

# The Economic Advantage: assessing the value of climate change actions in agriculture



RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



Sonja Vermeulen, Meryl Richards, Alessandro De Pinto, Dino Ferrarese, Peter Läderach, Le Lan, Marty Luckert, Enrico Mazzoli, Laura Plant, Roberto Rinaldi, Jim Stephenson, Paul Watkiss



## Agriculture is a priority for the vast majority of parties to the UNFCCC



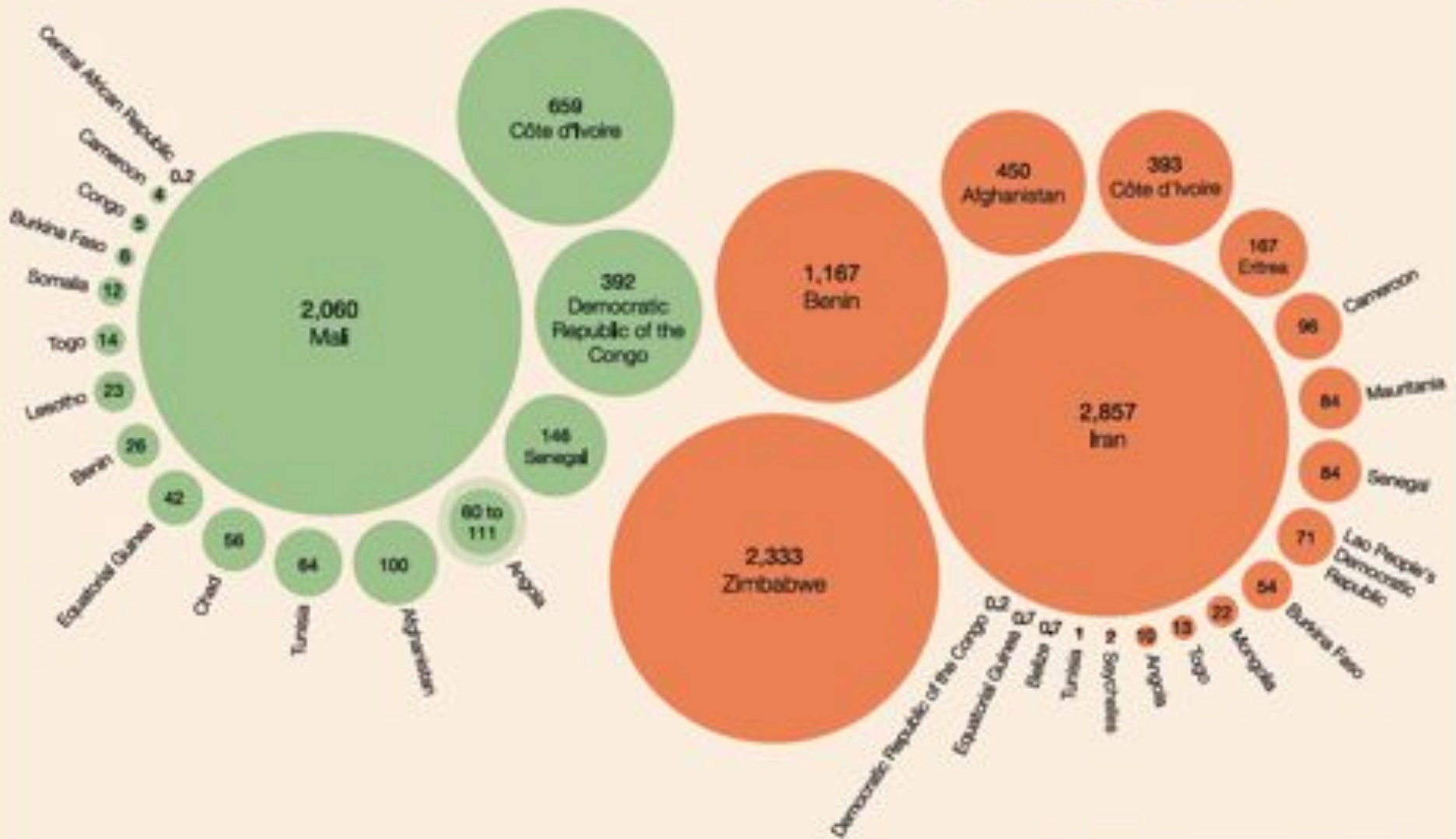
- Mitigation target and adaptation priorities include agriculture
- Mitigation target includes agriculture
- Adaptation priorities include agriculture
- INDC does not cover agriculture
- No INDC

Source: Adapted from Richards et al. 2016

# Huge diversity among INDC cost estimates

Costs per year (agriculture), US\$m

Mitigation (Green) Adaptation (Orange)



Source: Adapted from Richards et al. 2015



new ex-ante research

new empirical research



+ literature review of existing economic & financial studies



## Costs of climate change to agriculture: two topical examples

global



Photo: Mike Hutchings/Reuters

Wine industry yield losses due to El Nino in 2016:  
Chile -21%, losing US\$ 250 billion  
Argentina -35%  
South Africa -19%  
Major job losses expected

El Nino to double in frequency  
(Cai et al 2014 Nature)

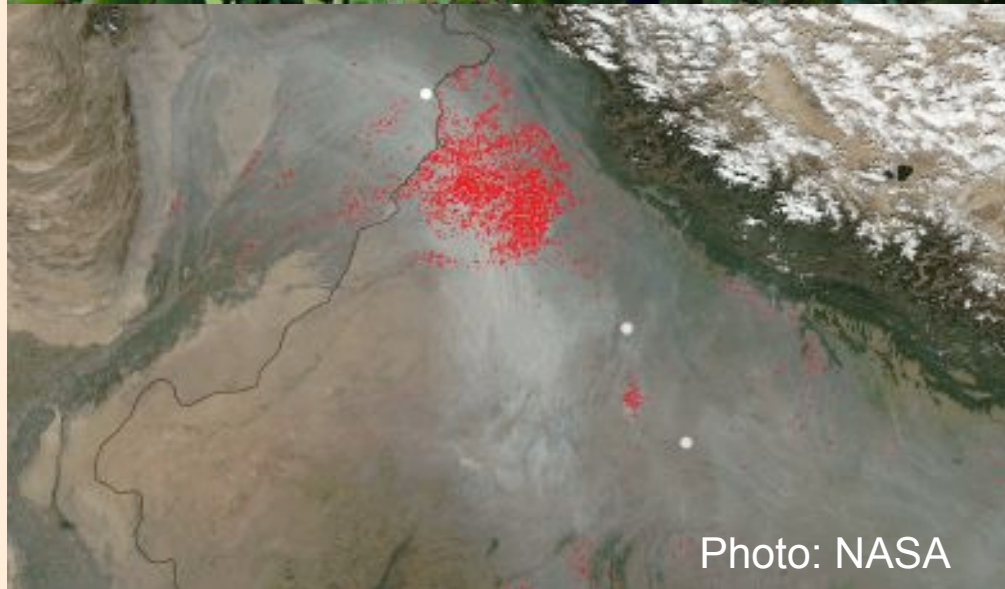


Photo: NASA

Wider socio-economic costs:  
Current straw/stubble burning  
in Punjab  
Major contributor to Delhi air  
pollution  
Major health issues  
1800 schools closed

Positive benefit-to-cost ratios across a wide range of ASAP geographies and types of investment (*ex ante*)

global



32 ASAP generate a mean net present value of US\$6.8 million

- Latin America and the Caribbean (LAC)
- East and Southern Africa (ESA)
- West Central Africa (WCA)
- Asia and the Pacific (APF)
- Near East and North Africa (NEN)

Source: Adapted from Ferrasse et al. 2010

global

Investments robust across a range of possible future climates

Probable climate impacts on crop production under long-term climate scenarios

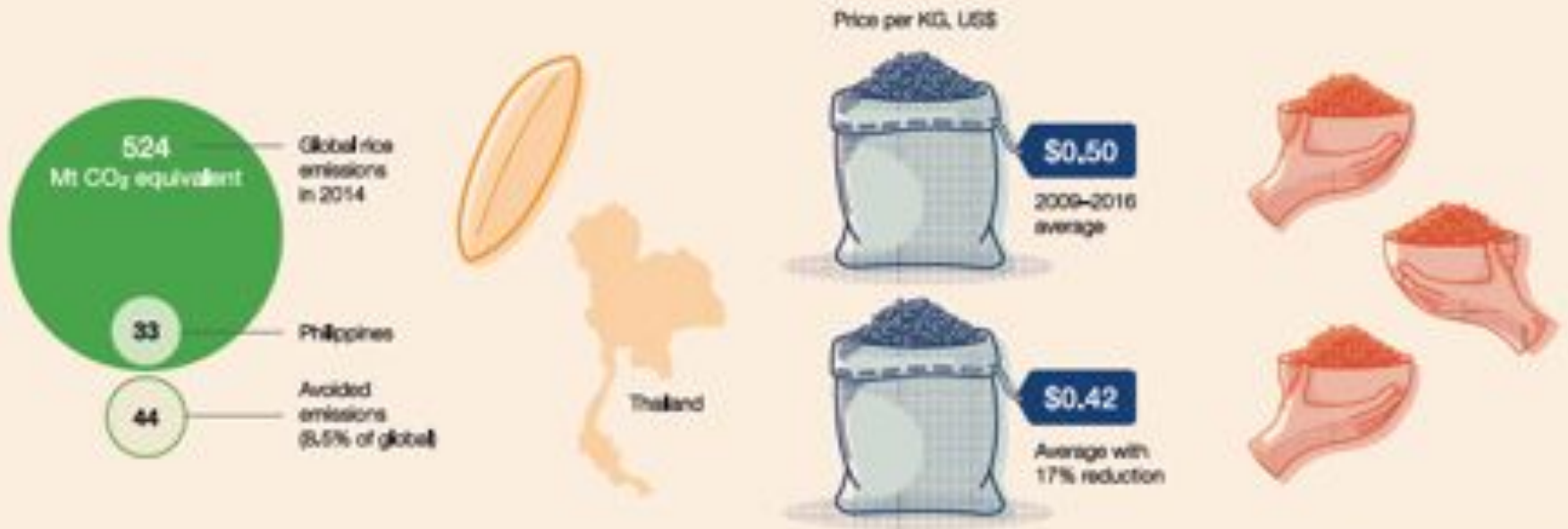
Light = no change  
Dark = high



Source: Adapted from Ferrisee et al. 2016

# Socio-economic benefits of new climate technologies in global rice production

global

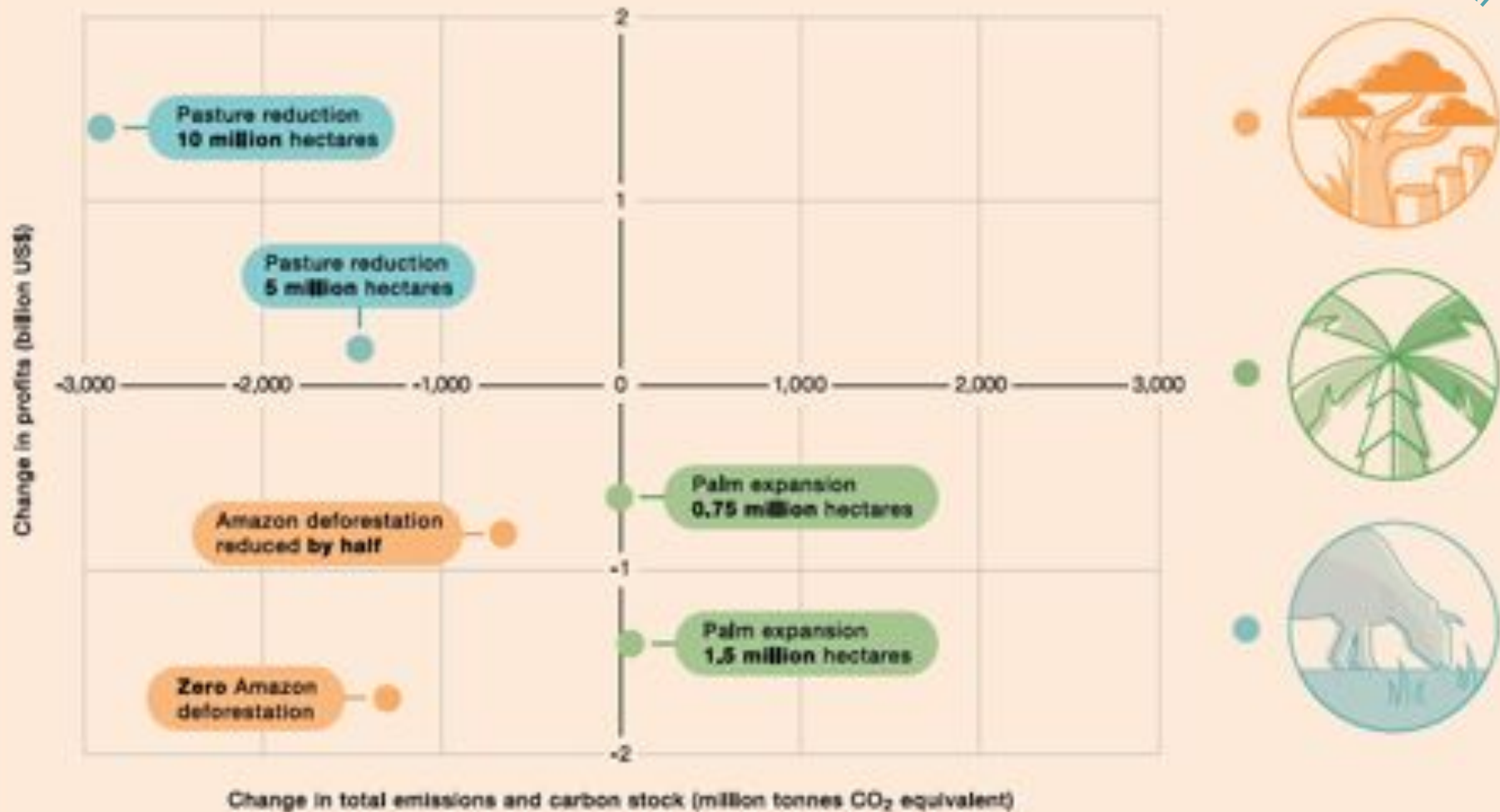


Source: IFPRI (in process)



# Financial assessment to help difficult choices among options for investment at the national level

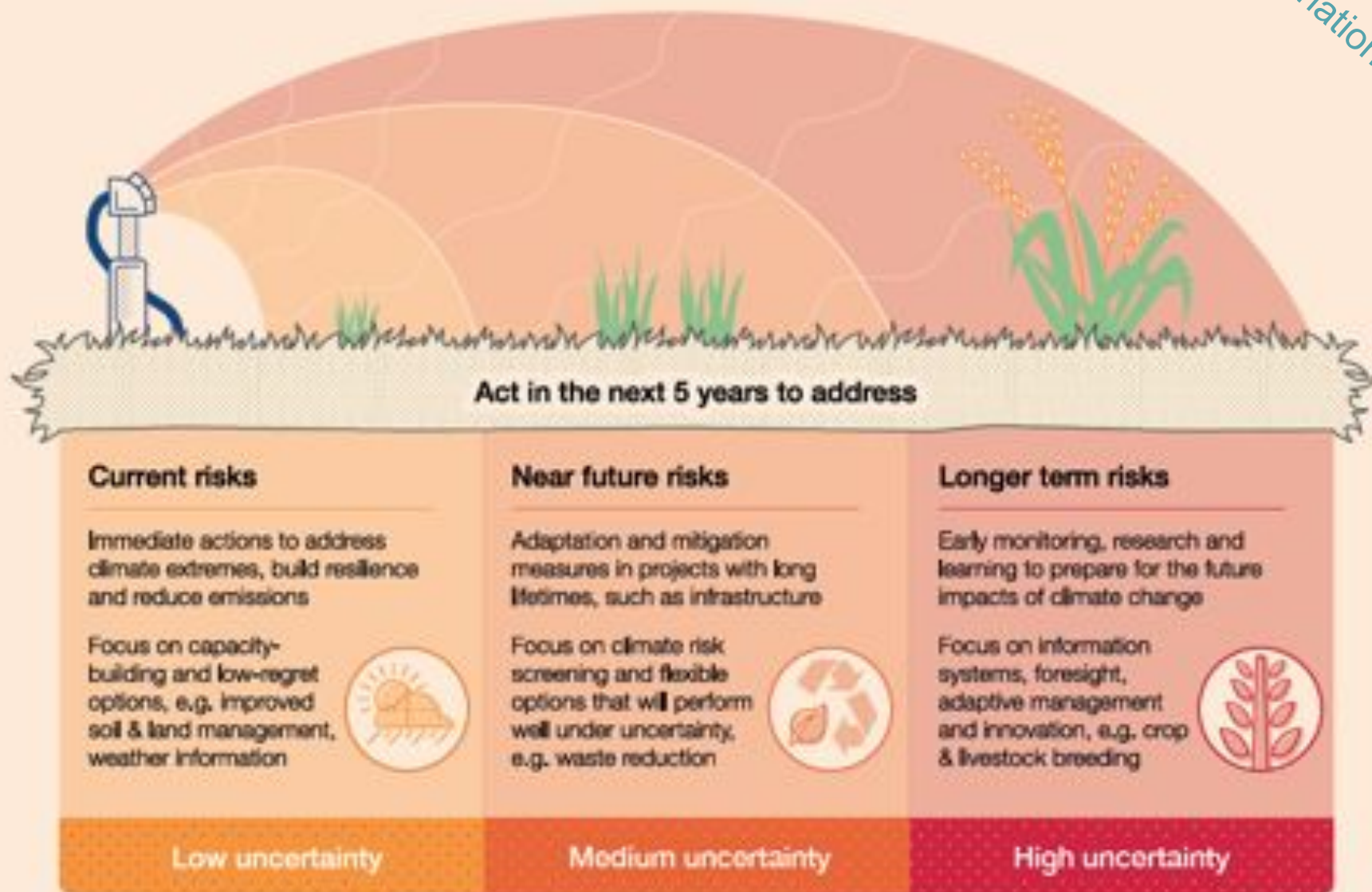
national



Source: Adapted from De Pinto et al. 2016

# Economic assessment can provide information at three key timeframes for NDCs, NAPs & other policy instruments

national

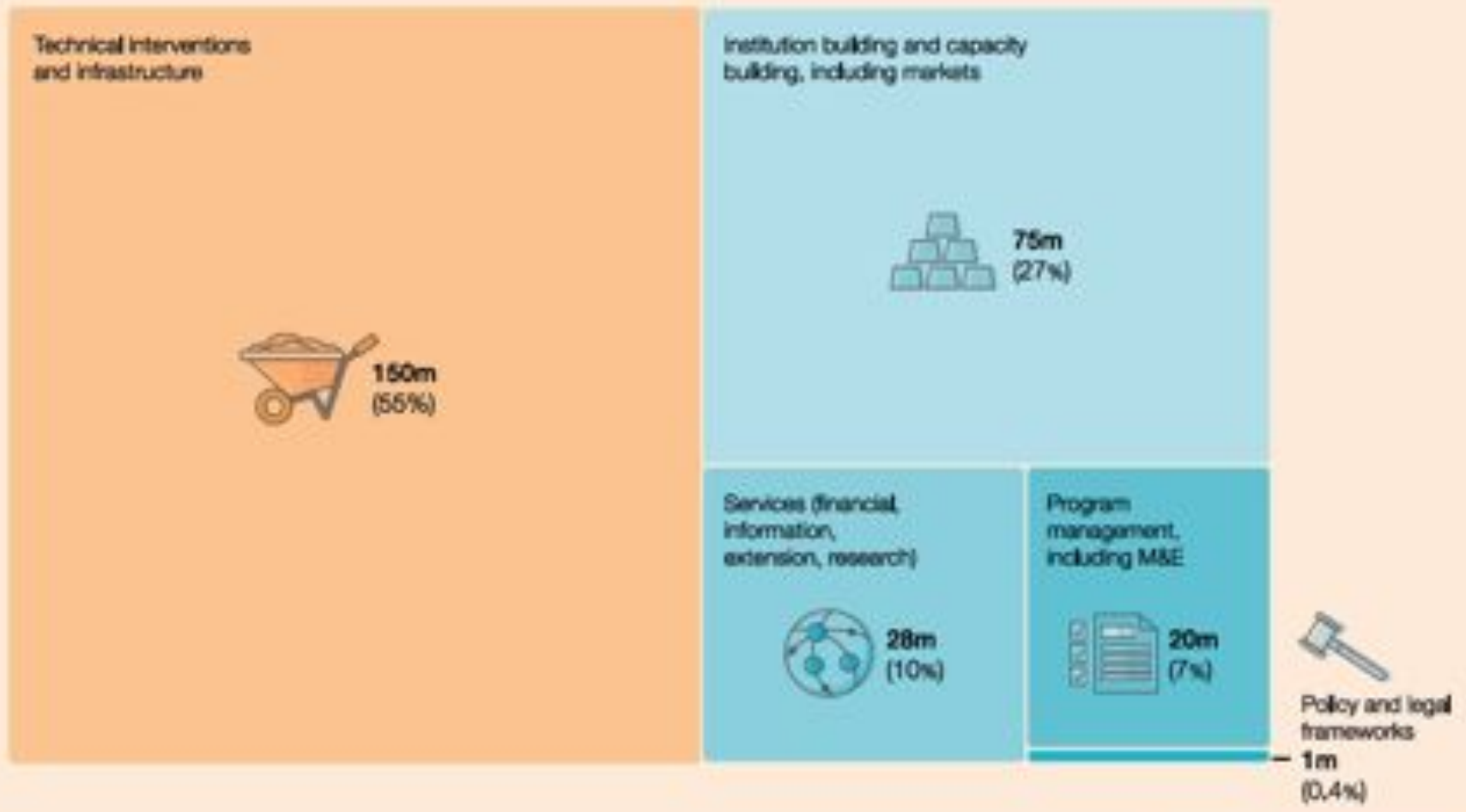


Source: Watkins 2015

project

**ASAP economic cost (US\$)**  
(Proportion of total economic cost)

Actions on institutions, capacity, services & management form an important component of costs



Source: Adapted from Watkins 2015

e.g. Climate information services

project



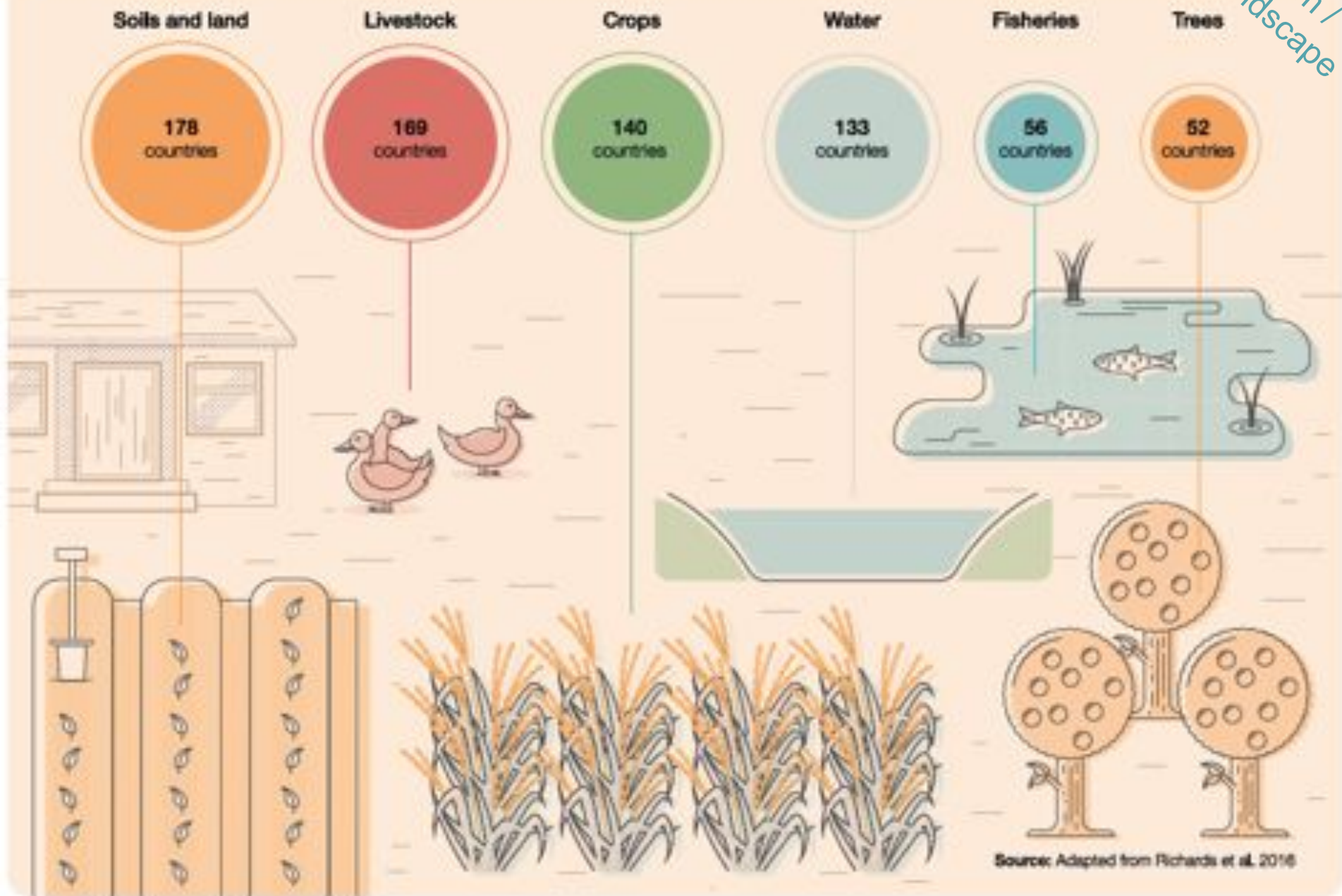
Photo: Vanessa Meadu

- Benefit-to-cost ratios for national hydro-meteorological services are positive in all reviewed cases globally
- Benefit-to-cost ratios of 4:1 to 36:1 at national level
- Household-level benefit-to-cost ratios are also positive

(WMO 2015)

# Clear sub-sectoral priorities for action at the farm level in NDCs

*farm /  
landscape*



## Summary tables for each agricultural sub-sector

Many practices deliver positive benefit-to-cost ratios and net present value

The value of any practice is context-specific – and time-specific

*farm /  
landscape*

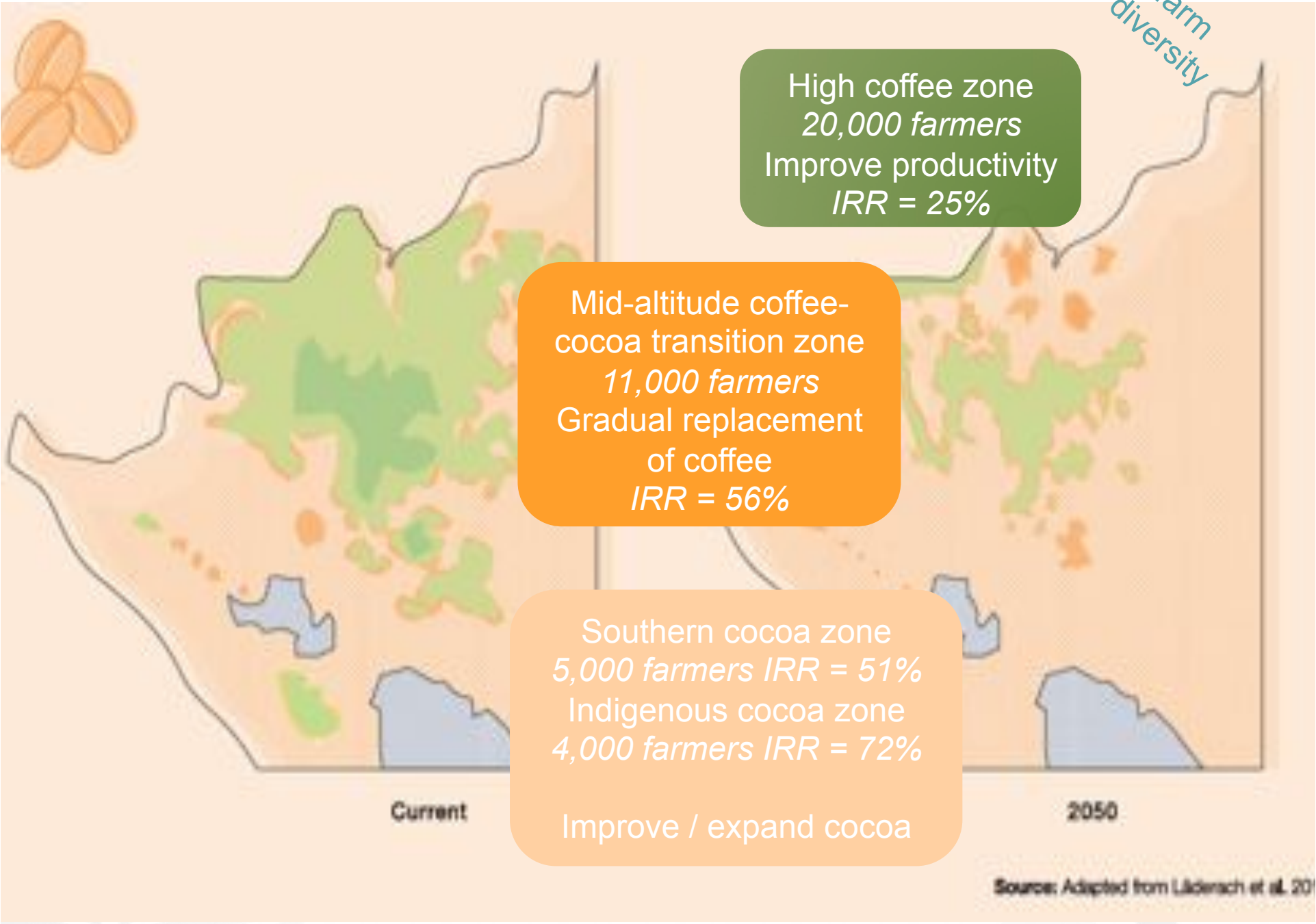
Practices	Adaptation	Mitigation	Economics	Time frame	Factors influencing distribution of benefits
Tillage and residue management	Improves soil structure and fertility. Reduces the negative yield effects of rainfall variability.	Combining no-till with residue retention increases the potential for carbon accumulation in soils.	Evidence on the profitability of tillage and residue management is mixed.	Long-term.	May have higher chance of profitability in mechanised cereal agriculture (e.g. in Indo-Gangetic Plain) due to decreased tillage costs. Profitability in non-mechanised systems depends on cost of labor and competition for crop residue. May shift labour burdens between women and men.
Improved pasture (irrigation, planting leguminous or improved species, fertilization)	Improved ecological functioning allows pastures and rangelands to continue supporting livestock even with variable or extreme weather.	Enhances carbon storage.	Generally profitable for market-oriented farmers.	Long-term. More likely to provide early economic benefits to farmers when are combined with other productivity-enhancing practices.	Livestock are often owned or controlled by men, so care must be taken to ensure benefits accrue equitably. Farmers with small herds may bear higher opportunity costs than those with medium and large herds.

farm  
diversity

High coffee zone  
20,000 farmers  
Improve productivity  
IRR = 25%

Mid-altitude coffee-  
cocoa transition zone  
11,000 farmers  
Gradual replacement  
of coffee  
IRR = 56%

Southern cocoa zone  
5,000 farmers IRR = 51%  
Indigenous cocoa zone  
4,000 farmers IRR = 72%  
Improve / expand cocoa



Current

2050

Source: Adapted from Läderach et al. 2017

Studies on farmers' behaviours can help devise the right targeting & incentives

e.g. ASAP in Viet Nam

farmer  
behaviour



All farmers agree that this is a good idea

But for higher-income farmers:

- initial cost is a small proportion of annual income
- but may have less interest given that rice is only 10% of income

While for lower-income farmers:

- initial cost is 67% of annual income
- but attractive under extreme climate conditions for rice  
(if financial support were available)



farmer  
behaviour

### Significant marginal effects at 10% level

- Positive effects
- Negative effects
- Not significant



Despite context-specificity, there may be some fairly universal drivers & incentives

# Economic & financial assessments are tools to support decision-making

*national*

Some useful ingredients are:

mainstreaming across development and climate

near-, medium-, long-term actions

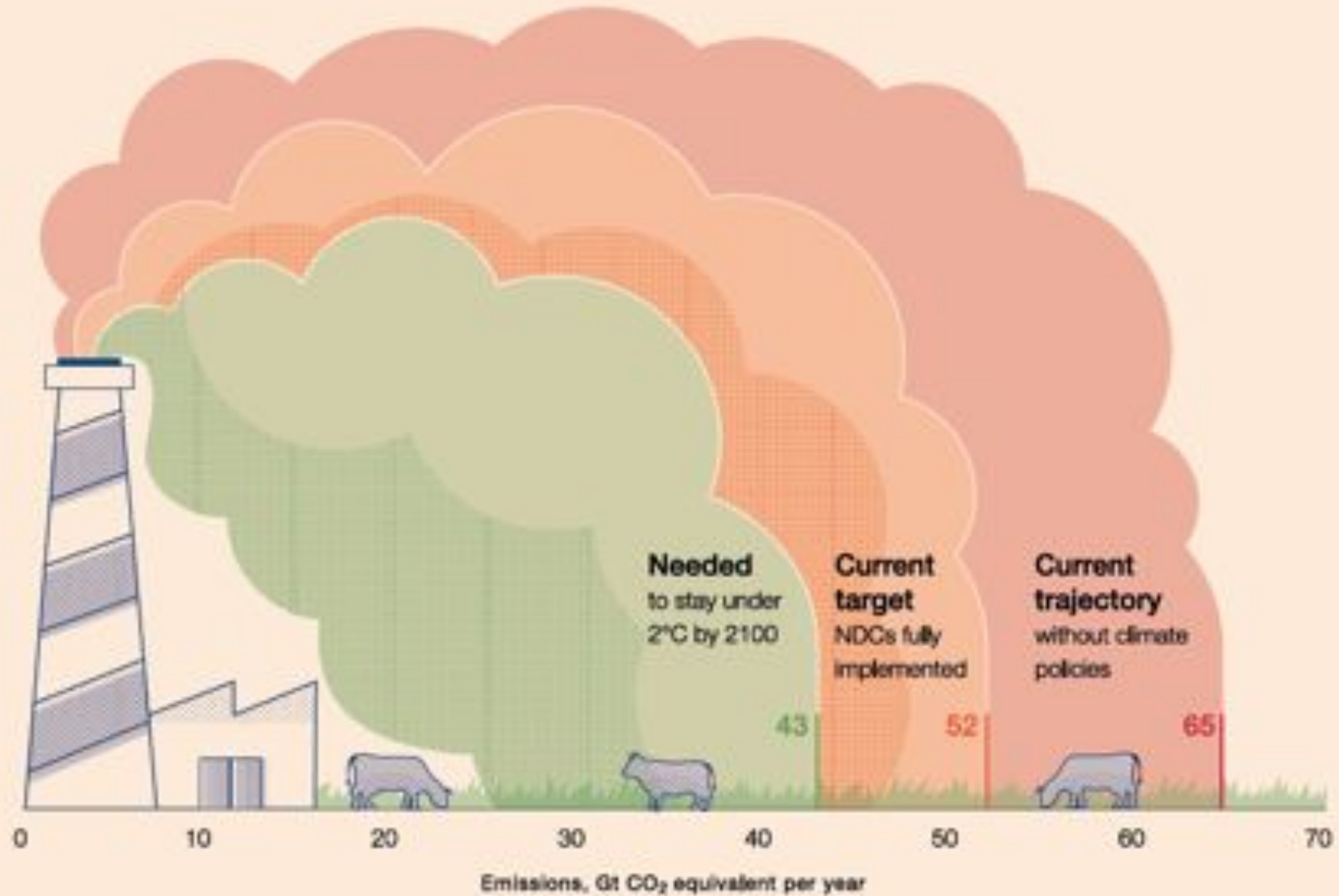
both project-level & farmer-level actions, costs & benefits

analysis of distribution, behaviours & incentives

theory of change  
(to help keep it simple)

NDCs will need ratcheting up to meet global targets for emissions reductions, creating new opportunities & challenges for agriculture

NDCs



Source: Adapted from Rogelj et al. 2018

Robust development policies  
& ambitious NDCs  
can strengthen each other

NDCs



# Thank you

Download the full report:  
[bit.ly/EconomicAdvantage](http://bit.ly/EconomicAdvantage)

