TRANS-SAHARA

EXPERT TALKS SERIES

23 SEPTEMBER 2025

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ONLINE

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(PROGRAMME DIRECTOR AT IGES)

IGES
Institute for Global Environmental Strategies

Funded by the European Union

1. Enhancing Resilience to Climate and Ecosystem Changes in Asia and Semi-Arid Africa (CECAR-Asia & CECAR-Africa)
2. Development Strategy for Urban Sustainability in Africa on the Basis of SDGs Interlinkage Analysis (USiA project, FY2017-FY2019)

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2. Program Director, Institute for Global Environmental Strategies (IGES)/ Visiting Professor, Institute for Future Initiatives (IFI), The University of Tokyo

CECAR
ASIA
Climate and Ecosystem Change Adaptation and Resilience Research

Climate and Ecosystem Adaptation and Resilience in Rural Asia

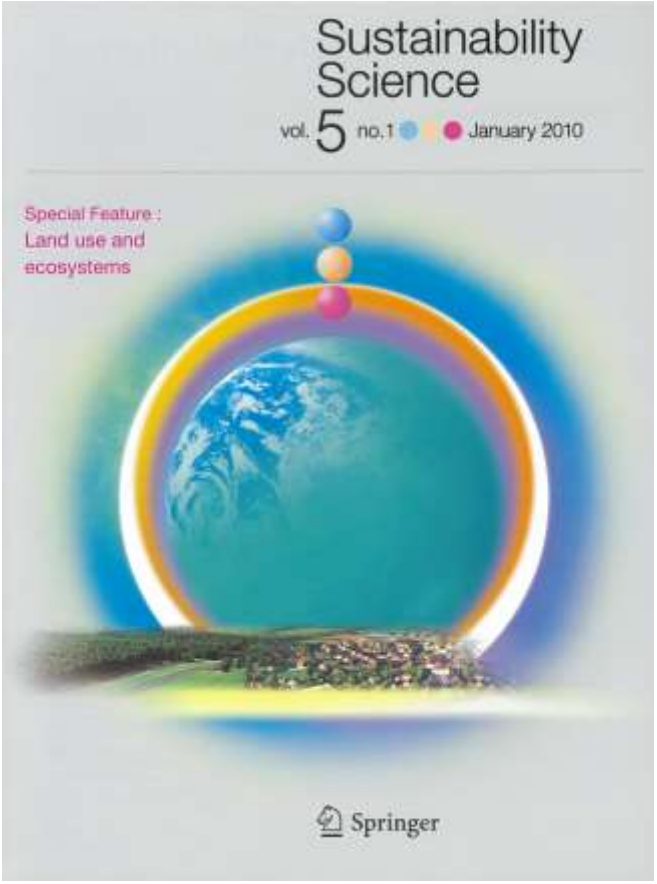
(CECAR-Asia)

Prof. Kazuhiko Takeuchi

Vice-Rector and Director, United Nations University Institute for Sustainability and Peace (UNU-ISP)

Need for Sustainability Science

- New discipline that comprehensively deals with complex problems and leads to integrated solutions is needed.
- "Integrated Research System for Sustainability Science (IR3S)", an alliance comprising the University of Tokyo (headquarters), and 11 other universities and research institutes in Japan including UNU-ISP, was established.
- IR3S publishes an international journal "Sustainability Science" jointly with UNU-ISP and promotes flagship projects.
- Developing educational programs, in cooperation with the 5 allied universities on sustainability science.
- Creating research meta-networks on sustainability science worldwide.



Background: International perspectives

UNFCCC /COP16 decided

- Establish Cancun Adaptation Framework
- Enhance adaptation actions including establishment of resilience of ecosystem to climate change
- Encourage activities on REDD+

UNCBD/COP10 decided

- Implement of sustainable use of ecosystem services that will contribute to adaptation to climate change and REDD+
- Recommend early establishment of IPBES (decided at UN assembly)
- Recommend SATOYAMA initiative

Key message; we should

- strive for integrating climate change and biodiversity policies
- establish effective International frameworks on adaptation and REDD+ as well as that on mitigation

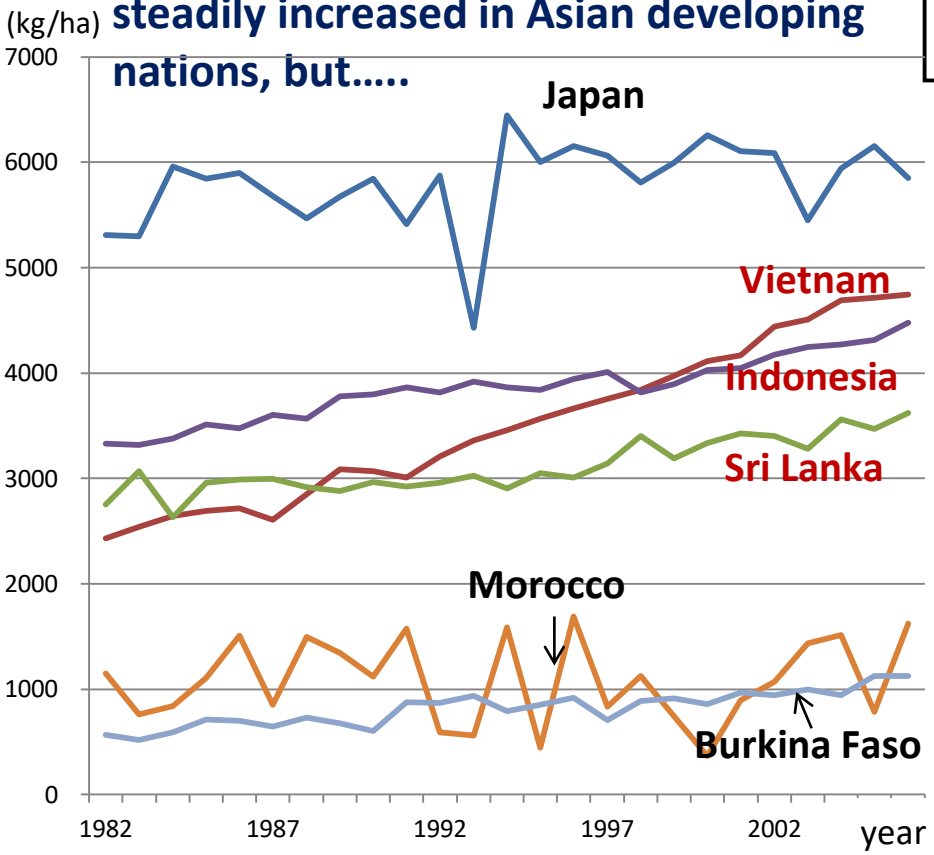
Role of Higher Education in Adapting to Climate and Ecosystem Changes

- 19 Universities in AP, IR3S from Japan
- Lack of HR and facilities - share efficiently
- Establish a University Network
- Do not limit to Climate change - Broader framework
- Education, Research, Country Needs

UNITED NATIONS UNIVERSITY
UNU-ISP

Overview of crop production in Asia

In recent quarter century, yield has been steadily increased in Asian developing nations, but…..



Asian agriculture has been rapidly developed through shift from Labor intensive to capital intensive production system, however, in the future

Socio-economic risk
- Population shift to cities
- Impacts of Int'l market
- Further needs to food supply

Environmental risk

Climate change
- Heat wave
- Flood
- Drought, over-usage of irrigation
- Intrusion of saline water

Ecosystem change
- Biodiversity loss
- Soil degradation
- Water pollution by Chemical fertilizers
- Loss of wetland

- How should we establish strategy for sustainable development in rural Asia ?
- How resilient to climate and ecosystem changes ? How can we measure it ?
- How effective can traditional bio-production system be applied to enhance resilience in rural Asia ?

Research framework

Bio-production system | Social system | Ecosystem

Collaboration of climate change and biodiversity policies

Introduction of "resilience" concept into global environmental policy

Resilience is about the capacity that society or ecosystem absorbs shocks and disturbances and to retrieve from the changes

Re-evaluation of traditional knowledge and technologies, integration with social system in advanced technologies

Sub-Theme1
Research on adaptation of biological production to climate and ecosystem change

Sub-Theme 2
Research on Resilience enhancement through traditional knowledge and technology

Sub-Theme 3
Research on crop production system in harmony with conservation of biodiversity

Strategy for enhancing resilience to climate and ecosystem changes
(in national, provincial, local, community scales)

Traditional Bio-production systems

Sri Lanka

- High rural population ratio (85%)
- Two thirds of national land is arid region
- Need effective water management system

Indonesia

- Conversion from traditional bio-production to extensive plantations
- Forest and biodiversity loss from development

Vietnam

- 2nd largest rice exporting countries
- Sea level rise and sea water intrusion
- Affecting international food security

Tank irrigation system

Irrigation network system with tanks and waterways

Kandyan homegardens

Compound system of diverse trees, crops and husbandry

Pekarangan: Tropical homegarden system

Kebun-talun: Combination system of forestation and slush and burn cultivation

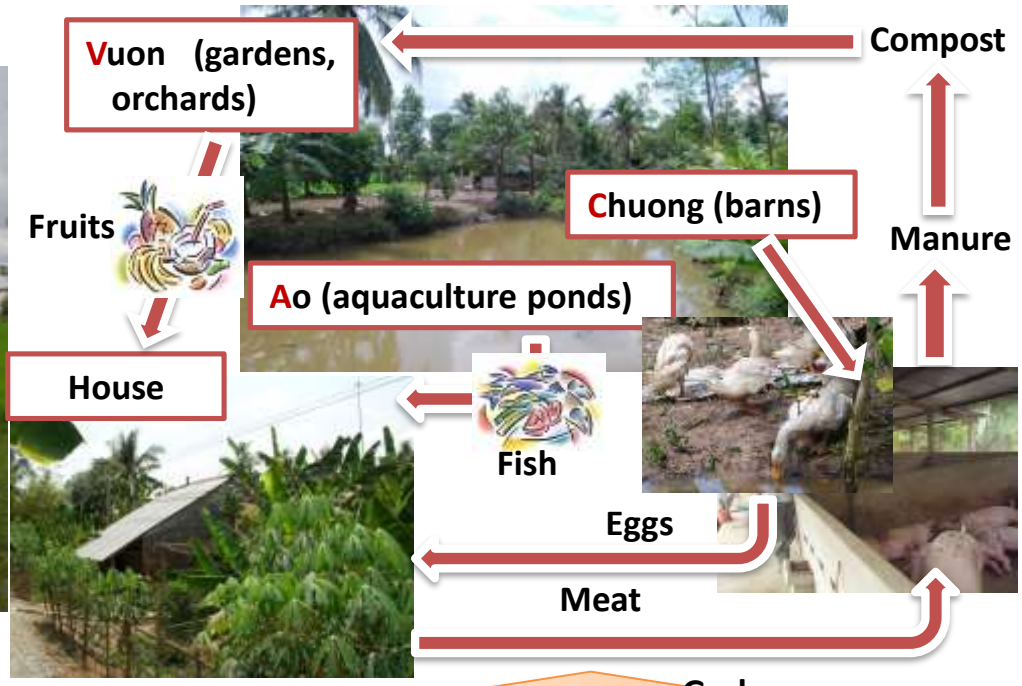
VAC System: Combination system consisting of homegarden, aquaculture pond, livestock barn

Bio-production system: Vietnamese case

- One of the world's most modernized rice production system（2nd largest rice exporter)
- Farmlands in delta; vulnerable to sea water intrusion
- Resilience of biological production; contribution to food security

Modern & commercial rice production system

V.A.C.（Circulated system that is composed of gardens, Orchards, Aquaculture ponds and barns）



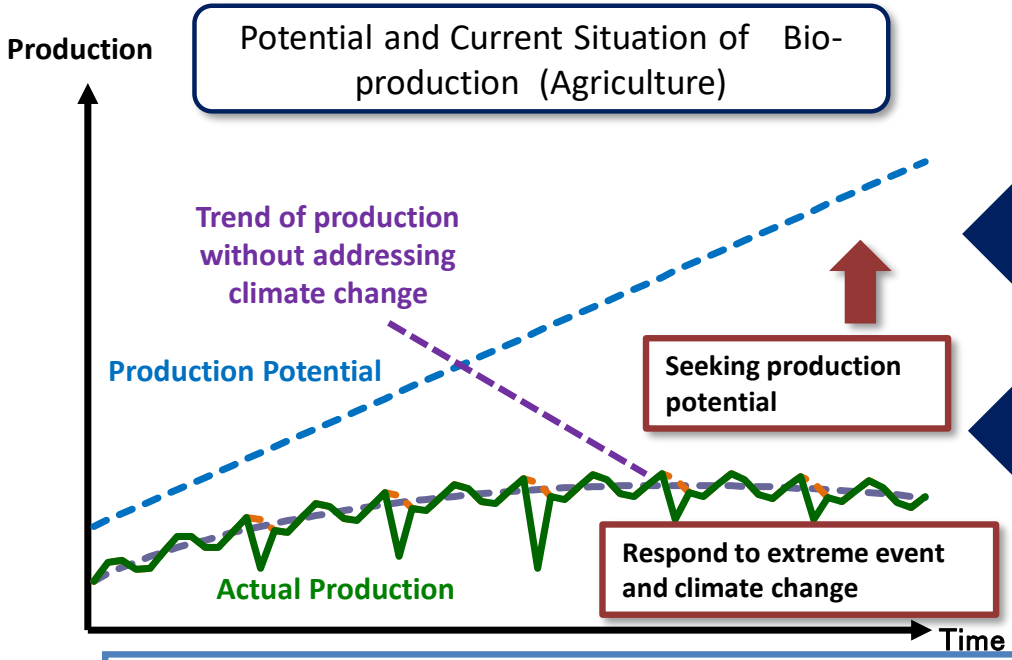
- High input, high yield, low variety
- single function optimization,
- high emission (waste, discharge)

- Low input, low yield
- high variety, multiple functions
- low emission (waste, discharge)

Sub-Theme1 : Adaptation of Bio-production to Climate/Ecosystem Change

Objectives

- Indicating high-resilience biological production systems and high-resilience biological production management systems based on the evaluation of impacts of climate/ecosystem change and vulnerability of biological production in research objective area.



Strengthening the resilience of biological production

Contents of Sub-Theme 1

- **a. Evaluation of modern biological production systems**
- **b. Study of biological production systems and technologies**
- **c. Study of comprehensive agriculture**

a. Evaluation of modern Bio-production systems

Analyzing ⅰ) **production gap between current situation and production potential** and ⅱ) **impact of climate change** by applying econometric method to the data of production input and climate

Work with “b” and “c”

b. Study of Bio-production systems and technologies

- Work with “a.”
- Conducting field survey and using secondary data

- Analyzing and evaluating biological production systems and technologies based on field survey.
- Research respond to the risk of yield variability and extracting the resilience factors (e.g. cultural system, labor and cropping system)

Harvesting modern variety

- Increasing production by modern agriculture
- The risk of yield variability by homogenized variety？
- Environmental load-increasing？

Strengthening the resilience by integrating agriculture

High-Resilience Biological Production

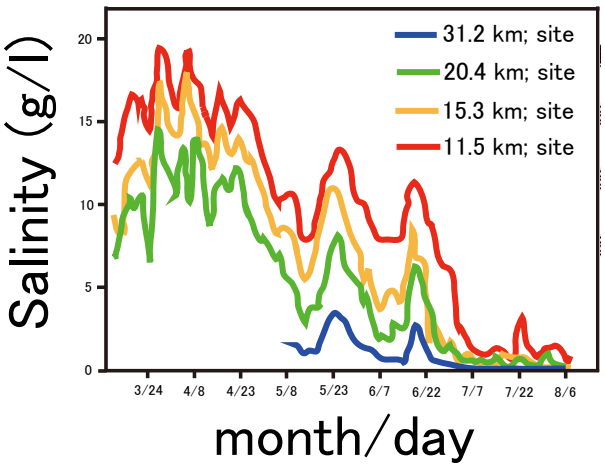
Integrating of rice cultivation with vegetables

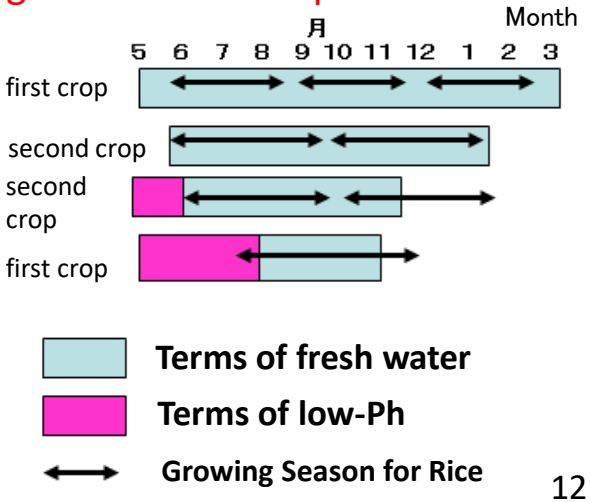
- Stagnating production by traditional agriculture？
- Environmental load-decreasing？
- Difficulty to production increasing？

c. Study of comprehensive agriculture

- Analyzing and evaluating comprehensive agriculture based on field survey.
- Evaluating candidate integrating farm management systems of agriculture with aquaculture

Change of rice production by salinity intrusion and integrating with shrimp aquaculture (Vietnam)





Sub-Theme 2 : Resilience enhancement through traditional knowledge and technology

Objectives

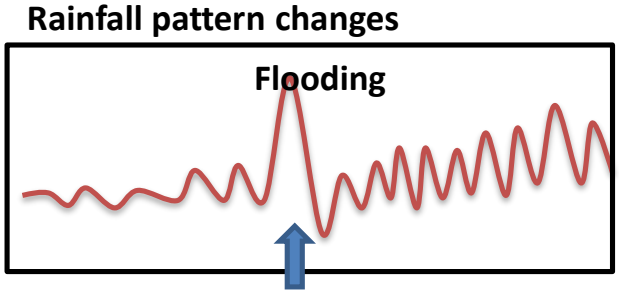
- Collect available traditional knowledge and technologies and assess their effectiveness for climate and ecosystem adaptation in target countries
- Apply traditional knowledge and technologies to rural development
- Propose resilience enhancement options and their application conditions to sub-theme 1 & 2

Methods

a. Collect traditional knowledge and technologies and develop the database in collaboration with the researchers from C/P universities (Vietnam National Univ. Hanoi, Universitas Gadjah Mada, Peradeniya Univ.)

b. Conduct a pre- and post-survey against recent extreme events at village and community scale

c. Assess effectiveness of traditional knowledge and technologies against different climate and ecosystem changes



Onsite survey and interviews

Sub-Theme 2 : Resilience enhancement through traditional knowledge and technology

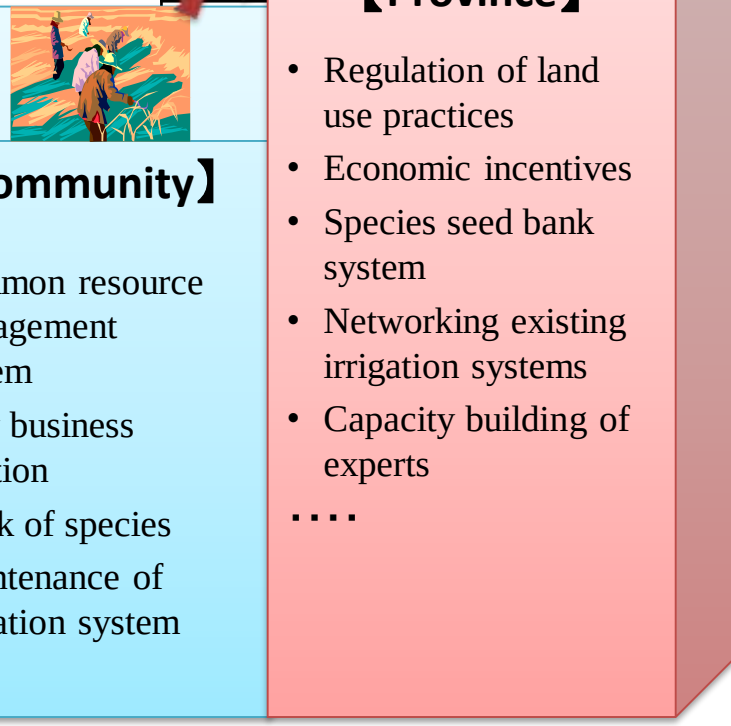
	Traditional knowledge and technologies	Basic data			Climate and ecosystem changes	SWOT Analysis			
						Internal		External	
		Agriculture/Engineering	Social conditions	Land use		Strengths	Weaknesses	Opportunities	Threats
Common	Local species				Temperature rise Drought Flood Deforestation	Hot tolerence, Drought resistance	Low yield	Regional brand	International market, Exchange rate
	Multi-cropping								
	Water resource management								
Vietnam	VAC system								
Indonesia	Pekarangan								
	Kebun-talun								
Sri Lanka	Kandyan Home Garden system								
	Tank irrigation system								

Modern bio-production

Traditional bio-production

complement

complement



Sub-Theme3 Bio-production system in harmony with conservation of biodiversity

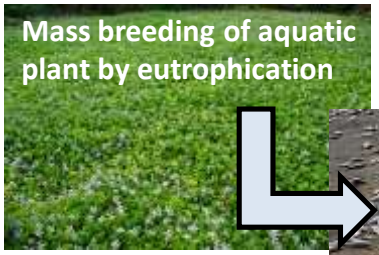
Objectives

- To assess effect of recent and traditional crop production systems on ecosystem services
- To reveal response of ecosystem to external shocks (e.g., flood and drought)
- To suggest optional crop production system contributes to strengthen resilience
- To suggest mosaic crop production system consisted from developed recent and traditional crop production systems

Materials and Method

1. Assessment of ecosystem by environmental traceability method (isotope and chemical analysis)
2. Development of ecosystem services inventory (crops, fruits, birds, fishes, aquatic plants ……etc.)
3. Examine farmer's coping behaviors and ecosystem's response to external shocks by field reconnaissance and questionnaires survey

Analysis of environmental dynamics and assessment of effect on ecosystem services



Death of Fish from lack of oxygen

Ecosystem services inventory

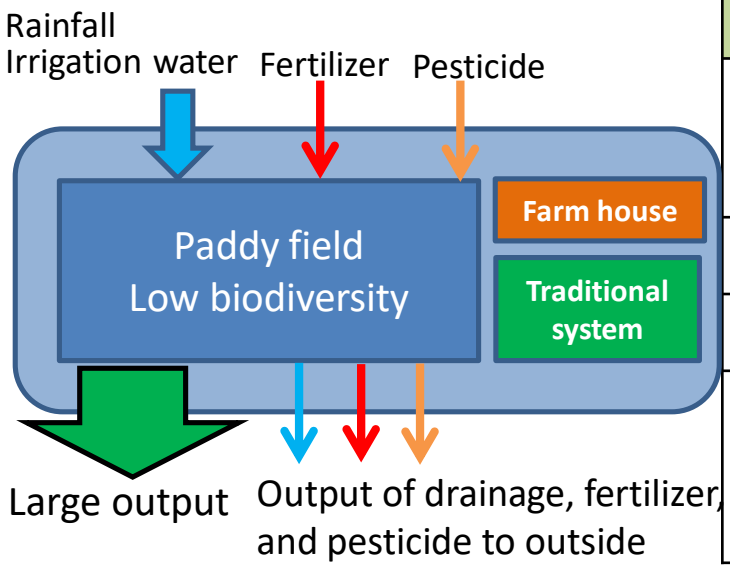
1) Provisioning service
.....
2) Regulating services
.....
3) Supporting services
.....

Field reconnaissance and questionnaire survey

Sub-Theme3 Bio-production system in harmony with conservation of biodiversity

Modern crop production system

Large input from outside of the system

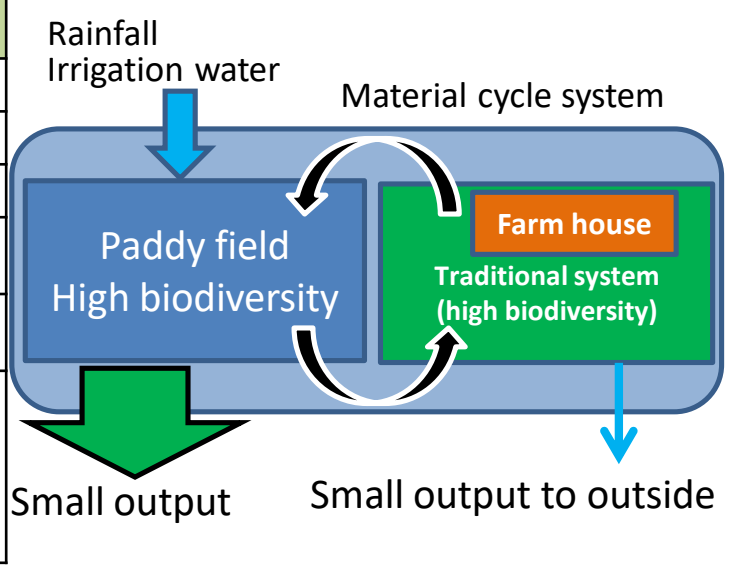


Ecosystem services inventory

Ecosystem service	Index	Flow/ Stock
Provisioning service	Rice	···
	Orchards	···
	Fishes	···
Regulating services	Water purification	···
Supporting services	Nutrient cycle	···
Bio-diversity service	Crops, Orchards, Birds, Fishes, Plants, ……etc	···

Traditional crop production system

Small input from outside of the system



Work together with sub theme 1

Development of technology and social system of low input sustainable production system which prevent catastrophic collapse

Synthesis between modern and traditional crop production systems

Work together with sub theme 2

Presentation of policy options for the use of local resources through strengthening resilience with scientific evidence

Mosaic crop production system resilience strengthen

Conclusion

- The integrated approach to address both climate and ecosystem changes could provide us with a new scientific framework and fresh policy design perspectives
- Such global and trans-disciplinary framework and perspectives could guide us to bring developed and developing countries together to streamline the international community's efforts
- We now stand at a critical juncture to combat against the impacts of these environmental changes that human societies have never faced before
- Researchers must respond to these rapid and dynamic changes to provide timely solutions to problems
- In light of the broadness and comprehensiveness of the issues at hand, such undertakings can be accomplished only through extensive collaboration among cutting-edge research institutes in the field

CECAR AFRICA

Climate and Ecosystem Change Adaptation and Resilience Research

Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach （FY2011～FY2016）

Professor Kazuhiko Takeuchi

Director, IR3S, The University of Tokyo

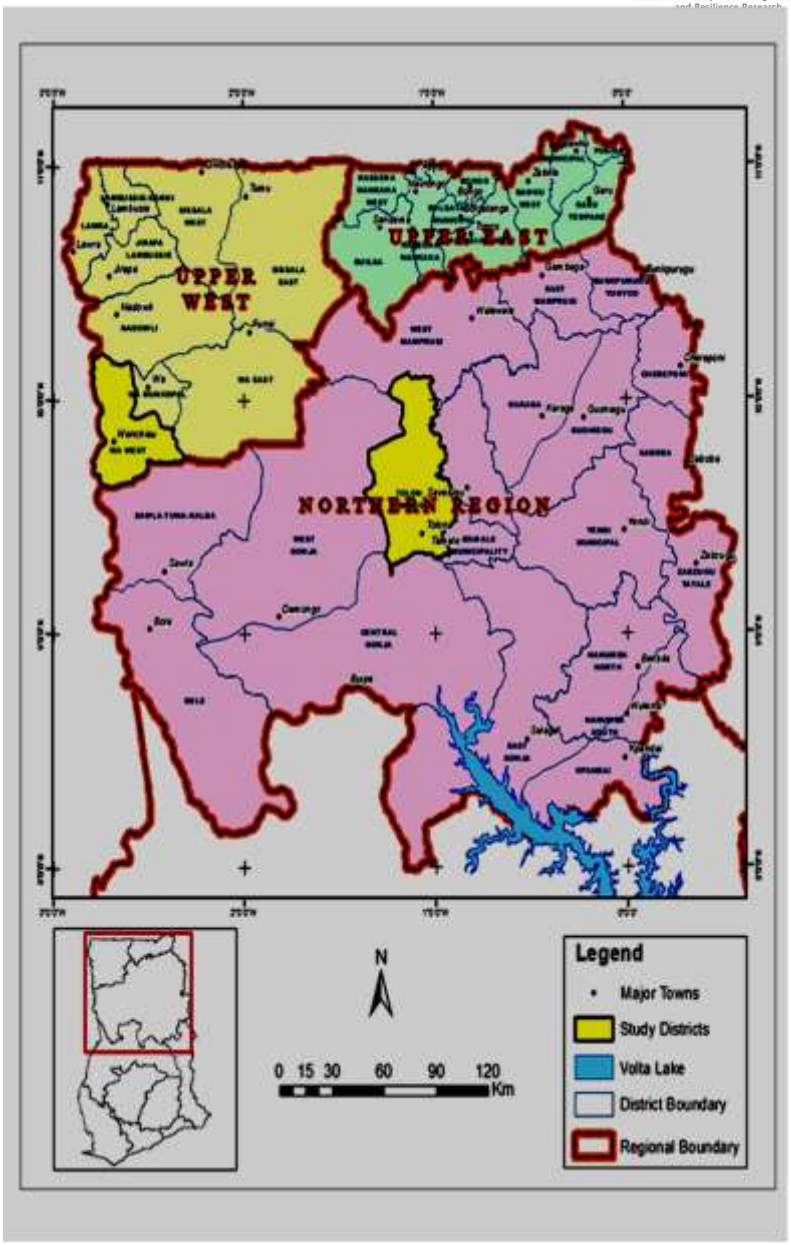
Senior Visiting Professor, United Nations University

Presentation Outline

1. Objectives, Research Structure, and Milestone
2. Integrated Resilience Assessment and Synergy among Three Themes
3. Social Implementation and Impacts of the CECAR-Africa Project
   - Community Level
   - Regional and National Level
4. Outreach and Upscaling of the Ghana Model
5. Research Outputs
6. Capacity Development and Exit Strategy
7. Key Messages and Recommendations to Policy Makers

The Goal of CECAR-Africa Project

- The project's primary goal was to develop a community-based resilience enhancement framework for flood- and drought-prone rural communities in semi-arid Ghana, as the "Ghana Model."
- The project examines resilience from the perspective of rural communities with the engagement and participation of relevant stakeholders at local, district, regional, and national levels, in particular targeting northern Ghana.



Three Thematic Areas and Research Structure

Theme 1: Forecast and assessment of climate change (CC) impact on agro-ecosystem

Agro-Ecological Resilience:

Theme 2: Risk assessment of extreme weather hazards and development of adaptive resource management methods

Engineering Resilience:

Downscaling of CC prediction

Mapping land use & ecosystem changes

Mapping CC impact on agro-ecosystems

Risk assessment under CC predictions

Improvement of weather monitoring & forecast

Flood & drought prediction

Hydrological modeling

CC down-scaling

Crop modeling

GIS & down-scaling training

Hazard maps

Early warning system

Training GMet staff

Information Platform

Local coping options:

- Multiple cropping
- Local knowledge
- Local variety
- Diversification of income sources

Capacity development

New business model

DRR* education

Institutional Technological training

Mitigating disaster risk through community-based capacity development

Ecosystem services & crop value chain assessment

Local perception & capacity assessment

Farmland and soil assessment & Household livelihood assessment

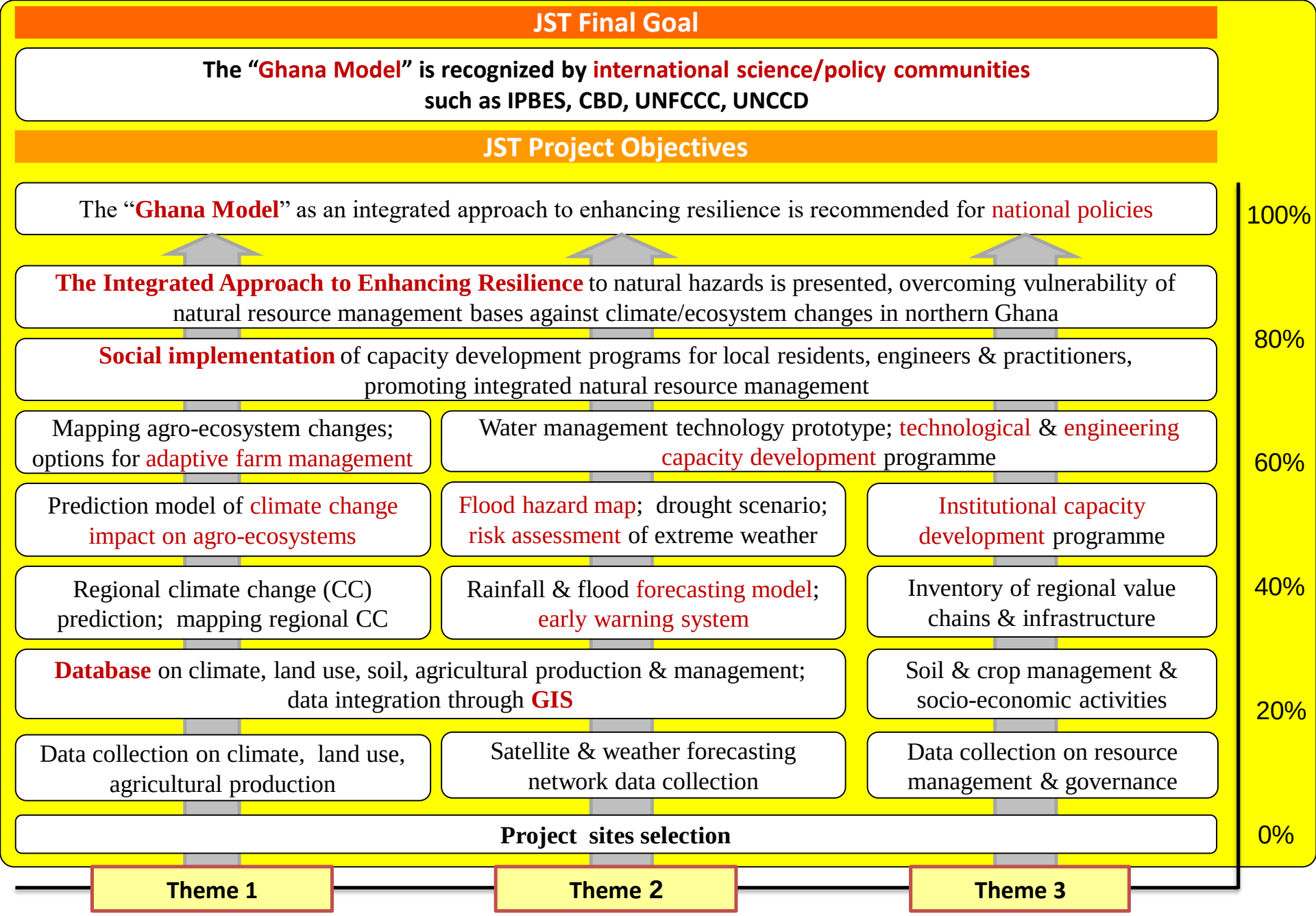
*DRR: Disaster risk reduction

Theme 3: Implementing capacity development programs for local leaders and practitioners

Institutional & Technological Capacity Development

Socio-Economic Resilience

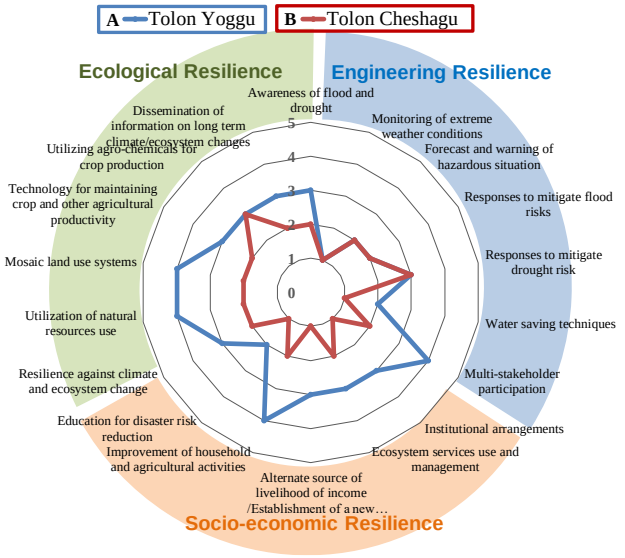
Establishment of Integrated Strategies to Enhancing Resilience


JST Final Goal
The "Ghana Model" is recognized by international science/policy communities such as IPBES, CBD, UNFCCC, UNCCD
JST Project Objectives
The "Ghana Model" as an integrated approach to enhancing resilience is recommended for national policies
The Integrated Approach to Enhancing Resilience to natural hazards is presented, overcoming vulnerability of natural resource management bases against climate/ecosystem changes in northern Ghana
Social implementation of capacity development programs for local residents, engineers & practitioners, promoting integrated natural resource management
Mapping agro-ecosystem changes; options for adaptive farm management
Water management technology prototype; technological & engineering capacity development programme
Prediction model of climate change impact on agro-ecosystems
Flood hazard map; drought scenario; risk assessment of extreme weather
Institutional capacity development programme
Regional climate change (CC) prediction; mapping regional CC
Rainfall & flood forecasting model; early warning system
Inventory of regional value chains & infrastructure
Database on climate, land use, soil, agricultural production & management; data integration through GIS
Soil & crop management & socio-economic activities
Data collection on climate, land use, agricultural production
Satellite & weather forecasting network data collection
Data collection on resource management & governance
Project sites selection
100%
80%
60%
40%
20%
0%
Theme 1
Theme 2
Theme 3

2. Integrated Resilience Assessment and Synergy among Three Themes

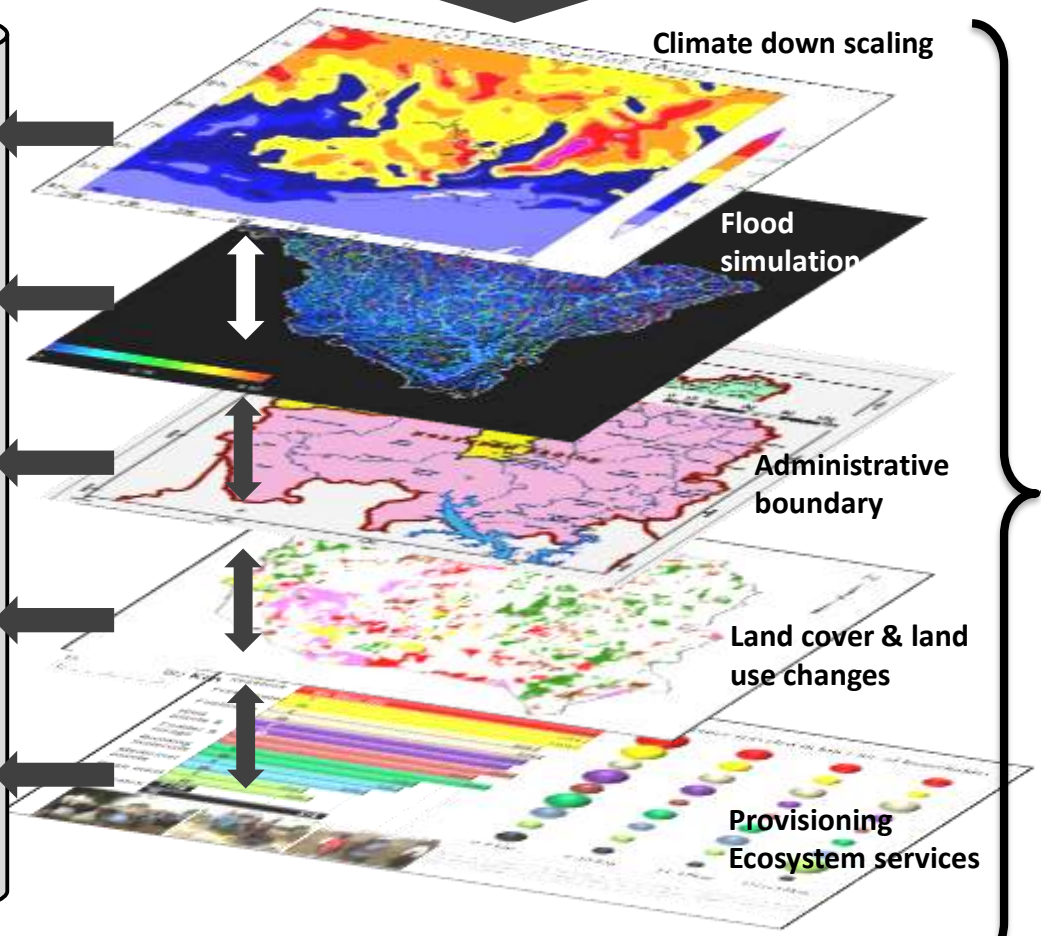
Definition of 'Ghana Model'

- **'Ghana Model' is an integrated resilience enhancement strategy against climate and ecosystem changes based on the assessments from agro-ecological, engineering, and socio-economic dimensions in vulnerable semi-arid Africa.**
- **It also includes the implementation of changes in social practices to improve livelihood, wellbeing and environment.**
- **This implementation occurs through multi-level and multi-stakeholder engagement, involving local communities and local and central governments.**



Major Drivers in sub-Saharan Africa: Climate, ecosystem, and socio-economic changes

Information platform
(GIS based data, maps, resources inventory, socio-economic status, etc.)
& Resilience indicator systems



Participatory approach

Knowledge sharing

Stakeholders

- International organizations
- National government
- Local government
- Urban residents /migrants
- NGOs
- GMet
- Business / Markets
- Universities / Schools
- **Rural Communities**

Participation

Social implementation

Co-designing Ghana Model as an integrated resilience enhancement strategy based on full scale resilience assessment

Application to Sub-Saharan Africa

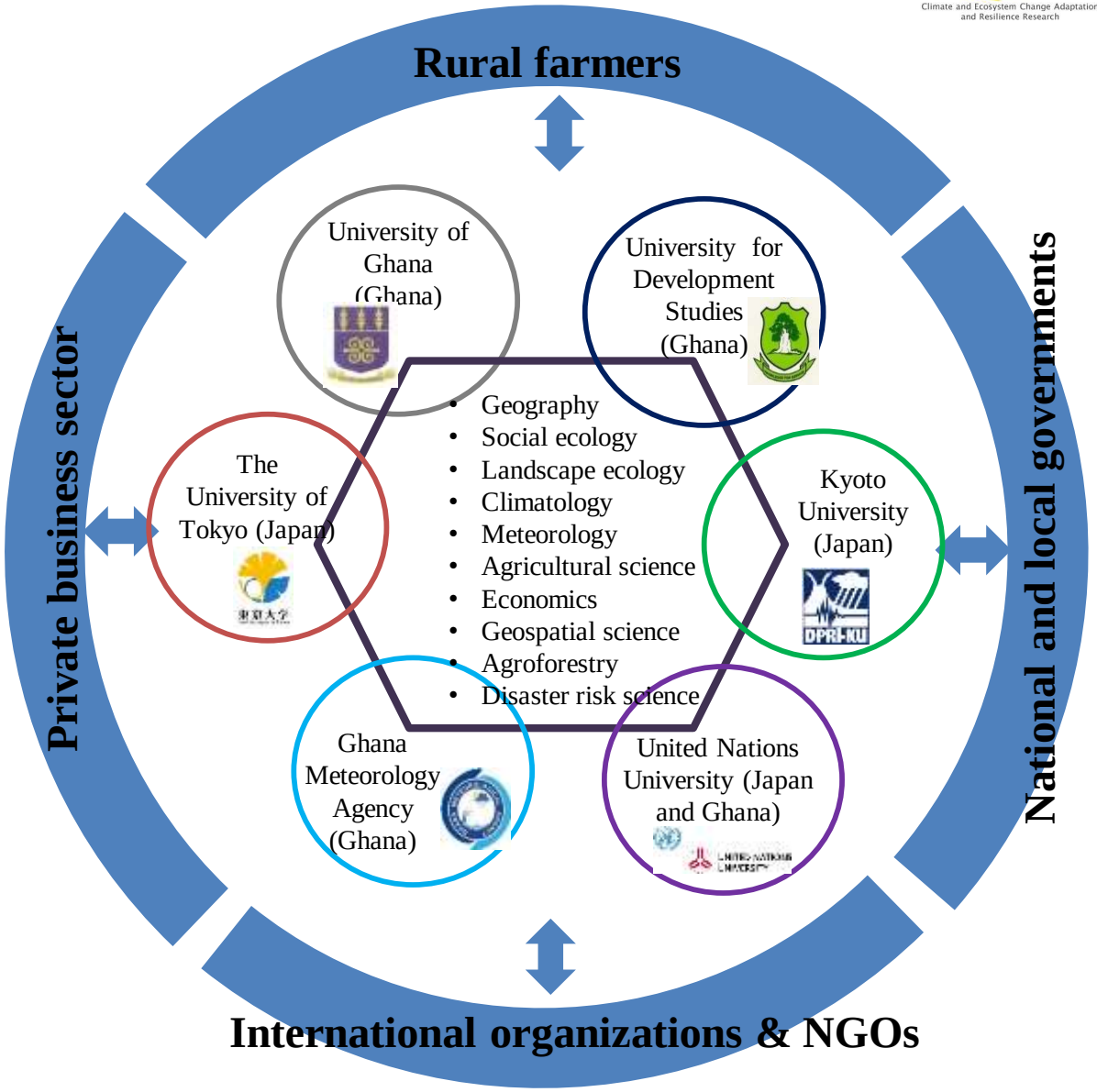
Full scale application and customization of Ghana Model

Fast-track and simplified application of Ghana Model

7 Guiding Principles (P) of Ghana Model

P 1: Formulating a transdisciplinary research team

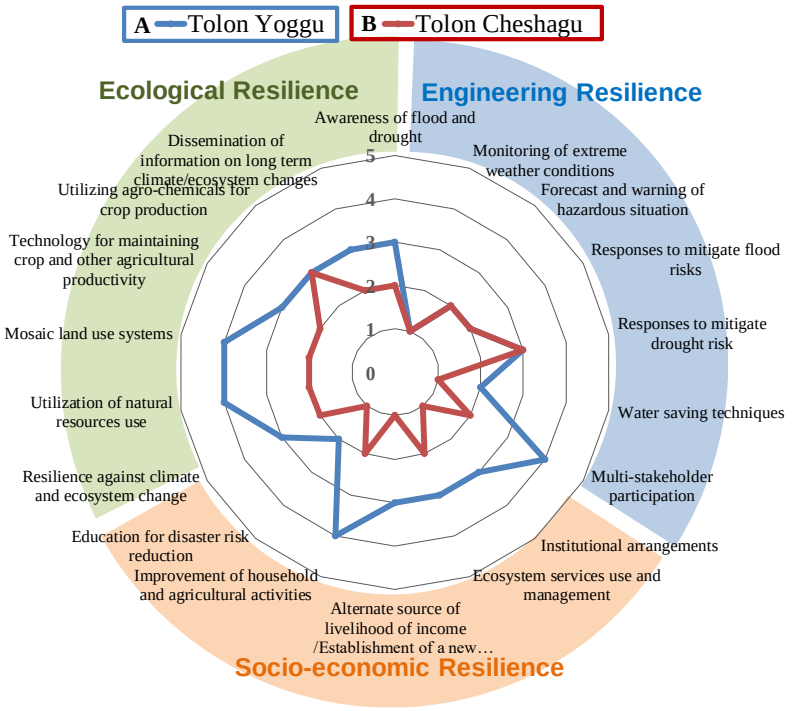
P 2: Creating fora for multi-level, multi-stakeholder and collaborative engagements in the research process: designing, implementation and monitoring stages



Guiding Principles (P) of Ghana Model

P 3: Comprehensive assessment of resilience from regional to community scale using appropriate parameters and indicators

P 4: Establishing common platform for data collection, sharing and management



Guiding Principles (P) of Ghana Model

P 5: Recognizing community institutions and their traditional and local knowledge systems and practices as critical components in co-design and co-production of resilience enhancement strategies

P 6: Creating avenues for cross-scale integration and inclusivity in capacity development

P 7: Recognizing and responding to the need for local ownership and sustainable efforts

Resilience status in 6 drought-prone communities

Resilience status in 4 flood-prone communities

Agro-Ecological resilience

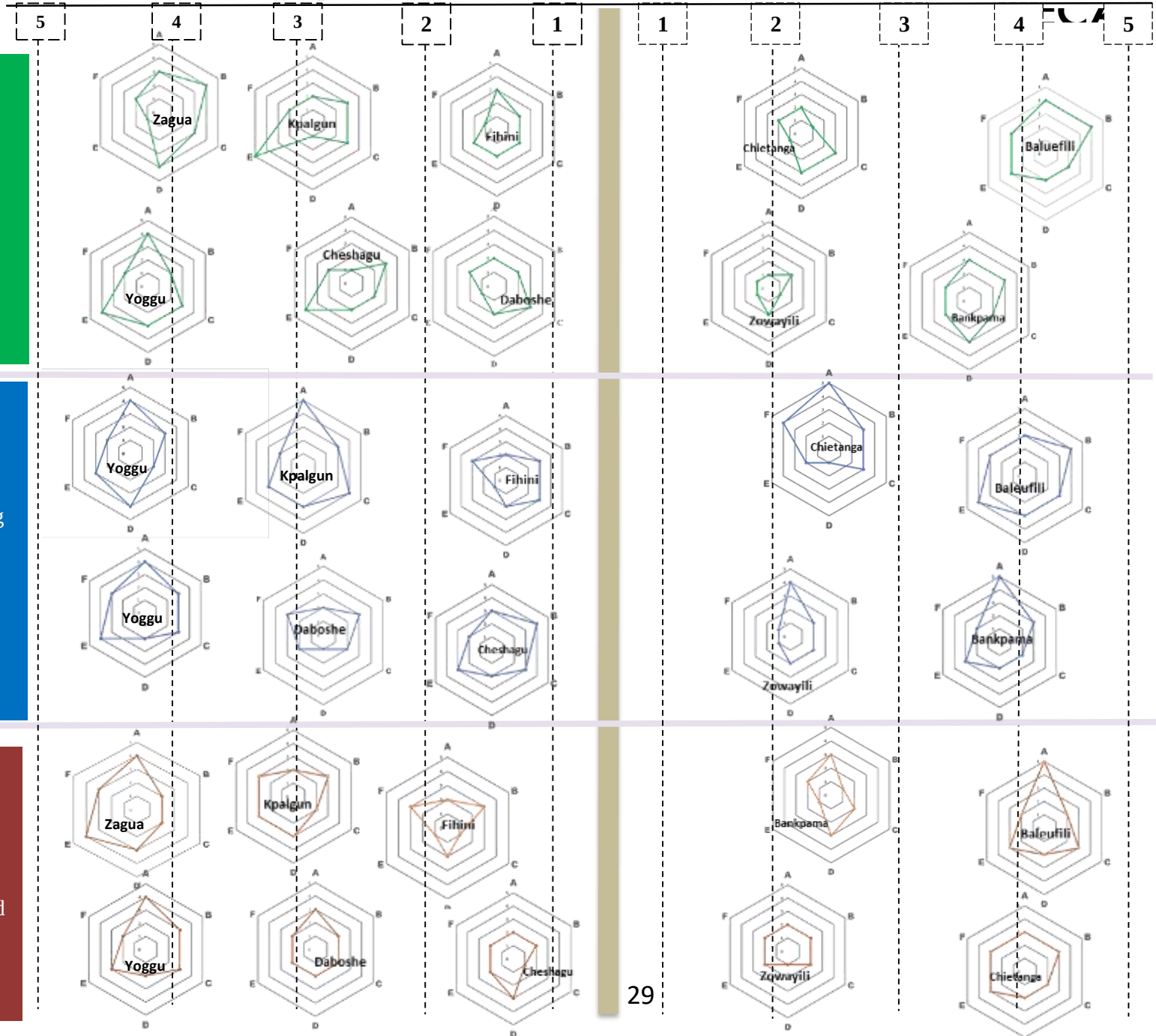
- **A**= Climate change resilience
- **B**= Natural resource use
- **C**= Mosaic land use systems
- **D**= Agriculture tech
- **E**= Agro-chemical use
- **F**= Information dissemination

Engineering resilience

- **A**= Flood and drought impact
- **B**= Extreme weather monitoring
- **C**= Forecast and warning of hazards
- **D**= Mitigating flood impacts
- **E**= Mitigating drought impacts
- **F**= Water saving techniques

Socio-economic resilience

- **A**= Multi-stakeholder
- **B**= Institutional arrangements
- **C**= Eco. services use
- **D**= Alternative livelihood
- **E**= Household entrepreneurship
- **F**= DRR Education



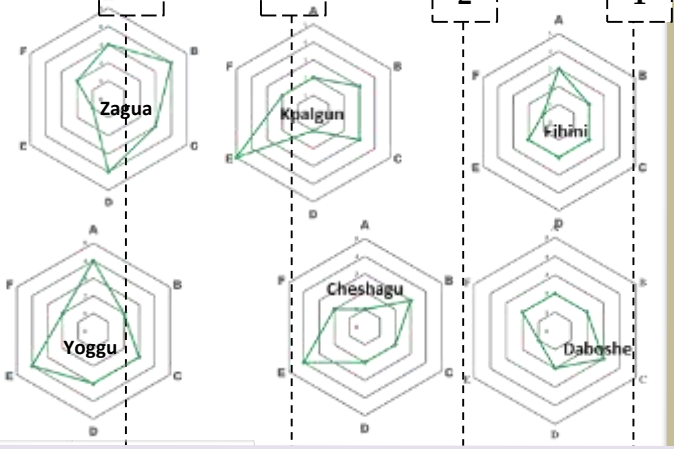
Resilience status in 6 drought-prone communities

Example of Interventions

5 4 3 2 1

Agro-Ecological resilience

- A= Climate change resilience
- B= Natural resource use
- C= Mosaic land use systems
- D= Agriculture tech
- E= Agro-chemical use
- F= Information dissemination



Engineering resilience

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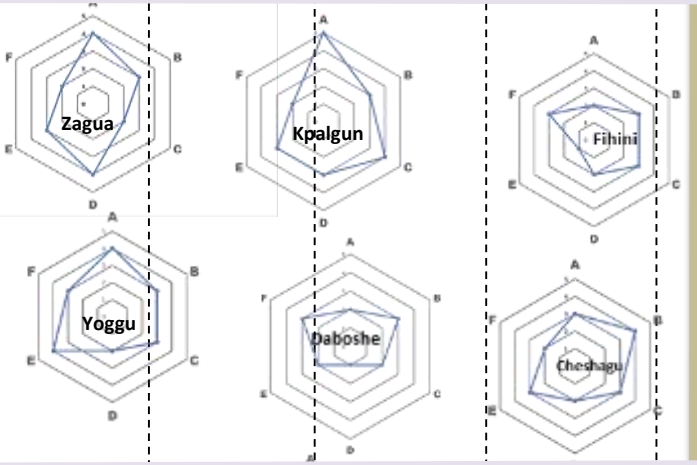

Socio-economic resilience

- A= Multi-stakeholder
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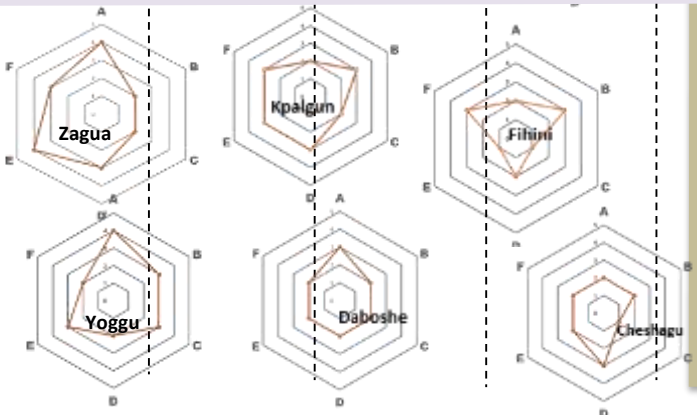


Using agro-fertilizer (organic, manure) — ZG YG KP CH DB — FH DB

Introducing suitable crop varieties — ZG YG KP CH DB — FH CH

Combining modern land use with traditional land use (woodlots) — ZG YG KP CH DB — FH KP

Agricultural field experiments (introducing drought resistant rice) — ZG YG DB KP — FH CH

Water level study and borehole construction — ZG YG KP — FH CH

Satellite observation of rainfall, flood and soil moisture — ZG YG DB KP — FH CH

Livelihood diversification: Promoting pepper (women crop) cultivation for income diversification — ZG YG KP DB CH FH

Value addition of shea butter — KP CH ZG — YG ZG

DRR training of teachers — ZG YG KP DB CH FH

Demonstration plots on okra and pepper to teach locals in using resilient local land management practices

Co-creating drama (environmental theatre) using local culture and knowledge systems — DB FH CH KP YG ZG

Example of Interventions

Co-creating drama (environmental theatre) using local culture and knowledge systems

ZY CT BL BK

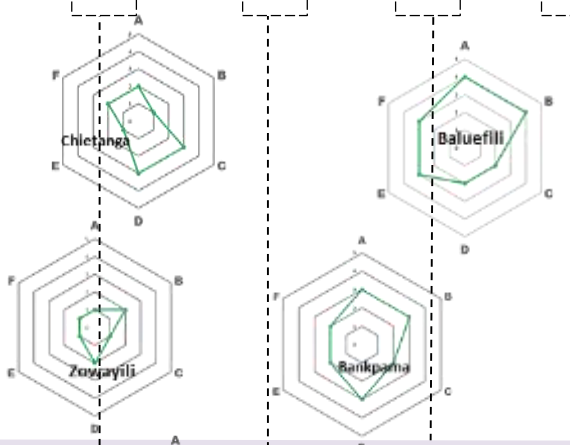
Demonstration plots on okura and pepper to teach locals in using resilient local land management practices

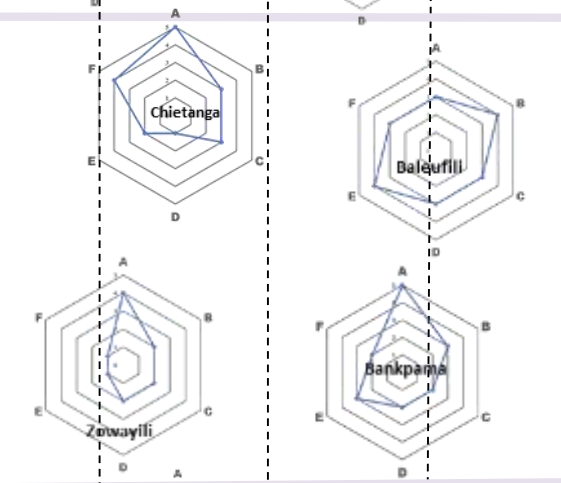
ZY CT BL BK

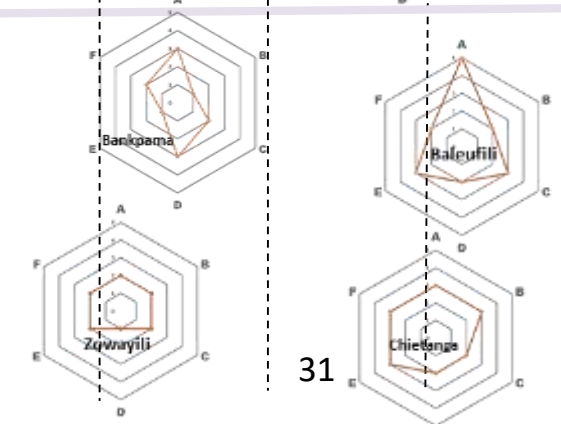
- Using agro-fertilizer (organic, manure) — ZY CT BK BL
- Improvement farm management techniques (shifting planting date) — ZY CT BK BL
- Using natural resources (forest & crop land) properly — ZY CT BK BL
- Design and promotion of flood refuge with stakeholders — ZY CT BK BL
- Flood forecasting and drought alert (Early warning systems) — ZY CT BK BL
- Sustainable use of water for dry season farming — ZY CT BK BL
- DRR training of teachers — BK ZY CT BL
- Promotion of aquaculture — ZY CT BK BL
- Livelihood diversification (honey bee keeping & marketing) — BK ZY CT BL

Resilience status in 4 flood-prone communities

1 2 3 4 5







Agro-Ecological resilience

- **A**= Climate change resilience
- **B**= Natural resource use
- **C**= Mosaic land use systems
- **D**= Agriculture tech
- **E**= Agro-chemical use
- **F**= Information dissemination

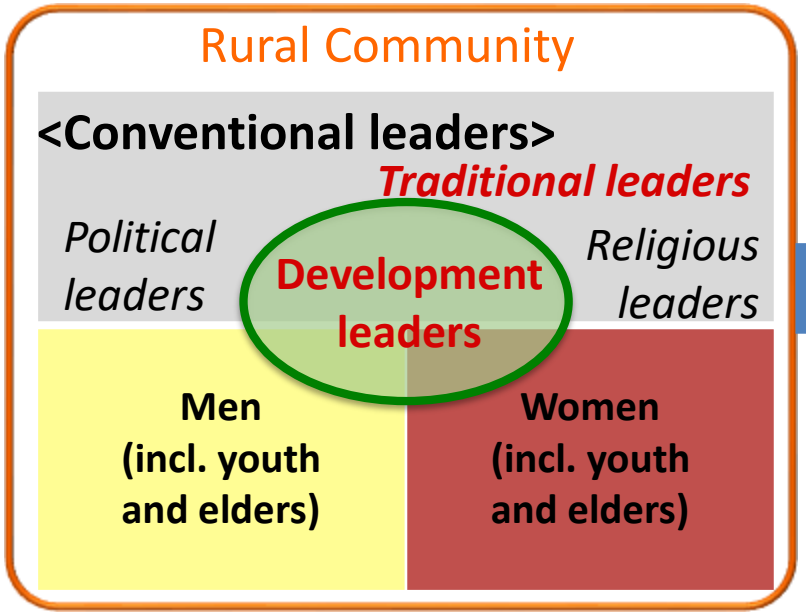
Engineering resilience

- **A**= Flood and drought impact
- **B**= Extreme weather monitoring
- **C**= Forecast and warning of hazards
- **D**= Mitigating flood impacts
- **E**= Mitigating drought impacts
- **F**= Water saving techniques

Socio-economic resilience

- **A**= Multi-stakeholder
- **B**= Institutional arrangements
- **C**= Eco. services use
- **D**= Alternative livelihood
- **E**= Household entrepreneurship
- **F**= DRR Education

Community-level Capacity Assessment and Enhancing Resilience Capacity



Internal factors

Community-level Capacities

Institutional Capacities of Dev. Leaders in community

- Mutual Accountability
- Engagement & Participation
- Ownership

Technical Capacities of community

Various sectors

Education | Health | Shelter | Sanitation | Potable water | Agriculture | Food security | Electricity | Firewood | Road & transport | Peace | Security etc.

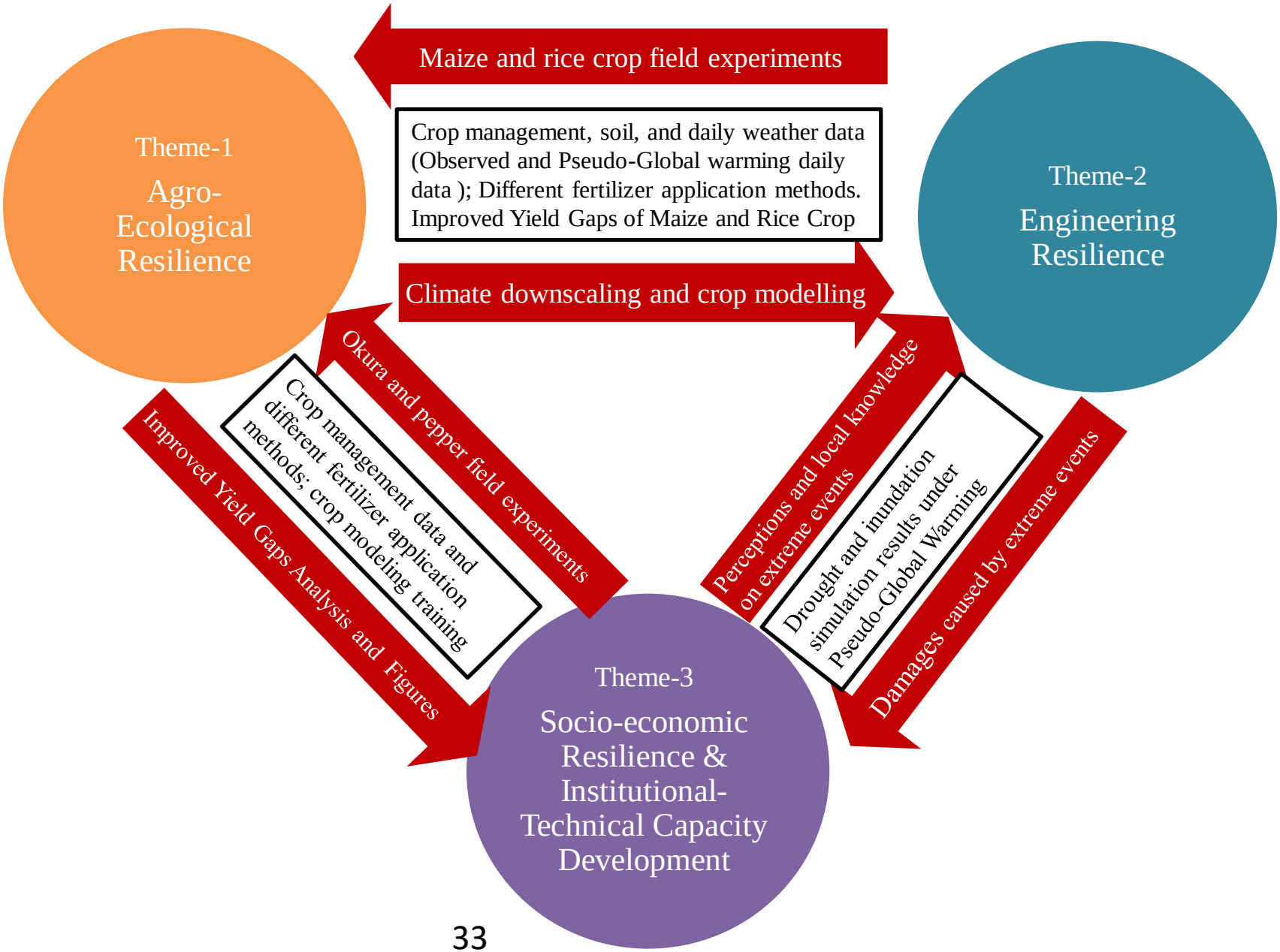
- Disaster Management
- Asset Management

Key basic community attributes

- Locations
- Socio-demographic characteristics (e.g., population, ethnic groups, religious beliefs)
- Leadership structures
- Availability of assets

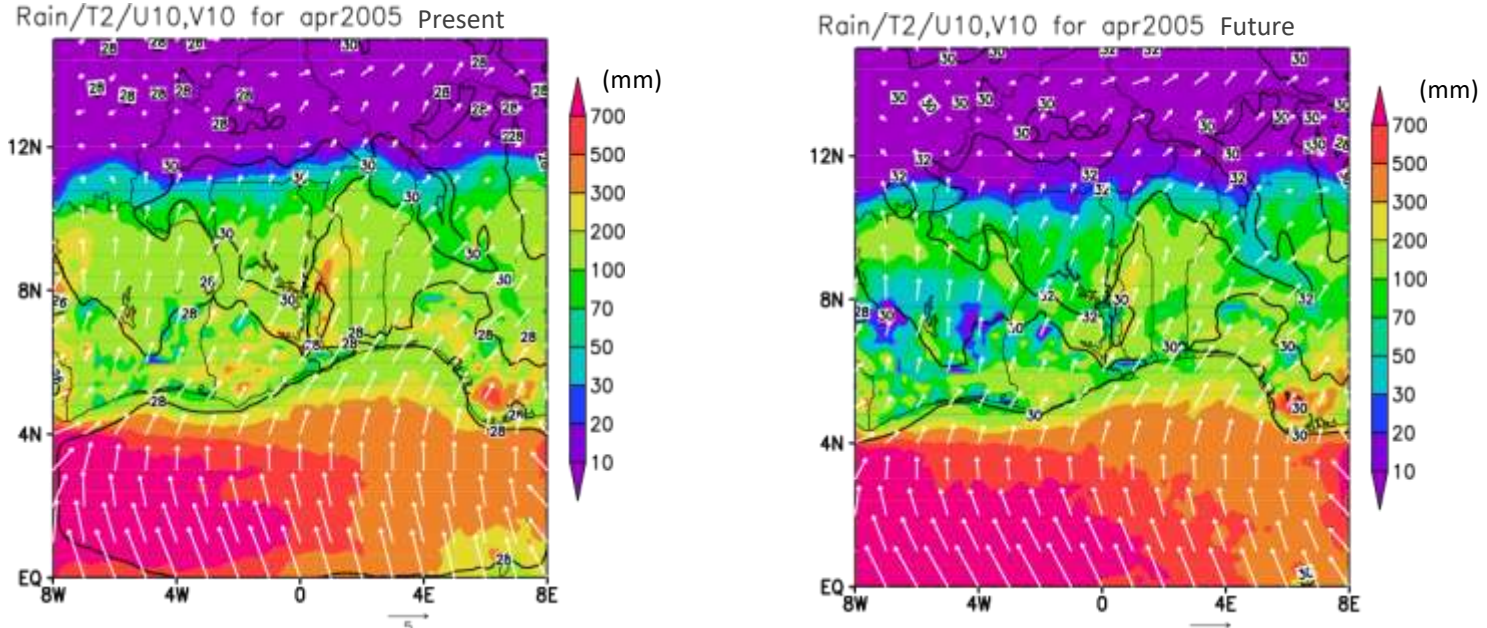
Community-Driven Development through forging:
Mutual Accountability (e.g., institutionalized platform for development), **Engagement & Participation** (e.g., proactive external engagement through citizen government engagement approaches), and **Ownership** (e.g., self-help efforts)

Integration Approach of Three Thematic Themes



Theme 1: Climate Downscaling, Climate and Ecosystem Changes Impacts on Agriculture Production and Agro-biodiversity

Example of results of pseudo-global warming (RCP6.0)



Comparison between DDS and pseudo-global warming (case of precipitation in April)

Month	Precipitation change	Temperature increase	Wind change
January	No change	+3.5	Westerly anomaly
April	Much drier (50% down)	+3	Easterly anomaly
July	No change	+3	Northerly anomaly
October	No change	+3	No change

RCP: Representative Concentration Pathways (8.5, 6.0, 4.5, 2.6)

DDS: Dynamic downscaling

Synergy among Three Themes through Climate Downscaling and Pseudo-Global Warming Experiment

Theme 1

Climate Change

Dynamical Downscaling (RCP4.5&8.5)

Building model for simulating impact of climate change (**pseudo-global warming**)

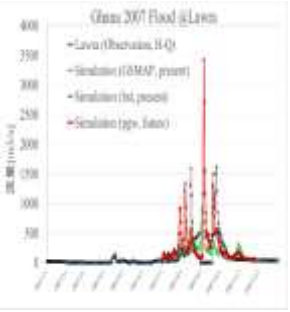
Agricultural Production

Simulating agricultural production by crop model

Theme 2

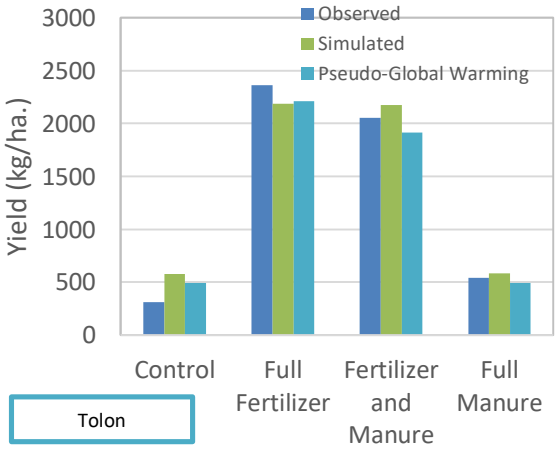
Extreme Event

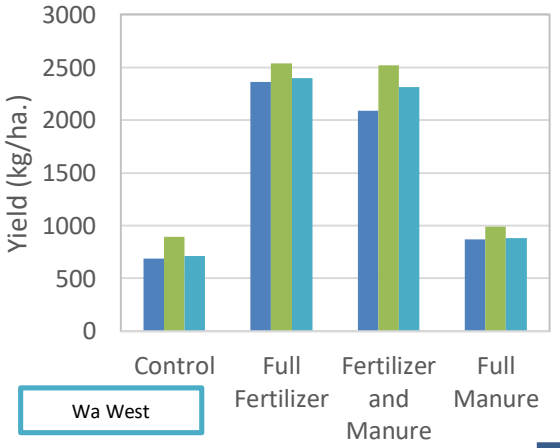
- Change in river water level and inundation area
- Change in seasonality of climate



Two purposes of crop model simulation to enhance resilience

Impact of climate change

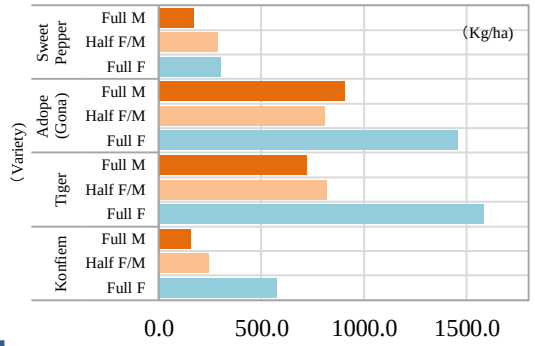




Comparison simulation results of maize and adaptation strategy

Crop Diversification

- Field experiments and simulation for crop diversification
- E.g. *Maize, pepper, okra*

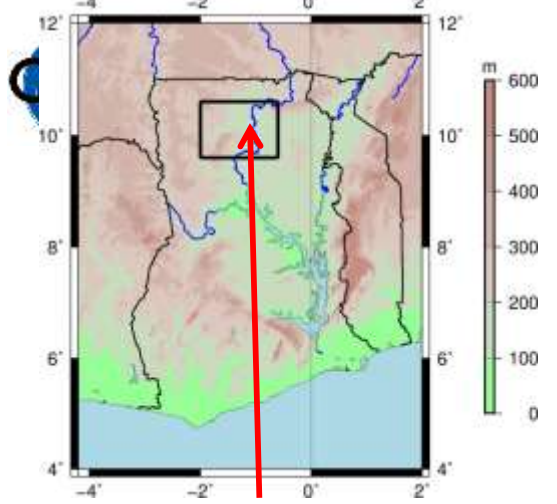


Simulation results of pepper (Wa West)

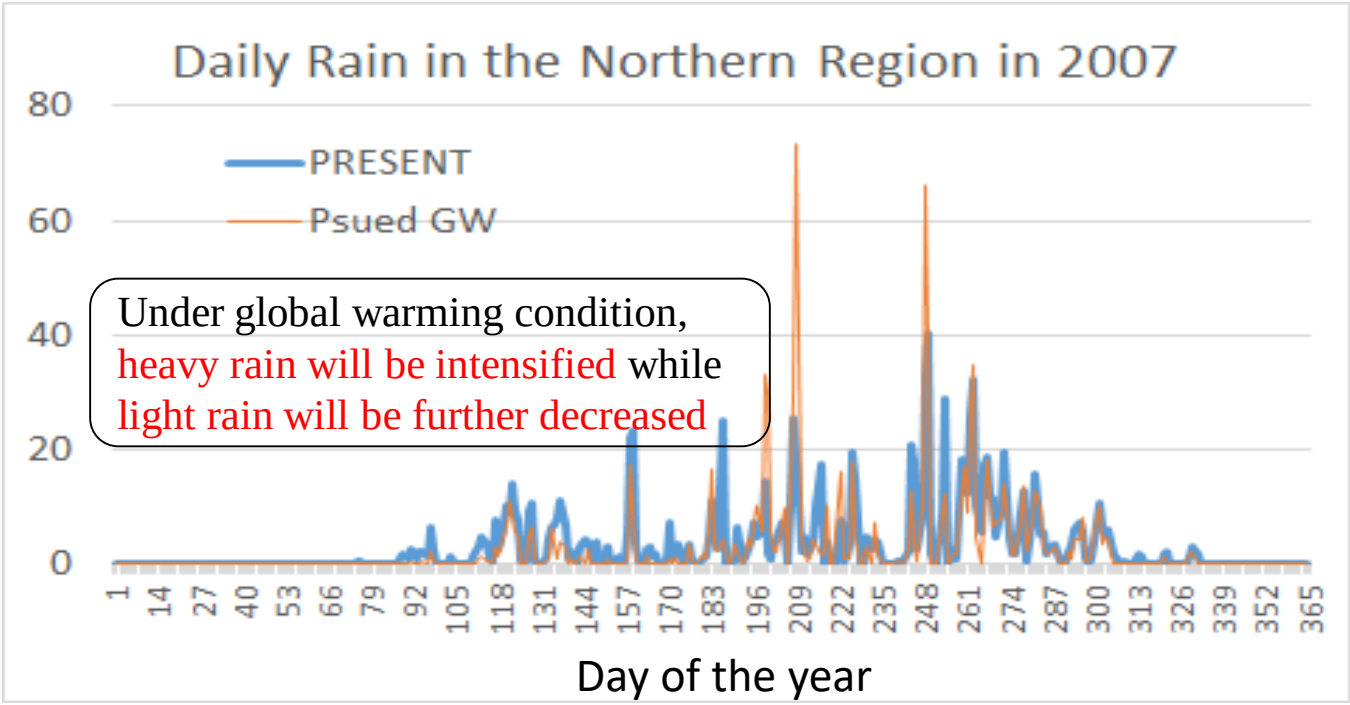
Theme 3

Building Resilience Enhancement Strategy

- Diversification of Income sources and crop variety
- Farmland soil improvement through manure application
- Relocation of farmland and houses
- Agroforestry

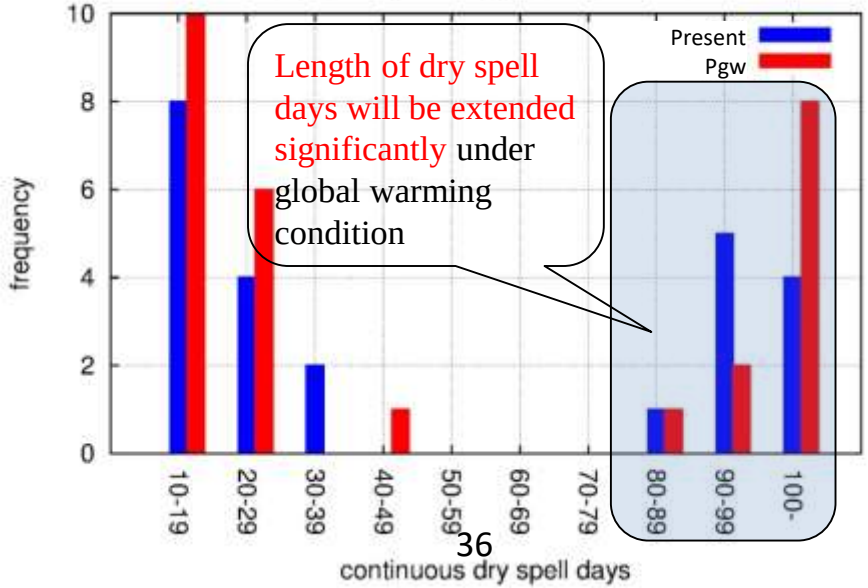


Target area of analysis
(2W-0.6W, 9.6N-10.6N)



Under global warming condition, heavy rain will be intensified while light rain will be further decreased

Frequency of continuous dry spell at Tolon
During dry season (Nov – May)



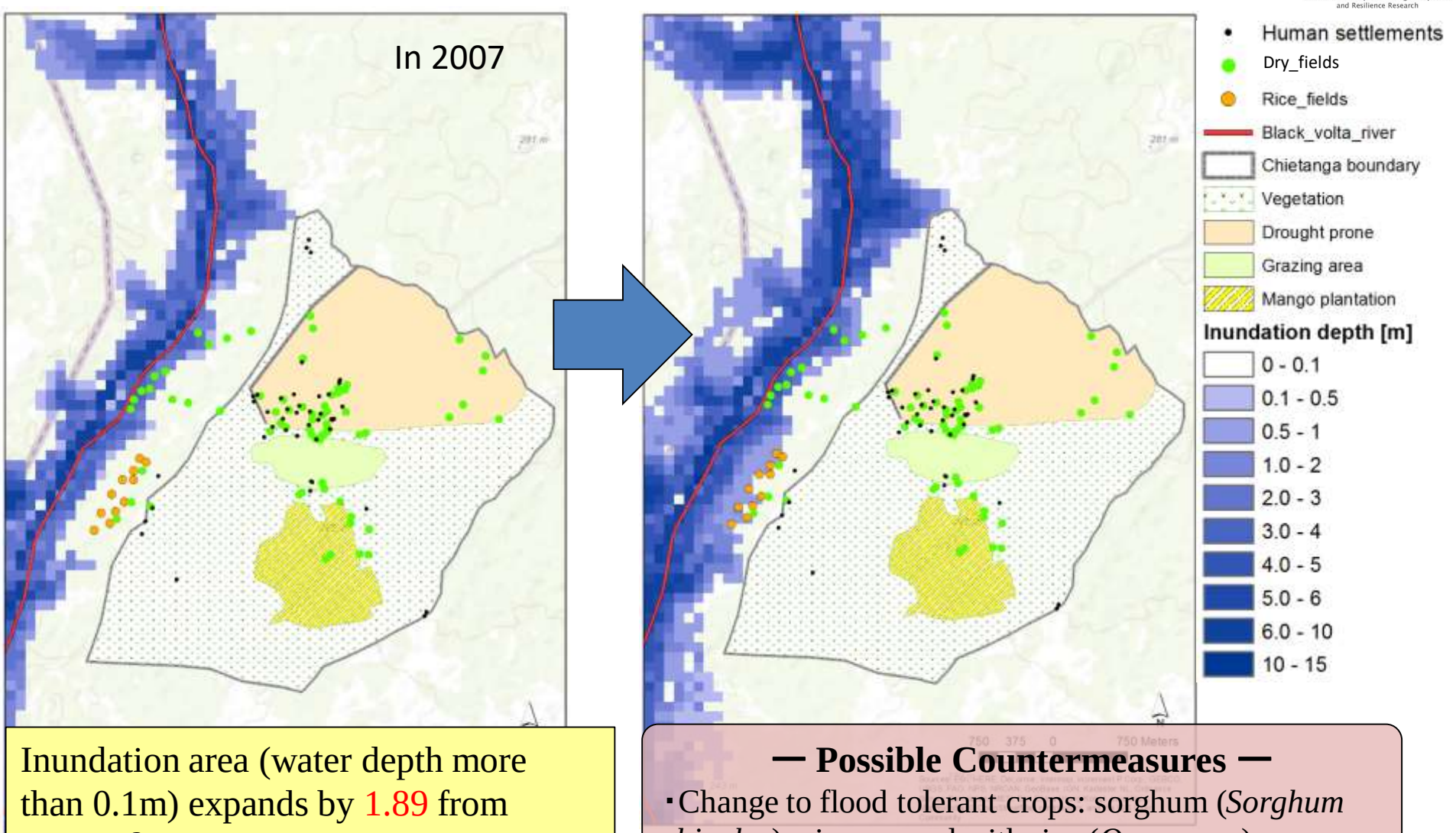
Present: present climate
Pgw: Pseudo global warming simulation

– Possible Countermeasures –

- Water saving agriculture
- Shift of crops calendar
- Use of borehole for drinking water
- Weather Index Insurance (WII)

Estimated Inundation Area under Current Climate Simulation（After 8 days)

Estimated Inundation Area under Pseudo Global Warming Experiment（After 8 days)



Inundation area (water depth more than 0.1m) expands by 1.89 from 45.6km^2 under the current climate to 86.1km^2 under Pseudo Global Warming experiment

— Possible Countermeasures —

- Change to flood tolerant crops: sorghum (*Sorghum bicolor*) mix-cropped with rice (*Oryza* spp.)
- Design temporal flood protection levee by sandbag
- Slight shift of houses to the higher field

3. Social Implementation and Impacts of the CECAR-Africa Project

Project Impacts at Community Scale: Diversification of Livelihoods

- Household members — both men and women — look for diverse livelihood opportunities inside and outside of their communities.
- Livelihood diversity (on-farm, off-farm & non-farm opportunities) can enhance the resilience of the community.
- Expanding the value chain to sell products in the community.

Promoting peppers and okra (crop diversification)

Selling honey
(livelihood diversification)

Livelihood Strategies Improvement Activities in Collaboration with Communities

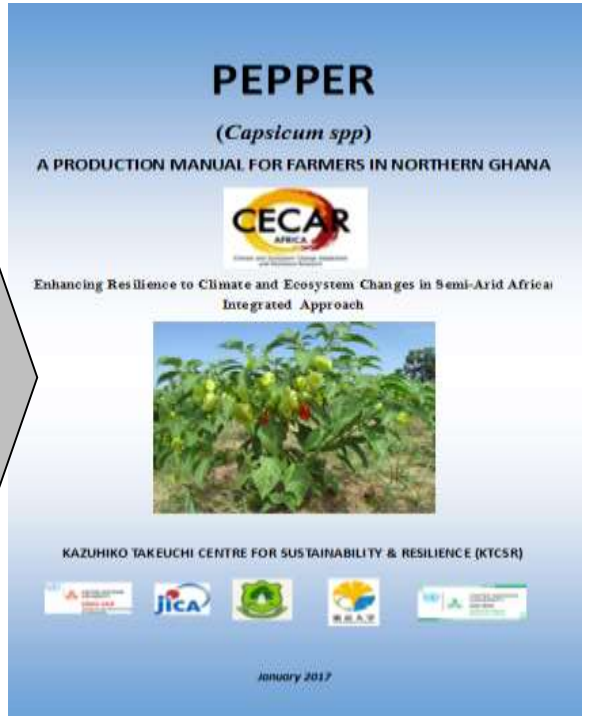
Teaching good land management practices on community rice farms

Climate-smart agriculture techniques
(Applied the banding method on the rice field for water conservation and climate-smart response)

Bore-hole construction

Improving Pepper (*Capsicum spp.)* Value Chain: Solar Dryer & Manual produced

- *Pepper Production Manual',* workshops were organized for the multi level stakeholders to validate the manual in Wa and Nyankpala, with representatives from different organizations.
- Their inputs have been incorporated into the Manual and its being printed for uses by farmers, Ministry of Food & Agriculture (MOFA) extension staff etc
- Commercial orientation for pepper crop being promoted
- Similar manuals and training will be promoted to other commercial crops such as okura and yam



Training Workshops on Improved Cook Stove Construction

Objective: To reduce biomass (fuel wood) consumption

Target: Shea butter processors, rice parboilers and household fuelwood users

Process:

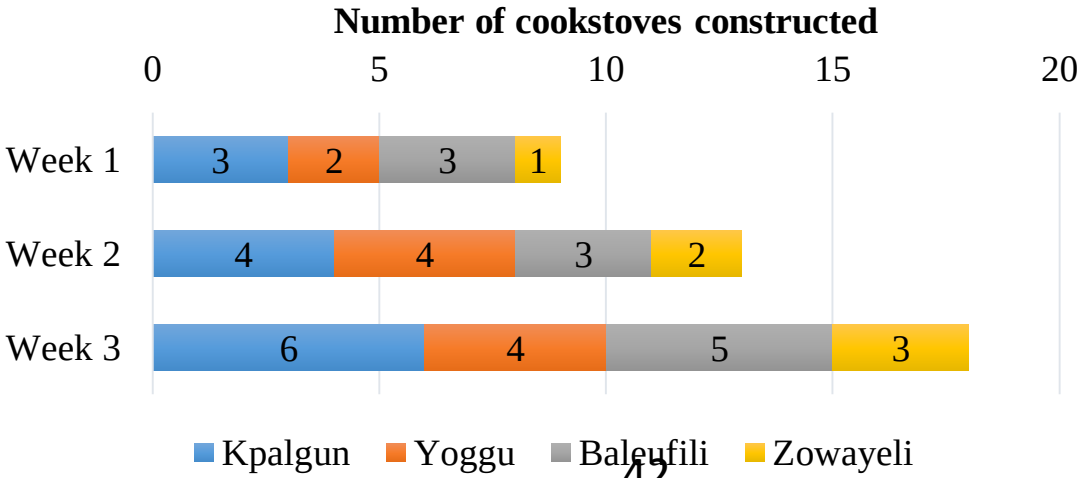
- At least, 15 women trained in each of four communities in February, 2016
- At least 3 women in each community are now experts in stove construction and will be supported help other communities construct their own

Conventional stone stove

32-39% fuel wood saving

Improved stove

Outcomes



Co-Creating Drama with Communities

- There are major challenges in effectively engaging communities and disseminating scientific findings where illiteracy rates are high.
- Locals draw on traditional culture and practices to tell stories of changes in their community.
- An opportunity to empower local communities to understand research findings and promote self-action beyond immediate project interventions.

Key Messages in Theatre

Past

- Predictable weather
- Fertile land

Present

- Unpredictability in weather
- Shortage of fertile farmlands

Future

- Extreme weather
- Multiple livelihood sources
- Integrating knowledge
- Climate -smart agriculture

Impact at Regional and National Scales: Final Project Workshops in Tamale and Accra, Ghana

Objective: To disseminate key policy and development relevant outcomes and to present the template for the development and implementation of the 'Ghana Model'

1. Tamale WS (31 Jan. 2017): Community members presented in contributing to discussions cited examples of the positive impact.
2. Accra WS (2 Feb. 2017): 87 Representatives from different organizations such as governmental and non-governmental institutions, private sectors and research institutions presented to deliberate on the policy relevance.

- Discussed how to effectively scale up and apply the Ghana Model within Ghana and beyond in Sub-Saharan Africa.
- Examined how the project outcomes provides critical baseline data and concrete inputs to relevant national development strategies and plans in Ghana.

Daily Graphic, 3 Feb 2017

Daily Graphic

Truth & Accuracy Every Day

‘Integrated research needed to minimise dangers of climate change’

By Charles Andoh & Esther Omoha, ACCRA

STAKEHOLDERS at a forum on climate change adaptation have called for integrated research approaches to help minimise the dangers of climate change on human lives and properties.

They were of the view that instead of tackling only an aspect of climate change, there was the need to incorporate established approaches, such as environmental and developmental challenges, social, ecological and economic in order to bring the situation under control.

The forum, held in Accra yesterday, was to mark the end of a five-year project titled: "Climate and Ecosystem Change Adaptation and Resilience Research (CECAR) Africa."

The programme was organised by the Institute of Environment and Sanitation Studies, College of Basic and Applied Sciences of the University of Ghana, Legon, and the Integrated Research System for Sustainability Science (IR3S) of the University of Tokyo under the Japanese International Cooperation Agency (JICA).

The stakeholders, drawn from academia, research institutions, policy makers, civil society organisations (CSOs) and non-governmental organisations (NGOs) in Ghana, deliberated on how to minimise climate change and educate Ghanaians on climate change adaptation.

Holistic approach

Briefing the media after the closing session, the Chairman of the CECAR Project, Prof. Chris Gordon, said the project sought to ensure that members of communities where it was carried out adopted modern ways of minimising climate change.

"In helping to reduce climate change, you consider a holistic approach in order to save human lives, as well as protect properties," he said.

Prof. Gordon stated that the project would go a long way to solve many of the problems affecting people in the northern part of the country, adding that there were plans to scale it up to other parts of the country.

"The project was able to establish that there is the need to bring integrated factors, including traditional knowledge, parallel relationships between the various social groups, gender and migration, together to help reduce the debilitating effect of climate change on the ecosystem," he added.

Quick Read

Adehyeman Savings & Loans

A research has established the need for integrated research approaches to help reduce the effect of climate change on the ecosystems.

Long-term goals of CECAR Project

The Director of the CECAR Africa Project, Prof. Kazuhito Takeuchi, indicated that the project had the long-term goal of providing members of the community with enough knowledge on climate change resilience.

"The project examines resilience from the perspective of rural communities with the engagement and participation of relevant stakeholders at the local, district, regional and national levels, in particular targeting northern Ghana," he said.

http://www.graphic.com.gh/news/general-news/integrated-research-needed-to-minimise-dangers-of-climate-change.html

Holistic approach

“In helping to reduce climate change, you consider a holistic approach in order to save human lives, as well as protect properties,” Prof. Gordon said. He stated that the project would go a long way to solve many of the problems affecting people in the northern part of the country, adding that there were plans to scale it up to other parts of the country. “The project was able to establish that there is the need to bring integrated factors, including traditional knowledge, parallel relationships between the various social groups, gender and migration, together to help reduce the debilitating effect of climate change on the ecosystem,” he added.

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Impacts on the Relevant Stakeholders in Social Implementation Process

Collaboration at District and National Level

Main Ministries: Education, Food and Agriculture, Communications
National Disaster Management Organization (NADMO)
Environmental Protection Agency
District Assemblies: Tolon, Wa West

Multi-lateral Agencies:

United Nations Development Program (UNDP)
Food and Agriculture Organization (FAO)
World Food Program (WFP)
USAID
CARE International

NGO/Business Entities:

Northern Rural Growth Programme (NRGP)
Savannah Accelerated Development Authority (SADA)
TAMA Shea processing
Tamaiko Food Processing
Association of Church Development Projects (ACDEP)
CARE International
GIZ, Tamale
Center for Sustainable Local Development (CSLD)
Melchia Investments Ghana Limited
Agri-Impact Consult
Franerix Solar Solutions Ltd

National Research Institutes:

Water Research Institute
Savanna Agriculture Research Institute (SARI)

Lunch meeting with representatives from business sectors hosted by VC of the University of Ghana on 3 Feb. 2017

Inputs into National and Global Policies and Frameworks

❖**Providing relevant and timely empirical data towards addressing climate and ecosystem changes & accelerated modernization of agriculture in Ghana:**

Ghana Shared Growth & Development Agenda II (2014-2017)

- *Working with District Assemblies on implementation & providing feedback through the annual evaluation system of the National Development Planning Commission (NDPC)*
- *Designing and providing evidence of practical research and adaptation techniques to be upscaled to other ecological zones of Ghana*
- *Improved climate smart techniques for crop (maize, rice, pepper, okra) production along a value chain*

❖**Critical database for examining progress of National Climate Change Adaptation Strategy & Sustainable Development Goals**

4. Outreach and Upscaling of the Ghana Model

Side-event:
"Enhancing Resilience against climate and ecosystem changes in Sub-Saharan Africa through utilizing indigenous and local knowledge"

- Date: 25 August 2016, 13:30 – 17:00
- Venue: University of Nairobi
- Objectives:
  1. Share recent research findings and best practices to enhance resilience of socio-ecological systems against climate, ecosystem and socio-economic changes.
  2. Strengthen international networks for further research and capacity development to implement relevant goals and targets indicated in the SDGs; and
  3. Discuss future action plans to promote collaborative research, capacity development, and social implementation.

- Highlighted the Ghana Model resilience enhancement framework as a prime example of needs-oriented research aiming to drive appropriate action by governments and development practitioners.
- Stressed its potential to be upscaled and encouraged researchers to replicate it in similar ecological regions within Sub-Saharan Africa.

Ghana Model Sessions in Sept.-Oct. 2016

- CECAR-Africa project organized Ghana Model Sessions in September 2016 at UNU by inviting young researchers and practitioners from 9 African countries.
- Five of them were invited through the financial support by JST.
- The sessions were conducted in three parts aimed at:

(1) sharing the key findings of the CECAR-Africa and the key principles of Ghana Model with the participants,

(2) exploring effective ways to upscale and apply the Ghana Model to other African countries beyond Ghana, and

(3) Collecting feedbacks and lessons learned from upscaling and applying the Ghana Model to other African countries.

Ghana, Zimbabwe, Cameroon, Lesotho, Kenya, Zambia, Ethiopia, Uganda, and South Africa

CBD COP 13 in Mexico, December 2016

- Prof. Takeuchi made a statement in the high-level segment and the opening plenary of CBD-COP 13, highlighting various outcomes related with UNU activities.
- He also emphasized in a side event the importance of collective efforts to restoring the links between nature and people under climate and ecosystem changes, particularly introducing the Ghana Model developed by CECAR-Africa project.

http://ias.unu.edu/en/news/news/unu-ias-research-highlighted-at-un-biodiversity-conference.html

Tokyo International Symposium Combating Desertification

東京国際シンポジウム「砂漠化と闘う」

豊かな土地を守るために－土地劣化の中立性

Date / Time: 7 February, 2017

- Interaction between global initiatives and local actions → Activating multi-level efforts for combating desertification — from the global to the local level — for achieving the global goals.
- Establishing resilient & sustainable communities

  → Promoting not only the rehabilitation of biodiversity and ecosystems to achieve Land Degradation Neutrality (SDG15.3), but also the establishment of resilient and sustainable communities.
- Global partnership → Japan needs to take a lead in promoting global partnerships (SDG 17) to strengthen implementation for combating desertification and land degradation.

IPBES-5 from 7 to 10 March 2017 in Bonn, Germany

- The Ghana Model will be introduced as a practical approach to building synergies between ILK and science through knowledge co-design and co-production and multiple-evidence bases as well as guiding principles for novel and culturally-appropriate ways to review, validate and disseminate results.
- The Ghana Model is also important for IPBES since it emphasizes community-based monitoring of environmental and global change, and local assessments of the status of indigenous languages, knowledge and community well-being.

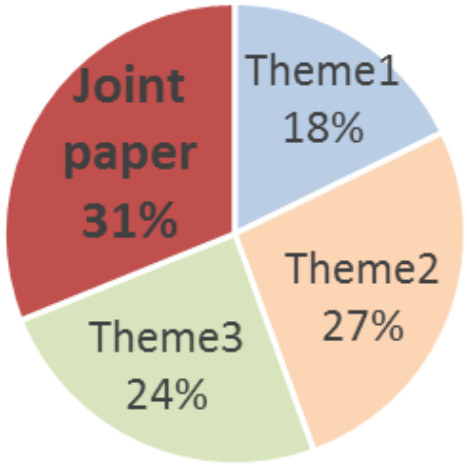
IPBES-1（Bonn, 2013/1/21-26）

5. Research Outputs

Summary of Research Outputs

- 45 Peer-reviewed papers
  - 28 Original research papers (22 collaborative papers by Japanese & Ghanaian researchers)
  - 17 Book chapters (8 collaborative papers by Japanese & Ghanaian teams)
- 47 Conference presentations
  - 3 Invited
  - 39 Oral presentations
  - 5 Poster presentations
- 8 news media coverages (articles) and TV news coverage

Peer-reviewed papers (N=45)



KTCSR Outdoors Ghana Model

News Published: 11 February 2017 Hits: 93

UDS website

The Ghana model for enhancing resilie
outdoored. This was done at a worksh
Resilience (KTCSR) of the University for D

The workshop was organized as part of
Africa (CECAR- AFRICA) project- a fi
change adaptation and resilience resea
change impact on agro- diversity, risk as
resource management method, and imp
professionals.

Delivering his welcome address, the Vice-Chancellor of UDS, Prof. Gabriel Ayum Teye note
aspects of Ghana's development agenda especially in the areas of agriculture and rural devel
building resilience in Africa through JICA. He added that "I am aware of the various capacity
output, the building of the capacity of the communities to improve their resilience and sustain
stations geared towards early warning and the development of the Ghana model which is expe

For his part a former Under- Secretary General of the United Nations and Executive Director,
of Tokyo, Prof Kazuhiko Takeuchi was grateful to the Japanese Ambassador and UDS man
collaboration with Ghanaian institutions would further be deepened especially for purposes of r

CECAR-Africa Book: *Strategies for Building Resilience against Climate and Ecosystem Changes in Sub-Saharan Africa* (2017 in press)

Part I: Formulation of 'Ghana Model'
(Chapter 1 ～Chapter 2)

Part II - IV: Case Studies

Part II - IV: Case Studies on Climate and Ecosystem Change Impacts on Agriculture and Livelihood
(Chapter 3 ～Chapter 7)

Part III: Case Studies on Ecosystem, Bio-production and Socio-ecological Production Landscapes
(Chapter 8 ～Chapter 11)

Part IV: Case studies on Climate Change Adaptation and Coping Strategies
(Chapter 12～Chapter 17)

Part V: Synthesis

Chapter 18 Internationalization and Localization of the Ghana Model: Lessons Learned, Opportunities for Upscaling, and Future Directions

6. Capacity Development and Exit Strategy

Sustaining the Ghana Model (Contribution from Theme 1)

University of Ghana Institute for Environment & Sanitation Studies (IESS)

University of Ghana Department of Geography and Resource Development

United Nations University Institute for Natural Resources in Africa (UNU-INRA)

Interdisciplinary and policy relevant research

- ❖ *Climate change*
- ❖ *Biodiversity & Ecosystem*
- ❖ *Sustainability & Resilience*

- Masters and PhD in Sustainability Science
- Field practicum in CECAR project sites
- Sustainability Dialogue Series with UDS

- Remote Sensing and GIS training
- Geography and Sustainability/Resilience
- Education for Sustainable Development in Africa (ESDA)
- Statistical Downscaling (Climate DSSAT Crop Modelling)

- Remote Sensing and GIS training
- Scientific knowledge to policy and decision makers
- Green economy in African development
- Statistical Downscaling (Climate DSSAT Crop Modelling)

The University of Tokyo, Integrated Research System for Sustainability Science(IR3S)

- Sustainability Science and Resilience Projects
- Future Earth
- Academic Publications and Policy Briefs
- Inter-faculty Collaboration

United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS)

- Masters and PhD in Sustainability Science
- UNU Intensive Core Courses
- Leadership for Sustainability Course
- Education for Sustainable Development

Impact at Regional and National Scales: Furtherance of the Theme_2 Products

Ghana Meteorological Agency is

- to operate satellite monitoring system of precipitation, soil moisture and flood.
- to maintain eleven Automatic Weather Stations (AWSs) and twenty Automatic Rain Gauges (ARGs) as a part of routine observation of the Ghana Meteorological Agency.
- to integrate the trial Numerical Weather Forecasting to operational weather forecast and operationalized Early Warning System (EWS)

Water Research Institute and Water Resources Commission are

- to apply the Video-Camera River gauging to Volta river Basin (WRI),
- to succeed the modeling capability of river discharge, flood and inundation of present and future climate (WRI/WRC), and
- to carry out the community-based flood risk management using the simulated results with/without the climate change (WRC)

University for Development Studies (UDS) is

- to prevail water saving agriculture,
- to enhance the underground water use, and cope with drought in global warming environment.

KT Centre for Sustainability and Resilience at UDS: A Strategy for Sustaining the Ghana Model

Guiding Principles:

KTCSR does:

- carry out resilience research; and
- develop and implement training modules, leading to out-of-classroom innovative knowledge acquisition and knowledge sharing.

Initial activities of the Centre:

- Complete the outstanding research and produce relevant publications
- Monitoring and evaluation of on-going works;
- Continue and improve capacity for disaster risk reduction and links with local govt. (NADMO etc. and through theatre/drama)
- Market identification for improved products developed by the project, etc.

Knowledge dissemination & experience sharing sessions-KTCSR (Project Trainees at United Nations University, Tokyo)

- The **UNU-IAS-IC course 2015** participants from Ghana staged knowledge dissemination workshops in Tolon and Wa, following the completion of the ICC 2015 at the request of ***JICA-Tokyo evaluation unit.***

- IC participants organized the workshops in both Tolon and Wa by inviting farmers from the project communities, representatives of district assemblies, disaster management organisations and members of the press

Climate Impacts Research Uptake Workshop

Collaboration between Faculty of Natural Resources & Environment, KTCSR, UDS and EPA under the Climate Impacts Research Capacity and Leadership Enhancement in Sub-Saharan Africa (CIRCLE)/Association of Commonwealth Universities (ACU) with funding from UKAID

Aim: 1) Creating a platform that will engage community leaders and other stakeholders who play a role in control/reduction of indiscriminate bush burning in the Region; and **2)** Developing posters/leaflets/policy briefs on the effect of bush fires & decline in ecosystem services to target stakeholders across different areas

7. Key Messages and Recommendations to Policy Makers

Key messages from CECAR-Africa

- Develop and operationalize the Ghana Model through seven guiding principles
- Applied climate downscaling and crop modelling with different fertilizer application under pseudo-global warming experiments
- Improved weather forecasting and monitoring by using satellite data and installing Automatic Weather Stations (AWSs) and Automatic Rain Gauges (ARGs) and Video-Camera River gauging.
- Developed various simulations include reproduction of past flood events and assessment of future flood and drought impacts in global warming environment.
- Assessed community resilience and implemented practical interventions with respect of local tradition and knowledge
- Applied ecosystem services approach to build a resilient rural community in harmony with nature through inventory and material flow analysis of various available ecosystem services

Recommendations for Policy Makers

(presented at the final workshop in Accra on 2 Feb. 2017)

- **Incorporate the Ghana Model into development strategy, plans, and policies**:
  - Apply the resilience assessment framework and criteria to identify more effective and localized policy interventions
  - Strengthen co-design and co-production process to enhance resilience at multi-scales with multi-stakeholders
  - Implement localized capacity development programs (both institutional and engineering capacities) for extension officers, NADMO, school teachers, practitioners, and community leaders.
  - Build a network of the existing actions and projects associated with resilience and climate adaption within and beyond Ghana
  - Promote upscaling and internationalizing the Ghana Model

- **Response to climate and ecosystem change:**
  - Improve technological and engineering capacity for climate downscaling, hydrological modelling and crop modelling under global climate change condition
  - Utilize the existing crop varieties to respond to climate change with fertilizer and manure application
- **Income generating activities**
  - Diversified crop planting, such as okra and pepper, and improvement of their productivity
- **Building a resilient and sustainable community in harmony with nature:**
  - Promote developing more inclusive accounting system to regularly assess natural capital (*stock*) and ecosystem services (*flow*), which provide diversity and redundancy of natural resouces
  - Introduce a new conservation scheme to balance between utilization and protection of natural capital and ecosystem services such as payment for ecosystem services (PES)

TICAD V Side Event Seminar

2 June 2013, Yokohama, Japan

Resilience in Traditional Agriculture

Prof. Kazuhiko Takeuchi

Senior Vice-Rector, United Nations University

Director, Institute for Sustainability and Peace (UNU-ISP)

Director, Integrated Research System for Sustainability Science (IR3S), The University of Tokyo

Risks in Agriculture

Natural Environment + **Socio-Economic**

Production Risks

•Conditions directly affecting production volatility and livestock morbidity:

- **Climate change**; weather events such as droughts, floods, hurricane, cyclone, sudden drop or increase of temperature, frost etc
- **Ecosystem change**; decreasing biodiversity, soil fertility decline, pest and disease outbreaks
- Bush fire, windstorm etc

Market Risks

- Market forces/ activities which indirectly affect farmers and all stakeholders:
- Commodity and input price volatility
- Exchange rate and interest rate volatility
- Counterparty/default risks, etc

Social Risks

- Changes in social environment/ regulations that lead to financial losses:

- Government or business regulations
- Macro-economic environment
- Political risks
- Conflict
-Trade restrictions, etc

Source: World Bank

Resilience of Traditional Agriculture in Dealing with Multiple Risks

Agrodiversity for Enhancing Resilience

Farmers adopt traditional ways of diversification of not only choice of crops but also management of land, water and biota as a whole.

Integrate biological, technological and social components and helps farmers cope with stresses and uncertainties due to climate and environmental changes

Genetic Diversity

- Spread production risk over diversity of crops and livestock that have different resistance to biotic and abiotic stresses.
- Adaptive to
  - cool or hot climate
  - flooding or dry
  - variable soil conditions
- Pest resistance
- Genetic resources to breed new varieties

Technological Diversity

- Variation in production and management technologies.
- Scattering of crops and livestock over different niches on the landscape, mixed systems, ingenious soil and water management help even out production risks in variable environments.

Social Diversity

- Exchange, mobility (e.g. pastoralist), kinship and social networks could help spread risk of food insecurity over families and communities at a distance.

4 Elements for Assessment of Resilience

Resilience

Capacity of a system to absorb external shocks and maintain its functions

Specified Resilience	• Ability to recover from specific shocks such as natural disasters. • E.g. Crop diversification, switch crops.
General Resilience	• Capacity to keep high potential of recovery in response to various changes • E.g. Home-gardens
Intervention	• Support from government or private sector in response to change • E.g. Certification systems and branding
Transformability	• Capacity to not only make use of the intervention options to control the current change, but also value-adding and generate new systems for adapting to future changes • E.g. Integration of various sectors

Resilience in Traditional Agriculture

Integration of plants and animals

Rice-fish agriculture (China)

Agro-pastoral system (China)

Slope management

Drain rainwater: Ridge & furrow down slope (India)

Retain water: Contour terracing (China)

Resilience

Field scattering

Spread fields across different eco-zones from hilly to coastal areas (Italy)

Water management

Too much water: Floating Hydroponic gardens (Myanmar)

Too little water: Karez water irrigation system (China)

Mixed Farming Systems in Fouta Djallon Highland, Guinea: a GIAHS Candidate Site

- Natural soils are poor, acidic, sparse and gravely.

- Two major farming systems integrated with livestock component evolved over last few centuries:
  - **In-field** (tapades) created with use of livestock manure, domestic refuse, mulch, compost and bush litters for intensive and permanent cultivation of diverse crops and trees
  - **Out-field**: shifting cultivation with fonio millet as a major crop adaptable to poor soils

Integrated in-fields & out-fields system

Enhancing Resilience of Traditional Agriculture (1)

- **UNU Project People, Land Management and Environmental Change (PLEC) brought together the best of scientists and farmers to identify and promote agrodiversity in Kenya, Uganda, Tanzania, Ghana and Guniea**
  - ***Oprowka***, a no-burn traditional farming practice that involves mulching by leaving slashed vegetation to decompose *in-situ*
  - **Agroforestry** features diversity of crops in farm boundaries to include trees for timber, fodder and crops

Southern Ghana

Arusha, Tanzania

Enhancing Resilience of Traditional Agriculture (2)

UNU Project on Climate and Ecosystem Change Adaptation (CECAR) in Africa

Resilience

Drought-prone zone in Tolon District, Northern Ghana

Ecological Resilience

■ Indigenous species: Shea tree for shea butter

■ Value add by promoting agroforestry

Engineering Resilience

■ Wider scale irrigation/water management system building

■ Rainwater harvesting system

Socio-economic, and Insituational Resilience

■ Risk management via EWS and adaptive management based on future scenario

■ Commercialization of ecosystem services and spontaneous natural resource management

- Landscape diversity
  Crop diversity
- Soil quality
- Early warning system
- Farming system
- Prevention and restoration technologies
- Alternative source of livelihood
- Active and diverse community associations
- Past response to disaster/ Communal labour

Development Strategy for Urban Sustainability in Africa on the Basis of SDGs Interlinkage Analysis (USiA)

Date: 27 August 2019
Venue: Kamome, JICA Yokohama

Kazuhiko TAKEUCHI

Project Professor, The University of Tokyo
Institute for Future Initiatives (IFI)
President, Institute for Global Environmental Strategies (IGES)

Project Focus:
Interlinkage across SDGs 9&11 and other goals

Project Focus: SDGs 9&11

Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation

Goal 11: Make cities inclusive, safe, resilient and sustainable

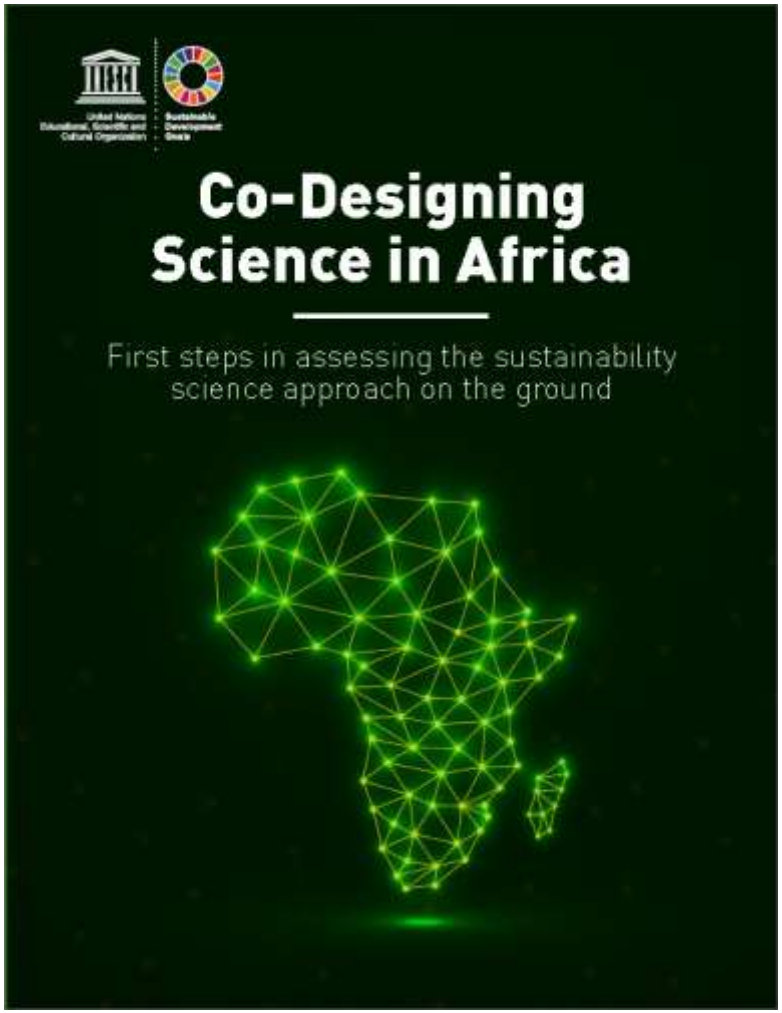
Objectives of the USiA Project

1. Investigate various on-going efforts to promote and implement SDGs, in particular regarding Goal-9 “Industry, innovation, and infrastructure” and Goal-11 “Sustainable cities and communities”
2. Explore innovative directions and solutions for JICA and potential funding organizations to effectively implement SDGs, in particular focusing on Goal-9&11 in Africa
3. Operationalize an inclusive process to realize the co-design and co-production approach when implementing SDGs
4. Strengthen mutual learning and capacity development to achieve SDGs under various contexts of Sub-Sahara Africa

Target Countries and themes:

- **Ghana: Urban-rural linkages**
- **Malawi: Water, Sanitation, and Health**
- **South Africa: Sustainable urban transportation**

Research Outputs



1. Sustainability science: Where and how?

Carlos Aguirre-Bastos, Juliana Chaves-Chaparro, Osamu Saito, Kazuhiko Takeuchi

2. The role of sustainability science in addressing Africa's sustainable development challenges and priorities: A bibliometric survey

Yaw Agyeman Boafo, Rodolfo Dam Lam, Denabo Billo Juju, Osamu Saito

Open Access eBook published by UNESCO in June 2019

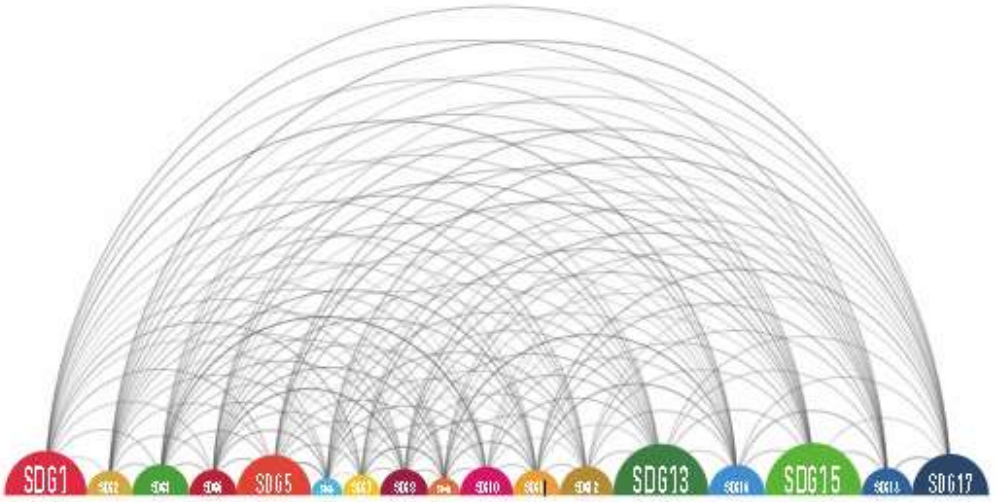
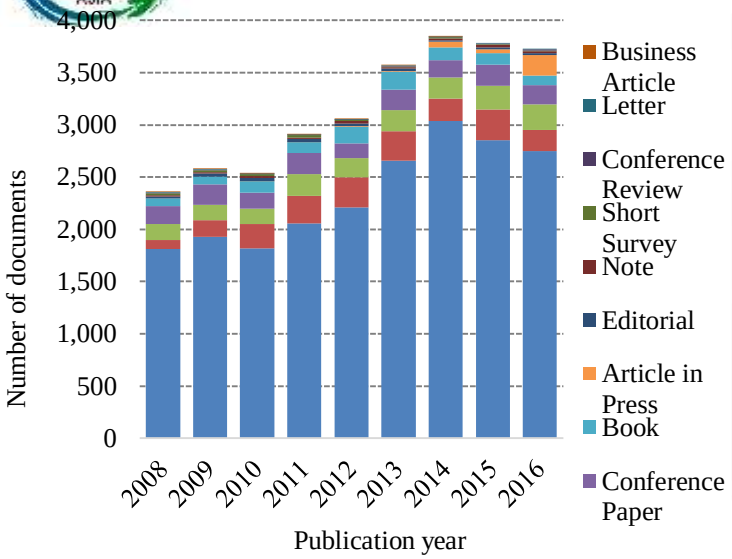


Figure 2.11. SDG linkages and coverage across all literature sources.
Source: Scopus literature collection.

Continental Scale Literature Review of SDGs research and ODA



Academic research landscape

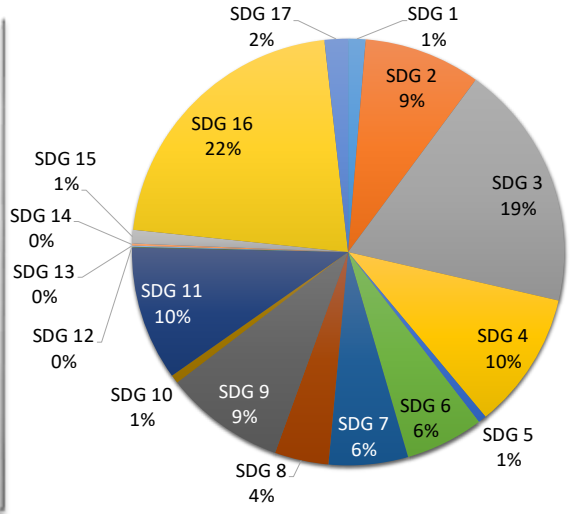
Data Source:

- Systematic literature review from Scopus
- Contains publications addressing SDG between 2008-2016
- A total of 30,407 literature were considered for the analysis

Africa ODA investment

Data Source:

- Detailed ODA information by SDG developed by AidData[1]
- Covers ODA by country (both donors and recipient) between 2000-2013
- Methodology includes distributing ODA between multiple SDGs
- A total of 436,173 projects mapped



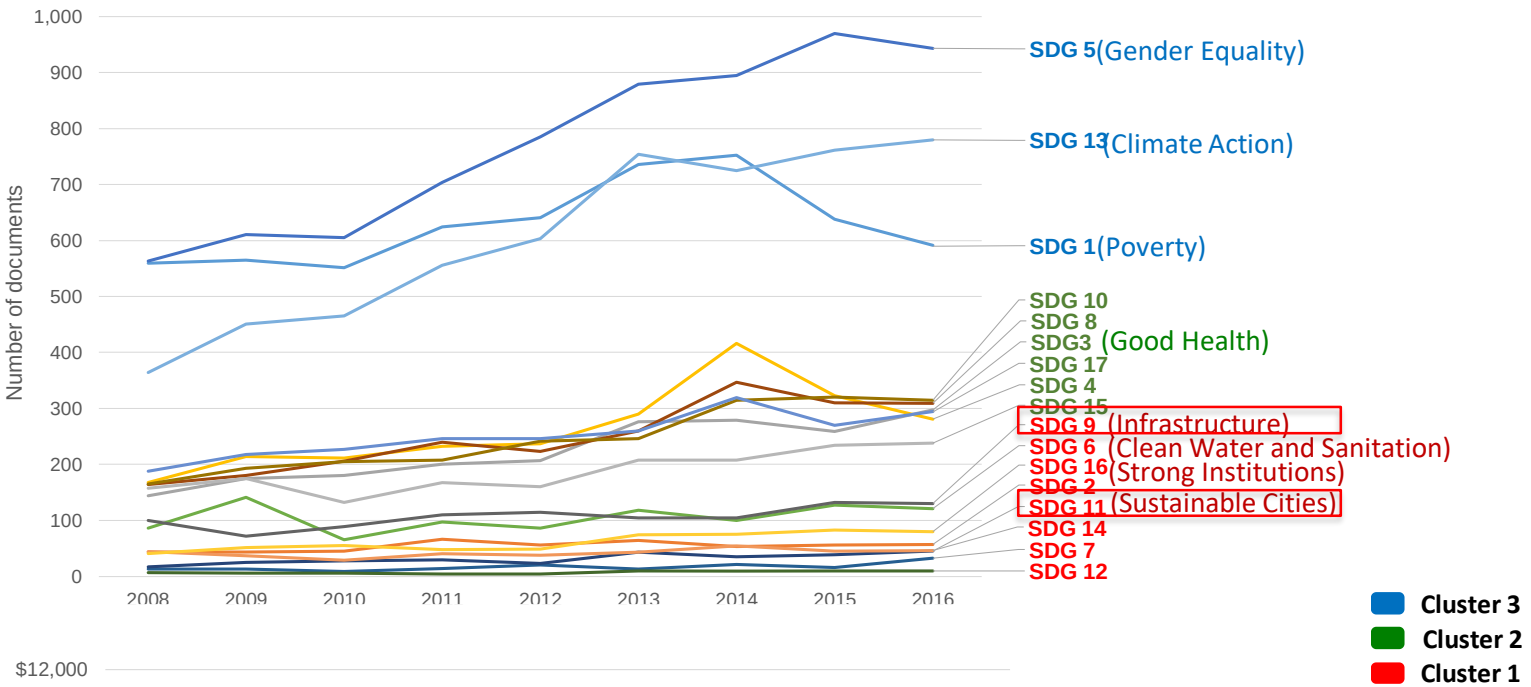
1. Sethi, T., Custer, S., Turner, J., Sims, J., DiLorenzo, M., and R. Latourell. (2017) Realizing Agenda 2030: Will donor dollars and country priorities align with global goals? Williamsburg, VA: AidData at the College of William & Mary.

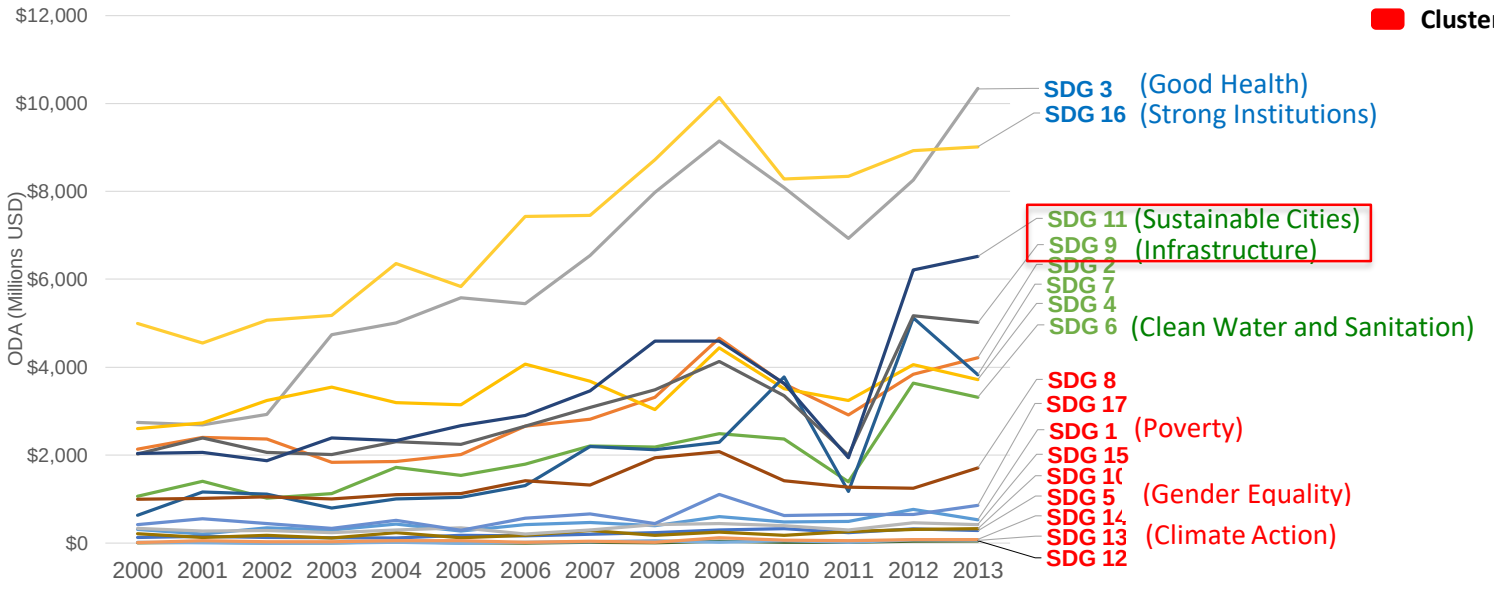
Continental level SDGs related research and Investment (aid) trend

Climate and Ecosystem Change Adaptation and Resilience Research

Academic Landscape trends by SDG

Investment Landscape trends by SDG

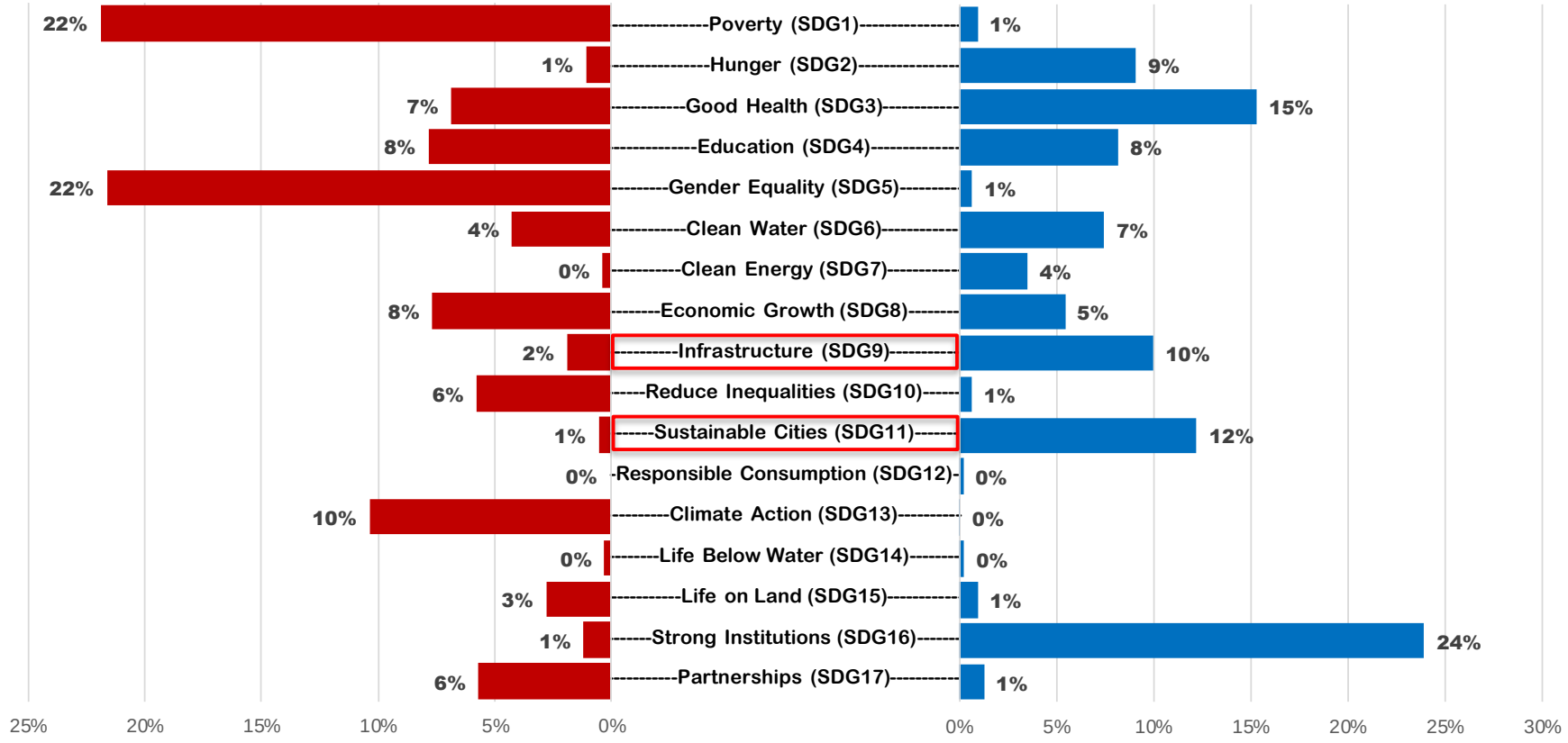




SDGs related research and ODA in Ghana

SDG research in Ghana **(888 literature)**
(Between 2008-2016; Source: Scopus)

ODA by SDG in Ghana **(16.3 Billion USD)**
(Between 2000-2013; source: AidData)

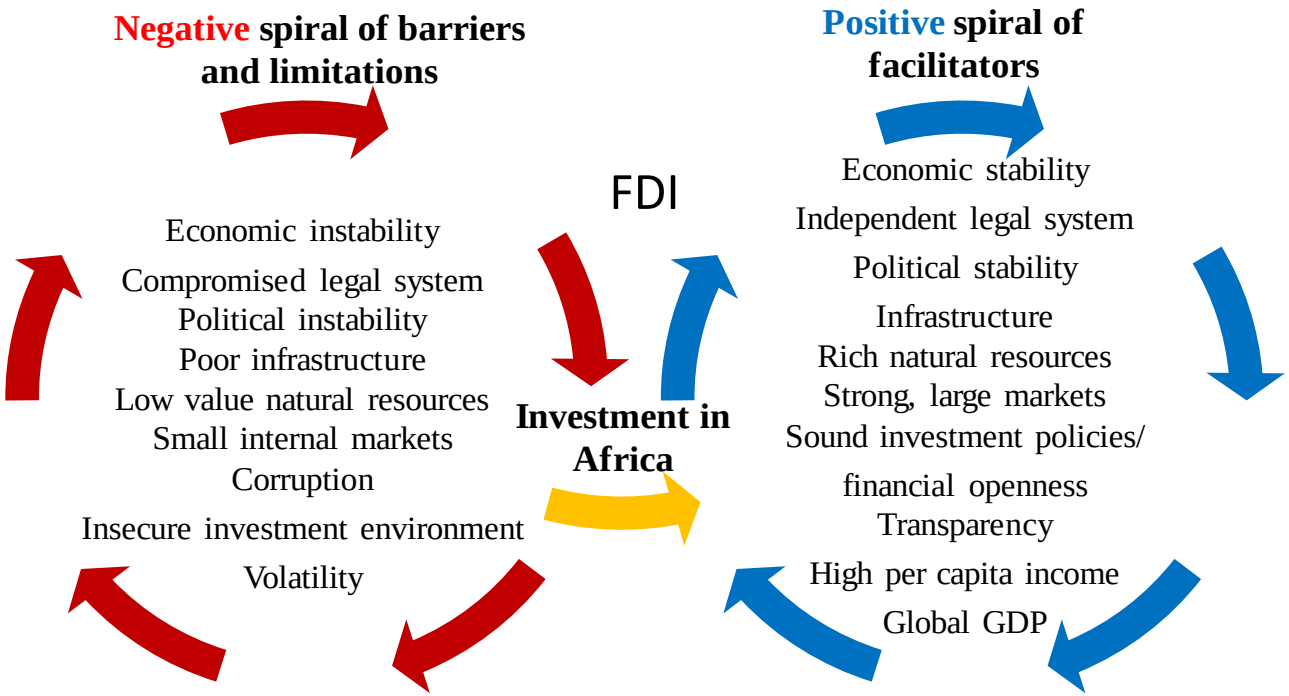


22% of ODA's on sustainable cities and infrastructure (SDG11, 9), but with few studies focus on those areas (3%)

Positive and negative spirals determining Foreign Direct Investment (FDI) in Africa

(Identified by literature review of 35 research articles)

FDI the main factors that attract such investments include (a) stable economic, legal, and democratic systems, (b) robust and open business environments with financial openness and good investment frameworks



(Source) Lopes et al (in press) Determinants of foreign investment and international aid for meeting the Sustainable Development Goals in Africa: a visual cognitive review of the literature. In Gasparatos et al.(eds) *Sustainability Challenges in Sub-Sahara Africa I: Continental Perspectives and Insights from Western and Central Africa*. Springer, Berlin.

Country-level Case Studies in Ghana, Malawi, and South Africa

USiA project policy brief series, No. 1-3 (2019)

USiA project policy brief series, No.1

東京大学未来ビジョン研究センター
Institute for Future Initiatives
The University of Tokyo

Japan International Cooperation Agency

Strategies towards sustainable Urban–Rural Interlinkages in Ghana

Albert Novas Sc
Saito[1], Kazuhik

1. Unite Nation
2. University of
3. The Universi
4. Institute for C

Highlights

To achieve sust
addressed are ir
decentralization

- Gender
- Investm
- Promoti

USiA project policy brief series, No.3

東京大学未来ビジョン研究センター
Institute for Future Initiatives
The University of Tokyo

Japan International Cooperation Agency

Strategies for the sustainability of urban water, sanitation, and health in Malawi

Albert Novas Somanje[1], Julia
Osamu Saito[1], Kazuhiko Take

1. Unite Nations University Inst
2. University of Malawi
3. Freelance consultant
4. The University of Tokyo
5. Institute for Global Environm

Highlights

The sustainability of water, sa
supply, limited access to saf
catchment areas, poor waste m
recommend that Malawi's pric

- improved access to saf
- enhanced human, finar
- smart watershed mana
- improvement of waste
- raising awareness and

USiA project policy brief series, No.2

東京大学未来ビジョン研究センター
Institute for Future Initiatives
The University of Tokyo

Japan International Cooperation Agency

Key Interventions toward Urban Sustainable Transportation in South Africa

Marianne Vanderschuren[1], Alison Gwynne-Evans[1], Esteban Velez Vega[2], Geetha Mohan[2], Osamu Saito[2], Kazuhiko Takeuchi[3,4]

1. University of Cape Town
2. United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS)
3. The University of Tokyo
4. Institute for Global Environmental Strategies (IGES)

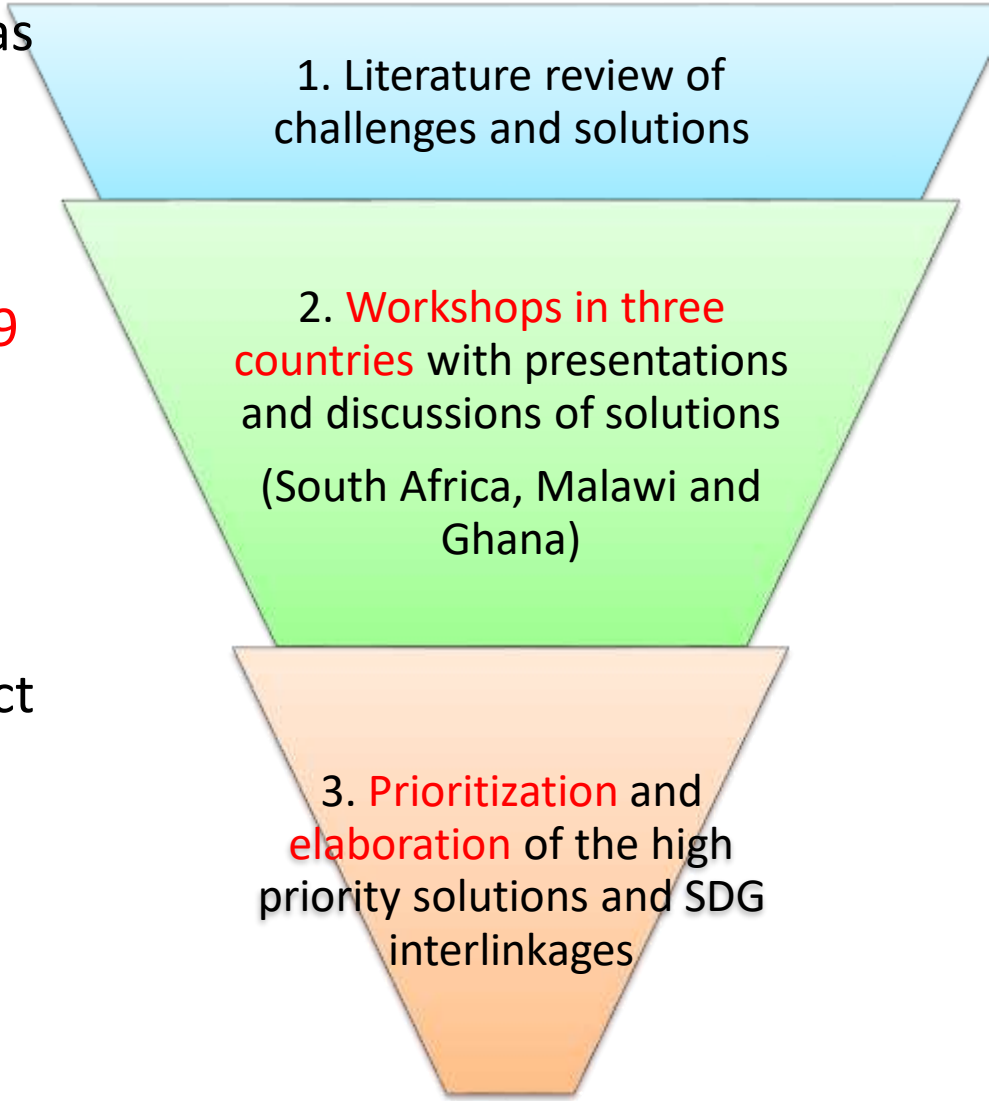
Highlights

In identifying sustainable transport interventions in South Africa, key challenges include fragmented government structures, the safety and security of transport users; the bias towards motorized transport; poverty and inequity levels and ad-hoc funding practices. High priority interventions include:

- Investment in essential non-motorized transport infrastructure
- Spatial transformation including transit-oriented development (TOD)
- Road safety and security of people
- Universal access focused planning
- Sustainable funding solutions

Two workshops in three target countries

1. Share the project aims and scope as well as preliminary research findings;
2. Collect information, data, experiences in relation with SDGs 9 (Infrastructure, industry and innovation) and 11 (Sustainable cities and communities).
3. Identify, prioritize, and elaborate potential solutions as policy/project directions for the funding organizations in Africa, such as Development Bank of Southern Africa (DBSA) and African Development Bank (AfDB).



Top 5 solutions for *Urban-Rural linkages in Ghana.*

based on stakeholders ranking questionnaire survey (n=20)

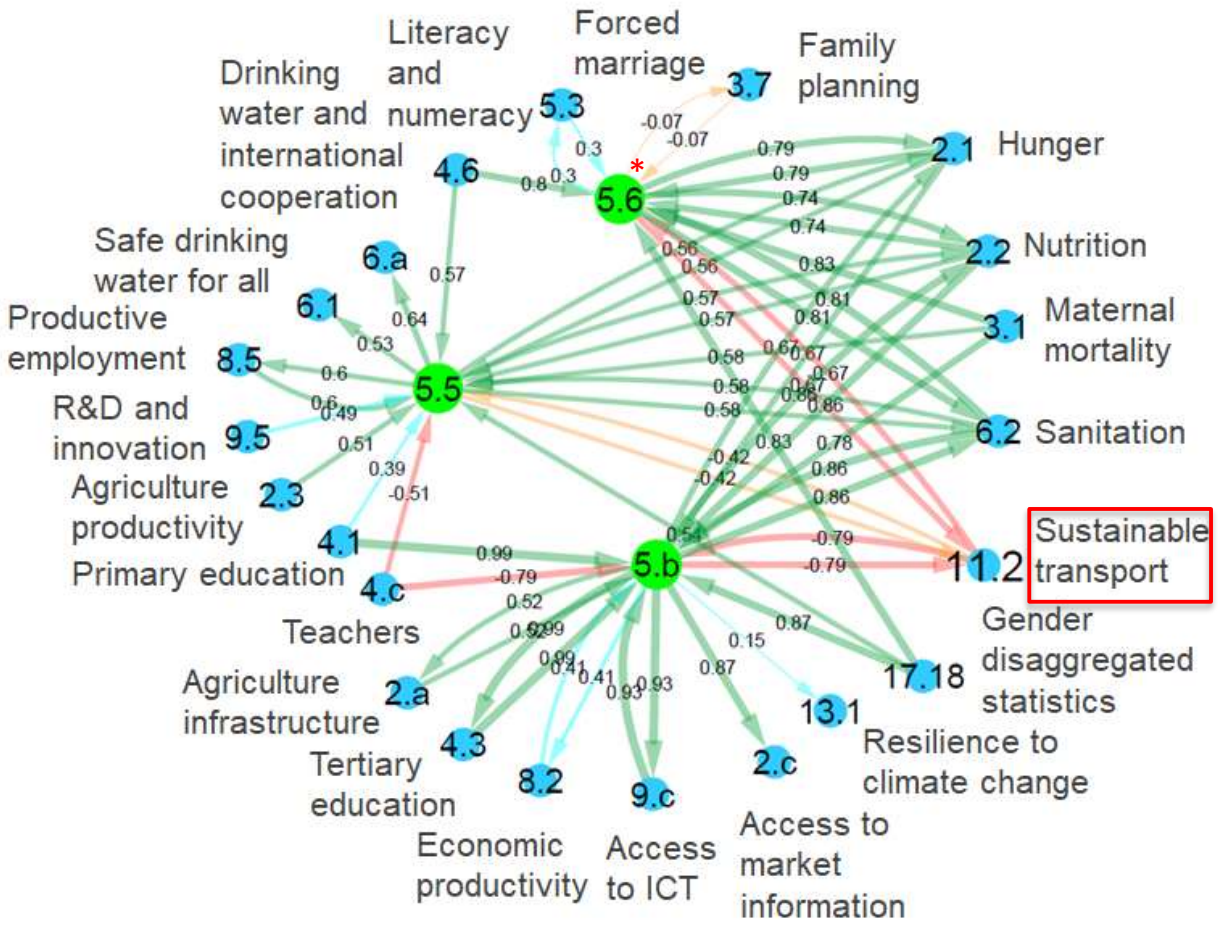
1. **Gender inclusiveness**
3. **Investment in basic and economic infrastructure**
7. **Promotion of modernized and sustainable agriculture systems**
2. **Promotion of effective decentralized system**
13.a. **Innovative financial inclusion systems (including crop insurance, innovative sustainable credits, etc)**

Accra Workshop, Ghana (15-16th, August 2018)

1. Gender inclusiveness

E.g. Training rural women, such as those involved in groundnut and shea butter processing, soap making, and smock weaving, on value addition and marketing of their produce, will improve income generation.

Gender inclusiveness in urban-rural linkages in Ghana



Note: Green line – strong positive link; Blue line – weak positive link; Red line – strong negative link; Orange line – weak negative link; Line thickness – strength of the link; Arrow – direction of the impact.

Source: IGES SDG Interlinkages Tool (https://sdginterlinkages.iges.jp/visualisationtool.html).

- Gender-inclusiveness, particularly Targets 5.5 (women's participation and equal leadership) and 5.b (technology for women's empowerment) generated multiple social and economic benefits, which can be used as the leverage point for building sound urban-rural linkages.
- The lagged behind transport system and associated infrastructure (Target 11.2) may constrain further enhancement of gender inclusion and should be addressed urgently.

*__Target 5.6:__ Ensure universal access to sexual and reproductive health and reproductive rights

Top 5 solutions for *Water, Sanitation and Health in Malawi*.
based on stakeholders ranking questionnaire survey (n=20)

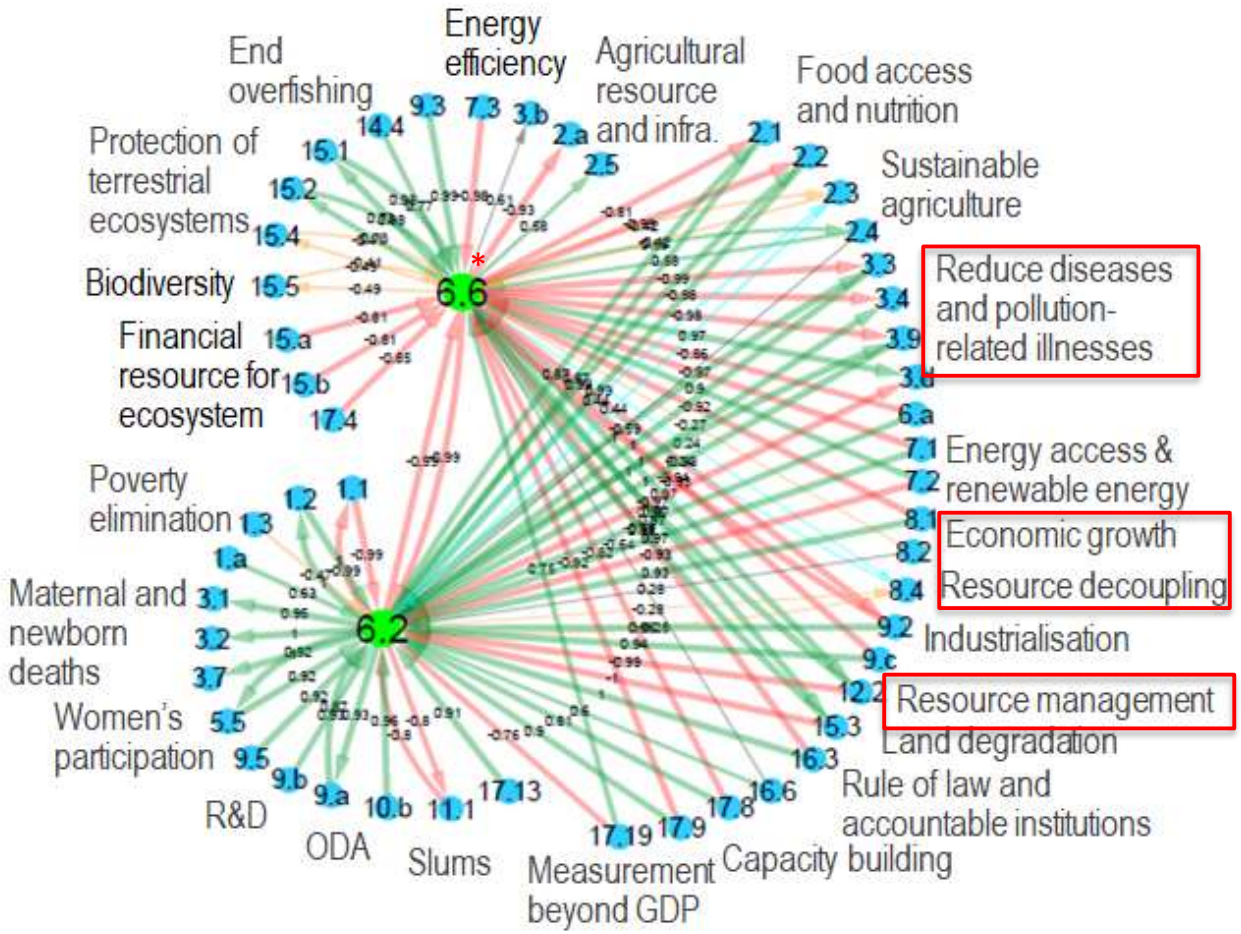
1. Access of safe drinking water
13. Enhance human, financial and capital investment capacity
2. Smart watershed management
9. Improvement of liquid and solid waste management and policy
19. Awareness raising and maintaining of good political will

Lilongwe Workshop, Malawi (10th, August 2018)

1. Access of safe drinking water

- Undertake major rehabilitation and new investments in infrastructure for water, sanitation and health.
- New projects should be transformative projects
- Exploit synergies between water uses, water harvesting, reuse and recycling
- Integration of spatial planning of water supply and new settlements.
- Adopt a mixture of demand management and population-focused distribution of service delivery
- Encouraging local service provision and private and public partnerships

Sanitation, water resources and SDG interlinkages in Malawi



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Source: IGES SDG Interlinkages Tool (https://sdginterlinkages.iges.jp/visualisationtool.html).

- Improved sanitation (Target 6.2) has the synergies with many social targets, particularly related to poverty reduction (Goal 1), food and nutrition (Goal 2), health improvement (Goal 3) and gender inclusiveness (Goal 5), etc.
- Slightly degraded water ecosystems (Target 6.6), together with other degraded terrestrial ecosystems, indicated the trade-offs with other social and economic targets, particularly Goal 3 (public health), Goal 8 (economic growth) and 12 (resource management).

*__Target 6.6:__ By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Top 5 solutions for *Sustainable Urban Transportation in South Africa*.
based on stakeholders ranking questionnaire survey (n=20)

2.b Investment in essential non-motorized transportation (NMT) infrastructure, including the spatial environment
8. Spatial transformation, including transit-oriented development (TOD)
21.a Security of people
11. Providing universal access for all
18. Sustainable funding solutions

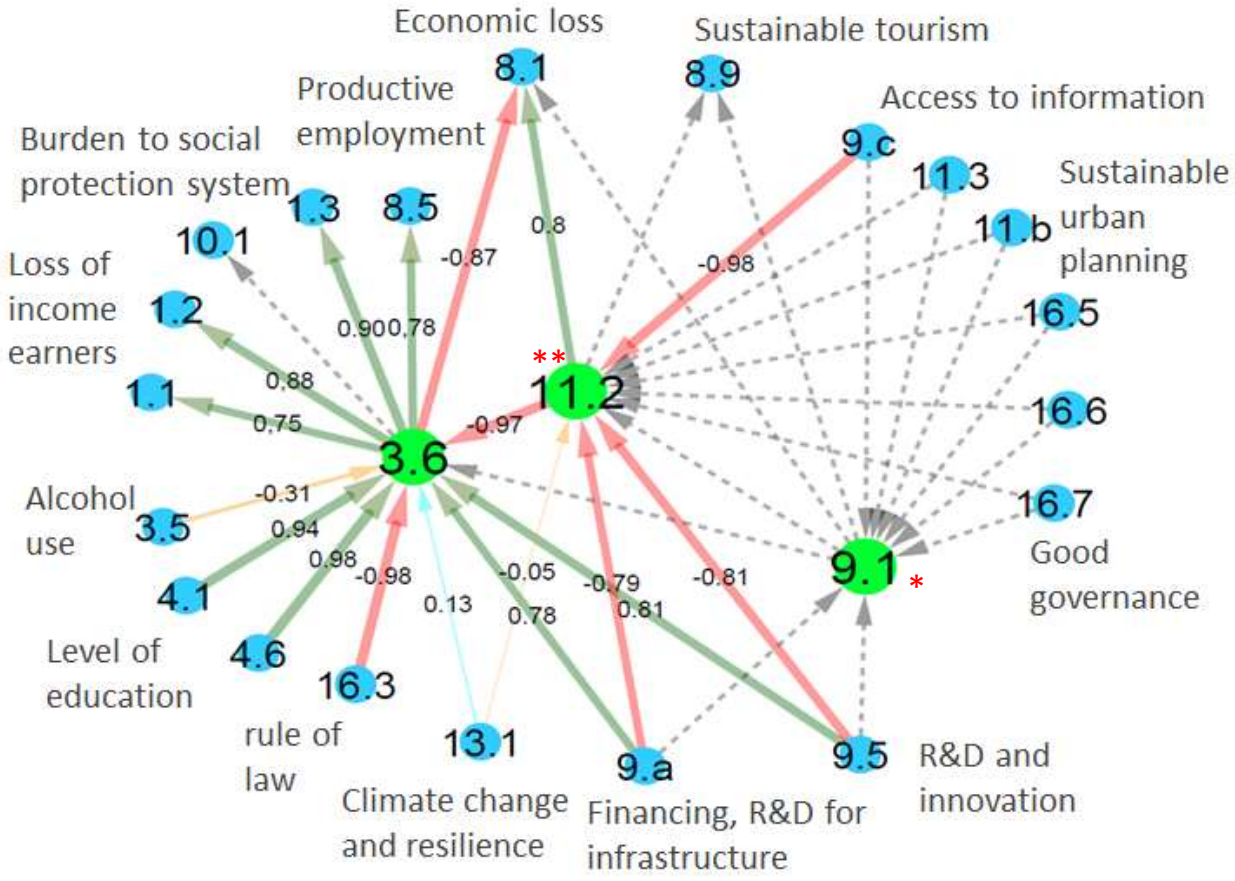
Cape Town Workshop, South Africa (7-8th, August 2018)

1. Investment in essential Non-motorized Transportation (NMT) infrastructure, including the spatial environment

- Augment levels of multimodality
- Provide access of NMT modes for everyone.
- Build safe and interconnected NMT infrastructure.
- Reduce access and speed in city centers for motorized polluting vehicles.
- Promote healthy and sustainable lifestyles.

The health and carbon effects of a Bike-Sharing System in Stellenbosch, South Africa

Road safety and SDG interlinkages for South Africa



- Reducing road traffic accidents (Target 3.6) as a leverage point can generate many social and economic benefits.
- The existing lagged behind transport system and associated infrastructure (Target 11.2) may constrain further improvement of road safety and should be addressed urgently.

Note: Solid line - quantified link; Dotted line – link without quantification due to data unavailability; Green line – strong positive link; Blue line – weak positive link; Red line – strong negative link; Orange line – weak negative link; Line thickness – strength of the link; Arrow – direction of the impact.

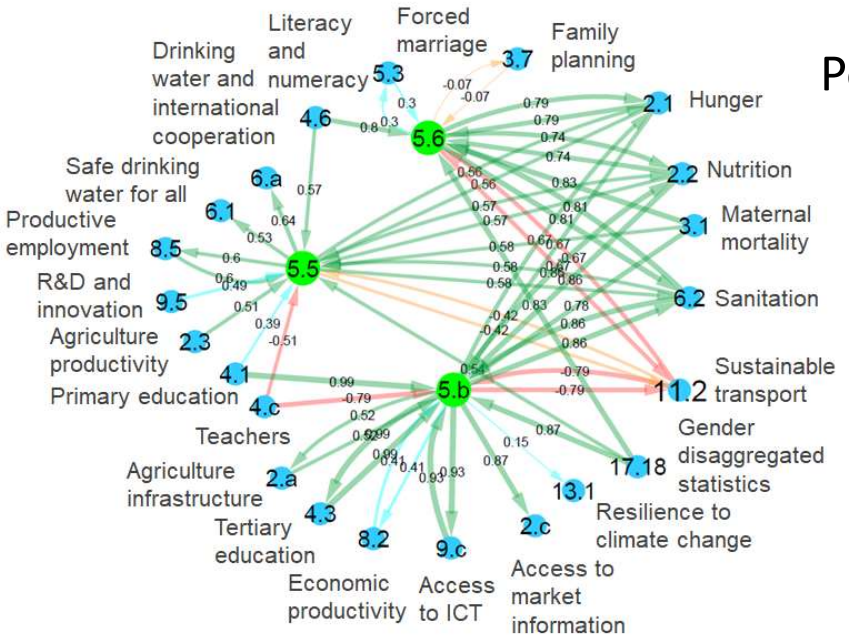
Source: IGES SDG Interlinkages Tool (https://sdginterlinkages.iges.jp/visualisationtool.html)

*__Target 9.1__: Develop quality, reliable, sustainable and resilient infrastructure

**__Target 11.2__: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all

Next Steps: Toward Project-level Application

National-level SDGs interlinkage analysis



Project-level application

Financial investment

Potential interlinkages

Major Positive Links

Co-benefit analysis

+

Cost/benefit analysis

+

Major Negative Links

Trade-off analysis

Partnership/
Risk sharing

Your Questions, Our Expert Answers

Scan the QR Code to discover more about the TRANS-SAHARA project!