

(3) Constraining factors

Unstable utility infrastructure, such as electricity supply and telecommunication network in northern Ghana had constrained several research activities under thematic group-2. Provided equipment, especially data servers, AWSs and ARGs, rely on such infrastructure, and continual data accumulation had been difficult. The situation regarding the power supply was improved in G-Met by installing a high capacity uninterruptible power supply (UPS) and generators. AWSs and ARGs, which uses mobile communication network to transmit the data to the server, fail to send the data properly at some installation points.

4. Follow-up actions to the recommendations of Mid-term Review

4-1 Involvement of Line Ministries

At the district level, the Project works with active involvement of local stakeholders, such as National Disaster Management Organization (NADMO), Ministry of Food and Agriculture (MoFA) and community leaders. Based, on the feedback from the Stakeholders at the District level it can be inferred that the project has potentials for informing policy decisions in the areas of climate change. The outputs of the Project, including published papers, are expected to be made open to the public on the web site of KTCSR so that all stakeholders can access the fruits of the Project.

4-2 Utilization of the Provided Equipment

Most of the equipment provided by the Project have been installed and are being used for the intended purposes. Although 2 AWSs installed in Bole and Yendi are not working properly due to deterioration of batteries, G-Met have noted that this will be addressed as soon as possible. There is still a challenge for G-Met to secure budget for operation and maintenance of the equipment; however, since G-Met is aware of the importance of accumulating reliable data and use of automatic system, it is considered that the equipment will be fully in use for the daily duty even after the Project's completion, with the help of knowledge / skill gained in the Project. The GIS facility provided to UNU-INRA is utilized for GIS training course to be held 4 times a year.

4-3 Establishment of the Strategy to Enhance Resilience

The Project is in the final stage to establish the Ghana Model as the strategy to enhance resilience of target groups. Outreach activities are in progress at the community level as well. During the interview survey at communities (Chietanga, Wa West district and Yoggu, Tolon district), local people mentioned that their awareness of climate change and disaster risks have improved by the intervention of the Project.

4-4 Team Building among All Project Stakeholders

Since UDS is an institute which creates linkages between the local community and academic societies, there is a great significance to establish KTCSR in UDS. Continuing research activities and capacity building through KTCSR would contribute to the enhancement of resilience and enabling target groups to overcome the vulnerability of natural resource management. However, collaboration scheme among related institution is still not clear at this moment.



4-5 Coordination with Outside Agencies

While obtaining hydrological data was a challenge in the first half of the Project period, significant progress has been observed after WRI and WRC joined the Project as counterparts. One example of the Project's collaboration with other donors is that the Project, with their expertise³, is supporting establishment of an operational flood forecasting system for the White Volta assisted by World Bank. There is no problem in the coordination with outside agencies. SARI and local NGOs, such as Care International are also interested in the ground-based observation network data and there would possibly be various opportunities for collaboration.

5. Results of the Evaluation based on the Five Criteria

5-1 Relevance: High

The Project intends to develop an integrated approach to enhancing resilience to climate and ecosystem changes in Northern Ghana to enable the target groups to overcome the vulnerability to climate change. The contents and approach of the Project are highly consistent with the national policy and development needs of Ghana. The Project is also consistent with Japan's cooperation policy for Ghana.

(1) Consistency with National Policy

The Project is consistent with existing strategies and policies of Ghana related to resilience to climate and ecosystem changes. The Government of Ghana formulated Ghana National Climate Change Policy (NCCP) in 2014, which emphasizes the importance of enhancement on national resilience to disaster and active and effective risk reduction. The second Ghana Shared Growth and Development Agenda (GSGDA II, 2014-2017) also puts high priorities on climate variability and change. The Ghana National Climate Change Master Plan Action Programmes for Implementation (2015-2020) is in line with the objective of the Project as well.

(2) Consistency with Assistance Policy of Japanese Government

The Project is in line with the "Country Assistance Policy for the Republic of Ghana" formulated in April 2012. The Priority areas include agricultural development, and the Project is regarded under the above prioritized area. In September 2014, the Japanese Prime Minister pledged to assist in the human resource development of 14,000 people in the area of climate change in developing countries at the Plenary Session of the UN Climate Summit, and the Project is consistent with this pledge too. JICA also has actively extended support to mitigation, adaptation, and the mechanism to accelerate mitigation and adaptation in developing countries. Ensuring inclusive, resilient, and environmentally sustainable growth is one of key elements under JICA's principle toward achievement of the SDGs as well.

(3) Relevance to the needs of target beneficiaries

The major economic activity of Northern semi-arid area of Ghana is agriculture and it is vulnerable to natural disaster and sensitive to negative effect of climate change. The capacity building of local stakeholders would enable the building of climate change measures in agriculture, water resource, and disaster management in the area. Thus, the support of the Project meets the needs of target

³ Source of information: <http://www.worldbank.org/en/news/feature/2016/08/08/expanding-flood-resilience-in-the-volta-basin-with-expertise-and-support-from-japan> / access date: 21 August 2016



beneficiaries.

5-2 Effectiveness: Relatively High

Although the indicator of the Project Purpose has not yet been fully achieved at this moment, all the indicators are expected to be achieved by the end of the Project. Attaining Outputs contributes to the achievement of the Project purpose and the relationship between Project purpose and Outputs is appropriate.

(1) Achievement of the Project purpose

As mentioned in “3-3 Achievements of the Project Purpose”, the formulation of the Ghana Model, as indicated in the Project purpose, is expected to be achieved, with room for further continuous improvement. The Project compiles the various findings of each thematic group and all process and results will be integrated into Ghana Model by the end of the Project. KTCSR have been established in UDS for improvement of sustainability and resilience to climate and ecosystem changes in Africa. It is expected that the centre promotes further improvement and implementation of Ghana Model with continual efforts with contribution by the Ghanaian C/Ps.

(2) Relation between Project Purpose and Outputs

All Outputs were designed to contribute to the achievement of the Project purpose aiming at the development of an integrated approach to enable target groups to overcome the vulnerability of natural resource management. Studies on the resilience of ecosystem and agricultural production (Outputs 1), the resilience of engineering (Output 2) and the resilience of social system and capacity development (Output 3) are to be integrated to develop the Ghana Model. These Outputs are indispensable for achieving the target of the Project.

(3) Important Assumptions Affecting Achievement of Project Purpose

The external conditions for achieving the Project purpose set at the design stage, “The Ministry of Education and the Ministry of Communications do not drastically change the educational policy and relevant capacity development” and “There is no drastic change in climate change adaptation policy framework and strategy of the Government of Ghana”, are satisfied at the time of terminal evaluation.

5-3 Efficiency: Relatively High

The quality, volume and timing of the Project inputs by Japanese side and Ghana side have been adequate in general, which led to the achievement of Outputs. Although there had been some difficulty in the initial stage in building understanding of internal fiscal rules and procedures of the Project among project members, the Project activities are appropriately implemented by efficient project management at the time of the terminal evaluation.

(1) Efficiency of Input by Japanese side

For the achievement of Outputs, JICA experts, possessing high degrees of expertise and are highly committed to the Project, have been adequately dispatched. When Japanese experts visit Ghana with



limited duration and frequency, the Project members communicate by e-mail before their visit and make the short stay effective and productive. In the initial stage of the Project, the coordination among Project members to build understanding of the fiscal rules and procedures had not been very efficient. It cannot be denied that the lack of coordination slowed down the activities. The issue was adequately solved by the joint efforts of the Project members. Equipment has been procured according to the necessity of each research subject. All the equipment is properly managed by the Ghanaian side. Training in Japan was provided to enhance skills and knowledge of Ghanaian members. As of October 2015, a total of 22 persons participated in the training and 1 person earned a PhD at UNU by the long term training in Japan. All these inputs contribute to the attainment of Outputs.

(2) Efficiency of Input by Ghanaian side

Ghanaian side provided human resources, which are the most important input of the cooperation project. Although the degree of their involvement was limited in the 1st year of the Project due to a lack of secured budget to cover the expenses to implement the Project activities, a number of C/Ps actively participated to achieve the objective of the Project. Necessary project office spaces at 5 places for the Project members and installation places for the equipment have been provided. GIS Resource Center has been established by UNU-INRA and G-Met has borne the operational cost of AWSs and ARGs. UG and UDS also have contributed part of activity expenses as necessary.

(3) Outreach activities and utilization of its feedback

Various outreach activities have been conducted at the local level, such as match making workshops, stakeholder meetings, community workshops, a community theater, and so forth. Constant feedbacks through these activities have been valuable inputs to formulate an integrated approach.

5-4 Impact: Relatively High

As mentioned in "3-5. Prospective on Achievement of the Overall Goal", the prospect for the achievement of the Overall Goal is positive with continued efforts for research, implementation and monitoring of the various components of Ghana Model. The objective of the Project is highly consistent with the climate change policy of Government of Ghana and there is high possibility that the integrated approach developed by the Project will be applied to the other regions in Ghana. Also, the Ghana Model has positive prospect of replicability in other areas of Sub-Saharan Africa, considering the efforts being made by the Project members such as presentation planned at international conferences and hosting of international conferences, even though concrete outcomes have not yet been obtained from these approaches at this moment.

Other positive impact has been observed at the local level such as awareness raising and behavior change of local community members towards climate change and disaster risk reductions. Another positive impact is expected at the national level. Since the outcome of the Project will fit in the national policies and strategies of Ghana, the important findings of the Project will contribute to the ongoing policy formulation, especially the 40-year development plan of Ghana.

5-5 Sustainability: Moderate

The political and technical sustainability will be secured as the Project has already been aligned with the existing policies and conducted solid capacity buildings for the Ghanaian partners. Organizational

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sustainability is expected to be secured in Output 3; however, it is difficult to assess sustainability in the integration of Output 1, 2 and 3. For the financial sustainability, adequate budget allocation for continuous implementation is required.

(1) Political aspect

The objective of the Project is highly consistent with the current national development plan and climate change policy of the Government of Ghana, such as NCCP. The issues of vulnerability on climate and ecosystem changes are captured in the 40 years Development Plan as well. In view of these policies, it is assumed that the policy support would continuously be secured in the post Project period.

(2) Technical sustainability

Each research theme is in common with the C/P's own theme, and capacity building has been conducted in line with their regular duties. The research methods and outcomes of the Project will be continuously used by them. The Project has trained a number of young researchers by various means and fostered the understanding of climate and ecosystem changes; they are potential human resources and professionals of the concerned fields and can outreach to local communities in the future.

Furthermore, a large variety of information accumulated during the Project is expected to be utilized by different actors via Project's information platform. Since the information infrastructure is not fully reliable in Ghana, the data will be managed in multiple locations with the interconnection networks. On top of the management structure, all the data is planned to be backed up on the Japanese side too.

(3) Organizational aspect

While a series of workshops, demonstrations and community theaters at the local level will continue to enhance the sense of resilience of local communities, it requires time for the Project's approach to take root. Establishment of KTCSR by UDS will be one of the most important exit strategies of the Project, and it will lead the further research and capacity building of stakeholders. In addition, the Project has made efforts to incorporate Ghana Model approaches into training program of C/Ps to secure the institutional sustainability. However, it is difficult to assess sustainability in the integration of Output 1, 2 and 3, since the scheme to integrate three Outputs is not yet clearly identified.

(4) Financial sustainability

It is observed that financial resources allocated for the C/Ps by the Government of Ghanaian have been limited. While the Team deems the financial sustainability of the C/Ps' activities has not yet been secured, as each C/P makes efforts to obtain funds from alternative sources, such as international research funds and other cooperation schemes by development partners, the scope of financial sustainability is positive.

6. Conclusion

The activities have been conducted according to the PO and most of activities related to Output 1 and Output 3 have been implemented without significant delay. Although some activities of Output 2 have slightly delayed, the Project purpose is expected to be achieved by the end of the Project period.

From the perspective of the five evaluation criteria, the relevance of the Project is assessed as High



since the enhancement of resilience to climate and ecosystem changes are one of the high priorities of the Government of Ghana, and secondly, the Project's target is in line with the national development plan. The effectiveness of the Project is deemed as Relatively High. The Project purpose is highly expected to be achieved by the end of the Project. The efficiency of the Project is also assessed as Relatively High. Most inputs necessary for successful implementation of the Project activities have been allocated as planned. The timing, quality and volume of input by Ghanaian side and Japanese side were deemed as appropriate. The Project's impact is assessed to be Relatively High due to its high possibility of achieving the overall goal by the continual effort by the Ghanaian side. The Sustainability of the Project is assessed as Moderate. Though political and technical sustainability is expected to be secured, organizational and financial sustainability still remains an issue. For further improvement of the Project in its remaining term and the post Project period, the Team recommends the measures presented in "7. Recommendations".

7. Recommendations

Based on the above findings, the Team recommends the following to the Project and the JCC for follow-up during the remaining Project period and post Project period.

7-1 Recommendations for the remaining Project period

(1) Clarification of the Ghana Model

Since the development of an integrated approach of enhancing resilience to climate and ecosystem changes in northern Ghana, as the Project purpose, is in its final stage, all partners are strongly encouraged to accelerate its final works, maintaining the present momentum. Toward achievement of the Project purpose, the Team recommends the Project to clarify the Ghana Model on what aspects are customized to the specific settings of the project areas and what aspects are common and applicable to outer areas. Since the Ghana Model is meant for application in neighboring countries, the Model also needs to identify the roles of different stakeholders, as well as the advantage of the Model.

(2) Strengthen ties with local government

As the Project carried out many activities closely related to the services the local government provides the residents such as agricultural extension and borehole construction, the Project should strengthen its ties with the local government so that the important activities would be continued and shared with other areas.

(3) Incorporation into education policies

Since the project produced valuable Outputs from educational point of views, the Team recommends that relevant parties take steps to incorporate these Outputs of the Project in the education policies of Ghana for the enhancement of resilience and sustainability.

(4) Support to formulation and implementation of relevant national policies

The objective of the Project is highly consistent with the current Ghana National Climate Change Policy (NCCP: 2014) and the Ghana National Climate Change Master Plan Action Programmes for Implementation (2015-2020) which serves as the implementation tool for the Policy. It is recommended



that collaborating institutions enable implementers of these documents to access the scientific findings produced under the Project to enhance climate change mitigation and adaptation interventions in Ghana. While some parts of the policy formulation are out of control of the Project, it will contribute to the upcoming policy and strategy formulations, including Long Term National Development Plans, by incorporating the aspect of resilience against climate and ecosystem changes because some key Project personnel are actively involved in the policy formulation processes.

(5) Identification of integration scheme

The Ghana Model is a process which requires continuous research, implementation and monitoring; therefore all actors are encouraged to be involved in the process to improve the Model. However, there is no clear identification of an integration scheme for three Outputs. The Team recommends the Project to identify which data, information and knowledge from Output 1 and Output 2 are utilized in Output 3 and how to make use of them. An integration scheme needs to be clearly described and examined by the end of the Project.

7-2 Recommendations for the post Project period

(1) Adequate budget allocation

For further enhancement of resilience using outcome of the Project, the Ghanaian stakeholders will be required to secure necessary budgets for research and outreach activities as well as maintenance of the equipment. The establishment of KTCSR by UDS is a significant step to build up local resilience using the works of different stakeholders, and the Team recommends the relevant authorities, in particular Ministry of Education, takes steps to secure relevant budgets to support the center.

Also the Project has built significant capacities with G-Met for timely collection of weather and other relevant data that assist local populations and international communities. To make this practice sustainable, G-Met and relevant authorities are strongly encouraged to secure necessary budget lines to support regular maintenance works of the installed AWSs and ARGs with trained personnel.

(2) Sustainable collaboration scheme among Ghanaian stakeholders

UG, G-Met, UNU-INRA, UDS, WRC, WRI and the relevant stakeholders are recommended to establish sustainable collaboration scheme so that a platform will be established for further upgrading of the Ghana Model and future utilization of the Model for social profit.



Annex 1 Schedule of Terminal Evaluation

No.	Date	Day	Mr. Hajime Nabeta (Team Leader)	Dr. Yasuoka and Ms. Takagi (JST Team)	Ms. Teppei Okano (Evaluation Analysis)	Ghanaian Team Members
1	8-Aug	Mon			11:35 Arriving in Accra 14:00 Meeting with the Ghanaian evaluation team members at JICA office 16:15 Interview to WRI	14:00 Meeting with Mr.Okano at JICA
2	9-Aug	Tue			9:00 Interview to UNU-INRA 10:15 Interview to G-Met 11:20 Interview to WRI 14:00 Interview to UG 16:20 Interview to G-Met	
3	10-Aug	Wed			7:00 Travel to Tamale(AW160) 10:30 Travel to Wa 15:00 Visit PJ Office at Wa campus, Interview to UDS, NADAMO, MOFA	
4	11-Aug	Thu			8:00 Interview/Site observation in Chiatanga community 10:00 Interview/Site observation in Balefili community 13:00 Travel to Tamale 17:00 Interview to UDS	
5	12-Aug	Fri			9:00 Visit PJ Office at Nyankpala campus, Interview to UDS	
6	13-Aug	Sat			15:00 Interview/Site observation in Yaggu community	
7	14-Aug	Sun			Report Preparation	
8	15-Aug	Mon	11:35 Arriving in Accra 13:30 JICA Ghana Office Official visit 15:00 Courtesy Call on Embassy of Japan		Report Preparation	
9	16-Aug	Tue	7:00 Travel to Tamale(AW160) Meeting with UDS Community Theatre		Meeting with UDS Community Theatre	7:00 Travel to Tamale(AW160) Meeting with UDS Community Theatre
10	17-Aug	Wed	10:00 UDS Sustainability centre launching 14:00 Travel to Wa 17:30 Arrive Wa		10:00 UDS Sustainability centre launching 13:30 Travel to Accra Report Preparation	10:00 UDS Sustainability centre launching 14:00 Travel to Wa 17:30 Arrive Wa
11	18-Aug	Thu	9:00 Observation of AWS in Yendi 14:40 Travel to Tamale		Report Preparation	9:00 Observation of AWS in Yendi 14:40 Travel to Tamale
12	19-Aug	Fri	8:30 Travel to Accra 10:00 Visit/Observation at G-Met and WRI Field Meeting with UG Internall Meeting and Prepare M/M		Report Preparation 10:00 Visit/Observation at G-Met and WRI Field Meeting with UG Internall Meeting and Prepare M/M	8:30 Travel to Accra 10:00 Visit/Observation at G-Met and WRI Field Meeting with UG Internall Meeting and Prepare M/M
13	20-Aug	Sat	Internall Meeting and Prepare M/M			-
14	21-Aug	Sun	Internall Meeting and Prepare M/M			-
15	22-Aug	Mon	9:00: Meeting at UNU-INRA 14:00: JCC 18:00 Reception			
16	23-Aug	Tue	-		Departing from Accra	-
17	24-Aug	Wed	-		Arriving at Tokyo	-

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Annex 2 List of the Interviewees

No.	Name	Affiliation
1	Dr.K.Awere Gyeke	Department of Geography and Resource Development, GU
2	Mr.Richmond Ametefe	Department of Geography and Resource Development, GU
3	Ms.Dina Adjei Mensah	Department of Geography and Resource Development, GU
4	Mr.Issac Botchey	Department of Geography and Resource Development, GU
5	Gp. Capt. Stephen Y. Komla	Ghana Meteorological Agency
6	Mr. Ayilari-Naa Juati	Ghana Meteorological Agency
7	Mr.AGYEMAN Richard Yao	Ghana Meteorological Agency
8	Dr.K.Kankam-Yeboah	Water Research Institute
9	Mr.Frank Teye OBLIM	Water Research Institute
10	Mr.Fred Yaw LOGAH	Water Research Institute
11	Dr. Bob Alfa	Water Resources Commission
12	Prof. Gordana Kranjac-Berisavljevic	University of Development Studies
13	Dr. Francis Kwabena Obeng	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
14	Mr. Victor Lolig	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
15	Dr. Richard Yeboah	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
16	Dr. Godfred Jasaw	Department of Community Development (Wa)
17	Dr.Jonas Akurigu	Senior lecturer, UDS
18	Mr.Nujeeb Adams	Researcher, UDS
19	Dr. Elias T. Ayuk	UNU-INRA
20	Mr.Fian Naah Ali Seidu	Planning officer, Wa west district office
21	Mr.Joseph Kambunada	Ministry of Food and Agriculture, Wa west
22	Mr.Dramani File	Head of Operation, NADMO, Wa west
23	Mr. Ziem Romanas	Assembly officer
24	Mr. Naa Ibrahim Dassah	Community Chief of Chietanga
25	Community members of Chietanga	Community members (Female:4, Male:3)
26	Community members of Baleofili	Community members (Female:16, Male:7)
27	Community members of Yoggu	Community members (Female:3, Male:3)

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Annex 3 Project Design Matrix (PDM)

Project title: (Duration): (Science and Technology) **Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach (5 years/ 2012-2017)**

Target area: Northern Ghana (Northern Region, Upper East Region, Upper West Region)

Target groups: counterpart researchers, local engineers, local residents in Northern Ghana, Ghanaian administrative officers and policy makers

Direct beneficiaries: Ghanaian researchers and staff involved in the Project Indirect beneficiaries: Local communities indirectly involved in the Project activities

Project Summary	Indicators	Indicator Acquiring Methods	External Conditions
<p><u>Overall Goal</u></p> <p>The Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be incorporated in international environmental policies</p>	<p>Policy recommendations shared in the science and technology community (e.g. OECD/GSF) and presented to international panels and conventions such as UNFCCC, CBD, UNCSD, as well as platforms like IPCC, IPBES, and CBD Secretariat.</p>		No drastic change in international policies on climate change and ecosystem changes.
<p><u>Project Purpose</u></p> <p>An Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes in Northern Ghana will be developed as the 'Ghana Model', enabling target groups to overcome the vulnerability of natural resource management.</p>	<ul style="list-style-type: none"> Educational policy and curriculum development at university level, which focus on climate and ecosystem changes Educational policy for engineers and observation capacity development for the Ghana Meteorological Agency Contribution to the ongoing policy formulation for climate adaptive capacity development by the Ghana Government 	<ul style="list-style-type: none"> * Project progress report * Annual report * Educational policy of Ghana * Policy paper 	<p>The Ministry of Education and the Ministry of Communications do not drastically change the educational policy and relevant capacity development.</p> <p>There is no drastic change in climate change adaptation policy framework and strategy of the Government of Ghana.</p>
<p><u>Outputs</u></p> <ol style="list-style-type: none"> Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed Prototype of water resources management is applied through prediction and risk analysis of extreme weather events using satellite remote sensing and ground-based observation network Institutional and engineering capacity development programs for local communities and engineers are developed and implemented 	<ol style="list-style-type: none"> 1.1. Journal articles on climate and ecosystem change will be published 1.2. Assessment of climate change impact to agro ecosystem will be utilized 1.3. Report on options of adaptive agricultural production management to climate change (land utilization and cropping system etc.) will be issued. 2.1. Report on flood risk assessment and extreme weather risk assessment will be issued. 2.2. Report on prototypes of water resource management methods will be issued. 2.3. Journal articles on extreme weather risk or water resource management will be published 3.1. Journal articles on regional disaster governance in Northern Ghana will be published 3.2. Report on business models against for climate and ecosystem changes will be issued 3.3. The capacity development program on resilience for climate and ecosystem changes will be developed 3.4. Training course for local engineering, governors and community will be implemented at the project site and 	<ol style="list-style-type: none"> 1. * Project progress reports * Annual report 2. * Project progress reports * Annual report 3. * Project progress reports * Annual report 	Counterparts are not transferred.

Activities	the monitoring report will be issued. 3.5. Guidelines for establishing an Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be presented.	
<p>1-1. Build meteorological data base (time series and spatial)</p> <p>1-2. Build land utilization and soil distribution data base (time series and spatial)</p> <p>1-3. Build agricultural production and management data base (time series and spatial)</p> <p>1-4. Integrate above three data bases by GIS</p> <p>1-5. Build regional climate change prediction model and use the model to predict (solution constraint factors for downscaling of climate change prediction model)</p> <p>1-6. Assess climate change impact to agro-ecosystem utilization</p> <p>1-7. Assess land utilization, soil distribution and climate change by GIS</p> <p>1-8. Develop agro-ecosystem valuation map based on 1-7</p> <p>1-9. Develop alternative approaches on adaptive agricultural production management to climate change</p> <p>1-10. Establish the institutional design of collaboration across Theme 1 to 3</p> <p>2-1. Survey the satellite and ground based observation network and construct the database</p> <p>2-2. Make an early warning system, hazard map of flood and scenario of drought database</p> <p>2-3. Quantitatively analyze the risks of disasters due to extreme weather for Volta river basin in Northern Ghana</p> <p>2-4. Propose a prototype scheme of on-site water resources management by using outcomes from 2-3</p> <p>3-1. Select the project sites in collaboration with Theme 1 and 2</p> <p>3-2. Interview key actors and observe authority at different levels of governance institutions in the region</p> <p>3-3. Survey farm household to understand socioeconomic activities</p> <p>3-4. Outline specific crop value chains and potential business models</p> <p>3-5. Based on analyses of findings derived from 3-2 to 3-4, develop institutional capacity development program</p> <p>3-6. Based on analyses of findings derived from 2-4 and 3-3, develop engineering models/solutions for natural resource management capacity development program</p> <p>3-7. Establish an integrated approach to enhancing resilience based on 3-5 and 3-6</p>	<p>Inputs</p> <p>Japan</p> <p>(a) <u>Expert</u></p> <ul style="list-style-type: none"> - Long-term expert - Administrative Coordinator - Short-term expert - Project Leader - Climate Change Modeling - Agricultural Economics - GIS Analysis - Meteorology - Planning - Hydrology - Agronomy - Disaster Risk Management - Natural Resources Management - Governance - Rural Livelihood and Local Capacity Development <p>(b) <u>Training</u></p> <p>Trainings in Japan</p> <p>(c) <u>Machinery and Equipment</u></p> <ul style="list-style-type: none"> - Project vehicle - GIS-related materials (hardware and software) - Satellite image, map and data from international sources - Weather and water resources observation data from international sources - Remote video / TV conference system - Capacity development support materials (remote vide/TV conference system, PCs, projectors, screens, etc.) - Statistical database and relevant literature from international sources - Other machinery and equipment necessary for implementation of the project 	<p>Ghana</p> <p>Project Director Project Manager Counterpart researchers Office space Laboratory Communication facilities Water, electricity etc.</p> <p><u>Pre-conditions</u></p>

Glossary for this Project:

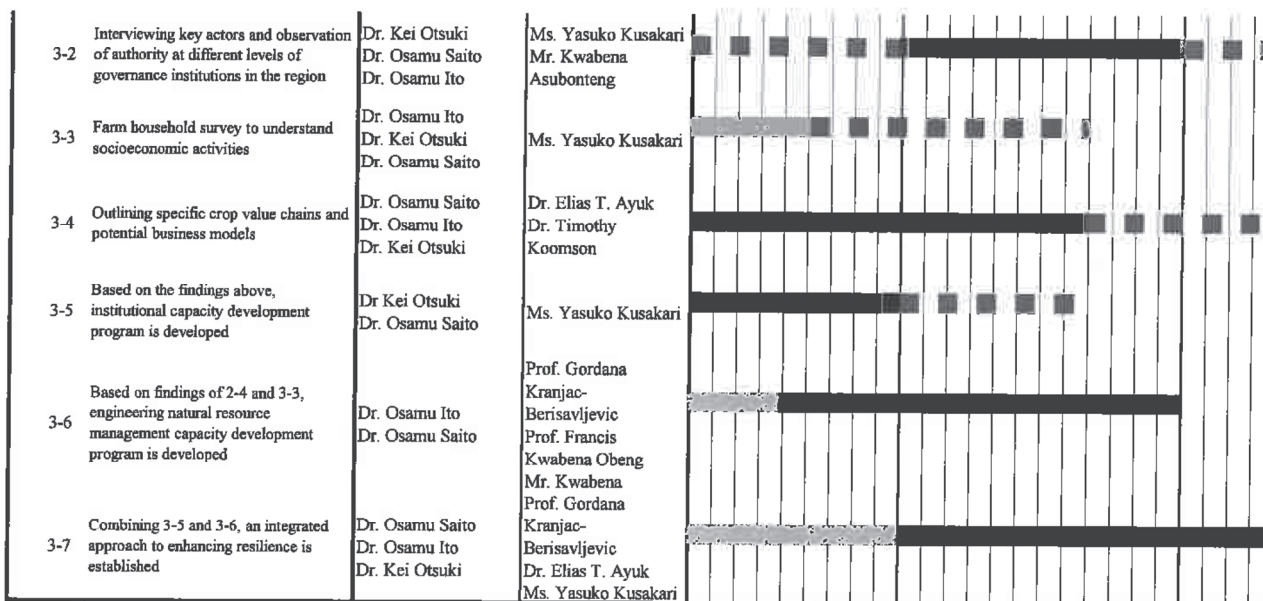
Project site: Area in which capacity development program will be socially implemented (e.g. selected communities or districts). Study area: Area in which weather observation, climate change model application, or GIS analyses are conducted (e.g. Northern Ghana, Savannah, etc.). Social implementation: The Project researchers and capacity development beneficiaries/ stakeholders form partnerships to jointly shape the capacity development programs in such a way as to promote co-evolution of mutual knowledge and co-learning.

Annex 4 Plan of Operation

Outputs		The person in Charge		4th Year												5th Year															
		Japan	Ghana	2015												2016												2017			
				4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4			
1	Climate and ecosystem change forecasting methods are developed and the impacts on agroecosystem use are assessed (Theme1)	Univ. Tokyo	UG																												
1-1	Building meteorological data base	Prof. Akimasa Sumi Dr. Hirotaka Matsuda	Dr. Kwadwo Owusu																												
1-2	Building land utilization and soil distribution data base	Dr. Antwi, Effah Kwah	Prof. M.K. Abekoe Dr. Owusu Barima																												
1-3	Building agricultural production and management data base	Dr. Hirotaka Matsuda	Dr. K. Awere Gyekye Mr. George Owusu																												
1-4	Integrating above three data bases by GIS	Dr. Antwi, Effah Kwah	Dr. Owusu Barima																												
1-5	Building regional climate change prediction model and prediction by the model	Prof. Akimasa Sumi Dr. Hirotaka Matsuda	Mr. George Owusu Mr. Emmanuel Tachie-Obeng Dr. Oteng Ababio																												
1-6	Assessment of climate change impact to agroecosystem utilization	Dr. Hirotaka Matsuda	Dr. E.M Attua Dr. Adelina Mensah Dr. Oteng Ababio																												
1-7	Assessment of land utilization, soil distribution and climate change by GIS	Dr. Antwi, Effah Kwah	Dr. K. Awere Gyeke Mr. George Owusu																												
1-8	Making agroecosystem valuation map based on 1-8	Dr. Antwi, Effah Kwah	Mr. G. Yiran Dr. E. M Attua Dr. Owusu Barima																												
1-9	Making options of adaptive agricultural production management to climate change	Prof. Akimasa Sumi Dr. Hirotaka Matsuda Dr. Antwi, Effah Kwabena	Prof. E.A. Gyasi																												
1-10	Institutional design of collaboration Theme 1 to 3	Prof. Takeuchi	To be confirmed																												
2	Using satellite remote sensing and ground-based observation network, prediction and risk analysis of extreme weather events are conducted. Prototype of water resource management is applied (Theme2)	Kyoto Univ.	Gmet																												
2-1	Sattelite and Ground-based observation network is surveyed and database is built	Prof. Hirohiko Ishikawa	Mr. Andrew Nkansah Mr. Dominic Pokperlaar Mr. Amos Narh																												
2-2	Using 2-1, an early warning system, hazard map of flood and scenario of drought are made	Prof. Hirohiko Ishikawa Dr. Kenichiro Kobayashi	Mr. Zinedeme Minia Mr. Ayilari-Naa Juati Mr. Charles Yorke																												
2-3	Risks of disasters due to extreme weather is quantitatively analyzed for Volta River basin	Prof. Norio Okada A postdoctoral fellow	Mr. Zinedeme Minia Mr. Andrew Nkansah Mr. Ayilari-Naa Juati																												
2-4	Using outcomes from 2-3, a prototype scheme of on-site water resource management is proposed	Prof. Norio Okada A postdoctoral fellow	Prof. Gordana Kranjac-Berisavljevic																												
3	Institutional and engineering capacity development programs for local residents and engineers are outlined and socially implemented (Theme3)	UNU-ISP	UDS, UNU-INRA																												
3-1	Selection of the project sites in collaboration with Theme 1 and 2	Dr. Osamu Saito Dr. Osamu Ito Dr. Kei Otsuki	Prof. Edwin A. Gyasi Prof. Gordana Kranjac-Berisavljevic Ms. Yasuko Kusakari																												

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(Legend) Core operation period
 Preparatory and/or supplementary operation period
 Follow-up period

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