（地球規模課題対応国際科学技術協力）

ガーナ共和国
アフリカ半乾燥地域における気候・生態系変動の予測・影響評価と統合的レジリエンス強化戦略の構築
中間レビュー調査報告書

平成 27 年 2 月
（2015 年）

独立行政法人国際協力機構
農村開発部

農 村
ＪＲ
15-017

（地球規模課題対応国際科学技術協力）

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アフリカ半乾燥地域における気候・生態系変動の予測・影響評価と統合的レジリエンス強化戦略の構築
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序　　文

日本国政府はガーナ共和国政府の要請に基づき、ガーナ国の半乾燥地域における気候・生態系変動の予測および影響評価と、統合的レジリエンス強化戦略を構築することを目的とした地球規模課題に対する研究型技術協力プロジェクト（SATREPS）を実施することを決定し、独立行政法人国際協力機構（JICA）は 2012 年 3 月から 5 年間の計画で本案件を開始しました。

今般、本プロジェクトの中間地点を迎えたことを受け、協力期間前半における実績の確認、計画に対する達成度の検証、評価 5 項目の観点からの評価を行うとともに、プロジェクト後半の行動計画について検討することを目的として、2014 年 9 月 14 日～10 月 1 日までの 18 日間にわたり、中間レビュー調査団を現地に派遣しました。調査団は、ガーナ国側評価メンバーと合同評価調査団を構成して現地調査を行い、その結果を合同評価レポートとして取りまとめ、ガーナ国側調査団と日本国側調査団の間で署名交換を行いました。

本報告書は、中間レビュー時の調査および協議に基づく結果を取りまとめたものであり、本プロジェクトならびに関連する国際協力の推進に活用されることを願うものです。

終わりに、これら一連の調査および協議にご協力とご支援をいただいた関係者の皆様に対し、心より感謝申し上げます。

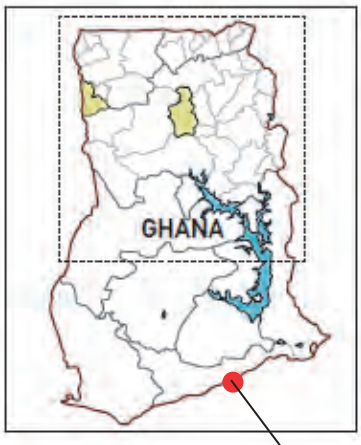
平成 27 年 2 月

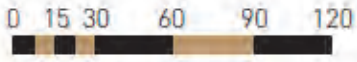
独立行政法人 国際協力機構

農村開発部長　北中　真人

目　　次

プロジェクト位置図



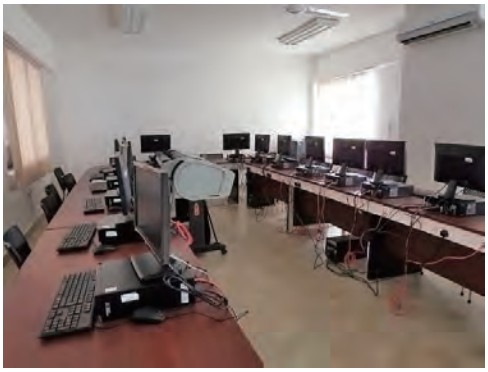


首都：アクラ
ガーナ大学、気象局（本部）、
国連大学アフリカ自然資源研究所

写　　真

レビュー報告書の署名

合同調整委員会でのレビュー結果報告



UNU-INRA の GIS 研究教育センター

気象局の自動気象観測装置（ボレ観測所）

対象村落の地図・写真集（プロジェクトで作成）

土壌管理試験圃場（フィフィニ集落）

行政担当官ほか関係者からの聞き取り

対象村落住民からの聞き取り

略　語　表

AAP	Africa Adaptation Programme	アフリカ気候変動適応支援プログラム
AU	African Union	アフリカ連合
AWS	Automatic Weather System	自動気象観測装置
C/P	Counterpart	カウンターパート
GHS	Ghana Cedi	ガーナ・セディ（通貨）
GIS	Geographical Information System	地理情報システム
G-Met	Ghana Meteorological Agency	ガーナ気象庁
GOG	Government of Ghana	ガーナ国政府
GOJ	Government of Japan	日本国政府
JCC	Joint Coordination Committee	合同調整委員会
JICA	Japan International Cooperation Agency	独立行政法人国際協力機構
JPY	Japanese Yen	日本円
JST	Japan Science and Technology Agency	独立行政法人科学技術振興機構
MEST	Ministry of Environment, Science and Technology	環境科学技術省
M/M	Minutes of Meeting	協議議事録
MOFA	Ministry of Food and Agriculture	食糧農業省
MOF	Ministry of Finance	財務省
NADMO	National Disaster Management Organization	国家災害管理機構
NCCAS	National Climate Change Adaptation Strategy	国家気候変動適応戦略
NCCC	National Climate Change Committee	国家気候変動委員会
NCCP	National Climate Change Policy	国家気候変動政策
NCCPF	National Climate Change Policy Framework	国家気候変動政策枠組
PDM	Project Design Matrix	プロジェクト・デザイン・マトリックス
PO	Plan of Operation	活動計画
R/D	Record of Discussion	討議議事録
SATREPS	Science and Technology Research Partnership for Sustainable Development	地球規模課題対応国際科学技術協力プログラム
TFP	Total Factor Productivity	総要素生産性
UDS	University of Development Studies	ガーナ開発学大学
UG	University of Ghana	ガーナ大学
UNDP	United Nations Development Plan	国連開発計画

UNU-IAS	the United Nations University-Institute for the Advanced Study of Sustainability	国連大学サステイナビリティ高等研究所
UNU-INRA	the United Nations University-Institute of Natural Resources in Africa	国連大学アフリカ自然資源研究所
USD	United States Dollar	米国ドル
WRC	Water Resource Committee	水資源委員会
WRF	Weather Research and Forecasting model	気象予測モデル

中間レビュー評価調査結果要約表

<table>
<tr><td colspan="3">１．案件の概要</td></tr>
<tr><td colspan="2">国名：ガーナ共和国</td><td>案件名：アフリカ半乾燥地域における気候・生態系変動の予測・影響評価と統合的レジリエンス強化戦略の構築</td></tr>
<tr><td colspan="2">分野：農業一般</td><td>援助形態：技術協力プロジェクト（SATREPS）</td></tr>
<tr><td colspan="2">所轄部署：農村開発部</td><td>協力金額（評価時点）：384,185 千円</td></tr>
<tr><td rowspan="3">協力期間</td><td rowspan="3">（R/D）：2012 年 3 月～2017 年 3 月</td><td>先方関係機関：ガーナ大学、ガーナ気象庁、ガーナ開発学大学、国連大学アフリカ自然資源研究所</td></tr>
<tr><td>日本側協力機関：東京大学、京都大学、国連大学サステイナビリティ高等研究所</td></tr>
<tr><td>他の関連協力：なし</td></tr>
<tr><td colspan="3">１－１　協力の背景と概要
ガーナ共和国（以下、「ガーナ」と記す）は、政治的・社会的に安定し、近年、西アフリカやアフリカ連合（AU）において主導的な役割を果たしていることから、国境を越えた半乾燥地域の気候変動への対応についても西アフリカ諸国の先導的立場にある。しかし、ガーナ国内では南北の経済格差が深刻化し、北部サバンナの農村若年人口が南部へ流出することによって資源管理基盤が弱体化し、地域によっては、これが紛争の起こる原因にもなっている。またガーナ北部の農村では、女性や高齢者が生存維持レベルの農業を営み生計を立てている世帯が多く、彼らの資源管理能力向上とともに、農村での雇用創出や農村開発に従事する人材育成が緊急に求められている。ガーナでは、気候変動・農業生産・生態系・資源管理等複雑な関係性を明らかにするための地理情報データの整備、IT 技術の確立および普及、継続的な人材育成のための能力開発プログラムとその実施体制がまだ十分に確立されておらず、地球規模の気候・生態系変動への対応の一環として資源管理基盤の有効かつ実現可能な対策のニーズが高い。
ガーナ政府およびガーナを代表する大学であるガーナ大学（UG）は、ガーナ気象庁（G-Met）、ガーナ開発学大学（UDS）、国連大学アフリカ自然資源研究所（UNU-INRA）との共同研究体制で、ガーナの半乾燥地域で頻発する気候変動に起因する異常気象に対して、地域住民の災害に対するレジリエンス（回復能力）[1] を高めることによる資源管理能力の向上を目指し、2010 年 11 月に我が国に、科学技術協力プロジェクトの枠組みによる UG と東京大学との共同研究を要請した。これを受け、日本側は 2012 年 3 月から 5 年間の予定で本プロジェクトを開始した。2014 年 9 月にプロジェクトが協力期間の中間地点を迎えることから中間レビュー調査が実施された。

１－２　協力内容
本プロジェクトは、資源管理基盤が脆弱であるガーナ北部半乾燥地域のなかでも、特に脆弱なガーナ北部のボルタ河流域を対象に、地球規模の気候・生態系変動への対応への一環として、①気候・生態系変動が農業生態系にもたらす影響の予測評価、②異常気象のリスク評価と水資源管理手法の開発・適用、更にはそれらを踏まえた③地域住民および技術者の能力開発を推進</td></tr>
</table>

[1] レジリエンス（回復能力）とは、何らかの攪乱に対して、システムがそれを吸収し、機能や構造を維持する能力を示す概念である。本プロジェクトでは、不安定な気候変動および災害・人為的環境負荷に弾力的に対応する能力をレジリエンス（回復能力）と定義されている。

するプログラムの形成・実施、の 3 点を核とする実証国際共同研究を行っている。この研究プロジェクトを通して、統合的レジリエンス強化戦略の構築を図り、「ガーナモデル」としてアフリカ半乾燥地域全域への対応を目指している。

（1）上位目標

気候・生態系変動に対するレジリエンス強化戦略モデルが国際政策で活用される。

（2）プロジェクト目標

気候・生態系変動に対する自然資源環境管理基盤の脆弱性を克服し、北部ガーナ地域の自然災害に対するレジリエンス（回復能力）を高めて資源管理能力を向上させる、統合的レジリエンス強化戦略モデルが「ガーナモデル」として策定される。

（3）成果

成果１：アフリカ半乾燥地域における気候・生態系変動の農業生態系への影響の予測評価手法が開発される。

成果２：衛星技術・現地観測網を用いた異常気象予測・リスク評価が行われ、水資源管理技術の方策が提示される。

成果３：地域住民および技術者の能力開発を推進するプログラムが開発され、実施される。

（4）投入（評価時点）

日本側

専門家派遣：短期専門家　延べ 36 名（29.50 人／月）、機材供与：約 21,305,995 円

長期専門家：（業務調整員）延べ 2 名（29 人／月）、本邦研修員受入れ：合計 9 名

ローカルコスト：約 807,765 ガーナ・セディ（2014 年 9 月時点）

ガーナ側

カウンターパート（C/P）配置：延べ 42 名

土地・施設提供：プロジェクト執務スペース 5 カ所（UG、G-Met、UNU-INRA、UDS ニャンパラ、ワ・キャンパス）、自動気象観測装置（AWS）設置場所、UNU-INRA 内 GIS 研究教育センター

２．評価調査団の概要

日本側 調査団	（担当分野・氏名・職位） 団長／総括：栗栖昌紀　JICA 農村開発部　農業・農村開発第二グループ第五チーム課長 科学技術計画・評価：安岡善文　JST 研究主幹 科学技術計画・評価：高橋美穂　JST 国際科学技術部　地球環境課題協力グループ調査員 評価分析：中村美都子　国際航業（株）海外事業部コンサルタント
ガーナ側 調査団	団長：Mr. Francis Mensah, Economics Officer,（Japan/ Korea/China - Schedule Officer）, Ministry of Finance 団員：Mr. Bernard Ayensu, Policy, Planning and Monitoring and Evaluation Officer, Ministry of Education

	団員：Mr. Kingsley Kwako Amoako, Envt. Land and Water Management Unit, Directorate of Crop Services, Ministry of Food & Agriculture 団員：Mr. Mahama A. Nuhu, Deputy Director, Research, Statistics and Information Management, Ministry of Communications	
調査期間	2014 年 9 月 14 日～ 10 月 1 日	評価種類：中間レビュー評価

３．評価結果の概要

３－１　実績の確認

３－１－１　成果達成の実績

成果１：アフリカ半乾燥地域における気候・生態系変動の農業生態系への影響の予測評価手法が開発される。

実　績：気候変動影響の予測評価については、地域気候変動予測モデルの力学的ダウンスケーリングが実施され、異常現象（多雨・少雨など）の気候メカニズムの理解が進み、ガーナにおける降水の実態が明らかになった。農業生産活動への気候変動による影響予測については、ガーナの農業総要素生産性（TFP）の推計ならびに実際の農家経済と気候変動対応状況把握のための詳細な家計調査が実施され、現在成果を取りまとめられている。また、農業生態系変動についても、衛星画像データ分析と現地調査が実施され、農業生産と土地利用の関係、気候変動影響について基本的な分析枠組みが確立された。上記活動に基づき、5 本の研究論文が発表されている。

成果２：衛星技術・現地観測網を用いた異常気象予測・リスク評価が行われ、水資源管理技術の方策が提示される。

実　績：衛星データ収集とデータベース構築用の気象データサーバーおよび地上気象観測網の構築のため AWS が設置され、衛星データと地上観測データの比較による降水量の解析が進められた。これらを用いた気象予測モデル（WRF）を使った気象予測技術が開発され、C/P 職員に技術移転後、G-Met において試験的運用が開始された。同時に、衛星データや WRF で得られる降水量を用いた洪水予測計算モデルも開発されている。水資源管理技術の方策の一つとして、干ばつ対応のための作付け方法の研究が UDS のイニシアティブで実施され、同方策の検討は予定よりも 1 年早く開始されている。上記活動に基づき、5 本の研究論文が発表されている。

成果３：地域住民および技術者の能力開発を推進するプログラムが開発され、実施される。

実　績：プロジェクトサイトの選定基準として、本プロジェクトにおける 3 つのレジリエンス（生態学的、工学的、社会経済学的）と、洪水、干ばつに対する脆弱性の概念および指標が定義され、すべての研究グループが参加して対象 10 村落が選定された。対象村落の土壌・農地利用調査や社会経済活動調査に加え、行政担当官や関係省庁の技術者、地域住民を対象に現地気候変動にかかるガバナンス制度の調査が行われた。これら調査結果の分析により、地域住民や関係者の能力開発プログラムを策定するうえできわめて重要な農民たちによる気候変動の影響からの様々な生存戦略（適応策）や認識が明らかになった。上記活動に基づき、11 本の研究論文が発表されている。

（3）プロジェクト目標

総じてプロジェクトの活動は計画通りに進んでいる。各成果を達成するために必要なデータは収集され、重要な研究結果も得られており、プロジェクトの中間地点においてプロジェクト目標を達成するための基盤は確立されたと考えられる。プロジェクトはすべての研究成果を活用し、気候・生態系変動に対するレジリエンス強化オプションを提案、能力開発プログラムを策定することで本協力期間中に最終的には対象グループのレジリエンスを統合的に強化する戦略、すなわち「ガーナモデル」が構築されることが期待できる。

3－2　評価結果の要約

（1）妥当性

ガーナ政府は災害に対する国家的なレジリエンス強化や積極的かつ効果的なリスク軽減の重要性を強調した国家気候変動政策を 2013 年に策定したが、これまでの主要な気候変動政策から大きな変更はなく、本プロジェクトの協力内容は上記政策に合致している。2012 年に策定された日本の国別援助方針との整合性も確認された。また、ガーナ北部半乾燥地域の農業、水資源、防災分野の気候変動対応策の構築を可能とする研究者の能力向上ニーズは依然として高い。

（2）有効性

プロジェクトの活動は総じて計画通りに実施されている。その結果、プロジェクトは気候・生態系変動の予測評価手法や気象予測モデル、洪水予測モデル、異常気象のリスク評価手法の開発が進んでいる。これまでの活動実績にかんがみ、中間レビュー時点でプロジェクト目標を達成するための基盤は確立されたと考えられる。一方で、プロジェクト目標に掲げられた統合的レジリエンス強化戦略（「ガーナモデル」）を確立、実施するための今後の行動計画は、全研究者間でいまだ十分に議論されておらず、プロジェクト後半においては早期にプロジェクトが目指す統合的戦略構築への道筋が提案されることが期待される。

（3）効率性

中間レビュー調査時点において、一部調達機材の遅延があったものの、本プロジェクトの運営に特段の問題はない。そのほか多くの投入がほぼ計画どおりに実施され、研究成果の産出および研究活動の推進に結び付いている。

（4）インパクト

本プロジェクトの目標は、気候変動に対する国家的レジリエンス強化やリスク軽減を目指すガーナ国家政策と一致していることから、研究成果が国家レベルでの政策立案・実施において利用される可能性は非常に高いといえる。また、プロジェクトは、研究成果を発表するため国際会議を主催するなど積極的に対外活動を進めていることから、サブ・サハラアフリカ地域において「ガーナモデル」が国際的に活用される可能性も高いと考えられる。調査活動の対象村落では、一連の調査を通じて衛生的な水利用、小規模灌漑や単作栽培などに関する意識の変化や対策を実施したというインタビュー結果もあり、正のインパクトが確認された。

（5）持続性

政策上、気候変動適応策の重要性の認識が継続する可能性は高い。各実施機関は気候変動の予測・影響評価やレジリエンス強化は既存の研究開発活動として取り組んでおり、プロジェクト終了後も本プロジェクトの研究成果や研究方法などは持続的に利用される可能性は高い。プロジェクトは同分野における研究者やコミュニティの現場での社会実装を実現する潜在的な人的資源として、様々な手段を通じてガーナ人若手研究者の育成を図っており、技術の活用性も高い。ただし、プロジェクト終了後も実施機関が自ら同様の研究活動を継続していけるかについては、実施機関の財政状況にかんがみると、本プロジェクトで開発された統合的戦略が国家的な活動計画などに組み込まれる必要がある。

3－3　効果発現に貢献した要因

（1）計画内容に関すること

特になし。

（2）実施プロセスに関すること

プロジェクトでは、年1回の合同調整会議(JCC)に加えて、JCC 開催前後に各研究グループが参加する現地調査や、各研究の進捗を共有するためのワークショップを開催するほか、各研究代表者による電話会議、本邦での進捗会議など、プロジェクト運営に必要なコミュニケーションを図るために様々な工夫をしている。多くの関係者が、これらの合同調査や会合、電話会議などは、調査活動の効率化や各研究グループで得た研究成果を研究者が共有できる貴重な手段であり活動を進めるうえで非常に重要であったとの認識をもっていた。今後、プロジェクト目標を達成するうえで更に重要性を増すものと思われる。

3－4　問題点および問題を惹起した要因

（1）計画内容に関すること

本プロジェクトの研究計画について、これまで研究計画のプロセスが主に日本側によって進められ、ガーナ側が十分にプロセスを共有できていないため、ガーナ側研究者によるプロジェクト活動の改善や、プロジェクトに関連する自らの研究活動の実施が困難だったとの意見があった。プロジェクトの研究成果の達成に大きな影響を及ぼしてはいないが、プロジェクトの活動が進むにつれてガーナ側研究者の主体性が高まってきた表れでもあり、今後プロジェクト目標を達成するうえで日本側、ガーナ側全関係者の研究グループ間の全体的な調整を強化することで改善が見込まれる。

（2）実施プロセスに関すること

プロジェクトの活動経費について、JICA の予算制度はガーナ側研究者にとって通常の研究資金の使い方と異なり新しいものであったため、年間の活動予算や活動経費の申請・支払い手続きにかかる規則が明確ではなく、円滑なプロジェクト活動の実施に若干の影響があった。なお、中間レビュー時点で活動経費申請の内規が作成され、日本の会計年度に合わせたプロジェクト後半の年間予算計画の共有も予定されており今後は改善される見込みである。

3－5　結　論

プロジェクトでは当初、プロジェクト運営に関する日本側、ガーナ側の情報共有などに課題

があったものの、既にプロジェクト実施上の様々な調整やコミュニケーションの観点に問題の焦点が当てられ改善に向かっている。本中間レビュー調査の時点で、プロジェクトを実施するうえで重大な問題や遅延はなく、期待された成果が達成されつつあることが確認された。プロジェクトは既に各研究結果を統合する段階にきており、プロジェクト目標達成に向けて順調に進捗している。

３－６　提　言

（１）関係省庁のプロジェクトへの関与

プロジェクトによる研究成果が国内外に普及され、持続的に活用されていくためには、まず各実施機関のライン省庁（例えば、教育省）内において、それら研究成果の内容や活用方法について、更に関心や意識を高める必要がある。JCC を通じた情報発信だけでなくメールやメーリングシステムなど簡便な手段で研究活動の進捗を周知させるなど工夫することが望ましい。

（２）供与資機材の活用

本プロジェクトで技術移転されている地理情報システム（GIS）技術へのニーズは非常に高く、プロジェクトの供与資機材を利用して、UNU-INRA や UG によって GIS 研修コースが実施されている。一方で、プロジェクトによって供与された AWS のうち 1 台に関しては適切な安全対策（フェンス設置など）がとられていない。したがって、今後更に供与予定の AWS も含めて速やかに対策をとる必要がある。

（３）レジリエンス強化戦略の構築に向けて

研究テーマ 1(成果 1)および研究テーマ 2(成果 2)は複数の気候変動シナリオを、研究テーマ 3（成果 3）は現地コミュニティのレジリエンスを強化する対策を提示する。これらの対策は生態学的、工学的、社会経済学的な 3 つのアプローチに基づいた戦略として確立される予定である。プロジェクトでは研究結果を活用したレジリエンス強化オプション（対策）の議論を始めたところであるが、レジリエンス強化戦略をより強固なものにするため、これら 3 つのアプローチに考慮した戦略を今後探究し続ける必要がある。

（４）プロジェクト全関係者によるチームビルディング

各研究（成果）を統合するためには、研究グループ間の全体的な調整を強化し、関係省庁に研究結果やプロジェクトの進捗について情報の共有・普及を行うことで、プロジェクトにかかわる全関係者間のチームビルディングを図る必要がある。

（５）プロジェクト外部関係者との調整

プロジェクトの研究活動にプロジェクト外部関係者が所有する追加データが必要な場合は、プロジェクトのために関係省庁が調整・便宜を図ることでデータを入手することを強く期待する。

第１章　中間レビュー調査の概要

１－１　調査団派遣の経緯と目的

１－１－１　経　緯

ガーナ共和国（以下、「ガーナ」と記す）は、政治的・社会的に安定し、近年、西アフリカやアフリカ連合（African Union：AU）において主導的な役割を果たしていることから、国境を越えた半乾燥地域の気候変動への対応についても西アフリカ諸国の先導的立場にある。しかし、ガーナ国内では南北の経済格差が深刻化し、北部サバンナの農村若年人口が南部へ流出することによって資源管理基盤が弱体化し、地域によっては、これが紛争の起こる原因にもなっている。またガーナ北部の農村では、女性や高齢者が生存維持レベルの農業を営み生計を立てている世帯が多く、彼らの資源管理能力向上とともに、農村での雇用創出や農村開発に従事する人材育成が緊急に求められている。ガーナでは、気候変動・農業生産・生態系・資源管理等複雑な関係性を明らかにするための地理情報データの整備、IT 技術の確立および普及、継続的な人材育成のための能力開発プログラムとその実施体制がまだ十分に確立されておらず、地球規模の気候・生態系変動への対応の一環として資源管理基盤の有効かつ実現可能な対策のニーズが高い。

ガーナ政府およびガーナ国を代表する大学であるガーナ大学（University of Ghana：UG）は、ガーナ気象庁（Ghana Meteorological Agency：G-Met）、ガーナ開発学大学（University of Development Studies：UDS）、国連大学アフリカ自然資源研究所（the United Nations University-Institute of Natural Resources in Africa：UNU-INRA）との共同研究体制で、ガーナ半乾燥地域で頻発する気候変動に起因する異常気象に対して、地域住民の災害に対するレジリエンス（回復能力）を高めることによる資源管理能力の向上を目指し、2010 年 11 月に我が国に、科学技術協力プロジェクトの枠組みによる UG と東京大学との共同研究を要請した。これを受け、日本側は 2012 年 3 月から 5 年間の予定で本プロジェクトを開始した。2014 年 9 月にプロジェクトが協力期間の中間地点を迎えることから中間レビュー調査が実施された。

１－１－２　目　的

中間レビュー評価調査の目的は、以下のとおりである。

（１）プロジェクト・デザイン・マトリックス（Project Design Matrix：PDM）に基づき、プロジェクトの進捗と実績を確認、レビューすること
（２）プロジェクト実施における貢献要因、阻害要因を分析すること
（３）5 項目評価（妥当性、有効性、効率性、インパクト、持続性）に沿ってプロジェクトを多面的に分析、評価すること
（４）より良い今後のプロジェクト実施のために、プロジェクト後半期に必要な対策の提言を行うこと

１－２　調査団の構成と調査期間

中間レビュー調査は、本邦からの調査団員とガーナ政府レビューメンバーからなる合同チームによって、2014 年 9 月 14 日から 30 日の 17 日間（現地調査期間）にわたり実施された。合同レ

ビューチームメンバーの構成は、以下のとおり。

（1）日本側調査団員

担当分野	氏名	所属
団長／総括	栗栖　昌紀	JICA 農村開発部　農業・農村開発第二グループ第五チーム　課長
科学技術計画・評価	安岡　善文	JST 研究主幹
科学技術計画・評価	高橋　美穂	JST 国際科学技術部　地球環境課題協力グループ　調査員
評価分析	中村　美都子	国際航業（株）海外事業部コンサルタント

（2）ガーナ側調査団員

担当分野	氏名	所属
団長	Mr. Francis Mensah	Economics Officer,（Japan/ Korea/China - Schedule Officer）, Ministry of Finance
団員	Mr. Bernard Ayensu	Policy, Planning and Monitoring and Evaluation Officer, Ministry of Education
団員	Mr. Kingsley Kwako Amoako,	Envt. Land and Water Management Unit, Directorate of Crop Services, Ministry of Food & Agriculture
団員	Mr. Mahama A. Nuhu	Deputy Director, Research, Statistics and Information Management, Ministry of Communications

１－３　調査日程

調査日程は、付属資料 1「合同評価レポート（英文）」の ANNEX 1 に示されたとおり。

１－４　主要面談者

現地調査期間の主要面談者リストは、同 ANNEX 2 に示されたとおり。

１－５　対象プロジェクトの概要

（1）協力終了時の達成目標（プロジェクト目標）

気候・生態系変動に対する自然資源環境管理基盤の脆弱性を克服し、北部ガーナ地域の自然災害に対するレジリエンス（回復能力）を高めて資源管理能力を向上させる、統合的レジリエンス強化戦略モデルが「ガーナモデル」として策定される。

（2）プロジェクトの成果（アウトプット）

成果 1：アフリカ半乾燥地域における気候・生態系変動の農業生態系への影響の予測評価手法が開発される。

成果 2：衛星技術・現地観測網を用いた異常気象予測・リスク評価が行われ、水資源管理技術の方策が提示される。
成果 3：地域住民および技術者の能力開発を推進するプログラムが開発され、実施される。

（3）活動

【成果 1】

1-1. 気象に関するデータ（時系列、空間）の収集、蓄積を行う
1-2. 土地利用・土壌分布に関するデータ（時系列、空間）の収集、蓄積を行う
1-3. 農業生産・農家経営に関するデータ（時系列、空間）の収集、蓄積を行う
1-4. 地理情報システム（Geographical Information System：GIS）によるデータの統合とデータベースの構築を行う
1-5. 地域気候変動予測モデルを構築し（地球気候変動予測モデルのダウンスケーリングの制約の解明）、地域気候変化を推定する
1-6. 農業生態系利用への気候変動の影響分析を実施する
1-7. GIS により土地利用・土壌分布・気候変動を統合的に分析する
1-8. 1-7 に基づき、農業生態系変動図を作成する
1-9. 気候変動に適応可能な農家経営体系（土地利用、作物構成等）のオプションを提示する
1-10. 各テーマ間（成果 1、2、3）連携のための体制を整備する

【成果 2】

2-1. 衛星および地上観測網を把握し、降水量データベースを構築する
2-2. 2-1 により、早期警報システム、水害ハザードマップおよび干ばつシナリオを作成する
2-3. ガーナ北部ボルタ河流域での異常気象に伴う災害リスクを分析評価する
2-4. 2-3 に基づき、既存のインフラを利用した水資源管理技術のプロトタイプを提示する

【成果 3】

3-1. テーマ 1 および 2 のチームと共同でサイト選定を行う
3-2. 地域の資源管理実態とガバナンス制度把握のための聞き取り調査を実施する
3-3. 農民世帯の土壌・作物管理技術と社会経済活動把握のための調査を実施する
3-4. 具体的な作物バリュー・チェーンを把握し、ビジネスモデルのオプションを提示する。
3-5. 3-2 から 3-4 により住民・行政担当者および研究者共同参画による制度的能力開発プログラムを開発する
3-6. 2-4 および 3-3 により技術者および研究者共同参画による工学的資源管理技術能力開発プログラムを開発する
3-7. 3-5 および 3-6 に基づき、統合的レジリエンス強化戦略を構築する

（４）実施期間

2012 年 3 月～ 2017 年 3 月

（５）対象地域

北部州、アッパーイースト州、アッパーウェスト州

（６）カウンターパート（Counterpart：C/P）機関

UG、G-Met、UDS、UNU-INRA

第２章　中間レビュー調査の方法

地球規模課題対応国際科学技術協力プログラム（Science and Technology Research Partnership for Sustainable Development：SATREPS）は、独立行政法人科学技術振興機構（Japan Science and Technology Agency：JST）による研究支援およびJICAによる技術協力の連携により推進されることから、レビューおよび評価においてもJSTおよびJICAが連携して実施する。JSTは、地球規模課題解決に資する国際共同研究の成果、科学技術水準の向上、科学技術政策への貢献の観点から日本国内および相手国を含めた国際共同研究全体の評価を実施する。他方、JICAは通常の技術協力プロジェクトと同様、「新JICA事業評価ガイドライン第１版」に沿って、ODA事業としての評価を行っており、以下に本中間レビュー調査の方法を説明する。

２－１　本国際科学技術協力プロジェクト（SATREPS）評価にかかる特徴

通常の技術協力プロジェクトでは、投入から活動、アウトプットへとつながる過程を直線的なものと想定し、PDMをプロジェクト計画として位置づけ、PDMの枠組みに基づいた中間レビュー調査を実施している。しかし、SATREPSでは一連の過程は必ずしも直線的なものと想定されていない。したがって、本中間レビュー調査においては「新JICA事業評価ガイドライン第1版」の基本的考え方を踏まえるものの、仮説検証の過程を経て最適解を特定していく科学技術的発想とは異なる部分があることから、SATREPSの特徴を踏まえて、評価のデザインを設定した。

２－２　レビュー調査の視点と手法

本中間レビュー調査は、「新JICA事業評価ガイドライン　第１版」（2010年６月）に沿って、JICAプロジェクトのマネジメント・ツールとして用いられるPDMに基づき、以下の手順で実施した。

（１）プロジェクトの現状把握・検証（投入・実績・実施プロセスの確認）
（２）評価５項目（妥当性、有効性、効率性、インパクト、持続性）による進捗レビュー
（３）上記評価結果に基づく今後の活動に対する提言の取りまとめ

２－３　調査項目と方法

２－３－１　調査項目

本レビューの主な調査項目は、以下のとおりであった。

（１）プロジェクトの進捗状況の確認

プロジェクトの投入実績、活動実績、アウトプット（成果）の現状、プロジェクト目標の達成見込みを確認、検証した。「２－１」で述べたSATREPSの特徴を踏まえて、成果およびプロジェクト目標の達成度合いという視点ではなく、研究項目ごとの進捗・成果産出状況、および全体の研究体系に照らし合わせた成果産出状況という視点で行った。

（２）プロジェクト実施プロセスの確認・検証

プロジェクト活動を円滑にするための工夫、モニタリングの仕組みの有無、プロジェク

ト関係者（日本人専門家、ガーナ側 C/P 、その他プロジェクト関係者）間の連携状況などを確認した。

（3）評価 5 項目の視点からの分析

プロジェクトの実績と実施プロセスの確認・検証を通して収集した情報を基に、以下に示す評価 5 項目の視点からプロジェクトを評価した。

＜評価 5 項目と定義＞

項目	定義
妥当性	プロジェクトの目指している効果（プロジェクト目標や上位目標）が受益者のニーズに合致しているか、問題や課題の解決策として適切か、被援助国および日本側の政策との整合性はあるか、プロジェクトの戦略・アプローチは妥当か、などといった「プロジェクトの正当性・必要性」を問う視点。
有効性	プロジェクトの実施により本当に受益者もしくは社会への便益がもたらされているのか（あるいは、もたらされるのか）を問う視点。プロジェクト目標は達成される見込みか、それはプロジェクトのアウトプットの結果もたらされる見込みか、プロジェクト目標に至るまでの外部条件の影響はあるか、有効性を貢献・阻害する要因は何かなどを分析する。
効率性	主にプロジェクトのコストと効果の関係に着目し、資源が有効に活用されているか（あるいは、されるか）を問う視点。プロジェクト目標の達成度はコスト（投入）に見合うか、より低いコストで達成する代替手段はなかったか、プロジェクトの実施プロセスの効率性を阻害・促進する要因は何かなどを分析する。
インパクト	プロジェクトの実施によりもたらされる、より長期的、間接的効果や波及効果（上位目標の達成度を含む）をみる視点。予期していなかった正・負の効果・影響を含む。
持続性	援助が終了してもプロジェクトで発現した効果が持続しているか（あるいは、持続の見込みはあるか）を問う視点。

２－３－２　評価グリッドの作成と情報・データの収集

上記の調査を実施するに先立ち、評価項目に沿った評価設問を設定した。それぞれの評価設問に対して、必要な情報・データ、その情報源や収集方法について検討し、この結果を付属資料 1 の ANNEX5 に示した評価グリッドを作成した。本調査のための情報・データの収集は、作成した評価グリッドに沿って実施した。

具体的な情報・データの収集方法は、以下のとおり。

（1）既存資料のレビューと分析（文献調査）

プロジェクトに関する資料（詳細計画策定調査報告書、プロジェクト進捗報告書等）をレビューし、分析に活用した。

（2）プロジェクト関係者に対するインタビューの実施

現地調査に先立ち、ガーナ側C/P研究者を対象に、プロジェクトの実績、実施プロセス、評価5項目に関する質問票を作成、配布し、現地調査中は可能な限り受益者（C/P、対象地域行政官・関係者、村落住民リーダーなど）に面会し、関係する質問票の回答および質問票から得られない情報の補完的な収集に努めた。

（3）現場視察

C/P機関ならびにプロジェクト対象村落において、活動、施設、供与資機材の維持管理等の現状を視察・確認した。

２－４　調査の制約・限界

特になし。

第３章　プロジェクトの進捗状況

３－１　プロジェクトの実績

３－１－１　投入の実績

＜日本側投入＞

（１）専門家派遣	長期専門家（業務調整員）延べ 2 名（29 人 / 月） 短期専門家（研究者）延べ 36 名（29.50 人 / 月） （2014 年 8 月末現在の実績）〔詳細は、付属資料 1 の ANNEX 6 を参照〕
（２）本邦研修	現在まで 9 名の C/P が本邦研修に参加した。〔詳細は、付属資料 1 の ANNEX 7 を参照〕
（３）供与機材	供与機材の総額：およそ 2,130 万円〔777,590 セディ（GHS）/ 交換比率は GHS1.0 = JPY27.4 を使用〕主な供与機材としては、データサーバーと自動気象観測装置（Automatic Weather System：AWS）、実験用機材〔詳細は、付属資料 1 の ANNEX 8 を参照〕
（４）ローカルコスト負担	現地業務費：総額およそ 807,766GHS（2,200 万円 / 交換比率は GHS1.0 = JPY27.4 を使用）

＜ガーナ側投入＞

（１）C/P 配置	2014 年 8 月末現在、延べ 42 名の C/P が配置されている。内訳は、プロジェクト・ダイレクター 1 名（UG）、UG 11 名、G-Met 11 名、UDS 14 名、UNU-INRA 5 名。〔詳細は、付属資料 1 の ANNEX 9 を参照〕
（２）土地・施設の提供	プロジェクト執務スペース 5 か所（UG、G-Met、UDS ニャンパラ、ワ・キャンパス）、AWS 設置場所、UNU-INRA 内の GIS 研究教育センター
（３）プロジェクト活動費（C/P ファンド）	C/P の旅費・日当はガーナ政府からの C/P ファンドによって負担されることが期待されている。C/P 機関によって予算獲得の努力がなされ始めたが、実現にいたっていない。

３－１－２　活動の実績

中間レビュー時点でのプロジェクト活動は、おおむね順調に行われている。各活動の具体的な進捗については、以下の成果（アウトプット）の達成状況のなかで適宜言及した。

３－２　成果の達成状況

本プロジェクトにおいては、「気候・生態系変動に対する自然資源環境管理基盤の脆弱性を克服し、北部ガーナ地域の自然災害に対するレジリエンス（回復能力）を高めて資源管理能力を向上させる、統合的レジリエンス強化戦略モデルが「ガーナモデル」として策定される」ことを目標として、3 つの成果（研究項目）が設定されている。各成果（研究成果）達成に向けた活動の進捗状況および成果産出状況は以下のとおりである。

なお、「２－３－１」で述べたとおり、SATREPS の特徴を踏まえて、通常の成果およびプロジェクト目標の達成度合いという視点ではなく、研究項目ごとの進捗・成果産出状況、および全体の研究体系に照らし合わせた成果産出状況を把握することで成果の達成状況を確認した。

成果 1：アフリカ半乾燥地域における気候・生態系変動の農業生態系への影響の予測評価手法が開発される。

地域気候変動予測モデルを構築し、モデルを使って予測をするため、ガーナの過去の多雨年、少雨年を対象に力学的ダウンスケーリングが実施され、懸念される極端現象の気候メカニズムの把握が進んだ。その結果、ガーナにおける降水の実態が明らかになった。特に、ガーナ国中心のボルタ湖周辺のローカルな大気循環とアフリカモンスーンとの相互作用による局地的な降水の可能性を示唆することができた。

生態系システムおよび農業生産活動への気候変動の影響予測については、農業の総要素生産性（Total Factor Productivity：TFP）と呼称され、全投入要素に対して、どれだけの生産量や付加価値を生み出したかを示す TFP が推計された。その結果、なんらかの方策が考慮されない限り、ガーナの農業生産性の停滞傾向が続くことが予測された。これらのマクロ、セミマクロの観点からの分析に加え、実際の農家経済の状況と気候変動への対応を把握するために、調査対象地であるトロン郡の対象 6 集落の合計 150 世帯、ワ・ウェスト郡の合計 81 世帯について詳細な家計調査が行われた。この調査の成果については、現在取りまとめられている。これらの調査活動に基づき、農業生産性への気候変動の影響を明らかにすることにより、農業生産方法や品種の適切な選択などの戦略を立案することが重要であることが結論づけられた。

さらに、プロジェクトは衛星画像データおよび現地調査を組み合わせることで対象村落におけるガーナの生態系システムにおける地域的な土地利用の変化や、土壌分布、農地管理に関する調査を実施した。この結果、ガーナ北部地域では、湿地など水源に近い土地や森林等が農用地に転換されていることが明らかとなり、農業生産性と土地利用の変化や、気候変動影響についてさらに詳細な分析が行われる予定である。

成果 3 で後述するとおり、プロジェクトは生態学的、工学的（物理的・物質的）、社会経済学的な 3 つの側面の統合的レジリエンスの指標を開発し、洪水・干ばつに脆弱な地域のコミュニティのレジリエンスの状況を定量化する手法を開発した。

上記活動に基づき、これまで 5 本の研究論文が発表されている。詳細は付属資料 1 の ANNEX 10 を参照。

成果 2：衛星技術・現地観測網を用いた異常気象予測・リスク評価が行われ、水資源管理技術の方策が提示される。

衛星データ収集とデータベース構築用の気象データサーバーおよび地上気象観測網の構築のため、G-Met、UDS に合計 2 台のデータサーバーが設置され、データサーバーの使用方法について本邦研修が行われた後、G-Met での運用が開始されている。プロジェクトは対象地域内のイェンディ（Yendi）、ボレ（Bore）、サラガ（Salaga）観測所に合計 3 台の AWS を設置、気象庁本部の観測網につなげ、衛星データ（GSMap）と地上観測雨量データを比較し、上記データの連関性が明らかとなった。この連関性に基づき、準リアルタイムの衛星データと地上雨量データによる調

整機能がデータサーバーに追加された。

気象予測に関しては、これらの調査結果を用いて、気象予測モデル（Weather Research and Forecasting model：WRF）を使った異常気象予測技術が開発され、本邦での試行運用後、気象庁C/P職員にガーナと同様のデータサーバーを使用した本邦C/P研修による技術移転が行われた。研修修了後は、C/P職員自らがソフトウェアをインストールするまで技術力を向上させた。

プロジェクトは、衛星データやWRFで得られる降水量を用いて洪水予測計算モデルを開発し、2007年の氾濫を例題にモデル調整を行っている。モデル検証に必要な水文データ（流量や水位データ）が入手困難なため、衛星データを用いて氾濫域を検出するツールの開発が開始されている。上記モデルの完成を待って、洪水や干ばつのシナリオが作成される予定である。干ばつシナリオの開発ため、土壌水分計測装置を供与し、衛星データの地上検証用のフィールドデータ取得を開始している。

また、ボルタ河流域での異常気象リスクの評価に必要となる対象村落の社会・環境調査の結果、洪水よりも干ばつが重大な災害として位置づけられていることから、水資源管理技術の方策の一つとして、干ばつ対応のための作付け方法の研究がUDSのイニシアティブで実施され、同方策の検討は予定よりも1年早く開始されている。

上記活動に基づき5本の研究論文が発表されている。詳細は付属資料1のANNEX 10を参照。

成果3：地域住民および技術者の能力開発を推進するプログラムが開発され、実施される。

プロジェクトサイト選定にあたり、成果1で前述したとおり、本プロジェクトにおける脆弱性を定義するための論文が作成された[2]。サイト選定基準として、3つのレジリエンスのレベル（生態学的、工学的、社会経済的）および、洪水、干ばつに対する3つの脆弱性のレベル（物理的・物質的、社会組織・制度、動機・態度）の概念と指標が定義され、サイト選定ための概念的枠組みが確立された。

日本側・ガーナ側の研究者は対象郡のコミュニティを合同で訪問し、サイト選定のための予備調査が行われた。このサイト選定の議論には、成果1から3の全研究グループのメンバーが参加し、各研究グループの主要メンバーからなるタスクフォース・チームが設置され、サイト選定のための評価を実施し、候補サイトを提案した。最終的にプロジェクトは以下の＜サイト選定の概要＞のとおり、合計10対象村落を選定した。

＜サイト選定の概要＞

州	対象郡	異常気象の種類	村落	
			より低い脆弱性	より高い脆弱性
北部州	Tolon	干ばつ	Cheshegu, Gabogshie, Zagua	Fihini, Yoggu, Kpaligum
アッパーウェスト州	Wa West	洪水（ボルタ河からの氾濫）	Bamkpama, Zewayeli	Chietanga, Baleuhili

出典：プロジェクト提供資料

[2] 合同評価レポートには記載されなかったが、中間レビュー時の2014年9月27日に本論文の査読が完了し、近日中に出版される見通しとなった。

トロン（Tolon）郡のフィフィニ（Fihini）集落の全戸 36 世帯を対象に、コミュニティの概要を把握するために現地調査が行われた。その後、選ばれた 17 世帯に対して詳細な農地調査が行われた。農業活動と関連して、包括的に農家世帯および現地行政担当者や技術者の能力形成を推進する道筋を探究するために、両対象郡（トロン、ワ・ウェスト）において社会経済活動ならびにガバナンス制度の調査が行われた。また、上記の圃場調査との関連において、女性が主に生産する作物である、落花生やオクラなどの作付け状況と女性の家計に資する影響についても調査が進められている。

これら調査結果の分析により、地域住民や関係者の能力開発プログラムを策定するうえで極めて重要な、農民たちによる気候変動の影響に対する様々な生存戦略（適応策）や認識が明らかになった。中間レビューの時点で、上記活動に基づき 11 本の研究論文が発表されている。詳細は付属資料 1 の ANNEX 10 を参照。

３－３　プロジェクト目標の達成見込み

プロジェクト目標：	気候・生態系変動に対する自然資源環境管理基盤の脆弱性を克服し、北部ガーナ地域の自然災害に対するレジリエンス（回復能力）を高めて資源管理能力を向上させる、統合的レジリエンス強化戦略モデルが「ガーナモデル」として策定される。

総じてプロジェクトの活動は計画通りに進んでおり、各成果を達成するために必要なデータは収集され、重要な研究結果も得られていることから、プロジェクトの中間地点において、プロジェクト目標を達成するための基盤は確立されたと考えられる。これまでの研究活動の成果は、学術論文誌『Journal of Disaster Management Vol.9 No.4』（2014 年 8 月）特別号として出版され、プロジェクトが開催した国際会議において発表されるだけでなく、対象村落でのワークショップを通じて調査結果の検証、協議も行われている。したがって、プロジェクトは、すべての研究成果を活用し、気候・生態系変動に対するレジリエンス強化オプションを提案、能力開発プログラムを策定することで、本協力期間中に最終的には対象グループのレジリエンスを統合的に強化するアプローチ、すなわち「ガーナモデル」が構築されることが期待できる。

３－４　プロジェクトの実施プロセスにおける特記事項

（１）意思決定・モニタリングのメカニズム

プロジェクトの最高意思決定機関である合同調整員会（Joint Coordination Committee：JCC）がプロジェクト活動の進捗の確認、次期活動計画の承認、プロジェクト実施上の課題を議論するため、これまで 2 回開催された。JCC に加えて、プロジェクトでは研究手法や内容、研究活動の進捗を共有するために、研究者達による会合、現地調査、ワークショップやそのほか多くの活動が合同で行われている。さらに、現地調査や本邦研修や、様々なタスクの役割・責任分担を調整するため、プロジェクト・オペレーション会議が、電話遠隔会議や、ガーナ、日本で複数回行われた。JCC に参加した主要な C/P へのインタビューによれば、JCC の意思決定・モニタリングメカニズムは非常によく機能している。一方で、ガーナ側 C/P 機関の代表者からは、前述のとおり、JCC の前後に研究者による会議やワークショップが行われているが、プロジェクトチームや関係者間でプロジェクト活動の結果を共有した

り、意見を交換したり、次の活動の方向性をタイミングよく調整するための機会はまだ十分ではないとの報告もあった。また、JCC における関係者の関与が不足しており、今後は関係者と相互に意見を交換する機会を多くつくり、今後コミットメントを更に高める必要があるとの意見で一致した。

（2）プロジェクト関係者間の調整・コミュニケーション

プロジェクトでは、当初、プロジェクトサイトの選定のため日本側、ガーナ側の各 C/P 実施機関の代表研究者からなるタスクフォース・チームが設置され、チームはプロジェクト研究者による協働で選定基準を設定し、現地調査によるデータ収集に貢献した。各調査テーマに応じたデータ収集・分析を中心とした、これまでの各研究グループの活動は、日本側研究者も含めグループ内のコミュニケーションに大きな問題はなく実施された。

一方で、本プロジェクトの研究計画について、これまで研究計画のプロセスが主に日本側によって進められ、ガーナ側が十分にプロセスを共有できていないため、ガーナ側研究者によるプロジェクト活動の改善や、プロジェクトに関連する自らの研究活動の実施が困難だったとの意見があった。プロジェクトの研究成果の達成に大きな影響を及ぼしてはいないが、今後プロジェクト目標を達成するうえで日本側、ガーナ側全関係者の研究グループ間の全体的な調整を強化することで改善が見込まれる。

（3）その他の阻害要因

プロジェクトの活動経費について、JICA の予算制度はガーナ側研究者にとって通常の研究資金の使い方と異なり新しいものであったため、年間の活動予算や活動経費の申請・支払い手続きにかかる規則が明確ではなく、円滑なプロジェクト活動の実施に若干の影響があった。なお、中間レビュー時点で、活動経費申請の内規が作成され、日本の会計年度に合わせたプロジェクト後半の年間予算計画の共有も予定されており、今後は改善される見込みである。

第4章　評価結果

４－１　評価5項目による評価結果

４－１－１　妥当性

以下の理由から、本プロジェクトの妥当性は高いと評価される。

（１）ガーナ政府の政策との合致

ガーナ政府は災害に対する国家的なレジリエンス強化や積極的かつ効果的なリスク軽減の重要性を強調した国家気候変動政策を2013年に策定したが、国家気候変動政策フレームワーク（National Climate Change Policy Framework：NCCPF）および国家気候変動適応戦略（National Climate Change Adaptation Strategy：NCCAS）など、本プロジェクトの協力内容に合致している、これまでの主要な気候変動政策から大きな変更はない。本プロジェクトは、これらガーナ政府の政策の方向性に依然として非常に合致している。

（２）日本の開発援助政策との整合性

2012年4月に策定された日本の国別援助方針では、農業開発は4重点分野の一つとされているおり、本プロジェクトは重点分野のもとに位置づけられている。さらに、ガーナはアフリカの国家レベル、地方レベル、コミュニティ・レベルで気候変動への対応能力の強化を支援する、「気候変動対策に関するパートナーシップ構築のための日本とUNDPの共同枠組み」のもと創設され、2008年から2012年に実施されたアフリカ気候変動適応支援プログラム（Africa Adaptation Programme：AAP）の対象国でもある。日本政府の政策を踏まえ、JICAは開発途上国による以下の緩和策、適応策、緩和策・適応策の実施を促進する仕組みに対する支援を積極的に展開している。①持続可能な開発と気候変動への対応の両立、②開発途上国の多様なニーズに応える包括的な支援、③開発と気候変動の両分野におけるパートナーシップの推進。これらの観点から、本プロジェクトと我が国の援助政策の整合性は確保されていると考えられる。

（３）ターゲット・グループのニーズ

ガーナ北部半乾燥地域は常襲的に自然災害（例、洪水、干ばつ）の被害を被っており、特に同地域の主要産業が気候変動の負の影響を受けやすい農業であるため脆弱である。そのため、ガーナ北部半乾燥地域の農業、水資源、防災分野の気候変動対応策の構築を可能とする研究者の能力向上ニーズは依然として高い。

４－１－２　有効性

本プロジェクトの有効性は高～中程度である。

（１）プロジェクト目標達成の見込み

プロジェクトの活動は機材調達の遅延などのため一部遅れもあるが、総じて計画通り実施されている。その結果、プロジェクトでは気候・生態系変動の予測評価手法や気象予測モデル、洪水予測モデル、異常気象のリスク評価手法の開発が進んでおり、対象村落の

様々なデータの蓄積や分析が続けられている。プロジェクトは各研究グループの研究結果と開発された概念的枠組みに基づき、生態学的、工学的、社会経済学的観点からレジリエンス強化オプションの検討を開始したところである。例えば、生態学的レジリエンスとしては、農業生態系の多様性や作付け品種の多様性、耐寒性、土壌環境に関するオプションや、工学的レジリエンスとしては、気象情報の早期警戒システム、雨水集水技術、貯水技術等のオプション、社会経済学的レジリエンスとしては、生業・収入源の多様化、集落内・集落間での災害時の協力や防災教育プログラム等がオプションに含まれる。したがって、中間レビュー時点でプロジェクト目標「統合的レジリエンス強化戦略モデルが「ガーナモデル」として策定される」を達成するための基盤は確立されたと考えられる。

一方で、プロジェクト目標に掲げられた統合的レジリエンス強化戦略(「ガーナモデル」)を確立、実施するための今後の行動計画（ロードマップ）は、全研究グループ間でいまだ十分に議論されていないことから、プロジェクト後半早期に各研究グループ間の連携を改善し、収集されたデータおよび分析結果に基づくとともに、対象村落における気象周期や農業活動の季節性に応じて能力向上開発プログラムを実施するための統合的戦略構築への概要が提案されることが期待される。

（2）外部条件の変化による影響

これまでのプロジェクト実施において、外的な要因が活動に影響を及ぼした例はなかった。

4－1－3　効率性

本プロジェクトの効率性は、高～中程度と判断する。

中間レビュー調査時点において、一部調達機材の遅延があったものの、本プロジェクトの運営に特段の問題はなく、そのほか多くの投入がほぼ計画どおりに実施され、研究成果の産出および研究活動の推進に結び付いている。

（1）日本人専門家の投入

これまで本プロジェクトの研究内容と合致した専門分野の日本人専門家がプロジェクト実施上の期待された役割を適切に果たしており、C/P 側研究者に認められている。

（2）資機材の投入

プロジェクト活用に必要な資機材ならびに技術移転は、成果 2 に関連する機材を除き、計画通り供与された。これら供与資機材はいずれも良好な状態で維持管理され、研修活動およびプロジェクト運営管理業務のために有効活用されている。機材の仕様作成や調達先の選定などに時間がかかったため、AWS の設置が遅れ、結果的にその他機材の調達に遅れが生じているものの、これまでのところプロジェクトの実施に大きな影響は与えていない。

（3）C/P の本邦研修

本邦で実施された C/P 研修の内容は適切であったと判断される。研修参加者はこれら研

修が妥当かつ有益であったと評価しており、ほとんどの参加者がプロジェクト活動を実施するだけでなく、各々の業務遂行に際しても研修で習得した知識や技能を活用しているとの報告があった。本邦での GIS 研修期間中に研修参加者によって作成されたカリキュラムに基づき、ガーナ国内でプロジェクト関係者を対象にした GIS 研修が能力開発プログラムの準備的な活動として既に実施されている。

現在、UDS からの研修参加者が大学構内の施設やソフトウェアがないため、研修後に習得した GIS 技術を実践することができないという報告があったが、プロジェクト後半期間で UDS においても GIS 関連の能力強化プログラムを開始する予定であることが確認された。

（4）ガーナ側投入

すべての C/P 機関から C/P 職員が配置され活動に参加している。しかし、活動経費の予算（C/P ファンド）が確保されていないため、C/P 職員の関与は若干限定的と言わざるを得ない。ガーナ側は予算確保の努力を開始したところであるが、いまだ実現に至っていない。

プロジェクトの執務スペースとその付帯設備が提供され、円滑なプロジェクト活動運営に貢献している。G-Met の 3 つの観測所内に AWS 設置用の土地が提供され、機材は機能しているが、一部適切な安全対策（フェンス設置など）が取られていない。今後更に追加の AWS を設置する際にも対策を考慮に入れる必要がある。

（5）在来知の活用

プロジェクトは、現地固有の伝統的な知識や既存の現地関連調査の結果や文書情報を活用している。本プロジェクトの調査結果は、白紙からではなく既存の在来知のうえに構築されており効率性は高い。

4－1－4　インパクト

本中間レビューの時点で、5 年間のプロジェクトのインパクトを述べることは時期尚早かつ困難ではあるが、プロジェクトが期待するインパクトは概して正のインパクトが予想される。暫定的な見込みは以下のとおり。

（1）政策面

本プロジェクトの目標は、気候変動に対する国家的レジリエンス強化やリスク軽減を目指すガーナ国家政策と一致していることから、ガーナ北部地域の気候・生態系変動に対する統合的レジリエンス強化戦略が、環境科学技術省（Ministry of Environment, Science and Technology：MEST）や食糧農業省（Ministry of Food and Agriculture：MOFA）、水資源委員会（Water Resource Committee：WRC）など、JCC にオブザーバーとして参加している関係省庁機関や他ドナーに活用されれば、他地域や国家レベルで気候変動適応計画の一部として、今後活用される可能性は非常に高いといえる。また、プロジェクトは、研究成果を発表するため国際会議を主催するなど積極的に対外活動を進めていることから、サブ・サハラアフリカ地域において「ガーナモデル」が国際的に活用される可能性も高いと考えられる。

（２）技術面

これまでのところ、ワークショップやプロジェクト会議、現地活動、本邦研修や国際会議での発表など様々な活動を通じて、ガーナ側 C/P に対する技術移転は適切に行われてきている。今後、期待されるインパクトの兆しもいくつか確認されている。例えば、衛星降水データを利用した技術研修や WRF に関する実践的な C/P 研修は高い評価を受け、G-Met ではプロジェクトとは別に同様の研修を若手職員に提供することが計画されている。GIS 技術の知識や運用スキルに関しても、C/P 研修で作成されたカリキュラムを改定し、UNU-INRA で研修プログラムに活用されており、UG や UDS でも必要な資源が入手できれば同様な活動をすることが可能である。また、プロジェクトで開発されたモデルの一つ一つが当該分野に技術的なインパクトを与える可能性が高い。

（３）社会・文化面

調査活動の対象村落では、一連の調査を通じて衛生的な水利用、小規模灌漑や単作栽培などに関する意識の変化や対策を実施したというインタビュー結果を得られた。また、プロジェクトでは、女性によるもっとも重要な経済活動であるシアバター加工のバリュー・チェーン調査を開始しており、シアバター加工に関するビジネスモデルの開発が気候変動に対する女性のレジリエンスを強化する可能性もあり、プロジェクトによる正のインパクトが見込まれる。

４－１－５　持続性

以下の理由により、本プロジェクトの持続性の見込みは高～中程度である。

（１）政策および制度面での持続性の見込み

本プロジェクトは、ガーナ政府の国家計画および NCCPF や NCCAS など気候変動政策と合致している。ガーナ政府は国家気候変動政策を 2013 年に策定したが、これまでの主要な気候変動政策から大きな変更はない。これらの政策の観点から、気候変動適応策の重要性の認識が継続する可能性は高い。UG や UDS は科学に基づいた研究成果を社会に還元する、ガーナ国内でも先導的な教育機関である。プロジェクトの活動は、C/P 機関の責務に沿って実施されており、制度的な持続性の見込みは高いと判断できる。

一方で、中間レビュー評価の時点で、JCC のオブザーバーである関係機関の関与や、プロジェクトが提案する統合アプローチを適用するコミットメントが弱いと思われることから、政策的な持続性を維持するためには強化する必要がある。

（２）組織および財政面での持続性

C/P 機関の財政状況にかんがみると、政府からの資金配賦は限定されており、UG や UDS の場合、現場での調査活動や現地コミュニティに対する能力開発プログラムを実施するための資金にも制約がある。G-Met も同様に人員、財源不足が恒常的な課題となっている。したがって、C/P 機関の財政面での持続性は十分に確保されておらず、前述したとおり、本プロジェクトで開発された統合的戦略（「ガーナ・モデル」）が国家的な活動計画などに組み込まれる必要がある。

（3）技術面での持続性の見込み

各実施機関は気候変動の予測・影響評価やレジリエンス強化は既存の研究開発活動として取り組んでおり、プロジェクト終了後も本プロジェクトの研究成果や研究方法などは持続的に利用される可能性は高い。また、本プロジェクトは気候変動分野における研究者やコミュニティの現場での社会実装を実現する潜在的な人的資源として、様々な手段を通じてガーナ人若手研究者の育成を図っており、技術の活用性も高い。技術面の持続性に関しては、プロジェクトで供与した機材の中には仕様が精密なものもあり、深刻な故障が発生した場合、修理やスペアパーツの調達に必要なガーナ側コストの負担について十分に検討する必要がある。

第5章　提　言

（1）関係省庁のプロジェクトへの関与

プロジェクトによる研究成果が国内外に普及され、持続的に活用されていくためには、まず各実施機関のライン省庁（例えば、教育省）内において、それら研究成果の内容や活用方法について、さらに関心や意識を高める必要がある。JCC を通じた情報発信だけでなくメールやメーリングシステムなど簡便な手段で研究活動の進捗を周知させるなど工夫することが望ましい。

（2）供与資機材の活用

本プロジェクトで技術移転されている地理情報科学技術へのニーズは非常に高く、プロジェクトの供与資機材を利用して、UNU-INRA や UG によって GIS 研修コースが実施されている。一方で、同様にプロジェクトによって供与された AWS のうち 1 台に関しては適切な安全対策（フェンス設置など）が取られていない。したがって、今後更に供与予定の AWS も含めて速やかに対策をとる必要がある。

（3）レジリエンス強化戦略の構築に向けて

研究テーマ 1(成果 1)および研究テーマ 2(成果 2)は複数の気候変動シナリオを、研究テーマ 3（成果 3）は現地コミュニティのレジリエンスを強化する対策を提示し、これらの対策は生態学的、工学的、社会経済学的な 3 つのアプローチに基づいた戦略として確立される予定である。プロジェクトでは研究結果を活用したレジリエンス強化オプション（対策）の議論を始めたところであるが、レジリエンス強化戦略をより強固なものにするため、これら 3 つのアプローチに考慮した戦略を今後探究し続ける必要がある。

（4）プロジェクト全関係者によるチームビルディング

各研究（成果）を統合するためには、研究グループ間の全体的な調整を強化し、関係省庁に研究結果やプロジェクトの進捗について情報の共有・普及を行うことで、プロジェクトにかかわる全関係者間のチームビルディングを図る必要がある。

（5）プロジェクト外部関係者との調整

プロジェクトの研究活動にとって、プロジェクト外部の関係者が所有する追加データが必要な場合は、プロジェクトのために関係省庁が調整・便宜を図ることでデータを入手することを強く期待する。

第６章　SATREPS の特徴にかかるレビュー

「２－１」で述べたとおり、SATREPS は通常の技術協力プロジェクトとは異なる特徴をもっている。本中間レビューを通じて、他の SATREPS 案件にも共通した事象であるかは、検証が必要であるが、今後の SATREPS 案件の調査および案件の実施の参考となるよう、本章では本中間レビュー調査の実施を通じて得られた知見を取りまとめることとする。

６－１　SATREPS の特徴

本プロジェクトでは、SATREPS の特徴として、活動、アウトプット、プロジェクト目標、活動 / アウトプット / プロジェクト目標の関係という枠組み以外にも、プロジェクトの成果の活用方法についても通常の技術協力プロジェクトとは異なる点がみられた。通常の技術協力プロジェクトでは、プロジェクトによって能力開発がなされ、習得した知識・技能が業務に適用・活用され、当該業務に変化（改善）が起こることによって問題の解決を目指す。プロジェクトの成果は問題解決に活用され貢献することを前提としている。SATREPS も課題解決型研究開発を中心としており、科学的な根拠に基づいた研究開発の結果が社会で実際に使えることを具体的に確認する「社会実装」までを目標としている。

一方で、SATREPS は、地球規模課題解決に資する国際共同研究の成果、科学技術水準の向上、科学技術政策への貢献なども期待されることから、目的志向の研究開発を通して基礎研究の未開拓部分を明らかにするという方向性も併せ持つ。この場合、研究開発アプローチ（手法）の確立や研究開発成果の達成そのものもプロジェクトの成果でもあり、これらの研究成果の活用方法は、通常の技術協力プロジェクトの考え方に加え、研究開発アプローチ（手法）や研究開発成果が相手国側の科学技術水準の向上のために活用されることも考えられる。本プロジェクトの場合、開発された様々なモデルや開発プログラムは、C/P である UG において今後開発される予定の「持続可能な開発」などの修士レベルの教育プログラムに活用が検討されているほか、UDS でも新たな教育プログラムの開発の検討がなされており、UNU-INRA の GIS 研究教育センターでもプロジェクトの成果を活用した継続的な研修プログラムの実施が見込まれている。

６－２　SATREPS の実施および評価にかかる提言

「２－１」および「６－１」の分析を踏まえると、本中間レビュー調査の経験から以下の提言が導き出せる。

（１）SATREPS 用評価枠組みの必要性

「２－１」で述べたとおり、SATREPS 案件の中間レビュー調査では、『「新 JICA 事業評価ガイドライン第１版」の基本的考え方を踏まえる』こととしているが、当該ガイドラインが採用している評価ツールは基本的にログフレームであり、プロジェクトを投入から活動、アウトプット、プロジェクト目標へとつながる直線的な因果関係としてとらえている。このような考え方に基づく評価枠組みは、仮説検証の過程を経て最適解を特定していく科学技術的発想とは異なる部分があることから、SATREPS の特徴を踏まえた評価枠組みの構築を検討することが望ましい。特に、中間レビューにおける実績の検証は、アウトプット及びプロジェクト目標の達成度合い（達成見込み）という視点ではなく、①研究項目ごとの進捗・成

果産出状況、および②全体の研究体系に照らし合わせた成果産出状況という視点で行うのがより望ましいと思われる。

（2）評価5項目

5項目評価のうち、プロジェクト活動終了後の「持続性」については、本プロジェクトの場合は最終的には政府の政策決定プロセスに資する研究成果の創出であり、従来JICAで行っている農業系の技術協力プロジェクトにみられるような、農民への技術の普及、能力向上というステップは想定されておらず、研究開発の結果が社会で実際に使えることを具体的に確認する「社会実装」の範疇にとどまる。このため、持続性という観点で必要なことは、プロジェクトの研究開発活動や研究成果の活用が継続され、更に成果を出すかということであり、そのために必要な人材、機材、研究開発費などの視点で検討することが有効であると思われる。

第7章　所　感

７－１　科学技術計画・評価　所感

（SATREPS 環境・エネルギー分野 JST 研究主幹　安岡善文）

一部データの入手等に遅れが生じているが、ほぼ当初の予定通りに進捗していることを確認した。

（１）進捗状況について

3 つの研究テーマは、個別にはほぼ予定通りの進捗状況である。それぞれ学術誌への投稿および国際会議での発表を行っている。特に、プロジェクトとして、英文学術誌『Journal of Disaster Research』に特集号を組むとともに、2014 年 8 月にはアクラにおいて国際シンポジウムを開催している。

（２）現時点での進捗に関する問題点

１）研究テーマの連携

個別の研究テーマについては、モデル開発、ハザードマップ開発、観測システム構築、および現地コミュニティとの連携関係構築等において精力的な活動がなされ、成果も順調に上がっている。個別課題については、論文等の成果発表もなされており、また国際シンポジウムの開催等を行うなど成果が上がっていると評価できる。

一方で、個別の成果が最終的にどうゴールにつながるのか、その姿は必ずしも明確になってはいない。具体的には、研究テーマ 1 からの気候モデル（ダウンスケーリングも含む）による将来予測やハザードマップ等の出力、また研究テーマ 2 からの地域レベルでの水文情報や洪水・旱魃情報が、どのように研究テーマ 3 に渡され、地域コミュニティにおける適応策等に活用されるのか、その道筋は明らかになっていないように感じた。

最終的な社会実装に向けて、これらの連携をどう確立し、プロジェクト終了後もその連携が持続するように設計することが必要である。

２）現地観測データによるモデル予測等の検証

現時点では、必ずしも現地での水文データ、気象・気候データのデータセットが十分に整備されておらず、また今後どう整備するかの道筋が明確になっていない。

前述のように、個別モデル等の開発はほぼ順調に進捗しているものの、現場データを用いたモデル出力やハザードマップの検証は、その信頼性を評価するうえで必須であり、現地コミュニティの信頼を得て連携を確固たるものにするためにも不可欠である。

AWS 等のシステムの導入により新たなデータの収集については目処が立っているものの、水文や気象・気候に関する過去の観測データの活用も不可欠であり、その収集、整備への道筋を早急に詰めることが必要であろう。

（３）プロジェクト運営について

武内リーダーの指導力は全課題において浸透しており、運営には大きな問題がない。特に、日本側研究者が研究テーマ間でミーティングをもち、まとまっているという印象が強い。また、それぞれの研究テーマごとに日本人研究者とガーナ側研究者の連携もよく取れて

いると感じた。一方で、ガーナ側における研究テーマ間の連携については必ずしも十分に機能していないのでは、との印象も受けた。

課題終了後にプロジェクトを持続的に継続するためには、ガーナ側のステークホルダー、特に UG、UDS、G-Met の連携は不可欠であり、現時点からの連携強化策の検討が必要と感じた。

（4）今後の課題

前掲（2）にも示したとおり、

① 研究テーマ間の連携強化と最終ゴールに向けた道筋の明確化（メンバーによる意識の共有も含め）
② 現地の観測データに基づくモデル予測やハザードマップの検証
③ ガーナ側ステークホルダー間の連携強化

が必要である。加えて、

④ 水文データを衛星データ等で置き換えるなどの変更を行った場合の研究方針の具体化（衛星データの検証や今後の衛星データ収集の持続性確保など）
⑤ 今後の 2 年間の最終ゴールに向けたロードマップの作成

が必要であろう。

７－２　団長所感

（JICA 農村開発部農業・農村開発第二グループ第五チーム課長　栗栖昌紀）

私のガーナへの渡航歴は 92 年、99 年、02 年と今回で 4 回となる。約 20 年を通してみるとアクラ、クマシの大都市部は大きく発展し、その他の地方都市も同様である。特に、現大統領が力を入れている北部州はドナーからの支援も集中し援助バブルの様相を呈している。この状況は援助に対する過度な期待に留意すべきものの、北部での活動を含んでいる本プロジェクトとしては積極的なコミュニティからの参加が期待でき、レジリエンス強化のモデル化とその実現のためには条件は良い。SATREPS 共通の課題である社会実装に関しては研究成果として構築されたモデルを実務者の目から検証するプロセスであり、これまでも地方の農業局などと連携してきているが、より一層彼らの巻き込みが課題である。

プロジェクト外のことであるが 01 年に引退したローリング政権以降それまで開発資金が多く投入されていたボルタ州は不遇の状況が続いており交通インフラは 20 年前よりもひどい状況にあった。政治や政策でこれほど変わるものかと驚かされた。更には 20 年前と比べて人々が政治の話をしなくなっている。プロジェクト専門家でガーナ人であるエファ氏によれば「国民は政府に対する期待よりも自分たちのビジネスが重要だと思う人が増えている」とのこと。実際「地方分権化」や「行政のスリム化」が図られており、政府機能を限定し民間を活用することを進めている。我々の援助もこのような潮流に沿って検討する必要があると感じた。

付　属　資　料

１．合同評価レポート

２．質問票

３．協議議事録

Joint Mid-term Review Report
for
the Project on Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach in the Republic of Ghana

September 29, 2014

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Abbreviations

AAP	Africa Adaptation Program
GHS	Ghana Cedi
GIS	Geographical Information System
GMet	Ghana Meteorological Agency
GOG	Government of Ghana
GOJ	Government of Japan
JCC	Joint Coordination Committee
JPY	Japanese Yen
MOFA	Ministry of Food and Agriculture
MOF	Ministry of Finance
NADMO	National Disaster Management Organization
NCCAS	National Climate Change Adaptation Strategy
NCCC	National Climate Change Committee
NCCP	National Climate Change Policy
NCCPF	National Climate Change Policy Framework
R/D	Record of Discussion
UDS	University for Development Studies
UG	University of Ghana
UNDP	United Nations Development Plan
UNU-INRA	United Nations University-Institute of Natural Resources in Africa
USD	United States Dollar

1. Introduction

1-1 Background of the Review

On the basis of the request from the Government of Ghana, Japan International Cooperation Agency (JICA) launched the five-year technical cooperation project (SATREPS: Science and Technology Research Partnership for Sustainable Development) entitled “Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach in the Republic of Ghana,” (herein after referred to as “the Project”) on May 2012, under the implementation structure consisting of University of Ghana (UG), Ghana Meteorological Agency (G-Met), University for Development Studies (UDS) and the United Nations University-Institute for Natural Resources in Africa (UNU-INRA) as counterpart research institutes from Ghanaian side, and University of Tokyo, University of Kyoto, and United Nation University - Institute for the Advanced Study of Sustainability (UNU-IAS) as research institutes from Japanese side.

As two and half years have passed since the commencement of the Project, JICA has conducted the Mid-term Review to confirm challenges and direction of the Project for the betterment of the project activities in the remaining project period.

1-2 Objectives of the Review

The objectives of the Mid-Term Review are outlined as follows:

(1) To review and confirm the progress and achievements of the Project based on the Project Design Matrix (PDM)
(2) To identify the promoting and inhabiting factors, if any, for project implementation
(3) To analyze and evaluate the Project in terms of the five evaluation criteria, namely relevance, effectiveness, efficiency, impact and sustainability
(4) To recommend necessary measures to be taken during the latter half of the Project for further improvement of the Project

1-3 Member of the Review Team

The Joint Mid-term Review Team (hereinafter referred to as “the Team”) was organized with the following members from both the Japanese and Ghanaian sides.

(1) Japanese Evaluation Team

Job Title	Name / Position
Team Leader	Mr. KURISU, Masanori Director, Aid and Semi-Arid Farming Area Division 2, Rural Development Department, Japan International Cooperation Agency (JICA)
Evaluation	Ms. NAKAMURA Misuko Consultant, Kokusai Kogyo Co., Ltd.
Science and Technology Planning/Evaluation	Dr. YASUOKA, Yoshifumi Prof. Emeritus, The University of Tokyo Program Officer, Japan Science and Technology Agency (JST)
Science and Technology Planning/Evaluation	Ms. TAKAHASHI, Miho Assistant Program Officer, Dept. of International Affairs, Research Partnership for Sustainable Development Group, JST

(2) Ghanaian Evaluation Team

Job Title	Name / Position
Team Leader	Mr. Francis Mensah, Economics Officer, (Japan/ Korea/China - Schedule Officer), Ministry of Finance
Member	Mr. Bernard Ayensu, Policy, Planning and Monitoring and Evaluation Officer, Ministry of Education
Member	Mr. Kingsley Kwako Amoako, Envt. Land and Water Management Unit, Directorate of Crop Services, Ministry of Food & Agriculture
Member	Mr. Mahama A. Nuhu, Deputy Director, Research, Statistics and Information Management, Ministry of Communications

1-4 Schedule of the Review

The schedule is attached as Annex 1.

1-5 Methodology of the Review

1-5-1 Design of the Review

The Team formulated The Evaluation Grid which identified the specific review points and the data collection methods as shown in Annex 5

1-5-2 Data collection Methods

For the data and information collection, the Team applied various methods such as analysis on reports, interviews with counterparts researchers (hereinafter referred to as the "C/P"), JICA experts (researchers), administrative officers, community leaders and members in the Project's targeted communities, based on the questionnaire, group discussions and the observation of the project site and the provided equipment in use. The details of interviewees is attached as Annex 2

1-5-3 Points for the Review and Analysis

(1) Achievements and Implementation Process of the Project

Achievement of the Project was reviewed in terms of Inputs, Activities, Outputs, and Project Purpose based on materials showing the framework of the Project such as the Record of Discussion (R/D), PDM, and Plan of Operations (PO). Implementation of the Project was examined to see if the activities had been implemented according to the schedule described in the PO, to see if the Project had been managed properly, and to identify promoting and inhabiting factors that had affected the implementation process.

(2) Five Evaluation Criteria

In addition to the review of the achievement and implementation process, the Team reviewed the Project from the viewpoints of the following Five Evaluation Criteria.

Table1-1: Definitions of Five Evaluation Criteria

Five Criteria	Definitions by "the JICA Evaluation Guideline"
Relevance	Relevance refers to the validity of the Project Purpose and the Overall Goal in connection with the development policy of the government of Ghana and assistance policy of Japan.
Effectiveness	Effectiveness refers to the extent to which the expected benefit(s) was (were) brought about as a result of the Project.
Efficiency	Efficiency refers to the productivity of the implementation process. It examines

	whether the inputs of the Project have been efficiently converted into the outputs.
Impact	Impact refers to direct and indirect, positive and negative impacts caused by the implementation of the Project, including the extent to which the Overall Goal has been attained.
Sustainability	Sustainability refers to the extent to which the Project can be further developed by the Ghanaian authorities concerned and the extent to which the benefits generated by the Project can be sustained under the national policies, technology, systems and financial state.

2. Outline of the Project

The outline of the Project is as shown in the following table. Details of the Project are as shown in PDM (Annex 3) and PO (as of 5 August 2013, Annex 4).

Table 2-1: Outline of the Project

Project Title		Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach in the Republic of Ghana
Cooperation Period		5 years (2012 - 2017)
Target Group		Counterpart researchers, local engineers, local residents in Northern Ghana, Ghanaian administrative officers and policy makers
Target Area		Northern Ghana (The Three (3) Northern Regions of Ghana) (Northern Region, Upper East Region, Upper West Region)
Overall Goal		The Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be incorporated in international environmental policies.
Project Purposes		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.
Outputs	**Output 1**	Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed
	Output 2	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
	Output 3	Institutional and engineering capacity development programs for local communities and engineers are developed and implemented

(Source: PDM of the Project)

3. Achievements and Implementation Processes of the Project

3-1 Inputs

The Team has confirmed that the Project has provided the following inputs along with the plan stated in PDM and PO, i.e. in Annex 3 and 4.

3-1-1. Inputs from the Japanese side

(1) Assignment of Japanese Experts

A cumulative total of 36 Short-term Experts (Researchers) in the 12 fields of expertise such as Chief Adviser, GIS Analysis, Meteorology, Flood Management, Disaster Risk Management, Resilience Evaluation, Resilience Strategy, Agronomy and so forth, have been dispatched to the Project from May 2012 until August 2014. The total duration of their assignments by the end of August 2014 is approximately 29.50 man/months, the details of which are shown in Annex 6. In addition, 2 Project Coordinators have been dispatched. The total duration of their assignments by the end of August 2014 is approximately 29 man/months.

(2) Training of C/P in Japan

A cumulative total of 9 C/Ps participated in the training in Japan. The details of training are shown in Annex 7. 1 C/P from UDS is currently studying at PhD course of UNU-IAS as a long-term trainee of the Project.

(3) Provision of Equipment

Machinery and equipment of approximately total value equivalent to 21.3 million JPY (777,590 GHS) have been provided for the Project activities. (Exchange rate GHS 1.0 = JPY 27.4 as of September 2014). The list of these machinery and equipment are shown in Annex 8.

(4) Local Operation Cost

A total amount of 807,765.85 GHS (approximately 22 million JPY with exchange rate GHS 1.0 = JPY 27.4 as of September 2014) has been provided for the necessary expenses to carry out project activities as of the end of August 2014. The details are as shown in Table 3-1. The cost includes computers, UPS and refurbishment of office space for the Project office, travel cost and fuel for field survey, field allowances, GIS training, workshops and various activities such as JCC, international conference and so forth.

Table 3-1: Local Expenses borne by the Japanese Side (GHS)

Fiscal Year (*1)	2012	2013	2014	Total
Total Local Expenses	252,79.82	314,996.21	239,972.82 (*2)	807,766.85

Note *1: Japanese Fiscal Year (April – March). Note *2: Figures are based on the accounts settled by the end of August 2014.
Source: Documents prepared by the Project

3-1-2. Inputs from the Ghanaian side

(1) Assignment of Counterparts

A cumulative total of 42 counterpart personnel assigned to the Project: 12 from UG, 11 from G-Met, 14 from UDS, and 5 from UNU-INRA at the time of the Review. The details are shown in Annex 9.

(2) Provision of Land and Facilities

The necessary project office spaces for the Project members have been provided by UG, G-Met, UNU-INRA, and UDS (Nyankpala and Wa campuses). Installation places for the provide equipment as well as land for Automatic Weather Station (AWS) in Yendi, Bole, and Salaga, have been also provided. GIS Resource Center has been established by UNU-INRA, and image processing software, GPS, and electronic meeting system were provided by the Project to support the Resource Center.

(3) Project Operational Cost (Counterpart Fund)

Travel and daily allowance for Ghanaian C/Ps have been expected to be borne by counterpart funds of the implementing agencies (i.e. UG, G-Met and UDS), which are supposed to be allocated by the Government of Ghana. Ghanaian side has started to make an effort to secure the budget, but it has not been realized yet.

3-2 Achievement of the Outputs

The Team reviewed the achievement of the Output including inputs and output indicators to measure the achievement of the Project purpose as well as the implementation processes of the Project, the results of which are described in the following.

The Project has implemented most of its activities as per the plan stipulated in the PDM and PO with some slight changes of PO regarding Output2. It has been confirmed that the Project has implemented its activities, without notable delays and could manage to cope up with any unprecedented difficulties encountered in the process. As a whole, it is expected by both the Japanese and Ghanaian sides that 50 % or more Outputs will be achieved by the end of March 2015. The Team examined the activities and achievement of the outputs so far as follows.

Output 1 Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed

Activities and Achievements:

In order to build a regional climate change prediction model and use the model to make predictions, the method of dynamic downscaling of selected past wet/dry years in the Ghana region was used to understand mechanisms of local weather and climate. As a result, although it must be remembered that the results are not foolproof, the actual rainfall situation in Ghana has been ascertained. Especially it was indicated that the possibility of local rainfall resulting from interaction between local atmospheric circulation in the peripheral of Lake Volta, the center of Ghana, and the African monsoon.

In parallel to the modeling of climate change, for assessment of the impact of climate change on agricultural production on eco-systems, the Total Factor Productivity (TPF), which is an attempt to measure productivity taking into account all factors of production and linking them to an aggregate production function, has been estimated, and it was expected from the result that without taking any measures, the trend of stagnation of agricultural productivity in Ghana will continue. In addition to the above analysis from macro and semi-micro points of view, detailed household surveys were conducted on a total 150 households of 6 target communities in Tolon District, and 81 households in Wa District in order to understand the real agroeconomic situation and measures to adopt climate change. The results of the survey are in the process of analysis. Based on these research activities, it is concluded that it is important to clarify the impact of climate change on agricultural productivity and formulate strategies such as improvement of agricultural production methods and selection of appropriate varieties of crops.

Furthermore, the Project also conducted the surveys on regional land utilization in the ecoregions of Ghana, soil distribution and farm management in the target communities by a combination of satellite data and field based research. As a result, in Northern Ghana, land and forest near water sources such as wet lands have been converted to agricultural land, and further analysis on detailed relationship between agricultural productivity and land utilization change, and climate change impacts are expected.

As mentioned later in Output 3, the Project developed integrated ecological, engineering (physical and material) and socioeconomic resilience indicators to develop with an index (methodology) to quantify the resilience status of communities in flood prone semi-arid region of Africa. The team has also provided community boundary maps and asset maps and an extensive database to other thematic groups

Based on the above research activities, five (5) research papers have been published so far, and several papers have been prepared, as shown in Annex 10.

Output 2: 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

Activities and Achievements:

In order to construct the satellite remote sensing and ground-based observation network, the Project has installed two (2) data servers at G-Met and UDS, and initiated its operation at G-Met after the C/P training in Japan on how to use data servers. The Project has also installed three (3) Automatic Weather Stations in Yendi, Bore, and Salaga, all of which are located in the target area, which are connected to G-met Headquarter. Then, the Project compared the satellite data (GSMap) and ground-based rain gauge observation data and clarified the correlation between the above data. Based on the correlation, a function to calibrate the semi-real time satellite data to ground-based rain gauge data has been added to the data server.

As for precipitation, the Project has initiated a study to establish extreme weather precipitation techniques using Weather Research and Forecasting (WRF), and after the experimental operation, transferred the techniques to C/Ps through the C/P training using the same data server installed in Ghana. After the training, the C/P were able to install the software by themselves.

The Project has also developed a run-off/inundation model and the model is in the process of being adjusted using data from flooding in 2007 in Ghana. Due to difficulties to collect hydrological data (i.e. flow and water level data) for verification, the Project also has initiated development of a tool to detect flooding areas. The study on scenario of runoff/inundation is to be initiated after the completion of the above models. For the development of a drought scenario, the Project has initiated to collect field data for verifying satellite data by providing soil moisture sensors.

As a result of analysis of social and environmental data in the target communities, which is necessary for risk assessment of extreme weather risk in the sub-catchment of the Volta River, the Project found that the communities perceived droughts as more serious disaster than floods. Thus, the study on prototypes (pilot initiatives) for the management of water resources has been initiated a year earlier than scheduled. And also, in order to enhance the study for mitigating the impact of droughts, field experiments for drought monitoring and development of cropping methods resilient to droughts have been initiated by initiative of the researchers from UDS. The Project has compiled the following findings so far as a result of surveys assessing vulnerability to floods and droughts, current water resources management, and locally appropriate water resources management methods:

- Drinking water risk (lack) is the most significant and observable problem in the area.
- Communities own initiatives for climate change adaptation are negligible, because livelihood risks are predominant among all communities. Absolute poverty and lack of economic opportunities have increased the susceptibility of communities to disaster risks.
- As their livelihoods are affected by droughts in upland areas, subsequently the local community becomes more exposed to floods and other natural calamities in order to maintain their livelihoods.
- Improving irrigation facilities through rainwater harvesting and watershed management and seasonal weather forecasting are found to be most preferred adaptation strategies.
- Though high intention of adopting non-structural preventive measures is observed, local communities reported that lack of knowledge and financial resources are major impediments to their implementation

Based on the above research activities, five (5) research papers have been published so far, as shown in Annex 10.

Output 3: Institutional and engineering capacity development programs for local communities and engineers are developed and implemented

Activities and Achievements:

As a part of efforts to select the target site of the Project, the Project prepared a background conceptual paper to define the resilience in the context of the Project. (referred to Output 1), which is currently in the process of publishing. As a method of community site selection, the Project has developed three level of "Resilience", i.e. ecological, engineering, and socio-economic, and three levels of "Vulnerability", i.e. physical/material, social organizational/institutional, and motivational/ attitudinal, to assess potential project sites in the target districts, and established a conceptual framework for studying site selection.

Researchers from both the Japanese and Ghanaian sides jointly visited communities in the selected district to work on site selection, and preliminary filed surveys were also conducted. All research group members from Output 1 to 3 participated in discussion of this site selection and a task force team was established consisting of key members from all research groups to conduct assessment and propose the potential site to the Project. Finally, the Project selected 10 target communities in total as listed in Table 3-2.

Table 3-2: Summary of Community Site-Selection

Region	Selected District	Type of extreme events	Name of communities	
			Less Resilient	More Resilient
Northern Region	Tolon	Drought-prone	Cheshegu, Gabogshie, Zagua	Fihini, Yoggu, Kpaligum
Upper West Region	Wa West	Flood–prone (Overflow from Black Volta)	Bamkpama, Zewayeli	Chietanga, Baleuhili

Source: Documents provided by the Project

The field survey on all 36 households at Fihini in Tolon district was conducted to understand the outline of the community and later a detailed farm field survey was conducted on 17 selected households to understand farming activities. In relation to the farming activities, and to find out the promoting drivers to develop the capacity of farm households, local administrative officers and engineers, a field survey on governance system and a socioeconomic household survey was conducted in both the target districts, i.e. Tolon and Wa West. Also, the cropping situation of the main crop of produced by women such as groundnuts and o-kra, and the effects on their households and a study on value chain of shea butter production, the growing of which is one of the most significant economic activities by women in Northern Ghana, is on-going.

Based on the above activities, various survival strategies in the event of extreme climate change by farm households and perceptions of climate change effects have been found as critical findings to formulate and propose capacity development programs to enable the farmers to adapt their farming activities and to enable local administrative officers and engineers to come up with appropriate adaptation strategies. At the time of the Mid-term Review, it was found that eleven (11) research papers on this Output (theme) had already been published as shown in Annex 10.

3-3 Prospects of Achievements of the Project Purpose

Project Purpose: 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.

On the whole, the Project activities have been implemented on schedule and relevant data have been acquired and analyzed by the three thematic research teams to generate critical findings. The outcome of the research activities of the Project so far have been published as a Special Issue of the Journal of Disaster Research Vol.9 No.4 in August, 2014, and the Project held an International Conference to present research findings, as well as community workshops in the target communities to verify the fact and to discuss with local communities.

Therefore, at the middle-point of the Project cooperation period, it is considered that basis for achieving the Project Purpose has been established. It is thus generally assumed that the Project will utilize the findings of all three research groups (Outputs), propose the options enhancing resilience to climate and ecosystem change based on the vulnerability assessment developed as a methodology by the Project, formulate capacity development programs in terms of institutional and engineering solutions for natural resource management, and eventually establish integrated approach to enhancing resilience of target groups to overcome their vulnerability, i.e. the Ghana Model by the end of the cooperation period.

3-4 Implementation Processes of the Project

(1) Decision making and monitoring mechanism

The Joint Coordinating Committee (JCC), which is the decision-making body of the Project, was held 2 times to confirm the progress of the Project activities, to approve the activity plans for the upcoming period, and to discuss other issues related to the Project implementation. Along with the JCC, project researchers' meetings, field trips, researchers' workshops and other joint activities were conducted to share the research methods, contents and progress of each research groups. In addition, the project operation meetings were held several times via remote telephone conference, and sometime in Ghana and in Japan, as a platform to coordinate project activities including conducting field surveys, preparation of training program in Japan, division of roles and responsibilities of various tasks and so forth, and to discuss operational issues related to the project implementation. The core counterparts, who participated to JCC, share with the Team, during interviews, that decision making and monitoring mechanism of JCC is functioning very well. However, it was reported from the leaders of Ghanaian C/P institutions that the frequency of opportunities to share findings of the activities, exchange ideas, and control the direction of upcoming activities on time among all the Project teams and stakeholders is not sufficient, although the Project has been making efforts to do that through researchers' meeting or workshops before or after the JCC as mentioned above. The team also shared the view with them that scarce involvement of some stakeholders in JCC, and more frequent opportunities to interact with the stakeholders would encourage more commitments in future..

(2) Coordination and communication among the Project personnel of the Project

At the initial stage, a task force team for the site selection of the Project, which consisted of representative members from each C/P institutions of both the Japanese and the Ghanaian sides, were established, and the team successfully contributed to set the criteria and conduct field survey and data collection in a collaborative manner of all the Project personnel. As for the Project activities of each theme group so far conducted, which were mostly focused on data collection and analysis for each thematic topics, the Team confirmed that there were no notable problem in communicating within the group including Japanese experts.

The Team shared the views with some C/Ps, during interviews, that research planning has been somewhat made by the Japanese side and the process has not been fully shared with the Ghanaian side, which caused difficulties for C/Ps to contribute to further improvement of field activities and initiate their own research activities related to the Project.

(3) Other hampering factors

The Team found that the Project members faced difficulties related to operational expenditure for the Project activities. It was pointed out that the amount of annual budget allocated to the Project had not been shared and internal rules and procedures for the CP to access the Project budget had not been clear. This is because the Ghanaian side was new to JICA's budgetary system, which is totally different from usual practice of other research fund.

Although it hampered the motivation of some C/Ps for active participation in the research activities of Project, the situation is beginning to change as the Project coordinator is now trying to organize and disclose the internal rules of operational expenditure in the Project officially, and also, it is planned to share the annual budget plan of the Project according to Japanese fiscal year with Ghanaian side in the latter half of project cooperation.

4. Results of the Evaluation based on the Five Criteria

The relevance, effectiveness, efficiency, impact and sustainability of the Project were assessed, the major findings of which are described in the section below.

4-1 Relevance

The relevance of the Project is evaluated as **High** based on the following confirmations:

(1) Relevance to the development policies and sector programs of GoG

The Government of Ghana (GoG) formulated Ghana National Climate Change Policy (NCCP) in 2013, which emphasize the importance of enhancement on national resilience to disaster and active and effective risk reduction. There has not been any notable change in the major thrust of climate change policy from the previous policies, i.e. Ghana National Climate Change Policy Framework (NCCPF) and National Climate Change Adaptation Strategy (NCCAS), which are still relevant to the scope of the Project. The Project is thus considered to be very much consistent with these policy directions of GoG.

(2) Consistency with the ODA policies of GoJ

In the Country Assistance Policy for the Republic of Ghana of Government of Japan (GoJ) formulated in April 2012, agricultural development is set as one of its four priority areas. The Project is regarded under the above prioritized area. Also, Ghana was a target country for Africa Adaptation Programme (AAP) which has been implemented from 2008 to 2012, under the Japan-UNDP Joint Framework for Partnering to Address Climate Change in Africa to support African countries' efforts at addressing and adapting to climate change at national, sub-national and community levels. Based on policies adopted by the GoJ, JICA has actively extended support to mitigation, adaptation, and mechanism to accelerate mitigation and adaptation in developing countries, according to the following principle: 1) climate compatible sustainable development, 2) comprehensive assistance using an array of schemes, and 3) collaboration with development and climate partners. From these viewpoints, it is assessed that the relevance of the Project to the Japanese aid policies is secured.

(3) Relevance to the needs of target beneficiaries

Northern semi-arid area of Ghana constantly suffers from natural disasters (i.e. flood and drought) and is particulary vunerable since agriculture is the key industry in the area, which is sensitive to negative effect of climate change. The needs for capacity building of researchers which would enable the building of climate change measures in agriculture, water resource, and disaster management field in the area still remains high.

4-2 Effectiveness

The effectiveness of the Project is assessed as **High – Moderate** though the following observation:

(1) Achievement of the Project purpose

On the whole, the Project activities have been implemented as scheduled although some activities were delayed due to the delay of procurement of equipment and so forth. As a result, the Project has acquired forecasting methods for climate and ecosystem change and weather precipitation model and inundation model for prediction and risk analysis of extreme weather events, and has continued to accumulate and analyze various data of target communities. The Project has initiated to discuss the resilience enhancing options from ecological, engineering and socioeconomic aspects, based on the findings of each thematic research group and the developed conceptual framework, for example, options related to agricultural and bio-diversity, diversity and drought resistance of crop varieties and soil environment as ecological resilience; options related to early warning system of weather information, rain water collection methods, and water storage techniques and so forth as engineering resilience; and diversity of livelihood and income source, cooperation within/between communities at the time of disaster, and educational program for disaster risk reduction as socioeconomic resilience.

Therefore, it is considered that basis for achieving the Project Purpose "An Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes in Northern Ghana will be developed as the 'Ghana Model'" has been established

A road map to establish and implement the Ghana Model has not been well discussed yet by all of the three research groups. At the early stage in the latter half of the Project, it is expected that outline of the integrated approach will be proposed based on the data acquired and consequent analyses under the improved collaboration among three research groups, in consideration of implementing capacity development programs according to meteorological cycle and seasonality of agricultural activities in the target areas.

(2) External conditions

There has not been any notable influence caused by the changes of the external conditions.

4-3 Efficiency

The efficiency of the Project is considered as **High - Moderate**, based on the following consideration:

(1) Japanese experts

The Japanese experts in the relevant fields of expertise have properly played their expected roles in the course of the implementation of the Project, which have been appreciated by the counterpart personnel.

(2) Machinery and equipment

The machinery and equipment required for the Project activities and technical transfer have been almost duly provided except the ones related to Output 2, and all the provided have been kept in good conditions. Due to the time took to formulate specifications and select a dealer, and other difficulties, the installment of AWS was delayed, which led to the delay of purchase of other equipment, although the Project implementation could be managed without critical problems. These machinery and equipment are fully utilized in research, training, and management of the Project.

(3) Training of the C/Ps in Japan

Those who have attended the overseas training under the arrangement of the Project generally assess the subjects of the training as relevant and adequate. The training participants unanimously appreciated the

usefulness of the training and most reported that they have applied knowledge and the skills learnt in carrying out both the activities of the Project and the other regular work activities. Based on the curriculum developed by the training participants during overseas training on GIS, training programs have been already implemented by the Project personnel in Ghana as a preliminary activity for capacity development program.

Although the Team noted that the training participants from UDS currently could not practice the learned GIS techniques after the training due to lack of facilities and software on campus, the Team confirmed that the Project would start capacity development program related to GIS technologies at UDS in the latter half of project cooperation.

(4) Inputs from the Ghanaian side

The counterpart personnel were assigned from all C/P institutions to participate in the Project activities. It should not be denied, however, that the degree of their involvement has been somewhat limited, although the problem has been a lack of secured budget (counterpart fund) to cover the expenses to implement the Project activities. The Ghanaian side has started to make an effort to secure the budget, but it has not been realized.

The provision of the office spaces with basic facilities for the Project has contributed to the smooth management of the Project. Land for three (3) AWSs at some stations of G-Met has been provided and all AWSs are functioning. However, it should be noted that the security measure, i.e. fencing of AWS installation sites has not been fully provided. It requires urgent execution on the Ghanaian side's responsibility. Also, it should be taken into consideration when the additional AWSs are provided.

(5) Utilization of Indigenous Knowledge

The Project has utilized locally adapted traditional knowledge and existing relevant local research findings, and documented information. Therefore, the Project could build the research findings on existing knowledge rather than starting from a blank slate.

4-4 Impact

As it is premature and difficult to describe the Impact of the five-year project at the moment of the Mid-term Review, however, the expected impacts of the Project are generally evaluated to be **Positive**, and a provisional description are as follow.

(1) Policy aspect

Since the Project Purpose of the Project is highly relevant with the context of climate change policy by the Government of Ghana, it is highly possible that the integrated approach to enhancing resilience to climate and ecosystem changes in Northern Ghana will be applied for the other regions and national level, as one of the climate change adaptation plans, if the approach is adopted or utilized by the relevant government institutions related to the Project activities, i.e. Observers for the JCC of the Project, including Ministry of Environment, Science and Technology (MEST), Ministry of Food and Agriculture (MOFA) and Water Resources Commission (WRC), as well as by other development partners. Also, the Project has a high prospect of replicability in other areas of Sub-Saharan Africa, considering the efforts which the Project made such as making many oral presentations in the international conferences and hosting the international conference of the Project, which was successfully implemented in Ghana.

(2) Technical aspect

Technology transfer to the Ghanaian counterpart personnel has been carried out adequately so far through various activities including workshops, project meeting, field activities, C/P training in Japan and international conference. There are already good signs of expected impact in future. For example, the practical C/P trainings on the use of satellite deprived precipitation data and numerical weather prediction

were highly regarded and thus it has been planned to provide similar trainings with young personnel aside from the Project, by G-met. As for the knowledge and operating skill of GIS, the developed curriculum of GIS training through C/P training in Japan has been modified and utilized for other training programs in UNU-INRA, and it would be also possible for UG and UDS if the resources are available. The Team shared the views with C/P institutions that each of all the models to be developed by the Project has high potential to give technical impact on the concerned field.

(3) Social and cultural aspect

The Team found during the interview in some target communities behavior change and climate change adaptation of community members even at the initial stage of the Project; for example, sanitizing borehole, small scale irrigation, water harvesting, and single cropping. Therefore, the Team already confirmed the positive sign of impact of the Project. The Project also has initiated the research of value chain of shea processing, which is one of the important livelihood activities for women, and development of business models related to shea might enable women to enhance their resilience to climate change.

4-5 Sustainability

The sustainability of the Project is assessed as **High-Moderate**, because the Team could expect high sustainability in some aspects, but some other aspects need further reinforcement, as described in the following:

(1) Policy and institutional sustainability

The Project is implemented in line with the current national development plan and climate change policy of the Government of Ghana, such as NCCPF and NCCAS. Although the Ghana National Climate Change Policy has been formulated in 2013, the succeeding plan has no drastic shift of priorities that may be contradictory to the directions of the Project. In view of those policies, it is assumed that the policy support would continuously be secured for the coming years.

As to the institutional aspects, UG and UDS are the leading educational institutions in Ghana, which provide science-based research results to the society. The activities of the Project have been carried out in line with their mandates, thus the institutional sustainability is also assessed as high.

On the other hand, it was found out through the review that involvement of the relevant government institutions, i.e. Observers of JCC has been somewhat still weak, and their commitment to adopt the integrated approach to be proposed by the Project, which is necessary for maintaining the sustainability of the policy, has not yet been fostered.

(2) Organizational and Financial sustainability

It has generally been observed that financial resources allocated by the GoG for the C/P institutions have been very limited. In case of UG and UDS, there are resource constraints for research activities in the field or implement any capacity development program for local community. Lack of human and financial resources has been a constant issue of concern in G-Met as well. Therefore the Team observes that the financial sustainability for the C/P institutions has not yet been secured. Financial sustainability of the Project would depend on how the integrated approach, i.e. Ghana model, could effectively been adopted and institutionalized in Ghana, as mentioned above.

(3) Technical sustainability

As research themes addressed under the Project are largely common to C/P institutions' own themes, it is likely that research methods, outcome of the research, and final products of the Project are continuously used by them even after the project is completed. The Project is also assisting many Ghanaian young researchers by various means to foster the understanding of climate and ecosystem changes as potential

human resources to become professionals in the concerned field and outreach to local community in the future.

For technology transfer within and among the C/P institutions, as mentioned at the section of Impact, GIS training courses have been implemented under the Project, since the C/Ps, who have developed the curriculum through the C/P training in Japan, have already acquired knowledge and skills to provide the technical guidance to other personnel in and around.

The Team is concerned that some of the equipment provided by the Project is very sensitive; however it has not been adequately discussed within the Project if the Ghanaian C/P institutions can bear the maintenance costs and spare parts when serious damage occurs

5. Conclusion

Although at the initial stage of the Project, there were hampering factors and issues for the smooth operation of the project activities such as information sharing about project operation between the Ghanaian and Japanese sides, the coordination and communication have been focal points for improvement. The Team has confirmed that the expected outputs have been achieved without any other critical problems or notable delay in the implementation of the Project. It has already come to the stage of the integration of respective research themes and their findings.

6. Recommendations

(1) Involvement of Line Ministries

As mentioned earlier in the report, it is more effective to raise the awareness about the outcome of the Project within the line ministries of the Project, e.g. Ministry of Education, from the perspectives of Impact and Sustainability of the Project. It is recommended to promote updating the Project progress to the line ministries, not only through JCC, but also by simple means such as email, mailing-list system, etc.

(2) Utilization of the Provided Equipment

The Team confirmed that needs for GIS technologies have been very high and GIS training courses have been implemented by UNU-INRA and UG, utilizing the equipment provided by the Project. Meanwhile, it was also observed that one of AWS facilities has not been provided with appropriate security measures, i.e. fencing. Thus, it is required to take measures immediately, as well as for up-coming AWSs to be provided.

(3) Towards Establishment of the Strategy to Enhance Resilience

Theme 1 and 2 would be generating several climate change scenarios. Theme 3 would address the countermeasures to enhance resilience of local communities. Those countermeasures would be strategized with the three approaches, ecological, engineering and socioeconomic approaches. The Project has just initiated discussions about resilience enhancing options by utilizing research findings. It is recommended to continue to study deeply the strategy taking these three approaches into account in order to make the strategy more robust.

(4) Team Building among All Project Stakeholders

It is recommended to strengthen the overall coordination between thematic research groups for integration of the research and to precede dissemination and sharing of research findings and progress of the Project with the line ministries to raise awareness of the Project.

(5) Coordination with Outside Agencies

In case that the Project needs additional data for research activities which is maintained by outside agencies, kind coordination for the Project to obtain the data by the line ministries is highly expected.

Annex 1 Schedule of Mid-term Review

No.	Date	Day	Mr. Masanori KURISU (Team Leader)	Ms. Mitsuko NAKAMURA (Evaluation Analysis)	Dr. Yasuoka and Ms. Takahashi (JST Team)	Accommodation	Ghanaian Team Members (Ministry of Education, Ministry of Communication, Ministry of Food and Agriculture)
1	Sep 14	Sun		11:35 Arriving in Accra		Accra	
2	Sep 15	Mon		8:30 Meeting with the Ghanaian evaluation team members at JICA office 10:30 Interview at UNU-INRA 12:00 Interview at G-Met 14:00 Intervew with Prof. Gyasi at UG		Accra	8:30 Meeting with Ms.Nakamura and Mr. Mensah at JICA
3	Sep 16	Tue		7:00 Travel to Tamale(AW160) 9:00 Meeting with Prof. Gordana at UDS (Tamale) 12:30 Meeting with Dr. Ogeng at UDS (Nyankpala)		Tamale	
4	Sep 17	Wed		8:30 Travel to Wa 13:30 Interview with DAO, NADAMO, MOFA 15:30 Interview with Mr. Fledrick at UDS (Wa)		Wa	
5	Sep 18	Thu		8:30 Visit PJ Office at Wa campus 9:30 Interview/Site observation in Bankpama community 13:30 Interview/Site observation in Balefili community		Wa	
6	Sep 19	Fri		7:30 Travel to Tamale 9:30 Observation of AWS in Bole 16:30 Travel to Accra (AW167)		Accra	
7	Sep 20	Sat		Data Analysis & Mid-term Review Report Preparation		Accra	
8	Sep 21	Sun		Mid-term Review Report Preparation		Accra	
9	Sep 22	Mon	11:35 Arriving in Accra 14:00 Internal meeting with Mid-term Review Team	Prepare Mid-term Review Report 14:00 Internal meeting with Mid-term Review Team	11:35 Arriving in Accra 14:00 Internal meeting with Mid-term Review Team	Accra	
10	Sep 23	Tue	9:30 Courtesy Call on EOJ	9:00 Meeting with Chief Director, Ministry of Communication Visit/Observation at G-Met (not confirmed)		Accra	11:00 Joint Evaluation Meeting at JICA office
			11:00 Joint Evaluation Meeting at JICA office 13:00 Meeting with Prof. Gyasi at UG (not confirmed) 15:00 Meeting with Mr. Ayuku at UNU-INRA				
11	Sep 24	Wed	7:00 Travel to Tamale (AW160) 9:00 Meeting with Dr. Obeng at UDS (Nyankpala) 13:00 Mini-Workshop at Fihini			Tamale	(Min. of Finance) 7:00 Travel to Tamale (AW160) 9:00 Meeting with Dr. Obeng at UDS (Nyankpala) 13:00 Mini-Workshop at Fihini
12	Sep 25	Thu	9:00 Observation of AWS in Yendi 14:40 Travel to Accra	Prepare Mid-tern Review Report 14:30 Travel to Accra	9:00 Observation of AWS in Yendi 14:40 Travel to Accra	Accra	(Min. of Finance) AM Travel to Accra
13	Sep 26	Fri	10:00 Visit/Observation at G-Met	Prepare Mid-term Review Report	10:00 Visit/Observation at G-Me	Accra	11:45 Joint Evaluation Meeting at JICA office
			11:45 Joint Evaluation Meeting at JICA office PM Prepare the Mid-term Review Report				
14	Sep 27	Sat	Prepare Mid-term Review Report			Accra	-
15	Sep 28	Sun	Prepare for JCC, Back-up Day for Report Prep			Accra	-
16	Sep 29	Mon	AM: Prepare M/M PM: JCC at UNU-INRA, Night: Reception			Accra	PM: JCC at UNU-INRA Night: Reception
17	Sep 30	Tue	-	Departing from Accra		-	-
18	Oct 1	Wed	-	Arriving at Tokyo		-	-

Annex 2 List of the Interviewees

No.	Name	Affiliation
1	Prof. Edwin Akonno Gyasi	Depatment of Geography and Resource Development
2	Dr. Alex Owusu Barima	Depatment of Geography and Resource Development
3	Dr. Kwabena Awere Gyekye	Depatment of Geography and Resource Development
4	Gp. Capt. Stephen Y. Komla	Ghana Meteorological Agency
5	Mr. Ayilari-Naa Juati	Ghana Meteorological Agency
6	Mr. Peter Nunekpeku	Ghana Meteorological Agency
7	Mr. Samuel Owusu Ansah	Ghana Meteorological Agency
8	Prof. Gordana Kranjac-Berisavljevic	University of Development Studies, Nyankala
9	Prof. Francis Z. L. Bacho	University of Development Studies, Wa
10	Dr. Francis Kwabena Obeng	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
11	Mr. Shaibu Abdul-Ganyu	Faculty of Agriculture (Nyankpala), UDS
12	Dr. Samuel A. Donkoh	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
13	Mr. Victor Lolig	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
14	Dr. Richard Yeboah	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
15	Mr. Felix K. Abagale	Faculty of Agriculture (Nyankpala), UDS
16	Mr. Vincent Kodjo Avornyo	Department of Agronomy, Faculty of Agriculture (Nyankpala), UDS
17	Mr. Raymond Tetteh	Faculty of Agriculture (Nyankpala), UDS
18	Mr. Frederick Dayuo	Department of Community Development (Wa), UDS
19	Mujeeb Rahaman Adams	Institute of Continuing and Distance Education (Wa), University of Ghana
20	Dr. Elias T. Ayuk	UNU-INRA
21	Mr. Kwabena Owusu Asubonteng	UNU-INRA
22	Ms. Charlotte Morgan - Asiedu	Director, Human Resource Management Department, Ministry of
23	Ms. Yieri Yvonne	Wa West, Ministry of Food and Agriculture
24	Mr. Dramawi File	National Disaster Management Organization (NADMO)
25	Mr. Adams Sabogu	Assembly Officer, Cheatanta
26	Mr. Bortuuro W. Abubaka	Assembly Officer, Baleufili
27	Mr. Devy K. Moses	Assembly Officer, Bankpama and Zowayeli
28	Mr. Takuu Kuuta	Bankpama Chief
29	Mr. Kwaku Vieri	Zowayeli Elder
30	Ms. Bagipla Koung	Women Representative, Bankpama
31	Ms. Ajara moses Defy	Women Representative, Bankpama
32	Mr. Ruuta Lawrence	Student Union, Bankpama
33	Mr. Maa Maufoug	Baleufili Chief
34	Mr. Maa Dauda Ruso	Baleufili Sub-Chief
35	Mr. Auadu Kubo	Baeufili Community Member
36	Mr. Alhassa Zekaria	Baeufili Community Member
37	Mr. Naadong Saliu	Baeufili Community Member
38	Mr. Mahama Dauda	Baeufili Community Member
39	Mr. Amadu Sidik	Baeufili Community Member
40	Mr. Nuhu Kopie	Baeufili Community Member
41	Mr. Alhassan Abdumai	Fihini Community Member
42	Mr. Seini Mhanmmed	Fihini Community Member
43	Mr. Ganiyu A. Iddrigu	Fihini Community Member
44	Mr. Massau Dawuda	Fihini Community Member
45	Mr. Abukari Alhassan	Fihini Community Member
46	Mr. Zakaria Sulemana	Fihini Community Member
47	Mr. Iddrisu Alhassan	Fihini Community Member
48	Mr. Abdumai Haruna	Fihini Community Member
49	Mr. Abdumai Wumblu	Fihini Community Member
50	Mr. Karima Abdul-Rahman	Fihini Community Member
51	Mr. Mohammed Iddrigu	Fihini Community Member
52	Mr. Sulemana Wumbei	Fihini Community Member
53	Mr. Alhassan Neindoo	Fihini Community Member
54	Mr. Alhassan Inusah	Cheshegu Community Member
55	Mr. Yamkana Sampson	Cheshegu Community Member
56	Mr. Abdallah Iddrigu	Cheshegu Community Member
57	Mr. Abdallah Munkaila	Cheshegu Community Member
58	Mr. Sulemana A. Fatawu	Cheshegu Community Member
59	Mr. Dahamani Munmuni	Cheshegu Community Member
60	Mr. Alhassan Musah	Cheshegu Community Member
61	Mr. Ziblim Adam	Dabogshei Community Member
62	Mr. Sulemana Alhassan	Dabogshei Community Member
63	Mr. Iddi Issah	Dabogshei Community Member
64	Mr. Alhassan Sumani	Dabogshei Community Member
65	Mr. Musah Issahaku	Dabogshei Community Member

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
Overall Goal The Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be incorporated in international environmental policies	Policy recommendations shared in the science and technology community (e.g. OECD/GSF) and presented to international panels and conventions such as UNFCC, CBD, UNCSD, as well as platforms like IPCC, IPBES, and CBD Secretariat.		No drastic change in international policies on climate change and ecosystem changes.
Project Purpose 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.	• 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	* Project progress report * Annual report * Educational policy of Ghana * Policy paper	The Ministry of Education and the Ministry of Communications do not drastically change the educational policy and relevant capacity development. There is no drastic change in climate change adaptation policy framework and strategy of the Government of Ghana.
Outputs 1. Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed	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.	1. * Project progress reports * Annual report	Counterparts are not transferred.
2. 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.	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	2. * Project progress reports * Annual report	
3. Institutional and engineering capacity development programs for local communities and engineers are developed and implemented	3.1. Journal articles on regional disaster governance in Northern Ghana will be published 3.2. Repost 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	3. * Project progress reposts * Annual report	

	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.		
Activities 1-1.Build meteorological data base (time series and spatial) 1-2.Build land utilization and soil distribution data base (time series and spatial) 1-3.Build agricultural production and management data base (time series and spatial) 1-4.Integrate above three data bases by GIS 1-5.Build regional climate change prediction model and use the model to predict (solution constraint factors for downscaling of climate change prediction model) 1-6.Assess climate change impact to agro-ecosystem utilization 1-7.Assess land utilization, soil distribution and climate change by GIS 1-8.Develop agro-ecosystem valuation map based on 1-7 1-9.Develop alternative approaches on adaptive agricultural production management to climate change 1-10.Establish the institutional design of collaboration across Theme1 to 3 2-1.Survey the satellite and ground based observation network and construct the database 2-2.Make an early warning system, hazard map of flood and scenario of drought database 2-3.Quantitatively analyze the risks of disasters due to extreme weather for Volta river basin in Northern Ghana 2-4.Propose a prototype scheme of on-site water resources management by using outcomes from 2-3 3-1.Select the project sites in collaboration with Theme1 and 2 3-2.Interview key actors and observe authority at different levels of governance institutions in the region 3-3.Survey farm household to understand socioeconomic activities 3-4.Outline specific crop value chains and potential business models 3-5.Based on analyses of findings derived from 3-2 to 3-4, develop institutional capacity development program 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 3-7.Establish an integrated approach to enhancing resilience based on 3-5 and 3-6	**Inputs**		
	Japan	**Ghana**	
	(a) Expert 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 (b) Training Trainings in Japan (c) Machinery and Equipment - 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	Project Director Project Manager Counterpart researchers Office space Laboratory Communication facilities Water, electricity etc.	Pre-conditions

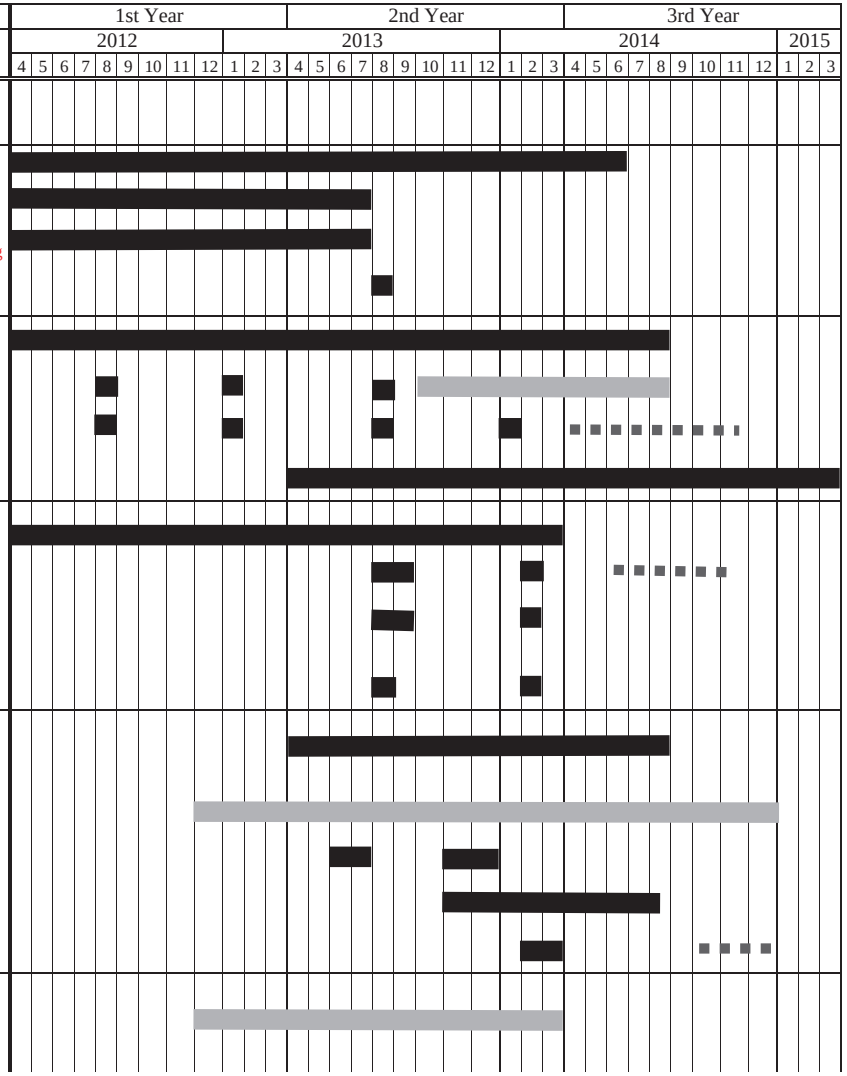
Glossary for this Project:

Project site: Area in which capacity development program will be socially implemented (e.g. selected communities or districts). Study area: Aarea 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 (PO) (approved by the JCC on 5 August, 2013)

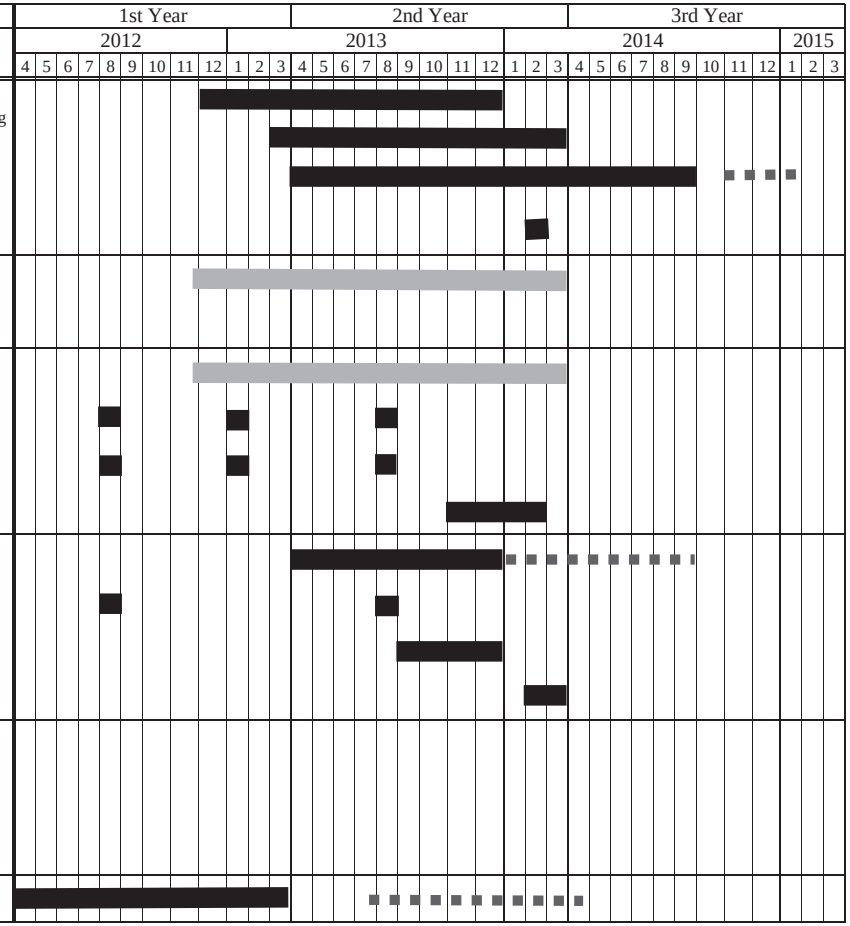
2012-2014 Plan of Operation (Theme 1)

Outputs / Activities		The person in Charge: Japan	The person in Charge: Ghana
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	Dr. Hirotaka Matsuda Dr. Srikantha Herath Dr. Geetha Mohan	Dr. Kwadwo Owusu Dr. Owusu Barima Mr. Gerald Yiran Mr. Emmanuel Tachie-Obeng Prof Daniel Sarpong
	(1) Collecting station observation data		
	(2) Survey on available datasets by previous studies		
	(3) Building pilot integratng database based on mutual discussion		
1-2	Building land utilization and soil distribution data base	Dr. Antwi, Effah Kwabena	Prof. M.K. Abekoe Dr. Owusu Barima Dr. Adelina Mensah
	(1) Field visit for ground truthing and land use data collection		
	(2) Soil sampling and developing soil inventory		
	(3) Building Project Database		
1-3	Building agricultural production and management data base	Dr. Hirotaka Matsuda Dr. Geetha Mohan	Dr. K. Awere Gyekye Mr. George Owusu Dr. Owusu Barima Prof Daniel Sarpong
	(1) Household farm level agriculture information from field surveys		
	(2) Collecting secondry data from several sources including government institutions		
	(3) Building pilot integratng database based on mutual discussion		
	(4) Soil organic carbon and farm management practices	Dr. Antwi, Effah Kwabena	Dr. Owusu Barima Mr. Gerald Yiran
1-4	Integrating above three data bases by GIS		
	(1) Conceptual/logical design of geodatabase (logical data model)		
	(2) Evaluate input data (inventory from) from 1-3		
	(3) Organize Geodatabase Structure		
1-5	Building regional climate change prediction model and prediction by the model(Simulations by regional climate model)		



2012-2014 Plan of Operation (Theme 1)

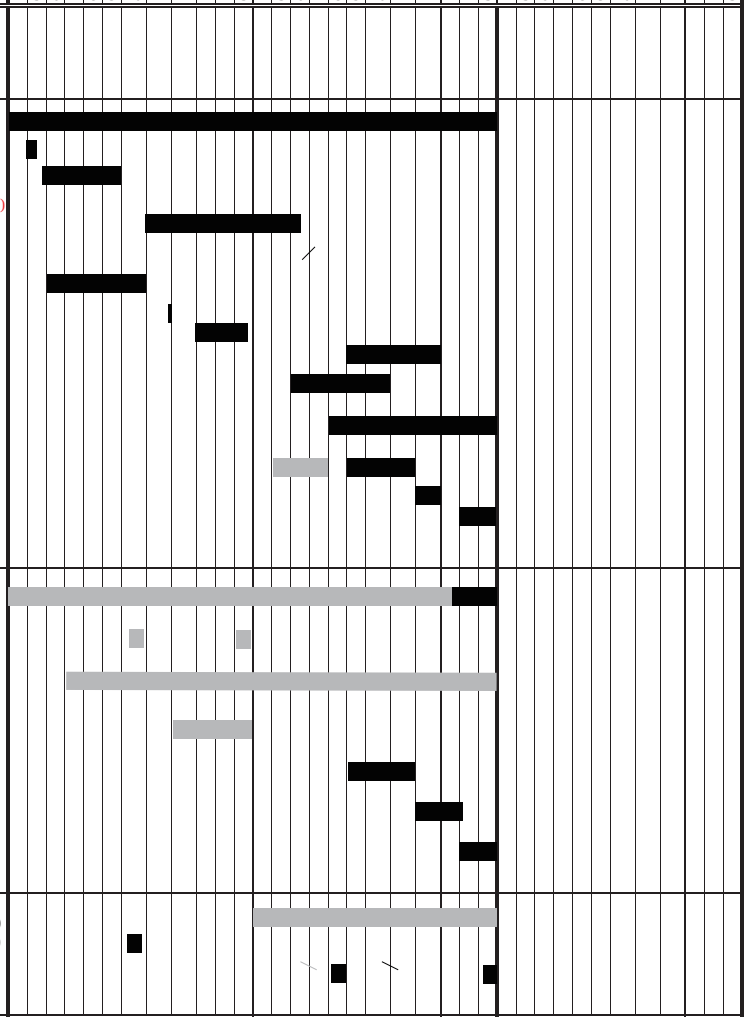
Outputs	Activities	The person in Charge: Japan	The person in Charge: Ghana
	(1) Downscaled simulation of selected years	Dr. Hirotaka Matsuda Dr. Srikantha Herath Dr. Geetha Mohan Dr. Yoshie Maeda	Mr. George Owusu Mr. Emmanuel Tachie-Obeng Dr. Oteng Ababio
	(2) Downscaled simulation of future climate		
	(3) Statistical downscaling		
	(3) Sharing the preriminaly results		
1-6	Assessment of climate change impact to agroecosystem utilization	Dr. Hirotaka Matsuda Dr. Geetha Mohan	Dr. E.M Attua Dr. Adelina Mensah Dr. Oteng Ababio Prof Daniel Sarpong
	(1) Acquisition and evaluation of climate data		
1-7	Assessment of land utilization, soil distribution and climate change by GIS	Dr. Antwi, Effah Kwabena	Dr. K. Awere Gyeke Mr. George Owusu Mr. G. Yiran
	(1) Survey of past and existing agricultural land uses		
	(2) Survey of past and present agricultural management practices		
	(3) Analyses of climate data, soil and land use data		
1-8	Making agroecosystem valuation map based on 1-8	Dr. Antwi, Effah Kwabena	Mr. G. Yiran Dr. E. M Attua Dr. Owusu Barima Prof Daniel Sarpong
	(1) Acquisition of Sattelite image and image processing		
	(2) Develop biodiversity inventory		
	(3) Map creation		
1-9	Making options of adaptive agricultural production management to climate change	Dr. Hirotaka Matsuda Dr. Antwi, Effah Kwabena Dr. Srikantha Herath Dr. Geetha Mohan Dr. Yoshie Maeda	Prof. E.A. Gyasi Dr. Adelina Mensah Dr. Kwadwo Owusu Prof Daniel Sarpong
1-10	Institutional design of collaboration Theme 1 to 3	Prof. Kazuhiko Takeuchi	Prof. E.A. Gyasi



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

2012-2014 Plan of Operation (Theme 2)

Outputs	Activities	The person in Charge: Japan	The person in Charge: Ghana
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/UDS
2-1	Sattelite and Ground-based observation network is surveyed and database is built fy12-(1) Site inspection fy12-(2) Planning AWS & Raingauge Instlation Scheme fy12-(3) Installation of three AWSs at Bole, Yendi and Salaga fy12-(4) Inspection of installed AWSs fy12-(5) Preliminary satellite data acquisition at KYOTO UNIV fy12-(6) Training for satellite data use fy12-(7) Installation of data server fy13-(1) Installation of AWS & Raingauges fy13-(2) Comparison of Satellite and Obs data fy13-(2+) Continuous Satellite Data Acquisition fy13-(3) Numerical Met. Prediction (Trial in Jpan) fy13-(4) ibid (Training in Japan) fy13-(5) ibid (Trial in Ghana) fy14-(6) Continuous Operatoin	Prof. Hirohiko Ishikawa Dr. Weiqiang Ma	Mr. Andrew Nkansah(GMet) Mr. Ayilari-Naa Juati(GMet) Mr. Amos Narh(GMet) Mr. Samuel Owusu Ansah (GMet) Miss Elikem Setsoafia (GMet) Mrs. Francisca Martey (GMet) Mr. Peter Nunekpeku (GMet) Mr. Shaibu Abdul-Ganiyu (UDS) Dr. Kwadwo OWUSU (U. Ghana)
2-2	Using 2-1, an early warning system, hazard map of flood and scenario of drought are made fy12-(1) Site inspection fy12-(2) Preliminary development of Hydrology model at KYOTO(KOBE) UNIVERSITY fy12-(3) Collection of Hydrogy Data fy13-(0) Collection of Satellite data for Hydrology fy13-(1) Tuning Model with Hydrogical data FY13-(2) Trial run with Satellite derived data	Prof. Hirohiko Ishikawa Prof. Kenichiro Kobayashi Dr. Samaddar	Mr. Zinedeme Minia(GMet) Mr. Charles Yorke(GMet) Mr. Dominic Pokperlaar(GMet) Prof. Gordana K-B(UDS) Mr. Shaibu Abdul-Ganiyu(UDS) Dr. Togbiga Dzivenu(UDS)
2-3	Risks of disasters due to extreme weather is quantitatively analyzed for Volta River basin fy12-(1) Preliminary site inspection fy13-(1) Site inspection, data collection and feasibility assessment	Prof. Norio Okada Prof. Muneta Yokomatsu Prof. Kobayashi Dr. Samaddar	~~Mr. Zinedeme Minia(GMet)~~ Mr. Andrew Nkansah(GMet) Mr. Ayilari-Naa Juati(GMet) Prof. Gordana K-B(UDS) Dr. Togbiga Dzivenu(UDS) Mr. Fauster Agbenyo(UDS)



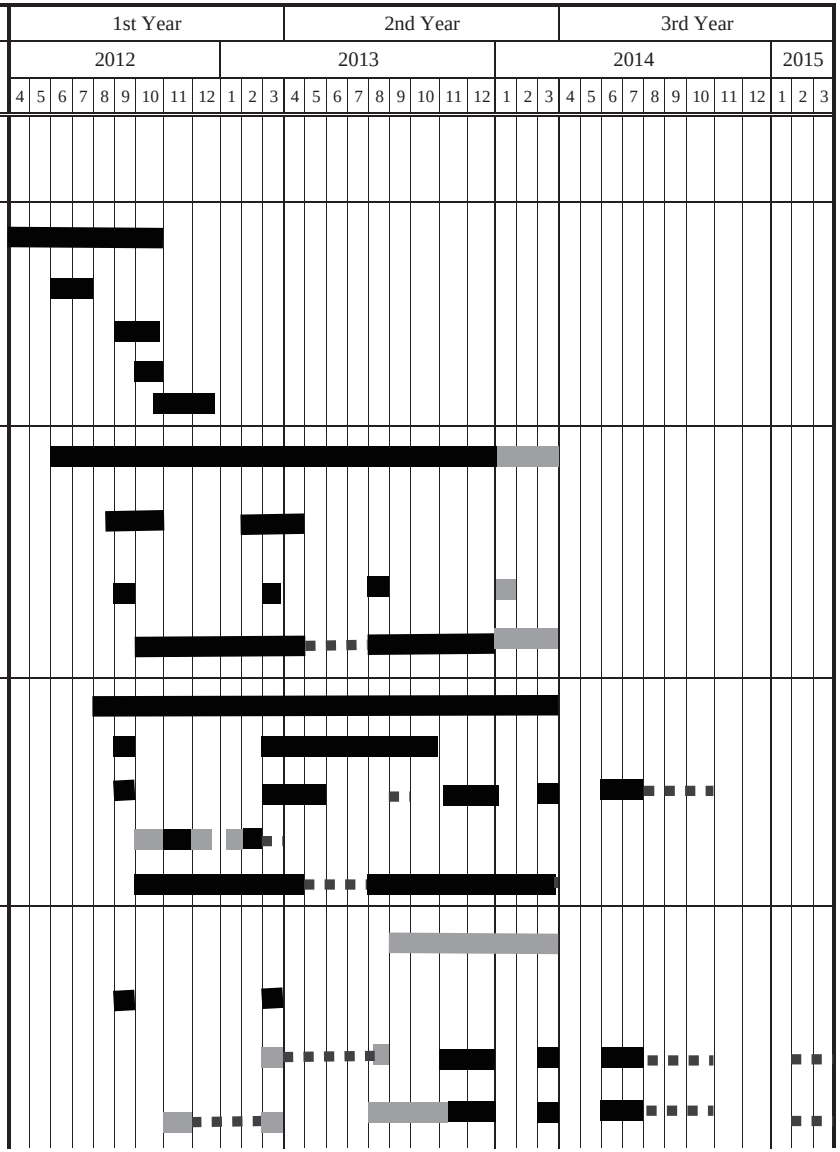
2012-2014 Plan of Operation (Theme 2)

Outputs	Activities	The person in Charge		1st Year												2nd Year												3rd Year												
		Japan	Ghana	2012												2013												2014												2015		
				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	5	6	7	8	9	10	11	12	1	2	3
2-4	Using outcomes from 2-3, a prototype scheme of on-site water resource management is proposed fy13-(1) Preliminary site inspection	Prof. Norio Okada Prof. Muneta Yokomatsu Dr. Samaddar	Prof. Gordana K-B																																					

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

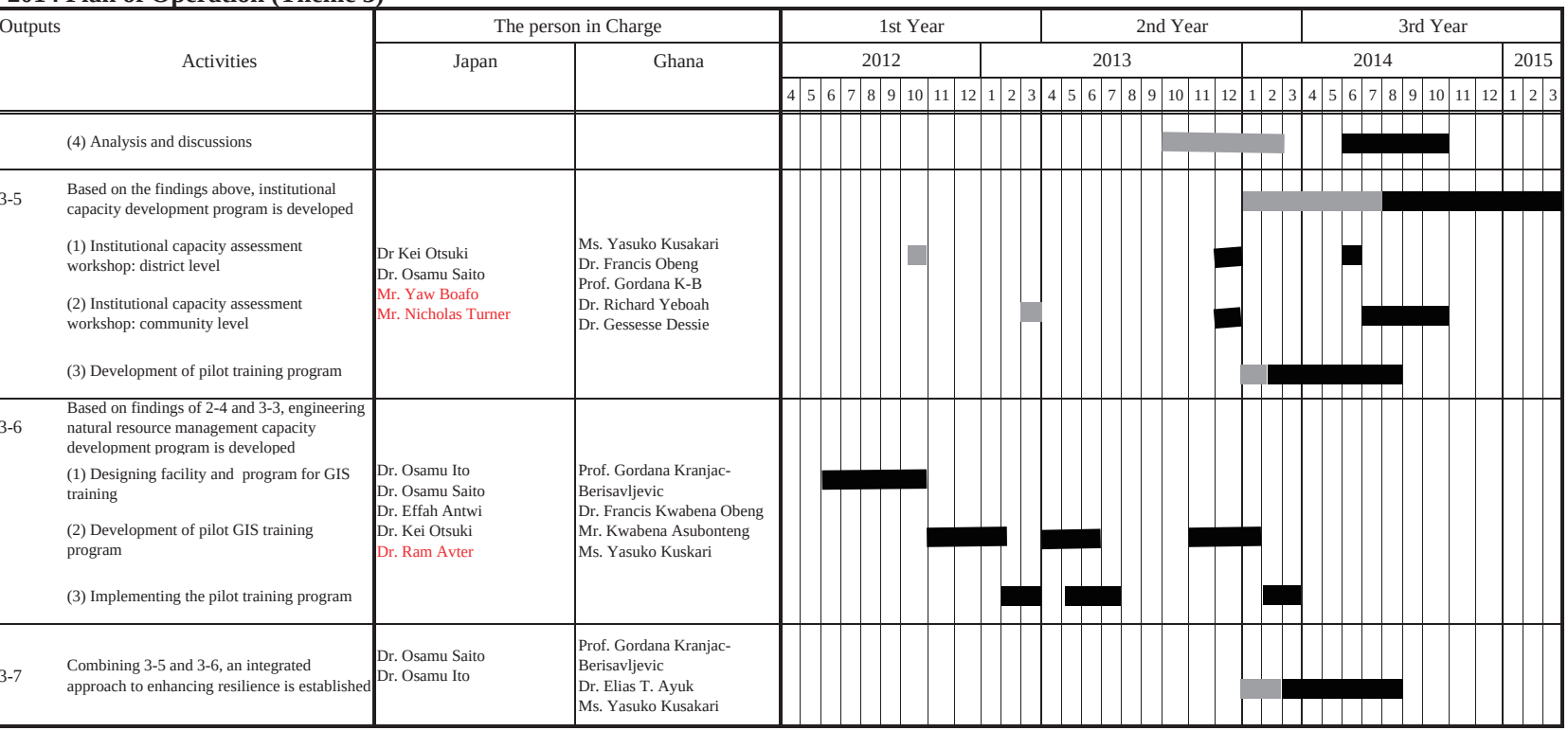
2012-2014 Plan of Operation (Theme 3)

Outputs / Activities		The person in Charge: Japan	The person in Charge: Ghana
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		Prof. Edwin A. Gyasi Prof. Gordana Kranjac-Berisavljevic
	(1) 1st Assessment: Distrct selection	Dr. Osamu Saito Dr. Osamu Ito Dr. Kei Otsuki Dr. Effah Antwi	Ms. Yasuko Kusakari Dr. Shaibu Abdul-Ganiyu Mr.Kwabena Asubonteng Dr.Togbiga Dzivenu Mr. Bizola Gadaa Mr. Frederick Dayuo Mr. Godfred Jasaw**
	(2) Field observation and communication with local stakeholders		
	(3) 2nd Assessment: Community selection		
	(4) Final decision making		
3-2	Interviewing key actors and observation of authority at different levels of governance institutions in the region		Ms. Yasuko Kusakari Mr. Kwabena Asubonteng Dr.Togbiga Dzivenu Dr. Shaibu Abdul-Ganiyu Mr. Bizoola Gadaa Mr. Frederick Dayuo Mr. Godfred Jasaw** (To be replaced with Frederick)
	(1) Preliminary field observation and questionnaire development	Dr. Kei Otsuki Dr. Osamu Saito Dr. Osamu Ito	
	(2) Interviewing key stakeholders		
	(3) Data input and analysis		
3-3	Farm household survey to understand socioeconomic activities		Ms. Yasuko Kusakari Mr.Kwabena Asubonteng Dr.Togbiga Dzivenu Dr. Samuel Donkoh Mr. Vincent Avonyo Mr. Victor Lolig Mr.Frederick Dayuo (To replace Godfred)
	(1)Preliminary field research on institutions of disaster governance	Dr. Osamu Ito Dr. Kei Otsuki Dr. Osamu Saito Dr. Effah Antwi	
	(2) Household survey		
	(3) Farm land survey		
	(4) Data input and analysis		
3-4	Outlining specific crop value chains and potential business models		Dr. Timothy Koomson Ms.Yasuko Kusakari Dr. Gessesse Dessie Dr.Togbiga Dzivenu Dr. Richard Yeboah Mr. Balma Yakubu
	(1)Preliminary field research on institutions of grassroots business situations(local markets, distributers, etc)	Dr. Osamu Saito Dr. Osamu Ito Dr. Kei Otsuki Mr. Yaw Boafo	
	(2) Supply and value chains of ecosystem services associated with major crop production		
	(3) Identification of useful crop for further value adding activities		



2012-2014 Plan of Operation (Theme 3)

Outputs / Activities		The person in Charge: Japan	The person in Charge: Ghana
	(4) Analysis and discussions		
3-5	Based on the findings above, institutional capacity development program is developed		
	(1) Institutional capacity assessment workshop: district level	Dr Kei Otsuki Dr. Osamu Saito Mr. Yaw Boafo Mr. Nicholas Turner	Ms. Yasuko Kusakari Dr. Francis Obeng Prof. Gordana K-B Dr. Richard Yeboah Dr. Gessesse Dessie
	(2) Institutional capacity assessment workshop: community level		
	(3) Development of pilot training program		
3-6	Based on findings of 2-4 and 3-3, engineering natural resource management capacity development program is developed		
	(1) Designing facility and program for GIS training	Dr. Osamu Ito Dr. Osamu Saito Dr. Effah Antwi Dr. Kei Otsuki Dr. Ram Avter	Prof. Gordana Kranjac-Berisavljevic Dr. Francis Kwabena Obeng Mr. Kwabena Asubonteng Ms. Yasuko Kuskari
	(2) Development of pilot GIS training program		
	(3) Implementing the pilot training program		
3-7	Combining 3-5 and 3-6, an integrated approach to enhancing resilience is established	Dr. Osamu Saito Dr. Osamu Ito	Prof. Gordana Kranjac-Berisavljevic Dr. Elias T. Ayuk Ms. Yasuko Kusakari



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

Annex 5 Evaluation Grid of Mid-Term Review

Project Name: Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach (CECAR-AFRICA)

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
Achievements of Input	Japanese side	Dispatch of Experts (Field of Expertise, Number, Timing of Dispatch, etc.)	List and record of assignment of researchers	Project Progress Report/ Mid-term Report	Literature Survey
		C/Ps Training (Theme, Contents, Number of Dispatched Trainees, Timing of Implementation)	List of C/Ps training in Japan		
		Provided Equipment (Items, Quantity, Timing of Provision, Maintenance, etc.)	List of Provided Equipment Maintenance/status of the equipment		Literature Survey Site Observation
		Local Cost Assistance (Project Running Cost, Purpose, Timing of Assistance, etc.)	Accounting record of local cost assistance		Literature Survey
	Ghanaian side	C/Ps Assignment (Number, Position, Turnover, etc.)	List and record of assignment of C/Ps researchers		
		Budget allocation plan and execution for the project activities	Data of budget allocation plan and execution	Information/ Documents to be provided by C/Ps	Questionnaires Interviews
		Arrangement of land, building, facilities, and equipment necessary for the project implementation	List of items input by the Ghanaian side	Project Progress Report/ Questionnaire/ Interview	Literature Survey Questionnaires Site Observation
	Achievement of the Outputs 1. Are forecasting methods for climate and ecosystem change developed? Are the impacts on agro-ecosystem assessed?	1.1 Were journal articles on climate and ecosystem change published?	Status of publishing journal articles on climate and ecosystem change	Project Progress Report/ Mid-term Report	Literature Survey Interviews
		1.2 Was assessment of climate change impact to agro-ecosystem utilized?	・Assessment result of climate change impact to agro-ecosystem ・Utilized case of assessment of climate change impact to agro-ecosystem		
		1.3 Was a report on options of adaptive agricultural production management to climate change (land utilization and cropping system etc.) issued?	Status of issuing a report on options of adaptive agricultural production management to climate change (land utilization and cropping system etc.)		
	2. Is a prototype of water resources management applied through prediction and risk analysis of extreme weather events using satellite remote sensing and ground-based observation network?	2.1 Was a report on flood risk assessment and extreme weather risk assessment issued?	Status of issuing a report on flood risk assessment and extreme weather risk assessment	Project Progress Report/ Mid-term Report	Literature Survey Interviews
		2.2 Was a report on prototypes of water resource management methods issued?	Status of issuing a report on prototypes of water resource management methods		
		2.3Were journal articles on extreme weather risk or water resource management issued?	Status of publishing journal articles on extreme weather risk or water resource management		

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
Achievements of Outputs as of August 2014	3. Are institutional and engineering capacity development programs for local communities and engineers developed and implemented?	3.1 Were journal articles on regional disaster governance in Northern Ghana published?	Status of publishing journal articles on regional disaster governance in Northern	Project Progress Report/ Mid-term Report	Literature Survey Interviews
		3.2 Is a report on business models against for climate and ecosystem changes issued?	Status of issuing a report on business models against for climate and ecosystem changes issued?		
		3.3 Is the capacity development program on resilience for climate and ecosystem changes developed?	Progress of developing the capacity development program on resilience for climate and ecosystem changes		
		3.4 Is training course for local engineering, governors and community implemented at the project site? Is the monitoring report issued?	Monitoring report of training course for local engineering, governors and community implemented at the project site		
		3.5 Are guidelines for establishing an integrated approach to enhancing resilience to climate and ecosystem changes presented?	Progress of presenting guidelines for establishing an integrated approach to enhancing resilience to climate and ecosystem changes		
	Achievement of Project Purpose (Prospect) Is the following project purpose likely to be achieved? "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?	・Educational policy and curriculum development at university level, with focus on climate and ecosystem changes ・Educational policy for engineers and observation capacity development of the Ghana Meteorological Agency ・Contribution to the ongoing policy formulation for climate adaptive capacity development by the Ghana Government	・ Comments by Governmental officials, Japanese Expert, C/Ps and etc.	National Climate Change Adaptation Strategy/ Educational policy of Ghana/ Other policy papers/ Project Progress Report/ Comments by JICA Experts/ C/Ps/ Other relevant organizations	Literature Survey Questionnaires Interviews
	Progress of activities	Were activities implemented as planned?	・Implementation status of activities ・Reason and countermeasures taken for problem-solving	Project Progress Report/ Mid-term Report, Comments by JICA Experts (researchers) and C/ Ps	Literature Survey Questionnaires Interviews
	Implementation structure	Was C/Ps assignment appropriate (number, ability)?	・ Number and ability of C/Ps ・ Formation of research working group, etc.		
		Does implementation structure function accordingly?			
	Monitoring	Has monitoring been carried out?	・ Monitoring mechanism for overall project (JCC, regular meeting, etc.) ・ Revised contents of research plan (if any)		
		Is monitoring mechanism appropriate?			
		Were PDM/PO revised appropriately as necessity arose?			

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
Implementation process	Communication	Is there sufficient communication/information sharing between the JICA Experts and C/Ps?	・Frequency and means of communication	Project Progress Report/ Mid-term Report Comments by JICA Experts and C/Ps	Literature Survey Questionnaires Interviews
		Ways to handle challenges and problems	・Measures taken when project plan is changed		
	Decision making system	Is decision making process appropriate?	・Decision making system in the project		
	Ownership of C/Ps organizations	Do C/Ps participate in the project activities with their own initiatives?	・Status of participation of C/Ps ・Status of support from senior officials ・Status of budget allocation (Counterpart fund)		
		Are there any change in C/Ps' attitude (independence and activeness) or self-motivated activity by C/Ps?			
		Are interests of senior officials sufficient to support the project?			
		Do C/Ps organization provide appropriate amount of budget for the project?			
	Technical transfer	Is method of technical transfer appropriate?	・Trainings and field research in Ghana ・Trainings in Japan		
	Outstanding issues, and inhibiting factors in implementation process?	Are there problems or inhibiting factors that were generated during the implementation?	・Problems or inhibiting factors (if any)		

Five Evaluation Criteria

Items to be investigated		Questions	Necessary Information and Data	Data Source	Data Collection Methods
Relevance	Needs and Priority (Policy)	Does the project meet the needs of target areas and societies?	・ SADA Strategy and action plan ・ Comments by administrative officers in Northern Ghana, Japanese Expert, C/Ps and etc.	Detail Planning Survey Report/ Project Progress Report/ JICA Expert/ C/Ps/ Administrative officers in Northern Ghana/ Local engineers and residents	Literature Survey Questionnaires Interview
		Does the project meet the needs of target groups?	・ Comments by Japanese researcher, C/Ps, local administrative officers, engineers and residents in Northern Ghana and etc.		
		Is the project consistent with Ghanaian development policy?	・ National Development Strategy ・ National Climate Change Policy Framework ・ NCCAS and Action Plan ・ Comments by Governmental officials, Japanese Expert, C/Ps and etc.	Detail Planning Survey Report/ Ghana's National Development Strategy/ Publications related to National Climate Change/ JICA Experts/ C/Ps/	

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
		Is the project consistent with Japanese assistance policy?	・Country Assistance Policy for Ghana ・Japan's assistance for Climate Change	Detailed Planning Survey Report/ Country Assistance Policy for Ghana	
	Appropriateness as means	Is the project strategy appropriate to contribute to the national climate change adaption of Ghana?	・ Project Progress Report ・ Mid-term Report ・ Comments by JICA Experts, C/Ps, other stakeholders	Project Progress Report/ Mid-term Report/ JICA Experts/ C/Ps	
		Is the project design appropriate considering the capacity of counterpart organizations?			
		Is the selection of beneficiaries appropriate?			
		Is the selection of counterparts appropriate?			
Effectiveness	Prospect of achieving the Project Purpose	Is the achievement level of the Project Purpose adequate at this stage?	・Refer to “achievements of outputs” for details.	Refer to “achievements of outputs” for details.	Literature Survey Questionnaires Interview
	Contribution of outputs to the achievement of the Project Purpose	Are the 3 outputs contributing to achieve the Project Purpose?	・Adequacy of number of outputs, contents and quality ・Relation between Project Purpose and each output	Project Progress Report/ JICA Experts/ C/Ps	
	Promoting and inhibiting factors	What are the promoting factors for the achievement of the Project Purposes?	・Situation of external factors ・Existence of promoting and inhibiting factor		
Efficiency	Prospect to achieve the Outputs	Is the achievement level of the outputs adequate at this stage?	・Refer to “achievements of outputs” for details.	Refer to “achievements of outputs” for details.	Literature Survey Questionnaires Interview
		Are there any promoting/inhibiting factors to achieve outputs?	・Situation of external factors ・Existence of promoting and inhibiting factor	Project Progress Report/ JICA researchers/ C/Ps	
	Appropriateness of the Input of the Japanese side to produce outputs	Are the field of expertise, number, duration of stay, timing of dispatch of assigned researchers appropriate?	・Verification of "achievement of inputs” ・Input status (Comparison to the plan） ・Status of utilization of the provided equipment ・Comments by JICA Experts and C/Ps	Project Progress Report/ Training Reports/ List of provided machinery/ JICA Experts/ C/Ps	Literature Survey Questionnaires Interview Site Observation
		Were items, quantity, timing of provision of the provided equipment appropriate?			
		Were the number of trainees, field, period, timing of the trainings in Japan and Ghana appropriate?			
		Are knowledge and experiences obtained through the trainings applied effectively to execute the duties and missions of the trainees?			

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
	Appropriateness of the Input of the Ghanaian side to produce outputs	Are the C/Ps assigned appropriately in terms of number and capacity?	・Verification of "achievement of inputs" ・Input status (Comparison to the plan) ・Comments by JICA Experts and C/Ps	Project Progress Report/ JICA Experts/ C/Ps	Literature Survey, Questionnaires Interview Site Observation
		Are there any problems as regards the land, buildings, facilities arranged by the Ghanaian side for the Project?			
		Are the budget provided by the Ghanaian side appropriated in terms of amount and timing?			
Impact (Prospect)	Effects of outputs and project purpose	Are there any positive, negative or unexpected impacts effects from technical, social, cultural, institutional and environmental points of view?	・Applicable cases of project outcomes ・Comments by JICA Experts and C/Ps	Project Progress Report/ JICA Experts/ C/Ps	Literature Survey Questionnaires Interview
		Are any countermeasures taken against negative impacts, if any?	・Any countermeasures		
Sustainability (Prospect)	Policy and intuitional sustainability	Will the political support continue after the completion of the Project?	・Refer to "relevance of policy" ・Comments by JICA Experts and C/Ps	Project Progress Report/ JICA Experts/ C/Ps and etc.	Literature Survey Questionnaires Interviews
		Are the efforts to support to extension of the project outcomes to other areas secured?	・Institutional setup for extension of research outcomes ・Sense of ownership, understanding and support for continuing research activities after the project by C/P agencies ・Comments by JICA Experts and C/Ps		
		Do the counterpart agencies have sufficient institutional capacity to conduct the project activities continuously?			
	Financial sustainability	Will the budget be secured to continue the related research activities after completion of the project?	・Comments by JICA Experts and C/Ps ・Comments by Administrative officers and stakeholders in Northern Ghana	Financial information by C/P agencies/ Financial information of related organization / JICA Experts/ C/Ps	
		Is there any financial resources to apply project outputs to their communities?			
	Technical sustainability	Are appropriate technologies developed and transferred, in consideration of the technical level of C/P agencies?	・Techniques acquired by C/Ps through the Project and trainings or workshop ・Techniques acquired by C/Ps through the implementation of Pilot Project	Project Progress Report/ JICA Experts/ C/Ps,	
		Have C/Ps acquire knowledge and the transferred technology enough?	・Comments by JICA Experts and C/Ps		
		Will the transferred technology and equipment be used widely?	・Status of utilization of provided equipment		

Annex 6 List of Japanese Experts

Japanese Fiscal Year 2012 (H.24)

No.	Name	Affiliation	Expertise	Duration From (YYMMDD)	Duration To (YYMMD	M/M
1	Kazuhiko Takeuchi	Univ. of Tokyo/UNU	Chief Adviser	20120501	20120504	0.13
				20121016	20121019	0.13
2	Kwabena Effah Antwi	Univ. of Tokyo/UNU-IAS	GIS Analysis	20120429	20120508	0.33
				20120818	20120908	0.70
				20121006	20121024	0.63
				20130216	20130323	1.27
3	Hirohiko Ishikawa	Univ. of Kyoto -DPRI	Meteorology	20120430	20120509	0.33
				20121015	20121021	0.23
				20130316	20130324	0.30
4	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20130316	20130324	0.30
5	Muneta Yokomatsu	Univ. of Kyoto -DPRI	Disaster Risk Management	20121010	20121019	0.33
6	Ma Weiqjang	Univ. of Kyoto -DPRI	Hydrology	20130316	20130324	0.30
7	Osamu Saito	UNU-IAS	Resilience Strategy	20120430	20120508	0.30
				20120827	20120906	0.33
				20121013	20121020	0.27
				20130224	20130303	0.33
8	Kei Otsuki	UNU-IAS	Governance	20120827	20120911	0.50
				20130217	20130222	0.20
9	Osamu Ito	UNU-IAS	Agronomy	20121028	20121110	0.43
				20130201	20130216	0.53
10	Yaw Agyman Boafo	UNU-IAS	Resilience Evaluation	20130216	20130317	1.07
Total						8.97

Japanese Fiscal Year 2013 (H.25)

No.	Name	Affiliation	Expertise	Duration From (YYMMDD)	Duration To (YYMMD	M/M
1	Kazuhiko Takeuchi	Univ. of Tokyo/UNU	Chief Adviser	20130804	20130809	0.20
2	Kwabena Effah Antwi	Univ. of Tokyo/UNU-IAS	GIS Analysis	20130423	20130521	0.97
				20130731	20130828	0.93
				20140217	20140316	1.00
3	Geetha Mohan	Univ. of Tokyo	Agronomy	20130804	20130816	0.43
				20140314	20140327	0.47
4	Hirohiko Ishikawa	Univ. of Kyoto -DPRI	Meteorology	20130615	20130622	0.27
				20130801	20130807	0.23
				20140304	20140311	0.27
5	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20130803	20130809	0.23
6	Muneta Yokomatsu	Univ. of Kyoto -DPRI	Disaster Risk Management	20130611	20130623	0.43
				20131107	20131124	0.60
7	Subhajyoti Samaddar	Univ. of Kyoto -DPRI	Disaster Risk Management	20130611	20130623	0.43
				20130803	20130810	0.27
				20131107	20131124	0.60
				20140303	20140315	0.43
8	Srikantha Herath	UNU-IAS	Disaster Risk Management	20140306	20140314	0.30
9	Osamu Saito	UNU-IAS	Resilience Strategy	20130803	20130815	0.43
				20140304	20140313	0.33
10	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20131020	20131103	0.47
11	Ram Avtar	UNU-IAS	GIS Analysis	20140306	20140314	0.30
12	Yaw Agyman Boafo	UNU-IAS	Resilience Evaluation	20130731	20130828	0.93
				20140209	20140323	1.50
13	Nicholas Turner	UNU-IAS	Systematic Capacity Development	20130805	20130813	0.30
Total						12.33

Japanese Fiscal Year 2014 (H.26)

No.	Name	Affiliation	Expertise	Duration From (YYMMDD)	Duration To (YYMMD	M/M
1	Kazuhiko Takeuchi	Univ. of Tokyo/UNU	Chief Adviser	20140804	20140813	0.33
2	Kwabena Effah Antwi	Univ. of Tokyo/UNU-IAS	GIS Analysis	20140723	20140825	1.10
3	Geetha Mohan	Univ. of Tokyo	Agronomy	20140803	20140814	0.40
4	Alexandros Gasparatos	Univ. of Tokyo	Agronomy	20140804	20140812	0.30

Annex 6 List of Japanese Experts

5	Hirohiko Ishikawa	Univ. of Kyoto -DPRI	Meteorology	20140613	20140623	0.37
				20140801	20140813	0.43
6	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20140801	20140813	0.43
7	Muneta Yokomatsu	Univ. of Kyoto -DPRI	Disaster Risk Management	20140705	20140717	0.43
8	Subhajyoti Samaddar	Univ. of Kyoto -DPRI	Disaster Risk Management	20140707	20140716	0.33
				20140804	20140817	0.47
9	Osamu Saito	UNU-IAS	Resilience Strategy	20140803	20140813	0.37
10	Osamu Ito	UNU-IAS	Agronomy	20140707	20140719	0.43
11	Yaw Agyman Boafo	UNU-IAS	Resilience Evaluation	20140720	20140826	1.23
12	Yasuko Kusakari	Univ. of Tokyo	Rural Livelihood and Local Capacity Development	20140731	20140828	0.93
13	Sadahisa Kato	UNU-IAS	Resilience Enhancement	20140730	20140818	0.63
Total						8.20

Grand Total	29.50

Note:
Data is as of 30 August 2014
UNU: United Nation University, UNU-IAS: United Nation University Institute for the Advanced Study of Sustainability,
DPRI: Disaster Prevention Research Institute

Annex 7 List of the trainees in Japan

No.	Name	Position	Affiliation	Training Organization	Field of Training	Period from YYMMDD	Period to YYMMDD	Days
1	Samuel Owusu Ansah	Assistant Meteorologist	Ghana Meteoroidal Agency (G-Met)	Univ. of Kyoto Univ. of Nagoya	The use of satellite derived precipitation data	20121109	20121203	25
2	Shaibu Abdul-Ganiyu	Senior Lecturer	University for Development Studies (UDS)	Univ. of Kyoto Univ. of Nagoya	The use of satellite derived precipitation data	20121109	20121203	25
3	Kwadwo Owusu	Lecturer	Univ. of Ghana	Univ. of Kyoto Univ. of Nagoya	The use of satellite derived precipitation data	20121109	20121203	25
4	Kwabena Asubonteng	Researcher	UNU-INRA	United Nations University (UNU), Univ. of Tokyo	GIS Training for joint development of GIS training program with CECARE-Africa cases	20130125	20130205	11
5	Alex Barima Owusu	Lecturer	Univ. of Ghana	United Nation Univ. Univ. of Tokyo	GIS Training for joint development of GIS training program with CECARE-Africa cases	20130125	20130205	11
6	Kwabena Asubonteng	Researcher	UNU-INRA	United Nation Univ.	GIS Training for joint development of GIS training program with CECARE-Africa cases	20140125	20140202	8
7	Victor Lolig	Researcher	UDS	United Nation Univ.	GIS Training for joint development of GIS training program with CECARE-Africa cases	20140125	20140202	8
8	Samuel Owusu Ansah	Assistant Meteorologist	Ghana Meteoroidal Agency (G-Met)	Univ. of Kyoto	Basics of Numerical weather prediction	20131109	20131220	42
9	Peter Nunekpeku	Assistant Meteorologist	Ghana Meteoroidal Agency (G-Met)	Univ. of Kyoto	Basics of Numerical weather prediction	20131109	20131220	42

Annex 8 List of the provided equipment

Japanese Fiscal Year 2012

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
1	Clear One Chat 150 (Speaker)	CHAT150USB 910-156-200	Clear One	4	JPY	252,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
2	Laptop PC	Think Pad L530 2481CTO	Lenovo	4	JPY	504,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
3	Liquid crystal projector	EB-W12	EPSON	4	JPY	336,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
4	Screen	ELPSC23	EPSON	4	JPY	160,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
5	Digital camera	DMC-TZ30-K	Panasonic	2	JPY	72,000	PJ Office	Good
6	Color Monitor	E2341V-BNX.AJLMOSN	LG	2	JPY	43,600	G-Met HQ	Good
7	Data Server(workstation) with software	RCR-X200(RCRXE5140-R32),Visual Fortram Composer XE2013, Visual Studio Pro2012	Real Computing	2	JPY	2,108,000	G-Met HQ	Good
8	Elemental Analyzer	Model:MH-5000 with Standard accessories	Micro Emission	1	JPY	3,000,000	UDS (Nyankpala)	Good
9	Carrying case	Model:Watertight case with special inner	Micro Emission	1	JPY	40,000	UDS (Nyankpala)	Good
10	Quartz Cuvette	Model:LepiCuve-C	Micro Emission	3	JPY	150,000	UDS (Nyankpala)	Good
11	Regin Cuvette	Model:LepiCuve-02	Micro Emission	1Pac	JPY	16,000	UDS (Nyankpala)	Good
12	GIS Software Licenses	Professional EMEA Educ Kit	ERADAS IMAGINE	10	USD	17,900	UNU-INRA (GIS Lab)	license renewed in 2014
Total					JPY	8,539,083	-	-
					GHS	311,645	-	-

Japanese Fiscal Year 2013

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
1	Data Server	HP Proliant DL380p 8G(470065-656)	HP	1	GHS	9,800	UG (Dept. of Geography and Resource Development)	Good
2	Desktop PC	HP Elite 8300SFF with23in.monitor	HP	1	GHS	3,530	UG (Dept. of Geography and Resource Development)	Good
3	Laptop PC	Toshiba Satellite S55-A5339	Toshiba	1	GHS	3,200	UG (Dept. of Geography and Resource Development)	Good
4	Automatic Weather Station (AWS)	MAWS301	VAISALA	3	GHS	265,000	G-Met Bole,Yendi, Salaga stations	Good
5	RC-C Server Xeon 4way with software	RC CS21K-SB20256,PowerChute Business Edition Delux for Linux;Unix 1node Simple Shutdown without upgrade license	Real Computing	1	JPY	2,498,370	G-Met HQ	Good
Total					JPY	10,212,292	-	-
					GHS	372,711	-	-

Japanese Fiscal Year 2014

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
9	Hydrosense	HS2P-12-C		1Set	JPY	242,100	UDS (Nyankpala for field)	Good
10	Hydrosense	HS2P-20-C		1	JPY	242,100	UDS (Nyankpala for field)	Good
11	Accu PAR Computer LP-80	N/A		1	JPY	675,400	UDS (Nyankpala for field)	Good
12	Mini Disk Infiltorometer Decagon Devices	N/A		1set	JPY	106,920	UDS (Nyankpala for field)	Good
13	Laptop PC	Panasonic Tough Book 19 CF-195W1ACS	Panasonic	1	JPY	285,500	UDS (Nyankpala for field)	Good
14	Rain Gauge	RG3-M		10	JPY	531,000	Field in Fihini *	Good
15	Optic USB Base Station	BASE-U-1		2set	JPY	20,000	UDS (Nyankpala)	Good
16	BHW-PRO-CD software	N/A		1	JPY	17,000	UDS (Nyankpala)	Good
17	U12 4-External Channel Outdoor Data Logger	N/A		2	JPY	70,600	UDS (Nyankpala)	Good

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
18	Temperature sensor	TMC20-HD		24	JPY	148,800	Field in Fihini*	Good
19	Tensiometer sensor	DIK-3160-11,DIK-3160-54,DIK-8333-11,DIK-3160-54, DIK-3160-11		2each	JPY	159,200	Field in Fihini	Good
20	Tensiometer indicator	DIK-3162-01		10	JPY	56,000	Field in Fihini	Good
Total					JPY	2,554,620	-	-
					GHS	93,234	-	-

*Only one rain gauge and temperature sensor were installed in the field of Fihini. The others will be installed at different places in future.
(Exchange rate USD 1.0 =JPY 103.77, GHS 1.0 = JPY 27.4 as of Sep 2014)

Grand Total	JPY	**21,305,995**
	GHS	**777,590**

Annex 9 List of Ghanaian Counterpart personnel

University of Ghana

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Prof. Edwin Akonno Gyasi	Professor	Department of Geography and Resource Development	1-9, 1-10, 3-1	Project Director (PD), Agricultural Land Management and Participatory Rural	
2	Prof. Daniel Sarpong	Professor	Department of Agriculture Economics	1-1, 1-3, 1-6, 1-8, 1-9		
3	Dr. Adelina Mensah	Lecturer	Department of Geography and Resource Development	1-2, 1-6, 1-9		
4	Dr. Alex Owusu Barima	Lecturer	Department of Geography and Resource Development	1-1, 1-2, 1-3, 1-4, 1-8		
5	Dr. Kwadwo Owusu	Lecturer	Department of Geography and Resource Development	1-1, 1-9, 2-1		
6	Mr. Gerald A. B. Yiran	Assistant Lecturer	Department of Geography and Resource Development	1-1, 1-4, 1-7, 1-8		
7	Prof. Mark Kofi Abekoe	Supervisor, Associate	Department of Soil Science	1-2		
8	Mr. George Owusu	Assistant Lecturer	Hydrology, Department of Geography and Resource	1-3, 1-5,1-7		
9	Dr. Oteng Ababio	Senior Lecturer	Department of Geography and Resource Development	1-5, 1-6		
10	Dr. Kwabena Awere Gyekye	Lecturer	Department of Geography and Resource Development	1-3, -1-7	Landscape Ecology	Team leader of Theme 1
11	Dr. Emmanuel Morgan Attua	Senior Lecturer	Department of Geography and Resource Development	1-6, 1-8		
12	Mr. Emmanuel Tachie-Obeng	Special Lecturer	Department of Geography and Resource Development	1-1, 1-5		

Ghana Meteorological Agency

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Mr. Zenede Minia	Director General	Ghana Meteorological Agency	2-2, 2-3	Climate Change	Transferred
2	Gp. Capt. Stephen Y. Komla	Director General	Ghana Meteorological Agency			
3	Miss Elikem Setsoafia		Ghana Meteorological Agency	2-1		
4	Mr. Ayilari-Naa Juati	Director	Ghana Meteorological Agency	2-1, 2-3	Weather Observation and Forecasting	Team leader of Theme 2
5	Mr. Amos Narh		Ghana Meteorological Agency	2-1	Operational Meteorology	
6	Mr. Peter Nunekpeku		Ghana Meteorological Agency	2-1		
7	Mr. Samuel Owusu Ansah		Ghana Meteorological Agency	2-1		
8	Mr. Charles Yorke		Ghana Meteorological Agency	2-2		
9	Mr. Dominic Pokperlaar		Ghana Meteorological Agency	2-2		
10	Mrs. Francisca Martey		Ghana Meteorological Agency	2-1		
11	Mr. Andrew Nkansah		Ghana Meteorological Agency	2-1, 2-3	Data Management	

University for Development Studies

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Prof. Gordana Kranjac-Berisavljevic	Professor	University of Development Studies,	2-2, 2,2, 2-3, 3-1. 3-5, 3-6,		
2	Dr. Francis Kwabena Obeng	Senior Lecturer	Faculty of Agribusiness and Communication Sciences	3-5, 3-6	Extension and Training	Team leader of Theme 3
3	Mr. Bizoola Zinzoola Gadaa	Lecturer/Researcher	Faculty of Agriculture (Nyankpala)	3-1, 3-2	On-farm Disaster/Management &SWC	Currently, Research in Holland from June 2014 - Oct 2014
4	Mr. Shaibu Abdul-Ganyu	Senior Lecturer	Faculty of Agriculture (Nyankpala)	2-1, 2-2	Hydrology	
5	Mr. Fauster Agbenyo	Lecturer	Department of Community Development (Wa)	2-3	Soil Science	
6	Dr.Togbiga Dzivenu	Executive Director	Center for Disaster Research and Education (Wa)	2-2, 3-1, 3-2, 3-3, 3-4		
7	Mr. Balma Yakubu	Lecturer	Faculty of agriculturebusines	3-4		
8	Mr. Frederick Dayuo	Lecturer	Department of Community Development (Wa)	3-1, 3-2		
9	Mr. Godfred Jasaw	Lecturer/Researcher	Department of Community Development (Wa)	3-1, 3-2		Currently, PhD student, UNU-IAS as CECARE long-term
10	Dr. Samuel A. Donkoh	Senior Lecturer	Faculty of Agribusiness and Communication Sciences	3-3	Economics	
11	Mr. Victor Lolig	Lecturer	Faculty of Agribusiness and Communication Sciences	3-3		
12	Dr. Richard Yeboah	Senior Lecturer	Faculty of Agribusiness and Communication Sciences	3-4, 3-5	Agribusiness	
13	Mr. Felix K. Abagale	Senior Lecturer	Faculty of Agriculture (Nyankpala)	3-3		Not listed in PO
14	Mr. Vincent Kodjo Avornyo	Lecture	Department of Agronomy, Faculty of Agriculture (Nyankpala)	3-3		PhD course in USA from June 2014 to Oct 2014

Institute for Natural Resources in Africa, United Nation University

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Dr. Elias T. Ayuk	Director	UNU-INRA	3-7	Agricultural Economist	
2	Mr. Kwabena Owusu Asubonteng	Geo-Information Analyst	UNU-INRA	3-1, 3-2, 3-3, 3-6		
3	Ms. Yasuko Kusakari	Socio-Economist Fellow	UNU-INRA	3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7	Rural Livelihoods and Local Capacity Developme	Currently, Ph.D. student, GPSS-GLI, Univ. of Tokyo and a member of Japanese expert
4	Dr. Timothy Koomson	Environmental Policy Fellow	UNU-INRA	3-4	Environment	Resigned
5	Dr. Gessesse Dessie	Capacity development fellow	UNU-INRA	3-4, 3-5		

Annex 10 List of the published original papers

Output 1

1) Ramu, K., Watanabe, T., Uchino, H., Sahrawat, K. L. Wani, S. P., Ito, O.: Fertilizer induced nitrous oxide emissions from Vertisols and Alfisols during sweet sorghum cultivation in the Indian semi-arid tropics, Science of the Total Environment, 438. pp. 9-14, 2012.
2) Mohan, G. and Matsuda, H.: Regional level total factor productivity growth in Ghana agriculture, Journal of Economics and Sustainable Development, Vol. 4, No.5, pp. 195-206, 2013.
3) Uchino, H., Watanabe, T., Ramu, K., Sahrawat, K. L., Marimuthu, S., Wani, S. P., Ito, O.: Effects of Nitrogen Application on Sweet Sorghum (Sorghum bicolor (L.) Moench) in the Semi-Arid Tropical Zone of India. JARQ - Japan Agricultural Research Quarterly, Vol. 47, No. 1, pp. 65-73, 2013.
4) Mohan, G., and Matsuda, H.: Regional level total factor productivity growth in Ghana agriculture, Journal of Economics and Sustainable Development, Vol. 4, No.5, pp. 195-206, 2013. http://www.iiste.org/Journals/index.php/JEDS/article/view/5017/5116
5) Mohan, G., Matsuda, H., Donkoh, S. A., Lolig, D. V., and Abbeam, G. D.: Effects of Research and Development Expenditure and Climate Variability on Agricultural Productivity Growth in Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 443-451, 2014.
6) Tachie-Obeng, E., Hewitson, B., Gyasi, E. A., Abekoe, M. K., and Owusu,G.: Downscaled Climate Change Projections for Wa District in the Savanna Zone of Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 422-431, 2014.

Output 2

1) Kobayashi, K. and Takara, K.: Development of a Distributed Rainfall-Runoff/Flood Inundation Simulation and Economic Risk Assessment Model, Journal of Flood Risk Management, DOI:10.1111/j.1753-318X.2012.01157, 2012.
2) Sawai, N., Takara, K., and Kobayashi, K.: Evaluation of water retention capacity and flood control function of the forest catchment, Journal on Food, Agriculture and Society, Vol. 1, No. 1 , pp. 13-22, 2013.
3) Kobayashi, K., and Takara, K.: Development of a Distributed Rainfall-Runoff/Flood Inundation Simulation and Economic Risk Assessment Model, Journal of Flood Risk Management, Vol. 6, Issue 2, pp. 85-98, 2013.
4) Samaddar, S., Yokomatsu, M., Dzivenu, T., Oteng-Abadio, M., Adams, M.R., Dayour, F., and Ishikawa, H.: Assessing Rural Communities Concerns for Improved Climate Change Adaptation Strategies in Northern Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 529-541, 2014.
5) Sawai, N., Kobayahsi, K., Apip, Takara, K., Ishikawa, H., Yokomatsu, M., Samaddar, S., Juati, A.-N., and Kranjac-Berisavljevic, G.: Impact of Climate Change on River Flows in the Black Volta River, Journal of Disaster Research, Journal of Disaster Research, Vol. 9 No. 4, pp. 432-442, 2014.

Output 3

1) Fujihara, Y., Yamada, R., Oda, M., Fujii, H., Ito, O., Kashiwagi, J.: Effects of puddling on percolation and rice yields in rainfed lowland paddy cultivation: Case study in Khammouane province, central Laos, Agricultural Sciences, Vol. 4, No. 8, pp.360-368, 2013.
2) Uchino, H., Watanabe, T., Ramu, K. Sahrawat, K. L. Marimuthu, S., Wani, S. P., Ito, O.: Calibrating Chlorophyll Meter (Spad-502) Reading by Specific Leaf Area for Estimating Leaf Nitrogen Concentration in Sweet Sorghum. Journal of Plant Nutrition, Vol. 6, No. 10, pp. 1640-1646, 2013.
3) Boafo, Y. A., Asiedu, A. B., Addo, K. A., Antwi, K. E., and Boakye-Danquah, J.: Assessing Landcover Changes from Coastal Tourism Development in Ghana: Evidence from the Kokrobite-Bortianor Coastline, Accra, Civil and Environmental Research, Vol. 6, No. 6, pp. 9-19, 2014.
4) Antwi, E.K., Boakye-Danquah, J., Boahen, A.S., Yiran, G., Seyram, K.L., Awere, G.K., Abagale, F.K., Asubonteng, K.O., Attua, M.E., and Owusu, A.B.: Land Use and Landscape Structural Changes in the Ecoregions of Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 452-467, 2014.
5) Avornyo, V.K., Ito, O., Kranjac-Berisavljevic, G., Saito, O., and Takeuchi, K.: Cropping Systems in Some

Drought-Prone Communities of the Northern Region of Ghana: Factors Affecting the Introduction of Rice, Journal of Disaster Research, Vol. 9 No. 4, pp. 475-483, 2014.

6) Boafo, Y.A., Saito, O., and Takeuchi, K.: Provisioning Ecosystem Services in Rural Savanna Landscapes of Northern Ghana: An Assessment of Supply, Utilization, and Drivers of Change. Journal of Disaster Research, Vol. 9 No. 4, pp. 501-515, 2014.
7) Boakye-Danquah, J., Antwi, E.K., Saito, O., Abekoe, M.K., and Takeuchi, K.: Impact of Farm Management Practices and Agricultural Land Use on Soil Organic Carbon Storage Potential in the Savannah Ecological Zone of Northern Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 484-500, 2014.
8) Kranjac-Berisavljevic, G., Abdul-Ghanyu, S., Gandaa, B.Z., and Abagale, F.K.: Dry Spells Occurrence in Tamale, Northern Ghana – Review of Available Information. Journal of Disaster Research, Vol. 9 No. 4, pp. 468-474, 2014.
9) Kusakari, Y., Asubonteng, K.O., Jasaw, G.S., Dayour, F., Dzivenu, T., Lolig, V., Donkoh, S.A., Obeng, F.K., Gandaa, B., and Kranjac-Berisavljevic, G.: Farmer-Perceived Effects of Climate Change on Livelihoods in Wa West District, Upper West Region of Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 516-528, 2014.
10) Lolig, V., Donkoh, S.A., Obeng, F.K., Kodwo, A.I.G., Jasaw, G.S., Kusakari, Y., Asubonteng, K.O., Gandaa, B., Dayour, F., Dzivenu, T., and Kranjac-Berisavljevic, G.: Households' Coping Strategies in Drought- and Flood-Prone Communities in Northern Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 542-553, 2014.
11) Otsuki, K., Jasaw, G.S., and Lolig, V.: Framing Community Resilience through Mobility and Gender, Journal of Disaster Research, Vol. 9 No. 4, pp. 554-562, 2014.

Output 1~3

1) Antwi, E.K., Otsuki, K., Saito, O., Obeng, F.K., Gyekye, K.A., Boakye-Danquah, J., Boafo, Y.A., Kusakari, Y., Yiran, G.A.B., Owusu, A.B., Asubonteng, K., Dzivenu, T., Avornyo, V.K., Abagale, F.K., Jasaw, G.S., Lolig, V., Ganiyu, S., Donkoh, S.A., Yeboah, R., Kranjac-Berisavljevic, G., Gyasi, E.A., Minia, Z., Ayuk, E., Matsuda, H., Ishikawa, H., Ito, O., and Takeuchi, K.: Developing a Community-Based Resilience Assessment Model in Northern Ghana. Journal of Integrated Disaster Risk Management.

Note: This is a result that the Project classified the papers into the most related Output. One article may not be related to only one Output.

Source: SATREPS Mid-tern Report, August 2014

２．質問票

List of questions:

During the interview survey and focus group discussion, all or some of the following questions will be asked by interviewers. Although the list of questions is in the form of a questionnaire, you do not have to write answers in advance. However, it would be a great help if you read it through in advance, and prepare for interviews and focus group discussions.

Name: _____

Organization and designation: _____

Period of your engagement in the Project：_____～_____

1. Your duties regarding CECAR Research

1.1 (For ALL Respondents) Could you kindly describe your duties in the Project?

1.2 (For ALL Respondents) Could you kindly describe your duties regarding Climate Change Adaptation in general?

2. About implementation process

2.1 (This is a question for those who participate in the JCC meetings). The Joint Coordinating Committee (JCC) was formed at the inauguration of the Project. Do this Joint Coordinating Committee and its meetings function adequately to support the Project? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

2.2 (This is a question for the Project Director and the Project Manager).

a. Overall satisfaction level with the progress of the Project

❑Adequate ❑Not adequate ❑No opinion

b. (For ALL Respondents) What is your role in the Project? Do you play the role adequately to support the Project? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved?

2.3 (This is a question for those who are counterpart researchers of each theme). Do your research team and its operational system function adequately to support the Project? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

2.4 (For ALL Respondents) How do you monitor the progress of the Project and share its monitoring information? Please describe the way you monitor the progress.

2.5 (For ALL Respondents) Does the monitoring mechanism you have mentioned above function adequately to monitor the progress of the project and share its information? If adequate, why you consider it is adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

2.6 (For ALL Respondents) Do Ghanaian C/Ps and Japanese experts communicate adequately enough to implement the Project efficiently and effectively? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

2.7 (For ALL Respondents) What are the major challenges that you have faced while implementing the Project? How do you overcome such difficulties? Please provide us some examples.

2.8 (For ALL Respondents) Has your attitude towards work/ your duties changed

before and after the Project? If so, how? Please explain.

3. Relevance: a criterion for considering the validity and necessity of the project

3.1 (For ALL Respondents) Does the Project adequately meet your needs? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

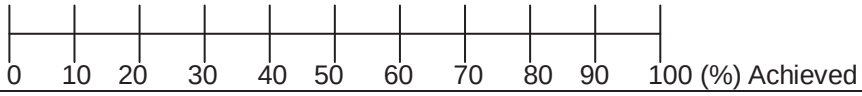
3.2 (For ALL Respondents) Are suggestions and technologies used in the Project appropriate? Please describe your opinion.

❑ Appropriate ❑Not appropriate ❑No opinion

3.3 (For ALL Respondents) Did you learn something new and useful suggestions from Japanese experts? If so, provide some examples.

4. Effectiveness : a criterion for considering whether the implementation of project will benefit the intended beneficiaries

4.1 (For ALL Respondents) Looking at the present situation, how much do you think the project purpose "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." is being achieved? Please describe the present achievement status.



4.2 (For ALL Respondents) Do you think that the project purpose will be achieved within the Project period (before May of 2017)? Please provide us the reason of your choice.

❑Will be achieved ❑Will not be achieved ❑No opinion

4.3 (For ALL Respondents) Do three outputs contribute enough to achieve the project

purposes? If not enough, what kind of additional outputs are necessary? Give us your opinions.

❑ Enough ❑Not enough ❑No opinion

5. Efficiency : a criterion for considering how economic resource / inputs are converted to results

5.1 (For ALL Respondents) Have the activities been sufficient to produce the outputs? Any additional activities that you would like to request for the rest of the project period?

5.2 (For ALL Respondents) Have Japanese experts been dispatched adequately in terms of their expertise, numbers of experts, period and timing in order to carry out the planned activities written in PDM? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved? Need more experts, or request longer stay?

❑Adequate ❑Not adequate ❑No opinion

5.3 (For ALL Respondents) Has provision of equipment been adequate in terms of variety, quantity and timing? If adequate, please describe why you consider it was adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

5.4 (Only to those who participated in trainings in Japan) Title of the training course and the period of the participation.

5.5 (Only to those who participated in trainings in Japan) Was the training course useful? If so, especially what was useful? If not so useful, how do you think the training could be improved?

❑Useful ❑Not useful ❑No opinion

5.6 (Only to those who participated in trainings in Japan) Considering practical

application of the techniques in your country, are the technical level of the course too specialized (high) or not too specialized (low)?

❑ Too specialized ❑ Adequate ❑ Not too specialized

5.7 (Only to those who participated in trainings in Japan) Could you kindly give us some examples of practical applications in your country? What are the learning and techniques that you utilize now, and how do you apply to your work now?

5.8 (For ALL Respondents) Are Ghanaian C/Ps allocated adequately in terms of their expertise and numbers in order to carry out the planned activities? If adequate, please describe why you consider it is adequate. If inadequate, how do you think it could be improved?

❑Adequate ❑Not adequate ❑No opinion

6. Impact : a criteria for considering the effect of the project with an eye on the longer term effects including direct or indirect, positive or negative, intended or unintended

6.1 (For ALL Respondents) Is the overall goal of the Project, "The Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be incorporated in international environmental policies", likely to be achieved in the future (after 5 to 10 years) with the Project's contribution? If "unlikely to be achieved", please describe how do you think the project should have been carried out.

❑Likely to be achieved ❑Unlikely to be achieved ❑No opinion

6.2 (For ALL Respondents) Will any other impact, change, influence of the positive and negative that the Project brought other than progress for the achievement of project purpose and outputs be expected, such as impact for relevant policy and strategies, technology , poverty reduction, socially vulnerable, gender, and environment?

7. Sustainability : a criteria for considering whether produced effects continue after the completion of the project

7.1 (For ALL Respondents) Are the learning and experiences obtained from the Project (the research) mainstreamed (became a part of the work) within your institution at present? How about at the end of the Project?

Present	❑ Mainstreamed	❑Little mainstreamed	❑ No opinion
At the end of the Project	❑ Mainstreamed	❑Little mainstreamed	❑ No opinion

7.2 (For ALL Respondents) Are the learning and experiences (research output) obtained from the Project shared with other relevant organizations and stakeholders? How about at the end of the Project?

Present	❑ Shared	❑Little shared	❑ No opinion
At the end of the Project	❑ Shared	❑Little shared	❑ No opinion

7.3 (For ALL Respondents) What can the Project do from now on in order to secure the sustainability of the Project?

By the Japanese experts

By the Ghanaian C/P (incl. financial/management aspect if necessary)

7.4 (For ALL Respondents) Do you think your institution will continue tackling Climate Change Adaptation after the Project? (Note: Examine the situation in terms of financial, organizational and technical aspects.)

8. Others

8.1 Any other comments that you would like to add?

Thank you for your cooperation.

MINUTES OF MEETING
BETWEEN JAPANESE MID-TERM REVIEW TEAM AND THE AUTHORITIES CONCERNED OF THE REPUBLIC OF GHANA ON THE TECHNICAL COOPERATION PROJECT (SATREPS) FOR THE PROJECT ON ENHNCING RESILIENCE TO CLIMATE AND ECOSYSTEM CHANGES IN SEMI-ARID AFRICA: INTEGRATED APPROACH

Japan International Cooperation Agency (hereinafter referred to as "JICA") organized the Mid-term Review team, headed by Mr. Masanori KURISU, and visited Ghana from September 14 to September 30, 2014, for the purpose of conducting the Mid-term Review on the Project for Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach (hereinafter referred to as "the Project").

The Joint Review Team (hereinafter referred to as "the Team"), which consists of four members from Japan and four members from Ghana, was formed. After intensive study and analysis of the activities and achievements of the Project, the Team prepared the Joint Mid-term Review Report (hereinafter referred to as "the Report"), and presented it to the Joint Coordinating Committee (hereinafter referred to as "JCC") held on September 29, 2014.

The JCC understood the contents of the Mid-term Report attached hereto.

Accra, September 29, 2014

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Joint Mid-term Review Report

for

the Project on Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach in the Republic of Ghana

September 29, 2014

Mr. KURISU, Masanori
Team Leader
Japanese Mid-term Review Team
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Mr. Francis Mensah
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Economics Officer
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ANNEXES:

Abbreviations

AAP	Africa Adaptation Program
GHS	Ghana Cedi
GIS	Geographical Information System
GMet	Ghana Meteorological Agency
GOG	Government of Ghana
GOJ	Government of Japan
JCC	Joint Coordination Committee
JPY	Japanese Yen
MOFA	Ministry of Food and Agriculture
MOF	Ministry of Finance
NADMO	National Disaster Management Organization
NCCAS	National Climate Change Adaptation Strategy
NCCC	National Climate Change Committee
NCCP	National Climate Change Policy
NCCPF	National Climate Change Policy Framework
R/D	Record of Discussion
UDS	University for Development Studies
UG	University of Ghana
UNDP	United Nations Development Plan
UNU-INRA	United Nations University-Institute of Natural Resources in Africa
USD	United States Dollar

1. Introduction

1-1 Background of the Review

On the basis of the request from the Government of Ghana, Japan International Cooperation Agency (JICA) launched the five-year technical cooperation project (SATREPS: Science and Technology Research Partnership for Sustainable Development) entitled "Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach in the Republic of Ghana," (herein after referred to as "the Project") on May 2012, under the implementation structure consisting of University of Ghana (UG), Ghana Meteorological Agency (G-Met), University for Development Studies (UDS) and the United Nations University-Institute for Natural Resources in Africa (UNU-INRA) as counterpart research institutes from Ghanaian side, and University of Tokyo, University of Kyoto, and United Nation University - Institute for the Advanced Study of Sustainability (UNU-IAS) as research institutes from Japanese side.

As two and half years have passed since the commencement of the Project, JICA has conducted the Mid-term Review to confirm challenges and direction of the Project for the betterment of the project activities in the remaining project period.

1-2 Objectives of the Review

The objectives of the Mid-Term Review are outlined as follows:

(1) To review and confirm the progress and achievements of the Project based on the Project Design Matrix (PDM)
(2) To identify the promoting and inhabiting factors, if any, for project implementation
(3) To analyze and evaluate the Project in terms of the five evaluation criteria, namely relevance, effectiveness, efficiency, impact and sustainability
(4) To recommend necessary measures to be taken during the latter half of the Project for further improvement of the Project

1-3 Member of the Review Team

The Joint Mid-term Review Team (hereinafter referred to as "the Team") was organized with the following members from both the Japanese and Ghanaian sides.

(1) Japanese Evaluation Team

Job Title	Name / Position
Team Leader	Mr. KURISU, Masanori Director, Aid and Semi-Arid Farming Area Division 2, Rural Development Department, Japan International Cooperation Agency (JICA)
Evaluation	Ms. NAKAMURA Misuko Consultant, Kokusai Kogyo Co., Ltd.
Science and Technology Planning/Evaluation	Dr. YASUOKA, Yoshifumi Prof. Emeritus, The University of Tokyo Program Officer, Japan Science and Technology Agency (JST)
Science and Technology Planning/Evaluation	Ms. TAKAHASHI, Miho Assistant Program Officer, Dept. of International Affairs, Research Partnership for Sustainable Development Group, JST

(2) Ghanaian Evaluation Team

Job Title	Name / Position
Team Leader	Mr. Francis Mensah, Economics Officer, (Japan/ Korea/China - Schedule Officer), Ministry of Finance
Member	Mr. Bernard Ayensu, Policy, Planning and Monitoring and Evaluation Officer, Ministry of Education
Member	Mr. Kingsley Kwako Amoako, Envt. Land and Water Management Unit, Directorate of Crop Services, Ministry of Food & Agriculture
Member	Mr. Mahama A. Nuhu, Deputy Director, Research, Statistics and Information Management, Ministry of Communications

1-4 Schedule of the Review

The schedule is attached as Annex 1.

1-5 Methodology of the Review

1-5-1 Design of the Review

The Team formulated The Evaluation Grid which identified the specific review points and the data collection methods as shown in Annex 5

1-5-2 Data collection Methods

For the data and information collection, the Team applied various methods such as analysis on reports, interviews with counterparts researchers (hereinafter referred to as the "C/P"), JICA experts (researchers), administrative officers, community leaders and members in the Project's targeted communities, based on the questionnaire, group discussions and the observation of the project site and the provided equipment in use. The details of interviewees is attached as Annex 2

1-5-3 Points for the Review and Analysis

(1) Achievements and Implementation Process of the Project

Achievement of the Project was reviewed in terms of Inputs, Activities, Outputs, and Project Purpose based on materials showing the framework of the Project such as the Record of Discussion (R/D), PDM, and Plan of Operations (PO). Implementation of the Project was examined to see if the activities had been implemented according to the schedule described in the PO, to see if the Project had been managed properly, and to identify promoting and inhabiting factors that had affected the implementation process.

(2) Five Evaluation Criteria

In addition to the review of the achievement and implementation process, the Team reviewed the Project from the viewpoints of the following Five Evaluation Criteria.

Table1-1: Definitions of Five Evaluation Criteria

Five Criteria	Definitions by "the JICA Evaluation Guideline"
Relevance	Relevance refers to the validity of the Project Purpose and the Overall Goal in connection with the development policy of the government of Ghana and assistance policy of Japan.
Effectiveness	Effectiveness refers to the extent to which the expected benefit(s) was (were) brought about as a result of the Project.
Efficiency	Efficiency refers to the productivity of the implementation process. It examines

	whether the inputs of the Project have been efficiently converted into the outputs.
Impact	Impact refers to direct and indirect, positive and negative impacts caused by the implementation of the Project, including the extent to which the Overall Goal has been attained.
Sustainability	Sustainability refers to the extent to which the Project can be further developed by the Ghanaian authorities concerned and the extent to which the benefits generated by the Project can be sustained under the national policies, technology, systems and financial state.

2. Outline of the Project

The outline of the Project is as shown in the following table. Details of the Project are as shown in PDM (Annex 3) and PO (as of 5 August 2013, Annex 4).

Table 2-1: Outline of the Project

Project Title		Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach in the Republic of Ghana
Cooperation Period		5 years (2012 - 2017)
Target Group		Counterpart researchers, local engineers, local residents in Northern Ghana, Ghanaian administrative officers and policy makers
Target Area		Northern Ghana (The Three (3) Northern Regions of Ghana) (Northern Region, Upper East Region, Upper West Region)
Overall Goal		The Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be incorporated in international environmental policies.
Project Purposes		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.
Outputs	**Output 1**	Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed
	Output 2	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
	Output 3	Institutional and engineering capacity development programs for local communities and engineers are developed and implemented

(Source: PDM of the Project)

3. Achievements and Implementation Processes of the Project

3-1 Inputs

The Team has confirmed that the Project has provided the following inputs along with the plan stated in PDM and PO, i.e. in Annex 3 and 4.

3-1-1. Inputs from the Japanese side

(1) Assignment of Japanese Experts

A cumulative total of 36 Short-term Experts (Researchers) in the 12 fields of expertise such as Chief Adviser, GIS Analysis, Meteorology, Flood Management, Disaster Risk Management, Resilience Evaluation, Resilience Strategy, Agronomy and so forth, have been dispatched to the Project from May 2012 until August 2014. The total duration of their assignments by the end of August 2014 is approximately 29.50 man/months, the details of which are shown in Annex 6. In addition, 2 Project Coordinators have been dispatched. The total duration of their assignments by the end of August 2014 is approximately 29 man/months.

(2) Training of C/P in Japan

A cumulative total of 9 C/Ps participated in the training in Japan. The details of training are shown in Annex 7. 1 C/P from UDS is currently studying at PhD course of UNU-IAS as a long-term trainee of the Project.

(3) Provision of Equipment

Machinery and equipment of approximately total value equivalent to 21.3 million JPY (777,590 GHS) have been provided for the Project activities. (Exchange rate GHS 1.0 = JPY 27.4 as of September 2014). The list of these machinery and equipment are shown in Annex 8.

(4) Local Operation Cost

A total amount of 807,765.85 GHS (approximately 22 million JPY with exchange rate GHS 1.0 = JPY 27.4 as of September 2014) has been provided for the necessary expenses to carry out project activities as of the end of August 2014. The details are as shown in Table 3-1. The cost includes computers, UPS and refurbishment of office space for the Project office, travel cost and fuel for field survey, field allowances, GIS training, workshops and various activities such as JCC, international conference and so forth.

Table 3-1: Local Expenses borne by the Japanese Side (GHS)

Fiscal Year(*1)	2012	2013	2014	Total
Total Local Expenses	252,79.82	314,996.21	239,972.82(*2)	807,766.85

Note *1: Japanese Fiscal Year (April – March). Note *2: Figures are based on the accounts settled by the end of August 2014.
Source: Documents prepared by the Project

3-1-2. Inputs from the Ghanaian side

(1) Assignment of Counterparts

A cumulative total of 42 counterpart personnel assigned to the Project: 12 from UG, 11 from G-Met, 14 from UDS, and 5 from UNU-INRA at the time of the Review. The details are shown in Annex 9.

(2) Provision of Land and Facilities

The necessary project office spaces for the Project members have been provided by UG, G-Met, UNU-INRA, and UDS (Nyankpala and Wa campuses). Installation places for the provide equipment as well as land for Automatic Weather Station (AWS) in Yendi, Bole, and Salaga, have been also provided. GIS Resource Center has been established by UNU-INRA, and image processing software, GPS, and electronic meeting system were provided by the Project to support the Resource Center.

(3) Project Operational Cost (Counterpart Fund)

Travel and daily allowance for Ghanaian C/Ps have been expected to be borne by counterpart funds of the implementing agencies (i.e. UG, G-Met and UDS), which are supposed to be allocated by the Government of Ghana. Ghanaian side has started to make an effort to secure the budget, but it has not been realized yet.

3-2 Achievement of the Outputs

The Team reviewed the achievement of the Output including inputs and output indicators to measure the achievement of the Project purpose as well as the implementation processes of the Project, the results of which are described in the following.

The Project has implemented most of its activities as per the plan stipulated in the PDM and PO with some slight changes of PO regarding Output2. It has been confirmed that the Project has implemented its activities, without notable delays and could manage to cope up with any unprecedented difficulties encountered in the process. As a whole, it is expected by both the Japanese and Ghanaian sides that 50 % or more Outputs will be achieved by the end of March 2015. The Team examined the activities and achievement of the outputs so far as follows.

Output 1 Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed

Activities and Achievements:

In order to build a regional climate change prediction model and use the model to make predictions, the method of dynamic downscaling of selected past wet/dry years in the Ghana region was used to understand mechanisms of local weather and climate. As a result, although it must be remembered that the results are not foolproof, the actual rainfall situation in Ghana has been ascertained. Especially it was indicated that the possibility of local rainfall resulting from interaction between local atmospheric circulation in the peripheral of Lake Volta, the center of Ghana, and the African monsoon.

In parallel to the modeling of climate change, for assessment of the impact of climate change on agricultural production on eco-systems, the Total Factor Productivity (TPF), which is an attempt to measure productivity taking into account all factors of production and linking them to an aggregate production function, has been estimated, and it was expected from the result that without taking any measures, the trend of stagnation of agricultural productivity in Ghana will continue. In addition to the above analysis from macro and semi-micro points of view, detailed household surveys were conducted on a total 150 households of 6 target communities in Tolon District, and 81 households in Wa District in order to understand the real agroeconomic situation and measures to adopt climate change. The results of the survey are in the process of analysis. Based on these research activities, it is concluded that it is important to clarify the impact of climate change on agricultural productivity and formulate strategies such as improvement of agricultural production methods and selection of appropriate varieties of crops.

Furthermore, the Project also conducted the surveys on regional land utilization in the ecoregions of Ghana, soil distribution and farm management in the target communities by a combination of satellite data and field based research. As a result, in Northern Ghana, land and forest near water sources such as wet lands have been converted to agricultural land, and further analysis on detailed relationship between agricultural productivity and land utilization change, and climate change impacts are expected.

As mentioned later in Output 3, the Project developed integrated ecological, engineering (physical and material) and socioeconomic resilience indicators to develop with an index (methodology) to quantify the resilience status of communities in flood prone semi-arid region of Africa. The team has also provided community boundary maps and asset maps and an extensive database to other thematic groups

Based on the above research activities, five (5) research papers have been published so far, and several papers have been prepared, as shown in Annex 10.

Output 2: 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

Activities and Achievements:

In order to construct the satellite remote sensing and ground-based observation network, the Project has installed two (2) data servers at G-Met and UDS, and initiated its operation at G-Met after the C/P training in Japan on how to use data servers. The Project has also installed three (3) Automatic Weather Stations in Yendi, Bore, and Salaga, all of which are located in the target area, which are connected to G-met Headquarter. Then, the Project compared the satellite data (GSMap) and ground-based rain gauge observation data and clarified the correlation between the above data. Based on the correlation, a function to calibrate the semi-real time satellite data to ground-based rain gauge data has been added to the data server.

As for precipitation, the Project has initiated a study to establish extreme weather precipitation techniques using Weather Research and Forecasting (WRF), and after the experimental operation, transferred the techniques to C/Ps through the C/P training using the same data server installed in Ghana. After the training, the C/P were able to install the software by themselves.

The Project has also developed a run-off/inundation model and the model is in the process of being adjusted using data from flooding in 2007 in Ghana. Due to difficulties to collect hydrological data (i.e. flow and water level data) for verification, the Project also has initiated development of a tool to detect flooding areas. The study on scenario of runoff/inundation is to be initiated after the completion of the above models. For the development of a drought scenario, the Project has initiated to collect field data for verifying satellite data by providing soil moisture sensors.

As a result of analysis of social and environmental data in the target communities, which is necessary for risk assessment of extreme weather risk in the sub-catchment of the Volta River, the Project found that the communities perceived droughts as more serious disaster than floods. Thus, the study on prototypes (pilot initiatives) for the management of water resources has been initiated a year earlier than scheduled. And also, in order to enhance the study for mitigating the impact of droughts, field experiments for drought monitoring and development of cropping methods resilient to droughts have been initiated by initiative of the researchers from UDS. The Project has compiled the following findings so far as a result of surveys assessing vulnerability to floods and droughts, current water resources management, and locally appropriate water resources management methods:

- Drinking water risk (lack) is the most significant and observable problem in the area.
- Communities own initiatives for climate change adaptation are negligible, because livelihood risks are predominant among all communities. Absolute poverty and lack of economic opportunities have increased the susceptibility of communities to disaster risks.
- As their livelihoods are affected by droughts in upland areas, subsequently the local community becomes more exposed to floods and other natural calamities in order to maintain their livelihoods.
- Improving irrigation facilities through rainwater harvesting and watershed management and seasonal weather forecasting are found to be most preferred adaptation strategies.
- Though high intention of adopting non-structural preventive measures is observed, local communities reported that lack of knowledge and financial resources are major impediments to their implementation

Based on the above research activities, five (5) research papers have been published so far, as shown in Annex 10.

Output 3: Institutional and engineering capacity development programs for local communities and engineers are developed and implemented

Activities and Achievements:

As a part of efforts to select the target site of the Project, the Project prepared a background conceptual paper to define the resilience in the context of the Project. (referred to Output 1), which is currently in the process of publishing. As a method of community site selection, the Project has developed three level of "Resilience", i.e. ecological, engineering, and socio-economic, and three levels of "Vulnerability", i.e. physical/material, social organizational/institutional, and motivational/ attitudinal, to assess potential project sites in the target districts, and established a conceptual framework for studying site selection.

Researchers from both the Japanese and Ghanaian sides jointly visited communities in the selected district to work on site selection, and preliminary filed surveys were also conducted. All research group members from Output 1 to 3 participated in discussion of this site selection and a task force team was established consisting of key members from all research groups to conduct assessment and propose the potential site to the Project. Finally, the Project selected 10 target communities in total as listed in Table 3-2.

Table 3-2: Summary of Community Site-Selection

Region	Selected District	Type of extreme events	Name of communities	
			Less Resilient	More Resilient
Northern Region	Tolon	Drought-prone	Cheshegu, Gabogshie, Zagua	Fihini, Yoggu, Kpaligum
Upper West Region	Wa West	Flood–prone (Overflow from Black Volta)	Bamkpama, Zewayeli	Chietanga, Baleuhili

Source: Documents provided by the Project

The field survey on all 36 households at Fihini in Tolon district was conducted to understand the outline of the community and later a detailed farm field survey was conducted on 17 selected households to understand farming activities. In relation to the farming activities, and to find out the promoting drivers to develop the capacity of farm households, local administrative officers and engineers, a field survey on governance system and a socioeconomic household survey was conducted in both the target districts, i.e. Tolon and Wa West. Also, the cropping situation of the main crop of produced by women such as groundnuts and o-kra, and the effects on their households and a study on value chain of shea butter production, the growing of which is one of the most significant economic activities by women in Northern Ghana, is on-going.

Based on the above activities, various survival strategies in the event of extreme climate change by farm households and perceptions of climate change effects have been found as critical findings to formulate and propose capacity development programs to enable the farmers to adapt their farming activities and to enable local administrative officers and engineers to come up with appropriate adaptation strategies. At the time of the Mid-term Review, it was found that eleven (11) research papers on this Output (theme) had already been published as shown in Annex 10.

3-3 Prospects of Achievements of the Project Purpose

Project Purpose: 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.

On the whole, the Project activities have been implemented on schedule and relevant data have been acquired and analyzed by the three thematic research teams to generate critical findings. The outcome of the research activities of the Project so far have been published as a Special Issue of the Journal of Disaster Research Vol.9 No.4 in August, 2014, and the Project held an International Conference to present research findings, as well as community workshops in the target communities to verify the fact and to discuss with local communities.

Therefore, at the middle-point of the Project cooperation period, it is considered that basis for achieving the Project Purpose has been established. It is thus generally assumed that the Project will utilize the findings of all three research groups (Outputs), propose the options enhancing resilience to climate and ecosystem change based on the vulnerability assessment developed as a methodology by the Project, formulate capacity development programs in terms of institutional and engineering solutions for natural resource management, and eventually establish integrated approach to enhancing resilience of target groups to overcome their vulnerability. i.e. the Ghana Model by the end of the cooperation period.

3-4 Implementation Processes of the Project

(1) Decision making and monitoring mechanism

The Joint Coordinating Committee (JCC), which is the decision-making body of the Project, was held 2 times to confirm the progress of the Project activities, to approve the activity plans for the upcoming period, and to discuss other issues related to the Project implementation. Along with the JCC, project researchers' meetings, field trips, researchers' workshops and other joint activities were conducted to share the research methods, contents and progress of each research groups. In addition, the project operation meetings were held several times via remote telephone conference, and sometime in Ghana and in Japan, as a platform to coordinate project activities including conducting field surveys, preparation of training program in Japan, division of roles and responsibilities of various tasks and so forth, and to discuss operational issues related to the project implementation. The core counterparts, who participated to JCC, share with the Team, during interviews, that decision making and monitoring mechanism of JCC is functioning very well. However, it was reported from the leaders of Ghanaian C/P institutions that the frequency of opportunities to share findings of the activities, exchange ideas, and control the direction of upcoming activities on time among all the Project teams and stakeholders is not sufficient, although the Project has been making efforts to do that through researchers' meeting or workshops before or after the JCC as mentioned above. The team also shared the view with them that scarce involvement of some stakeholders in JCC, and more frequent opportunities to interact with the stakeholders would encourage more commitments in future..

(2) Coordination and communication among the Project personnel of the Project

At the initial stage, a task force team for the site selection of the Project, which consisted of representative members from each C/P institutions of both the Japanese and the Ghanaian sides, were established, and the team successfully contributed to set the criteria and conduct field survey and data collection in a collaborative manner of all the Project personnel. As for the Project activities of each theme group so far conducted, which were mostly focused on data collection and analysis for each thematic topics, the Team confirmed that there were no notable problem in communicating within the group including Japanese experts.

The Team shared the views with some C/Ps, during interviews, that research planning has been somewhat made by the Japanese side and the process has not been fully shared with the Ghanaian side, which caused difficulties for C/Ps to contribute to further improvement of field activities and initiate their own research activities related to the Project.

(3) Other hampering factors

The Team found that the Project members faced difficulties related to operational expenditure for the Project activities. It was pointed out that the amount of annual budget allocated to the Project had not been shared and internal rules and procedures for the CP to access the Project budget had not been clear. This is because the Ghanaian side was new to JICA's budgetary system, which is totally different from usual practice of other research fund.

Although it hampered the motivation of some C/Ps for active participation in the research activities of Project, the situation is beginning to change as the Project coordinator is now trying to organize and disclose the internal rules of operational expenditure in the Project officially, and also, it is planned to share the annual budget plan of the Project according to Japanese fiscal year with Ghanaian side in the latter half of project cooperation.

4. Results of the Evaluation based on the Five Criteria

The relevance, effectiveness, efficiency, impact and sustainability of the Project were assessed, the major findings of which are described in the section below.

4-1 Relevance

The relevance of the Project is evaluated as **High** based on the following confirmations:

(1) Relevance to the development policies and sector programs of GoG

The Government of Ghana (GoG) formulated Ghana National Climate Change Policy (NCCP) in 2013, which emphasize the importance of enhancement on national resilience to disaster and active and effective risk reduction. There has not been any notable change in the major thrust of climate change policy from the previous policies, i.e. Ghana National Climate Change Policy Framework (NCCPF) and National Climate Change Adaptation Strategy (NCCAS), which are still relevant to the scope of the Project. The Project is thus considered to be very much consistent with these policy directions of GoG.

(2) Consistency with the ODA policies of GoJ

In the Country Assistance Policy for the Republic of Ghana of Government of Japan (GoJ) formulated in April 2012, agricultural development is set as one of its four priority areas. The Project is regarded under the above prioritized area. Also, Ghana was a target country for Africa Adaptation Programme (AAP) which has been implemented from 2008 to 2012, under the Japan-UNDP Joint Framework for Partnering to Address Climate Change in Africa to support African countries' efforts at addressing and adapting to climate change at national, sub-national and community levels. Based on policies adopted by the GoJ, JICA has actively extended support to mitigation, adaptation, and mechanism to accelerate mitigation and adaptation in developing countries, according to the following principle: 1) climate compatible sustainable development, 2) comprehensive assistance using an array of schemes, and 3) collaboration with development and climate partners. From these viewpoints, it is assessed that the relevance of the Project to the Japanese aid policies is secured.

(3) Relevance to the needs of target beneficiaries

Northern semi-arid area of Ghana constantly suffers from natural disasters (i.e. flood and drought) and is particulary vunerable since agriculture is the key industry in the area, which is sensitive to negative effect of climate change. The needs for capacity building of researchers which would enable the building of climate change measures in agriculture, water resource, and disaster management field in the area still remains high.

4-2 Effectiveness

The effectiveness of the Project is assessed as **High – Moderate** though the following observation:

(1) Achievement of the Project purpose

On the whole, the Project activities have been implemented as scheduled although some activities were delayed due to the delay of procurement of equipment and so forth. As a result, the Project has acquired forecasting methods for climate and ecosystem change and weather precipitation model and inundation model for prediction and risk analysis of extreme weather events, and has continued to accumulate and analyze various data of target communities. The Project has initiated to discuss the resilience enhancing options from ecological, engineering and socioeconomic aspects, based on the findings of each thematic research group and the developed conceptual framework, for example, options related to agricultural and bio-diversity, diversity and drought resistance of crop varieties and soil environment as ecological resilience; options related to early warning system of weather information, rain water collection methods, and water storage techniques and so forth as engineering resilience; and diversity of livelihood and income source, cooperation within/between communities at the time of disaster, and educational program for disaster risk reduction as socioeconomic resilience.

Therefore, it is considered that basis for achieving the Project Purpose "An Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes in Northern Ghana will be developed as the 'Ghana Model'" has been established

A road map to establish and implement the Ghana Model has not been well discussed yet by all of the three research groups. At the early stage in the latter half of the Project, it is expected that outline of the integrated approach will be proposed based on the data acquired and consequent analyses under the improved collaboration among three research groups, in consideration of implementing capacity development programs according to meteorological cycle and seasonality of agricultural activities in the target areas.

(2) External conditions

There has not been any notable influence caused by the changes of the external conditions.

4-3 Efficiency

The efficiency of the Project is considered as **High - Moderate**, based on the following consideration:

(1) Japanese experts

The Japanese experts in the relevant fields of expertise have properly played their expected roles in the course of the implementation of the Project, which have been appreciated by the counterpart personnel.

(2) Machinery and equipment

The machinery and equipment required for the Project activities and technical transfer have been almost duly provided except the ones related to Output 2, and all the provided have been kept in good conditions. Due to the time took to formulate specifications and select a dealer, and other difficulties, the installment of AWS was delayed, which led to the delay of purchase of other equipment, although the Project implementation could be managed without critical problems. These machinery and equipment are fully utilized in research, training, and management of the Project.

(3) Training of the C/Ps in Japan

Those who have attended the overseas training under the arrangement of the Project generally assess the subjects of the training as relevant and adequate. The training participants unanimously appreciated the

usefulness of the training and most reported that they have applied knowledge and the skills learnt in carrying out both the activities of the Project and the other regular work activities. Based on the curriculum developed by the training participants during overseas training on GIS, training programs have been already implemented by the Project personnel in Ghana as a preliminary activity for capacity development program.

Although the Team noted that the training participants from UDS currently could not practice the learned GIS techniques after the training due to lack of facilities and software on campus, the Team confirmed that the Project would start capacity development program related to GIS technologies at UDS in the latter half of project cooperation.

(4) Inputs from the Ghanaian side

The counterpart personnel were assigned from all C/P institutions to participate in the Project activities. It should not be denied, however, that the degree of their involvement has been somewhat limited, although the problem has been a lack of secured budget (counterpart fund) to cover the expenses to implement the Project activities. The Ghanaian side has started to make an effort to secure the budget, but it has not been realized.

The provision of the office spaces with basic facilities for the Project has contributed to the smooth management of the Project. Land for three (3) AWSs at some stations of G-Met has been provided and all AWSs are functioning. However, it should be noted that the security measure, i.e. fencing of AWS installation sites has not been fully provided. It requires urgent execution on the Ghanaian side's responsibility. Also, it should be taken into consideration when the additional AWSs are provided.

(5) Utilization of Indigenous Knowledge

The Project has utilized locally adapted traditional knowledge and existing relevant local research findings, and documented information. Therefore, the Project could build the research findings on existing knowledge rather than starting from a blank slate.

4-4 Impact

As it is premature and difficult to describe the Impact of the five-year project at the moment of the Mid-term Review, however, the expected impacts of the Project are generally evaluated to be **Positive**, and a provisional description are as follow.

(1) Policy aspect

Since the Project Purpose of the Project is highly relevant with the context of climate change policy by the Government of Ghana, it is highly possible that the integrated approach to enhancing resilience to climate and ecosystem changes in Northern Ghana will be applied for the other regions and national level, as one of the climate change adaptation plans, if the approach is adopted or utilized by the relevant government institutions related to the Project activities, i.e. Observers for the JCC of the Project, including Ministry of Environment, Science and Technology (MEST), Ministry of Food and Agriculture (MOFA) and Water Resources Commission (WRC), as well as by other development partners. Also, the Project has a high prospect of replicability in other areas of Sub-Saharan Africa, considering the efforts which the Project made such as making many oral presentations in the international conferences and hosting the international conference of the Project, which was successfully implemented in Ghana.

(2) Technical aspect

Technology transfer to the Ghanaian counterpart personnel has been carried out adequately so far through various activities including workshops, project meeting, field activities, C/P training in Japan and international conference. There are already good signs of expected impact in future. For example, the practical C/P trainings on the use of satellite deprived precipitation data and numerical weather prediction

were highly regarded and thus it has been planned to provide similar trainings with young personnel aside from the Project, by G-met. As for the knowledge and operating skill of GIS, the developed curriculum of GIS training through C/P training in Japan has been modified and utilized for other training programs in UNU-INRA, and it would be also possible for UG and UDS if the resources are available. The Team shared the views with C/P institutions that each of all the models to be developed by the Project has high potential to give technical impact on the concerned field.

(3) Social and cultural aspect

The Team found during the interview in some target communities behavior change and climate change adaptation of community members even at the initial stage of the Project; for example, sanitizing borehole, small scale irrigation, water harvesting, and single cropping. Therefore, the Team already confirmed the positive sign of impact of the Project. The Project also has initiated the research of value chain of shea processing, which is one of the important livelihood activities for women, and development of business models related to shea might enable women to enhance their resilience to climate change.

4-5 Sustainability

The sustainability of the Project is assessed as **High-Moderate**, because the Team could expect high sustainability in some aspects, but some other aspects need further reinforcement, as described in the following:

(1) Policy and institutional sustainability

The Project is implemented in line with the current national development plan and climate change policy of the Government of Ghana, such as NCCPF and NCCAS. Although the Ghana National Climate Change Policy has been formulated in 2013, the succeeding plan has no drastic shift of priorities that may be contradictory to the directions of the Project. In view of those policies, it is assumed that the policy support would continuously be secured for the coming years.

As to the institutional aspects, UG and UDS are the leading educational institutions in Ghana, which provide science-based research results to the society. The activities of the Project have been carried out in line with their mandates, thus the institutional sustainability is also assessed as high.

On the other hand, it was found out through the review that involvement of the relevant government institutions, i.e. Observers of JCC has been somewhat still weak, and their commitment to adopt the integrated approach to be proposed by the Project, which is necessary for maintaining the sustainability of the policy, has not yet been fostered.

(2) Organizational and Financial sustainability

It has generally been observed that financial resources allocated by the GoG for the C/P institutions have been very limited. In case of UG and UDS, there are resource constraints for research activities in the field or implement any capacity development program for local community. Lack of human and financial resources has been a constant issue of concern in G-Met as well. Therefore the Team observes that the financial sustainability for the C/P institutions has not yet been secured. Financial sustainability of the Project would depend on how the integrated approach, i.e. Ghana model, could effectively been adopted and institutionalized in Ghana, as mentioned above.

(3) Technical sustainability

As research themes addressed under the Project are largely common to C/P institutions' own themes, it is likely that research methods, outcome of the research, and final products of the Project are continuously used by them even after the project is completed. The Project is also assisting many Ghanaian young researchers by various means to foster the understanding of climate and ecosystem changes as potential

human resources to become professionals in the concerned field and outreach to local community in the future.

For technology transfer within and among the C/P institutions, as mentioned at the section of Impact, GIS training courses have been implemented under the Project, since the C/Ps, who have developed the curriculum through the C/P training in Japan, have already acquired knowledge and skills to provide the technical guidance to other personnel in and around.

The Team is concerned that some of the equipment provided by the Project is very sensitive; however it has not been adequately discussed within the Project if the Ghanaian C/P institutions can bear the maintenance costs and spare parts when serious damage occurs

5. Conclusion

Although at the initial stage of the Project, there were hampering factors and issues for the smooth operation of the project activities such as information sharing about project operation between the Ghanaian and Japanese sides, the coordination and communication have been focal points for improvement. The Team has confirmed that the expected outputs have been achieved without any other critical problems or notable delay in the implementation of the Project. It has already come to the stage of the integration of respective research themes and their findings.

6. Recommendations

(1) Involvement of Line Ministries

As mentioned earlier in the report, it is more effective to raise the awareness about the outcome of the Project within the line ministries of the Project, e.g. Ministry of Education, from the perspectives of Impact and Sustainability of the Project. It is recommended to promote updating the Project progress to the line ministries, not only through JCC, but also by simple means such as email, mailing-list system, etc.

(2) Utilization of the Provided Equipment

The Team confirmed that needs for GIS technologies have been very high and GIS training courses have been implemented by UNU-INRA and UG, utilizing the equipment provided by the Project. Meanwhile, it was also observed that one of AWS facilities has not been provided with appropriate security measures, i.e. fencing. Thus, it is required to take measures immediately, as well as for up-coming AWSs to be provided.

(3) Towards Establishment of the Strategy to Enhance Resilience

Theme 1 and 2 would be generating several climate change scenarios. Theme 3 would address the countermeasures to enhance resilience of local communities. Those countermeasures would be strategized with the three approaches, ecological, engineering and socioeconomic approaches. The Project has just initiated discussions about resilience enhancing options by utilizing research findings. It is recommended to continue to study deeply the strategy taking these three approaches into account in order to make the strategy more robust.

(4) Team Building among All Project Stakeholders

It is recommended to strengthen the overall coordination between thematic research groups for integration of the research and to precede dissemination and sharing of research findings and progress of the Project with the line ministries to raise awareness of the Project.

(5) Coordination with Outside Agencies

In case that the Project needs additional data for research activities which is maintained by outside agencies, kind coordination for the Project to obtain the data by the line ministries is highly expected.

Annex 1 Schedule of Mid-term Review

No.	Date	Day	Mr. Masanori KURISU (Team Leader)	Ms. Mitsuko NAKAMURA (Evaluation Analysis)	Dr. Yasuoka and Ms. Takahashi (JST Team)	Accommodation	Ghanaian Team Members (Ministry of Education, Ministry of Communication, Ministry of Food and Agriculture)
1	Sep 14	Sun		11:35 Arriving in Accra		Accra	
2	Sep 15	Mon		8:30 Meeting with the Ghanaian evaluation team members at JICA office 10:30 Interview at UNU-INRA 12:00 Interview at G-Met 14:00 Interview with Prof. Gyasi at UG		Accra	8:30 Meeting with Ms.Nakamura and Mr. Mensah at JICA
3	Sep 16	Tue		7:00 Travel to Tamale(AW160) 9:00 Meeting with Prof. Gordana at UDS (Tamale) 12:30 Meeting with Dr. Ogeng at UDS (Nyankpala)		Tamale	
4	Sep 17	Wed		8:30 Travel to Wa 13:30 Interview with DAO, NADAMO, MOFA 15:30 Interview with Mr. Fledrick at UDS (Wa)		Wa	
5	Sep 18	Thu		8:30 Visit PJ Office at Wa campus 9:30 Interview/Site observation in Bankpama community 13:30 Interview/Site observation in Balefili community		Wa	
6	Sep 19	Fri		7:30 Travel to Tamale 9:30 Observation of AWS in Bole 16:30 Travel to Accra (AW167)		Accra	
7	Sep 20	Sat		Data Analysis & Mid-term Review Report Preparation		Accra	
8	Sep 21	Sun		Mid-term Review Report Preparation		Accra	
9	Sep 22	Mon	11:35 Arriving in Accra 14:00 Internal meeting with Mid-term Review Team	Prepare Mid-term Review Report 14:00 Internal meeting with Mid-term Review Team	11:35 Arriving in Accra 14:00 Internal meeting with Mid-term Review Team	Accra	
10	Sep 23	Tue	9:30 Courtesy Call on EOJ 11:00 Joint Evaluation Meeting at JICA office 13:00 Meeting with Prof. Gyasi at UG (not confirmed) 15:00 Meeting with Mr. Ayuku at UNU-INRA	9:00 Meeting with Chief Director, Ministry of Communication Visit/Observation at G-Met (not confirmed)		Accra	11:00 Joint Evaluation Meeting at JICA office
11	Sep 24	Wed	7:00 Travel to Tamale (AW160) 9:00 Meeting with Dr. Obeng at UDS (Nyankpala) 13:00 Mini-Workshop at Fihini			Tamale	(Min. of Finance) 7:00 Travel to Tamale (AW160) 9:00 Meeting with Dr. Obeng at UDS (Nyankpala) 13:00 Mini-Workshop at Fihini
12	Sep 25	Thu	9:00 Observation of AWS in Yendi 14:40 Travel to Accra	Prepare Mid-term Review Report 14:30 Travel to Accra	9:00 Observation of AWS in Yendi 14:40 Travel to Accra	Accra	(Min. of Finance) AM Travel to Accra
13	Sep 26	Fri	10:00 Visit/Observation at G-Met 11:45 Joint Evaluation Meeting at JICA office PM Prepare the Mid-term Review Report	Prepare Mid-term Review Report	10:00 Visit/Observation at G-Me	Accra	11:45 Joint Evaluation Meeting at JICA office
14	Sep 27	Sat	Prepare Mid-term Review Report			Accra	-
15	Sep 28	Sun	Prepare for JCC, Back-up Day for Report Prep			Accra	-
16	Sep 29	Mon	AM: Prepare M/M PM: JCC at UNU-INRA, Night: Reception			Accra	PM: JCC at UNU-INRA Night: Reception
17	Sep 30	Tue	-	Departing from Accra		-	-
18	Oct 1	Wed	-	Arriving at Tokyo		-	-

Annex 2 List of the Interviewees

No.	Name	Affiliation
1	Prof. Edwin Akonno Gyasi	Depatment of Geography and Resource Development
2	Dr. Alex Owusu Barima	Depatment of Geography and Resource Development
3	Dr. Kwabena Awere Gyekye	Depatment of Geography and Resource Development
4	Gp. Capt. Stephen Y. Komla	Ghana Meteorological Agency
5	Mr. Ayilari-Naa Juati	Ghana Meteorological Agency
6	Mr. Peter Nunekpeku	Ghana Meteorological Agency
7	Mr. Samuel Owusu Ansah	Ghana Meteorological Agency
8	Prof. Gordana Kranjac-Berisavljevic	University of Development Studies, Nyankala
9	Prof. Francis Z. L. Bacho	University of Development Studies, Wa
10	Dr. Francis Kwabena Obeng	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
11	Mr. Shaibu Abdul-Ganyu	Faculty of Agriculture (Nyankpala), UDS
12	Dr. Samuel A. Donkoh	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
13	Mr. Victor Lolig	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
14	Dr. Richard Yeboah	Faculty of Agribusiness and Communication Sciences (Nyankpala), UDS
15	Mr. Felix K. Abagale	Faculty of Agriculture (Nyankpala), UDS
16	Mr. Vincent Kodjo Avornyo	Department of Agronomy, Faculty of Agriculture (Nyankpala), UDS
17	Mr. Raymond Tetteh	Faculty of Agriculture (Nyankpala), UDS
18	Mr. Frederick Dayuo	Department of Community Development (Wa), UDS
19	Mujeeb Rahaman Adams	Institute of Continuing and Distance Education (Wa), University of Ghana
20	Dr. Elias T. Ayuk	UNU-INRA
21	Mr. Kwabena Owusu Asubonteng	UNU-INRA
22	Ms. Charlotte Morgan - Asiedu	Director, Human Resource Management Department, Ministry of
23	Ms. Yieri Yvonne	Wa West, Ministry of Food and Agriculture
24	Mr. Dramawi File	National Disaster Management Organization (NADMO)
25	Mr. Adams Sabogu	Assembly Officer, Cheatanta
26	Mr. Bortuuro W. Abubaka	Assembly Officer, Baleufili
27	Mr. Devy K. Moses	Assembly Officer, Bankpama and Zowayeli
28	Mr. Takuu Kuuta	Bankpama Chief
29	Mr. Kwaku Vieri	Zowayeli Elder
30	Ms. Bagipla Koung	Women Representative, Bankpama
31	Ms. Ajara moses Defy	Women Representative, Bankpama
32	Mr. Ruuta Lawrence	Student Union, Bankpama
33	Mr. Maa Maufoug	Baleufili Chief
34	Mr. Maa Dauda Ruso	Baleufili Sub-Chief
35	Mr. Auadu Kubo	Baeufili Community Member
36	Mr. Alhassa Zekaria	Baeufili Community Member
37	Mr. Nandong Saliu	Baeufili Community Member
38	Mr. Mahama Dauda	Baeufili Community Member
39	Mr. Amadu Sidik	Baeufili Community Member
40	Mr. Nuhu Kopie	Baeufili Community Member
41	Mr. Alhassan Abdumai	Fihini Community Member
42	Mr. Seini Mhammed	Fihini Community Member
43	Mr. Ganiyu A. Iddrigu	Fihini Community Member
44	Mr. Massau Dawuda	Fihini Community Member
45	Mr. Abukari Alhassan	Fihini Community Member
46	Mr. Zakaria Sulemana	Fihini Community Member
47	Mr. Iddrisu Alhassan	Fihini Community Member
48	Mr. Abdumai Haruna	Fihini Community Member
49	Mr. Abdumai Wumblu	Fihini Community Member
50	Mr. Karima Abdul-Rahman	Fihini Community Member
51	Mr. Mohammed Iddrigu	Fihini Community Member
52	Mr. Sulemana Wumbei	Fihini Community Member
53	Mr. Alhassan Neindoo	Fihini Community Member
54	Mr. Alhassan Inusah	Cheshegu Community Member
55	Mr. Yamkana Sampson	Cheshegu Community Member
56	Mr. Abdallah Iddrigu	Cheshegu Community Member
57	Mr. Abdallah Munkaila	Cheshegu Community Member
58	Mr. Sulemana A. Fatawu	Cheshegu Community Member
59	Mr. Dahamani Munmuni	Cheshegu Community Member
60	Mr. Alhassan Musah	Cheshegu Community Member
61	Mr. Ziblim Adam	Dabogshei Community Member
62	Mr. Sulemana Alhassan	Dabogshei Community Member
63	Mr. Iddi Issah	Dabogshei Community Member
64	Mr. Alhassan Sumani	Dabogshei Community Member
65	Mr. Musah Issahaku	Dabogshei Community Member

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
Overall Goal The Integrated Approach to Enhancing Resilience to Climate and Ecosystem Changes will be incorporated in international environmental policies	Policy recommendations shared in the science and technology community (e.g. OECD/GSF) and presented to international panels and conventions such as UNFCC, CBD, UNCSD, as well as platforms like IPCC, IPBES, and CBD Secretariat.		No drastic change in international policies on climate change and ecosystem changes.
Project Purpose 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.	• 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	* Project progress report * Annual report * Educational policy of Ghana * Policy paper	The Ministry of Education and the Ministry of Communications do not drastically change the educational policy and relevant capacity development. There is no drastic change in climate change adaptation policy framework and strategy of the Government of Ghana.
Outputs 1. Forecasting methods for climate and ecosystem change are developed and the impacts on agro-ecosystem use are assessed	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.	1. * Project progress reports * Annual report	Counterparts are not transferred.
2. 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.	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	2. * Project progress reports * Annual report	
3. Institutional and engineering capacity development programs for local communities and engineers are developed and implemented	3.1. Journal articles on regional disaster governance in Northern Ghana will be published 3.2. Repost 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	3. * Project progress reposts * Annual report	

	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.		
Activities 1-1.Build meteorological data base (time series and spatial) 1-2.Build land utilization and soil distribution data base (time series and spatial) 1-3.Build agricultural production and management data base (time series and spatial) 1-4.Integrate above three data bases by GIS 1-5.Build regional climate change prediction model and use the model to predict (solution constraint factors for downscaling of climate change prediction model) 1-6.Assess climate change impact to agro-ecosystem utilization 1-7.Assess land utilization, soil distribution and climate change by GIS 1-8.Develop agro-ecosystem valuation map based on 1-7 1-9.Develop alternative approaches on adaptive agricultural production management to climate change 1-10.Establish the institutional design of collaboration across Theme1 to 3 2-1.Survey the satellite and ground based observation network and construct the database 2-2.Make an early warning system, hazard map of flood and scenario of drought database 2-3.Quantitatively analyze the risks of disasters due to extreme weather for Volta river basin in Northern Ghana 2-4.Propose a prototype scheme of on-site water resources management by using outcomes from 2-3 3-1.Select the project sites in collaboration with Theme1 and 2 3-2.Interview key actors and observe authority at different levels of governance institutions in the region 3-3.Survey farm household to understand socioeconomic activities 3-4.Outline specific crop value chains and potential business models 3-5.Based on analyses of findings derived from 3-2 to 3-4, develop institutional capacity development program 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 3-7.Establish an integrated approach to enhancing resilience based on 3-5 and 3-6	**Inputs**		
	Japan	**Ghana**	
	(a) Expert 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 (b) Training Trainings in Japan (c) Machinery and Equipment - 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	Project Director Project Manager Counterpart researchers Office space Laboratory Communication facilities Water, electricity etc.	Pre-conditions

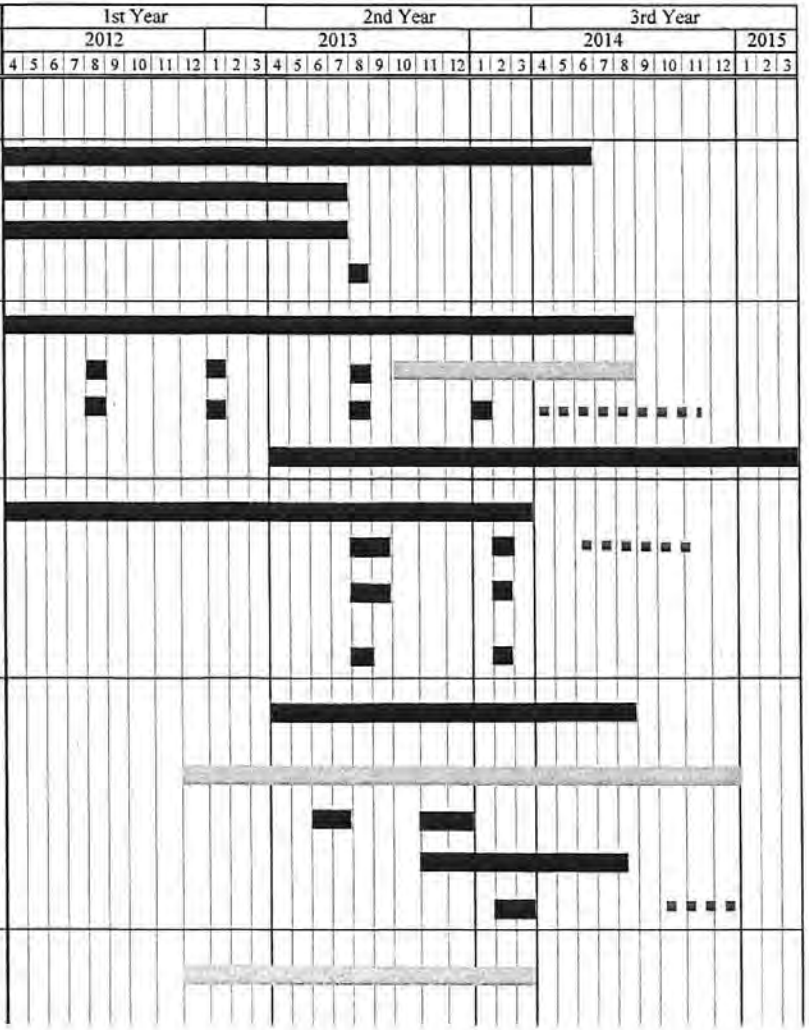
Glossary for this Project:

Project site: Area in which capacity development program will be socially implemented (e.g. selected communities or districts). Study area: Aarea 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 (PO) (approved by the JCC on 5 August, 2013)

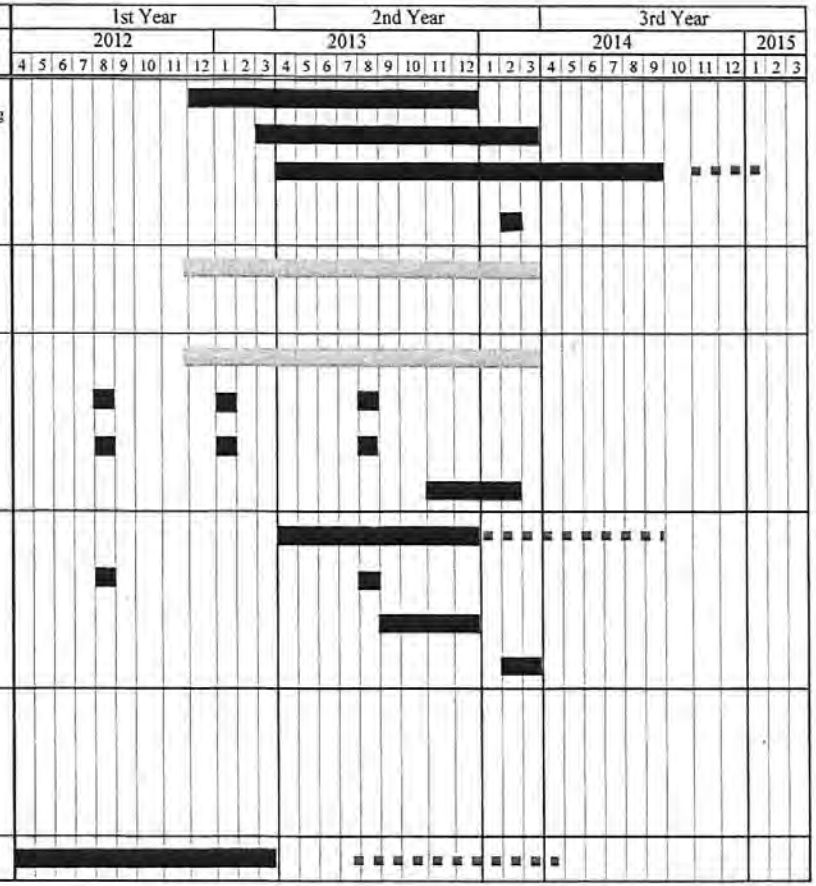
2012-2014 Plan of Operation (Theme 1)

Outputs	Activities	The person in Charge: Japan	The person in Charge: Ghana
I	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 (1) Collecting station observation data (2) Survey on available datasets by previous studies (3) Building pilot integratng database based on mutual discussion	Dr. Hirotaka Matsuda Dr. Srikantha Herath Dr. Geetha Mohan	Dr. Kwadwo Owusu Dr. Owusu Barima Mr. Gerald Yiran Mr. Emmanuel Tachie-Obeng Prof Daniel Sarpong
1-2	Building land utilization and soil distribution data base (1) Field visit for ground truthing and land use data collection (2) Soil sampling and developing soil inventory (3) Building Project Database	Dr. Antwi, Effah Kwabena	Prof. M.K. Abekoe Dr. Owusu Barima Dr. Adelina Mensah
1-3	Building agricultural production and management data base (1) Household farm level agriculture information from field surveys (2) Collecting secondry data from several sources including government institutions (3) Building pilot integratng database based on mutual discussion	Dr. Hirotaka Matsuda Dr. Geetha Mohan	Dr. K. Awere Gyekye Mr. George Owusu Dr. Owusu Barima Prof Daniel Sarpong
1-4	(4) Soil organic carbon and farm management practices Integrating above three data bases by GIS (1) Conceptual/logical design of geodatabase (logical data model) (2) Evaluate input data (inventory from) from 1-3 (3) Organize Geodatabase Structure	Dr. Antwi, Effah Kwabena	Dr. Owusu Barima Mr. Gerald Yiran
1-5	Building regional climate change prediction model and prediction by the model(Simulations by regional climate model)		



2012-2014 Plan of Operation (Theme 1)

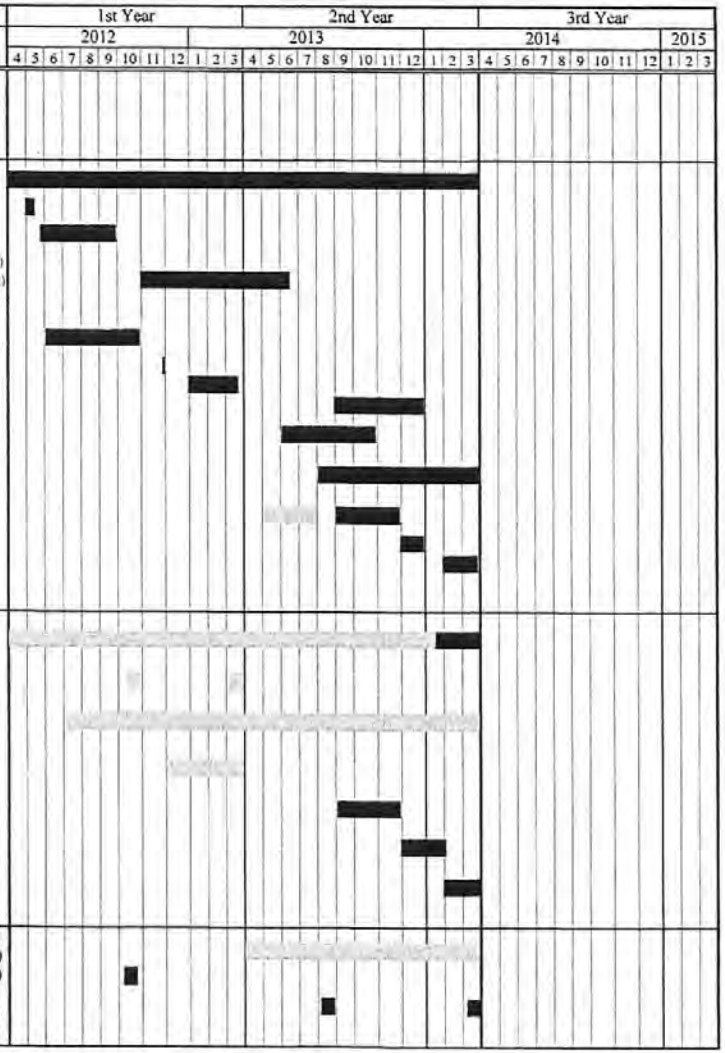
Outputs	Activities	The person in Charge: Japan	The person in Charge: Ghana
	(1) Downscaled simulation of selected years (2) Downscaled simulation of future climate (3) Statistical downscaling (3) Sharing the preriminaly results	Dr. Hirotaka Matsuda Dr. Srikantha Herath Dr. Geetha Mohan Dr. Yoshie Maeda	Mr. George Owusu Mr. Emmanuel Tachie-Obeng Dr. Oteng Ababio
1-6	Assessment of climate change impact to agroecosystem utilization (1) Acquisition and evaluation of climate data	Dr. Hirotaka Matsuda Dr. Geetha Mohan	Dr. E.M Attua Dr. Adelina Mensah Dr. Oteng Ababio Prof Daniel Sarpong
1-7	Assessment of land utilization, soil distribution and climate change by GIS (1) Survey of past and existing agricultural land uses (2) Survey of past and present agricultural management practices (3) Analyses of climate data, soil and land use data	Dr. Antwi, Effah Kwabena	Dr. K. Awere Gyeke Mr. George Owusu Mr. G. Yiran
1-8	Making agroecosystem valuation map based on 1-8 (1) Acquisition of Sattelite image and image processing (2) Develop biodiversity inventory (3) Map creation	Dr. Antwi, Effah Kwabena	Mr. G. Yiran Dr. E. M Attua Dr. Owusu Barima Prof Daniel Sarpong
1-9	Making options of adaptive agricultural production management to climate change	Dr. Hirotaka Matsuda Dr. Antwi, Effah Kwabena Dr. Srikantha Herath Dr. Geetha Mohan Dr. Yoshie Maeda	Prof. E.A. Gyasi Dr. Adelina Mensah Dr. Kwadwo Owusu Prof Daniel Sarpong
1-10	Institutional design of collaboration Theme 1 to 3	Prof. Kazuhiko Takeuchi	Prof. E.A. Gyasi



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

2012-2014 Plan of Operation (Theme 2)

Outputs	Activities	The person in Charge: Japan	The person in Charge: Ghana
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/UDS
2-1	Sattelite and Ground-based observation network is surveyed and database is built fy12-(1) Site inspection fy12-(2) Planning AWS & Raingauge Instlation Seheme fy12-(3) Installation of three AWSs at Bole, Yendi and Salaga fy12-(4) Inspection of installed AWSs fy12-(5) Preliminary satellite data acquisition at KYOTO UNIV fy12-(6) Training for satellite data use fy12-(7) Installation of data server fy13-(1) Installation of AWS & Raingauges fy13-(2) Comparison of Satellite and Obs data fy13-(2+) Continuous Satellite Data Aequisition fy13-(3) Numerical Met. Prediction (Trial in Jpan) fy13-(4) ibid (Training in Japan) fy13-(5) ibid (Trial in Ghana) fy14-(6) Continuous Operatoin	Prof. Hirohiko Ishikawa Dr. Weiqiang Ma	Mr. Andrew Nkansah(GMet) Mr. Ayilari-Naa Juati(GMet) Mr. Amos Narh(GMet) Mr. Samuel Owusu Ansah (GMet) Miss Elikem Setsoafia (GMet) Mrs. Francisca Martey (GMet) Mr. Peter Nunekpeku (GMet) Mr. Shaibu Abdul-Ganiyu (UDS) Dr. Kwadwo OWUSU (U. Ghana)
2-2	Using 2-1, an early warning system, hazard map of flood and scenario of drought are made fy12-(1) Site inspection fy12-(2) Preliminary development of Hydrology model at KYOTO(KOBE) UNIVERSITY fy12-(3) Collection of Hydrogy Data fy13-(0) Collection of Satellite data for Hydrology fy13-(1) Tuning Model with Hydrogical data FY13-(2) Trial run with Satellite derived data	Prof. Hirohiko Ishikawa Prof. Kenichiro Kobayashi Dr. Samaddar	Mr. Zinedeme Minia(GMet) Mr. Charles Yorke(GMet) Mr. Dominic Pokperlaar(GMet) Prof. Gordana K-B(UDS) Mr. Shaibu Abdul-Ganiyu(UDS) Dr. Togbiga Dzivenu(UDS)
2-3	Risks of disasters due to extreme weather is quantitatively analyzed for Volta River basin fy12-(1) Preliminary site inspection fy13-(1) Site inspection, data collection and feasibility assessment	Prof. Norio Okada Prof. Muneta Yokomatsu Prof. Kobayashi Dr. Samaddar	~~Mr. Zinedeme Minia(GMet)~~ Mr. Andrew Nkansah(GMet) Mr. Ayilari-Naa Juati(GMet) Prof. Gordana K-B(UDS) Dr. Togbiga Dzivenu(UDS) Mr. Fauster Agbenyo(UDS)



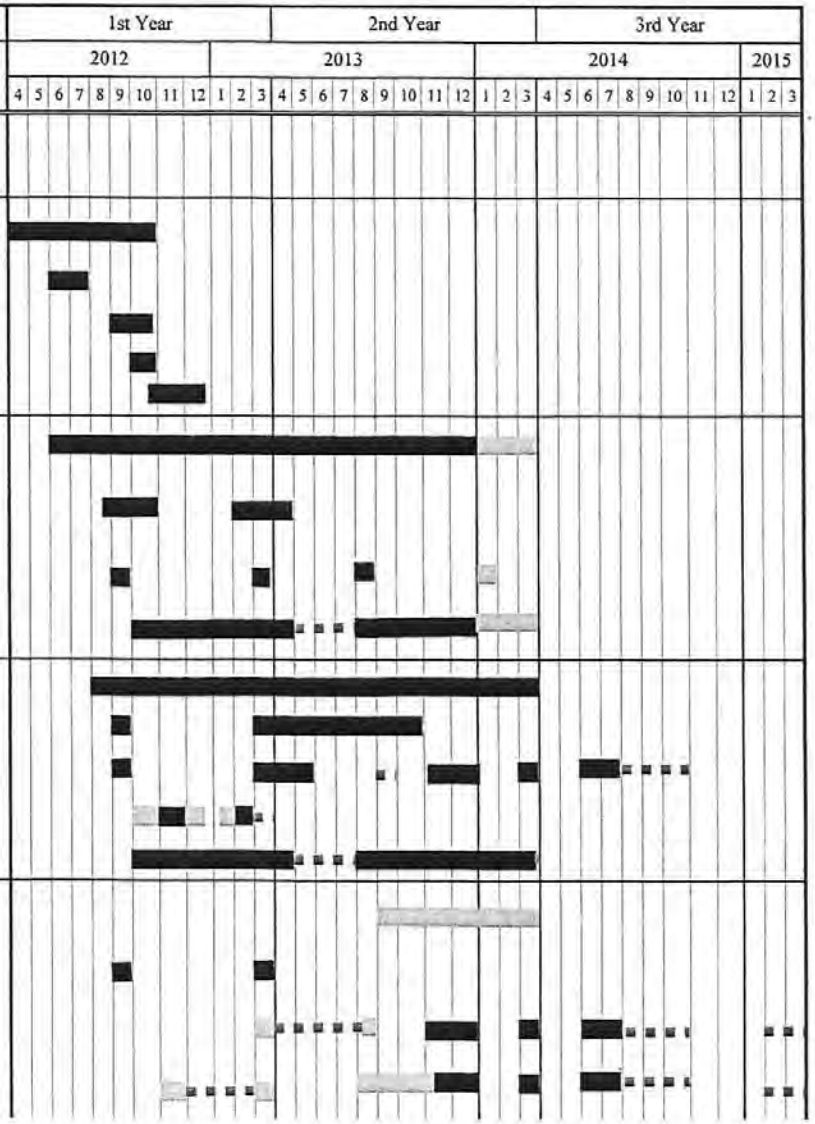
2012-2014 Plan of Operation (Theme 2)

Outputs	Activities	The person in Charge		1st Year												2nd Year												3rd Year												2015		
		Japan	Ghana	2012												2013												2014														
				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	5	6	7	8	9	10	11	12	1	2	3			
2-4	Using outcomes from 2-3, a prototype scheme of on-site water resource management is proposed fy13-(1) Preliminary site inspection	Prof. Norio Okada Prof. Muneta Yokomatsu Dr Samaddar	Prof. Gordana K-B																																						

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

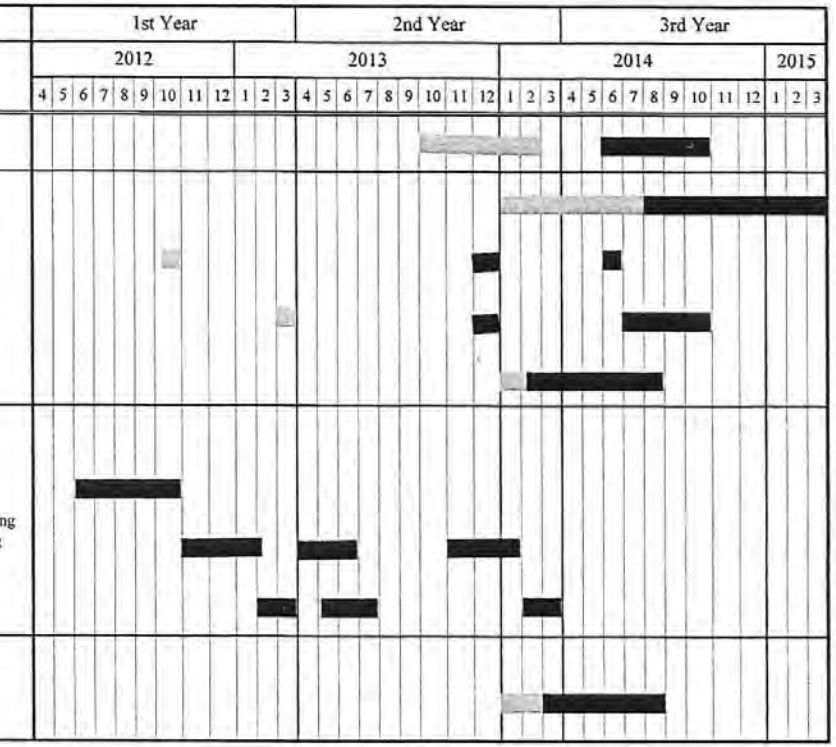
2012-2014 Plan of Operation (Theme 3)

Outputs / Activities	Japan	Ghana
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		Prof. Edwin A. Gyasi
		Prof. Gordana Kranjac-Berisavljevic
(1) 1st Assessment: Distrct selection	Dr. Osamu Saito	Ms. Yasuko Kusakari
	Dr. Osamu Ito	Dr. Shaibu Abdul-Ganiyu
(2) Field observation and communication with local stakeholders	Dr. Kei Otsuki	Mr.Kwabena Asubonteng
	Dr. Effah Antwi	Dr.Togbiga Dzivenu
(3) 2nd Assessment: Community selection		Mr. Bizola Gadaa
		Mr. Frederick Dayuo
(4) Final decision making		Mr. Godfred Jasaw**
3-2 Interviewing key actors and observation of authority at different levels of governance institutions in the region		Ms. Yasuko Kusakari
		Mr. Kwabena Asubonteng
(1) Preliminary field observation and questionnaire development	Dr. Kei Otsuki	Dr.Togbiga Dzivenu
	Dr. Osamu Saito	Dr. Shaibu Abdul-Ganiyu
(2) Interviewing key stakeholders	Dr. Osamu Ito	Mr. Bizoola Gadaa
		Mr. Frederick Dayuo
		Mr. Godfred Jasaw** (To be replaced with Frederick)
(3) Data input and analysis		
3-3 Farm household survey to understand socioeconomic activities		Ms. Yasuko Kusakari
		Mr.Kwabena Asubonteng
(1)Preliminary field research on institutions of disaster governance	Dr. Osamu Ito	Dr.Togbiga Dzivenu
	Dr. Kei Otsuki	Dr. Samuel Donkoh
(2) Household survey	Dr. Osamu Saito	Mr. Vincent Avonyo
	Dr. Effah Antwi	Mr. Victor Lolig
(3) Farm land survey		Mr.Frederick Dayuo (To replace Godfred)
(4) Data input and analysis		
3-4 Outlining specific crop value chains and potential business models		
(1)Preliminary field research on institutions of grassroots business situations(local markets, distributers, etc)		Dr. Timothy Koomson
	Dr. Osamu Saito	Ms.Yasuko Kusakari
(2) Supply and value chains of ecosystem services associated with major crop production	Dr. Osamu Ito	Dr. Gessesse Dessie
	Dr. Kei Otsuki	Dr.Togbiga Dzivenu
(3) Identification of useful crop for further value adding activities	Mr. Yaw Boafo	Dr. Richard Yeboah
		Mr. Balma Yakubu



2012-2014 Plan of Operation (Theme 3)

Outputs / Activities		The person in Charge	
		Japan	Ghana
	(4) Analysis and discussions		
3-5	Based on the findings above, institutional capacity development program is developed		
	(1) Institutional capacity assessment workshop: district level	Dr Kei Otsuki Dr. Osamu Saito Mr. Yaw Boafo Mr. Nicholas Turner	Ms. Yasuko Kusakari Dr. Francis Obeng Prof. Gordana K-B Dr. Richard Yeboah Dr. Gessesse Dessie
	(2) Institutional capacity assessment workshop: community level		
	(3) Development of pilot training program		
3-6	Based on findings of 2-4 and 3-3, engineering natural resource management capacity development program is developed		
	(1) Designing facility and program for GIS training	Dr. Osamu Ito Dr. Osamu Saito Dr. Effah Antwi Dr. Kei Otsuki Dr. Ram Avter	Prof. Gordana Kranjac-Berisavljevic Dr. Francis Kwabena Obeng Mr. Kwabena Asubonteng Ms. Yasuko Kuskari
	(2) Development of pilot GIS training program		
	(3) Implementing the pilot training program		
3-7	Combining 3-5 and 3-6, an integrated approach to enhancing resilience is established	Dr. Osamu Saito Dr. Osamu Ito	Prof. Gordana Kranjac-Berisavljevic Dr. Elias T. Ayuk Ms. Yasuko Kusakari



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

Annex 5 Evaluation Grid of Mid-Term Review

Project Name: Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach (CECAR-AFRICA)

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
Achievements of Input	Japanese side	Dispatch of Experts (Field of Expertise, Number, Timing of Dispatch, etc.)	List and record of assignment of researchers	Project Progress Report/ Mid-term Report	Literature Survey
		C/Ps Training (Theme, Contents, Number of Dispatched Trainees, Timing of Implementation)	List of C/Ps training in Japan		
		Provided Equipment (Items, Quantity, Timing of Provision, Maintenance, etc.)	List of Provided Equipment Maintenance/status of the equipment		Literature Survey Site Observation
		Local Cost Assistance (Project Running Cost, Purpose, Timing of Assistance, etc.)	Accounting record of local cost assistance		Literature Survey
	Ghanaian side	C/Ps Assignment (Number, Position, Turnover, etc.)	List and record of assignment of C/Ps researchers		
		Budget allocation plan and execution for the project activities	Data of budget allocation plan and execution	Information/ Documents to be provided by C/Ps	Questionnaires Interviews
		Arrangement of land, building, facilities, and equipment necessary for the project implementation	List of items input by the Ghanaian side	Project Progress Report/ Questionnaire/ Interview	Literature Survey Questionnaires Site Observation
	Achievement of the Outputs 1. Are forecasting methods for climate and ecosystem change developed? Are the impacts on agro-ecosystem assessed?	1.1 Were journal articles on climate and ecosystem change published?	Status of publishing journal articles on climate and ecosystem change	Project Progress Report/ Mid-term Report	Literature Survey Interviews
		1.2 Was assessment of climate change impact to agro-ecosystem utilized?	・Assessment result of climate change impact to agro-ecosystem ・Utilized case of assessment of climate change impact to agro-ecosystem		
		1.3 Was a report on options of adaptive agricultural production management to climate change (land utilization and cropping system etc.) issued?	Status of issuing a report on options of adaptive agricultural production management to climate change (land utilization and cropping system etc.)		
	2. Is a prototype of water resources management applied through prediction and risk analysis of extreme weather events using satellite remote sensing and ground-based observation network?	2.1 Was a report on flood risk assessment and extreme weather risk assessment issued?	Status of issuing a report on flood risk assessment and extreme weather risk assessment	Project Progress Report/ Mid-term Report	Literature Survey Interviews
		2.2 Was a report on prototypes of water resource management methods issued?	Status of issuing a report on prototypes of water resource management methods		
		2.3 Were journal articles on extreme weather risk or water resource management issued?	Status of publishing journal articles on extreme weather risk or water resource management		

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
Achievements of Outputs as of August 2014	3. Are institutional and engineering capacity development programs for local communities and engineers developed and implemented?	3.1 Were journal articles on regional disaster governance in Northern Ghana published?	Status of publishing journal articles on regional disaster governance in Northern	Project Progress Report/ Mid-term Report	Literature Survey Interviews
		3.2 Is a report on business models against for climate and ecosystem changes issued?	Status of issuing a report on business models against for climate and ecosystem changes issued?		
		3.3 Is the capacity development program on resilience for climate and ecosystem changes developed?	Progress of developing the capacity development program on resilience for climate and ecosystem changes		
		3.4 Is training course for local engineering, governors and community implemented at the project site? Is the monitoring report issued?	Monitoring report of training course for local engineering, governors and community implemented at the project site		
		3.5 Are guidelines for establishing an integrated approach to enhancing resilience to climate and ecosystem changes presented?	Progress of presenting guidelines for establishing an integrated approach to enhancing resilience to climate and ecosystem changes		
	Achievement of Project Purpose (Prospect) Is the following project purpose likely to be achieved? "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?	・Educational policy and curriculum development at university level, with focus on climate and ecosystem changes ・Educational policy for engineers and observation capacity development of the Ghana Meteorological Agency ・Contribution to the ongoing policy formulation for climate adaptive capacity development by the Ghana Government	・ Comments by Governmental officials, Japanese Expert, C/Ps and etc.	National Climate Change Adaptation Strategy/ Educational policy of Ghana/ Other policy papers/ Project Progress Report/ Comments by JICA Experts/ C/Ps/ Other relevant organizations	Literature Survey Questionnaires Interviews
	Progress of activities	Were activities implemented as planned?	・Implementation status of activities ・Reason and countermeasures taken for problem-solving	Project Progress Report/ Mid-term Report, Comments by JICA Experts (researchers) and C/ Ps	Literature Survey Questionnaires Interviews
	Implementation structure	Was C/Ps assignment appropriate (number, ability)?	・ Number and ability of C/Ps ・ Formation of research working group, etc.		
		Does implementation structure function accordingly?			
	Monitoring	Has monitoring been carried out?	・ Monitoring mechanism for overall project (JCC, regular meeting, etc.) ・ Revised contents of research plan (if any)		
		Is monitoring mechanism appropriate?			
		Were PDM/PO revised appropriately as necessity arose?			

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
Implementation process	Communication	Is there sufficient communication/information sharing between the JICA Experts and C/Ps?	・Frequency and means of communication	Project Progress Report/ Mid-term Report Comments by JICA Experts and C/Ps	Literature Survey Questionnaires Interviews
		Ways to handle challenges and problems	・Measures taken when project plan is changed		
	Decision making system	Is decision making process appropriate?	・Decision making system in the project		
	Ownership of C/Ps organizations	Do C/Ps participate in the project activities with their own initiatives?	・Status of participation of C/Ps ・Status of support from senior officials ・Status of budget allocation (Counterpart fund)		
		Are there any change in C/Ps' attitude (independence and activeness) or self-motivated activity by C/Ps?			
		Are interests of senior officials sufficient to support the project?			
		Do C/Ps organization provide appropriate amount of budget for the project?			
	Technical transfer	Is method of technical transfer appropriate?	・Trainings and field research in Ghana ・Trainings in Japan		
	Outstanding issues, and inhibiting factors in implementation process?	Are there problems or inhibiting factors that were generated during the implementation?	・Problems or inhibiting factors (if any)		

Five Evaluation Criteria

Items to be investigated		Questions	Necessary Information and Data	Data Source	Data Collection Methods
Relevance	Needs and Priority (Policy)	Does the project meet the needs of target areas and societies?	・SADA Strategy and action plan ・Comments by administrative officers in Northern Ghana, Japanese Expert, C/Ps and etc.	Detail Planning Survey Report/ Project Progress Report/ JICA Expert/ C/Ps/ Administrative officers in Northern Ghana/ Local engineers and residents	Literature Survey Questionnaires Interview
		Does the project meet the needs of target groups?	・Comments by Japanese researcher, C/Ps, local administrative officers, engineers and residents in Northern Ghana and etc.		
		Is the project consistent with Ghanaian development policy?	・National Development Strategy ・National Climate Change Policy Framework ・NCCAS and Action Plan ・Comments by Governmental officials, Japanese Expert, C/Ps and etc.	Detail Planning Survey Report/ Ghana's National Development Strategy/ Publications related to National Climate Change/ JICA Experts/ C/Ps/	

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
		Is the project consistent with Japanese assistance policy?	・Country Assistance Policy for Ghana ・Japan's assistance for Climate Change	Detailed Planning Survey Report/ Country Assistance Policy for Ghana	
	Appropriateness as means	Is the project strategy appropriate to contribute to the national climate change adaption of Ghana?	・Project Progress Report ・Mid-term Report ・Comments by JICA Experts, C/Ps, other stakeholders	Project Progress Report/ Mid-term Report/ JICA Experts/ C/Ps	
		Is the project design appropriate considering the capacity of counterpart organizations?			
		Is the selection of beneficiaries appropriate?			
		Is the selection of counterparts appropriate?			
Effectiveness	Prospect of achieving the Project Purpose	Is the achievement level of the Project Purpose adequate at this stage?	・Refer to "achievements of outputs" for details.	Refer to "achievements of outputs" for details.	Literature Survey Questionnaires Interview
	Contribution of outputs to the achievement of the Project Purpose	Are the 3 outputs contributing to achieve the Project Purpose?	・Adequacy of number of outputs, contents and quality ・Relation between Project Purpose and each output	Project Progress Report/ JICA Experts/ C/Ps	
	Promoting and inhibiting factors	What are the promoting factors for the achievement of the Project Purposes?	・Situation of external factors ・Existence of promoting and inhibiting factor		
Efficiency	Prospect to achieve the Outputs	Is the achievement level of the outputs adequate at this stage?	・Refer to "achievements of outputs" for details.	Refer to "achievements of outputs" for details.	Literature Survey Questionnaires Interview
		Are there any promoting/inhibiting factors to achieve outputs?	・Situation of external factors ・Existence of promoting and inhibiting factor	Project Progress Report/ JICA researchers/ C/Ps	
	Appropriateness of the Input of the Japanese side to produce outputs	Are the field of expertise, number, duration of stay, timing of dispatch of assigned researchers appropriate?	・Verification of "achievement of inputs" ・Input status (Comparison to the plan) ・Status of utilization of the provided equipment ・Comments by JICA Experts and C/Ps	Project Progress Report/ Training Reports/ List of provided machinery/ JICA Experts/ C/Ps	Literature Survey Questionnaires Interview Site Observation
		Were items, quantity, timing of provision of the provided equipment appropriate?			
		Were the number of trainees, field, period, timing of the trainings in Japan and Ghana appropriate?			
		Are knowledge and experiences obtained through the trainings applied effectively to execute the duties and missions of the trainees?			

Item to be investigated		Questions (indicators)	Necessary Information and Data	Data Source	Data Collection Methods
	Appropriateness of the Input of the Ghanaian side to produce outputs	Are the C/Ps assigned appropriately in terms of number and capacity?	・Verification of "achievement of inputs" ・Input status (Comparison to the plan) ・Comments by JICA Experts and C/Ps	Project Progress Report/ JICA Experts/ C/Ps	Literature Survey, Questionnaires Interview Site Observation
		Are there any problems as regards the land, buildings, facilities arranged by the Ghanaian side for the Project?			
		Are the budget provided by the Ghanaian side appropriated in terms of amount and timing?			
Impact (Prospect)	Effects of outputs and project purpose	Are there any positive, negative or unexpected impacts effects from technical, social, cultural, institutional and environmental points of view?	・Applicable cases of project outcomes ・Comments by JICA Experts and C/Ps	Project Progress Report/ JICA Experts/ C/Ps	Literature Survey Questionnaires Interview
		Are any countermeasures taken against negative impacts, if any?	・Any countermeasures		
Sustainability (Prospect)	Policy and intuitional sustainability	Will the political support continue after the completion of the Project?	・Refer to "relevance of policy" ・Comments by JICA Experts and C/Ps	Project Progress Report/ JICA Experts/ C/Ps and etc.	Literature Survey Questionnaires Interviews
		Are the efforts to support to extension of the project outcomes to other areas secured?	・Institutional setup for extension of research outcomes ・Sense of ownership, understanding and support for continuing research activities after the project by C/P agencies ・Comments by JICA Experts and C/Ps		
		Do the counterpart agencies have sufficient institutional capacity to conduct the project activities continuously?			
	Financial sustainability	Will the budget be secured to continue the related research activities after completion of the project?	・Comments by JICA Experts and C/Ps ・Comments by Administrative officers and stakeholders in Northern Ghana	Financial information by C/P agencies/ Financial information of related organization / JICA Experts/ C/Ps	
		Is there any financial resources to apply project outputs to their communities?			
	Technical sustainability	Are appropriate technologies developed and transferred, in consideration of the technical level of C/P agencies?	・Techniques acquired by C/Ps through the Project and trainings or workshop ・Techniques acquired by C/Ps through the implementation of Pilot Project	Project Progress Report/ JICA Experts/ C/Ps,	
		Have C/Ps acquire knowledge and the transferred technology enough?	・Comments by JICA Experts and C/Ps		
		Will the transferred technology and equipment be used widely?	・Status of utilization of provided equipment		

Annex 6 List of Japanese Experts

Japanese Fiscal Year 2012 (H.24)

No.	Name	Affiliation	Expertise	Duration From (YYMMDD)	Duration To (YYMMD	M/M
1	Kazuhiko Takeuchi	Univ. of Tokyo/UNU	Chief Adviser	20120501	20120504	0.13
				20121016	20121019	0.13
2	Kwabena Effah Antwi	Univ. of Tokyo/UNU-IAS	GIS Analysis	20120429	20120508	0.33
				20120818	20120908	0.70
				20121006	20121024	0.63
				20130216	20130323	1.27
3	Hirohiko Ishikawa	Univ. of Kyoto -DPRI	Meteorology	20120430	20120509	0.33
				20121015	20121021	0.23
				20130316	20130324	0.30
4	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20130316	20130324	0.30
5	Muneta Yokomatsu	Univ. of Kyoto -DPRI	Disaster Risk Management	20121010	20121019	0.33
6	Ma Weiqjang	Univ. of Kyoto -DPRI	Hydrology	20130316	20130324	0.30
7	Osamu Saito	UNU-IAS	Resilience Strategy	20120430	20120508	0.30
				20120827	20120906	0.33
				20121013	20121020	0.27
				20130224	20130303	0.33
8	Kei Otsuki	UNU-IAS	Governance	20120827	20120911	0.50
				20130217	20130222	0.20
9	Osamu Ito	UNU-IAS	Agronomy	20121028	20121110	0.43
				20130201	20130216	0.53
10	Yaw Agyman Boafo	UNU-IAS	Resilience Evaluation	20130216	20130317	1.07
Total						8.97

Japanese Fiscal Year 2013 (H.25)

No.	Name	Affiliation	Expertise	Duration From (YYMMDD)	Duration To (YYMMD	M/M
1	Kazuhiko Takeuchi	Univ. of Tokyo/UNU	Chief Adviser	20130804	20130809	0.20
2	Kwabena Effah Antwi	Univ. of Tokyo/UNU-IAS	GIS Analysis	20130423	20130521	0.97
				20130731	20130828	0.93
				20140217	20140316	1.00
3	Geetha Mohan	Univ. of Tokyo	Agronomy	20130804	20130816	0.43
				20140314	20140327	0.47
4	Hirohiko Ishikawa	Univ. of Kyoto -DPRI	Meteorology	20130615	20130622	0.27
				20130801	20130807	0.23
				20140304	20140311	0.27
5	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20130803	20130809	0.23
6	Muneta Yokomatsu	Univ. of Kyoto -DPRI	Disaster Risk Management	20130611	20130623	0.43
				20131107	20131124	0.60
7	Subhajyoti Samaddar	Univ. of Kyoto -DPRI	Disaster Risk Management	20130611	20130623	0.43
				20130803	20130810	0.27
				20131107	20131124	0.60
				20140303	20140315	0.43
8	Srikantha Herath	UNU-IAS	Disaster Risk Management	20140306	20140314	0.30
9	Osamu Saito	UNU-IAS	Resilience Strategy	20130803	20130815	0.43
				20140304	20140313	0.33
10	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20131020	20131103	0.47
11	Ram Avtar	UNU-IAS	GIS Analysis	20140306	20140314	0.30
12	Yaw Agyman Boafo	UNU-IAS	Resilience Evaluation	20130731	20130828	0.93
				20140209	20140323	1.50
13	Nicholas Turner	UNU-IAS	Systematic Capacity Development	20130805	20130813	0.30
Total						12.33

Japanese Fiscal Year 2014 (H.26)

No.	Name	Affiliation	Expertise	Duration From (YYMMDD)	Duration To (YYMMD	M/M
1	Kazuhiko Takeuchi	Univ. of Tokyo/UNU	Chief Adviser	20140804	20140813	0.33
2	Kwabena Effah Antwi	Univ. of Tokyo/UNU-IAS	GIS Analysis	20140723	20140825	1.10
3	Geetha Mohan	Univ. of Tokyo	Agronomy	20140803	20140814	0.40
4	Alexandros Gasparatos	Univ. of Tokyo	Agronomy	20140804	20140812	0.30

Annex 6 List of Japanese Experts

5	Hirohiko Ishikawa	Univ. of Kyoto -DPRI	Meteorology	20140613	20140623	0.37
				20140801	20140813	0.43
6	Kenichiro Kobayashi	Univ. of Kobe	Flood Management	20140801	20140813	0.43
7	Muneta Yokomatsu	Univ. of Kyoto -DPRI	Disaster Risk Management	20140705	20140717	0.43
8	Subhajyoti Samaddar	Univ. of Kyoto -DPRI	Disaster Risk Management	20140707	20140716	0.33
				20140804	20140817	0.47
9	Osamu Saito	UNU-IAS	Resilience Strategy	20140803	20140813	0.37
10	Osamu Ito	UNU-IAS	Agronomy	20140707	20140719	0.43
11	Yaw Agyman Boafo	UNU-IAS	Resilience Evaluation	20140720	20140826	1.23
12	Yasuko Kusakari	Univ. of Tokyo	Rural Livelihood and Local Capacity Development	20140731	20140828	0.93
13	Sadahisa Kato	UNU-IAS	Resilience Enhancement	20140730	20140818	0.63
Total						8.20

Grand Total	29.50

Note:
Data is as of 30 August 2014
UNU: United Nation University, UNU-IAS: United Nation University Institute for the Advanced Study of Sustainability,
DPRI: Disaster Prevention Research Institute

Annex 7 List of the trainees in Japan

No.	Name	Position	Affiliation	Training Organization	Field of Training	Period from YYMMDD	Period to YYMMDD	Days
1	Samuel Owusu Ansah	Assistant Meteorologist	Ghana Meteoroidal Agency (G-Met)	Univ. of Kyoto Univ. of Nagoya	The use of satellite derived precipitation data	20121109	20121203	25
2	Shaibu Abdul-Ganiyu	Senior Lecturer	University for Development Studies (UDS)	Univ. of Kyoto Univ. of Nagoya	The use of satellite derived precipitation data	20121109	20121203	25
3	Kwadwo Owusu	Lecturer	Univ. of Ghana	Univ. of Kyoto Univ. of Nagoya	The use of satellite derived precipitation data	20121109	20121203	25
4	Kwabena Asubonteng	Researcher	UNU-INRA	United Nations University (UNU), Univ. of Tokyo	GIS Training for joint development of GIS training program with CECARE-Africa cases	20130125	20130205	11
5	Alex Barima Owusu	Lecturer	Univ. of Ghana	United Nation Univ. Univ. of Tokyo	GIS Training for joint development of GIS training program with CECARE-Africa cases	20130125	20130205	11
6	Kwabena Asubonteng	Researcher	UNU-INRA	United Nation Univ.	GIS Training for joint development of GIS training program with CECARE-Africa cases	20140125	20140202	8
7	Victor Lolig	Researcher	UDS	United Nation Univ.	GIS Training for joint development of GIS training program with CECARE-Africa cases	20140125	20140202	8
8	Samuel Owusu Ansah	Assistant Meteorologist	Ghana Meteoroidal Agency (G-Met)	Univ. of Kyoto	Basics of Numerical weather prediction	20131109	20131220	42
9	Peter Nunekpeku	Assistant Meteorologist	Ghana Meteoroidal Agency (G-Met)	Univ. of Kyoto	Basics of Numerical weather prediction	20131109	20131220	42

Annex 8 List of the provided equipment

Japanese Fiscal Year 2012

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
1	Clear One Chat 150 (Speaker)	CHAT150USB 910-156-200	Clear One	4	JPY	252,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
2	Laptop PC	Think Pad L530 2481CTO	Lenovo	4	JPY	504,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
3	Liquid crystal projector	EB-W12	EPSON	4	JPY	336,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
4	Screen	ELPSC23	EPSON	4	JPY	160,000	UG, G-Met, UDS (Nyankpala), UNU-INRA	Good
5	Digital camera	DMC-TZ30-K	Panasonic	2	JPY	72,000	PJ Office	Good
6	Color Monitor	E2341V-BNX,AJLMOSN	LG	2	JPY	43,600	G-Met HQ	Good
7	Data Server(workstation) with software	RCR-X200(RCRXE5140-R32),Visual Fortram Composer XE2013, Visual Studio Pro2012	Real Computing	2	JPY	2,108,000	G-Met HQ	Good
8	Elemental Analyzer	Model:MH-5000 with Standard accessories	Micro Emission	1	JPY	3,000,000	UDS (Nyankpala)	Good
9	Carrying case	Model:Watertight case with special inner	Micro Emission	1	JPY	40,000	UDS (Nyankpala)	Good
10	Quartz Cuvette	Model:LepiCuve-C	Micro Emission	3	JPY	150,000	UDS (Nyankpala)	Good
11	Regin Cuvette	Model:LepiCuve-02	Micro Emission	1Pac	JPY	16,000	UDS (Nyankpala)	Good
12	GIS Software Licenses	Professional EMEA Educ Kit	ERADAS IMAGINE	10	USD	17,900	UNU-INRA (GIS Lab)	license renewed in 2014
Total					JPY	8,539,083	-	-
					GHS	311,645	-	-

Japanese Fiscal Year 2013

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
1	Data Server	HP Proliant DL380p 8G(470065-656)	HP	1	GHS	9,800	UG (Dept. of Geography and Resource Development)	Good
2	Desktop PC	HP Elite 8300SFF with23in.monitor	HP	1	GHS	3,530	UG (Dept. of Geography and Resource Development)	Good
3	Laptop PC	Toshiba Satellite S55-A5339	Toshiba	1	GHS	3,200	UG (Dept. of Geography and Resource Development)	Good
4	Automatic Weather Station (AWS)	MAWS301	VAISALA	3	GHS	265,000	G-Met Bole,Yendi, Salaga stations	Good
5	RC-C Server Xeon 4way with software	RC CS21K-SB20256,PowerChute Business Edition Delux for Linux;Unix 1node Simple Shutdown without upgrade license	Real Computing	1	JPY	2,498,370	G-Met HQ	Good
Total					JPY	10,212,292	-	-
					GHS	372,711	-	-

Japanese Fiscal Year 2014

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
9	Hydrosense	HS2P-12-C		1Set	JPY	242,100	UDS (Nyankpala for field)	Good
10	Hydrosense	HS2P-20-C		1	JPY	242,100	UDS (Nyankpala for field)	Good
11	Accu PAR Computer LP-80	N/A		1	JPY	675,400	UDS (Nyankpala for field)	Good
12	Mini Disk Infiltorometer Decagon Devices	N/A		1set	JPY	106,920	UDS (Nyankpala for field)	Good
13	Laptop PC	Panasonic Tough Book 19 CF-195W1ACS	Panasonic	1	JPY	285,500	UDS (Nyankpala for field)	Good
14	Rain Gauge	RG3-M		10	JPY	531,000	Field in Fihini *	Good
15	Optic USB Base Station	BASE-U-1		2set	JPY	20,000	UDS (Nyankpala)	Good
16	BHW-PRO-CD software	N/A		1	JPY	17,000	UDS (Nyankpala)	Good
17	U12 4-External Channel Outdoor Data Logger	N/A		2	JPY	70,600	UDS (Nyankpala)	Good

No.	Name	Equipment	Maker	Quantity	Currency	Price	Installation Place	Current Condition
18	Temperature sensor	TMC20-HD		24	JPY	148,800	Field in Fihini*	Good
19	Tensiometer sensor	DIK-3160-11,DIK-3160-54,DIK-8333-11,DIK-3160-54, DIK-3160-11		2each	JPY	159,200	Field in Fihini	Good
20	Tensiometer indicator	DIK-3162-01		10	JPY	56,000	Field in Fihini	Good
Total					JPY	2,554,620	-	-
					GHS	93,234	-	-

*Only one rain gauge and temperature sensor were installed in the field of Fihini. The others will be installed at different places in future.
(Exchange rate USD 1.0 =JPY 103.77, GHS 1.0 = JPY 27.4 as of Sep 2014)

Grand Total	JPY	**21,305,995**
	GHS	777,590

Annex 9 List of Ghanaian Counterpart personnel

University of Ghana

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Prof. Edwin Akonno Gyasi	Professor	Department of Geography and Resource Development	1-9, 1-10, 3-1	Project Director (PD), Agricultural Land Management and Participatory Rural	
2	Prof. Daniel Sarpong	Professor	Department of Agriculture Economics	1-1, 1-3, 1-6, 1-8, 1-9		
3	Dr. Adelina Mensah	Lecturer	Department of Geography and Resource Development	1-2, 1-6, 1-9		
4	Dr. Alex Owusu Barima	Lecturer	Department of Geography and Resource Development	1-1, 1-2, 1-3, 1-4, 1-8		
5	Dr. Kwadwo Owusu	Lecturer	Department of Geography and Resource Development	1-1, 1-9, 2-1		
6	Mr. Gerald A. B. Yiran	Assistant Lecturer	Department of Geography and Resource Development	1-1, 1-4, 1-7, 1-8		
7	Prof. Mark Kofi Abekoe	Supervisor, Associate	Department of Soil Science	1-2		
8	Mr. George Owusu	Assistant Lecturer	Hydrology, Department of Geography and Resource	1-3, 1-5,1-7		
9	Dr. Oteng Ababio	Senior Lecturer	Department of Geography and Resource Development	1-5, 1-6		
10	Dr. Kwabena Awere Gyekye	Lecturer	Department of Geography and Resource Development	1-3, -1-7	Landscape Ecology	Team leader of Theme 1
11	Dr. Emmanuel Morgan Attua	Senior Lecturer	Department of Geography and Resource Development	1-6, 1-8		
12	Mr. Emmanuel Tachie-Obeng	Special Lecturer	Department of Geography and Resource Development	1-1, 1-5		

Ghana Meteorological Agency

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Mr. Zenede Minia	Director General	Ghana Meteorological Agency	2-2, 2-3	Climate Change	Transferred
2	Gp. Capt. Stephen Y. Komla	Director General	Ghana Meteorological Agency			
3	Miss Elikem Setsoafia		Ghana Meteorological Agency	2-1		
4	Mr. Ayilari-Naa Juati	Director	Ghana Meteorological Agency	2-1, 2-3	Weather Observation and Forecasting	Team leader of Theme 2
5	Mr. Amos Narh		Ghana Meteorological Agency	2-1	Operational Meteorology	
6	Mr. Peter Nunekpeku		Ghana Meteorological Agency	2-1		
7	Mr. Samuel Owusu Ansah		Ghana Meteorological Agency	2-1		
8	Mr. Charles Yorke		Ghana Meteorological Agency	2-2		
9	Mr. Dominic Pokperlaar		Ghana Meteorological Agency	2-2		
10	Mrs. Francisca Martey		Ghana Meteorological Agency	2-1		
11	Mr. Andrew Nkansah		Ghana Meteorological Agency	2-1, 2-3	Data Management	

University for Development Studies

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Prof. Gordana Kranjac-Berisavljevic	Professor	University of Development Studies,	2-2, 2,2, 2-3, 3-1, 3-5, 3-6,		
2	Dr. Francis Kwabena Obeng	Senior Lecturer	Faculty of Agribusiness and Communication Sciences	3-5, 3-6	Extension and Training	Team leader of Theme 3
3	Mr. Bizoola Zinzoola Gadaa	Lecturer/Researcher	Faculty of Agriculture (Nyankpala)	3-1, 3-2	On-farm Disaster/Management &SWC	Currently, Research in Holland from June 2014 - Oct 2014
4	Mr. Shaibu Abdul-Ganyu	Senior Lecturer	Faculty of Agriculture (Nyankpala)	2-1, 2-2	Hydrology	
5	Mr. Fauster Agbenyo	Lecturer	Department of Community Development (Wa)	2-3	Soil Science	
6	Dr.Togbiga Dzivenu	Executive Director	Center for Disaster Research and Education (Wa)	2-2, 3-1, 3-2, 3-3, 3-4		
7	Mr. Balma Yakubu	Lecturer	Faculty of agriculturebusines	3-4		
8	Mr. Frederick Dayuo	Lecturer	Department of Community Development (Wa)	3-1, 3-2		
9	Mr. Godfred Jasaw	Lecturer/Researcher	Department of Community Development (Wa)	3-1, 3-2		Currently, PhD student, UNU-IAS as CECARE long-term
10	Dr. Samuel A. Donkoh	Senior Lecturer	Faculty of Agribusiness and Communication Sciences	3-3	Economics	
11	Mr. Victor Lolig	Lecturer	Faculty of Agribusiness and Communication Sciences	3-3		
12	Dr. Richard Yeboah	Senior Lecturer	Faculty of Agribusiness and Communication Sciences	3-4, 3-5	Agribusiness	
13	Mr. Felix K. Abagale	Senior Lecturer	Faculty of Agriculture (Nyankpala)	3-3		Not listed in PO
14	Mr. Vincent Kodjo Avornyo	Lecture	Department of Agronomy, Faculty of Agriculture (Nyankpala)	3-3		PhD course in USA from June 2014 to Oct 2014

Institute for Natural Resources in Africa, United Nation University

No.	Name	Position	Affiliation	Activity	Project Position (RD)	Remarks
1	Dr. Elias T. Ayuk	Director	UNU-INRA	3-7	Agricultural Economist	
2	Mr. Kwabena Owusu Asuboteng	Geo-Information Analyst	UNU-INRA	3-1, 3-2, 3-3, 3-6		
3	Ms. Yasuko Kusakari	Socio-Economist Fellow	UNU-INRA	3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7	Rural Livelihoods and Local Capacity Developm	Currently, Ph.D. student, GPSS-GLI, Univ. of Tokyo and a member of Japanese expert
4	Dr. Timothy Koomson	Environmental Policy Fellow	UNU-INRA	3-4	Environment	Resigned
5	Dr. Gessesse Dessie	Capacity development fellow	UNU-INRA	3-4, 3-5		

Annex 10 List of the published original papers

Output 1

1) Ramu, K., Watanabe, T., Uchino, H., Sahrawat, K. L. Wani, S. P., Ito, O.: Fertilizer induced nitrous oxide emissions from Vertisols and Alfisols during sweet sorghum cultivation in the Indian semi-arid tropics, Science of the Total Environment, 438. pp. 9-14, 2012.
2) Mohan, G. and Matsuda, H.: Regional level total factor productivity growth in Ghana agriculture, Journal of Economics and Sustainable Development, Vol. 4, No.5, pp. 195-206, 2013.
3) Uchino, H., Watanabe, T., Ramu, K., Sahrawat, K. L., Marimuthu, S., Wani, S. P., Ito, O.: Effects of Nitrogen Application on Sweet Sorghum (Sorghum bicolor (L.) Moench) in the Semi-Arid Tropical Zone of India. JARQ - Japan Agricultural Research Quarterly, Vol. 47, No. 1, pp. 65-73, 2013.
4) Mohan, G., and Matsuda, H.: Regional level total factor productivity growth in Ghana agriculture, Journal of Economics and Sustainable Development, Vol. 4, No.5, pp. 195-206, 2013. http://www.iiste.org/Journals/index.php/JEDS/article/view/5017/5116
5) Mohan, G., Matsuda, H., Donkoh, S. A., Lolig, D. V., and Abbeam, G. D.: Effects of Research and Development Expenditure and Climate Variability on Agricultural Productivity Growth in Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 443-451, 2014.
6) Tachie-Obeng, E., Hewitson, B., Gyasi, E. A., Abekoe, M. K., and Owusu,G.: Downscaled Climate Change Projections for Wa District in the Savanna Zone of Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 422-431, 2014.

Output 2

1) Kobayashi, K. and Takara, K.: Development of a Distributed Rainfall-Runoff/Flood Inundation Simulation and Economic Risk Assessment Model, Journal of Flood Risk Management, DOI:10.1111/j.1753-318X.2012.01157, 2012.
2) Sawai, N., Takara, K., and Kobayashi, K.: Evaluation of water retention capacity and flood control function of the forest catchment, Journal on Food, Agriculture and Society, Vol. 1, No. 1 , pp. 13-22, 2013.
3) Kobayashi, K., and Takara, K.: Development of a Distributed Rainfall-Runoff/Flood Inundation Simulation and Economic Risk Assessment Model, Journal of Flood Risk Management, Vol. 6, Issue 2, pp. 85-98, 2013.
4) Samaddar, S., Yokomatsu, M., Dzivenu, T., Oteng-Abadio, M., Adams, M.R., Dayour, F., and Ishikawa, H.: Assessing Rural Communities Concerns for Improved Climate Change Adaptation Strategies in Northern Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 529-541, 2014.
5) Sawai, N., Kobayahsi, K., Apip, Takara, K., Ishikawa, H., Yokomatsu, M., Samaddar, S., Juati, A.-N., and Kranjac-Berisavljevic, G.: Impact of Climate Change on River Flows in the Black Volta River, Journal of Disaster Research, Journal of Disaster Research, Vol. 9 No. 4, pp. 432-442, 2014.

Output 3

1) Fujihara, Y., Yamada, R., Oda, M., Fujii, H., Ito, O., Kashiwagi, J.: Effects of puddling on percolation and rice yields in rainfed lowland paddy cultivation: Case study in Khammouane province, central Laos, Agricultural Sciences, Vol. 4, No. 8, pp.360-368, 2013.
2) Uchino, H., Watanabe, T., Ramu, K. Sahrawat, K. L. Marimuthu, S., Wani, S. P., Ito, O.: Calibrating Chlorophyll Meter (Spad-502) Reading by Specific Leaf Area for Estimating Leaf Nitrogen Concentration in Sweet Sorghum. Journal of Plant Nutrition, Vol. 6, No. 10, pp. 1640-1646, 2013.
3) Boafo, Y. A., Asiedu, A. B., Addo, K. A., Antwi, K. E., and Boakye-Danquah, J.: Assessing Landcover Changes from Coastal Tourism Development in Ghana: Evidence from the Kokrobite-Bortianor Coastline, Accra, Civil and Environmental Research, Vol. 6, No. 6, pp. 9-19, 2014.
4) Antwi, E.K., Boakye-Danquah, J., Boahen, A.S., Yiran, G., Seyram, K.L., Awere, G.K., Abagale, F.K., Asubonteng, K.O., Attua, M.E., and Owusu, A.B.: Land Use and Landscape Structural Changes in the Ecoregions of Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 452-467, 2014.
5) Avornyo, V.K., Ito, O., Kranjac-Berisavljevic, G., Saito, O., and Takeuchi, K.: Cropping Systems in Some

Drought-Prone Communities of the Northern Region of Ghana: Factors Affecting the Introduction of Rice, Journal of Disaster Research, Vol. 9 No. 4, pp. 475-483, 2014.

6) Boafo, Y.A., Saito, O., and Takeuchi, K.: Provisioning Ecosystem Services in Rural Savanna Landscapes of Northern Ghana: An Assessment of Supply, Utilization, and Drivers of Change. Journal of Disaster Research, Vol. 9 No. 4, pp. 501-515, 2014.
7) Boakye-Danquah, J., Antwi, E.K., Saito, O., Abekoe, M.K., and Takeuchi, K.: Impact of Farm Management Practices and Agricultural Land Use on Soil Organic Carbon Storage Potential in the Savannah Ecological Zone of Northern Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 484-500, 2014.
8) Kranjac-Berisavljevic, G., Abdul-Ghanyu, S., Gandaa, B.Z., and Abagale, F.K.: Dry Spells Occurrence in Tamale, Northern Ghana – Review of Available Information. Journal of Disaster Research, Vol. 9 No. 4, pp. 468-474, 2014.
9) Kusakari, Y., Asubonteng, K.O., Jasaw, G.S., Dayour, F., Dzivenu, T., Lolig, V., Donkoh, S.A., Obeng, F.K., Gandaa, B., and Kranjac-Berisavljevic, G.: Farmer-Perceived Effects of Climate Change on Livelihoods in Wa West District, Upper West Region of Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 516-528, 2014.
10) Lolig, V., Donkoh, S.A., Obeng, F.K., Kodwo, A.I.G., Jasaw, G.S., Kusakari, Y., Asubonteng, K.O., Gandaa, B., Dayour, F., Dzivenu, T., and Kranjac-Berisavljevic, G.: Households' Coping Strategies in Drought- and Flood-Prone Communities in Northern Ghana, Journal of Disaster Research, Vol. 9 No. 4, pp. 542-553, 2014.
11) Otsuki, K., Jasaw, G.S., and Lolig, V.: Framing Community Resilience through Mobility and Gender, Journal of Disaster Research, Vol. 9 No. 4, pp. 554-562, 2014.

Output 1~3

1) Antwi, E.K., Otsuki, K., Saito, O., Obeng, F.K., Gyekye, K.A., Boakye-Danquah, J., Boafo, Y.A., Kusakari, Y., Yiran, G.A.B., Owusu, A.B., Asubonteng, K., Dzivenu, T., Avornyo, V.K., Abagale, F.K., Jasaw, G.S., Lolig, V., Ganiyu, S., Donkoh, S.A., Yeboah, R., Kranjac-Berisavljevic, G., Gyasi, E.A., Minia, Z., Ayuk, E., Matsuda, H., Ishikawa, H., Ito, O., and Takeuchi, K.: Developing a Community-Based Resilience Assessment Model in Northern Ghana. Journal of Integrated Disaster Risk Management.

Note: This is a result that the Project classified the papers into the most related Output. One article may not be related to only one Output.

Source: SATREPS Mid-tern Report, August 2014