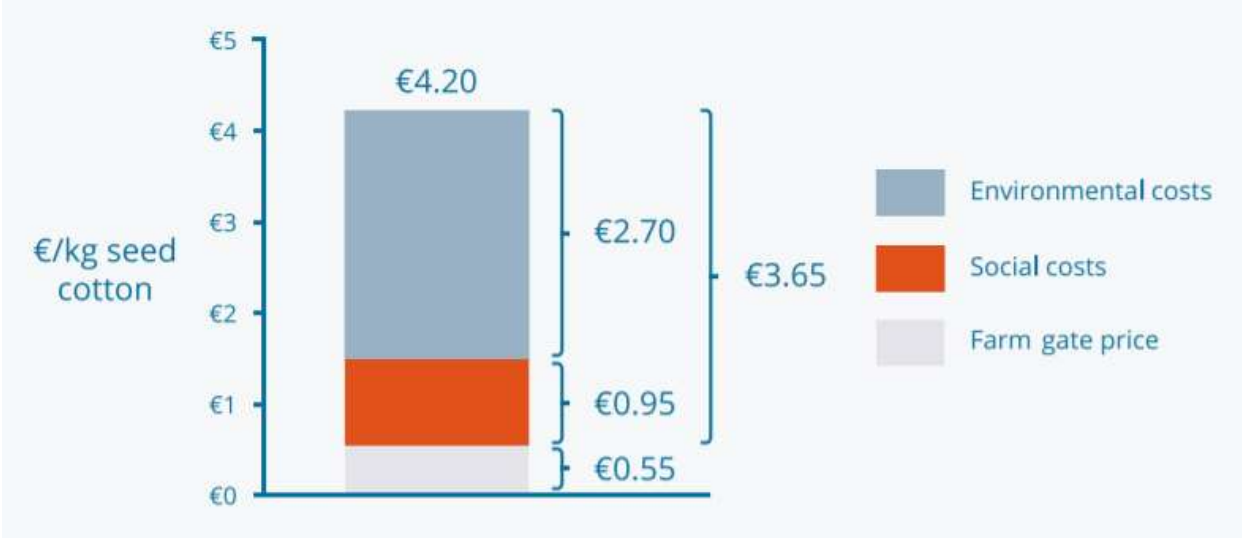
1 kg of cotton = 10,000 Litres of water → 1 T shirt 2500 = Litres of water → 1 pair of jeans = 8000 Litres of water


Cotton produced in India (2017-18) was 6.25 billion kg equivalent to 62500 billion Liters of Water!!

“The current EU price for a cotton T- shirt does not include the social and environmental costs, of which 70% is related to water costs!”

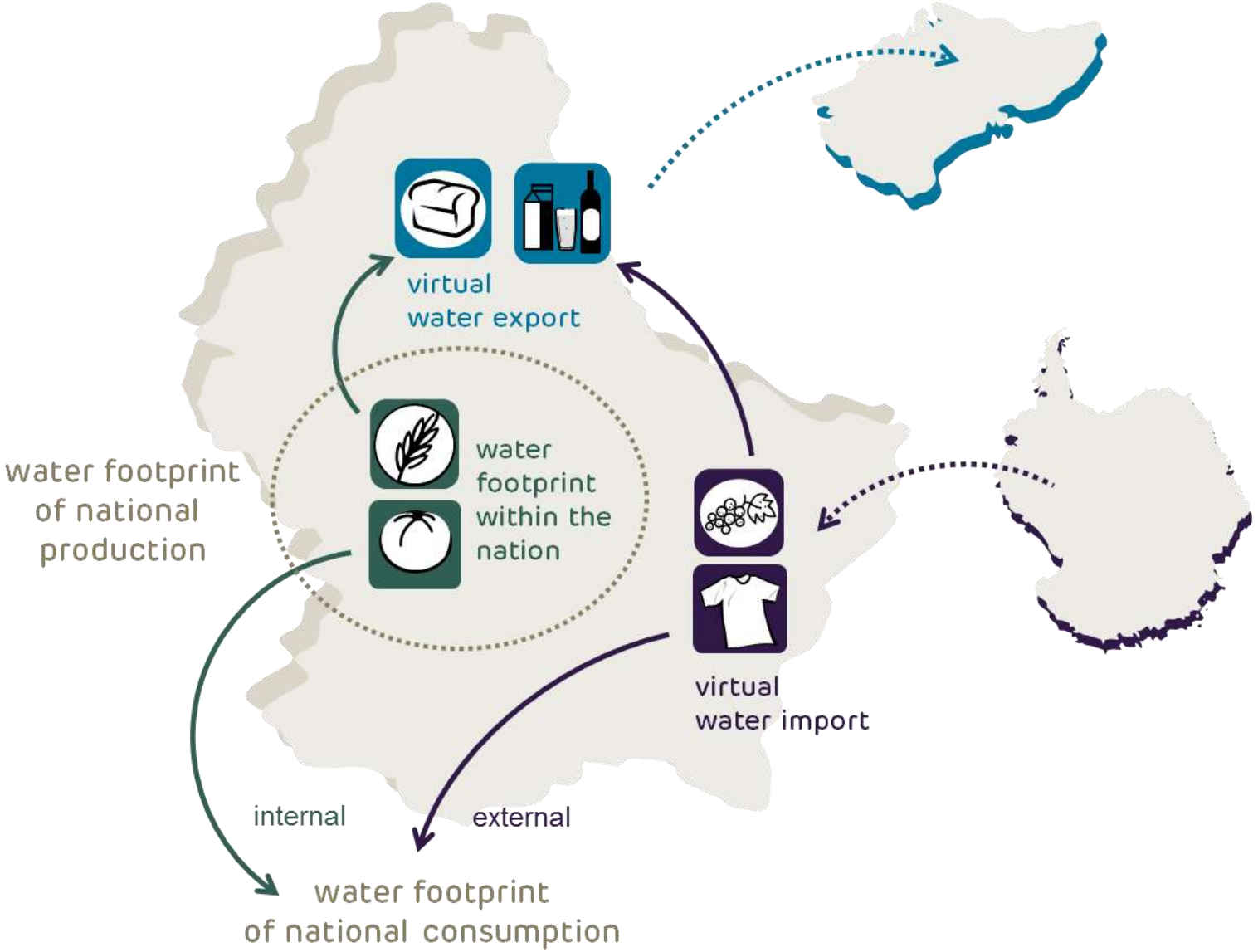


Source: https://trueprice.org/the-true-price-of-cotton-from-india/



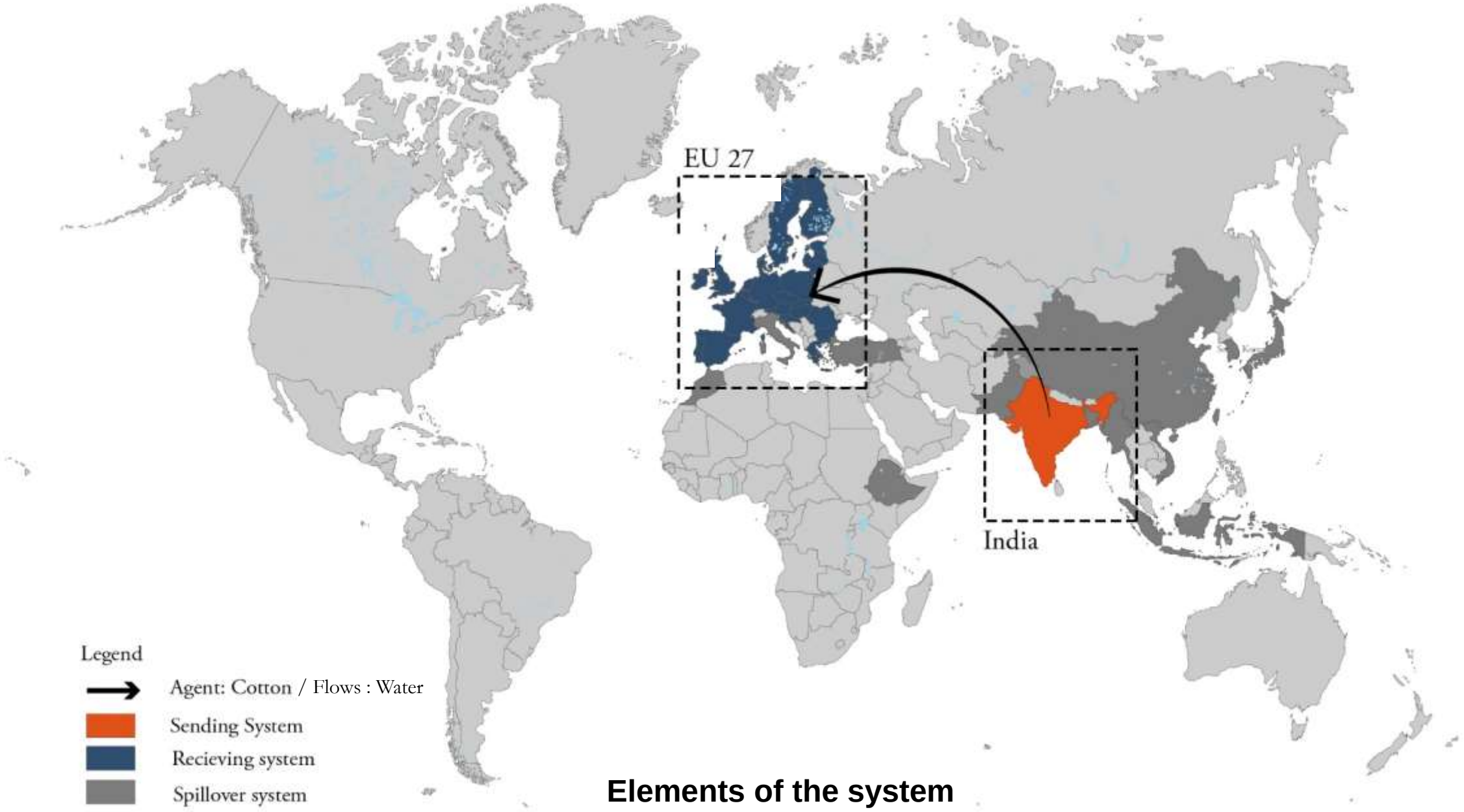
"We don't pay for it!!!"

“The story of water is global, but the impact of too little (or too much) water is intimately local.”
(NY Times)



"The concept of **water footprint** is rooted in the recognition that human impacts on freshwater systems can be linked to human consumption, and can be understood by considering production and **supply chains as a whole**"

(A.Y Hoekstra, 2013)



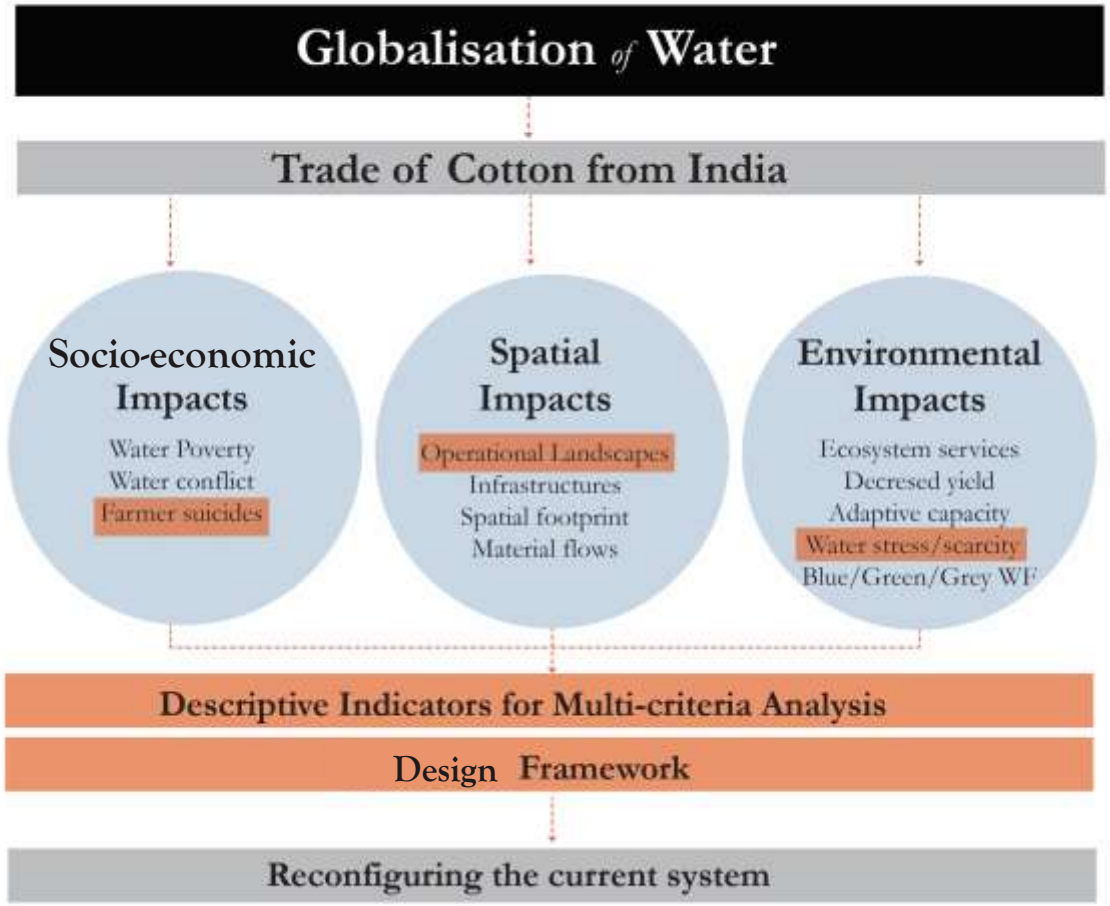
Elements of the system

A Telecoupling framework for analysis

(Liu, J. et, al. 2013)

Problem Statement & Research Aim

- **Problem Focus:** The **globalisation of water and virtual water trade** within and outside India as a contributor to water stress and scarcity in the region of Marathwada.
- **Problem Statement:** The socio-economic, spatial, environmental **impacts of virtual water trade** related to the supply chain of products such as Cotton.
- **Research aim:** Possible solutions to reorganise the current system by providing pathways to achieve a more **sustainable water footprint** for cotton production in India.

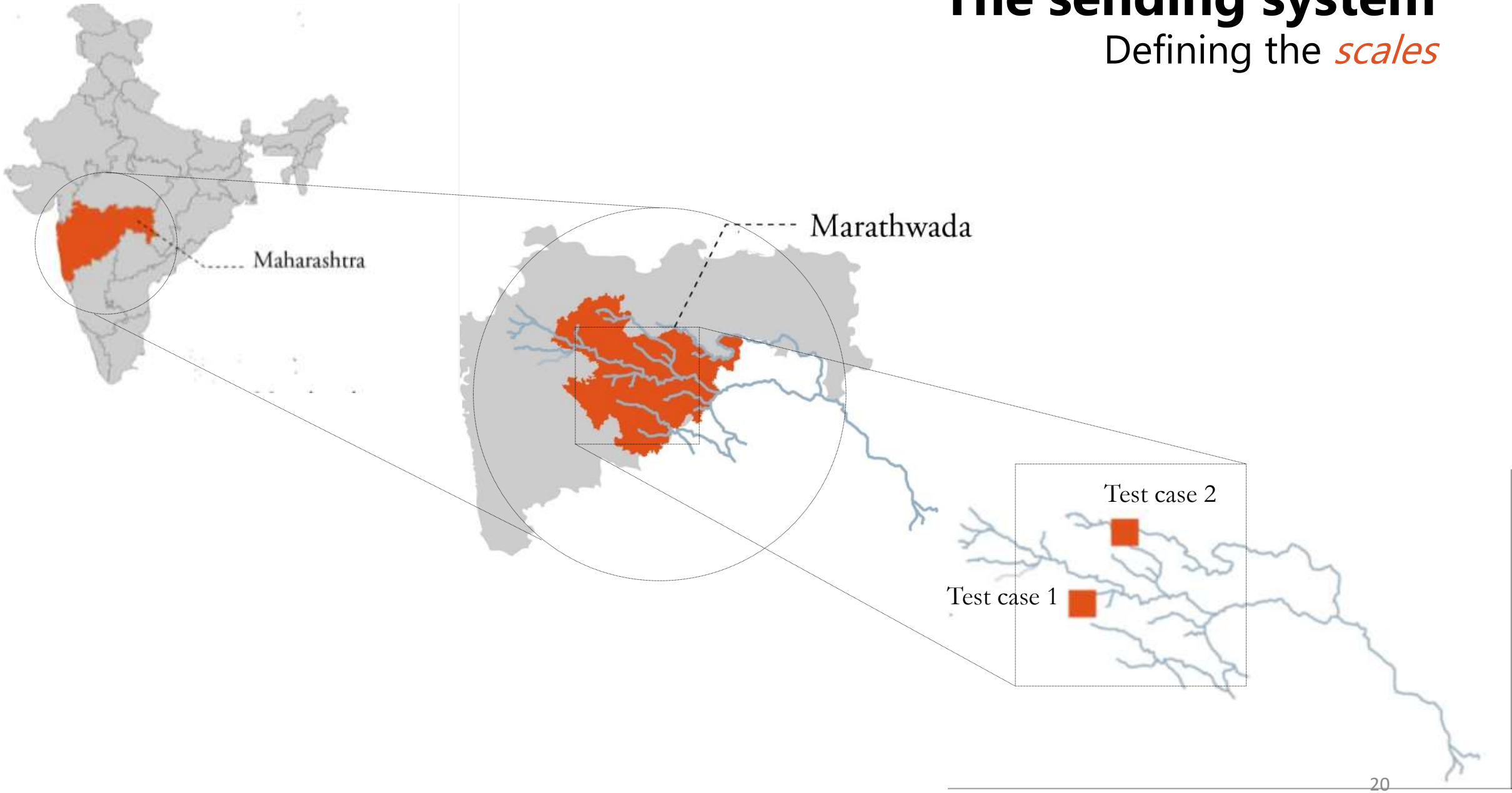


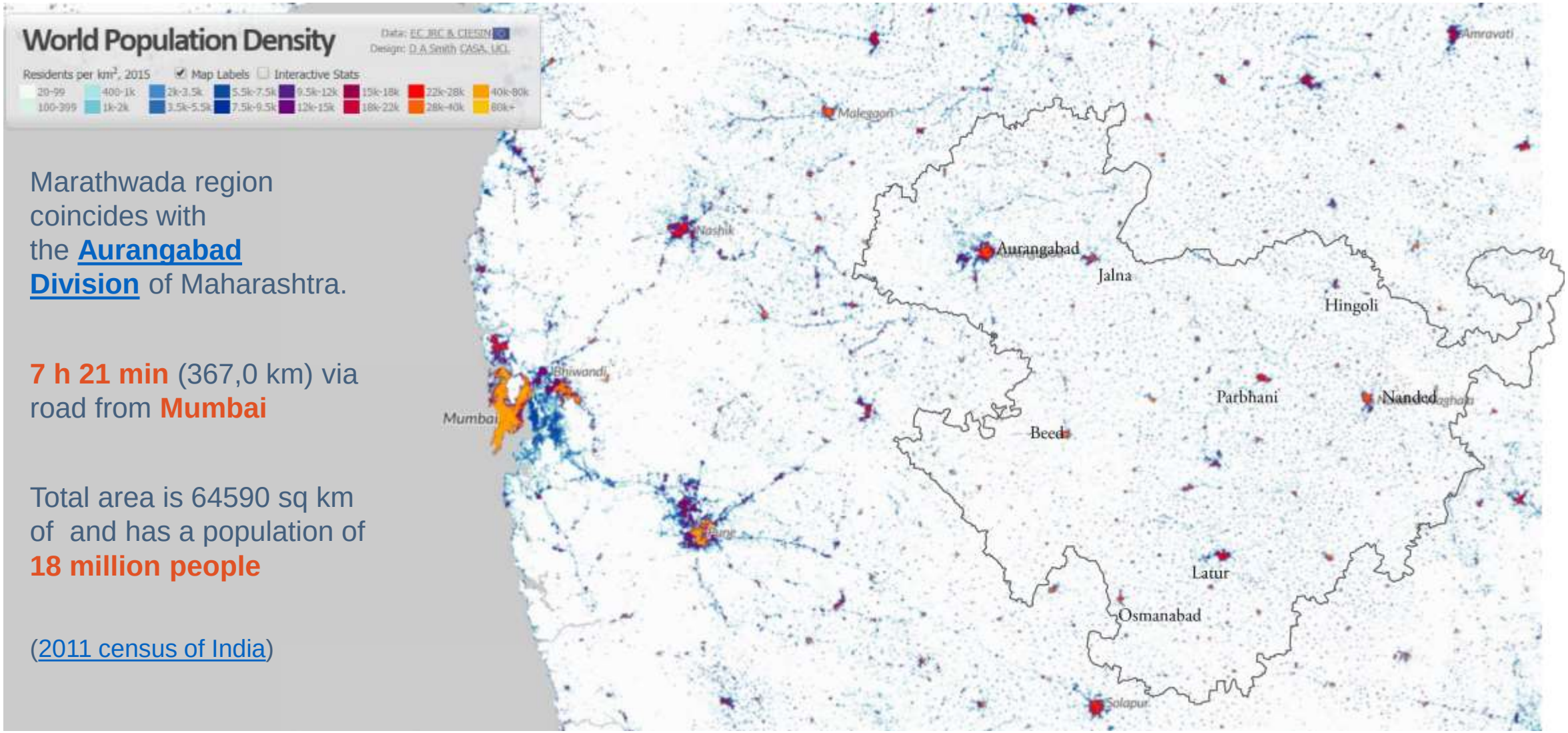
Research Question

To what extent can the **impacts of 'globalisation** of water' **be minimized** in order to achieve a more **just and sustainable** water footprint in **cotton supply chains**?

The sending system

Defining the *scales*





Marathwada region coincides with the **Aurangabad Division** of Maharashtra.

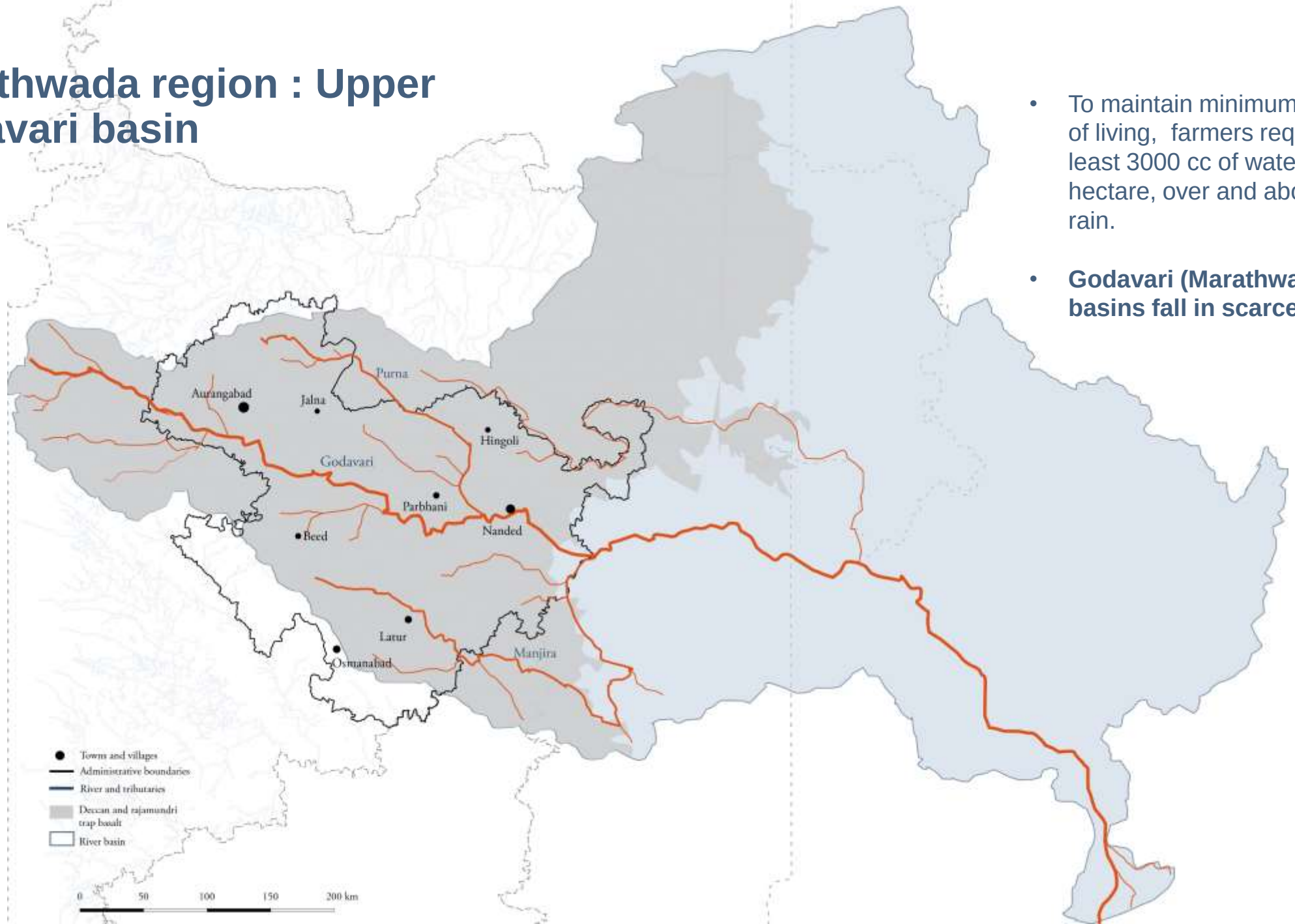
7 h 21 min (367,0 km) via road from **Mumbai**

Total area is 64590 sq km of and has a population of **18 million people**

(2011 census of India)

Producing landscapes
Peri urban and rural areas
(Image : www.gettyimages.com)

Marathwada region : Upper Godavari basin



- To maintain minimum standard of living, farmers require at least 3000 cc of water per hectare, over and above natural rain.
- **Godavari (Marathwada), sub basins fall in scarce zone.**

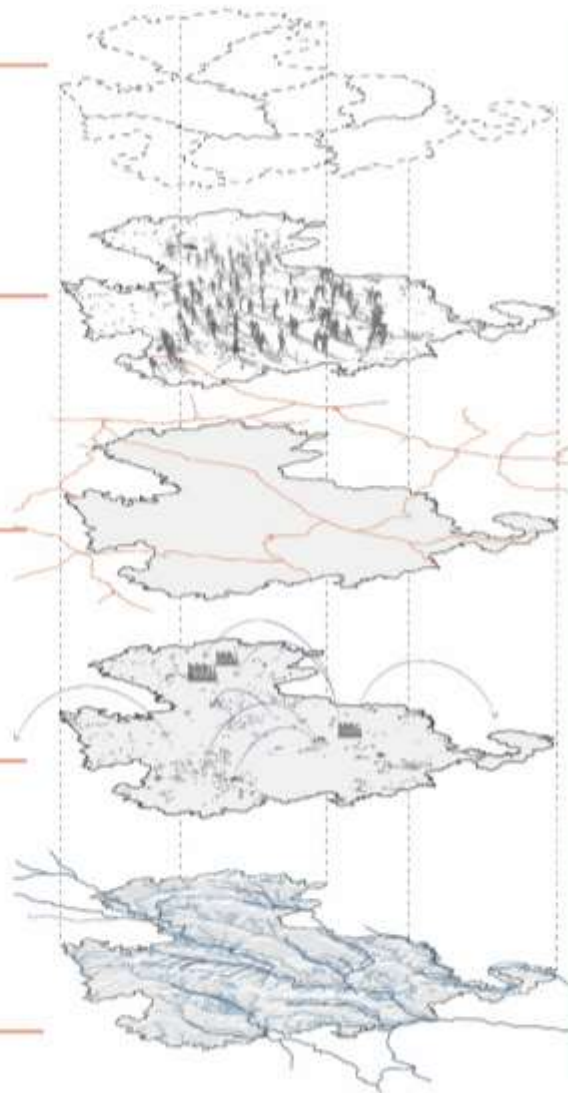
Analytical Framework

Parameters

- **Water Governance**
- **Water Management**
- **Water System**

Over scales

Layers



Policies

Land use policies
Processes &
Planning instruments

People

Socio-economic conditions
human development index

Infrastructure

Land water systems
Industry and processes

Metabolic Flows

System conditions
Metabolic processes

Resource Grounds

Ecology and hydrology
Land use patterns
Geomorphology

Research questions

What are the various spatial, socio-economic and environmental impacts of the virtual water trade of cotton in India?

Why is the current water footprint of cotton production in India (Marathwada) unsustainable and unjust?

Why is the current system of cotton water trade contribute to a continued depletion of water resources?

How can an improved system be developed in a more spatially just way that there is less negative externalities of virtual water trade of cotton?

Research Methods

Mapping and Cartography

Flow analysis and sections

Field work

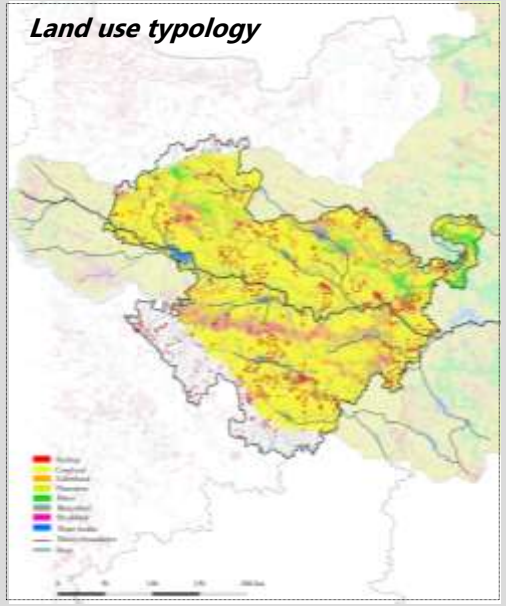
Interviews

Precedence study

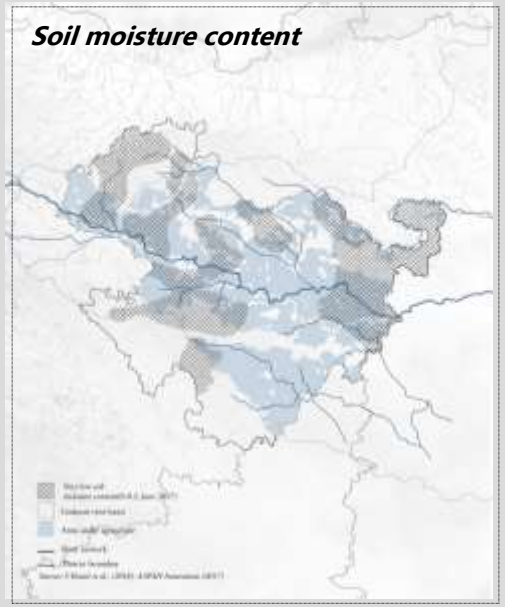
Governance structure

Stakeholder analysis

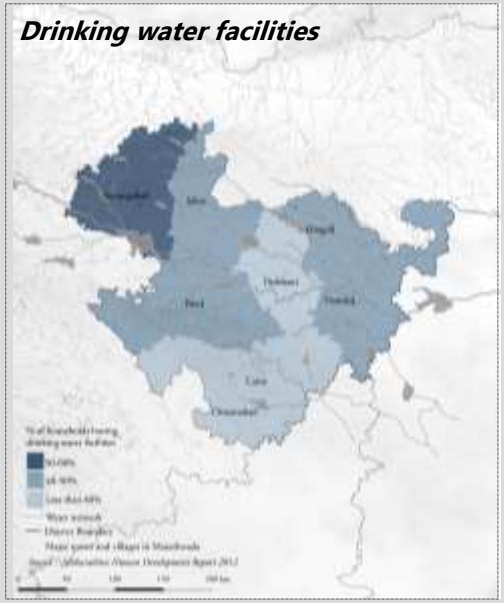
Land use typology



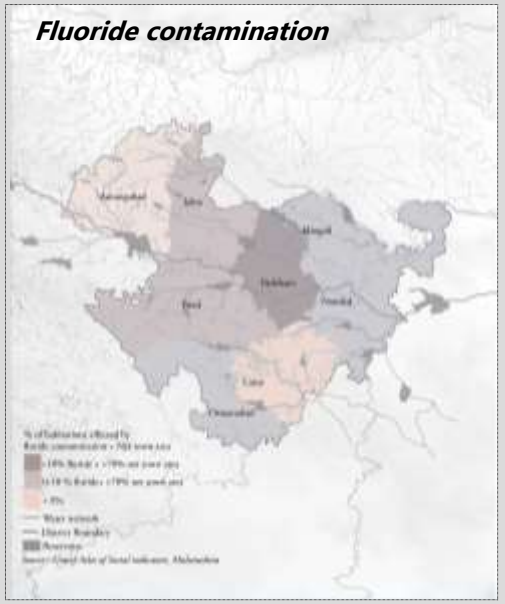
Soil moisture content



Drinking water facilities

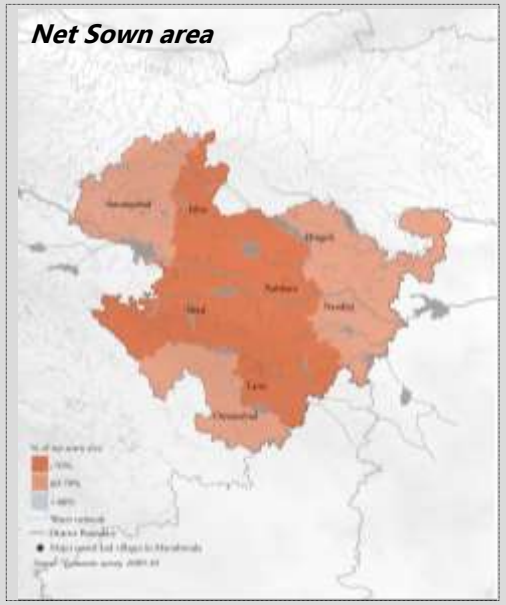


Fluoride contamination

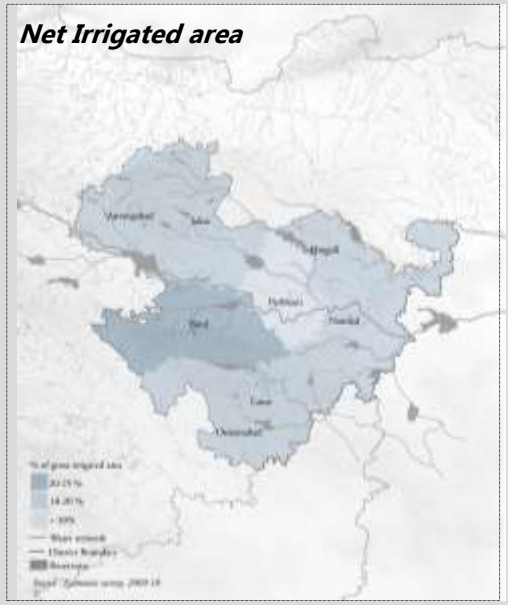


Dams and Reservoirs

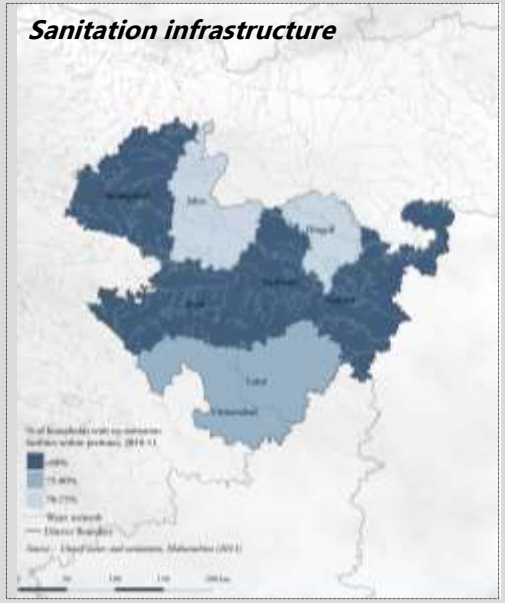
Net Sown area



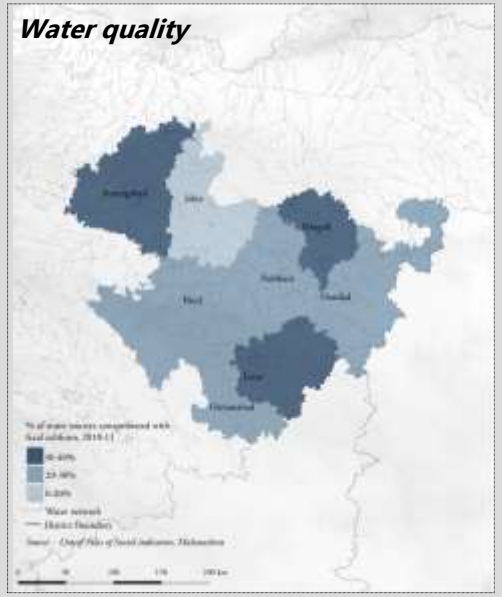
Net Irrigated area



Sanitation infrastructure



Water quality



Cotton infrastructure

Fieldwork : January – February 2020

Observations and interviews from the field

Partially funded by EFL Stichting and TU Delft Global Initiatives

Large Irrigation Infrastructure

Jayakwadi Dam- One of the largest dams in Maharahstra

(Image : www.flickr.com)

Who is it benefitting?

Water being pumped into tankers to take to industries
(Image: gettyimages.com)

The logistics of scarcity

Water being brought in trains from 300km away
(Image : www.gettyimages.com)

“There is not enough water to drink. Once in 4 days, a government tanker gives us 200 L for the whole family. If needed more, we need to buy from private tankers”.

“I have two bore wells in my land but both gives no water. 30 years ago there was a lot of water in the land, the land used to hold water.”

“I am unable to invest in farm ponds or drip irrigation, as I do anot have money to raise the initial investment. There is no water from the top or from the ground”.

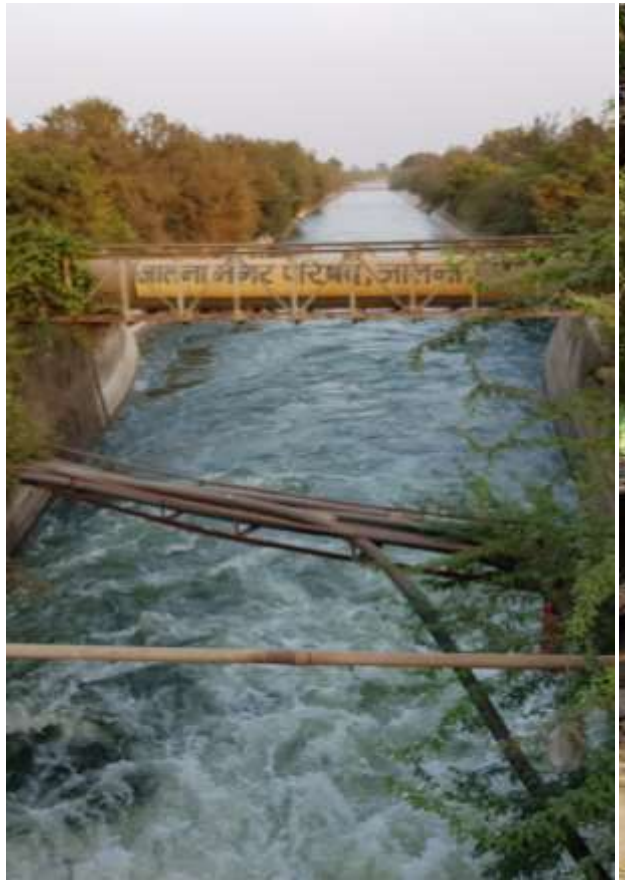
Scarcity Mentality!

Women waiting for hours a day to get drinking water

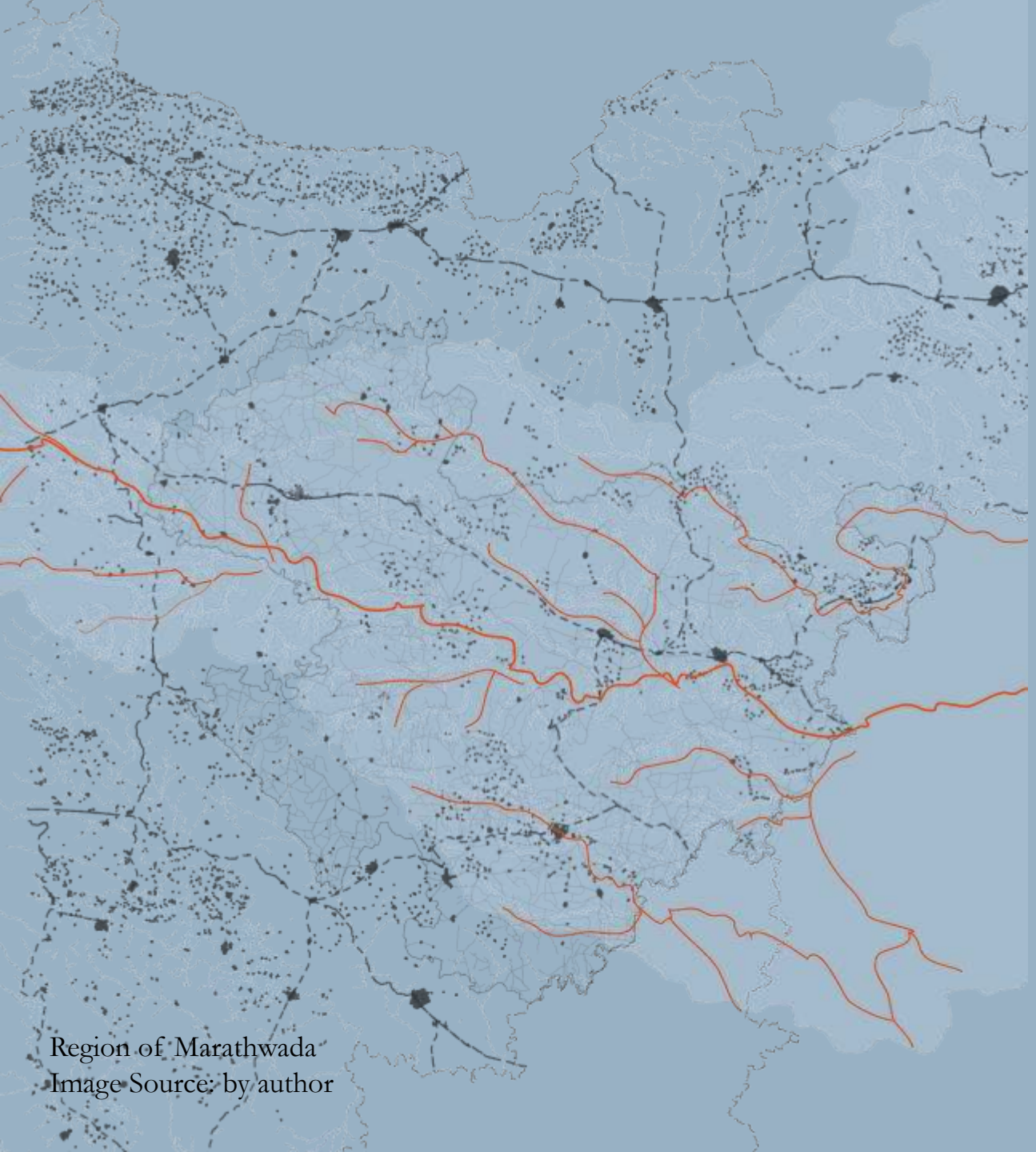
(Image : www.gettyimages.com)

Social costs and livelihoods based on cotton production

A mother working with her children in a cotton mill
(Image by author)

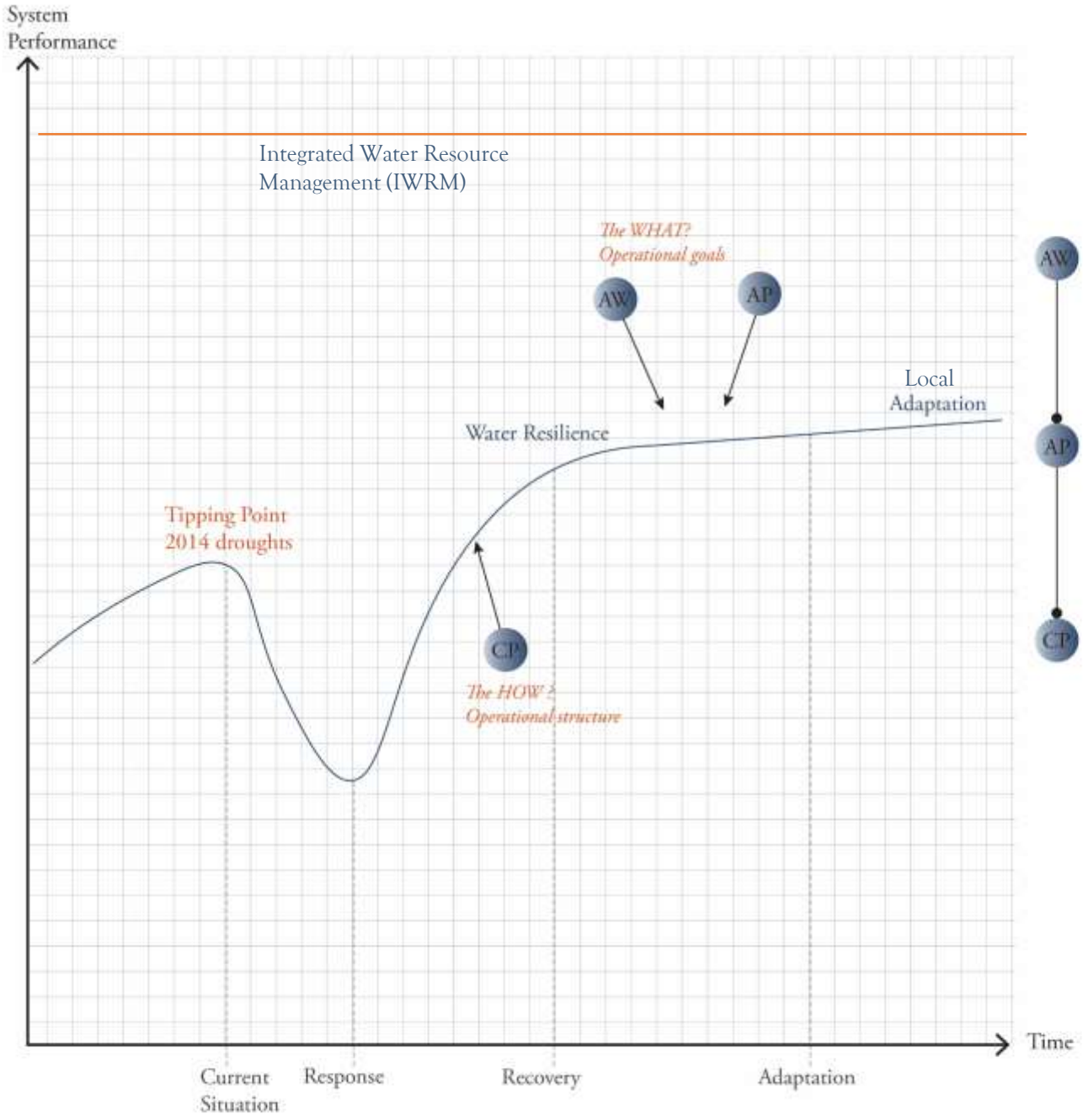


Lack of accountability + **Lack of compensation** + **Lack of awareness** → **Lack of Water**



Region of Marathwada
Image Source: by author

VISION & STRATEGIES



AW **Assured Water**

Assured Water is defined as the minimum water required for maintaining a comforatble living for farmers, 'water for livilehood' calculated as 5000 cubic meter per year. (Source: Waterconflictforum)

AP **Assured Price**

Assured Price is defined as the true price guarenteed for a product considering the social and environmental costs of production. (Source: Trueprice.org)

CP **Community participation**

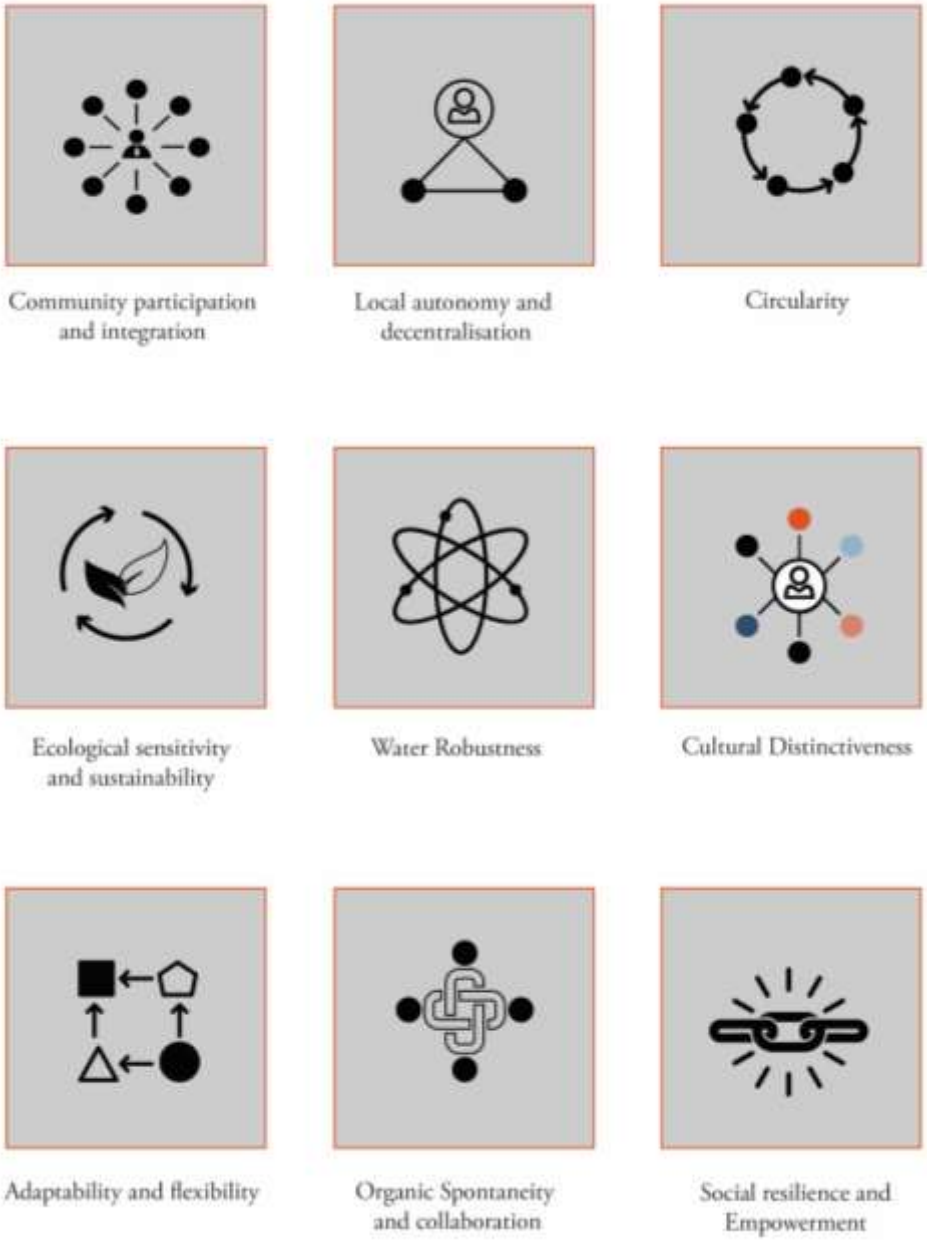
Community participation can be defined as the joint participation formed by farmer coalitions for monetary benefits as well as sharing psoitive and negative externalities.

Components for local adaptation

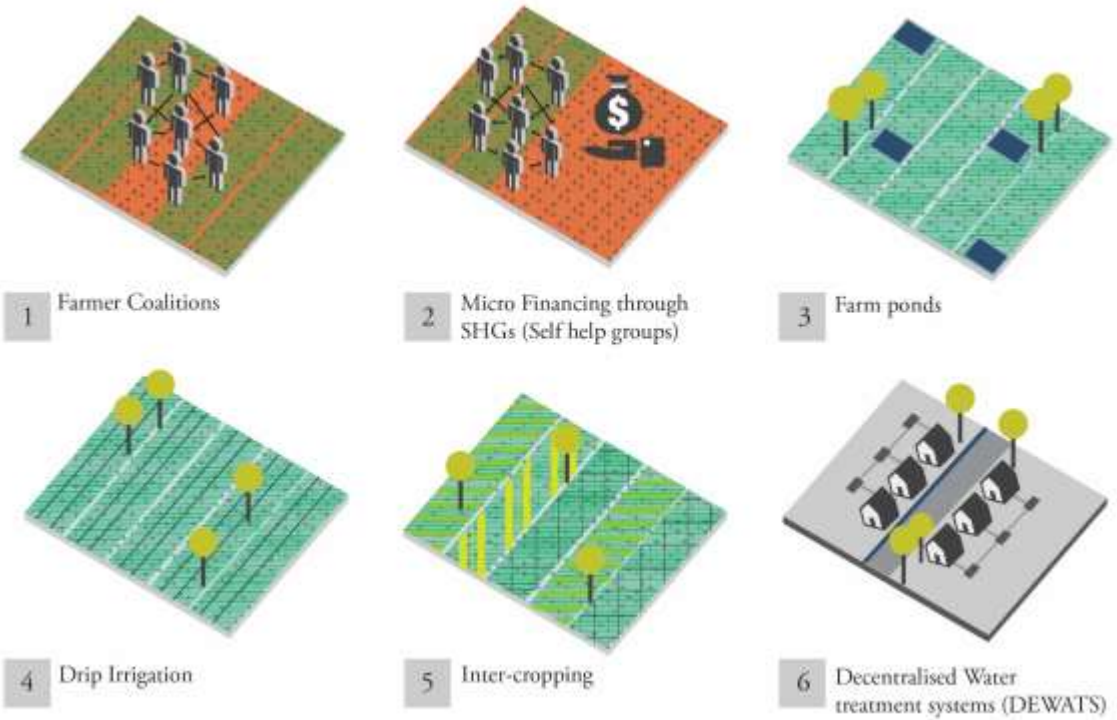
The 'what' and the 'how'

Towards vision: Principles for integrated water resource management

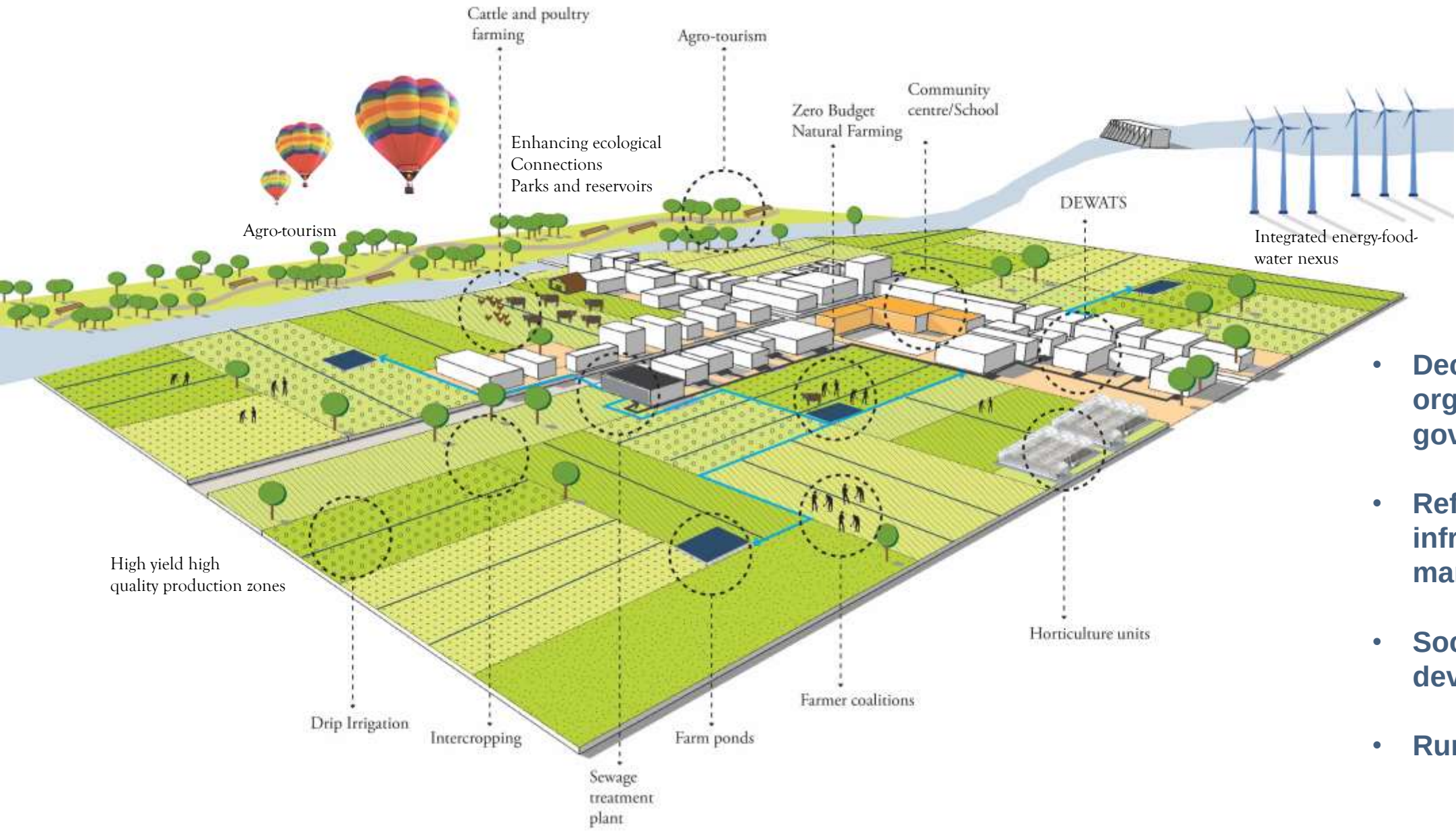
- Essential **tools to achieve Decentralisation** in the water resource management.
- **Power to the local community** to carry out implementation and monitoring.
- **Social resilience** and empowerment
- Increasing **water efficiency** of agricultural practices



Strategic actions for *local adaptation*



Vision 2050: *'Joint Action for Local Water Rich Initiatives – JALWaRI'*



- **Decentralisation self-organisation and governance**
- **Reform in irrigation infrastructure and management**
- **Social infrastructure development**
- **Rural transformation**

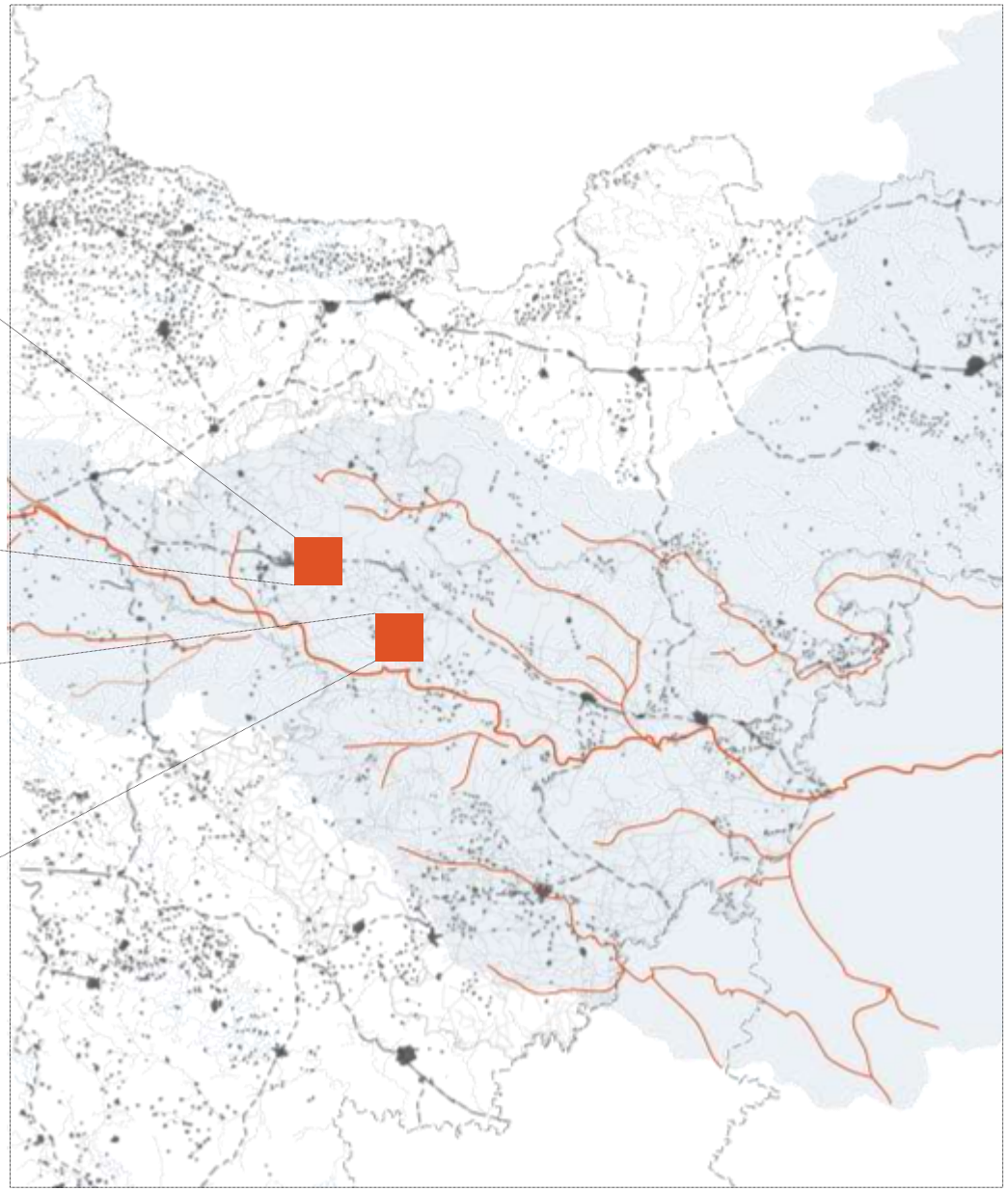
Research by design

Test Case 02

Shendra Kamnagar
An upcoming industrial area part of The Delhi-Mumbai Industrial Corridor in the outskirts(peri-urban) areas of the city of Aurangabad

Test Case 01

Sarangpur Village
A cotton village with a very low socio-economic development and acute water scarcity with mostly marginal and smallholder farmers



Site conditions

Poor living conditions

Absence of social infrastructure

Unsustainable cotton production

Design phasing of evolutionary strategies for change

	Energise Short term actions	Enhance Medium term actions	Empower Long term actions
Time frame	(+5 years)	(+10 years)	(+15 years)
			
Operational goals	- Awareness and Capacity building - Creating community participation and self organisation through self help groups - Micro credit systems - Leveraging existing institutional structure and cultural links	- Sustainable irrigation and farming practices through decentralised water resource management - Circularity in water cycles and recycling of water for irrigation through synergy between user groups - Generating additional income through empowering women and vulnerable communities	- Ecological restoration and landscape integration - Social infrastructure development and community empowerment - Integrated water resource management towards evolutionary resilience

Phase I

Energise
Short term goals and actions

- Awareness and Capacity building

- Creating community participation and self organisation

- Leveraging existing institutional structure and cultural links

1. Initiate village *JALWaRI* unit integrated with the formalised local self governance system at the village level or *Village panchayat*
2. Training and Vocational centres for capacity building and entrepreneurship programmes for women
3. Micro credit systems through *JALWaRI* unit

Phase II

Enhance

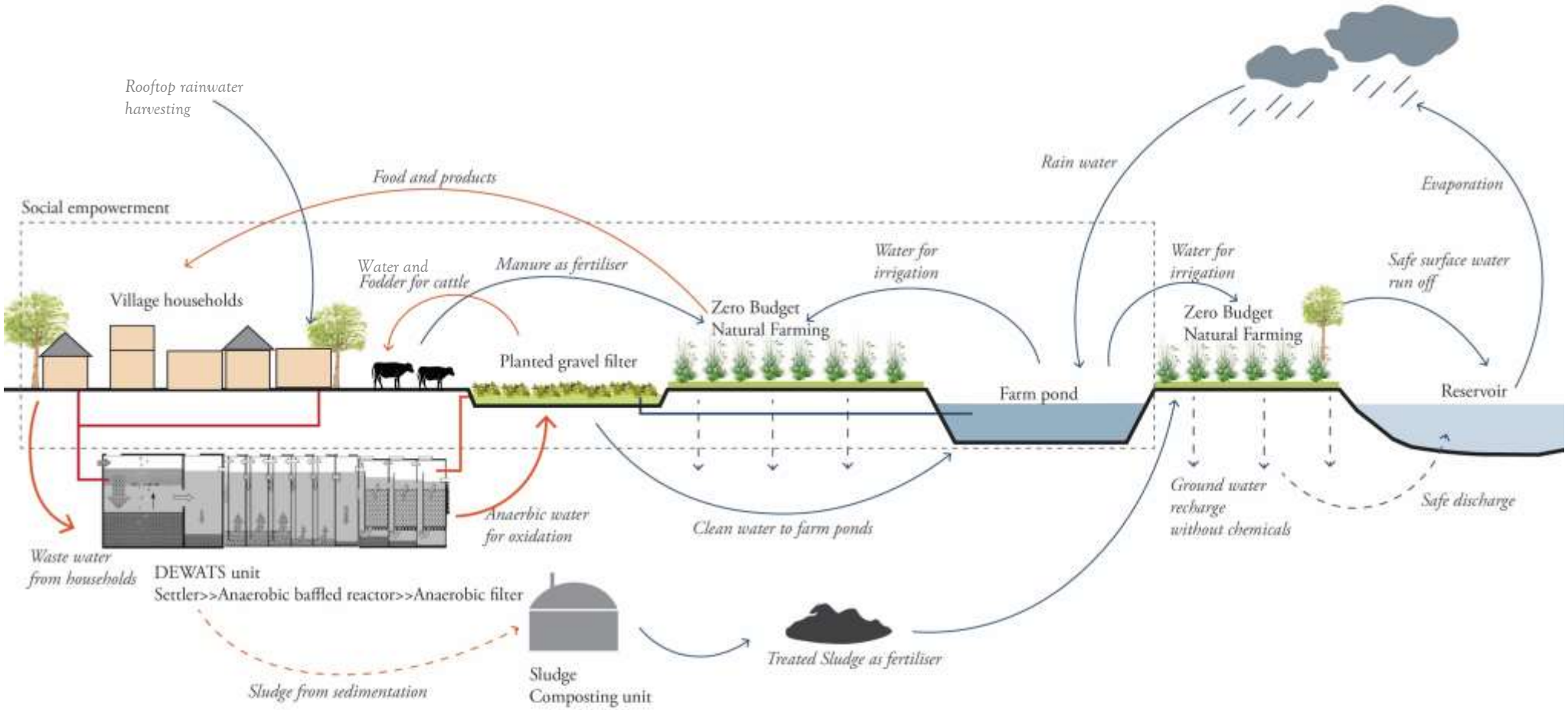
Medium term goals and actions

- Sustainable irrigation and farming practices through decentralised water resource management

- Circularity in water cycles and recycling of water for irrigation through synergy between user groups

- Generating additional income through empowering women and vulnerable communities

Systemic section: Flows



Phase III

Empower
Long term goals and actions

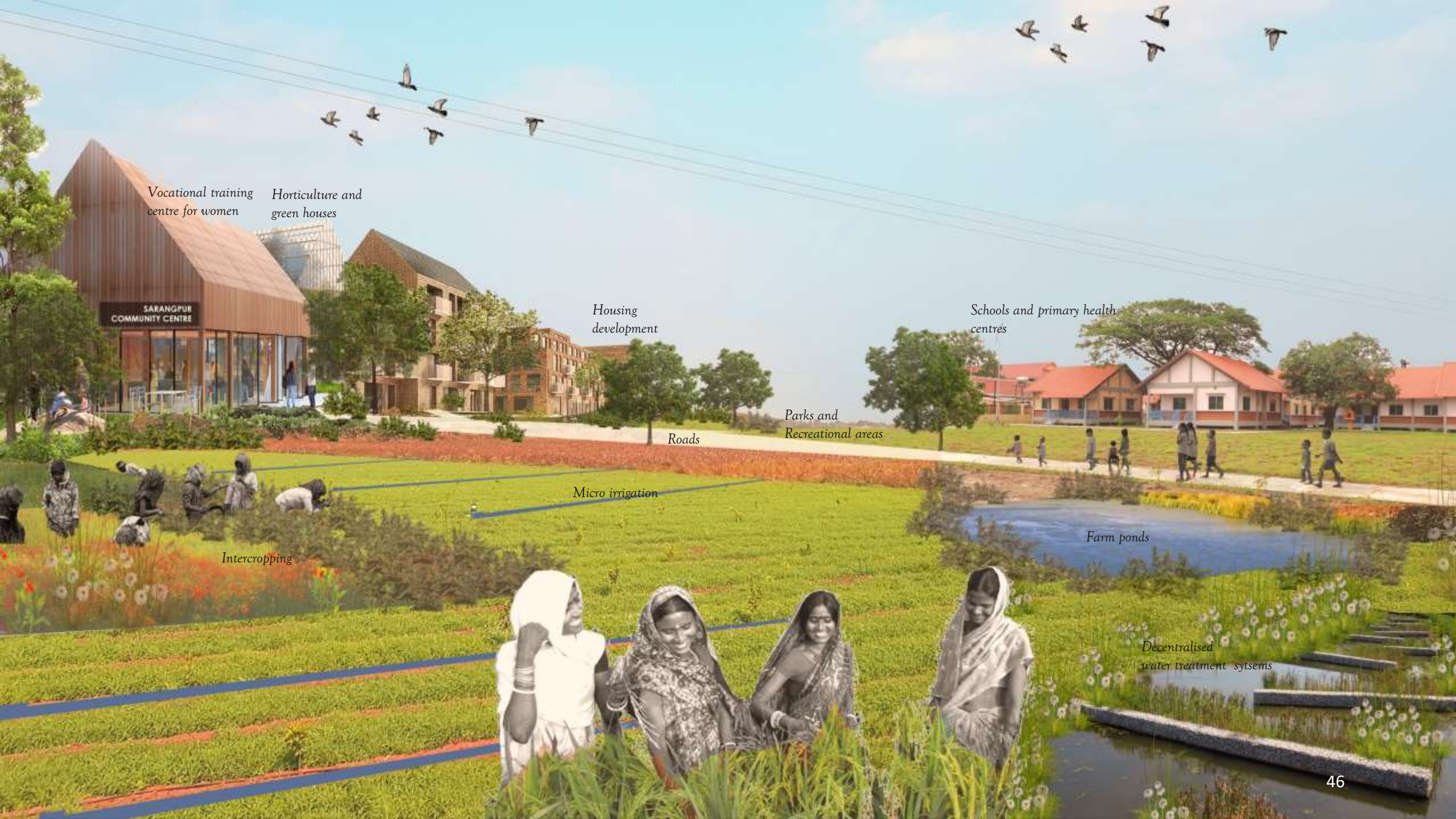
- Ecological restoration and landscape integration

- Social infrastructure development and community empowerment

- Integrated water resource management towards evolutionary resilience

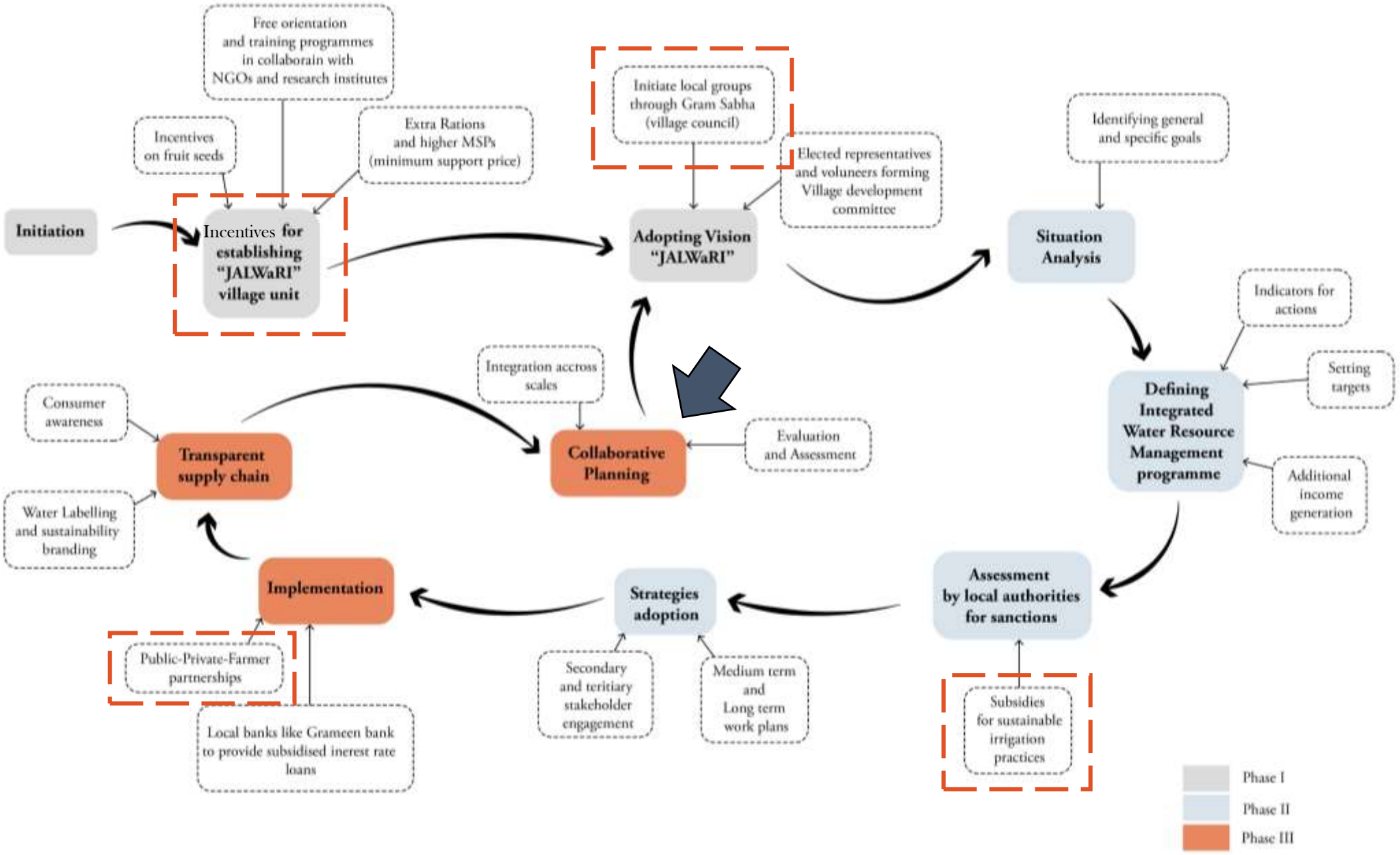
7 Social infrastructure development
- 7a Community centre, daycare and school
- 7b Women entrepreneur centre and vocational training
- 7c Public parks and roads

8 Community empowerment
- 8a Promoting agrotourism as a source of income generations
- 8b Vegetable and fruits market/ arts and crafts shops
- 8c Recreational areas and natural reservoirs

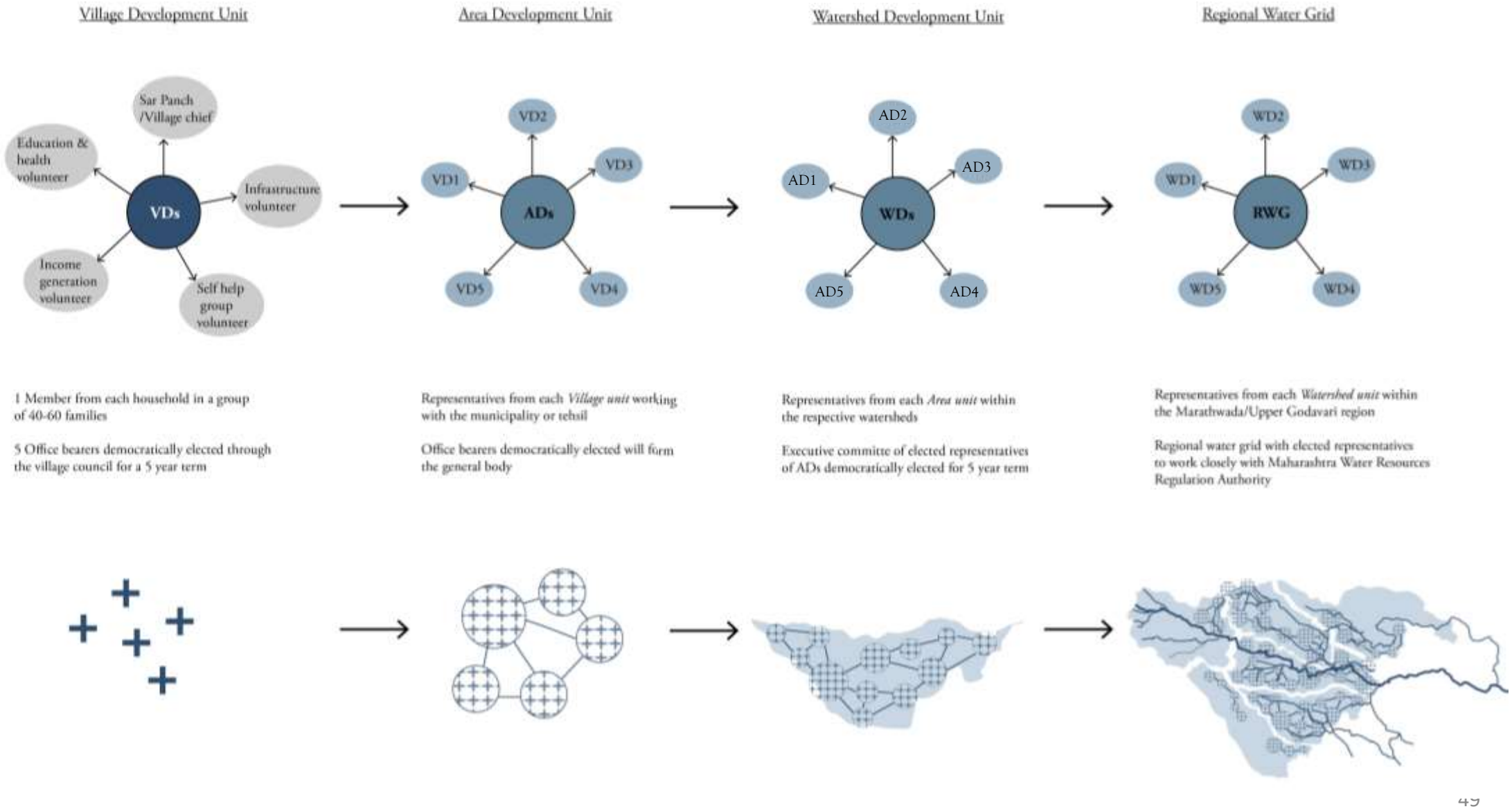

Vocational training centre for women
Horticulture and green houses
SARANGPUR COMMUNITY CENTRE
Housing development
Schools and primary health centres
Parks and Recreational areas
Roads
Micro irrigation
Farm ponds
Intercropping
Decentralised water treatment sytsems


Industries
Water treatment and recycling plants
Natural farming
Housing development
Roof top water harvesting
Constructed wetland for water purification
Agrotourism

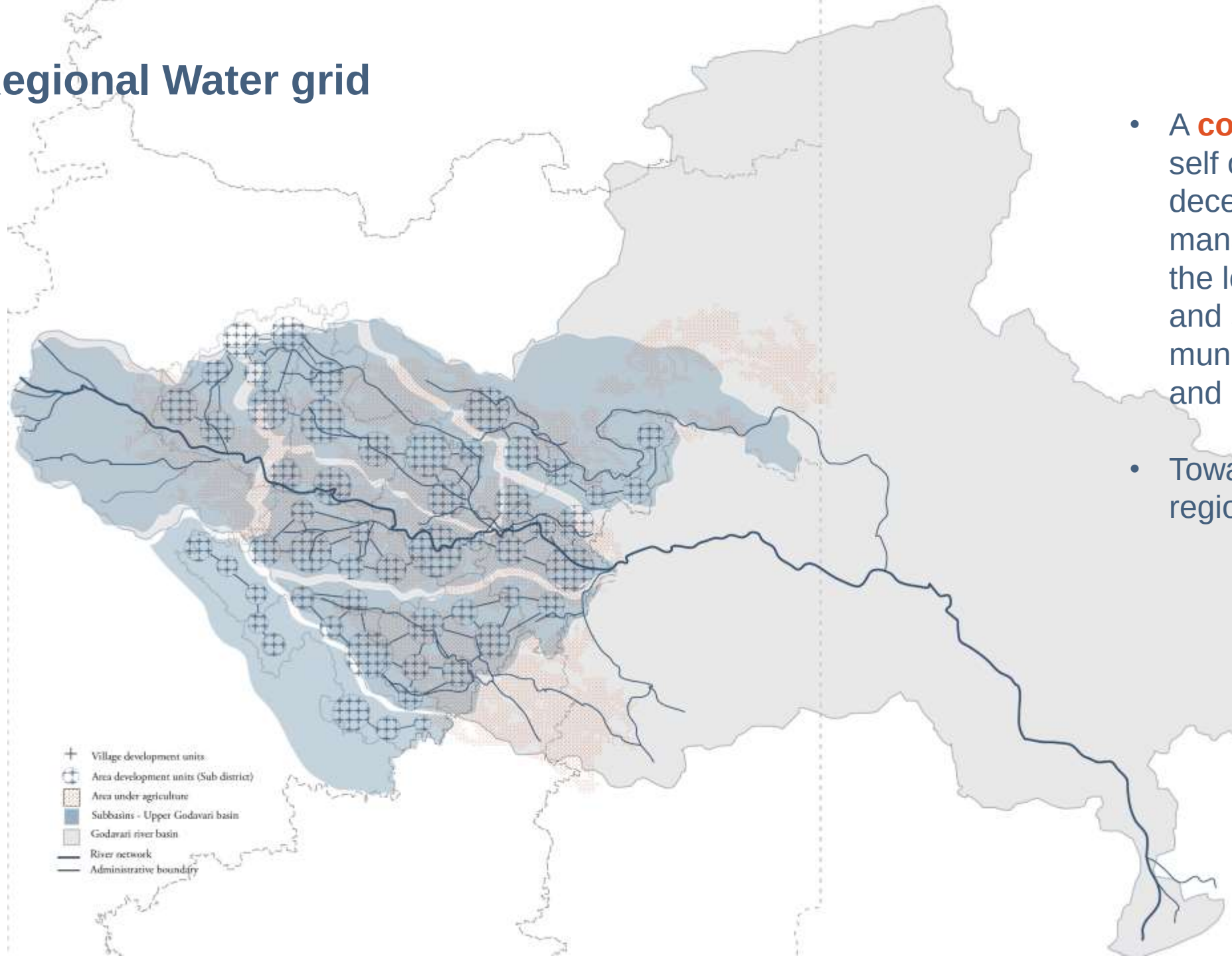
Policy Implementation Framework



A new model: ‘Participatory Water Governance’



Regional Water grid



- A **collective approach** of self organisation and decentralisation of water management systems at the local scale (villages) and scaling up to form municipalities, watersheds and regional coalitions.
- Towards a **water resilient** region of **Marathwada**

Regional Strategies

Equitable distribution and allocation

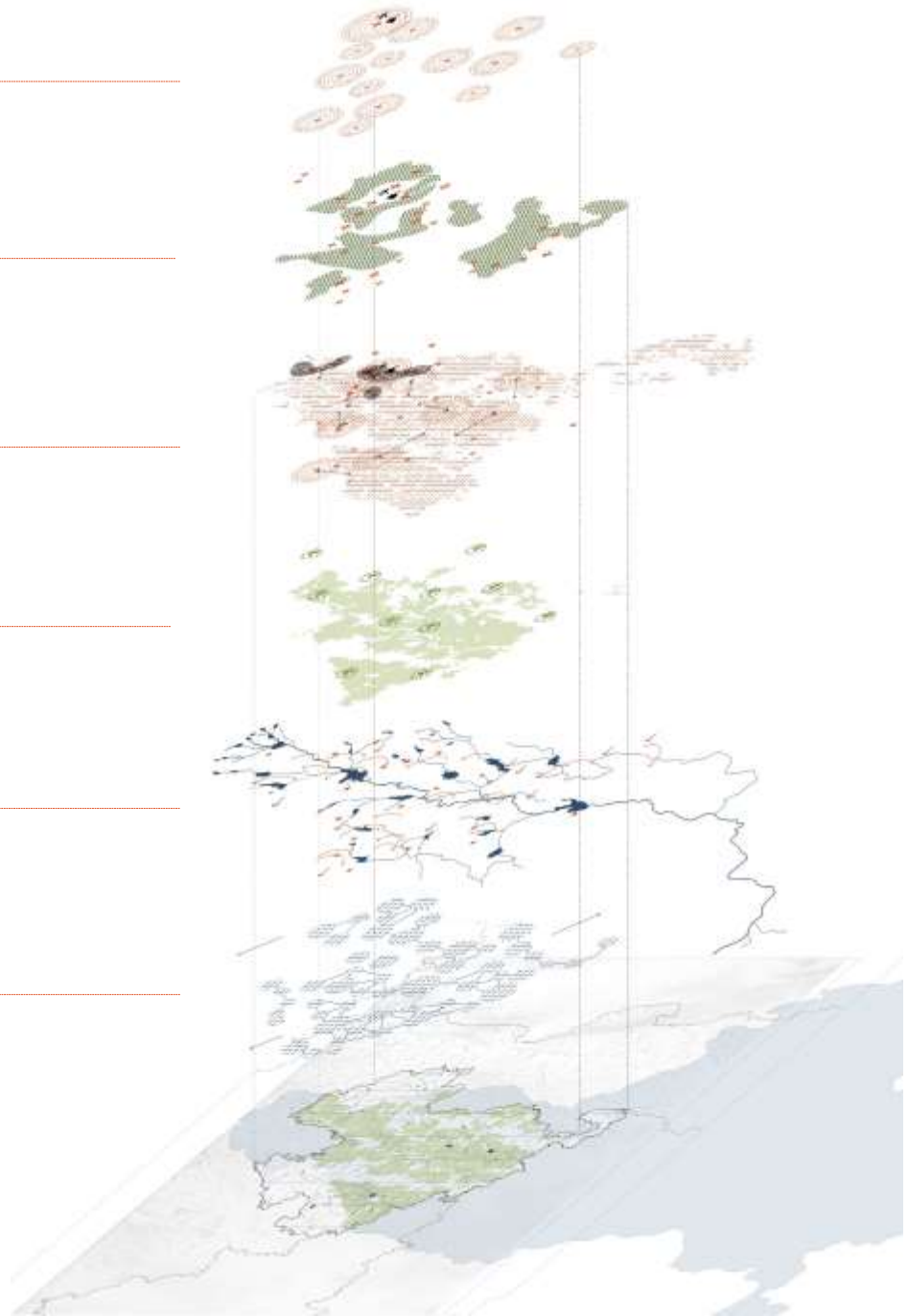
Landscape integration and agro-tourism

Social infrastructure development

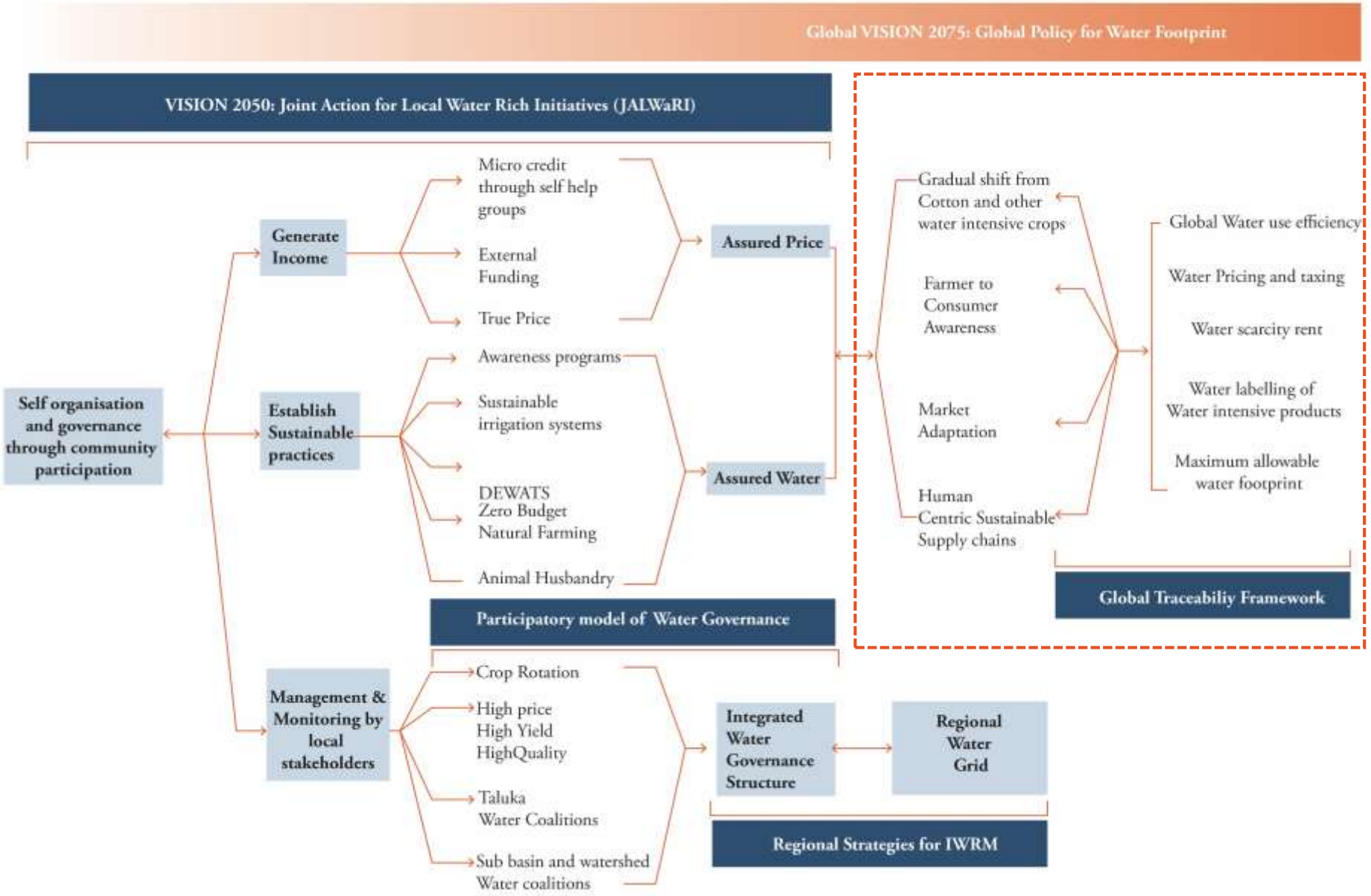
Sustainable agricultural practises

Circular water cycles

Community participation and decentralisation

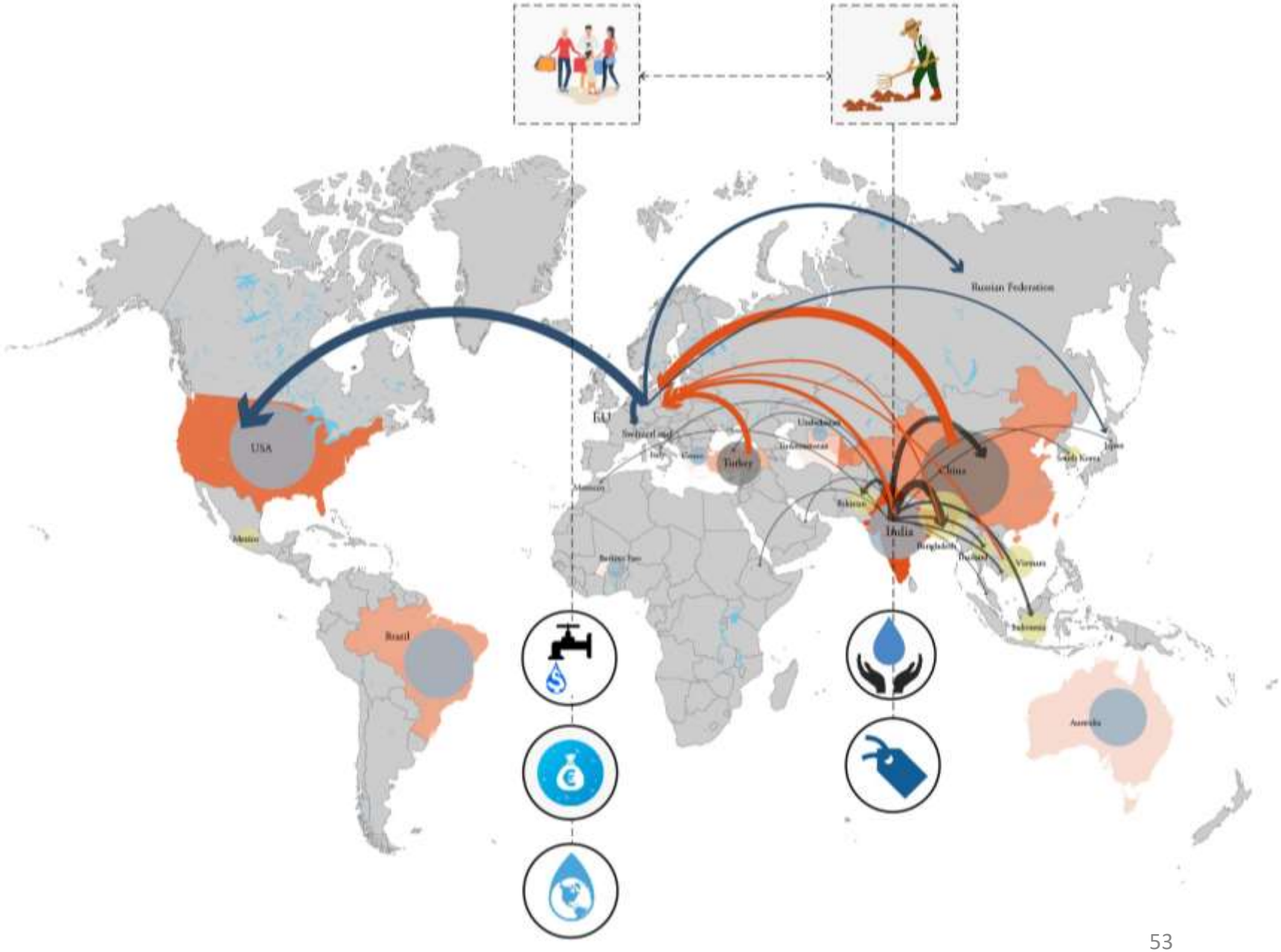


A roadmap towards achieving an integrated local adaptation to global mitigation



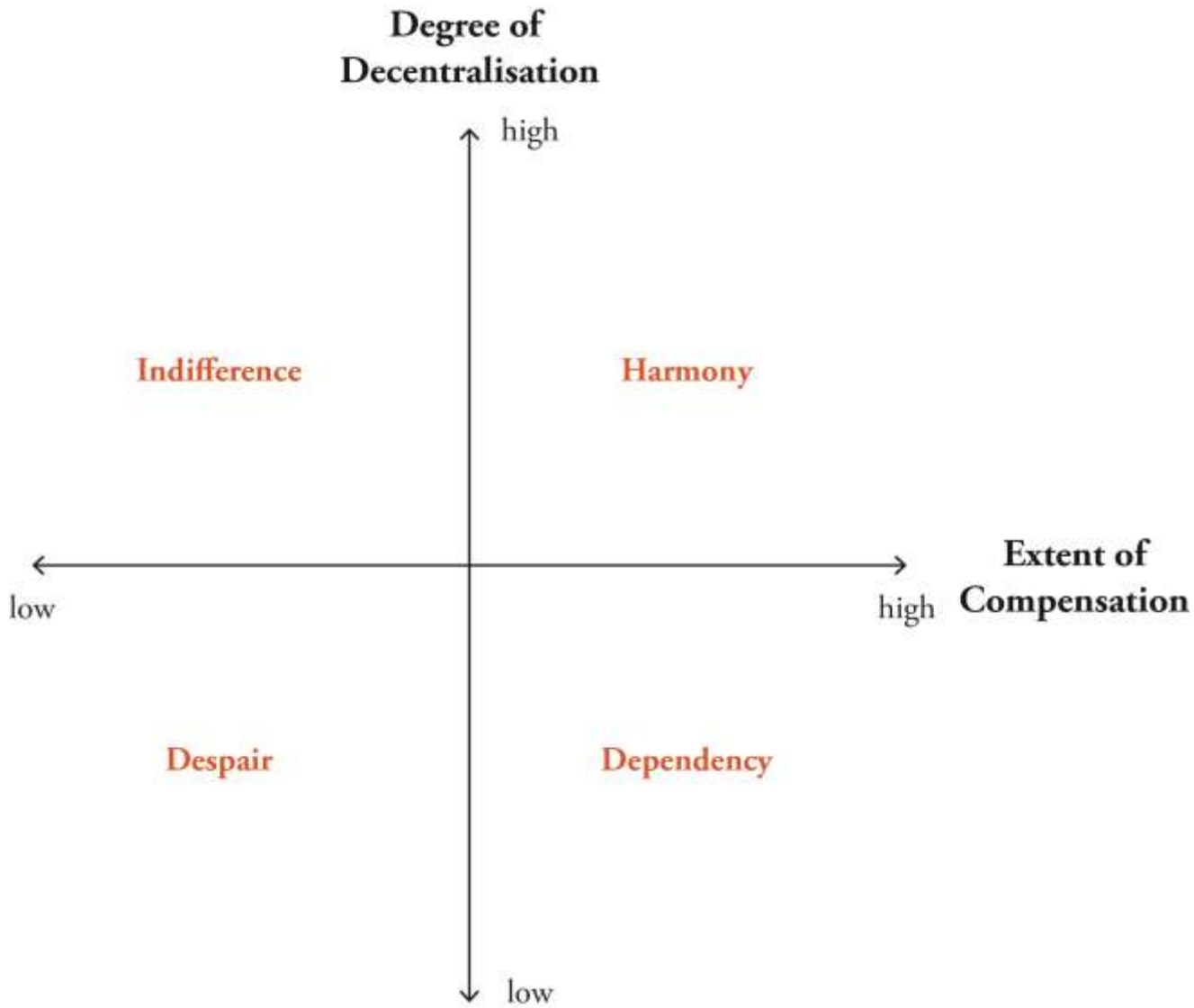
Global Traceability Framework

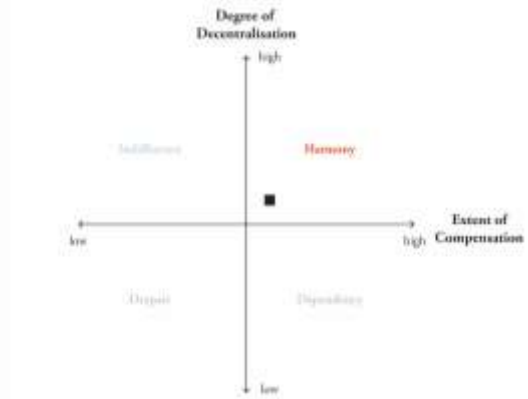
- Water pricing and taxing
- Water scarcity rent
- Maximum allowable water footprint
- Global water use efficiency
- Water labelling of water intensive products



Region of Marathwada
Image Source: by author

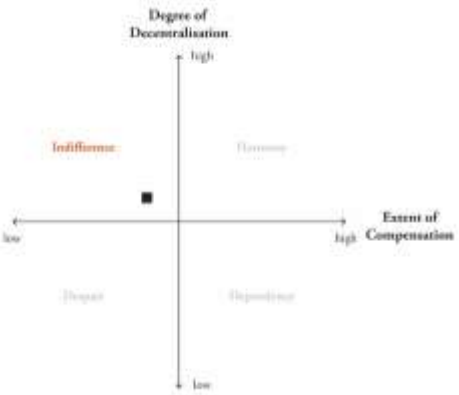
FUTURE SCENARIOS & PATHWAYS


Degree of
Decentralisation
high
Indifference
Harmony
low
high
Extent of
Compensation
Despair
Dependency
low


Degree of
Decentralisation
high
Harmony
Extent of
Compensation
low
high
low

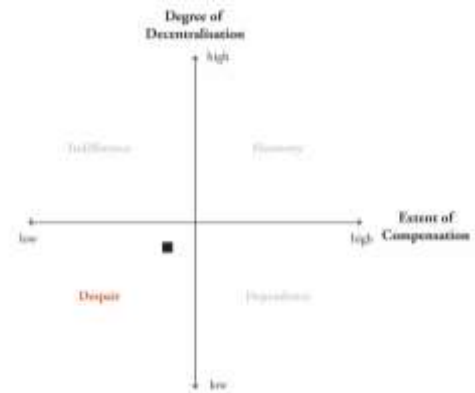

With respect for
people and planet
100%
ORGANIC
COTTON

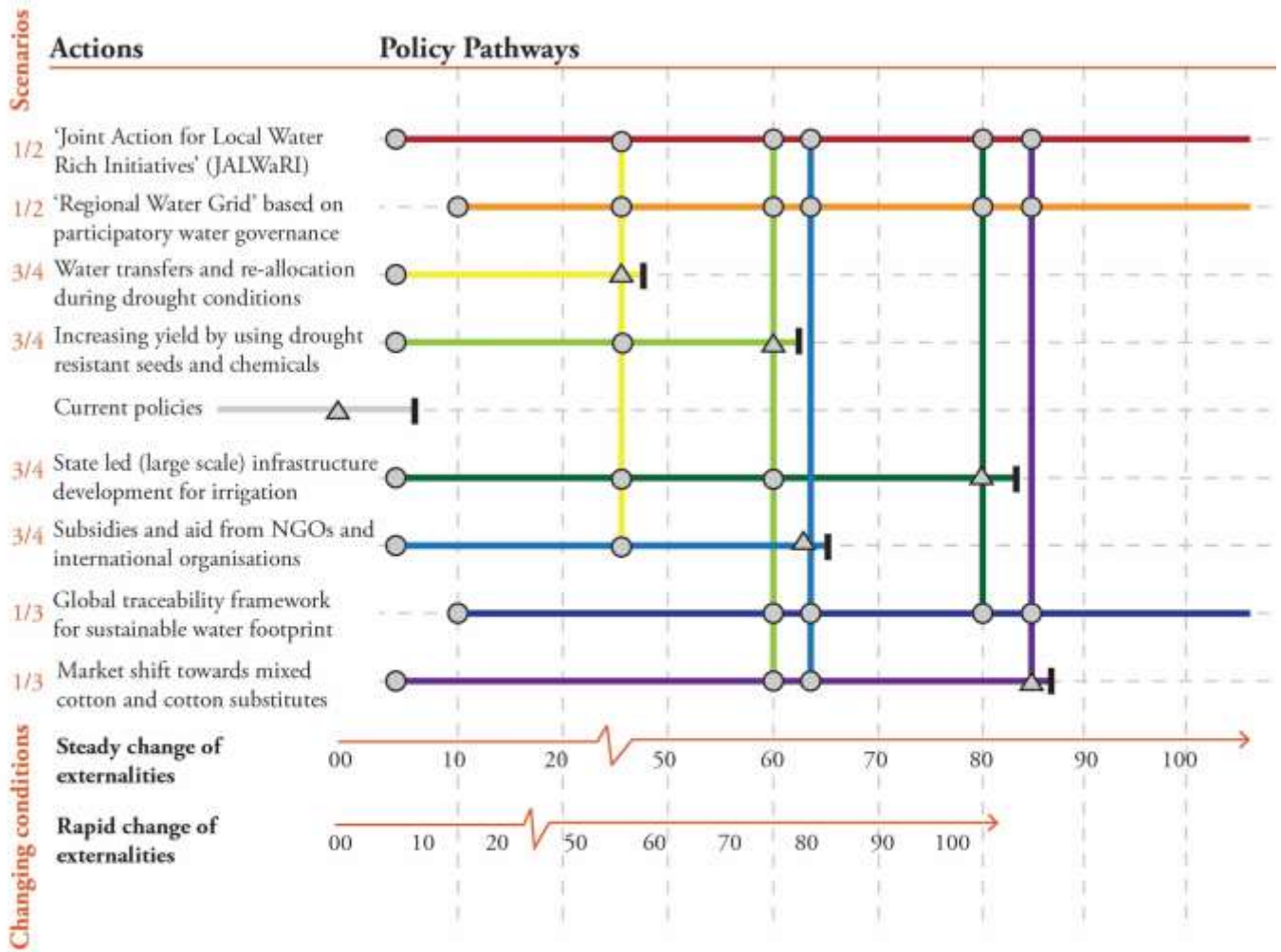

SALE
FLAT
40%
OFF
BLACK
FRIDAY
SALE!
UP TO
50%
OFF


Degree of
Decentralisation
high
Indifference
Extent of
Compensation
low
high
low


GREEN
with respect for people and planet
100% ORGANIC COTTON


CLEARANCE
SALE
LIMITED QUANTITIES
TEMPORARILY
OUT OF STOCK
TEMPORARILY


Degree of
Decentralisation
high
low
Extent of
Compensation
low
high
Despair


Scenarios
Actions
Policy Pathways
1/2 'Joint Action for Local Water Rich Initiatives' (JALWaRI)
1/2 'Regional Water Grid' based on participatory water governance
3/4 Water transfers and re-allocation during drought conditions
3/4 Increasing yield by using drought resistant seeds and chemicals
Current policies
3/4 State led (large scale) infrastructure development for irrigation
3/4 Subsidies and aid from NGOs and international organisations
1/3 Global traceability framework for sustainable water footprint
1/3 Market shift towards mixed cotton and cotton substitutes
Changing conditions
Steady change of externalities
Rapid change of externalities
00 10 20 50 60 70 80 90 100
00 10 20 50 60 70 80 90 100
Legend
Transfer station to a new policy action
Adaptation tipping point
Policy action effective
Decision mode
Externalities (steady/rapid)
Climate change
Production and consumption
Economic growth
Technological advancements

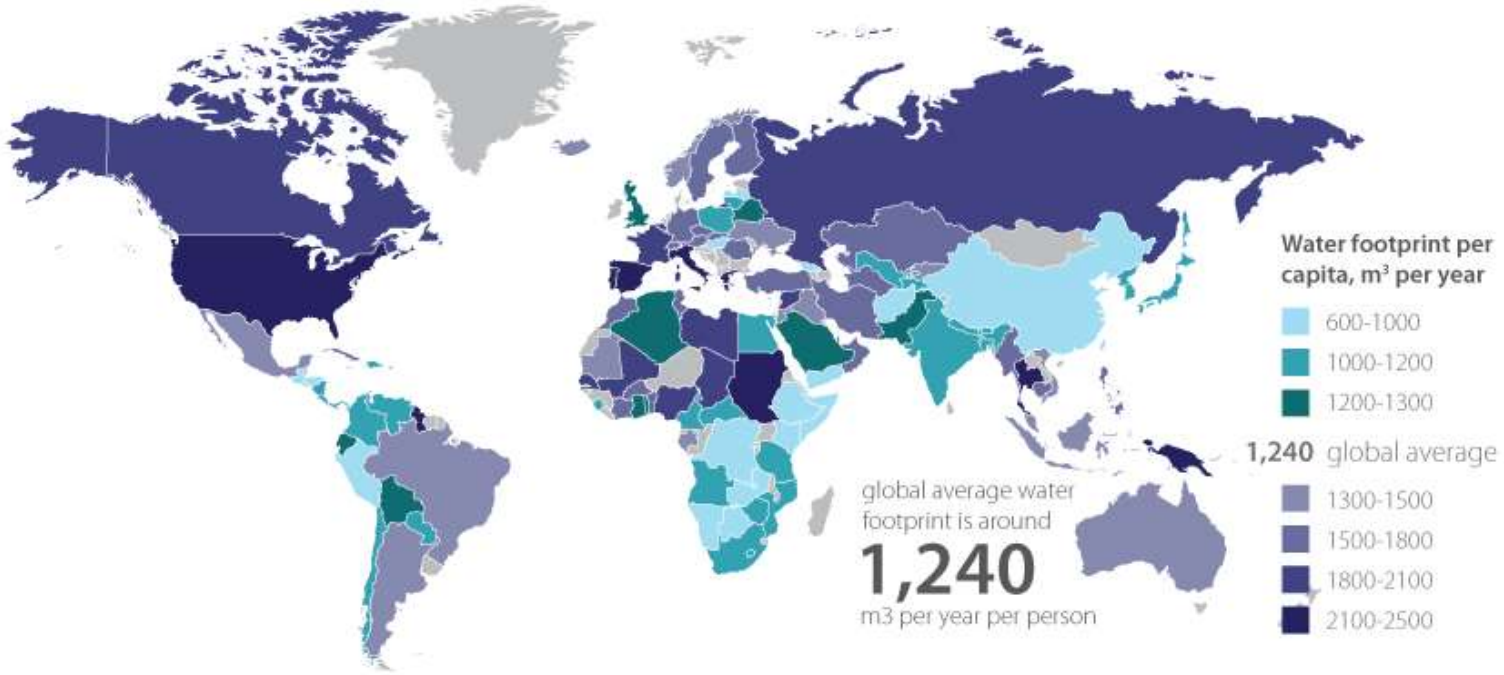
	Pathways	Score card	Impacts (+/-)		
		Costs	Water Conservation	Nature & Ecology	Society
1		Low	+++	+++	+++
2		Moderate	+++	+++	+++
3		Moderate	++	++	+
4		Moderately high	++	++	+
5		Moderately high	0	−−	−
6		Very high	+	−−	−
7		Moderately high	+	+	−
8		Moderate	++	+	+
9		Moderately high	++	+	+
10		Very high	+	−−−	0
11		Very high	++	+	+
12		Moderately high	+	+	+
13		High	++	+	+
14		High	++	+	+
15		Very high	++	+	+
16		Moderate	++	+	++
17		Moderately high	+	+	++
18		High	++	+	+
19		Moderately high	+	0	0
20		High	+++	+++	+++
21		Moderately high	++	++	++
22		Moderate	++	+	+
23		Moderate	++	+	+

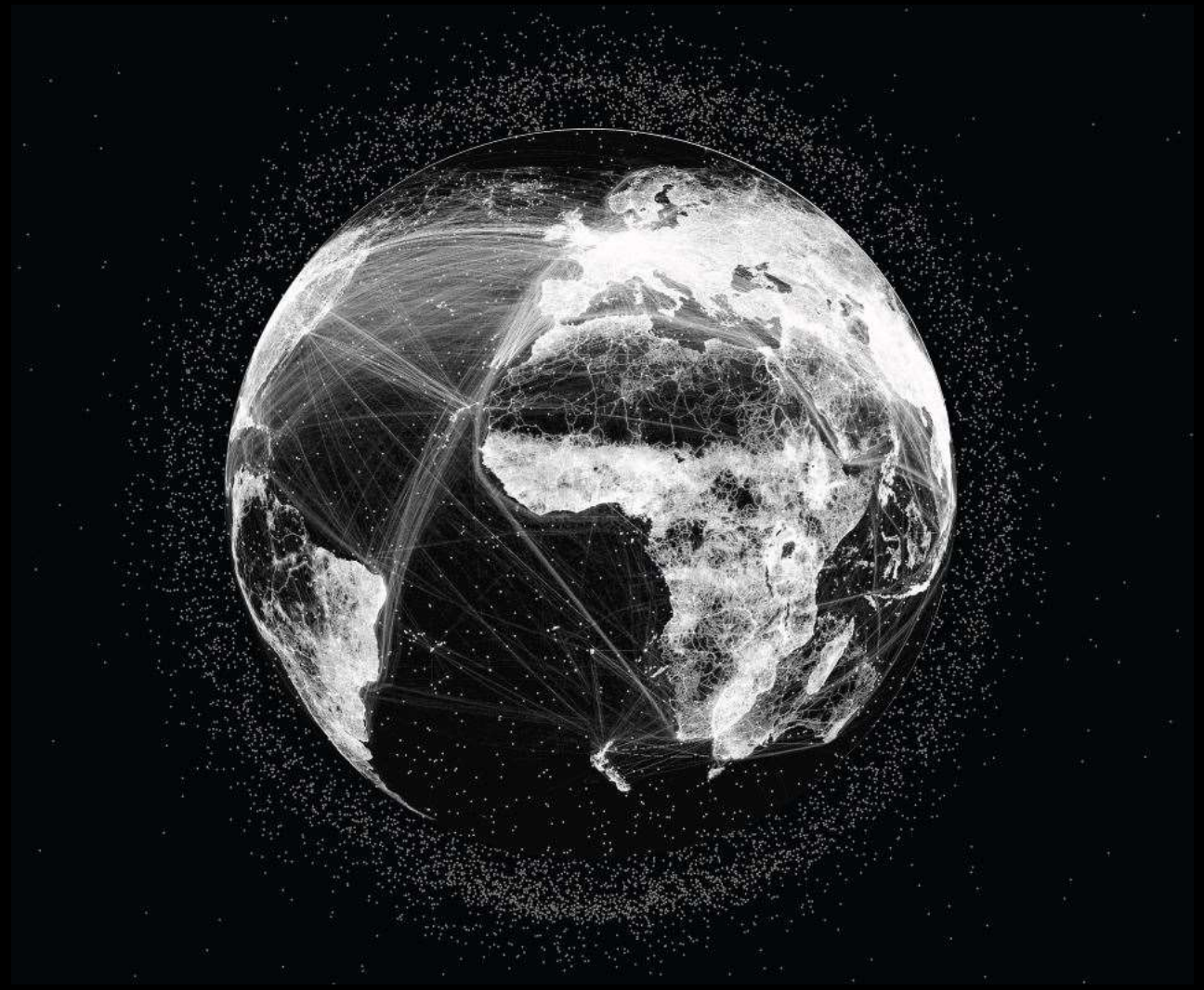
Legend

0	No impact	+/−	Positive or Negative impacts
+	Minor Positive impact	−	Minor Negative impact
++	Moderate Positive impact	−−	Moderate Negative impact
+++	Large Positive impact	−−−	Large Negative impact

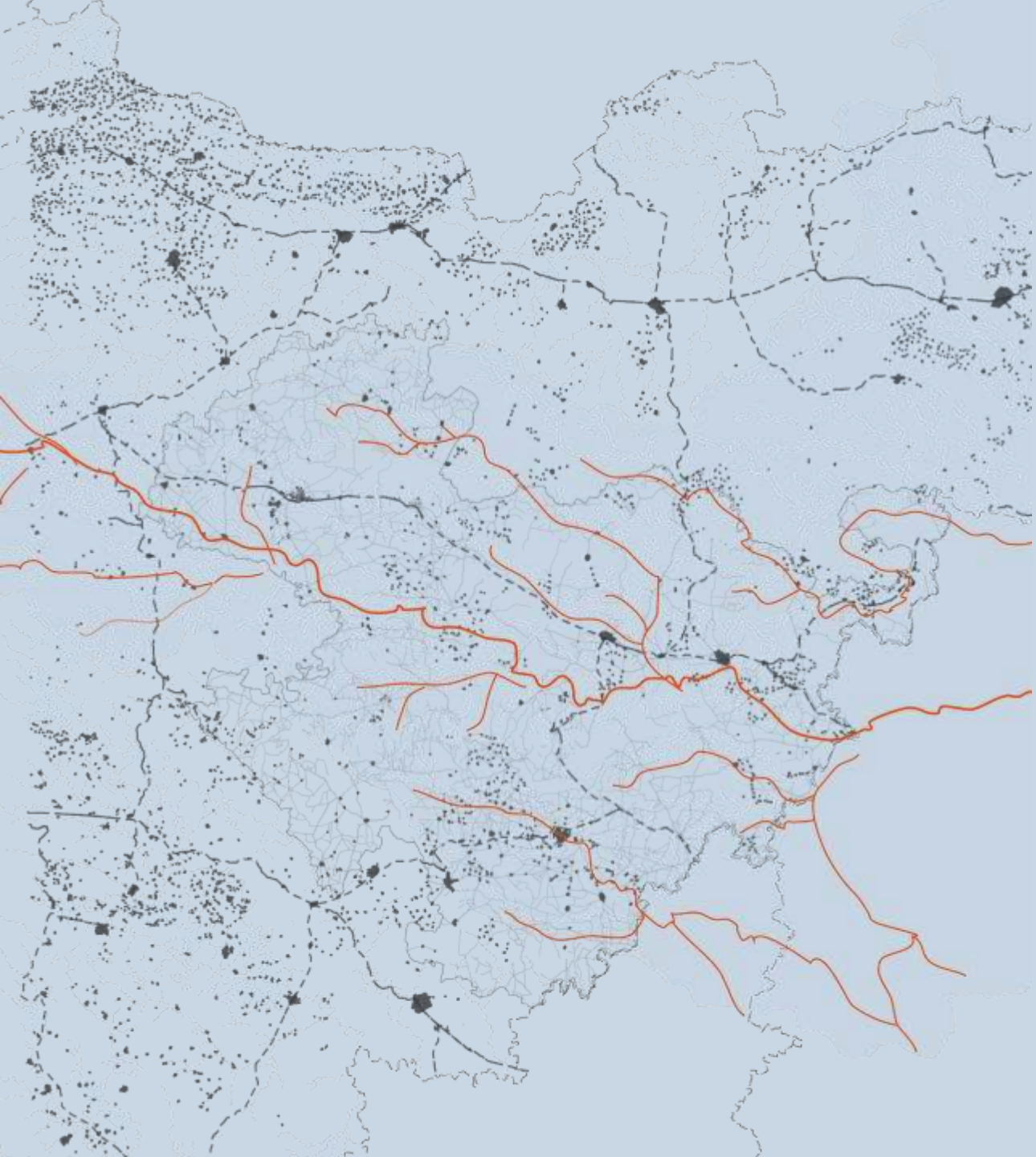
“It is often thought that water problems are to be solved locally where they occur. However, generally, local water depletion and pollution are closely tied to the structure of the national or even global economy”

(A.Y Hoekstra, 2013)





. “Towards a new epistemology of the urban”
Brenner and Schmid (2015)
(Image : https://www.gsd.harvard.edu/project/urban-theory-lab/)



Thank you.