FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

AGRILINKS

Sustainable Food Systems: How Better Natural Resources Management Leads to Better Food Security

Speakers: *Sara Scherr, EcoAgriculture Partners*

Faisal Hossain, University of Washington

Pete Pearson, World Wildlife Fund

Moderator: *Julie MacCartee, USAID Bureau for Food Security*

Date: January 29, 2020

Sara Scherr, EcoAgriculture Partners

Dr. Sara J. Scherr, an agricultural and resource economist, is a prominent voice globally in promoting restoration of degraded lands. She founded the non-profit EcoAgriculture Partners in 2002 to promote locally-led transformation of agricultural landscapes for food security, rural livelihoods and ecosystem services. A leading innovator in agricultural landscape analysis, planning, policy, and finance she has supported landscape partnerships in Africa, Latin America, Asia and U.S.; and advised landscape programs world-wide. Her research is widely published in scientific and policy literatures. She previously served as Director of Ecosystem Services at the non-profit Forest Trends, senior researcher at the International Food Policy Research Institute (IFPRI), adjunct professor at Univ. of Maryland, and principal researcher and later Board member of the World Agroforestry Centre (ICRAF). She served on the Millennium Project's Hunger Task Force to develop strategies to halve the incidence of hunger worldwide.

Pete Pearson, World Wildlife Fund

Pete Pearson is the Senior Director of Food Loss and Waste at World Wildlife Fund (WWF), helping businesses and communities understand agriculture's impact on wildlife and habitat conservation. Pete has 10 years of technology and grocery retail experience with companies including Hewlett-Packard, Accenture and Albertsons; has worked with public schools and hospitals as a sustainability and zero waste consultant, co-founded a sustainable agriculture non-profit in Idaho, and co-produced a documentary film on local and regenerative agriculture (www.ToLiveLocal.com). Pete currently lives in Washington DC and enjoys fly fishing, sailing, skiing, and exploring the outdoors with his family.

Faisal Hossain, University of Washington

Faisal Hossain received his Ph.D. from The University of Connecticut in 2004, his M.S (1999) and B.S (1996) from The National University of Singapore and Indian Institute of Technology, Varanasi, respectively. His research interests are hydrologic remote sensing, sustainable water resources engineering, transboundary water resources management and engineering education. He is the recipient of awards such as NASA New Investigator Award (2008), American Society of Engineering Education (ASEE) Outstanding Research Award (2009), US Fulbright Faculty Award (2012), G.O.L.D. (Graduate Of the Last Decade) award from University of Connecticut (2012), American Geophysical Union (AGU) Charles Falkenberg Award (2012), American Meteorological Society Editor's Award (2015) and ASCE Walter Huber Award (2015).

Transforming Landscapes to Achieve Food Security and the SDGs

Sara J. Scherr, EcoAgriculture Partners

Sustainablel Food Systems: AgriLinks Webinar, January 29, 2020

ecoagriculturepartners

Food Security depends on achieving all of the Sustainable Development Goals

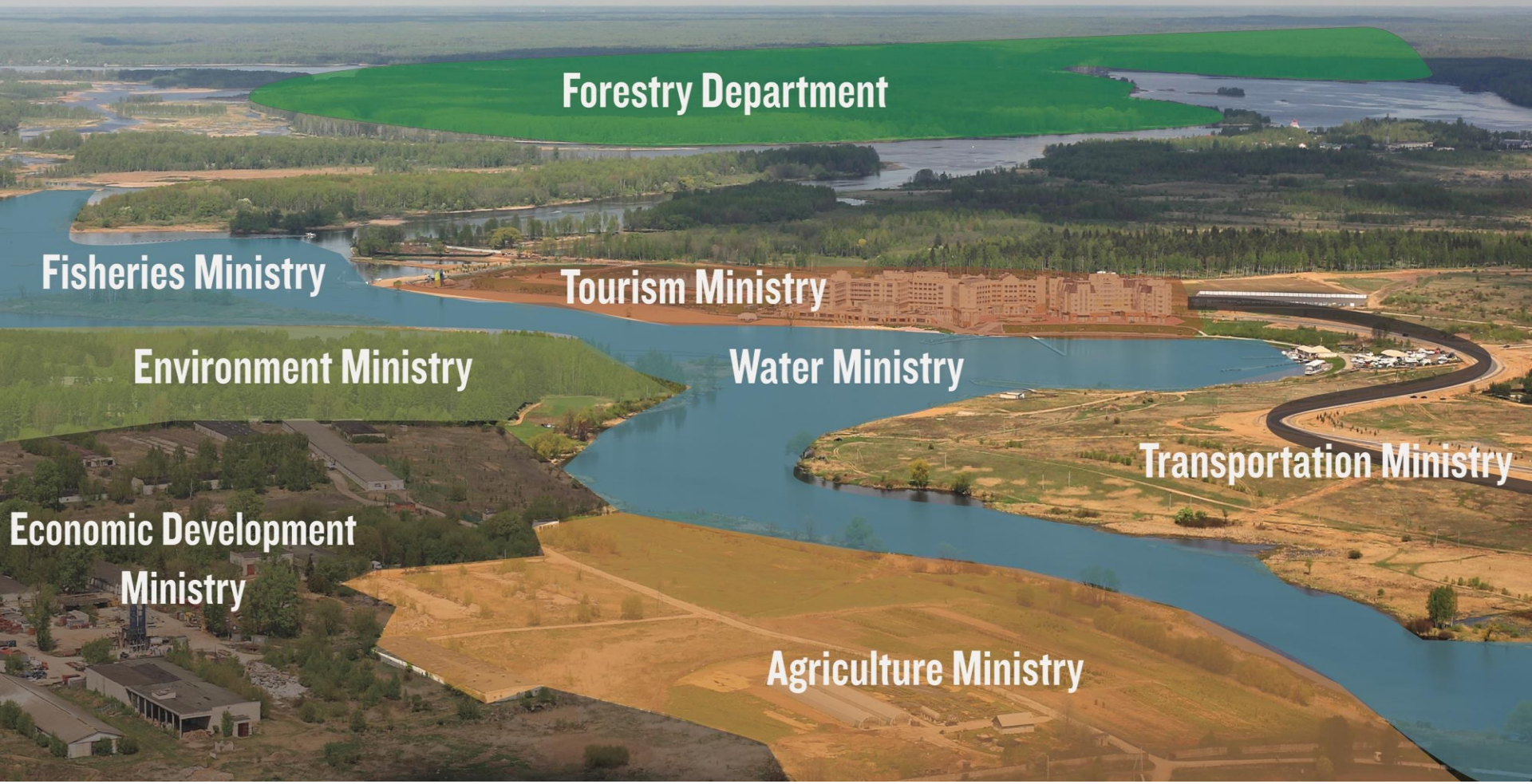
New Pathways for Sustainable Development

“Leave no one behind…’ means in every landscape

A landscape -- interconnecting people, food and nature

A socio-ecological system of natural and human-modified ecosystems, influenced by distinct ecological, historical, economic and socio-cultural processes and activities.

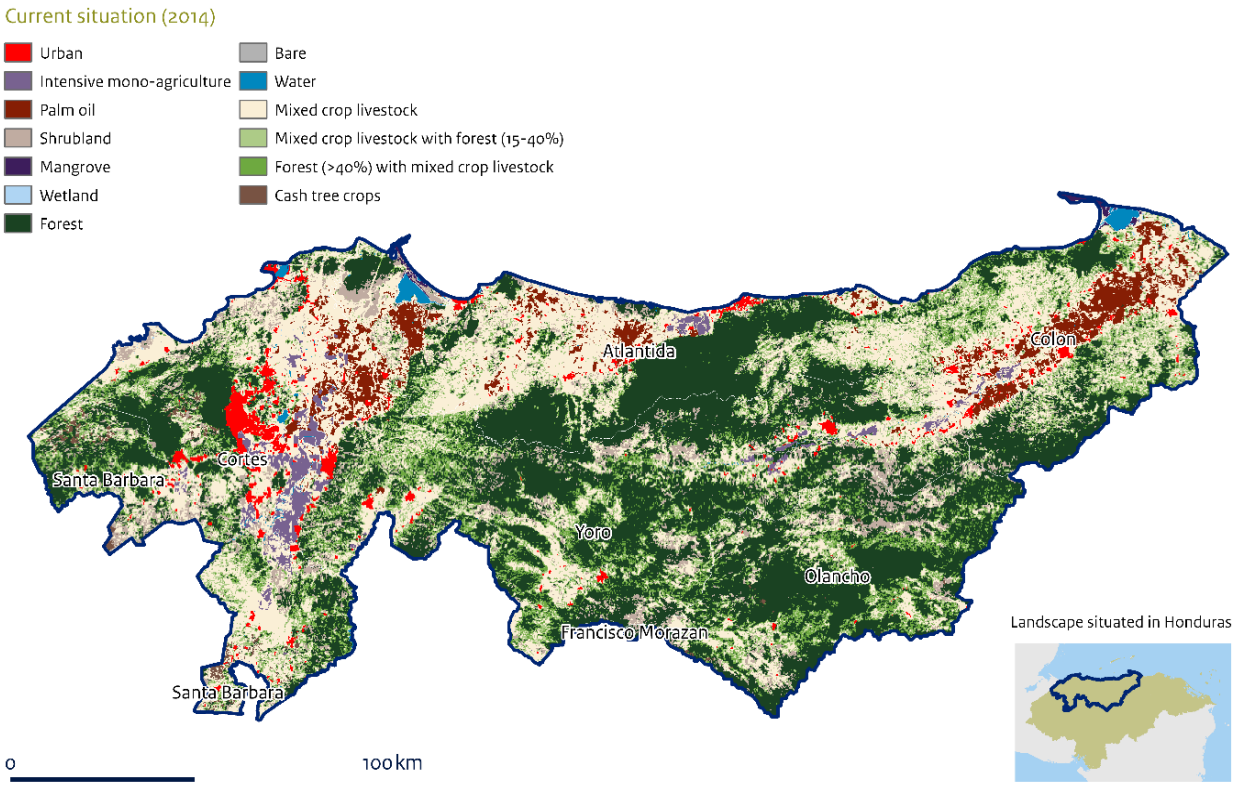
Yet land and resources are being managed today in ‘silos’



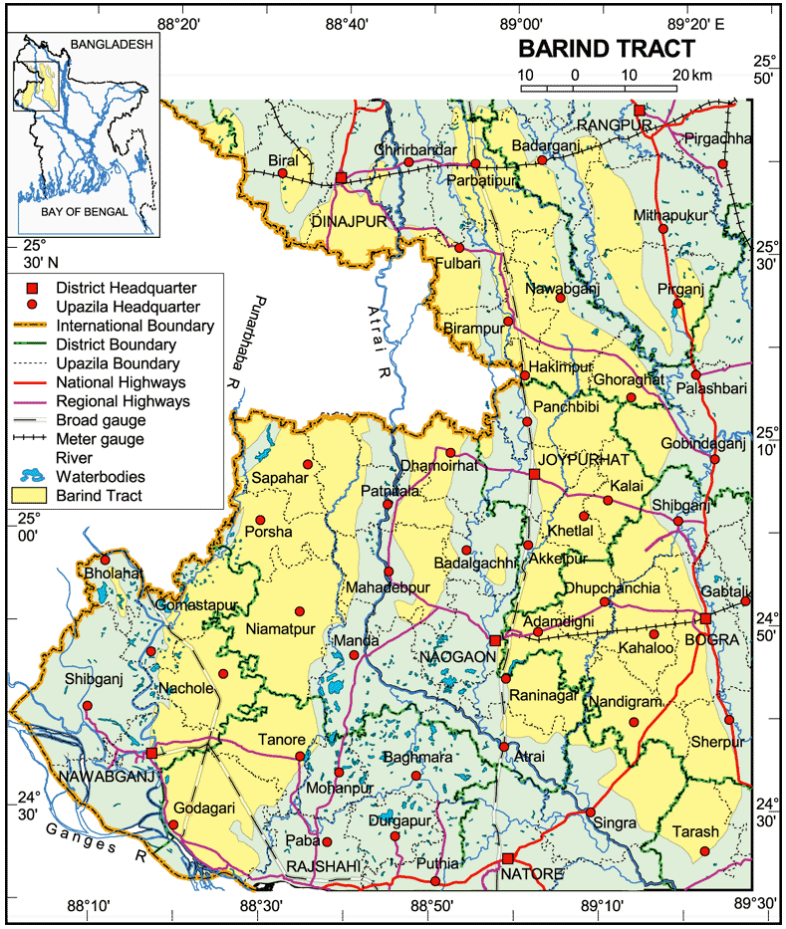
Integrated Landscape Management

Long-term collaboration among different groups of land managers and stakeholders to achieve the full range of goods and services needed from the landscape.

Linking food security and resource regeneration in North Coast of Honduras

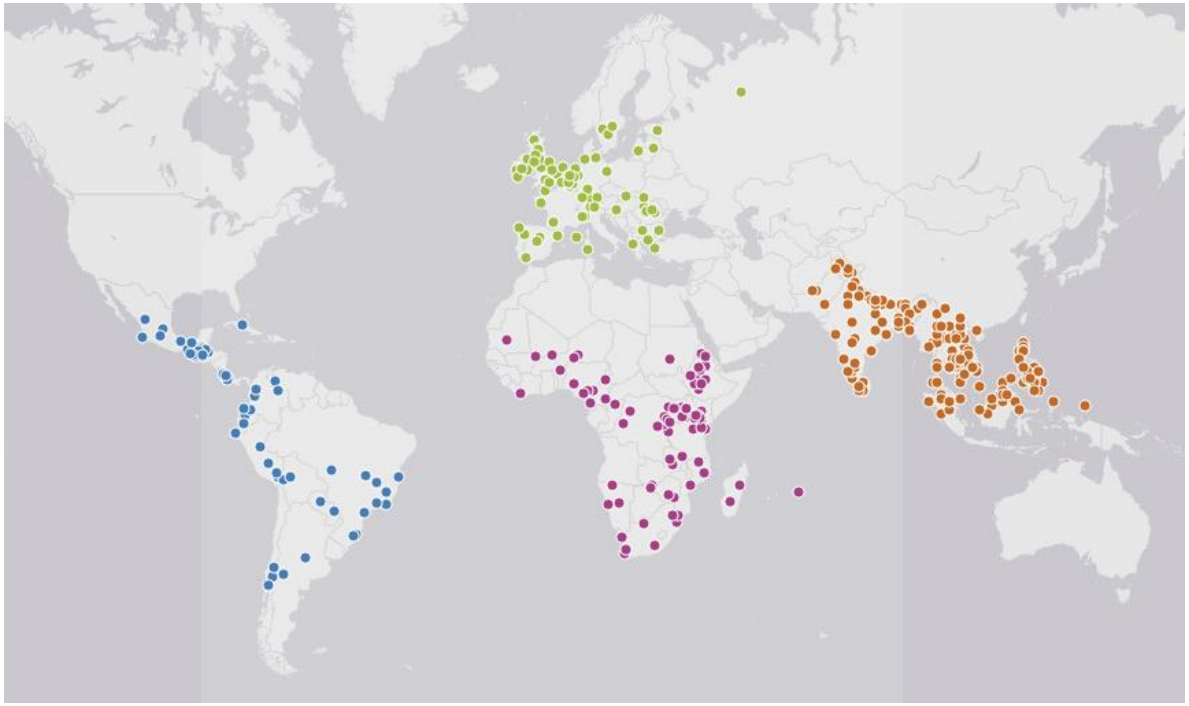


Adapting to climate change and water risks in the Barind Tract, Bangladesh



Linking land health and food security for vulnerable groups in Laikipia County, Kenya

A global movement for sustainable food security through integrated landscapes is underway



Continental surveys (428)

- Estrada-Carmona, N., Hart, A.K., DeClerck, F.A.J., Harvey, C.A. and J.C. Milder (2014)
- Martín-Rubí, M.G., C. Bieling, A.K. Hart and T. Plieninger (2016)
- Milder, J.C., Hart, A.K., Dobie, P., Minai, J., and Zaleski, C. (2014)
- Zanzanaini, C., Tran, B.T., Singh, C., Hart, A.K., Milder, J.C., and DeClerck, F.A.J., (2015)

Sector	Reported Impacts of Landscape Initiatives	Sub-Saharan Africa (%)	South and SE Asia (%)	Latin America-Caribbean (%)	Impacts - SDG #
Agriculture	**Increased yields**	**40**	**46**	**38**	2
	Increased profitability	29	53	37	1
	Reduced environmental impacts	39	57	56	6, 12, 15
Ecosystems	Improved biodiversity protection	51	87	66	15
	Improved water quality and regularity	29	52	42	6
Institutional	Greater empowerment of women	45	83	55	5, 10, 16
	Preserved/used indigenous and local knowledge	37	88	67	10, 16
Livelihoods	**Improved food security**	**46**	**69**	**42**	2
	Higher income for low-income households	46	96	52	8

Lots of different approaches….

but five common features……

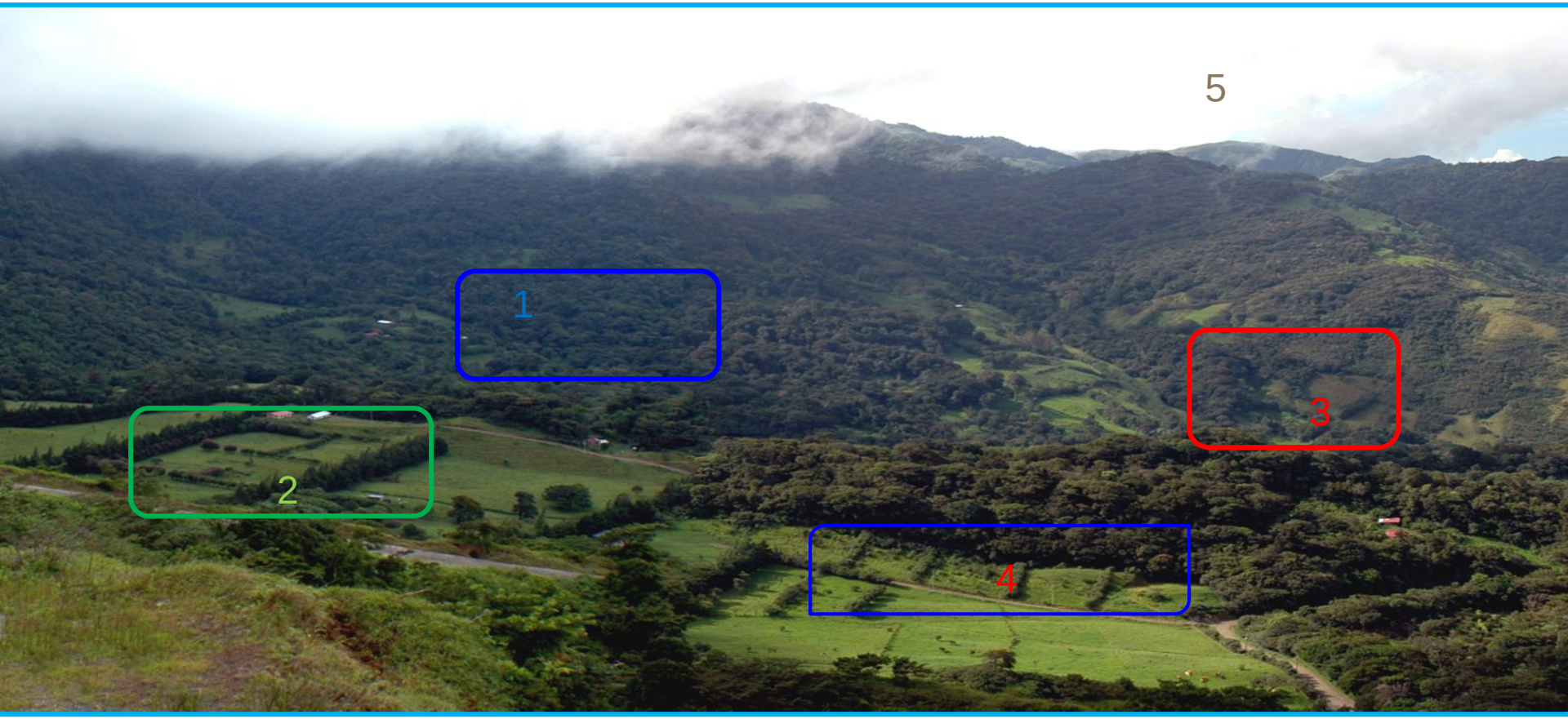
1) Collaborative, community-engaged processes for landscape dialogue, negotiation, planning and action

2) Shared or agreed landscape objectives that encompass the many benefits from landscapes

3) Field, farm and forest practices that benefit multiple landscape objectives

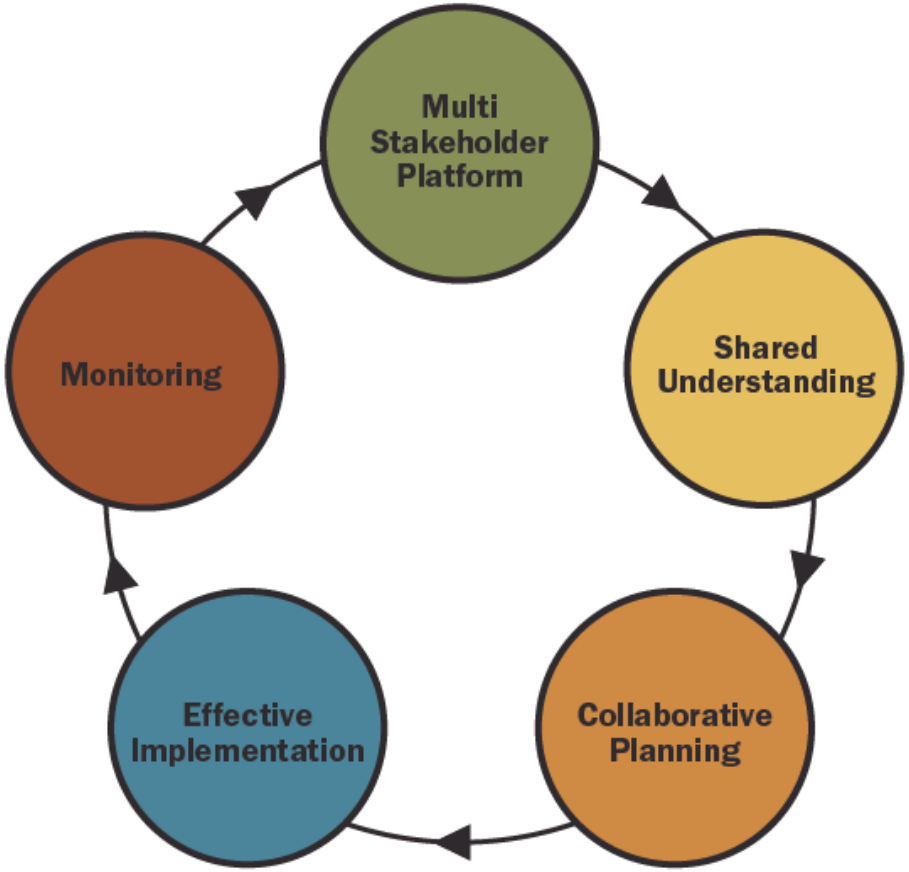
Adapted from: Victoria (Australia) provincial government framework "Building healthy and resilient ecosystems across the landscape", Chapter 6: 72-73.

4) Land uses across the landscape are managed to achieve synergy & reduce conflict

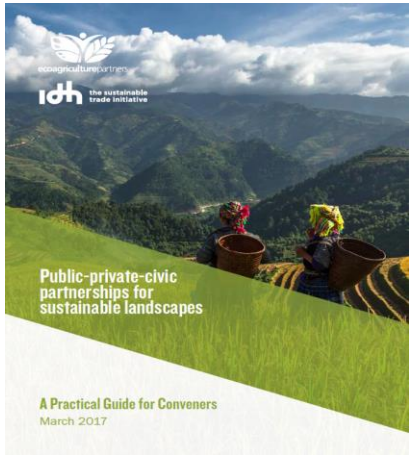


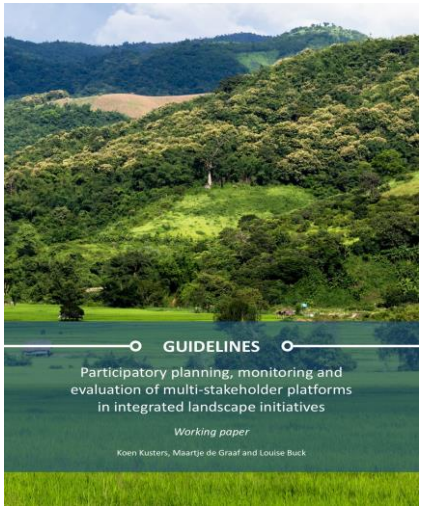
5) Markets, policies and finance are shaped to align with the integrated landscape strategy

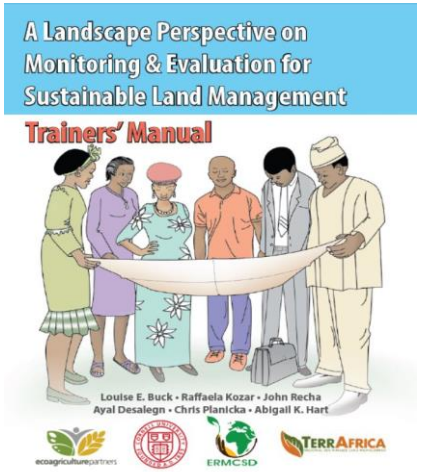
Advancing integrated landscape management

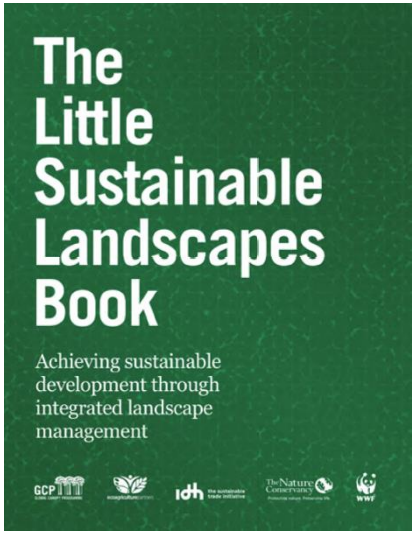


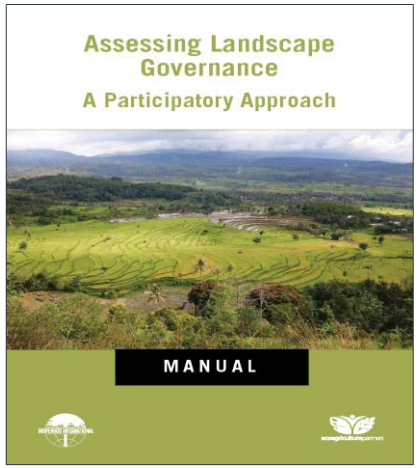
Tools to implement ILM

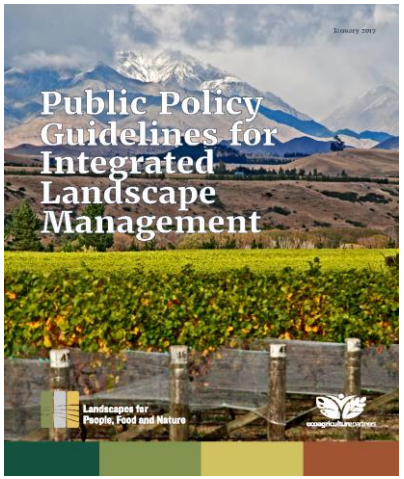












Scaling up locally-led landscape transformation for food security & the SDGs:

1000 Landscapes for 1 Billion People

ecoagriculturepartners

Questions and Answers

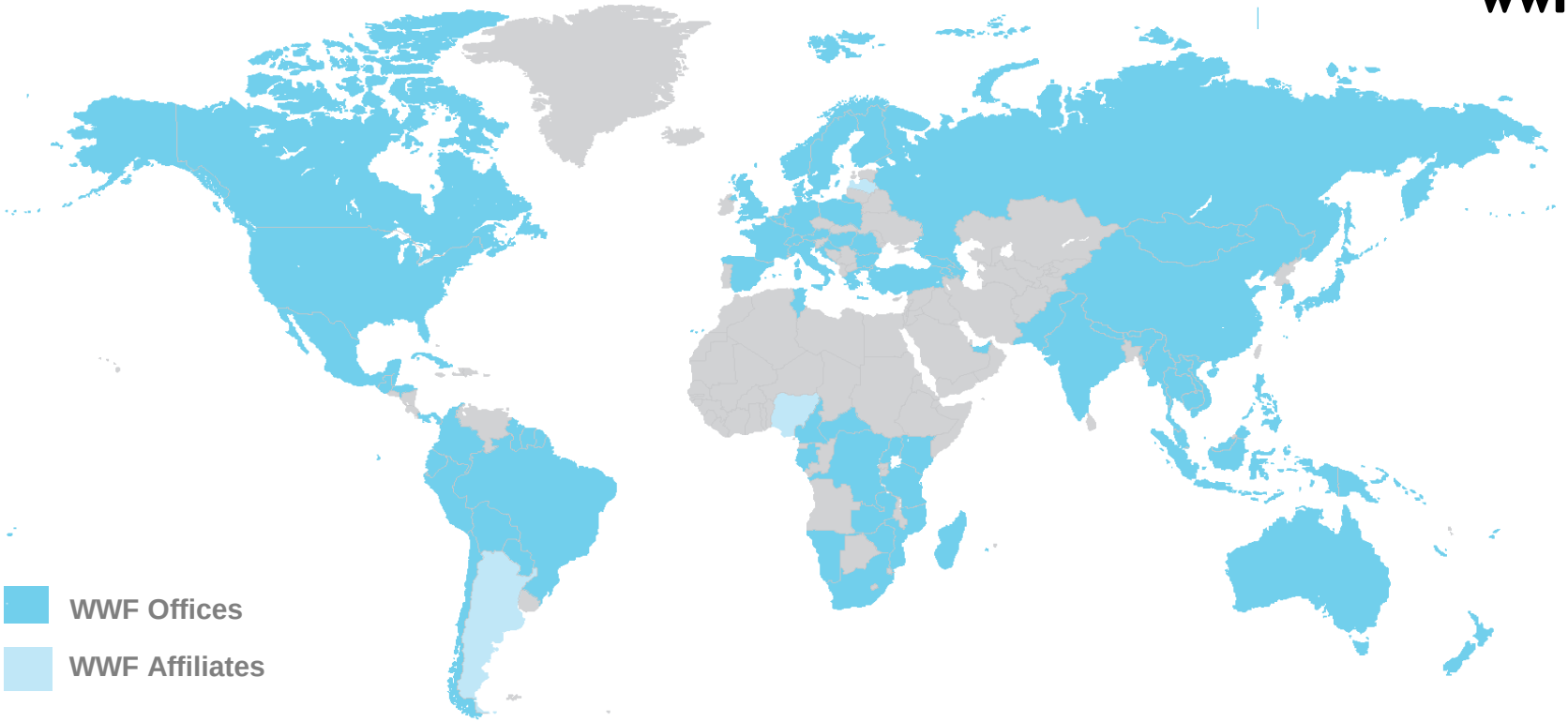
Our Mission

WWF PROTECTS THE FUTURE OF NATURE

- ✓ We are a global science-based organization
- ✓ We work with companies and communities
- ✓ ***We strive to meet the needs of both people and nature***

Our Work Is Global

WWF is the Largest multinational conservation organization in the world.
We have a presence in 100 countries.



Our Support Is Broad

WWF has built a movement of nearly

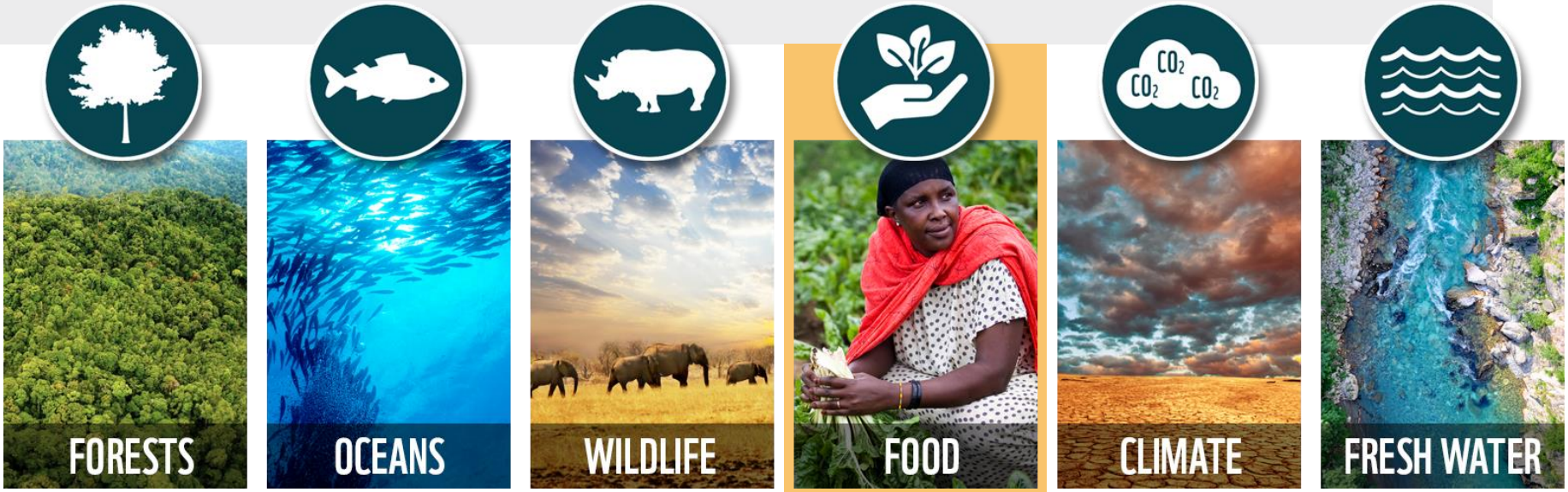
6,000,000

people around the globe

1,100,000 in the U.S.

We Focus on Protecting

We Focus on Protecting



1. Sustainable Production
2. Eliminate Waste
3. Sustainable Consumption

60%

decrease in populations of mammals, birds, amphibians, fish, and other vertebrates between 1970 and 2014.

Source: WWF 2016 Living Planet Report

© Michel Gunther / WWF

Source: Convention on Biological Diversity, CBD Technical Series No 79, 2014

Photo: earthnewsmedia.com

THE IMPACTS OF FOOD

24% of GHG emissions

Most chemical use

70% of freshwater use

90% of marine stocks fully exploited

50% of topsoil loss

Sources:

- Convention on Biological Diversity, CBD Technical Series No 79, 2014
- http://www.fao.org/3/y4252e/y4252e06.htm
- http://www.fao.org/nr/water/aquastat/tables/WorldData-Withdrawal_eng.pdf;
- http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/blaser.pdf
- Yadav, S.K. and S. Kumar (2007). Soil Ecology. APH Publishing Corporation. 194 pp.

HOW DO WE ACHIEVE THEM ALL?

SUSTAINABLE DEVELOPMENT GOALS

Freeze

the footprint of food

Food Loss/Waste Strategy

1

HOSPITALITY
TOURISM

2

RESTAURANTS
FOOD SERVICE

3

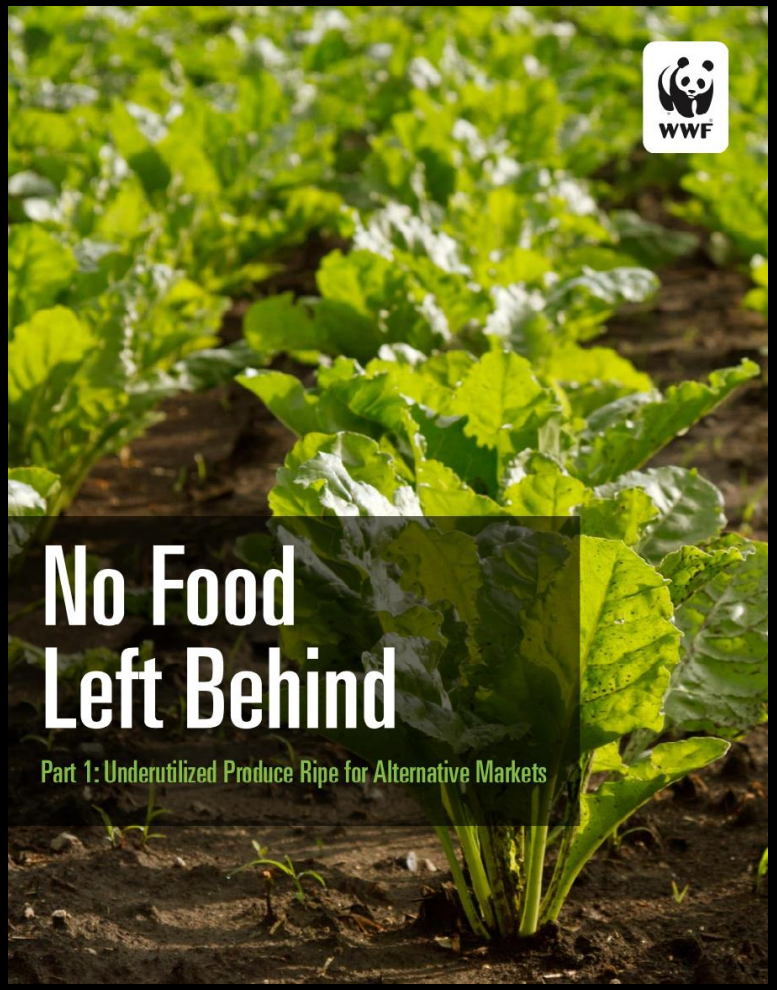
RETAIL
GROCERY

4

FARMS

5

SCHOOLS
UNIVERSITIES

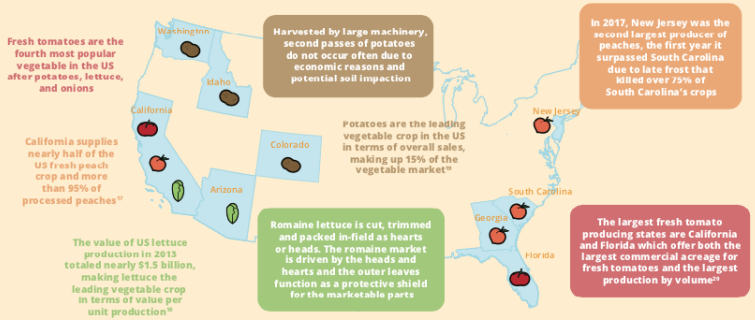


BACKGROUND ON

Fruits & Vegetables Studied

The four crops included in this study have varying production volumes, methods, locations, and end markets. The information below highlights some of these key differences, which were some of the major drivers behind choosing the crops for this study as WWF aimed to gather data on loss rates across a variety of crop types.

Who are the leading producers?



How and when are they harvested?

Fresh tomatoes are harvested *by hand*, while processed tomatoes are harvested *mechanically*

Peaches in California are harvested *by hand*, then mechanically by year five. In New Jersey, all peaches are harvested by hand

Roughly *90%* of US potatoes are planted in the spring and harvested mechanically *in the fall*

Almost all lettuce is *hand-harvested* and *field-packed* for bulk sale or sent to a processing facility

Where do they go?

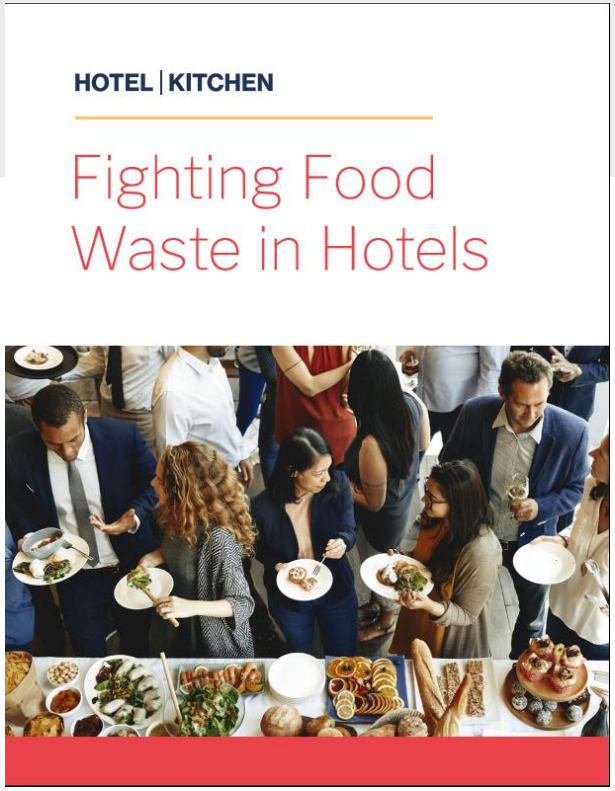
About *90%* of the domestic tomato market is sent for *processing* into tomato sauce, paste, and other value added products while the remaining *10%* is eaten fresh at *home* (70% of market) and at restaurants and other food service outlets (30%).[21]

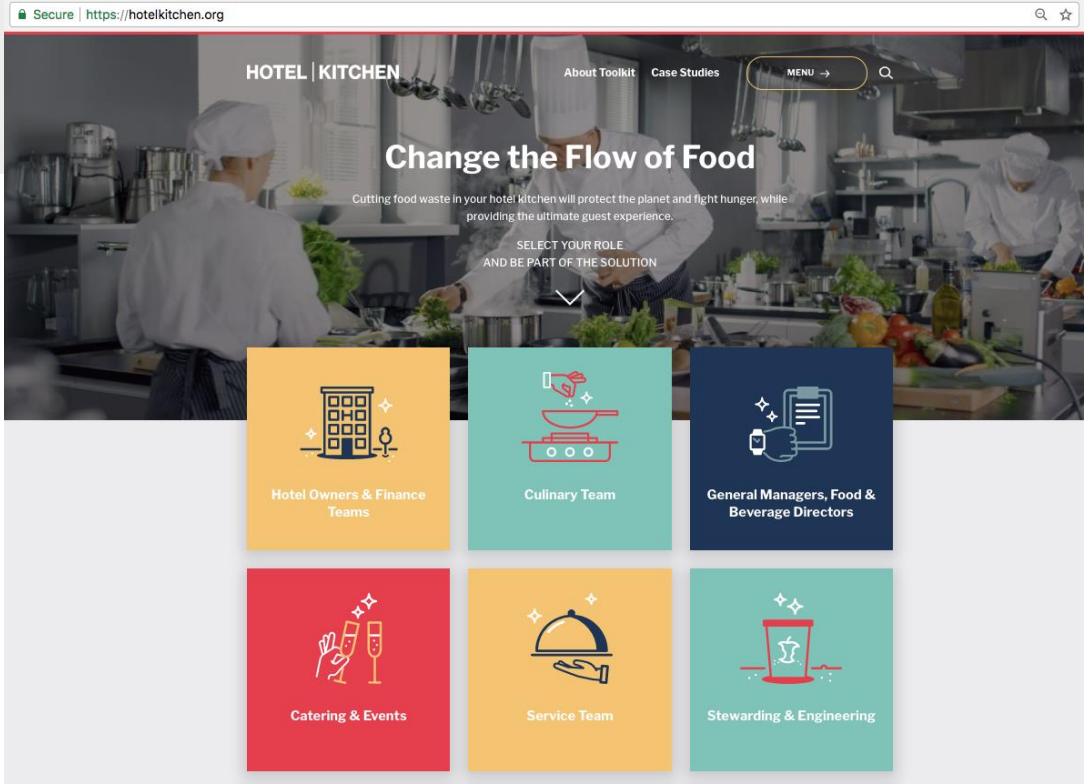
About *50%* of domestic peach production enters *fresh market* while the remaining *50%* is sent for canning (75% of market), freezing (21%), or dehydration (<5%).[22]

Nearly 60% of potato sales are to *processors* for French fries, chips, dehydrated potatoes and other potato products.

All lettuce is marketed as a *fresh product*.

17 https://www.agmrc.org/commodities-products/fruits/peaches/
18 https://www.agmrc.org/commodities-products/vegetables/lettuce
19 https://www.ers.usda.gov/topics/crops/vegetables-pulses/potatoes.aspx
20 https://www.ers.usda.gov/topics/crops/vegetables-pulses/tomatoes.aspx
21 https://www.ers.usda.gov/topics/crops/vegetables-pulses/tomatoes.aspx
22 http://usda.mannlib.cornell.edu/usda/current/noncitfruinv/noncitfruinv-06-27-2017.pdf

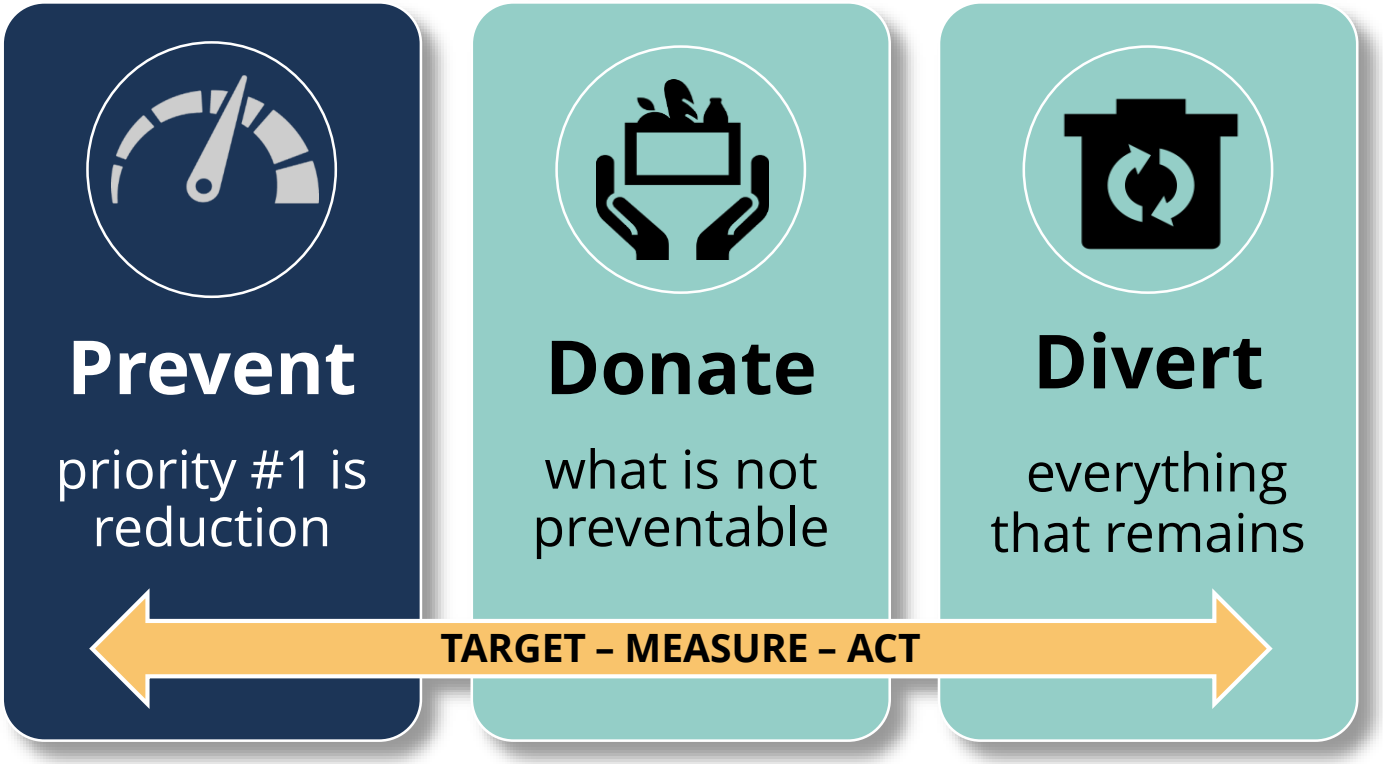




1

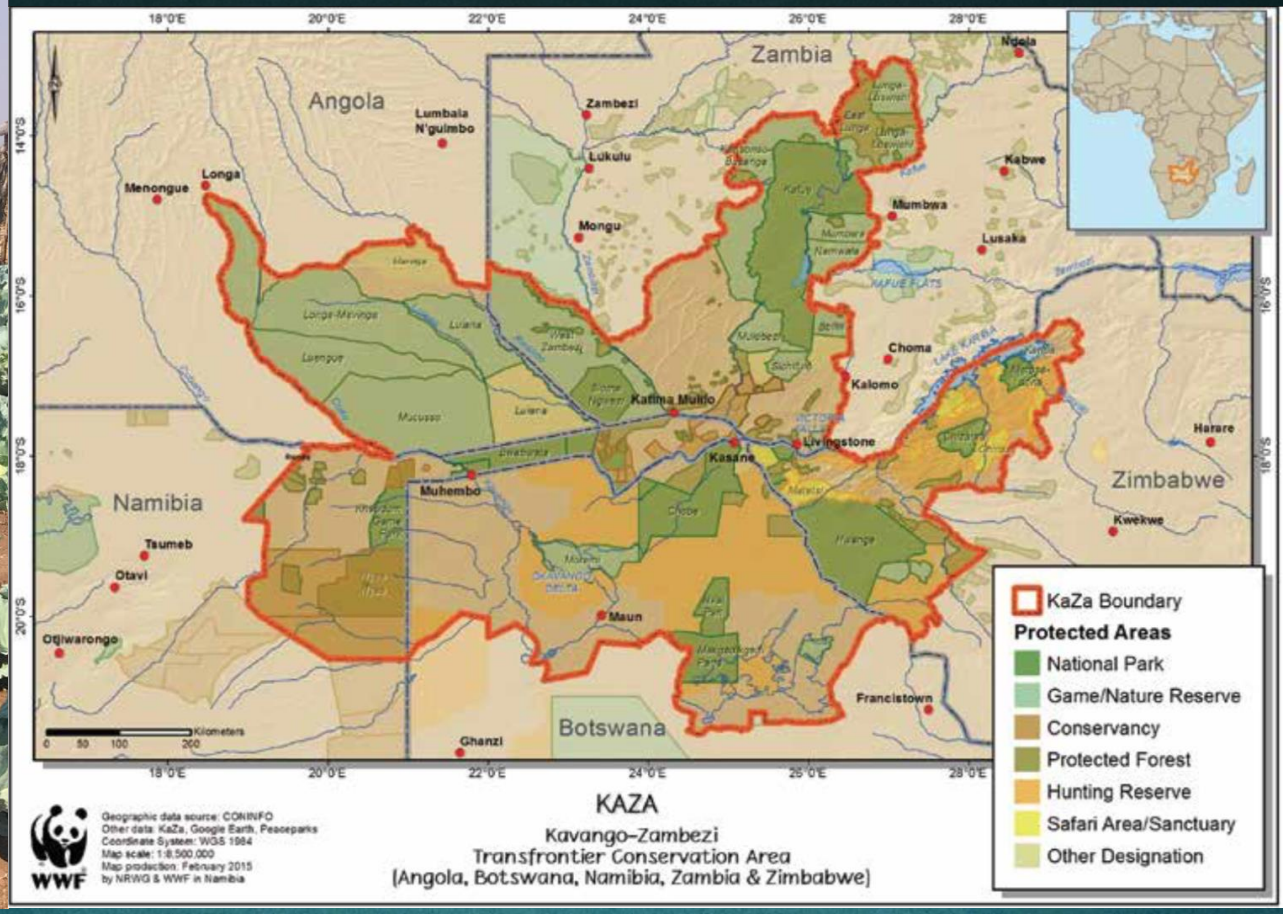
HOSPITALITY / TOURISM

Hospitality Program Strategy



Designing FLW Out of the Food System

Photo Credit: Pete Pearson



Questions and Answers

GROWING MORE WITH LESS:
SMART TECHNOLOGY SOLUTIONS TO FEED ASIA

Faisal Hossain

University of Washington

January 29, 2020

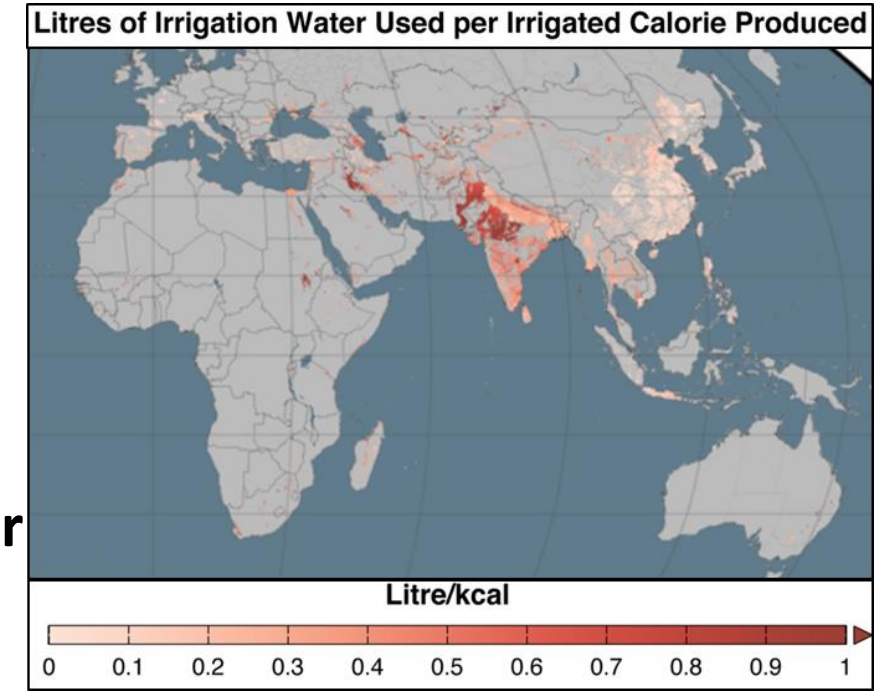
AVERAGE WATER USE FOR CEREAL CROPS IN ASIA TODAY

China: 0.82 kg (food)/ m^3 of water

India: 0.39 kg (food)/ m^3 of water

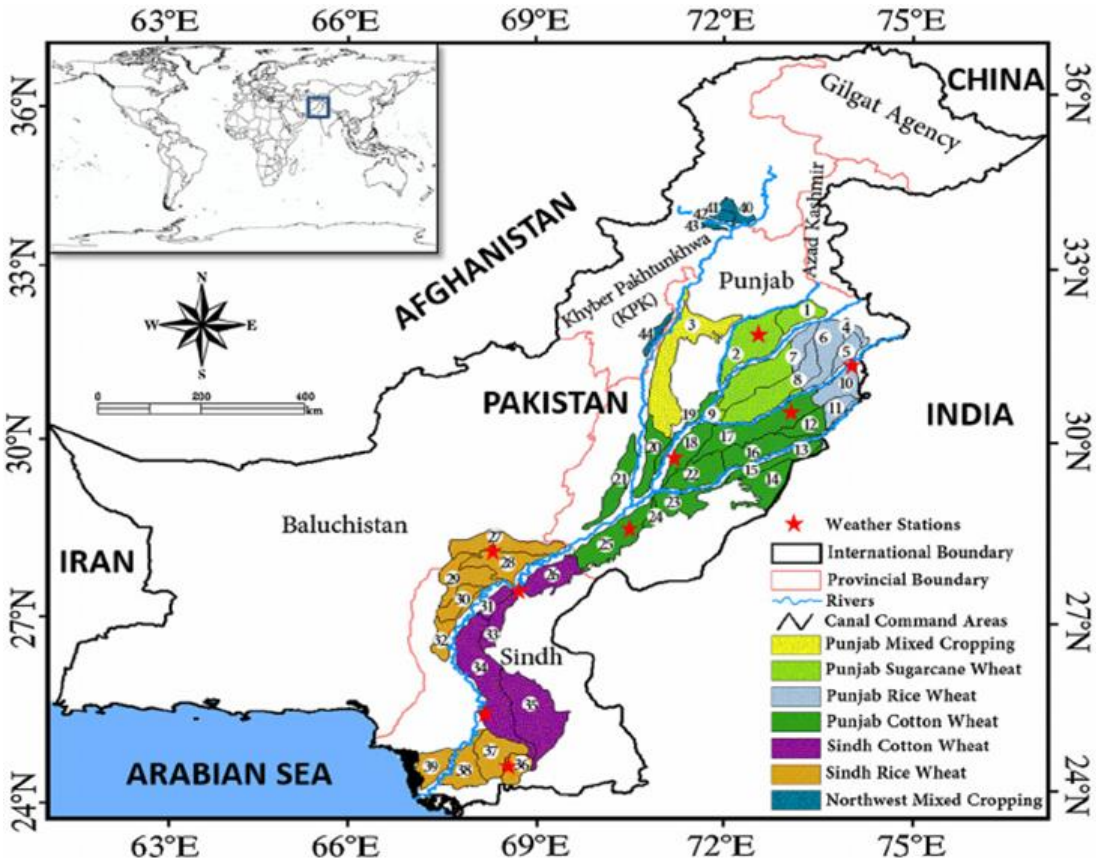
Pakistan: 0.13 kg (food)/ m^3 of water

Source: *International Water Management Institute (IWMI), working paper#60*, Author: MD Kumar (2003)



Foley et al., 2011 Solutions for a Cultivated Planet, *Nature.*

CAN WE GROW MORE WITH LESS?



- Lowest water use efficiency in Asia = 0.13 kg of food/m^3 of water
- The world's largest surface water irrigation system.
- Operating since the early 1900s
- Centrally planned with large crop zones (~1000 sq km)

Indus Basin Irrigation System –IBIS

CAN WE GROW MORE WITH LESS?

Original design: One crop/year **< surface water (=ok for 33.7 million people -1951)**

Reality Today: 2.5 crops/year **> surface water (=not ok for 198 million people - 2015)**

LET'S TALK ABOUT RICE FOR EXAMPLE

- **600 mm** in Punjab (humid) province **1,400 mm** in Sindh (dry) province

- Farmers apply **2,200 mm =** tremendous water loss = groundwater decline = costlier pumping each year + loss of crop productivity

SO WHAT IS THE PROBLEM TO SOLVE?

How do we change farmers mindset (that they do not need to 'irrigate' that much)?

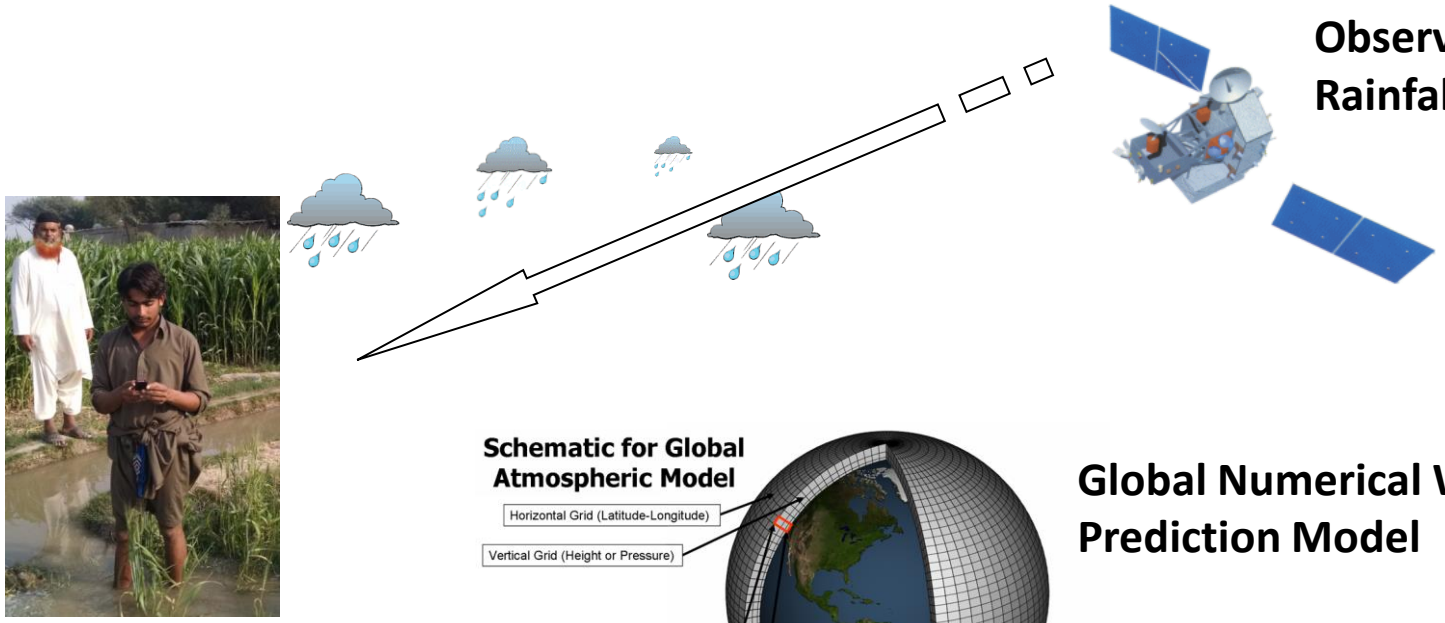
How do we make the solution <u>Affordable and Sustainable</u>?

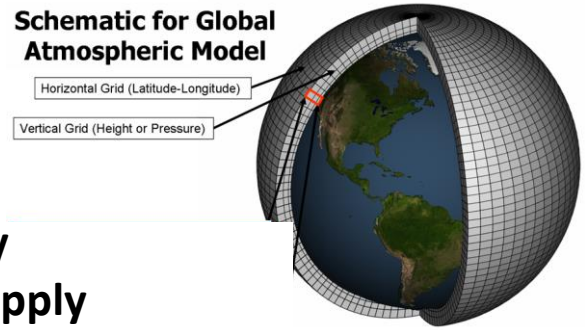
THE SOLUTION?

ET: Evapotranspiration – crop water demand

Earth Observing Satellites

Observe *Current/past* Rainfall and Crop ET





Global Numerical Weather Prediction Model

Predict *Current/Future* Rainfall and *Current/Future* crop ET

Irrigation if Demand> Supply
No irrigation if Demand < Supply

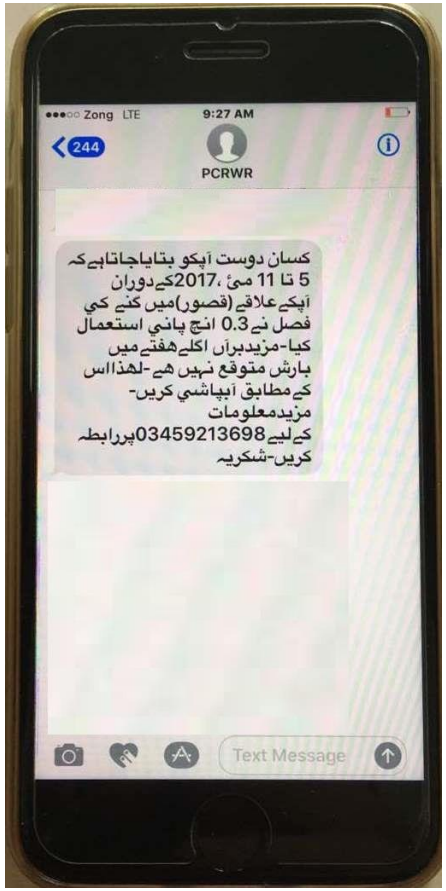
<u>Demand:</u> Crop ET
<u>Supply:</u> Rainfall or recent irrigation

BRINGING THE SOLUTION TO FARMERS

Forecast-based Advisory was added later and it was in highest demand

Dear farmer friend, we would like to inform you that your wheat crop does not need irrigation due to sufficient rainfall during the past week.

Dear farmer friend, we would like to inform you that the irrigation need for your banana crop was 2 inches during the past week.



700 farmers → **10,000** farmers → **100,000** farmers

2016 → **2017** → **2018**

QUANTITATIVE IMPACT EVALUATION

2.5 km^3 a year (40%) saved per 100,000 farmers

[2.5 km^3; A large dam: 10-15 km^3]

<u>80%</u> usage rate among farmers

<u>50-100%</u> increase in farmer income

MEANWHILE IN NEIGHBORING INDIA……

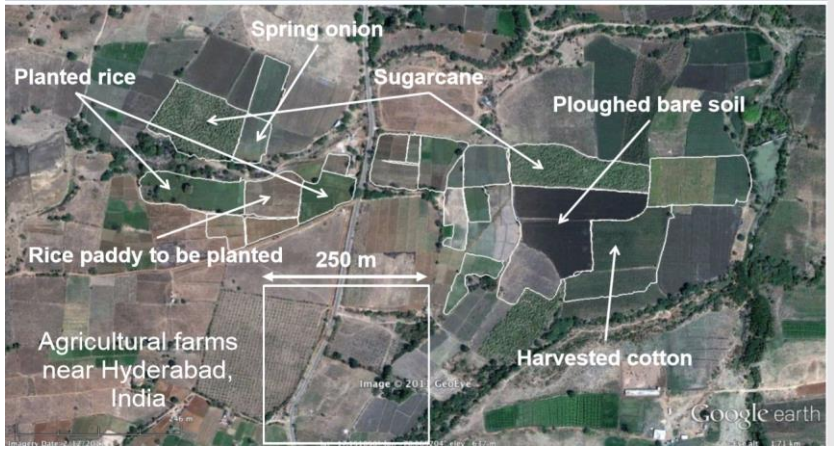


Image courtesy of Dr. Ryu, University of Melbourne

- **140 million farmers** in India
- Most (65%) are marginal (**plot size < 1 acre**)
- Coarse resolution data (~10-25km)from satellites and weather models ***will not work***
- Need ***finer*** resolution plot-scale crop/irrigation advisory (~1km-500m)

“Internet of Things” and Low Power Wide Area Network (LPWAN)

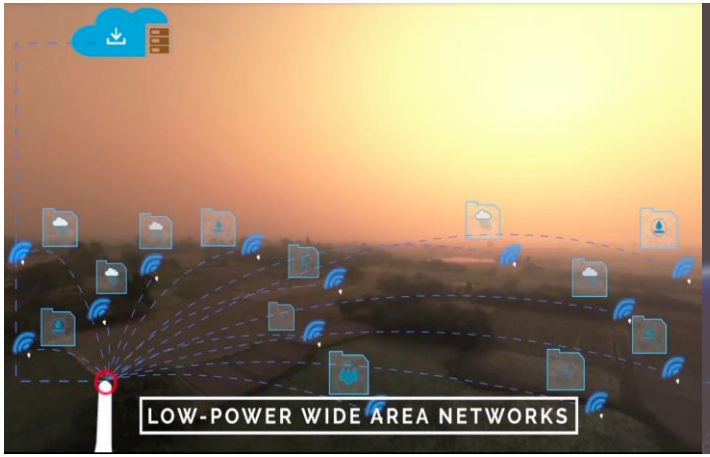
IoT compatible water level sensor – *Runs on 2 AA batteries for 2 years*

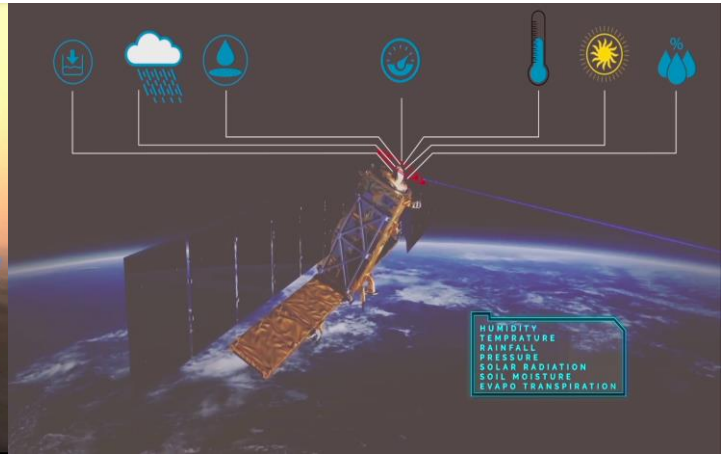
- **Router for LPWAN – *Needs one solar panel***
- **Collects data and pushes to cloud**

IoT sensors

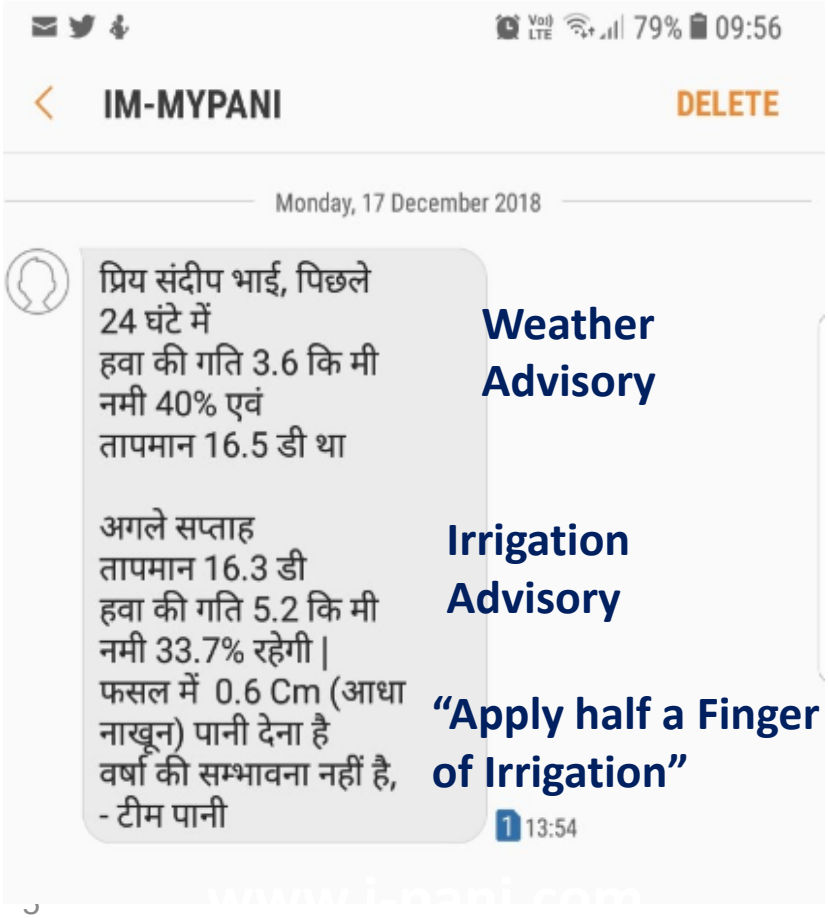
THE BIRTH OF *PANI*

Provision for **A**dvisory on **N**ecessary **I**rrigation





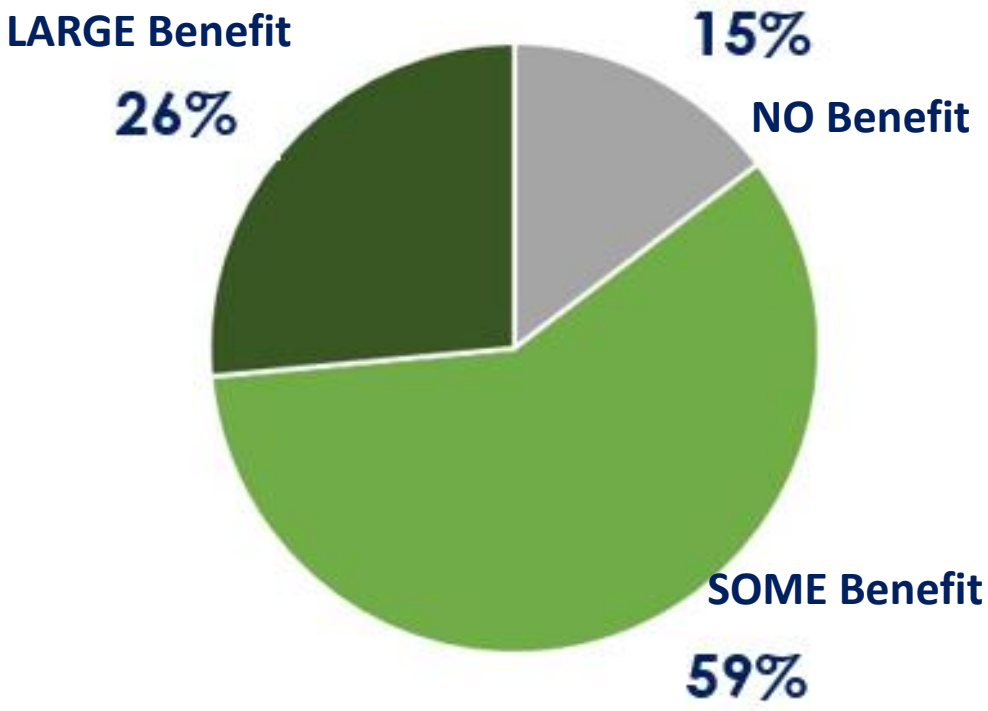
HOW AFFORDABLE IS *PANI*?



If 100 farmers live in 1 km^2 (average farmer density in rural India), setup cost per farmer= **5.00 USD/year**

Note: Average Farmer income = **1200 USD/year** (*according to National Sample Survey Office – India*)

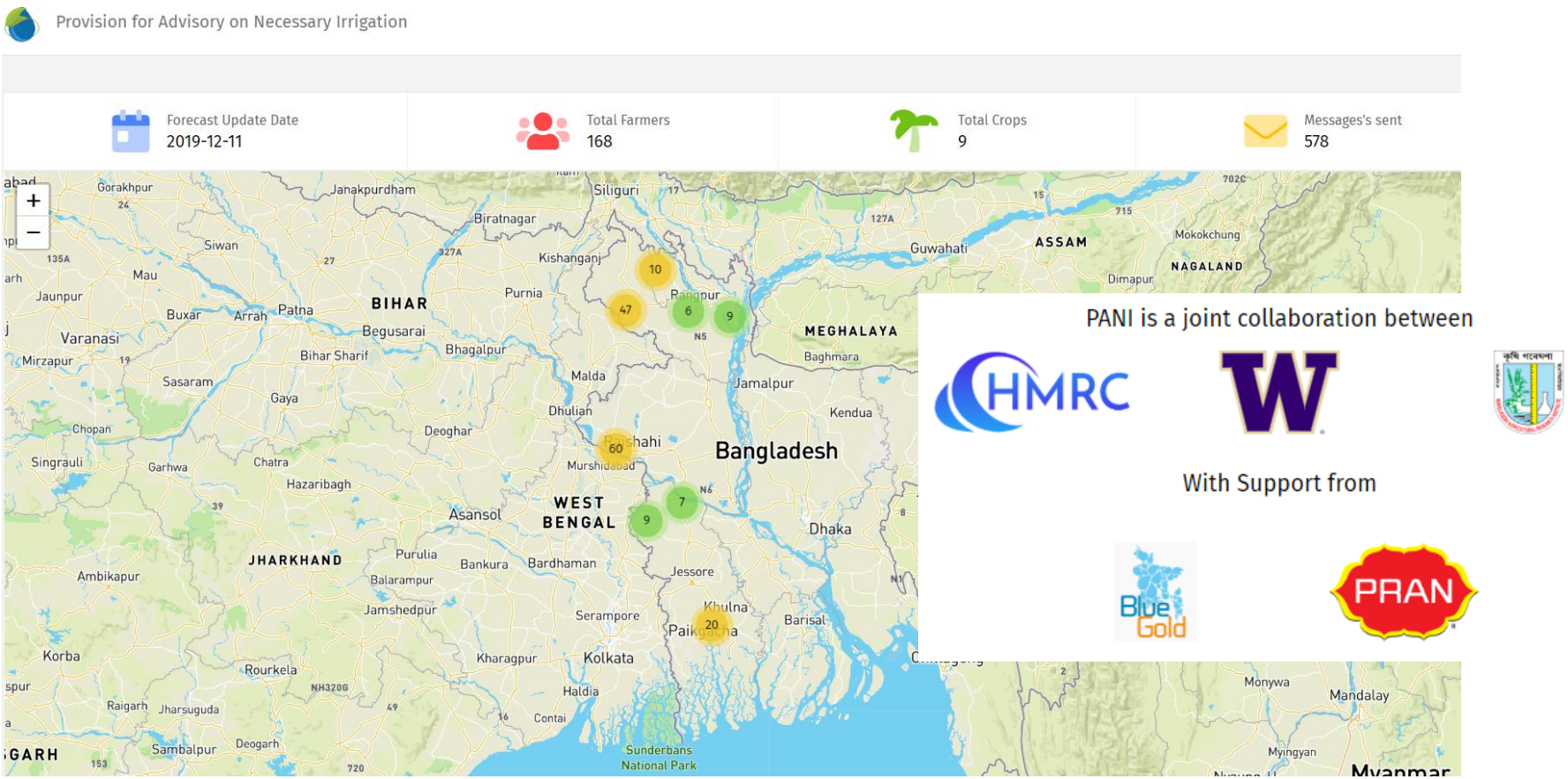
FARMER FEEDBACK ON *PANI*



A sample of the farmers during the pilot in 2018-2019 (stilling running)

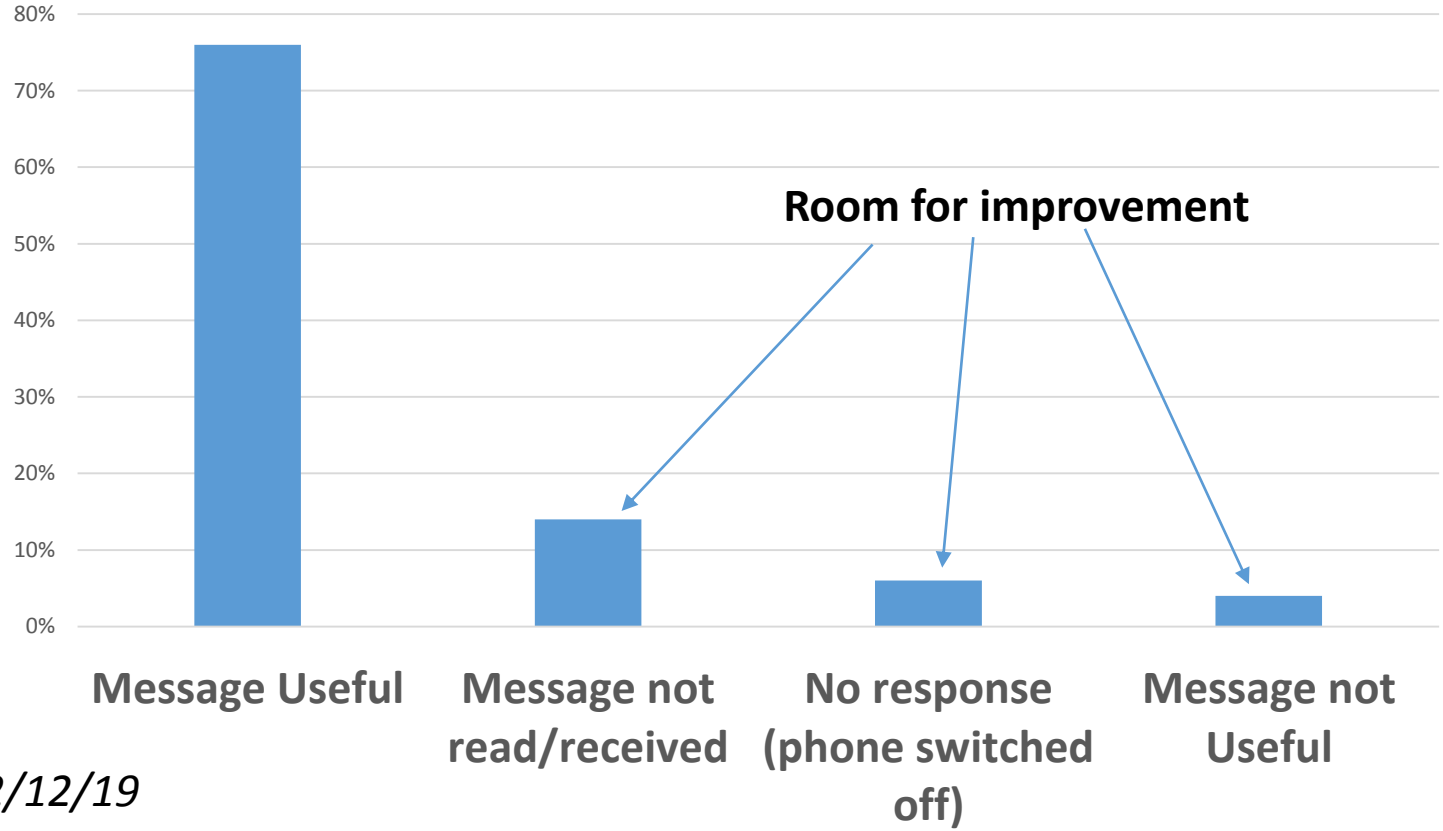
- ❑ **Average Wheat Yield <u>4000 kg/ha-5100 kg/ha</u> with PANI**
- ❑ **Govt reported historical yield at the site: 2867 kg/ha**

PANI EXPANSION IN BANGLADESH



PANI portal for Bangladesh (as of 01/27/20) at http://pani.hmrcweb.com

FARMER FEEDBACK OF PANI IN BANGLADESH



As of 12/12/19

Weather forecasts/irrigation advisory were particularly useful during cyclone Bulbul in 2019

TAKE HOME MESSAGES

- **Freely available satellite earth observations and numerical weather models are low hanging solutions for *growing more with less water in Asia***

- **Feeding Asia = *Empowering Marginal Farmers***

- **Technology that has precision and is smart *does not have to expensive***

ACKNOWLEDGEMENTS

- Sponsors – Ivanhoe Foundation, World Bank, Asian Development Bank, USAID, NASA Applied Sciences Program.
- Stakeholder agencies - PCRWR, IITK, Geokno, Kritsnam, Bangladesh Water & Agriculture Ministries, HMRC, BARI, BWDB.
- UW students- Shahryar Ahmad, Nishan Biswas, Hisham Eldardiry, Claire Beveridge, Kensey Daly, Matt Bonnema, Safat Sikder, Indira Bose, Asif Mahmood.
- Collaborators/Volunteers - Ahmed Zeeshan, Naveed Iqbal, Faizan Ul Haque, Muhammad Ashraf, Bharat Lohani, Shivam Tripathi, Harsha Karumanchi, Soham Adla, Sandeep Goyal, Golam Mahboob, Nazmul Ahsan, Raihanul Haque and many more……..

Questions and Answers

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