Working together in climate field labs for sustainable food production

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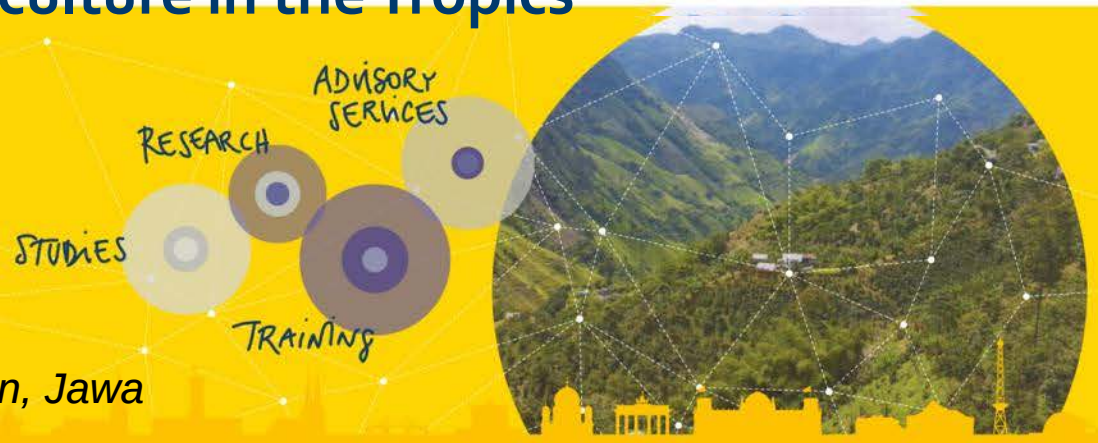
2nd International Conference on Food Security and Sustainable Agriculture in the Tropics

Brot für die Welt – Evangelischer Entwicklungsdienst



Climate resilient investigation and innovation project –Sulawesi Selatan, Jawa Barat / Jawa Tenggah

Outline of presentation

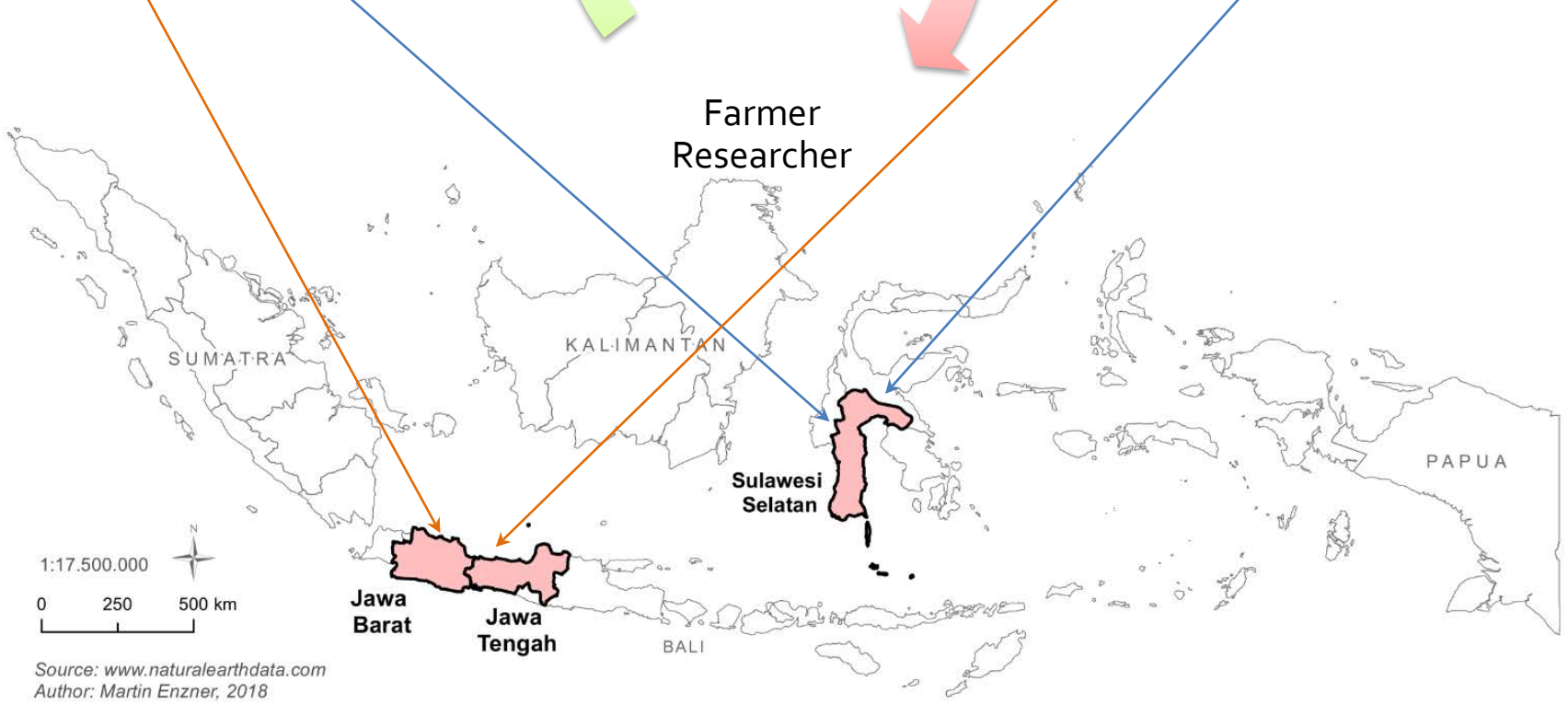
- Climate-resilient agriculture investigation and innovation project (CRAiiP)
- Food security and sustainable agriculture
- Climate change
- Impact of climate change on farming in Indonesia – selected issues: sea level rise – flooding – land degradation - salinisation
- No compromise - How to maintain healthy soils
- Is organic farming a solution?
- Yes we can – Academia and Farms together (climate field labs)
- Outlook – where small-scale farmers will go from today?

CRAIIP- Climate resilient agriculture investigation and innovation project

NGO/CSO

University Reasearcher

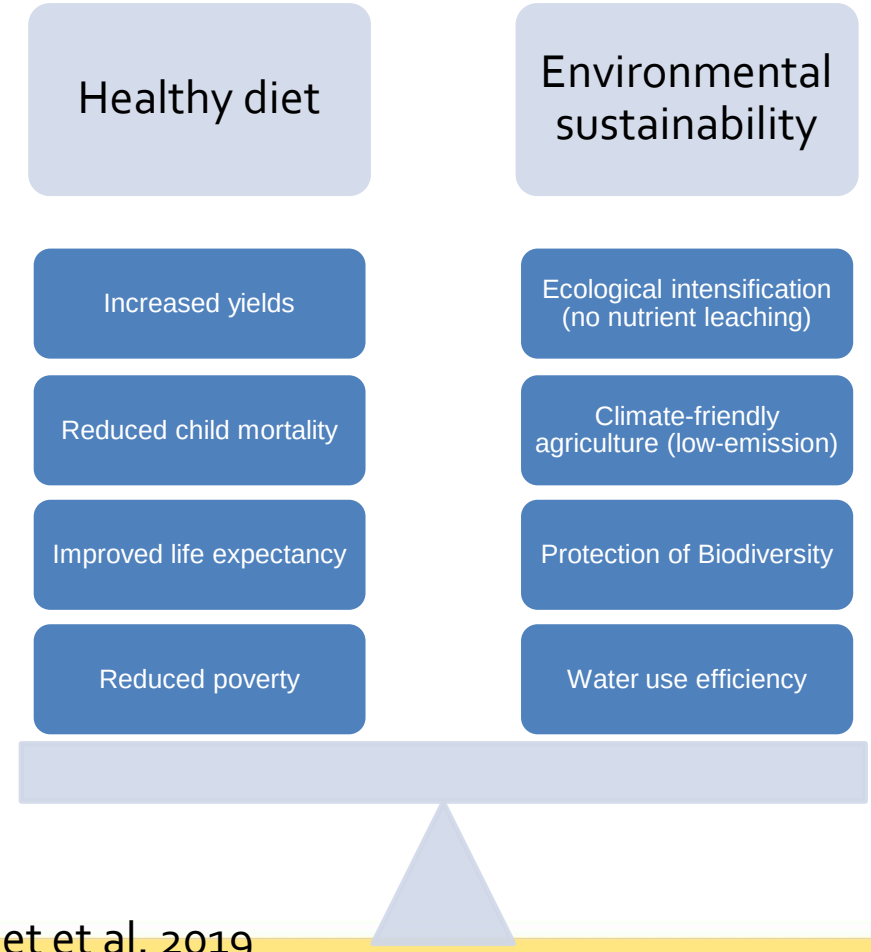
Farmer Researcher



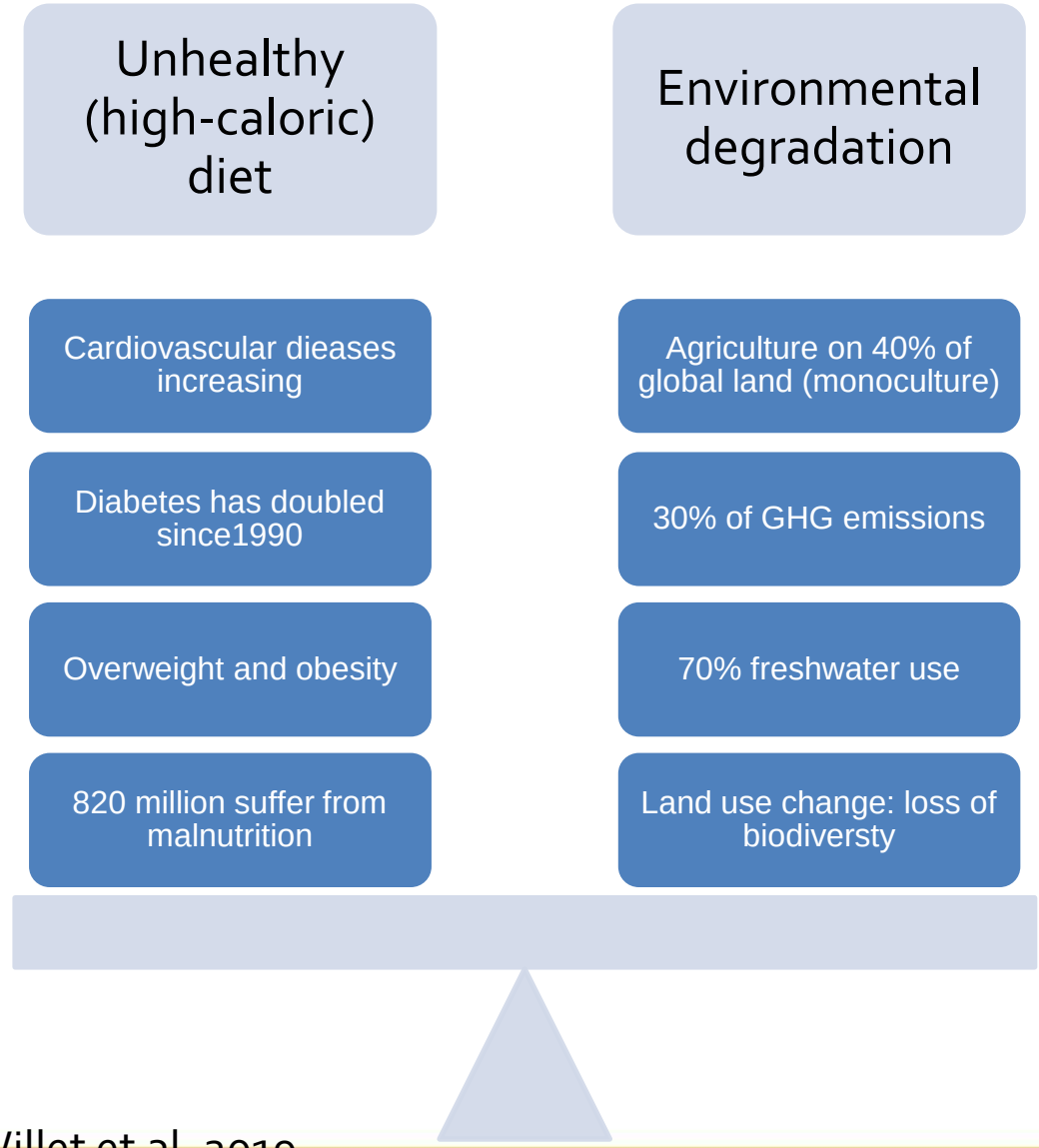
http://jamtani.org/public/vidio/5/craiip-climate-resilience-agriculture-innovation-and-investigation-program

Food security and sustainable agriculture

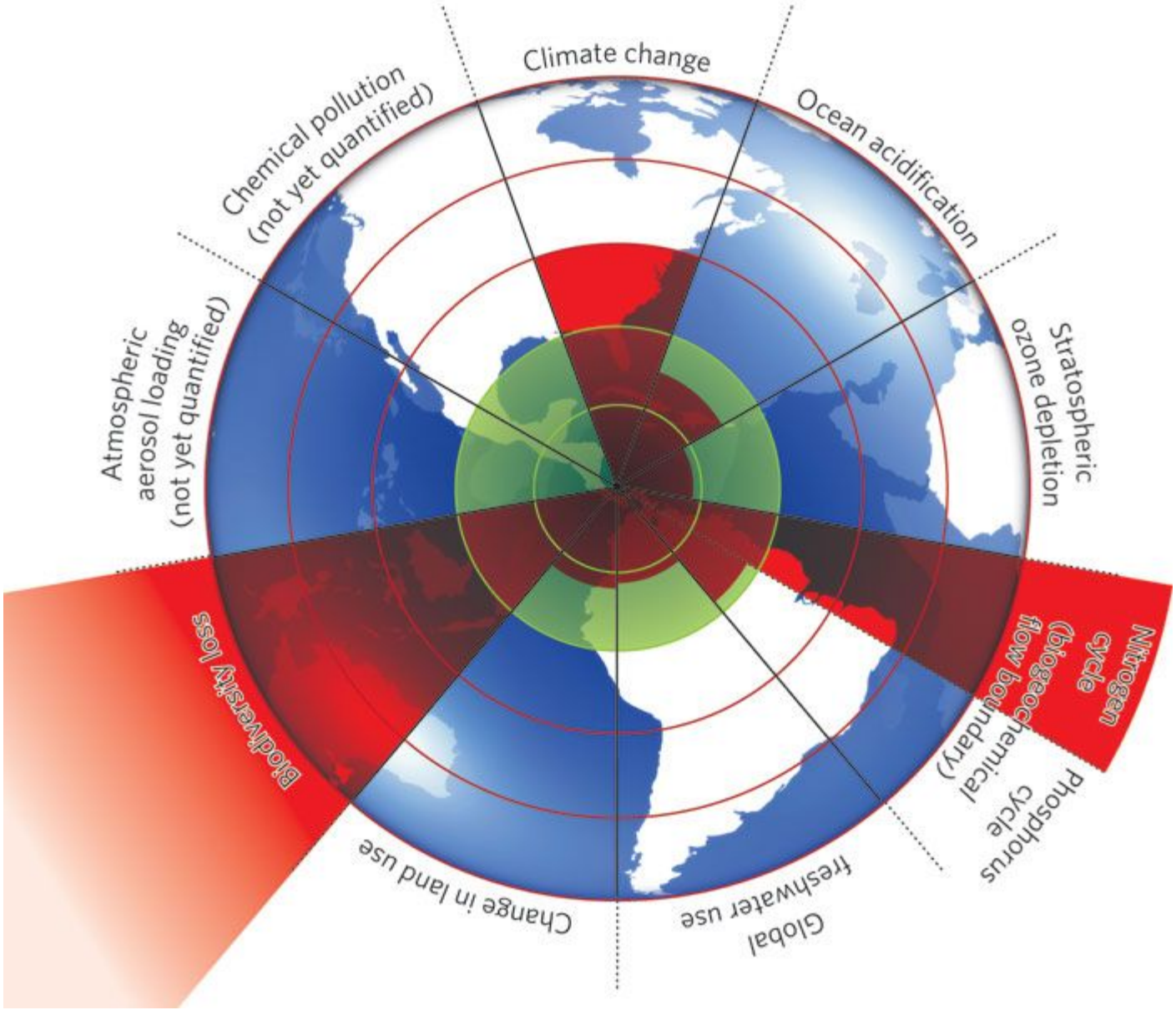
Our food systems contribute to human health and environmental sustainability



Source: data from Willet et al. 2019

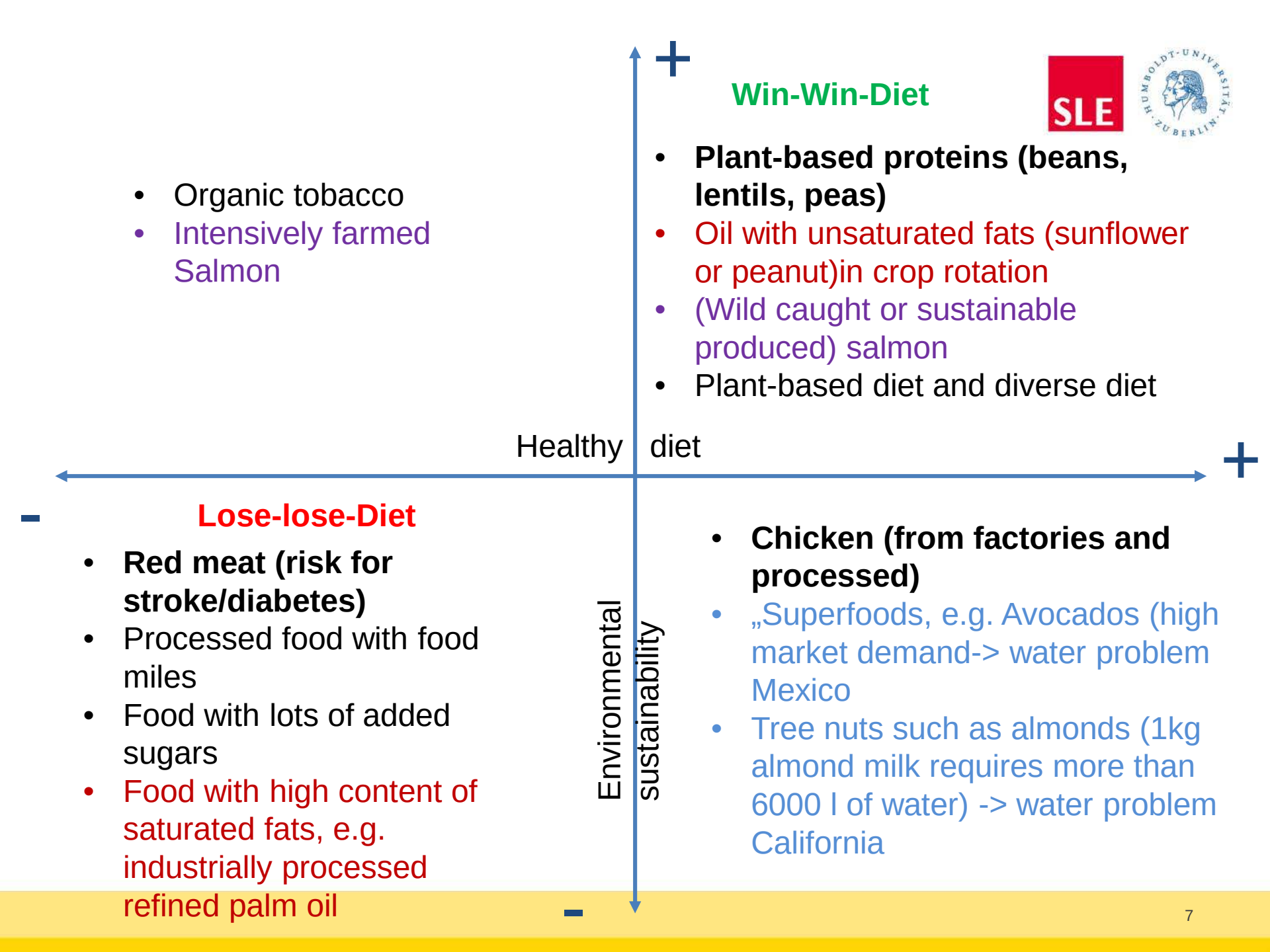


Source: data from Willet et al. 2019

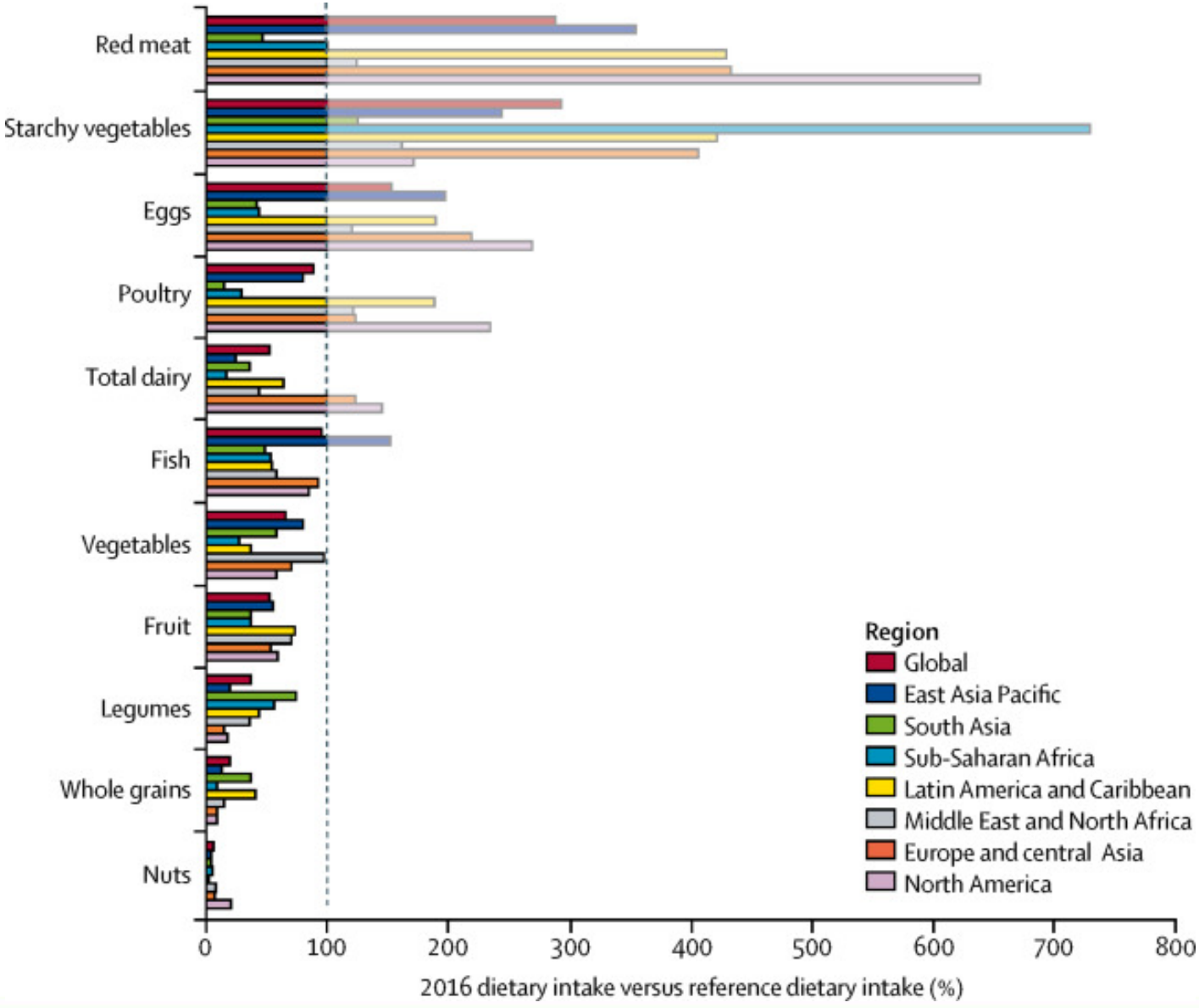


9 planetary boundaries

Source: Röckström et al. 2009: A safe operating space for humanity


+
Win-Win-Diet
• Plant-based proteins (beans, lentils, peas)
• Oil with unsaturated fats (sunflower or peanut)in crop rotation
• (Wild caught or sustainable produced) salmon
• Plant-based diet and diverse diet
• Organic tobacco
• Intensively farmed Salmon
Healthy diet
+
-
Lose-lose-Diet
• Red meat (risk for stroke/diabetes)
• Processed food with food miles
• Food with lots of added sugars
• Food with high content of saturated fats, e.g. industrially processed refined palm oil
Environmental sustainability
• Chicken (from factories and processed)
• „Superfoods, e.g. Avocados (high market demand-> water problem Mexico
• Tree nuts such as almonds (1kg almond milk requires more than 6000 l of water) -> water problem California
-

Healthy diet and food diversity is different and not yet too diverse.



Source: Willet et al. 2019

Sustainable food systems and diversification at all levels

…. on the farm

… in the trade/market

… on the plate

… in the transport/ distribution

Diversification

Sustainable food systems to adapt to climate change

Source: adapted from Cook et al. (2015): 23

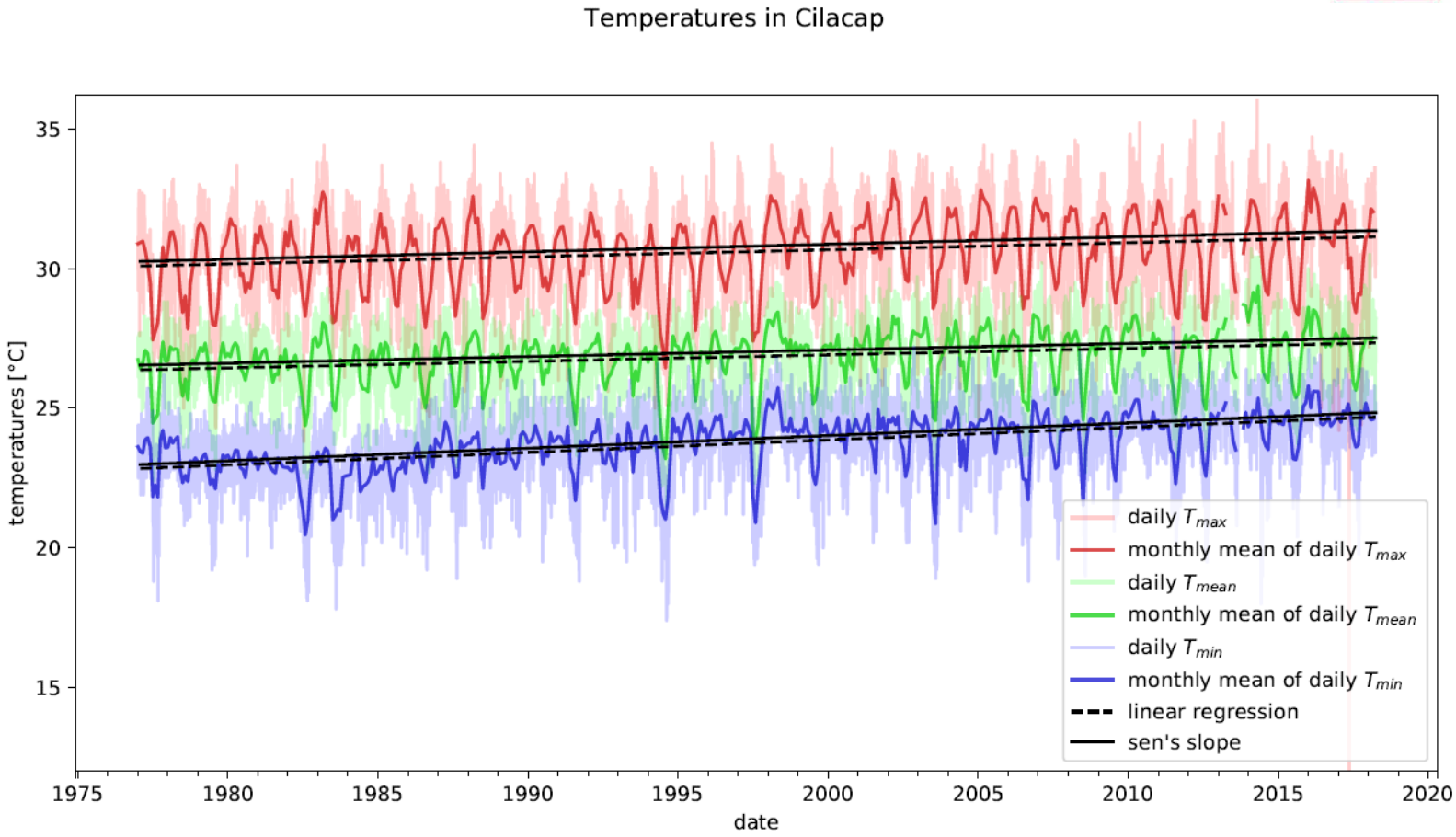
PAKISTAN
Nawabshah, in southern Sindh province, recorded a temperature of 50.2°C on 30 April, a preliminary world temperature record for April.

Two main messages:

- The annual global temperature keeps rising at 0.3°–0.4°C above the 1981–2010 average
- CO2 concentration keeps rising to 407.4 ppm (2.4%)

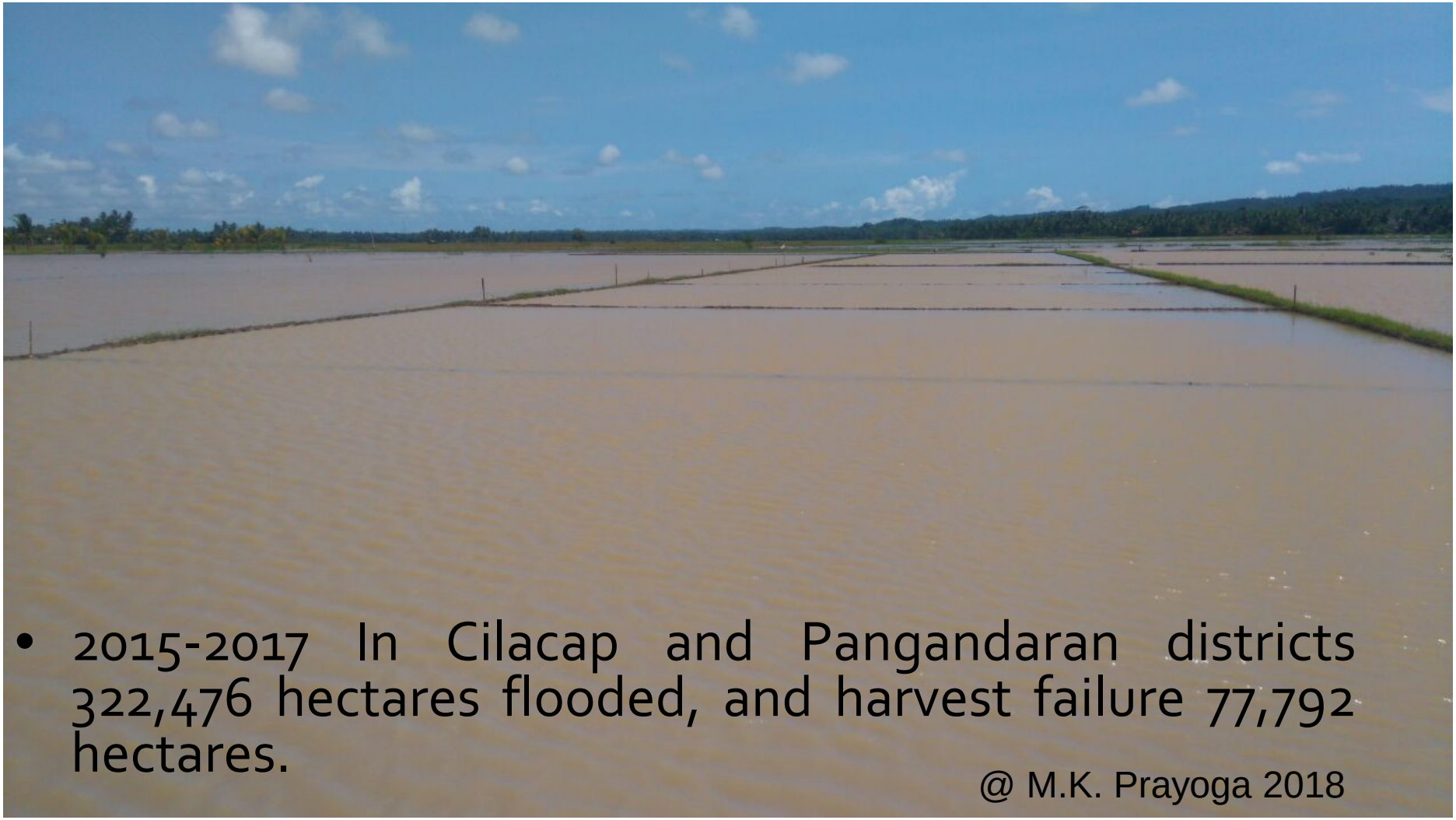
- The annual mean temperature of Indonesia was 26.7°C (+0.5°C above normal).
- On 20 May, the Wajo District of South Sulawesi: a record rainfall of 475 mm in 24 hours.
- East Nusa Tenggara experienced its longest number of consecutive dry days (259) from March to November.
- 82% of 92 stations recorded below normal precipitation. Southern Sumatra, Java, Bali, Nusa Tenggara, northern Sulawesi particular.

2. Climate Data Cilacap - **Temperature**



Increasing day and night time temperatures:
Tmin = +0.044 °C per year
Tmax = +0.025 °C per year
Tmean = +0.023 °C per year

January 2018 : Flooding of rice fields



- 2015-2017 In Cilacap and Pangandaran districts 322,476 hectares flooded, and harvest failure 77,792 hectares.

@ M.K. Prayoga 2018

Innudation, salinity, pH

Observation date	Inundation (cm)	Salinity (dS/m)	pH
05/07/2018	6.6	3.47	4.0
12/07/2018	7.4	2.39	4.3
19/07/2018	2.8	3.03	3.8
26/07/ 2018	5.4	2.85	3.9
02/08/2018	10.8	1.49	4.7
09/08/2018	1.8	2.89	3.8
16/08/2018	3.0	3.48	3.5
23/08/2018	0.0	5.04	3.5
30/08/2018	0.4	7.36	3.4
06/09/2018	0.0	6.02	4.2
13/09/2018	0.0	4.02	5.1

Climate field school

Hight salinity and ion toxicity

Irrigation with saline water (13-15 dS/m

+1 ton/ha dolomit
+0.5 ton/ha husk charcoal
+ Juiced Azolla (Foliar Feeding 70 L/ha)

AFTER TREATMENT

RECOVERY

HARVEST

Source: Rostini et al. 2019

What can a farmer do if the fields are getting more and more saline?

"Saline soil" = EC > 4 dS/m (Soil Science Society of America)
Here: 8 EC

Picture source: http://www.opdemariahoeve.nl/home

Yield and yield component

Varietas	Number of productive tillers	Number of grain per panicle	Percentage of filled grain per panicle (%)	Yield per hectare (ton)
Inpari 34	17.86[a]	124.54[a]	91.07[a]	3.98[b]
Inpari 41	23.26[a]	118.46[a]	86.93[a]	4.28[a]
Palalawan	17.40[a]	119.96[a]	85.88[a]	2.95[c]
Inpara 02	21.71[a]	82.42[b]	89.26[a]	3.08[bc]
Mendawak	23.71[a]	111.62[ab]	86.02[a]	4.32[a]
Average	**20.79**	**118.65**	**87.83**	**3.72**

Note: number followed by the same letter is non significant ($P<0.05$)

Hight yield, less marketable

Good taste, hight yield, easy to sell

Source: Rostini et al. 2019

Saline Potatoes

- Smaller and harder than normal potatoes, yield lower
- Not salty!
- Sea Water is pumped from the sea and sprayed on potatoes

Picture source: own 19.09.2018

Zouttolerante aardappel binnen Regionaal bod Proeftuin Zoet Water

Verslag van het volgen van aardappelrassen onder verschillende zoutregimes gedurende 2 groeiseizoenen

Juni 2017

Auteurs:
Guus Heselmans (Meijer); Perry de Louw (Deltares); Corstiaan Kempenaar (Meijer); Edvard Ahlrichs (Deltares); Inez Terpstra (Meijer); Joost Delsman (Deltares); Sheila Ball (Deltares); Cheryl van Kempen (Deltares); Esther van Baaren (Deltares); Jean-Pierre van Wesemael (Saeftinge Zilt)

Meijer · Deltares Enabling Delta Life · Saeftinghe Zilt · Provincie Zeeland

eration: nce and farmer

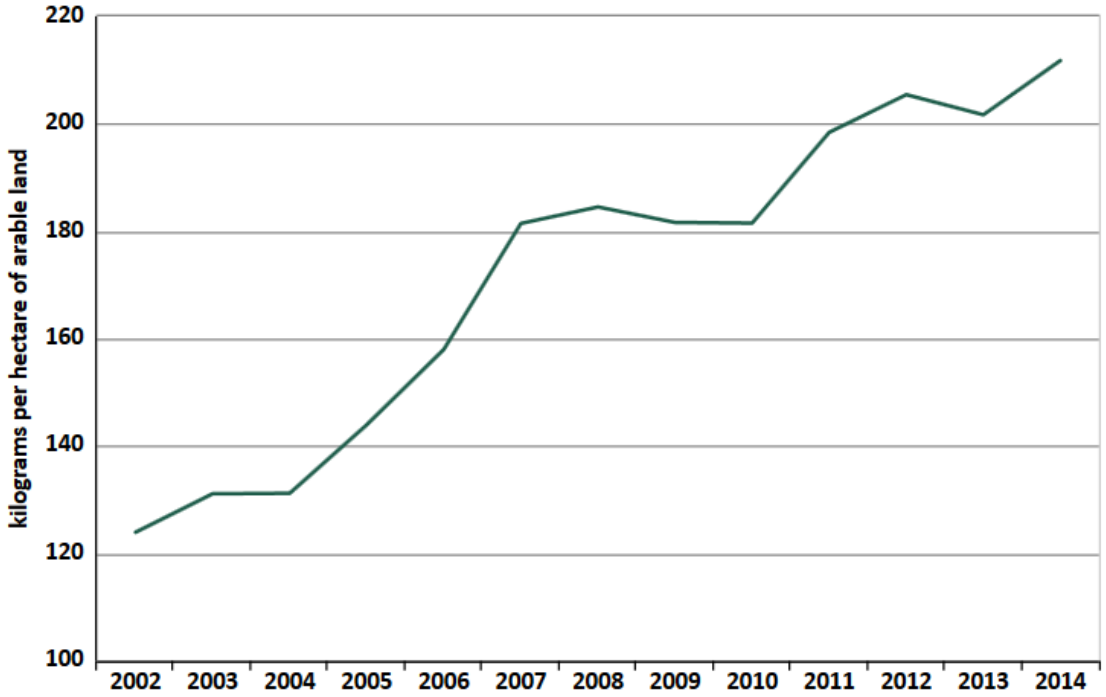
ılatie Z2014-049 in de zoute behandeling en rechts

Healthy soils and better rice productivity?

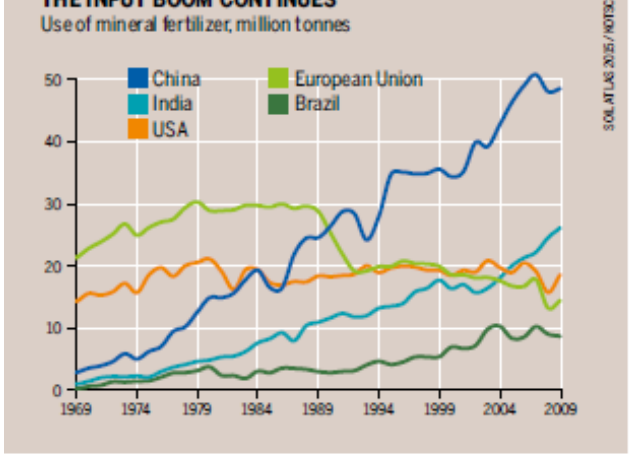
Pictures source: https://regional.kontan.co.id/news/gagal-panen-petani-di-bali-kebingungan

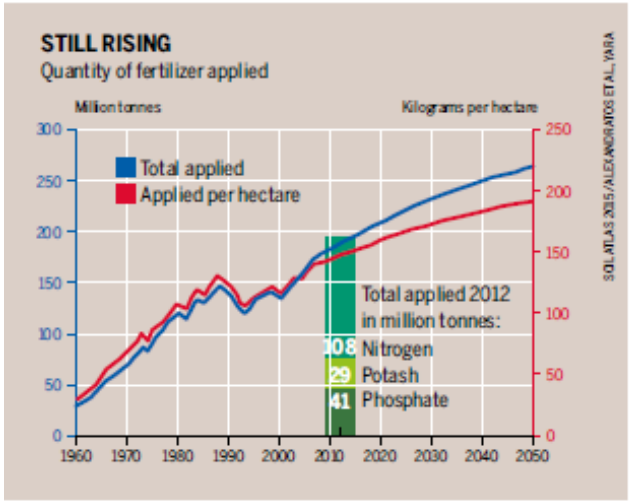
How to intensify on the farm?

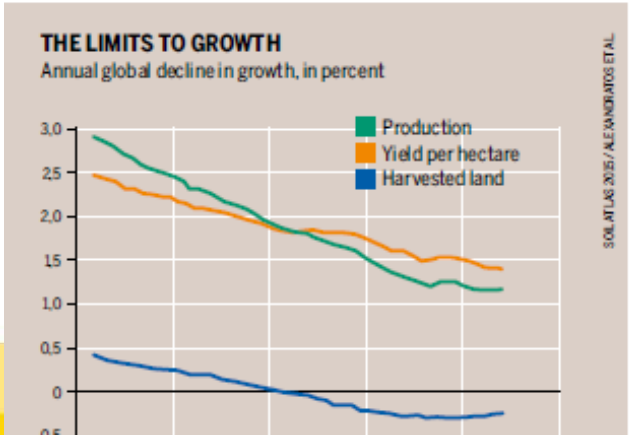
Fertilizer consumption in Indonesia



Source: https://knoema.com/atlas/Indonesia/Fertilizer-consumption



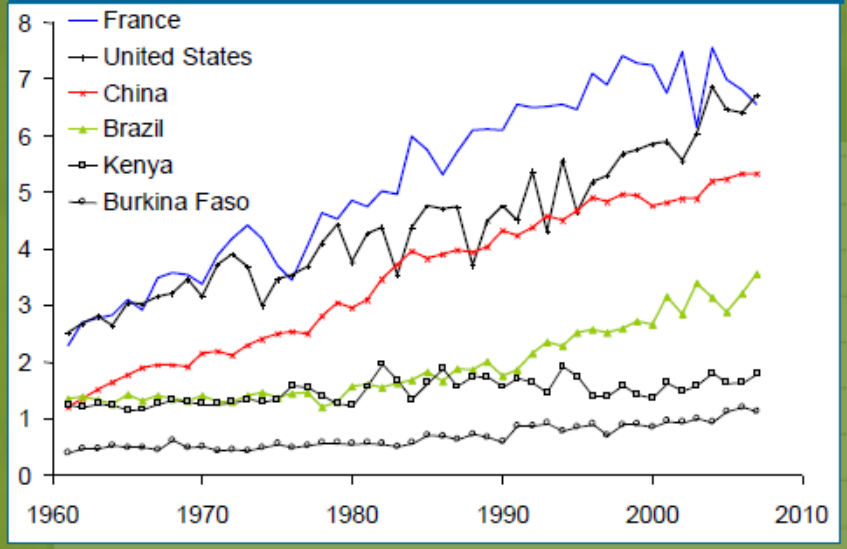




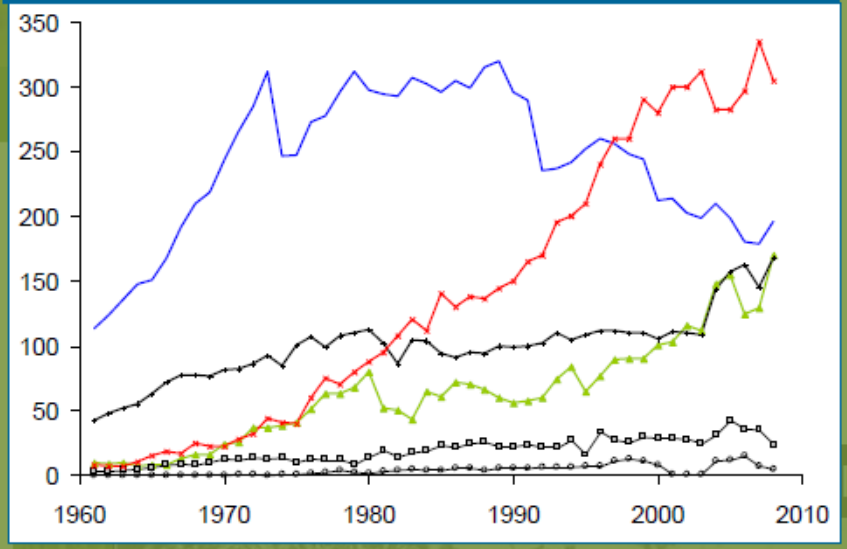
Source: HBS/IASS 2015

The green revolution

Cereal productivity (t ha^{-1} yr^{-1})



Fertiliser use intensity (kg ha^{-1} yr^{-1})



Fertiliser N use efficiency in China (Ju et al., 2009)

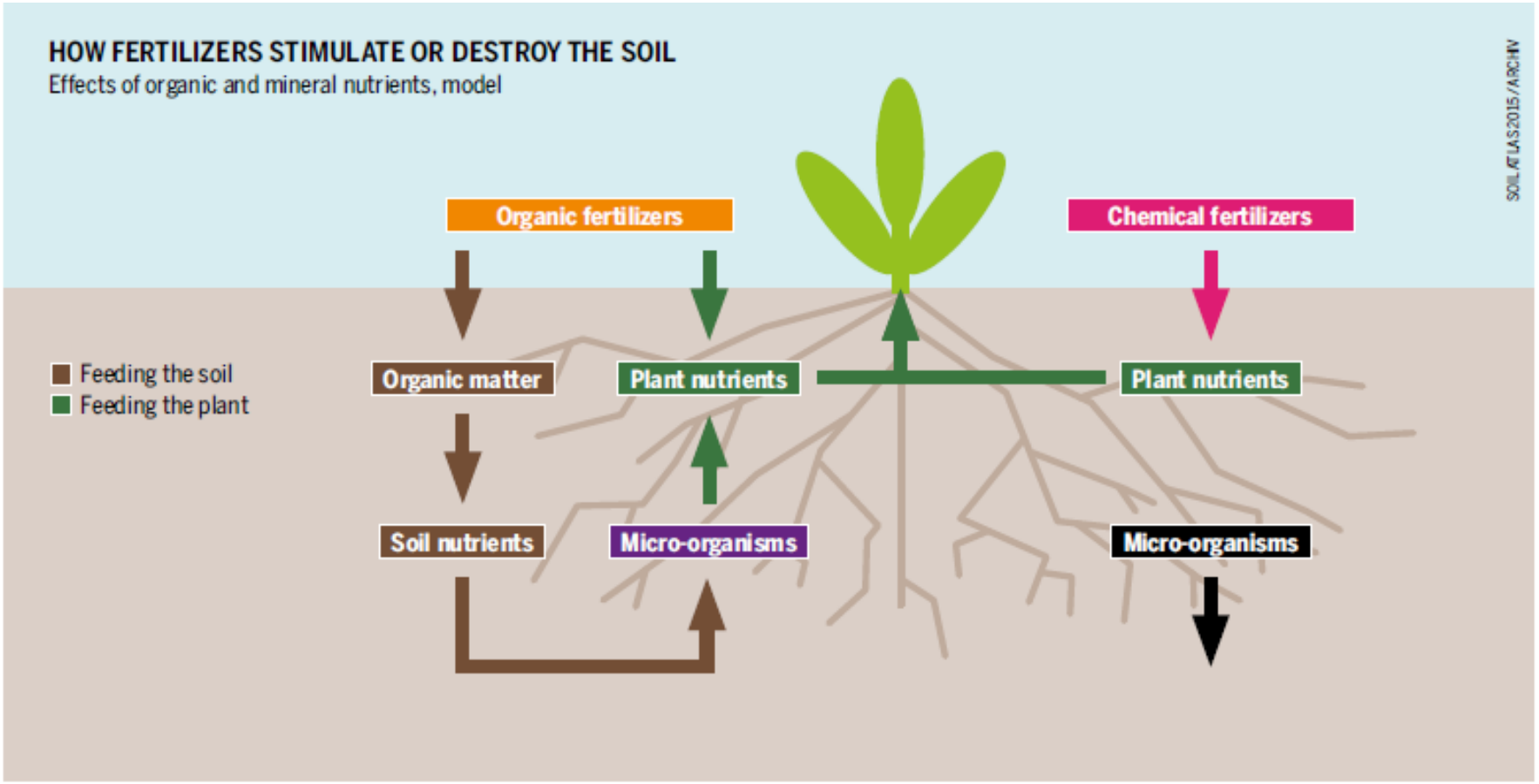
Year	Grain Production (M tonnes)	N fertiliser (M tonnes)	PFP_N (kg/kg)
1977	283	7.07	40.0
2005	484	26.21	18.5
% change	71%	271%	-54%

Source:Tittonell (2013)

STATUS OF SOIL HEALTH (CHEMICAL PROPERTIES) RESEARCH AREA (WEST JAVA)

Location	No. Sample	C-organic (%)	N (%)	P (%)	K (%)
Ciganjeng	S-768	0.53	0.06	4.49	16.07
		VL	VL	VL	L
Ciganjeng	S-769	0.54	0.06	7.13	35.93
		VL	VL	VL	Med
Ciganjeng	S-770	0.76	0.1	4.9	41.92
		VL	VL	VL	High
Ciganjeng	S-771	0.61	0.07	5.92	25.44
		VL	VL	VL	Med
Ciganjeng	S-1056	0.82	0.1	138.59	149.46
		VL	VL	VH	VH

Organic fertilizers



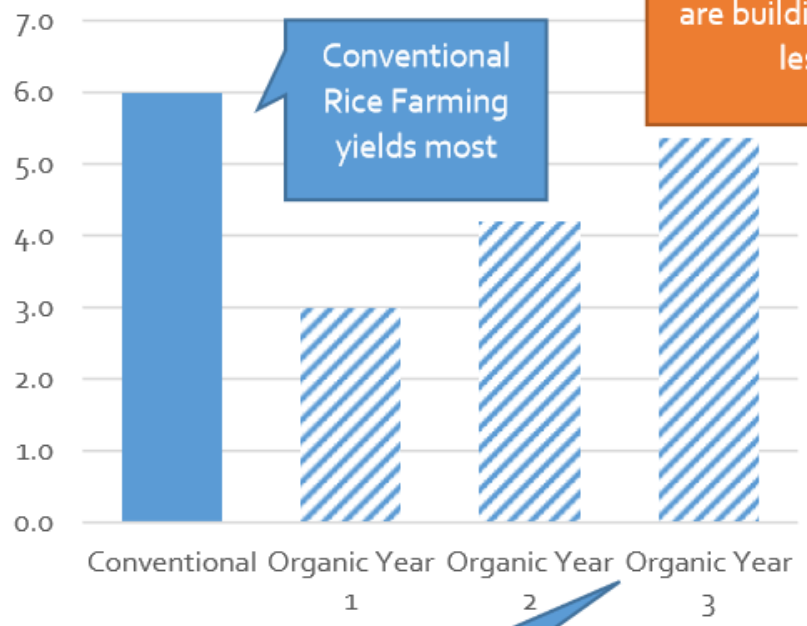
Appropriate Technology

- Soil Ecology health simple analysis/portable lab
- Biochar and organic pesticides
- Azolla for feeding fish and ducks

Climate change matters for us, as it impacts agriculture negatively. The temperature is higher than 15 years ago. It becomes difficult to decide on the right time of land preparation, as the onset of the rainy season is unpredictable. There are ***more pests and diseases and also a higher resistance to pesticides****. Lower yields, high chemical inputs and soil with low fertility and water holding capacity are common.*

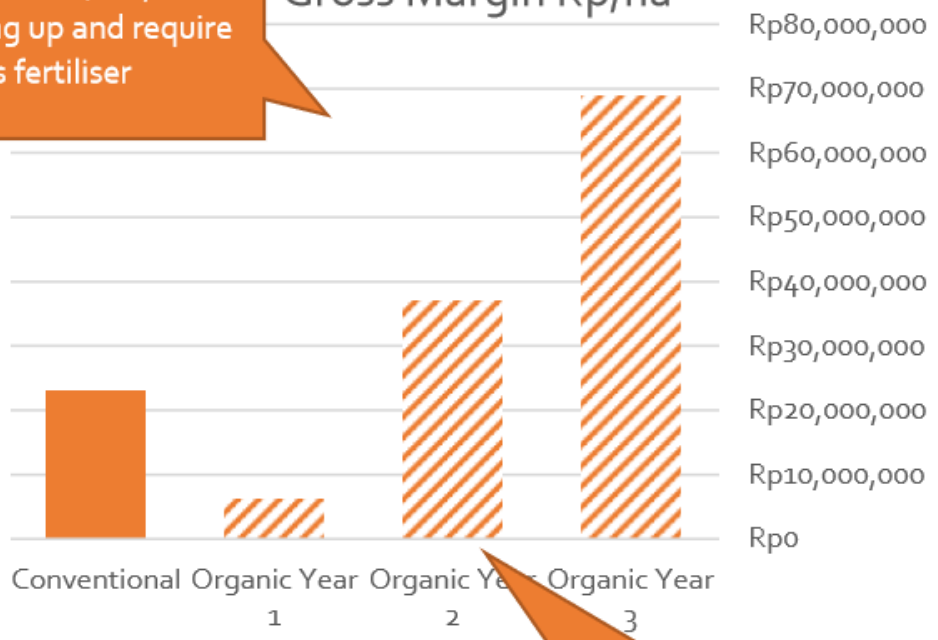
Pak Endi and Ibu Hera,, picture source: own

Economics of Organic Rice Farming + System of Rice Intensification (SRI)



Conventional Rice Farming yields most

Organic Farming gets more profitable, as yields are building up and require less fertiliser



Organic rice almost reaches conventional yield in third year

Prices 2018 (Rp/kg)	Conventional	Organic
White rice	12,000	15,000
Red rice	14,000	25,000
Black rice	15,000	31,000

Organic Rice Farming is more profitable from second year onwards:

Better prices + lower costs through organic fertilising (only labour costs)

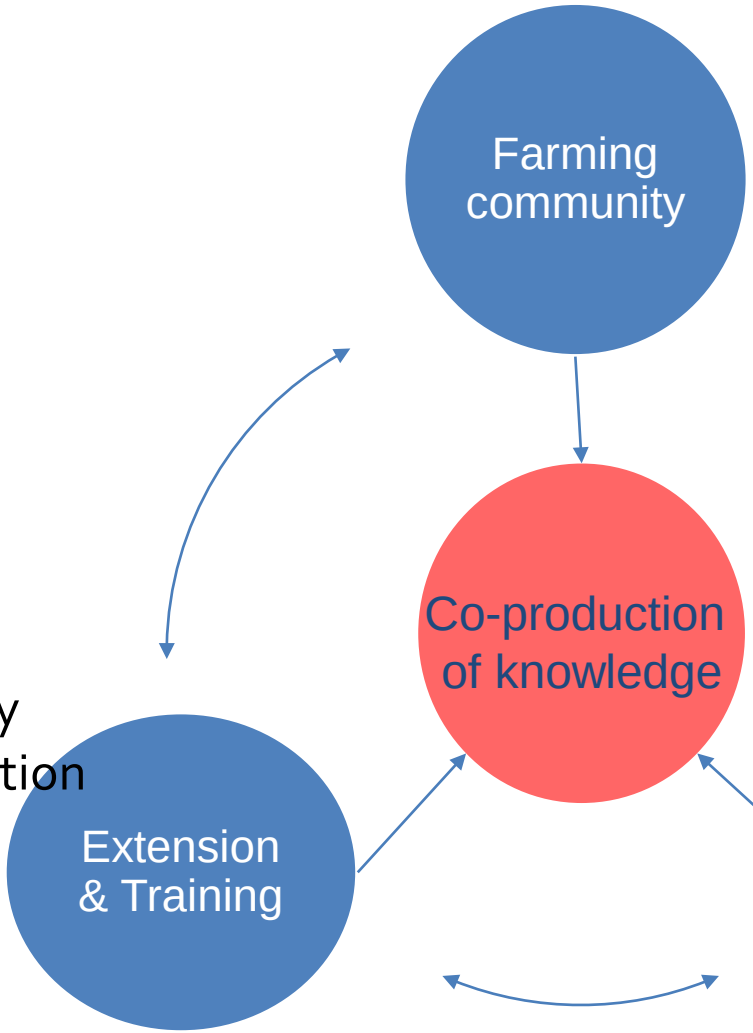
Merging knowledge systems

„Many innovations are done by farmers' hands."

„Before I do agriculture like a blind man, now I can see and understand."

Research farmer from Pangandaran, West Java

Co-production of knowledge approach



- Observation
- Intuitive
- Experience
- Traditional
- Local wisdom

- Facilitation
- Brokerage
- Participatory
- Communication

- International
- Analytical
- Literature
- Methods

Source: SLE 2019

- Climate Field School
- Research farmers


INPARA 02
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Academia and farmer in the field

Innovation in agriculture

- **Food is the basis of economic development**

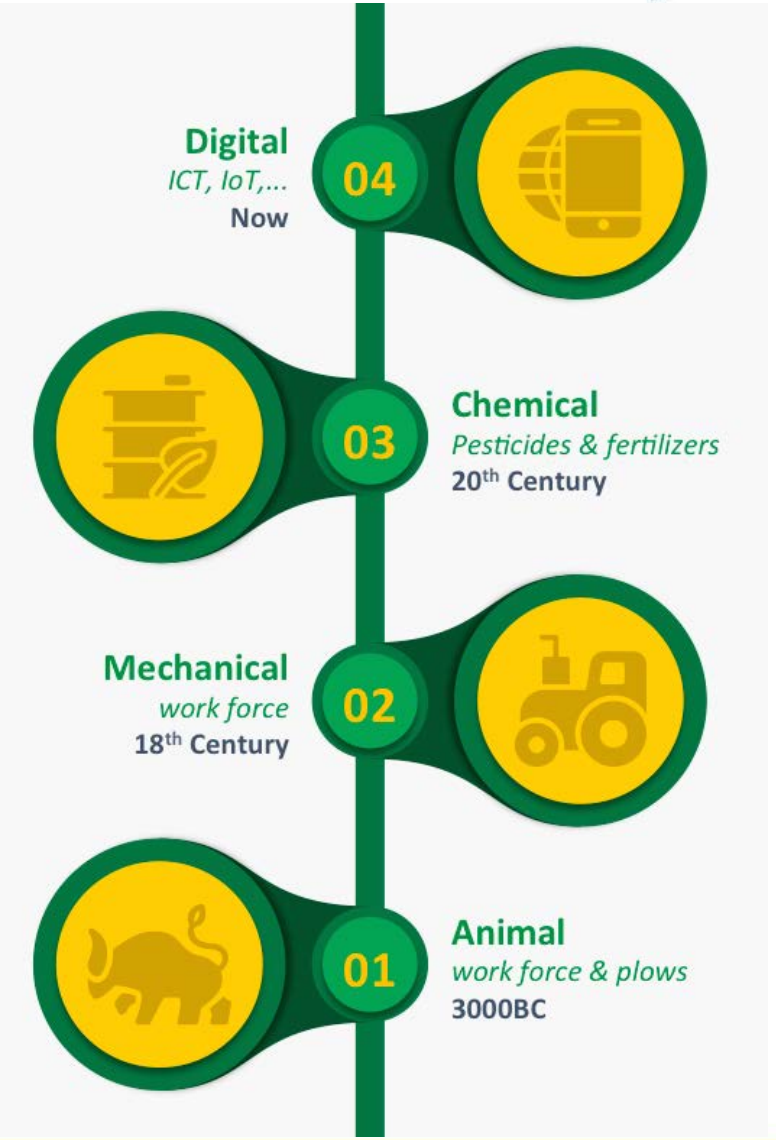
"Being able to gather, produce or trade food in sufficient quantity and quality allowed civilization to flourish"

- **Population growth + resource decline + climate change + urbanisation puts pressure but is a chance to develop**

A sustainable global food system

While diffusion of technologies uneven

Digital = knowledge revolution to capture, measure, analyse, diagnose



Source: slide courtesy J Henze 2018

Origin of agriculture **10.000 BC**

Camera

Smartphone

Notebook

- **Keep listening and connecting farmers and academia**

Thank you

Terima kasih

Kurre sumanga'

Hatur nuhun