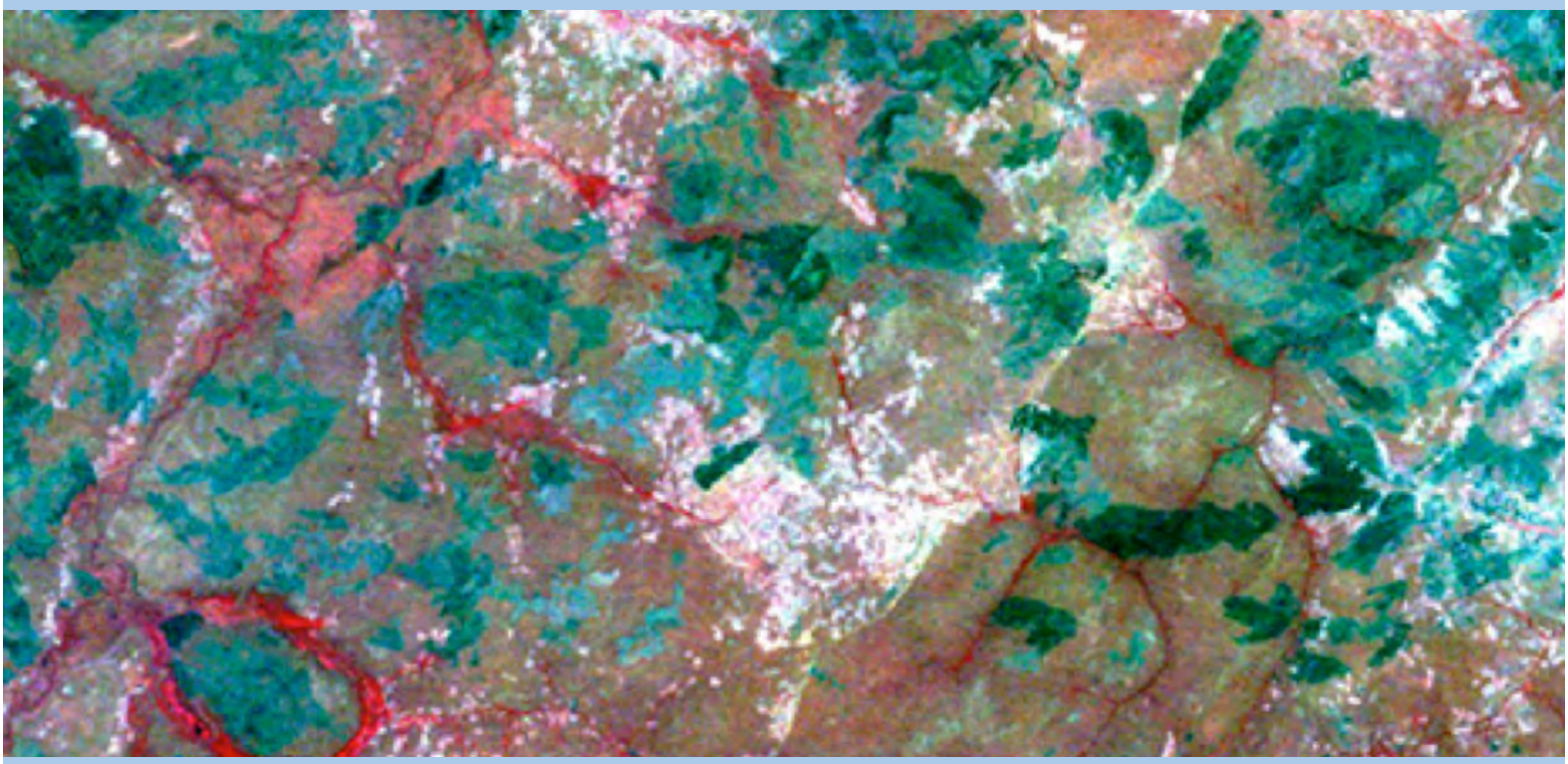
USAID
FROM THE AMERICAN PEOPLE



Assessment of Land Use Dynamics and Climate Change Activities

By the United States Geological Survey's Earth Resources Observation System and the Committee for Drought Control in the Sahel's Regional Center for Training and Application of Agrometeorology and Operational Hydrology - 2011-2015

September 2015

This publication was produced at the request of the United States Agency for International Development. It was prepared independently by Integra Government Services International LLC.

Cover image courtesy of USGS/EROS. It is a Landsat image depicting land use in western Burkina Faso taken in Oct 1972. Bright specks are areas of cultivation. Red and reddish brown areas are savanna woodlands and gallery forest. Bluish-grey areas indicate burned areas from seasonal grass fires. See http://lca.usgs.gov/lca/africalulc/objectives.php.

Assessment of Land Use Dynamics and Climate Change Activities

BY THE UNITED STATES GEOLOGICAL SURVEY'S EARTH RESOURCES OBSERVATION SYSTEM AND THE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL'S REGIONAL CENTER FOR TRAINING AND APPLICATION OF AGROMETEOROLOGY AND OPERATIONAL HYDROLOGY

2011-2015

September 10, 2015

AID-OAA-I-14-00018

TASK ORDER UNDER THE REPLACE IDIQ

This publication was produced at the request of the United States Agency for International Development. It was prepared independently by Integra Government Services International LLC.

DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

CONTENTS

ACRONYMS

ADS ..... Automated Directive System (of USAID)
AGRHYMET ..... Regional Center for Training and Application in Agrometeorology and Operational Hydrology (a specialized technical center of CILSS)
ARC ..... AGRHYMET Regional Center (Niamey)
ASTER ..... Advanced Spaceborne Thermal Emission and Reselection Radiometer (satellite inst.)
AVHRR ..... Advanced Very High Resolution Radiometer (satellite instrument)
CGIAR ..... Consultative Group on International Agricultural Research
CILSS ..... Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Permanent Interstate Committee for Drought Control in the Sahel)
CORONA ..... reconnaissance satellite (proper name commonly mistaken for an acronym)
CSE ..... Centre de Suivi Ecologique (Senegal)
CURAT ..... Centre Universitaire de Recherche et d'Application en Télédétection
ECOWAS ..... Economic Community of West African States
EROS ..... Earth Resources Observation Systems
ETM+ ..... Landsat Enhanced Thematic Mapper
EU ..... European Union
FAO ..... Food and Agriculture Organization of the United Nations
FEWS NET ..... Famine Early Warning Systems Network
FGDC ..... Federal Geographic Data Committee
GCAM ..... Global Change Assessment Model
GIS ..... Geographic Information System
GIZ ..... Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH German Organization for International Cooperation
INSAH ..... Institute for the Sahel (a specialized technical center of CILSS)
ISO ..... International Standards Organization
LUDACC ..... Land Use Dynamics and Adapting to Climate Change (the assessed activities)
LULC ..... Land Use/Land Cover
MESA ..... Monitoring for Environment and Security in Africa (EU program)
MODIS ..... Moderate Resolution Imaging Spectroradiometer
MRU ..... Mano River Union
NASA ..... US National Aeronautics and Space Agency
NDVI ..... Normalized Difference Vegetation Index
NOAA ..... US National Oceanographic and Atmospheric Agency
NAC ..... National CILSS/AGRHYMET Center
NRM ..... Natural Resources Management
OMB ..... Office of Management and Budget
PAPA ..... Participating Agency Program Agreement
PRGDT ..... Programme Régional de Gestion Durable des Terres et d'Adaptation

aux changements climatiques au Sahel et en Afrique de l'Ouest (program of CILSS)
PZ ..... Priority Zone
QGIS ..... Quantum Geographic Information System (an open source software program)
REDD ..... Reduced Emissions from Deforestation and Forest Degradation
REGIS AG ..... Resilience and Economic Growth in the Sahel (USAID program)
RLCM ..... Rapid Land Cover Mapper
ROECCR ..... Regional Office of Environment and Climate Change Response (USAID/West Africa)
RS ..... Remote Sensing
SOAG ..... Strategic Objective Grant Agreement
SODEFORE ..... Sociéte de Développement des Forêts de Côte d'Ivoire
STEWARD III ..... Sustainable Environments for West Africa's Regional Development
(a project implemented for USAID by the US Forest Service, in its third phase)
USAID ..... US Agency for International Development
USGS ..... US Geological Survey

EXECUTIVE SUMMARY

A. SCOPE OF ASSESSMENT

From mid-May through June, 2015, a team of five experts, organized by Integra Government Services International LLC (Integra), conducted an assessment of work undertaken on mapping land use and land cover dynamics in West Africa, during 2011 and 2015 by the Earth Resources Observation Systems center of the US Geological Survey (USGS/EROS) based in Sioux Falls South Dakota, and the Regional Center for Training and Application in Agrometeorology and Operational Hydrology (AGRHYMET) based in Niamey Niger, together with the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), based in Ouagadougou – Burkina Faso (henceforth CILSS/AGRHYMET). The assessment was commissioned by the US Agency for International Development (USAID). It covers the second phase of this activity, which in turn, is built upon decades of support provided by USAID to address the changing environment of West Africa.

To conduct the assessment, the Assessment Team divided into two groups, and visited more than 40 institutions in five West African countries and in the United States, and interviewed 130 experts. Mr. Andrew Stancioff, a geologist, and Geographic Information System (GIS) expert with more than 30 years' experience in land and natural resource management in the region, led the Assessment Team, and Mr. John Waugh, Integra LLC's Director for Climate and Environment led the second group. Other team members included:

- Dr. Ariane de Bremond, Social Geographer specializing in Climate Change;
- Mr. Benjamin White, Satellite Remote Sensing expert;
- Dr. John Lewis, Anthropologist with extensive experience in food production systems in the region.

The detailed biographies of all the team members are presented as Annex IX.

B. PROJECT BACKGROUND

The current era of USAID/West Africa's support to USGS/EROS for its work on remote sensing for development began in 2008. In the first phase during 2008-2011, the work primarily focused on livelihoods. The second phase of work (2011-2015), builds upon forty years of data collection to look at large scale change using a time-series of maps, which is also the subject topic on which this particular assessment was conducted.

For this second phase, USAID/West Africa entered into a separate agreement with CILSS/AGRHYMET with the two-fold objectives of i) supporting the work of USGS/EROS and ii) promoting a mutually supportive relationship between USGS/EROS and CILSS/AGRHYMET. Under this agreement, CILSS/AGRHYMET is to support national GIS facilities in the 17 participating countries across the region to produce land use/land cover change maps and a composite regional *Atlas of Environmental Transformations*, using data and technical backstopping from USGS/EROS. Slightly more than 82 percent of the project funding was directed to USGS/EROS, with the remainder to CILSS/AGRHYMET.

The original scope of work, which is being assessed under the current USAID commissioned assessment study, was organized under four themes:

1. A multi-year land use/land cover change map for the 17 countries of the region (USGS/EROS), with national inputs into the regional atlas being produced for each country (CILSS/AGRHYMET);
2. A Sahel Studies component focusing on documentation of efforts to combat desertification (USGS/EROS, CILSS/AGRHYMET);

3. Support for biodiversity conservation in the area in and around the trans-boundary Park W region of Benin, Burkina Faso, and Niger (cancelled mid-project[1]) (USGS/EROS); and

4. Support for biodiversity conservation in the Upper Guinea Forest ecosystem of West Africa (USGS/EROS).

These four themes were explicitly mentioned in the USAID Participating Agency Partnership Agreement (PAPA) with USGS/EROS, while the Implementation Letter governing the CILSS/AGRHYMET agreement addressed only the first two topics.

For purposes of this assessment, "project" will refer to the combined efforts of the both of the above two agreements, unless otherwise stated.

C. ASSESSMENT QUESTIONS, DESIGN, METHODS AND LIMITATIONS

This task assessed the progress of the activities carried out by USGS/EROS and CILSS/AGRHYMET against their respective work plans, and the findings of the assessment are used as reference to inform USAID on the scope and direction of future programming in this subject area. USAID provided the following five questions as guidelines to conduct the assessment:

1. What factors helped or hindered the achievement of the expected outcomes?

2. Are data standards and methodology made available to the public and policy makers in a manner consistent with the USG open government initiative?

3. What lessons can be drawn from the teaming arrangements for capacity building in the region?

4. To what extent have the two activities been able to build the capacity of analysts and decision-makers in government, civil society, groups and the media to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications?

5. To what extent has CILSS/AGRHYMET improved the management, sharing, and access to time series maps in its member countries?

As distinct from a formal evaluation, the objective of this assessment was to address the potential and actual capacity in the region for the use of remotely sensed earth observations for development.

- The team was required to visit the USGS EROS Data Center in Sioux Falls, South Dakota, the AGRHYMET Regional Center in Niamey, and the CILSS headquarters in Ouagadougou in Africa, and to conduct field studies in the following countries as determined by the USAID Agreement Officer's Representative (AOR): Burkina Faso, Côte d'Ivoire, Ghana, Liberia, and Niger.
- To complete the fieldwork within the allotted time, the Assessment Team divided into two groups, with one group covering Sioux Falls and Liberia, and the other group covering Ghana, Burkina Faso, Côte d'Ivoire, and Niger.
- The group that visited Sioux Falls interviewed the USGS project team, and conducted a technical review of mapping products produced under the project. The second group that visited the remaining countries in Africa conducted the project in-brief meeting with the USAID/West Africa Mission, interviewed the CILSS/AGRHYMET project team, and conducted the debrief at CILSS

[1] No documentation or rationale was provided concerning this cancellation

headquarters. Together, the two teams conducted personal interviews with 130 experts, who represented 45 different institutions from seven countries and a substantial number of international organizations, bilateral donors and implementing partners in the course of the assignment (see Annex IV for a full list). A survey questionnaire was developed to reach project participants from the countries that the teams were unable to visit personally. This was distributed to national focal points by CILSS/AGRHYMET. This generated information from an additional ten national experts. The method employed for collecting information was a semi-structured interview (the instrument is in Annex III, the transcripts are in Annex V).

A key limitation of this assessment, is the small number of participants in the national mapping exercise. As a mapping study benchmark, there should have been at least two participants per country for the 17[2] countries identified for the assessment. However, in actual fact, the total number of participants for all of the seventeen countries ranged between 20 and 24 only, because some countries did not participate at all and others dropped out mid-way through the exercise. To compensate for this inadequate participation, the teams also identified and interviewed more than 100 additional national experts who did not originally participate in the entire process. These experts were identified through professional networks and referrals from the CILSS/AGRHYMET national focal points, donors, and international organizations.

Controlling for availability bias was a challenge for the Assessment Team due to the very small pool of experts available for consultation in most of the countries where the assessment was conducted, coupled with the relative lack of technical capacity in GIS, mapping and satellite imagery interpretation, and the lack of objective documentation of capacity needs in the whole region. The team compensated for this through literature review of existing studies of land use/land cover change in the region, and by interviewing additional donor and international organization representatives for a wider perspective, who were originally not included in the initial project design.

D. FINDINGS AND CONCLUSIONS

Project Design and Management

The assessment team found that although several joint activities took place in the project (e.g., workshops, hotspot analysis and fieldwork), there was not a shared sense of coordination between CILSS/AGRHYMET and USGS/EROS. CILSS/AGRHYMET was insistent that they were not fully consulted in the design of activities. The assessment team determined that there was:

- Lack of evidence for clearly defined roles and responsibilities of each partner;
- Lack of evidence for joint work planning; and
- Insufficient engagement by USAID with the partners to promote appropriate coordination.

The Assessment Team found that the design of the combined activities of USGS/EROS and CILSS/AGRHYMET was inadequate, resulting in inadequate coordination of efforts. CILSS/AGRHYMET was unclear about the responsibilities of USGS/EROS, and no formal joint work planning was undertaken. Overall, oversight of both activities on the part of USAID did not identify and correct these problems.

[2] The USAID PAPA with USGS/EROS lists 18 "countries", splitting Nigeria into two (north and south) to accommodate two country teams, on account of the size of the country

The activities carried out by USGS/EROS and CILSS/AGRHYMET that were assessed did not have the benefit of an in-depth causal analysis such as a theory of change, that would explicitly link outputs to development outcomes. The focus of the work, as demonstrated through document review and interviews, was on the technical production of maps and not on systematic analysis to address the drivers of the change observed through the map products. As a result, map users will be left on their own to determine the drivers of change, yet an understanding of such drivers is precisely what is needed to inform development planning, including responding to the requirements for the use of the Global Climate Change and Biodiversity earmarks.

CILSS/AGRHYMET did not develop a clear plan for the uses of the maps, nor did it have a clear strategy to build adequate local and regional capacity to ensure sustainability of the ongoing work beyond the project life. As a result, only a small handful of the countries included in the project continue to have the capacity to reproduce the effort and contribute to land use/land cover change analysis through the generation of new map data and not sufficient new capacities were developed during the lifetime of the projects.

Deliverables

In terms of USGS deliverables, the Assessment Team's key findings include:

- The land use/land cover change product (Theme 1) was behind schedule, but nearly 100% complete in June 2015. A draft reviewed by the Assessment Team illustrates dramatic environmental changes during the period 1975-2010. When this document will be 100% complete, and if properly distributed, it will serve as a major reference document for environmental policy and planning at regional and national levels.
- The available documentation of re-greening in the Sahel (Theme 2), which was only 70% complete in June 2015, provides important support for farmer-initiated innovation that promotes resilience, illustrating the positive trends in environmental management in the region.
- Support for Theme 3 was truncated during the project and there was too little completed work available to the team to make any feasible assessment.
- Support for the protected areas and forest management of West Africa (Theme 4) provided the desperately needed map resources. However, the final maps were not delivered in a timeframe so as to be useful to the ongoing USAID-supported regional project, STEWARD III.

In terms of CILSS/AGRHYMET deliverables, the Assessment Team's key findings include:

- The prototype of the composite regional *Atlas of Environmental Transformations* was developed jointly by CILSS/AGRHYMET and USGS/EROS during a visit by CILSS/AGRHYMET project focal point Alfari Issifou to the EROS Data Center in Sioux Falls in 2013. Two meetings were held in Burkina Faso on the atlas production. Atlas development was delayed due to the late receipt of information from the national focal points. These delays resulted from the poor preparedness of the participating national focal points. The inadequate preparedness reflected the weaknesses in the participant selection process, which included poorly specified qualifications and an *ad hoc* process for the identification of participants.
- Too little was done to build local capacity within the region, both at the individual and institutional level.

The major outputs of this effort, including the Land Use/Land Cover time series and the atlas, were not yet complete at the time of Integra's assessment in June 2015. The use of available interdisciplinary assessment tools, in combination with the map data, will provide a more complete picture of the complex dynamics of the observed changes that have been sweeping across West Africa. USGS has extensive expertise with baselines; other agencies such as the US National Oceanographic and

Atmospheric Administration (NOAA) and the US National Aeronautics and Space Administration (NASA) have highly complementary expertise in modeling. Therefore, a follow up to this activity could benefit from expanded collaboration among these agencies.

Recommendations

1. The Assessment Team found that the final deliverable/theme products are in demand and will be used extensively once both the maps and map data are made available, and therefore, the project represents a potentially good value for the investment. However, the maximum value of such a project can be obtained only when the following conditions are met and addressed effectively:

- The products are effectively linked with on-the-ground development work, which requires adherence to and delivery on planned schedule. Lack of clarity about the timetable for deliverables and failure to deliver products in a timely manner were shortcomings of the current work as identified in the assessment.
- National and regional institutions develop the capacity to use and contribute to the production of these maps and atlases.
- Key constraints to uses of the technology are addressed, including
    - Poor or nonexistent bandwidth for data access
    - Expensive proprietary licenses for software to use data
    - Lack of investment in human resources to use the data

2. As one of the most significant recommendations for completion of the existing activity, the team suggests that it is imperative to develop a robust communications strategy for the dissemination of the final map products. Bearing in mind the observed constraints, it is important that the maps and the *Atlas of Environmental Transformations,* along with guidance on the interpretation of the map information, be printed and wildly distributed to government agencies, civil society organizations, and the press in every country in the region, in appropriate languages.
3. In addition, the Assessment Team established that there is a high demand for digital versions of the mapping products throughout government agencies and educational institutions that they interviewed in Cote d'Ivoire, Burkina Faso, Liberia, and Niger. Where possible, digital versions of the maps should be shared with the relevant government agencies, educational institutions and civil society organizations. This should take precedence over any other activity in the conclusion of the two activities.

Assessment Purpose and Questions

Assessment Purpose

The purpose of this assessment is to document progress against the respective activity work plans of USGS and CILSS/AGRHYMET and to inform USAID on future programming beyond the life of these activities. The intended audiences are USAID/West Africa, USGS, CILSS/AGRHYMET, and their national partners. USAID is particularly interested in learning ***whether there are any critical program issues that can be used to inform future programming related to capacity building of regional entities***. The assessment is expected to provide pertinent information, statistics, and judgments that could help assist USGS/EROS, CILSS/AGRHYMET and USAID/West Africa to learn what is being accomplished, what relevant management structure and practices are required to accomplish the objectives of the two activities, and what lessons can inform future USAID programming.

Assessment Questions

The Assessment Team was to focus its assessment on the following questions:

1. What factors (both internal and external to the program) helped or hindered the achievement of the two projects' expected outcomes as detailed in the USGS/EROS and CILSS/AGRHYMET work plans and agreements?
2. Are the data, standards and methodology made available to the public and policy makers in a manner consistent with the USG open government initiative?
3. What lessons can be drawn from USGS/CILSS/AGRHYMET teaming arrangement for capacity building in the region?
4. To what extent have the two activities been able to build the capacity of analysts and decision makers in government, civil society groups, and the media to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications?
5. To what extent has CILSS/AGRHYMET improved the management, sharing and access to time series maps in its member countries?

PROJECT BACKGROUND

USGS/EROS is a research facility for remote sensing and geographic information, based in Sioux Falls, South Dakota. Created in the early 1970s, it holds the world's largest collection of civilian remotely-sensed data concerning the Earth's surface. EROS combines data archives, engineering, and scientific expertise to study changes in land from both natural and human drivers. USGS/EROS has been mapping land use and land cover change in West Africa for approximately 40 years, and has been a close partner with USAID since initiating its West Africa work soon after its creation.

CILSS/AGRHYMET, based in Niamey, Niger, was created in 1974 as a specialized institution of CILSS. It was created in response to severe droughts in the region in the early 1970s. Originally a drought monitoring center, it has broadened its scope to address food security and climate change through research and training programs. AGRHYMET is expanding its scope beyond the Sahelian states to serve all of the members of the Economic Community of West African States (ECOWAS). This is reflected in its collaboration with USGS/EROS, and its joint implementation with the African Center for Meteorological Applications of the World Meteorological Organization-designated West Africa Regional Climate Center Network.

The current era of USAID/West Africa support for USGS/EROS began in 2008. In the first phase, from October 2008 to September 2011, the focus was on the analysis of geographic information for improved livelihoods and sustainable development. The second phase, the subject of this assessment, began in 2011. It builds upon forty years of data collection to look at large scale change using a time-series of maps. For the second phase, USAID/West Africa entered into a separate agreement with CILSS/AGRHYMET to provide regional and national assistance to USGS/EROS, with the intention of promoting a mutually supportive relationship between the two institutions. Under this arrangement, CILSS/AGRHYMET is intended to support national GIS laboratories across the region to produce land use/land cover change maps and country specific atlases. USGS/EROS is to provide satellite remote sensing data and technical assistance. Resources invested in USGS amounted to more than 82% of the funding for the combined activity.

USAID/West Africa funded activities two related activities undertaken by USGS/EROS and CILSS/ AGRHYMET:

a). Name: Land Use Dynamics and Adapting to Climate Change in West Africa
Project Number: 624-P-00-08-00060-00
Instrument: PAPA (Annex VI)
Implementing Partner: USGS
Amount: $3,200,000
Start and End dates: 10/1/2011-09/30/2015
AOR: Nicodeme Tchamou

b). Name: Land Use and Land Cover Change
Project Number: 624-A21-11-01
Instrument: SOAG and Implementation Letter (IL # 1) (Annex VII)
Implementing Partner: CILSS/AGRHYMET
Amount: $690,843
Start and End dates: 10/3/2011-09/30/2015
AOR: Nicodeme Tchamou

The USGS/EROS and CILSS/AGRHYMET activities represent the continuation of a long-term collaboration to map land use and land cover change across West Africa reaching back more than 30 years. The joint activity target area covers the 17 countries that constitute the overlapping memberships of CILSS and ECOWAS (Benin, Burkina Faso, Cape Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea Bissau, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo).

The activity being assessed is the second phase of an ongoing collaboration between USAID, USGS/EROS, and CILSS/AGRHYMET. Originally focused on Sahelian countries, the scope of the collaboration was widened to take into consideration some of West Africa's major challenges. These included high climatic variability, a rapidly growing population, and human and climate-driven land use and land cover changes. These factors contribute considerable pressure on the limited and fragile natural resource base. This phase includes a particular emphasis on the biodiverse forest region of the Upper Guinea Forest Ecosystem, particularly through support to the USAID Sustainable Environments for West Africa's Regional Development (STEWARD) III Project (Theme 4, see below).

The Earth Resources Observation and Science Center of the US Geological Survey (USGS/EROS) is a data management, systems development, and research center for the USGS's Climate and Land Use Change Mission Area. EROS collects and archives data from the NASA Landsat mission. It is also a repository of the data from other satellite earth observation missions including ASTER, MODIS, and CORONA. The West Africa Land Use and Land Cover Trends project team collaborates with CILSS/AGRHYMET to document and quantify the impacts of environmental and land resource change in West Africa.

There are four themes to the USGS/EROS activity, as documented in the USAID Participating Agency Partnership Agreement (PAPA) with USGS. The CILSS/AGRHYMET collaboration is supported through an Implementation Letter that provides limited detail on the activities to be undertaken, with activities corresponding to Themes 1 and 2 of the PAPA. See Annexes VI and VII for the PAPA and Implementation Letter respectively.

Theme 1: Map Land Use and Land Cover and Associated Trends from 1975 to 2011 for 17 West African Countries (USGS/EROS and CILSS/AGRHYMET)

Under this theme, the multi-date regional land use land cover map was to be produced for the 17 target countries at a 2km resolution. This was intended to serve as "guide map" for production of the 1km resolution national maps produced under CILSS/AGRHYMET leadership. In addition support was provided to upgrade CILSS/AGRHYMET's data holdings.

Theme 2: Sahel Studies: Document, Investigate and Promote Successes in Natural Resource Management and in the Re-Greening of the Sahel's Landscapes in Support of Improved Food Security, Increasing Biodiversity and Adaptation to Climate Change (USGS/EROS and CILSS/AGRHYMET)

Under this theme, a detailed geographic baseline was produced by USGS/EROS to show the extent and density of on-farm tree parklands in Niger and Burkina Faso. However, work in Mali was curtailed due to the suspension of USAID support during the period of political instability. CILSS/AGRHYMET was to promote improved natural resource management practices in the Sahel, based upon the USGS/EROS analysis and hotspot analysis conducted at the national level.

Theme 3: The Regional Park W: An Environmental Assessment of its Natural Resources Including Biodiverse Hotspots, Surrounding Land Use Pressures, And Land Cover Trends (USGS/EROS)

This activity was reported as discontinued by USGS/EROS project lead Tappan Gray, based upon personal communications with Ann Dix and Robert Buzzard, USAID/West Africa. USAID/West Africa reached out to the African Wildlife Foundation to prepare a proposal to conduct activities in Park W in 2012, but apparently USAID elected not to pursue this activity.

Theme 4: Monitoring Biodiverse Forests and Protected Areas in West Africa's Upper Guinean Forest Eco-Region (USGS/EROS)

Under this theme, biodiversity and forestry related activities were to be mapped for the USAID/West Africa regional office's Sustainable Environments for West Africa's Regional Development (STEWARD) III project being implemented by the US Forest Service. Activities included land use and land cover change maps for Mount Nimba, the Outamba-Kilimi National Park and surrounding area (Priority Zone 1), and the Taï/Grebo forest complex of eastern Liberia and southwest Côte d'Ivoire. The latter was discontinued as the STEWARD program suspended operations there due to security concerns.

ASSESSMENT METHODS AND LIMITATIONS

Assessment Design

To answer the assessment questions, the Assessment Team designed an approach that would: a) draw on the experiences of multiple relevant stakeholder groups including activity implementers, focal point participants, and potential data users (i.e., national government agencies, NGOs, other USAID and donor projects); b) permit triangulation of results in order to improve data validity; and c) maximize understanding of how the two activities might inform future programing related to capacity building of regional entities and organizations. Stakeholder and key informant interviews, site visits, and a structured questionnaire protocol distributed to focal point participants via a web-based platform, coupled with desk analysis of all available project materials were chosen as methods that would furnish both quantitative and qualitative understanding of the two projects and their outcomes. The assessment incorporated a site visit to USGS/EROS in South Dakota as well as to CILSS headquarters in Burkina Faso and CILSS/AGRHYMET in Niger. In addition, the team met with focal points and stakeholders in Liberia, Ghana, Côte d'Ivoire, Niger, and Burkina Faso, as well as focal points from Togo and Mali, as directed by USAID/West Africa. The team also met with USAID representatives in Ghana, Ghana, Côte d'Ivoire, Liberia, Niger, and Burkina Faso. The details of these site visits and personal meetings are provided in Annex V.

Data Collection and Analysis Methods

In each country visited, data were collected through structured and semi-structured interviews of multiple relevant stakeholder groups noted above, as well as through site visits (computer labs, satellite receiving stations, etc.). Detailed interview notes were taken for each meeting held (See Annex IV for a list of interviews and Annex V for interview notes), and these notes provide rich, qualitative descriptions and insights as inputs to the assessment questions. A semi-structured interview was the principal method to gather answers to the assessment questions. To reach the identified experts in all the countries that the Assessment Team did not visit, a survey questionnaire was developed which reflected in essence, the same interview questions that were used in personal interviews (Annex III).

For the Land Use/Land Cover Change (LULC) focal point participants, the Assessment Team employed a structured interview protocol using a survey questionnaire which i) was designed to permit quantitative and qualitative analysis; and ii) validated to provide insight into the assessment questions. In places where the Assessment Team was able to locate the focal point participant(s), this interview was

conducted in person. However, in an effort to maximize the participation of focal point participants and to gain a better understanding of their experience, the survey questionnaire was also distributed to the national focal points by CILSS/AGRHYMET via a web-based platform in French and English, at the request of the Assessment Team. In addition, the team collected available documents generated throughout the in-country assessment from various participants (i.e., socio-economic studies associated with the hotspot work, project documents, 'value added' documents generated by participants using project results as available). The survey instrument is presented in Annex III.

Methodological Strengths and Limitations

Using the semi-structured interview approach, the Assessment Team was able to carry out an assessment of the capacities and needs in seven of the 17 countries. These included the five countries that the team was directed to visit by USAID, and national participants from two additional countries encountered by the team[3]. Efforts to expand the participation in the assessment to other national teams, outside of the five visited, however, did not yield expected results since the response rate of the online survey was low. The survey was translated and validated by CILSS/AGRHYMET to ensure its adequacy for content and context. Of the 15 invitations sent out in French, eight responded (53%). For the English speaking countries, 11 invitations were sent out and two responses were received (18.2%).

The USGS/EROS team and the CILSS/AGRHYMET team were exceedingly generous with their time and provided a wealth of information about the mapping process and the map products. However, there was a significant gap in documentation, especially with regards to training, for which, very little data were collected. Data limitations in execution were further magnified by irregular reporting and missing documentation.

The Assessment Team was directed to visit five countries in West Africa, and USGS/EROS Center in Sioux Falls, South Dakota. The country selection, determined by the Agreement Officer's Representative, was not a random sample. The selected countries were Liberia, Côte d'Ivoire, Ghana, Burkina Faso, and Niger. Two of these were selected in part because of the presence of CILSS headquarters in Ouagadougou, where a debriefing meeting took place, and the AGRHYMET Center in Niamey. The remainder were coastal countries where comparatively little work has been done by USGS. The rationale that USAID provided to the team was that this assessment sought to bring forward more information regarding the capacities of these particular countries in their use of earth observations data for decision-making. The selection of these countries afforded an opportunity to obtain information on possible future programing priorities, but it was not an effective way of measuring results or lessons from past activities.

Controlling for availability bias was a challenge for the Assessment Team due to the very small pool of experts available in most of the countries where the assessment was conducted, coupled with the relative lack of technical capacity in GIS, mapping and satellite imagery interpretation, and the lack of objective documentation of capacity needs in the whole region. The team compensated for this through literature review of existing studies of land use/land cover change in the region where possible, through consultation with USAID projects, and by interviewing additional donor and international organization representatives for a wider perspective, who were originally not included in the initial project design. The Assessment Team succeeded in consulting with 40 institutions and 140 individuals during the assessment. This includes institutions and individuals on the demand side, as well as a much smaller

[3] Ghana, Niger, Burkina, Cote d'Ivoire, Liberia, Mali and Togo

number of individuals and institutions involved in the production of spatial analysis. The Assessment Team addressed the limitations imposed through a survey distributed through CILSS/AGRHYMET.

Finally, the Assessment Team found the documentation of the two assessed activities to be inadequate and lacking in several key decision areas. For example, the decision to curtail activities under Theme 3 of the USGS/EROS PAPA, and the specifications of the atlas to be produced by CILSS/AGRHYMET under the Implementation Letter were not documented. The Assessment Team was also unable to find an explanation for the absence of documentation.

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings

Question 1: What factors (both internal and external to the program) helped or hindered the achievement of the two projects' expected outcomes as detailed in the USGS/EROS and CILSS/AGRHYMET work plans and agreements.

i) Factors that helped USGS to achieve its outcomes

The Multi-Date Regional LULC Maps - Theme 1 of the PAPA

The production of the three multi-date Land Use Land Cover maps of West Africa by the USGS will be considered a significant achievement when completed. Decision makers in the five countries visited expressed appreciation for the visual impact of the maps in illustrating extraordinary changes in land use. Importantly, they reported that seeing the maps side by side had an immediate impact, clearly showing the damage to the environment and the degradation of ecosystems over the 35-year period. This group's immediate reaction was that such information was important and that the work should continue with more frequency. As the Minister High Commissioner for the Nigerien 3N Initiative "Niger Nourishes Nigeriens" expressed, *"land use and spatial data information such as this is critical to all of our work on food security. It could allow us to focus our efforts, provide proof of concept as we develop our projects, and aid in our future planning."*[4] Or as the Director General of the Société de Développement Des Forets (SODEFORE) of Cote d'Ivoire stated, "*If we could ask for one thing from USAID now, today it would be to have the data to understand where we are, in terms of forest cover.*"[5]

It was clear that the USGS had been prescient in proposing this product for use by decision makers. This is a reflection on the experience of USGS/EROS in the region and its understanding of the need to provide information that would effectively communicate land use and land cover change.

In proposing this approach, the USGS showed that it continues to lead the world community in its commitment to providing the most relevant products that permit decision makers to view the environment holistically as opposed to piece-meal. The knowledge of the USGS team leader, especially of the Sahel and its ecosystems, was a major factor that contributed to the production of these maps, which are in the final stages of development. Providing an example of the importance these maps have been to decision-makers in her country context (Nigeria) one focal point participant explained:

> "The USGS products, especially Landsat, have been used to train stakeholders, directors, foresters, conservators and other relevant decision makers to see how our environment, especially the forest lands, have degraded over time. This was with a view of creating awareness

[4] Interview: Dr. Ouendeba Botorou, Ministre Haute Commissaire, 12 May 2015

[5] Interview: Mamadou Sangaré, Directeur General, SODEFORE 25 May 2015

and influencing their decisions regarding their forest domain. They have, in turn, made poaching more difficult for poachers by making stiffer regulations and tightening forest securities." [6]

Target audiences

The diversity of requirements and frequently changing demands for products by different target users (including Sahel studies, STEWARD, 3N in Niger and others) were not managed well in this process. There were unrealistic or unclear understandings about deliverables, resulting in delayed completion of products and miscommunication between partners such as the information required of USGS by CILSS/AGRHYMET for the national atlases, the information required of STEWARD, and the interpretation and use of "hotspots", among other things. Given the requirements of individual users, the risk of a misalignment between delivery dates and user needs was high. Further, the management system in USGS was not adequate to address these complex scheduling and coordination issues.

Activity 1. Upgrade CILSS/AGRHYMET satellite image collection

Extensive data holdings of USGS were transferred to CILSS/AGRHYMET and provided the center an upgraded satellite image collection, including Landsat, ASTER and Corona satellite imagery and the derivative map data. This includes the regional 2km scale land use/land cover time series map.

Activity 2. Hotspot analysis

The national focal points were requested, at the training workshops convened by CILSS/AGRHYMET and led by USGS/EROS, to choose "hotspots" that would indicate degradation or improvement of the environment in their countries. The national focal points, working with USGS/EROS selected these "hotspots" through a combination of interpretation of anomalies in vegetation identified from composite satellite images, and change narrative (the process is described in Annex VIII). Training provided by USGS was intended to enable the focal points to make credible choices of hotspots for analysis. Focal points noted that whenever they had technical problems, the USGS team responded to their needs immediately and effectively. Overall, they reported good communication with AGRHYMET and USGS, and offered comments such as *"prompt [responses] to all solicitations,"* and *"all the technical support requests were satisfied by both USGS and AGRHYMET."* [7]

Although the methodology used for selecting "hotspots" (or improved land use/land degradation anomalies) was not uniform, the process of making the choices was a unique and positive exercise drawing on the local knowledge of the national focal point scientists. From interviews with members of six national focal point teams, it was clear that the exercise had given them a great deal of experience in combining various sets of data (Landsat, ASTER, AVHRR/MODIS) with personal knowledge to define the most significant areas of change. It also gave them a better understanding of socioeconomic drivers of land cover change: "*Hotspot analysis is a participative approach as the field work is carried out with local technicians and the hotspot analysis reveals the real dynamics of specific sensitive landscapes of our country."* [8]

We should note that not all focal points were able to make good use of USGS support, for reasons discussed below.

---

[6] Assessment online survey response – English version (Question 53)

[7] Asessment online survey response – French version (Questions 26 & 27)

[8] Assessment online survey response – French version (Questions 17)

Sahel Studies Derivative Map Products - Theme 2 of PAPA

The USGS team also provided the expertise and tools to produce a number of problem-specific maps and reports that focused on particular areas, regions and ecosystems in a number of countries. These maps and reports created derivative and value added products for technical teams operating with little or no previous natural resource data for their particular assignments and problems. Specifically, these maps include but are not limited to:

- A detailed land cover of the Casamance, Senegal mangrove maps for 2010-2011;
- A map of the extent and density of on-farm tree parklands in Niger, Mali and Burkina Faso; and
- Maps to use with the CILSS and CILSS/AGRHYMET to monitor the Re-Greening initiative.

ii) Factors that hindered the expected outcomes as detailed in the PAPA for USGS

The major factor that hindered the achievement of expected outcomes was the relative complexity of the activity given the available time and budget. This was compounded by the fact that the source of funds, USAID expectations for the projects, and the needs of the host countries all evolved or changed during the course of implementing the current phase.

In particular, the USGS/EROS team argues that there was a change of emphasis by USAID/West Africa from the Sahel to West Africa as a whole, beginning in 2012, with the de-emphasis on Theme 3. However, no evidence of a PAPA modification documenting such a shift was provided to the Assessment Team. It is clear, nevertheless, that there is a strong interest on the part of USAID/West Africa in expanding the land use and land cover change analysis to encompass the coastal nations in the analysis under Theme 1, as well as in improving the mapping of forests of the Upper Guinean Forest Ecoregion under Theme 4. USGS products have been substantially behind schedule in the Theme 4 work. The Assessment Team also noted the appearance of a gap in the understanding regarding the requirements for Theme 4, between USGS and USAID staff, as was evident through their interviews. Such gaps pertain, in particular, to the confusion between hotspot analysis undertaken in conjunction with the national atlas production under Theme 1 and global biodiversity hotspots, *sensu* Myers (1988, 1990, 2000)[9] addressed in Theme 4. The mapping methods that were highly effective in Sahel studies and land cover mapping in the Sahelian region were not as easy to use in the forest landscape. This is addressed in detail in Annex VIII.

It was also found that the 1 and 2km resolution map products showing the land use and land cover of West Africa in 1975, 1995 and 2011, are actually more appropriate for use in understanding change at the regional level than at the national level. Given that Landsat imagery has a 30-meter resolution it is difficult to make the case for the utility of the 1 and 2 km maps for field project support work. Those working in Togo pointed out that while the mapping products are being elaborated at a 'finer' 500m scale, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is currently undertaking similar land change maps at 5m resolution.[10] This is especially true in view of the requirements of projects

[9] The Guinean Forest ecosystem was identified by Conservation International as the world's foremost hotspot for mammalian diversity). In 1999 Conservation International convened a conservation priority-setting workshop in Elima, Ghana, to build a consensus on conservation priorities for this region. This was reported (Semkow et al, 2001) with an accompanying map. Given the changes that have taken place in the region an updated map of the "Guinean hotspot."

[10] Interview: Edwige Botoni, 16 May 2015

operating at the community level, as well as those attempting to measure degradation in complex forest environments where biodiversity assessments require detailed mapping.

USGS was hindered in its ability to satisfy the terms of the PAPA, both in terms of timely delivery as well as successful results. The task was too big and the team too small to accomplish these goals in the period defined. This was compounded by lack of clarity in the roles and responsibilities vis-à-vis CILSS/AGRHYMET, including the absence of a joint work plan.

A broader systemic limitation is the poor internet connectivity prevalent throughout the region. This seriously hampers the timely transfer of information and constrains the capacity of both USGS/EROS and CILSS/AGRHYMET to work effectively with each other and with other national partners. This is beyond the control of the USGS/EROS and CILSS/AGRHYMET, but is a well documented problem. Future USAID programing that is dependent upon information exchange should take this constraint into account.

Deliverables

The PAPA between USAID and USGS describes a series of outcomes, which mentions products, but does not clearly lay out specifications of the final deliverables (i.e., paper maps, map data, .pdf files) in all cases. This may require rectification for compliance with ADS 579, *USAID Development Data.* This policy was promulgated after the PAPA was concluded.

Most products as described in the PAPA are still outstanding, which made it difficult for the Integra team to make an accurate assessment of the achievements.

In Theme 1, a significant confounding factor is the composite regional *Atlas of Environmental Transformations* being developed by CILSS/AGRHYMET. Although not stipulated in the Implementation Letter, the Atlas is considered to be a capstone for the USGS/EROS and CILSS/AGRHYMET activities, bringing together all the national level products. As of June 2015, USGS/EROS is still in the process of completing the final 2km maps for some countries. In addition, some countries did not deliver their 1 km work to CILSS/AGRHYMET. CILSS/AGRHYMET has hired Dr. Andre Bassolé, an independent contractor, to produce the composite atlas. The atlas is behind schedule. While USGS is not responsible for the atlas, its production is dependent upon the final products from USGS for those countries that failed to deliver the national 1 km map and hotspots analyses.

Much of the Theme 2 work (Sahel studies/re-greening) is still in development. With less than four months remaining, only two thirds of the USGS budget has been utilized, according to the USGS team leader.

In Theme 4, the final STEWARD maps were not provided in the time frame that was needed for biodiversity monitoring. As a result, the STEWARD project had to hire consultants to produce maps separately to meet some of the management needs, although it received cooperation from USGS. USGS did eventually produce a map of Priority Zone (PZ) 1. The delivery of this map is in dispute. USGS claims that they provided this map to the US Forest Service and STEWARD Project in May 2013. In a memorandum dated July 7, 2014, Dr. John Stanturf, the US Forest Service biodiversity monitoring team leader said that USGS provided them a "preliminary map" for a part of PZ1, with a land cover map legend, at a scale of 1:100,000 from ASTER satellite data. Stanturf said "Our intent is to analyze the geospatial data using landscape ecological methods, once we have the completed data files. (The delivery of these data from USGS has been postponed since last November [2013], and we are uncertain when we will have them.)" It is to be noted that this communication took place only 13 months before the scheduled conclusion of STEWARD III.

At the time of the assessment, the process of dissemination of the various map products prepared by USGS for use by decision makers in all 17 countries was incomplete. Some products were definitely disseminated, but the process was not well organized.

USAID requested map products from USGS/EROS including all 2 km maps and the maps on mangroves and dense forest, to use in a Mission Review on May 18, 2014. USGS/EROS provided draft versions maps and PDF files, but did not provide map data.

Project design and planning

There was insufficient planning and coordination between USGS/EROS and CILSS/AGRHYMET, as well as ineffective oversight by USAID to ensure that such coordination took place. For example, the partners did not develop joint work plans. During the interviews, CILSS and AGRHYMET indicated that the PAPA had never been shared with them and that they had no idea about USGS work plans. As such, they continued their project activities without proper information about USGS and adequate joint planning throughout the course of the activities. According to one CILSS program manager:

"It's a project that has suffered from a lack of cooperative planning between the donors and USGS and CILSS /AGRHYMET. The way that the current project was done, it was very difficult to understand how to implement in a coordinated fashion and know who was responsible for each activity as they didn't match up at all."[11]

Critical components of the training, especially the decision to provide one laptop per national team, split between different institutions, were examples of unworkable solutions, which illustrate some of the challenges in training design. This resulted in limited productivity on the part of the national focal points. Additionally, some of the focal points noted that problems due to expired software licenses and mismatched hardware (for example, French language keyboards on laptops for Anglophone countries) had an outsized detrimental effect. These inefficiencies could have been prevented through a sound anticipation of training needs and adequate advance planning.

Security problems hindered USGS success

The USGS was twice faced with political problems that affected the progress and hindered the effective completion of the project. After the March 2012 coup d'état in Mali, USAID suspended all non-lifesaving assistance. The suspension was lifted in September 2013. Subsequently, CILSS released funding for the completion of the 1 km maps and the hotspot mapping. However, the effects of the suspension still presented in terms of delays in map production and in reaching the USGS goals.

Since 2011, USAID's focus in Côte d'Ivoire has been on promoting political stability and returning the nation to democratic rule. The activity of the USAID Office of Transition Initiatives entered a second phase in June 2014. Conditions were only emerging in June 2015, where full engagement was becoming a possibility again. During this transition period, there was limited engagement with national authorities. As a result, there was little engagement in Côte d'Ivoire, and the Assessment Team identified only one person there who was aware of the project.

The combination of the problems listed above clearly impeded USGS efficacy in reaching its targeted goal of providing decision-makers with hard evidence of environmental problems or success stories.

[11] Ibid.

iii) Factors that helped CILSS/AGRHYMET achieve the expected outcomes as defined by the USAID/CILSS/AGRHYMET agreement.

CILSS/AGRHYMET, a technical arm of the CILSS, has long been known to produce excellent results describing the food security needs of the Sahel. It continues to do so. For a short time during the early 90's, it was also known as a center of excellence for creating map products of food security issues, and the aggregation of information from natural resources, meteorological, and other sectors to provide integrated value added map products to the CILSS and its partners. Over the last 15-20 years, the food security data and weather forecasting information based on MODIS data, continued to flow from CILSS/AGRHYMET to the CILSS.

The CILSS/AGRHYMET Center has a history of working effectively with the USGS and USAID. This has allowed it to enjoy a favored status, resulting in continued investments as well as cooperative agreements with organizations such as the USGS. In instances where CILSS/AGRHYMET and USGS/EROS have invested in good inter-organizational communication and strengthened intellectual exchanges between the two through seminars and workshops towards developing better programs, excellent outcomes in project execution have been reported at CILSS/AGRHYMET.

CILSS/AGRHYMET continues to have good credibility among the member states that support its activities, notwithstanding its degraded mapping ability. Although the center was built in the 1970's and is somewhat antiquated, it has very attractive infrastructure with MODIS/MESA satellite reception capabilities, back-up generator systems, and large classrooms and dormitories providing ample room for training and lectures. CILSS/AGRHYMET had, at the beginning of the Land Use Dynamics and Adaptation to Climate Change activities, good GIS and remote sensing capabilities. The African Development Bank is funding the building of new training facilities and updated mapping equipment.

Factors that would help CILSS/AGRHYMET to achieve better results include additional staff and equipment, more training, and better access to data.

iv) Factors which hindered CILSS/AGRHYMET's ability to reach project targets

CILSS/AGRHYMET participation in the activity covered under the Implementation Letter was not even mentioned in the most recent annual report or on the CILSS/AGRHYMET website, suggesting that it is a relatively low priority.

The Assessment Team noted CILSS's loss of focus on GIS capacity, which was an important segment of the CILSS system established by the World Meteorological Organization, USAID, and other donors in the 1990's. The team's observations include the following, in particular:

- CILSS/AGRHYMET's Mapping Center has lost at least one senior mapping specialist since 2011, who has not been replaced, leaving only two individuals, at present, to service the needs of the Center at large (some CILSS/AGRHYMET units have their own project-sponsored GIS personnel).
- CILSS/AGRHYMET is also facing problems in attracting and retaining top talent. Demand for these skills is very high, and there are several major mapping projects under way, sponsored by other bilateral and multilateral donors. These much larger regional projects have been able to attract the attention of available talent staff with the USAID activity, leaving CILSS/AGRHYMET with less than stellar human resources.
- Mapping and reproduction facilities are severely degraded. There is shortage of qualified staff, of functional equipment (for example, plotter printers are dysfunctional), and a lack of required upgrades of the relevant software in the reproduction facilities.

The Center's work is also hampered by a lack of proper communication and joint planning with the USGS. Similarly, the CILSS technical coordinator cited that the efficacy of the CILSS/AGRYMET team was minimized due to a lack of planning and coordination, initially with USAID and later with USGS

during the operational phases. Additionally, during interviews with the Assessment Team, CILSS/AGRHYMET clearly drew attention to the lack of coordination between USAID and the CILSS/AGRHYMET technical team in the preparation of the agreement. This resulted in several poor project decisions such as lack of specificity in action plans, delivery timetables and budgets as well as inadequate fund allocation for activities such as hotspot fieldwork and preparation of material for the aggregate regional atlas.

v) Hindrances common to both USGS and CILSS/AGRHYMET

The Assessment Team found that there was inadequate coordination of the USGS/EROS and CILSS/AGRHYMET efforts. CILSS/AGRHYMET was unclear about the responsibilities of USGS/EROS, and no formal joint work planning was undertaken.

According to the Statement of Work (Annex I) for this assessment, USAID entered into an agreement in 2011 with CILSS/AGRHYMET to support USGS/EROS in implementing the work on land use dynamics and adapting to climate change. The Statement of Work for this assessment indicates that USAID intended USGS/EROS and CILSS/AGRHYMET activities to be mutually reinforcing, with USGS/EROS required to provide satellite imagery and technical support, and CILSS/AGRHYMET to provide services to national Geographic Information Systems (GIS) labs across the region to produce maps and national atlases[12].

The production of the *Atlas of Environmental Transformations* is a major concern. No documentation of the agreement on atlas production was given to the Assessment Team. CILSS/AGRHYMET is dependent upon USGS/EROS for hotspot and map imagery, due to its own lack of capacity, in part, as well as the failure of most teams to produce the national maps. At this point when the assessment was carried out, CILSS/AGRHYMET did not possess all the data required to complete the task, and the Assessment Team concluded that CILSS/AGRHYMET is not likely to complete the atlas production on their own unless USGS/EROS can support them by completing the work that was supposed to be done by the national focal points coordinated by CILSS/AGRHYMET.

Another area of serious concern that the Assessment Team noted is capacity building. Neither USGS/EROS nor CILSS/AGRHYMET presented an effective strategy for capacity-building to support their efforts. While the technical training imparted during the project had highly acceptable standards, the team observed several general shortcomings in the training plans and delivery:

- Measures of the change in capacity achieved through training were not quantified and did not show progress towards the achievement of specific training goals.
- According to the original intent as expressed in the PAPA, USGS was responsible to provide technical backstopping to CILSS/AGRHYMET for supporting GIS laboratories across West Africa. This, however, did not happen. Instead, both USGS and CILSS/AGRHYMET directed their capacity-building efforts towards developing individual capacities of the national focal points (two for each

[12] There is a lack of consistency within USAID concerning whether or not national atlases are part of the assignment for CILSS/AGRHYMET. The assessment Statement of Work explicitly refers to national atlases (Project Intent, Page 6). The USAID/CILSS Implementation Letter is not explicit on this point, and CILSS/AGRHYMET is focused on the composite regional atlas. USAID/West Africa ROECCR consistently took the view, however, that despite the Statement of Work, there are *no national atlas deliverables*. Project documentation provided is not clear. Our interpretation is that the 1km map and 3 hotspot maps constitute the "national atlas", that there are no plans to publish national atlases under the two projects assessed, and that these products are to be integrated into the regional composite atlas by CILSS/AGRHYMET.

participating country) and not of the institutions they represented. As a result, some institutions did not fully support or complete the envisioned country-specific maps and atlases.

- The capacity building aspect of the two activities did not effectively address much needed institutional development.
- The selection process of trainees was flawed due to the delegation of this process to CILSS and CILSS's reliance on the national focal points, which varied in understanding of the scope of the project and the appropriate qualifications for participants.
- Gender diversity, in terms of participation of women in the capacity-building programs and training, was low. Very few women trainees were selected (two national focal points). This is a matter not entirely in the hands of CILSS/AGRHYMET, which was responsible for selection of the trainees. CILSS, as an intergovernmental body, is restricted in its ability to direct its national members. Overall, very few women were identified and interviewed by the Assessment Team; there is a clear gender gap in this discipline in the whole region.

The relevance of the products and activities of this project to USAID regional and national development goals is very high and therefore justified a deep engagement of USAID, in this project. However, there are indications that this was not the case:

- USAID did not clearly specify the obligations and tasks of the CILSS and its technical arm AGRHYMET. CILSS and CILSS/AGRHYMET found it difficult to coordinate their activities with those of USGS because of the lack of specificity in the USAID/CILSS agreement. The themes, activities, and expected outcomes were not clearly articulated in a results framework.
- USAID did not adequately investigate or coordinate with other activities supporting remote sensing, mapping, and other geospatial/GIS efforts during the design phase of this activity, including activities of those donors who funded CILSS/AGRHYMET and CILSS and of other USAID sponsored mapping efforts in the region (detailed below).

USAID's nature and extent of involvement in the project may have been limited by the nature of PAPAs and Implementation Letters. The absence of USAID's direct authority to direct the work of implementing partners could have been compensated through a stronger collaborative and participatory working style adopted by USAID in order to monitor the work. However, the Assessment Team found that USAID did not visit CILSS/AGRHYMET on a regular basis, and did not effectively intervene with USGS/EROS even when it was clear that it was significantly behind schedule in the delivery of some outcomes.

The Assessment Team also noted the following specific activities at CILSS/AGRHYMET that were financed by other donors, in which CILSS/AGRHYMET cooperation/coordination could have produced better results:

- The programme Regional de Gestion durable des Terres et d'Adaptation aux Changements Climatiques au Sahel et en Afrique de L'Ouest (PRGDT) – mapping of "Gestion Durables des Terres", (EU/France, launched in 2011);
- "ModCartoFertiSol" – mapping agricultural practices in Burkina Faso (supported by the EU and a product of the PRGDT); and
- Monitoring for Environment and Security in Africa (MESA) - mapping agricultural and meteorological factors in the ECOWAS countries (EU, proposed 2010, funded 2013).

Other relevant donor activities that were not taken into account by the project include a World Bank project to use remote sensing to map community level development, the 3N Project supported by the Nigerien Government and the USAID Sahel Office in Dakar, and an OECD/Club du Sahel report

showing the multi-variant influence of social, political and environmental problems affecting the countries of the region.

There is a lack of coordination of all USGS land cover activities supported by USAID in the region. In addition to the USGS/EROS LULC work assessed here, this includes:

- The USAID Global Climate Change program funded activity implemented by the US Department of the Interior's International Technical Assistance Program, entitled Land Cover for Climate. The Department of the Interior is the parent agency of the USGS, and USGS personnel staff this activity. Although the objectives of the Land Cover for Climate Project differ in important ways from those of the USGS/EROS and CILSS/AGRHYMET activities[13], it is highly likely that there were missed opportunities for the coordination of training and possibly also some duplications and overlap in data products.
- The USGS components of FEWS-Net Africa.
- USGS collaboration with the USAID Resilience and Economic Growth in the Sahel – Accelerated Growth project (REGIS-AG).

Question 2: Are the data, standards and methodology made available to the public and policy makers in a manner consistent with the USG open government initiative?

- At the time of the assessment, the project is compliant with the ArcGIS version of ISO 19115-1, 19139, 19115-2. These three metadata standards form the basis for the USG Open Data Policy. The OMB regulation leaves it to each agency to create its own precise metadata standard to accommodate its own needs. USAID is in the process of developing its own metadata standards, as is USGS. ESRI, the commercial producer of ArcGIS, is assisting its government clients to be compliant. At this stage, using the ESRI version of ISO is the best that agencies can do to be complaint. However, it is important to note that the ESRI version may not be identical to the still-evolving USAID or USGS standards. It is reasonable to assume that USGS is on its way to being USG open data compliant. However, neither ESRI, USAID, nor USGS has completely defined an integrated, inter-agency metadata structure.

Question 3: What lessons can be drawn from USGS/CILSS/AGRHYMET teaming arrangement for capacity building in the region?

- The teaming arrangement was poorly designed and executed. The lack of a clear results framework with well-defined targets and indicators to be monitored resulted in a failure in meeting training and capacity building objectives. There were no clear standards or criteria for the selection of participants beyond some form of affiliation with the CILSS/AGRHYMET national committees. When training began, the USGS trainers were faced with the fact that most of the participants selected by CILSS/AGRHYMET and their national focal points did not meet USGS's expectations in terms of qualifications and experience. Many were not experienced with GIS, and some did not even possess basic computer skills. This only became apparent at the first workshop, when it was too late to adjust the training design or change the selection process. According to USGS/EROS, CILSS, as an

[13] The Land Cover for Climate project is similar to this activity in that it aims to enhance the capacity of developing country partners to improve techniques to generate and/or update existing land cover information using satellite imagery. It differs in focusing primarily on greenhouse gas emissions for climate mitigation.

intergovernmental body, engaged its State members to nominate participants. CILSS did not decline the nomination of unqualified nominees due to high levels of political sensitivity involved. Due to the varying levels of qualifications and experience of the nominees, only five of the 17 countries completed the production of the 1 km time series maps to USGS's satisfaction on their own, and the work of all the others had to be redone by USGS at additional costs and time. This put the entire project behind schedule, and ultimately left USGS/EROS with a substantial additional burden for project delivery.

- This deficient training design can be partially attributed to the fact that the ongoing partnership between USAID, USGS/EROS, and CILSS/AGRHYMET was apparently renewed without an appropriate evaluation. In particular, the training design capacities and methods for training delivery adopted by both USGS and CILSS/AGRHYMET were not evaluated. Along with a good training design, effective project management tools including a results frameworks and a monitoring and evaluation plan would have helped both the partners to increase national capacity.
- The project may have contributed to the technical capacity of some trainees (although this was not measured). However, this would not necessarily translate to improved institutional capacity in the near term. On the contrary, according to anecdotal information provided during interviews, institutions throughout the region, including CILSS/AGRHYMET itself, face attrition due to qualified personnel leaving to join donor projects or the private sector at better pay. Detailed analysis was outside the scope of work for this assessment, and an in-depth regional institutional assessment would be necessary for a more comprehensive understanding of the complex factors that influence institutional capacity.

Question 4: To what extent have the two activities been able to build the capacity of analysts and decision makers in government, civil society groups, and the media to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications?

- The CILSS/AGRHYMET agreement stipulated that at least 50 decision-makers would be sensitized and informed on the outputs of the project. However, the agreement does not define "decision-maker", nor does it describe parameters for sensitization that would allow a determination of whether this target had been achieved. Therefore, in this context, the Assessment Team can conclude, without qualification, that the two activities (USGS/AGRHYMET) have not built the capacity of decision makers in government, civil society groups, and the media to integrate geospatial data and technologies into their analyses, policy planning, management and communications.
- Of the seventeen countries included in the PAPA and Implementation Letter, the Assessment Team was directed by USAID to visit only five (Ghana, Niger, Liberia, Cote d'Ivoire, and Burkina Faso). On the basis of this limited sample, it is not possible to fully determine the extent of the contributions that USGS and CILSS/AGRHYMET made towards building the capacity of analysts and decision-makers in the use of geospatial data. However, the Assessment Team did identify indications of enhanced capacity in the countries visited, including university courses and apprenticeships, and in the use of GIS in land management agencies. They also found that the approximately 30 participants in the regional validation workshop in Ouagadougou, characterized as decision-makers, arrived at a consensus that the map was an important tool and expressed a strong interest in its use. The Assessment Team, however, was unable to independently verify the decision-making roles played by these participants.
- In Ghana, where a national workshop was held, the focal point from the Ministry of the Environment, provided evidence that decision-makers and the media were aware of the importance of the regional and national maps showing degradation and its effects. The Niger focal point also

advised that the Ministry of the Environment in Niamey had hosted a successful demonstration of the potential that the regional and national map products represent. Dr. Andre Bassolé, a regional remote sensing expert who works closely with the CILSS, advised the Assessment Team that the Regional Multi-year Change maps produced by the USGS are a very important asset for decision makers. Notwithstanding these examples of awareness raising, it is clear that the target groups were not effectively reached as required by the PAPA. The maps have not been finalized and distributed, nor has a communication strategy been developed to systematically promote the maps and the message of land cover change in the region. This has been corroborated unanimously by all of the survey respondents. This campaign should have been designed and promoted by USGS/AGRHYMET/CILSS with buy-in from the regional and bilateral USAID Missions.

- Since the Assessment Team visited only five countries, it could not ascertain whether national level decision makers and other target groups in all the countries were advised on or shown the results of the land use/land cover change efforts. However, the team could state with certainty that the intent to distribute LULC datasets to regional workshop participants in print and electronic formats, as required by the PAPA and the USAID/CILSS/AGRHYMET agreement, was not accomplished. The regional atlas that CILSS/AGRHYMET was supposed to complete and distribute, had been prototyped, but still lacked some of the final 1 km inputs from national focal points and had to request USGS/EROS for access to additional maps, according to Edwige Botoni of CILSS.
- The Assessment Team noted that notwithstanding the failure to reach all decision makers, in some cases, the national focal points were able to build their own capacity to use geospatial data for resource management and planning. The focal points' personal knowledge may have, in turn, informed and sensitized decision makers in their countries and expected to do so in future. The Team was able to locate such decision makers in two countries. Survey participants also provided several examples of where the maps supported collaboration with other institutions, Ministries and organizations. In Chad, maps provided the basis for organizations to collaborate around analysis of degradation in *Parc de Manda*. Still other participants noted that they had used map outputs in their countries in support of REDD[14] readiness preparations, for government analyses of changes in the agricultural frontier, and for agricultural planning (i.e., rice paddy development in northern Togo).[15]

Question 5: To what extent has CILSS/AGRHYMET improved the management, sharing and access to time series maps in its member countries?

- The time series maps and atlases have not been released at the time of the conclusion of this assessment. Therefore, the Team did not have opportunities to assess and measure their impact in terms of improved management, access, or sharing. Furthermore, there is neither a coherent strategy for releasing the products in future, nor one for measuring impact of the maps on improved

[14] Reduced Emissions from Deforestation and Forest Degradation, originally a market-based approach to offer incentives to protect forested lands through the sale of carbon credits, the REDD enterprise has evolved to incorporate other biomes and other finance options. For an overview of REDD readiness, see arquín, L., M. Chacón, S.N. Panfil, A. Adeleke, E. Florian, and R. Triraganon. 2014. *The Knowledge and Skills Needed to Engage in REDD+: A Competencies Framework.* Conservation International, Centro Agronómico Tropical de Investigación y Enseñanza, International Union for the Conservation of Nature, Regional Community Forestry Training Center. Arlington, Virginia, USA, produced by the USAID Forest Carbon, Markets and Communities program.

[15] Assessment online survey response – French version (Question 52)

management. USGS and CILSS are only beginning to give thought to such a strategy at the conclusion of the project.

Review of CILSS/AGRHYMET work products

This section summarizes the work undertaken by CILSS/AGRHYMET.

The major objective of the agreement between USAID and CILSS/AGRHYMET was to reinforce environmental information systems for decision-making, by providing reliable information on land use/land cover change and associated trends from 1975 to 2011 for West African countries, and by disseminating and promoting successful NRM practices in the Sahel to improve food security, increase biodiversity and allow for adaptation to climate change.

The provision of reliable information is related to Theme 1 of the USGS/EROS PAPA, and is titled "Cartography of Land Use and Cover." This involves the production of the map products, including 1 km land use/land cover maps and hotspot analysis. No formal documentation was furnished on the specifications for the composite regional atlas. However, the assessment Statement of Work (Annex I) indicates that the initial plan was for thirteen national atlases and a composite atlas. This has grown to seventeen with the expansion of the AGRHYMET remit as a regional organization to cover ECOWAS.

The atlases have not yet been produced at the conclusion of this assessment. This is a direct result of the delays in production of the maps by the national mapping teams selected by CILSS/AGRHYMET, as discussed above. AGRHYMET has turned to USGS for support in providing land use/land cover change time series maps for those twelve out of seventeen countries that were unable to produce maps themselves (see Table 2). The Assessment Team did not find evidence that AGRHYMET took any tangible steps to compensate for the shortcomings of the national teams. This work remains incomplete, pending availability of maps from USGS/EROS.

The second activity, the dissemination and promotion of successful NRM practices, is titled "Sahel Studies" and corresponds to Theme 2 of the USGS/EROS PAPA. AGRHYMET's contribution was primarily through hotspot analysis done in conjunction with USGS/EROS. This included the three in-depth studies of good sustainable land management practices. These studies included i) study of reforestation activities in Cape Verde and their socio-economic impacts, ii) study on the social and ecological impact of micro-hydro projects in northern Ghana, and iii) study of the impacts of cashew plantations on biodiversity conservation and improvement of the vegetation cover of the forest in Togo. AGRHYMET did not contribute significantly to the other analytical work undertaken by USGS/EROS. In addition, AGRHYMET, by its own admission, does a poor job of information dissemination (see interview, Alfari Issifou, in Annex V).

Review of USGS/EROS work products (by theme)

This section summarizes work undertaken by USGS/EROS. Table 1 summarizes the USGS work products, following which is a narrative describing the activities and outputs.

Theme 1: Map Land Use and Land Cover and Associated Trends from 1975-2011 for seventeen West African Countries

Under Theme 1, USGS/EROS was to work with CILSS/AGRHYMET to address environmental change and climate vulnerability through information concerning land use and land cover change over a 35-year period. Activities included i) produce a base map for seventeen countries in collaboration with CILSS/AGRHYMET and national teams; ii) identify and characterize landscape change including

"hotspots" and anomalies that represent landscape degradation or improvement; and iii) conduct specialized seminars at CILSS/AGRHYMET.

Annex VIII contains a more detailed review of the Theme 1 scientific and technical activities and products. Deliverables were:

- Delivery to CILSS/AGRHYMET of complete Landsat and ASTER satellite image coverage of seventeen Sahelian and coastal countries with 2009-2011 image acquisitions.

  Landsat, ASTER, and Corona images were delivered.

- A spatially explicit raster map of current and historical LULC in Mali using Landsat and ASTER image data from 1975 - 2011 using historical Landsat MSS imagery and statistical analyses of LULC trends. This was not completed due to suspension of US government activities in Mali.

- A spatially explicit raster map of current and historical LULC of seventeen countries in West Africa using Landsat and ASTER image data from year 2011. Provide current versions of ArcGIS software as the main mapping platform, hard drives for image data storage within the participating national institutions; quality check on all national mapping efforts to assure a seamless and high quality product within and across national borders. Deliver multi-date LULC maps to CILSS/AGRHYMET and national partner agencies in digital and hardcopy formats. Place the maps on EROS and CILSS/AGRHYMET websites.

  The Rapid Land Cover Mapping (RLCM) tool, a supervised land cover mapping approach that relies on expert input to classify grids of pixels, was developed and distributed. The tool ensures consistent registration of pixels for analysis when comparing maps of different time periods, and is central to the LULC mapping process employed. It is based on Arc GIS.

  As of June 2015, the Sahelian countries were complete, the West African countries were complete but in review, and Nigeria was in process. All these are scheduled for delivery in September 2015, and for inclusion in the aggregate regional atlas. Most maps have been produced but are not yet available on websites.

- A map and narrative description of at least 50 hotspots or anomalies across West Africa, characterized by type, and proximity to USAID project intervention sites. Longer-term project impacts on biodiversity, land use and NRM will be documented where possible.

  A collection of hotspots, with discrete biophysical footprints was produced with light analytical treatment. Three were to be submitted from each participating country for an estimated total of approximately 50 hotspots. The purpose of the hotspots was largely to illustrate success stories in land use/resource management that could be scaled up and used elsewhere in the region. Of the 50, three were to be selected as subjects for more intensive analysis with high levels of geospatial detail and narrative. Three hot spots per country yielded approximately 50 overall. This was too many for validation in the field so it was conducted primarily as a desktop study. USGS and their partners, therefore, narrowed down and picked three "heavy" hotspots in the region for detailed analysis, in order to provide a scalable lesson for use elsewhere in Africa. The three hotspots chosen were:

  - Cape Verde cloud forest – USGS
  - Ghana – CILSS
  - Togo – cashew production – NAC

- Seventeen national teams proficient in change detection analysis and research into potential driving forces of change using multi-resolution satellite data and secondary data.

  CILSS/AGRHYMET was responsible for facilitating product development by the national focal points, with the idea that 1km RLCM mapping would be supplemented by field study of sub-canopy

degradation and other phenomenon. In most cases, the 1km product was not completed and the USGS had to step in and where possible, do the 1km mapping. The work is partially complete.

No steps were taken to measure pre and post training proficiency is it is not possible to draw any conclusions about the relative value of the training. Table 2 shows that only 5 of the 17 national teams had completed the assignment. Skill is only one factor in the productivity of the national teams, but without data, it is not possible to determine the relative role that training played in performance. This deliverable is incomplete.

- Enhanced capacity of scientists at CILSS/AGRHYMET and key partners from national institutions to perform environmental mapping and monitoring tasks through a series of technical seminars.

  No steps were taken by USGS to measure the capacity of the target audience post-training or to measure impact and effectiveness of seminars, so there are no data with which to measure enhancements. The results are inconclusive.

Table 1: Work Products of PAPA				
PAPA Theme	**PAPA Activity**	**Activity Description**	**Assessment Question**	**Discussion**
1	MAP LAND USE AND LAND COVER AND ASSOCIATED TRENDS FROM 1975 TO 2011 FOR 16 WEST AFRICAN COUNTRIES			
	Main Theme Activity	Produce LULC maps of current (2010-2011) timeframe for 17 Sahelian and coastal countries in collaboration with CILSS/AGRHYMET and national teams	Was the map completed? Were there any issues that helped or hindered? Is it compliant with USGS and USAID open data standards? What lessons are to be learned?	See Assessment Report
	1.1	Upgrade the CILSS/AGRHYMET Regional Center's satellite data holdings of West Africa with recent satellite image data from Landsat and ASTER satellite systems	Were the images delivered to ARC? Do you know if they are available for download there? Should they be? If so, how could this be accomplished?	Last update was wall-to-wall West Africa 2013. They now also have corona from an archival delivery in 2012. USGS continues to provide ASTER as needed, largely through the workshops and for priority areas
	1.2	Prototype a revised and improved version (version 2) of the Rapid Land Cover Mapping (RLCM) tool using Mali as an example in collaboration with CILSS/AGRHYMET and the Mali National Team	Is the RLCM v2 complete and updated? Is it updated? How many people have access to it? How many have been trained to use it?	RLCM v2 was finished and a workshop was done in March 2015. An earlier update of the tool was done in 2011. The Mali reference is replaced by Niger due to limitations on Mali work.
	1.3	Produce LULC maps of current (2010-2011) timeframe for 17 Sahelian and coastal countries in collaboration with CILSS/AGRHYMET and national teams.	Was the map completed? Were there any issues that helped or hindered? Is it compliant with USGS and USAID open data standards? What lessons are to be learned?	Sept. is the scheduled delivery to ARC (and from them to NACs). ARC has the 1975/2000 layers and is waiting on the 2013 LC layer. 1975 was delivered by 2008. Note: Nigeria is challenging and was not part of the original scope.
	1.4	Conduct a regional workshop, coordinated and hosted by CILSS and CILSS/AGRHYMET, to roll out the major findings of the LULC mapping and trends program	Was the workshop conducted? How many attended? What was your impression of how it was received? How could outreach and capacity at future such workshops be improved?	This is an end of project deliverable but was done in March 2015. They used it to get to the decision makers. USGS sees this as the beginning of the final activity. They believe that they must share with the decision makers and engage and educate.
	2	Identify hotspots, anomalies representative of degradation or improvement.	Was the analysis completed? Were there any issues that helped or hindered? Is it compliant with USGS and USAID open data standards? What	The target of three hotspots analyzed per country was achieved. The three major hotspots for in depth analysis were completed. USGS/EROS is working on refining the narratives for publishing.

	2.1	Conduct training workshops	Was the workshop conducted, and how was it received? Do the trained individuals, institutions have the capacity to do hotspot analysis into the future? Describe the criteria for identifying hotspots (anthropogenic/non-anthropogenic)?	The hotspot workshops were integrated with the LULC workshops. The criteria for identifying hotspots were *ad hoc.*
	3	Conduct training workshops at the AGRHYMET Regional Center (ARC)	Were they conducted? Are the trained individuals proficient in the subject areas? Do you foresee a chance for the USGS/ARC/NAC relationship to become increasingly bidirectional in terms of its product development?	They were conducted. There are methodological challenges to assessing the proficiency of the trained individuals in the subject areas. The potential exists for a more bidirectional relationship in terms of product development but the project missed opportunities through lack of attention to national level *institutional* development
	3.1 to 3.4 and 3.8	Specifics on NDVI, evapotranspiration, surface energy balance model, climate variable in LCC, application of RS to LCC and hotspots	Provide specifics.	A series of specialized seminars was planned, to be conducted on topics of interest to ARC. The first specialized seminar was on the use of 30m SRTM imagery to derive watershed maps. As of May 8, further seminars were envisioned following the completion of the map products.
2	SAHEL STUDIES: DOCUMENT, INVESTIGATE AND PROMOTE SUCCESSES IN NATURAL RESOURCE MANAGEMENT AND IN THE RE-GREENING OF THE SAHEL'S LANDSCAPES IN SUPPORT OF IMPROVED FOOD SECURITY, INCREASING BIODIVERSITY AND ADAPTATION TO CLIMATE CHANGE.			
	4	Document, map, and prepare a detailed geographic baseline on the current extent and density of on-farm tree parklands in Niger, Burkina and Mali. This study is the starting point for the three that follow (activities 5, 6 & 7).		70% done.
	5	Work with CILSS, ARC and the Africa Re-Greening Initiative (ARI) to monitor increases in on-farm vegetation cover, tree density, biodiversity, and their impacts on local food production and livelihoods.		This is beyond tree cover and deals with practices. This is the mapping of all NRM practices, adaptation. 70% done for Niger and Burkina and have not started on Mali. Anticipates completion before end of project.
	6	Identify regions across the Sahel that are suitable for developing re-greening activities.		Not started yet. Poised to begin because the soil texture mapping is critical to this. Demographic mapping is done.

	7	Determine the effectiveness of Re-Greening activities on crop conditions and food security.		In progress. Two major field trips to Niger and Burkina, 2014, 2015 to look at in-situ impacts of FNMR on crop production and increasing biodiversity on farm. Discussions were held with funded partners looking at impacts. A report or map is forthcoming by project completion.
3	THE REGIONAL PARK W: AN ENVIRONMENTAL ASSESSMENT OF ITS NATURAL RESOURCES INCLUDING BIODIVERSE HOTSPOTS, SURROUNDING LAND USE PRESSURES, AND LAND COVER TRENDS			
	8	Inventory, Map and Assess Trends and Pressures in and around the Regional Park W; Support long-term management plans for the Park.		N/A: USGS was informed verbally that this activity was "off the table", though there has not been a formal amendment. They would be able to complete the work within the year if required.
	9	Inventory, Map and Assess Trends and Pressures in and around the entire Regional Park W – Pendjari National Park corridor		N/A
4	MONITORING BIODIVERSE FORESTS AND PROTECTED AREAS IN WEST AFRICA'S UPPER GUINEAN FOREST ECO-REGION			
	10	Map, monitor, and support biodiversity conservation and agro-forestry activities in the Outamba-Kilimi/Sierra Leone and Madina Oula & Ouré Kaba/Guinea Transboundary Area (Priority Zone 1)		Delivered working draft but mostly complete map to STEWARD and USFS in Freetown significantly behind schedule according to STEWARD. The map is 70% complete geographically but 100% complete within this. More area needs to be added for the Guinea side. The STEWARD III Program is scheduled to conclude in September, so this is a significant missed opportunity.
	11	Map, monitor, and support biodiversity conservation and agro-forestry activities in the Mount Nimba (Guinea / Côte d'Ivoire) and Nimba Nature Reserve (Liberia)(Priority Zone 2)		They delivered a preliminary image map based on ASTER with some hi-resolution windows into the areas. This is also too little and too late to have any impact on the intended target project.
	12	Map, monitor, and support conservation and agro-forestry activities in Taï National Park (Côte d'Ivoire) and Grebo National Forest (Liberia)(Priority Zone 3)		STEWARD dropped this for security reasons and therefore so did USGS.

•

Table 2: Theme 1 Deliverables by Countries				
Country	(Pre-project skill) Participant Readiness/Quality by USGS	Training Assessment by USGS	Performance/ Deliverable Assessment by USGS	Delivered to ARC? (First 1km draft was due by the end 2014)
Benin	4	5	5	Yes
Burkina Faso	4	5	4	Yes
Cape Verde	2	4	NS and no delivery	No
Chad	4	5	5	Yes
Gambia	1	1	1	No
Ghana	4	3	1	No
Guinea Bissau	2	1	1	No
Guinea Conakry	3	3	2	No
Ivory Coast	Didn't participate	N/A	N/A	No
Liberia	1	1	1	No
Mali	3	4	3	No
Mauritania	Didn't participate	N/A	N/A	No
Niger	4	5	4	No
Nigeria	3	4	2	Yes
Senegal	5	5	5	No
Sierra Leone	1	1	1	No
Togo	5	5	5	Yes
Key: 1 to 5, 5 being best, based upon expert opinion of USGS/EROS				

Theme 2: Sahel Studies: Document, Investigate and Promote Successes in Natural Resource Management and in the Re-Greening of the Sahel's Landscapes in Support of Improved Food Security, Increasing Biodiversity and Adaptation to Climate Change.

"Re-greening" is transforming the productivity and resilience of degraded landscapes through the widespread adoption of sustainable land management practices. The biophysical processes underlying the remotely sensed re-greening trend can be ambiguous. This is a fact USGS is aware of. Research has found a number of commonalities in study sites that experienced re-greening, many of which are social-economic. But re-greening is also site-specific – for example based on soil properties.

Under Theme 2 of the PAPA, USGS is to document, investigate and promote successes in natural resource management and in the re-greening of the Sahel's landscapes in support of improved food security, increasing biodiversity and adaptation to climate change. Activities include:

- Creating of a geographic baseline on the current extent and density of on-farm tree parklands in Niger, Burkina Faso, and Mali,
- Monitoring increases in on-farm vegetation cover, tree density, biodiversity, and impacts on local food production and livelihoods,
- Identifying regions suitable for developing additional re-greening activities, and
- Determining the effectiveness of re-greening activities on crop conditions and food security.

Table 3: Theme 2 outcomes	
Deliverable	**Status**
Maps, graphics, and a report that presents a baseline on the current extent and density of on-farm tree parklands	*70% complete (report not finished)*
A semi-automated approach for extracting tree cover that can be applied to other regions	*Prototype done and now in trial phase*
Documentation of changes in tree cover, biodiversity, agricultural productivity, and soil conservation as a result of re-greening activities	*Not initiated*
Maps, graphics and a report of priority candidate regions and sites in the Sahel suitable for re-greening	*Under way and partially completed; remaining to do are Mali's cotton basin, southern Niger, Burkina's Sahel zone, and Senegal's peanut basin*
Report on the impact of re-greening activities on crop conditions/yields, food security, biodiversity and impact on rural livelihoods	*Under way but not completed*
Satellite-derived data products staged on USGS/EROS, CILSS/AGRHYMET, and Africa Re-greening Initiative websites	*Not initiated*

One of the primary contributions of remote sensing is the monitoring of fluctuations in vegetative greenness through a Normalized Difference Vegetation Index (NDVI). The long-term NDVI record correlates with drought, thus establishing trends in re-greening. Because of recent integration efforts with long-term in-situ data records, the confidence in remotely sensed data is increasing. In addition, the bio-geo-physical drivers of re-greening and the commonalities of areas that have experienced re-greening are better understood now. To a limited extent, remote sensing data can be used to identify candidate areas, for example, by correlating certain vegetation types with soil types. But there are limitations to the remote sensing of soils and plant species. Remote sensing can supplement, but not substitute for, local knowledge and information about social drivers. It is worth noting, however, that recent innovations in remote sensing for the measurement of soil moisture (especially the latest NASA mission, Soil Moisture Active/Passive (SMAP), should soon contribute to a better understanding of candidate areas for re-greening activities.

In conclusion, remote sensing, with its increasing confidence and better tools, combined with the in-situ record, provides an integrated view to trends in greening and food security in the region and an integrated re-greening/desertification record. This is an important service that should be maintained. It is, however, important to note that the proposed activities in Theme 2 involved a level of effort that is not realistic for the budget and staff for this activity. In particular, it is necessary to separate the drivers of re-greening and the effects of human agency from effects of weather and climate, before drawing major conclusions about re-greening.

Theme 3: Park W. Work was not undertaken as priorities shifted from this region to the Upper Guinea Forest ecoregion addressed primarily under Theme 4.

According to USGS team leader Tappan Gray, the instruction not to proceed was given verbally by Ann Dix, then Regional Office of Environment and Climate Change Response Team Leader, and Robert Buzzard, then the project Agreement Officer's Representative.

In the Annual Report to Dix dated October 30, 2012, USGS reports that they are ahead of schedule on Activity 8, *Inventory, Map, and Assess Trends and Pressures In and Around the Regional Park W,* collecting thematic map layers for the region and remote sensing imagery from the ASTER instrument. They met with the park directors from the three respective countries.

However, in the annual report dated November 7, 2014, USGS reports that they have put the activity on hold citing "various discussions with the USAID/West Africa team" where "it became clear that mapping and monitoring land resources in and around the Regional Park W was not a high priority," indicating they are prepared to resume the activity "if the need arises".

Theme 4: monitoring biodiverse forests and protected areas in West Africa's Upper Guinean forest eco-region

Under this theme, USGS was to map, monitor, and support biodiversity conservation in support of phase 3 of the Sustainable Environments for West Africa's Regional Development (STEWARD) program (STEWARD III), implemented by the US Forest Service. These areas included the Madina Oula, Ouré Kaba, and Outamba-Kilimi NP area of Sierra Leone and Guinea (Priority Zone 1), the Mount Nimba area of Liberia, Guinea, and Côte d'Ivoire (Priority Zone 2), and the Taï National Park (Côte d'Ivoire) and Grebo National Forest area (Liberia) (Priority Zone 3). Due to security concerns, the Priority Zone 3 activity was suspended and was not mapped. USGS did produce a map for Priority Zone 1 and some remote sensing imagery for Priority Zone 2. These were delivered in 2013, with the expectation that additional work would come from USGS on both maps (the Forest Service referred to the Priority Zone 1 map as "preliminary"). The absence of final map products created significant delays for US Forest Service biodiversity monitoring efforts in STEWARD, which impacted other aspects of STEWARD implementation.

Conclusions

Question 1: What factors (both internal and external to the program) helped or hindered the achievement of the two projects' expected outcomes?

Finding: There were significant faults in project design that hindered the achievement of outcomes.

Because of decades of experience in working in the region, it was reasonable to assume that USGS/EROS and CILSS/AGRHYMET would work in sync. The assessment did not support this assumption; it was widely expressed in interviews conducted in the region that USGS/EROS had a top-down approach to this activity, and did not effectively engage local partners in design. CILSS/AGRHYMET did an inadequate job in the selection of trainees. The lack of a well-planned, consistent and objective approach to capacity building resulted in poor or undocumented capacity building results.

The suite of activities and deliverables was ambitious for the size of the budget allocated for these activities. The design of the work outlined in the PAPA and Implementation Letter was simplistic, and involved some naïve assumptions about the capacities of CILSS/AGRHYMET, the national focal points, and the level of effort involved in producing the major products, the time series maps and atlas. As a result, USGS/EROS had to take on far more work than envisioned, and call in additional partners and contractors. Even then, the project fell seriously behind schedule.

The absence of an in-depth causal analysis and robust results framework were important factor in the design. Had such a framework been required at the time of design, it could have helped USAID and its implementing partners to share a common understanding of the project objectives. Vague requirements in the instruments (PAPA and Implementation Letter) could have been made more explicit; in particular, the "hotspots" aspect of the work stands out as something for which there are competing interpretations, and lack of consensus of the correct approach and overall utility of the products.

The expansion in focus by USAID West Africa under these activities, encompassing all of West Africa, brought additional technical challenges and increased demands on the capacity of USGS and CILSS/AGRHYMET. The prior USGS/EROS engagement in West Africa, and the work of CILSS/AGRHYMET were strongly focused on the Sahel. The tools and techniques used by both institutions were adapted to use in interpreting the Sahelian environment. The transition of CILSS/AGRHYMET into an institution serving all of ECOWAS, and the expanded focus for USGS/EROS under the current PAPA, brought about new methodological challenges as the institutions adapted to interpreting Earth observation data in different biomes such as mangroves and dense forests.

As a result, none of the target outcomes has been properly accomplished at the time of the assessment, with the exception of the delivery of the imagery to CILSS/AGRHYMET. The production of the 2 km map series is very close to completion, but has not yet been completed at the time of writing this report and officially submitting to USAID.

These activities required a level of oversight that USAID did not provide. The control limits brought on by the choice of contracting instruments made by USAID, could have been compensated by a more hands-on engagement and collaborative working style adopted by the AOR. This could have included regular field trips to AGRHYMET, and a mid-term evaluation could have identified some of the challenges faced with sufficient time for mid-course corrections. The capacity of the USAID/West Africa Regional Office of Environment and Climate Change Response (ROECCR) to engage may have been constrained by factors not addressed in this assessment, such as staffing levels.

Question 2: Are the data, standards, and methodology made available to the public and policy makers in a manner consistent with the USG open government initiative.

Finding: this is an evolving issue in which all agencies are engaged to find a resolution.

It is reasonable to assume that USGS is on its way to being USG open data compliant. However, neither ESRI, USAID, nor USGS has completely defined an integrated, inter-agency metadata structure. This remains a work in progress.

Question 3: What lessons can be drawn from the USGS/CILSS/AGRHYMET teaming arrangement for capacity building in the region?

Finding: significant mistakes were made that provide important lessons for future project design.

The focus on technical subject matter on the part of USGS/EROS and CILSS/AGRHYMET overshadowed their efforts and performance in training design and execution. It is clear that some of the selected national focal points did learn a great deal about the methodology used by USGS/EROS to create land use/land cover change maps. But the selection of participants was not systematic, and there was insufficient attention paid to the institutional development needs at the national level. No attempt was made to measure change in the knowledge, skills, and abilities of participants both pre and post training, so it is not possible to conclude that significant gains in capacity were made through these efforts. At the same time, CILSS/AGRHYMET's overall institutional capacity has eroded over the life of the project; in its current configuration, it lacks the ability to provide the support that would be required of this kind of regional land cover work. The national focal points failed to deliver results towards successful production of the maps and hotspot analysis due to a weakly designed and executed selection process and due to lack of institutional interest and buy-in.

Question 4: To what extent have the two activities been able to build the capacity of analysts and decision makers in government, civil society groups, and the media to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications?

Finding: very little was done to date to build the capacity of analysts or to integrate findings into policy, planning, management, and communications. This is due to delays brought about through flawed assumptions in the initial design and project planning, which resulted in USGS having to take on a much larger role than initially envisioned. It is possible for this to happen by the conclusion of the project, but the time remaining is limited.

The capstone product is the completed regional land use/land cover change time series map, and the vehicle for dissemination is the atlas that CILSS/AGRHYMET is tasked to produce. The successful dissemination of this product is the key indicator of project success. This assessment shows that there is no dissemination plan. CILSS/AGRHYMET does not have strong capacity for information dissemination as noted in earlier sections, yet it has responsibility for the production and distribution of this key product. It is unlikely that the resources are available at CILSS/AGRHYMET to do this effectively.

Question 5: To what extent has CILSS/AGRHYMET improved the management, sharing and access to time series maps in its member countries?

Finding: the question is premature and cannot be answered because the production of the time series maps is behind schedule.

Recommendations

There is a need for rehabilitation of the spatial data infrastructure in the region in order to take advantage of advanced mapping and earth observations technology. There are significant constraints to this throughout the region, including, significantly, very poor Internet connectivity. Presently core users throughout the region lack stable permanent broadband access. The best they can get is often a 4G wireless data hotspot from a mobile service operator. This is expensive, as well as impractical for transfer of large spatial data files. Any future plans that may require electronic supply of spatial data must address the problem of long-term connectivity and access. This may or may not be addressed by USAID separately. Solutions such as next-generation wireless broadband technology (TV White Space) are, in principle, available. Such an arrangement could link key ministries and facilitate cloud -based data sharing under a "whole of government" approach. Incremental approaches to data may be advisable, with early efforts taking advantage of such tools as the TerraLook service developed by NASA and implemented by USGS. The choice of tools and approaches should be carefully studied, and the end users should be involved in the design of services.

Both human and institutional capacity to use spatial data is poor. Capacity building should address the viability and sustainability of the institutions where capacity is needed, and not only technical training of individuals. Training in most countries is through apprenticeship or study abroad. The demand for national level training institutions may be too low for a sustained training effort in many countries, but regional capacity and support networks for the limited number of users, and improved access to data, will increase demand.

High tech connectivity solutions and capacity building will not solve the problem of map literacy and data access in the largely remote communities that will be responsible for the management of significant land resources in the future due to the devolution of management in several areas of the region. It is essential that the needs of this constituency in be taken into account. Given technological barriers, and given the change that authorities would withhold information, the most important service that a regional mapping effort could provide in many places in the region would be to make paper maps available widely for little or no cost, while supporting training and mentoring of communities to grow into the use of technology for forest management. Specific recommendations include:

For the Existing PAPA and USAID/CILSS/AGRHYMET Agreements:

- The map products are valuable, but only to the extent that they are accessible. Paper maps remain the best way to distribute geographic information in the region. USGS/EROS and CILSS/AGRHYMET should ensure that mapping products are effectively distributed to decision makers and scientists in the appropriate ministries, to the press, and to civil society organizations through the development and execution of a communications strategy.

- Completion of remaining map products and production of all map products is the highest priority and all further activity should support this objective. USGS/EROS should also make at least 10 print copies of each relevant digital map product and CILSS/AGRHYMET should produce at least 10 print copies of the composite regional atlas for each of the seventeen countries, prorated for larger countries. For maximal impact, USGS/EROS should produce enough copies of the time series maps

(+/- 12,000[16]) and distribute them through the national focal points and other outlets so that the message cannot be ignored. It is important to avoid overreliance on online delivery systems for information due to widespread bandwidth constraints throughout the region.

- USGS/EROS and CILSS/AGRHYMET should also ensure that all products are uploaded on the websites of CILSS, CILSS/AGRHYMET, and Institute for the Sahel (INSAH), and, home institutions of the national focal points, to permissible and possible extents.

- If the distribution cannot take place before the conclusion of the respective agreements, a no-cost extension is recommended to allow this to take place. Because there is cause for concern that CILSS/AGRHYMET lacks that capacity to distribute the atlas, and is unlikely to have the budget to accomplish this task, USAID/West Africa should explore options to support it to ensure that this critical task is accomplished.

Future USAID Programming:

In view of leadership role played by the US in remote sensing and GIS in earth observation, the Assessment Team provides the following suggestions:

- USGS/EROS should continue to produce land use and land cover maps with support from USAID. Stakeholder inputs suggest that this would best be done every 3-5 years.
- USAID/West Africa must become more substantially involved in the implementation of projects of this kind, through technical, financial and management reviews as well as general oversight. Opportunities for bilateral Mission buy-in to the USAID/West Africa activity may help to increase the extent of intra-organizational coordination within USAID and inter-organizational collaboration between USAID and other implementing partners on land-cover change.

- Over the long term, regional and national geographic information infrastructure will be required to effectively receive, use, and share geodata resources. USAID should support geodata capacity in the region. A common cross-sector USAID regional geodata strategy should be promoted. This approach should be supported and secured by collaboration and buy-ins of Missions and Bureaus.

- USAID should ensure that all projects in the region consistently employ common metadata standards and data protocols to ensure interoperability of data and compliance with US government open data policy.

- The utility of LULC products would be enhanced if they were to incorporate a wider range of data. For example, demographic, infrastructure, and cadastral data is highly relevant to LULC applications. This would produce information on key drivers of LULC change, such as concessions and transhumance corridors.

---

[16] This figure is based upon a similar successful mapping outreach program undertaken by Gray Tappan of USGS in Senegal, which produced approximately 700 copies of a national land classification map that was widely distributed in schools and government offices.

- Future programming should explore the linkages between land use and land cover. This should include socioeconomic drivers that specifically involve water, food, agriculture, development and energy, using an integrated assessment model such as the Global Change Assessment Model (GCAM). Exploring these connections will permit the development of scenarios that capture change across sectors. The use of integrated assessment tools will also permit "hindcasting" to better understand the dynamics of the socio-economic and energy systems on LULC in the region. Several such experiments are underway, e.g. through the Pacific Northwest National Laboratory's Joint Global Change Research Institute.

- Internet Connectivity - Of overarching importance to the above is a regional connectivity (bandwidth) strategy. The present Internet connectivity constraints will limit and in some cases, negate the potential of any future programs or projects. It is proposed that USAID bring together major potential users (including donors) and technical services providers to develop a long-term strategy to support data exchange in support of climate change and biodiversity objectives.

- USAID should participate more effectively in developing detailed program definition, program planning, scheduling, and coordination and should seek detailed project reporting from programs and projects like LULC with higher frequency.

- USAID can coordinate more intensively and frequently with other development actors on LULC and change dynamics. This may increase opportunities to obtain direct financial support for high quality products such as those being produced by this project.

- USAID projects must support each other. Data collected by USAID financed projects at through programs such as INSAH (e.g., their Road Blocks and Trade Corridors in West Africa) should be used and integrated into other USAID projects through a common geodata infrastructure.

Capacity Development

- There are regional and national centers of excellence in West Africa. They should be supported and where necessary new centers developed for specific goals or objectives. A needs assessment of regional and national RS/GIS capabilities is required (e.g., at the Centre Universitaire de Recherche et d'Application en Télédétection (CURAT) in Côte d'Ivoire, the University Center for Remote Sensing in Burkina Faso, the Centre de Suivi Ecologique (CSE) in Senegal, and the National Center for Remote Sensing in Nigeria).
- An implementing partner with skilled knowledge in capacity development is needed to impart that component of any similar work in the future, to ensure that capacity-building efforts are designed to be sustainable and cost-effective.
- For future geodata programming, transparent and objective criteria should be developed and used for the selection of trainees.

Strategies to improve future USAID regional programs involving Earth observations and mapping

- CILSS/AGRHYMET needs to be restructured for better management. A review and needs analysis should be undertaken of CILSS/AGRHYMET to define roles, needs, management directions, restructuring of responsibilities, equipment requirements for GIS and RS, internet requirements for international and national information distribution, hiring practices, accounting and comptroller needs, and a redefinition of the role of the Center vis-à-vis, INSAH, CILSS and ECOWAS.

- CILSS/AGRHYMET is an important source of food security and climate variability data. It must become a data collection and distribution center for natural resources, climate change and resilience and other data such as carbon sequestration, soil moisture, transportation, trade and multiple stakeholder cost benefit analysis. It must become a source of technical data for both Sahelian and coastal countries.

- An institutional capacity assessment should be undertaken for CILSS/AGRHYMET including the development of performance goals for capacity building, which will provide the basis for subsequent capacity building activities, and guide evaluation of progress.

- CILSS/AGRHYMET needs to be placed on a more sustainable financial footing. As a first step, market analysis should complement the institutional capacity assessment. A business development specialist should work with CILSS/AGRHYMET Center staff to develop and conduct market research with the aim of determining demand for value-added analytical services such as climate services on the part of donors, international NGOs, the private sector, and governments. Such analysis may involve interviews with potential public and private sector customers identified through market research. Potential private sector customers may include extractive industries, agribusiness, banks, insurance providers, and mobile operators. On the basis of the analysis, a ten year business plan can be developed detailing product lines, revenue streams, required investment, and metrics for monitoring and risk assessment.

- Specific consideration should be given by CILSS/AGRHYMET to women as providers of map data, including understanding of barriers to their participation in the professions of geography and earth observations, to be reflected in project design, recruitment for training and in overall project design.

- Specific consideration should be given to specific information requirements and barriers to access to such information by social groups, including by gender.

- CILSS/AGRHYMET must nurture and develop working relationships with other data collection organizations in the region and globally, including the Consultative Group on International Agricultural Research (CGIAR), universities, the United Nations Food and Agriculture Organization (FAO), national ministries (census and demographics) and other non-profit research centers and facilities so that it can integrate data to create a holistic view of climate change and its effects.

- CILSS/AGRHYMET has the potential to become a technical center of excellence for the West Africa region in remote sensing interpretation and use of GIS for a range of development applications in addition to food security, including natural resources management, climate adaptation, and health. A needs assessment will help to determine priorities skills and research requirements, and identify the remote sensing tools most relevant.

- CILSS/AGRHYMET has the potential to develop additional tools to complement satellite remote sensing, including in-situ sensors and unmanned aerial systems for under-canopy and under-cloud applications. There will be increased demand for these activities if CILSS/AGRHYMET is expanding its scope to support coastal states. There will also be increased relevance for food security and climate-smart agriculture through precision agriculture; in this regard, it is noteworthy that CILSS/AGRHYMET includes a large farm that may be an asset for research.

- CILSS should have a high level technical advisor to interface with CILSS/AGRHYMET, INSAH, member nations, International Scientific Institutions, Donors, NGOs and others involved in NRMS and Climate Change.

Open Data

- Especially for geodata-intensive projects, USAID should clearly communicate the requirements for open data compliance to all implementing partners and require compliance, providing technical oversight as appropriate.
- USGS should document their use of the Yangambi system in the ISO/FAO Land Cover Classification System.
- Continue to develop the open source version of the RLCM, now under development by USGS.
- The use of the time series LULC maps will be substantially enhanced by knowledge of the associated drivers of change. USGS should make its data on drivers of land use and land cover change available per open data policies, including paired images.
- Outside of its archival function, the utility of open data and services relies, at least in part, on connectivity. ICT solutions should be explored to improve stakeholder access to open data and services, especially the key government agencies for each of the countries of the region.
- The entire range of stakeholders needs to find representation in the standards-making processes of the open-data movement. This includes representation from stakeholders in the developing world. USAID should consider the possibility of empowering its target constituencies for geodata through improved representation of developing country scientists and managers in relevant standard-setting fora.

ANNEXES

Annex I: Section C - Statement of Work

C.1 DESCRIPTION

1. PROJECT INFORMATION

This assessment covers two interrelated USAID/West Africa funded activities that include the United States Geological Survey/Earth Resources Observation Systems (USGS/EROS) and the Permanent Interstate Committee for Drought Control in the Sahel/Regional Center for Training and Application in Agrometeorology and Operational Hydrology (CILSS/AGRHYMET). This assessment has the objective to document progress against the respective activity work plans, and to inform USAID on why performance may be lacking. These objectives are important for future programming beyond the life of these activities.

The basic project data are presented below, separated by the USGS/EROS and the CILSS/AGRHYMET respective activities:

A. Basic Project Data for USGS/EROS

Identifying Information

Project Name:	Land Use Dynamics and Adapting to Climate Change in West Africa
Implementing Mechanism Number:	No. 624-P-00-08-00060-00 with a projected completion date of September 30, 2015
Implementing Mechanism Type:	Participating Agency Program Agreement (PAPA)
Prime Partner:	US Geological Survey/Earth Resources Observation Systems (USGS/EROS)
Partner:	Permanent Interstate Committee for Drought Control in the Sahel (CILSS) and AGRHYMET
Total Estimated Cost:	$ 3.2 M
Start and End Date:	October 1, 2011 to September 30, 2015
Agreement Officer's Representative**:**	Nicodeme Tchamou

B. Basic Project Data for CILSS/AGRHYMET

Identifying Information

Project Name: Land Use and Land Cover Change (LULC)

Implementing Mechanism Number:	No. 624-A21-11-01 with a projected completion date of September 30, 2015
Implementing Mechanism Type:	Strategic Objective Grant Agreement (SOAG), Implementation Letter (#1)
Prime Partner:	CILSS/AGRHYMET
Partner:	USGS/EROS
Total Estimated Cost:	$690,843
Start and End Date:	October 3, 2011-September 30, 2015
Agreement Officer's Representative **:**	Nicodeme Tchamou

Existing Information

The team shall find it useful to consult a broad range of background documents apart from project documents provided by USAID/West Africa (USAID/WA). These may include documents related to using geographic information to improve livelihood and planning for a sustainable environment, biodiversity conservation and climate change adaptation/mitigation. The team may also find the USGS (www.USGS.gov), CILSS (www.CILSS.bf) and AGHRYMET (www.AGRHYMET.ne) websites very useful.

USAID/WA, USGS, CILSS and AGRHYMET will provide the Assessment Team with a package of briefing materials, including:

Project quarterly and annual reports, work plans and any assessments developed as part of routine monitoring

Project publications and any related report/lessons learned

The Implementation Letter and program description

Annual work plans

Performance Management Plan (PMP)

Quarterly and Annual reports, and

USAID reports on field trips/site visits.

C. Project Background And Context

1. Problem or opportunity addressed

Deforestation, forest fragmentation and degradation have an enormous impact on biodiversity and contribute to climate change and declining crop production. One of the biggest challenges in West Africa is the availability and the capacity to produce accurate remote sensing maps and information to help shape decision-making.

Remote sensing is a key tool to help stakeholders and decision-makers "see" current and changing landscapes and better understand drivers of change. Biodiversity must be studied, documented and monitored on the ground at specific sites, but the vastness and complexity of the West African region calls for a remote sensing approach coupled with field studies.

The two USGS/EROS and CILSS/AGRHYMET interrelated projects capitalize on a wealth of time-series remote sensing imagery to map and monitor land use and land cover (LULC) across West Africa. This includes mapping the LULC changes from the 1970s to the present, and quantifying the trends to directly support Economic Community of West African States (ECOWAS) and Mano River Union (MRU) and their efforts to coordinate regional action plans for the management of their "trans-boundary" forests; establish forest and agricultural baselines using high resolution imagery, and monitor quantitative changes in forest resources; and to help national environmental agencies and their development partners protect the remaining national and community forests while improving agricultural productivity.

2. Target Areas and Groups

The project target area is, broadly, those countries that constitute the ECOWAS. The geographic area covers 17 countries (Guinea Conakry, Ivory Coast, Sierra Leone, Liberia, Ghana, Niger, Burkina Faso, Benin, Guinea Bissau, Gambia, Mali, Mauritania, Niger, Nigeria, Senegal, Chad and Togo).

The project target groups include USAID, USGS/EROS and CILSS/AGRHYMET. Bilateral USAID Missions in West Africa and USAID/Washington will take a particular interest in any lessons that could be disseminated to other missions with similar programs.

Project Intent

The initial intent during Phase I of the USGS/EROS project (from October 1, 2008 to September 30, 2011) was to use geographic information to improve livelihood and planning for a sustainable environment. This was to be attained through the provision of forest, land use and land cover and large-scale remote sensing imagery at site-specific and landscape scales. The imagery and associated technical assistance was to be used to monitor and describe measurable impacts associated with USAID-supported agriculture, biodiversity and natural resources management (NRM) field interventions over time.

In 2011, after three years into the implementation, USAID decided to support an extension of a USAID/ USGS/EROS partnership to focus on "Land Use Dynamics and Adapting to Climate Change in West Africa". This aimed to capitalize on a wealth of time-series remote sensing imagery and the EROS Center's considerable experience in mapping, monitoring and capacity building to monitor the state of West Africa's natural and agricultural resources. In the same year, USAID entered into an agreement with CILSS/AGRHYMET to support the USGS/EROS extension. USAID intended for USGS/EROS and CILSS/AGRHYMET to mutually reinforce each other's respective activity. USGS/EROS would provide satellite imagery and technical backstopping while CILSS/AGRHYMET would provide services to the national Geographic Information System (GIS) laboratories across West Africa to produce the LULC maps and country specific atlases.

D. Project Approach And Implementation

USGS: USGS/EROS is based out of Sioux Falls, South Dakota. Initially implemented through a USGS PAPA with USAID/West Africa under the Agriculture and Environment Office, the Phase I activity was to provide forest/land use and land cover large-scale remote sensing imagery at site-specific and landscape scales. The imagery and associated technical assistance were to be used to monitor and describe measurable impacts associated with USAID supported agriculture, biodiversity and natural resources management (NRM) field interventions over time.

Within this broad West African region, USGS was to assess the past and present extent of Upper Guinean Forest, as well as other Land use/ Land cover (LULC) types such as Sahel and mangrove biomes. This included mapping the LULC from the 1970s to the present, and quantifying the trends. This effort was to establishing forest and agricultural baselines using high-resolution imagery, and to monitor quantitative changes in forest resources to help national environmental agencies and their development partners protect the remaining national and community forests while improving agricultural productivity.

Currently in its second phase (October 1, 2011 to September 30, 2015), the "Land Use Dynamics and Adapting to Climate Change in West Africa", has a broader scope to take into consideration some of the West Africa's major challenges, including high climatic variability, a rapidly growing population, and human and climate-driven land use and land cover changes that result in considerable pressure on the limited and fragile natural resource base.

The project has four thematic areas with subsequent activities and outcomes.

Theme 1: Map Land Use and Land Cover and Associated Trends from 1975 to 2011 for 17 West African Countries

In this thematic area, USGS/EROS would work in close partnership with CILSS and its technical arm, the AGRHYMET Regional Center, to produce information and apply it to address the twin problems of environmental degradation and increased vulnerability to climate change. Three activities and several sub-activities are implemented under this theme.

Activity 1: Produce LULC maps of 2010-2011 timeframe for 17 Sahelian and coastal countries_in collaboration with AGRHYMET and national teams:

Upgrade the AGRHYMET Regional Center's satellite data holdings of West Africa with recent satellite image data from Landsat and ASTER satellite systems;

Prototype a revised and improved version of the Rapid Land Cover Mapping (RLCM) tool using Mali as an example in collaboration with AGRHYMET and the Mali National Team; and

Conduct a regional workshop, coordinated and hosted by CILSS and AGRHYMET, to roll out the major findings of the LULC mapping and trends program.

Outcome 1

Deliver to AGRHYMET complete LandSat and ASTER satellite image coverage of 17 Sahelian and coastal countries with 2009-2011 image acquisitions. Image date sets should be organized by country;

A spatially explicit raster map of current and historical LULC in Mali using Landsat and ASTER image data from 1975 - 2011 using historical Landsat MSS imagery and statistical analyses of LULC trends. The final products will be delivered to AGRHYMET and the Malian team in digital and hardcopy formats. They will also be placed on EROS and AGRHYMET websites for browsing and downloading;

A spatially explicit raster map of current and historical LULC of 17 countries in West Africa using Landsat and ASTER image data from circa 2011. Provide current versions of ArcGIS software as the main mapping platform, hard drives for image data storage within the participating national institutions; quality check on all national mapping efforts to assure a seamless, and high quality product within and across national borders. Deliver multi-date LULC maps to AGRHYMET and national partner agencies in digital and hardcopy formats. Place the maps on EROS and AGRHYMET websites for browse and downloading; and

Distribute LULC datasets to regional workshop participants in hardcopy and electronic (e.g. pdf) formats.

Activity 2: Identify and characterize landscape change, significant "hotspots" and anomalies that represent landscape degradation or improvements:

Conduct two regional technical training workshops on image analysis for identifying landscape hotspots; and

Conduct two regional training workshops with the national teams at the AGRHYMET Regional Center.

Outcome 2

A map and narrative description of at least 50 hotspots or anomalies across West Africa. These will be characterized by type, and those proximate to USAID project intervention sites will be identified. Longer-term project impacts on biodiversity, land use and NRM will be documented where possible.

17 national teams proficient in change detection analysis and research into potential driving forces of change using multi-resolution satellite data and secondary data.

Activity 3: Conduct specialized seminars at the AGRHYMET Regional Center:

Seminar 1: EROS Moderate Resolution Imaging Spectroradiometer/ Normalized Difference Vegetation Index (eMODIS/NDVI) for vegetation monitoring and analysis;

Seminar 2 - estimating Actual evapotranspiration (ET) using the Simplified Surface Energy Balance (SSEB) Model;

Seminar 3 - Integration of climate variables into land cover change analyses;

Seminar 4 - Use of remote sensing for assessing land degradation, land rehabilitation, and detecting "hot spots" or anomalies in land productivity; and

Seminars 5, 6, 7 and 8 additional seminars to identify and organize needs of AGRHYMET and its partners in the fields of climate change, environmental monitoring, sustainable landscapes, biomass and carbon accounting, natural resource management, and mapping LULC change.

Outcome 3

Enhanced ability of AGRHYMET scientists and key partners from national institutions to perform environmental mapping and monitoring tasks.

Theme 2: Sahel Studies: Document, Investigate and Promote Successes in Natural Resource Management and in the Re-Greening of the Sahel's Landscapes in Support of Improved Food Security, Increasing Biodiversity and Adaptation to Climate Change.

Under this theme, USGS would work in close collaboration and partnership with CILSS, and its technical service and training institution, AGRHYMET on a series of focused studies. Several activities and sub-activities are implemented under this theme:

Activity 1: Document, map, and prepare a detailed geographic baseline on the current extent and density of on-farm tree parklands in Niger, Burkina and Mali. This study is the starting point for the three that follow.

Activity 2: Work with CILSS, AGRHYMET and the Africa Re-Greening Initiative (ARI) to monitor increases in on-farm vegetation cover, tree density, biodiversity, and their impacts on local food production and livelihoods;

Activity 3: Identify regions across the Sahel that are suitable for developing re-greening activities; and

Activity 4: Determine the effectiveness of Re-Greening activities on crop conditions and food security.

Outcomes

Maps, graphics and a report that present a baseline on the current extent and density of on-farm tree parklands in Niger, Burkina and Mali.

Semi-automated approach developed for extracting tree cover which can be applied in other regions.

Documentation of changes in tree cover, biodiversity, agricultural productivity and soil conservation as a result of re-greening activities.

Maps, graphics and a report of priority candidate regions and sites in the Sahel which are suitable for scaling up re-greening activities. All methods, underlying data and assumptions about how the suitable areas were selected will be presented.

Report presenting the impact of re-greening activities on crop conditions/yields, food security, biodiversity and impact on rural livelihoods.

Satellite-derived data products staged on EROS, CILSS/AGRHYMET and ARI websites.

Theme 3: The Regional Park W: An Environmental Assessment of its Natural Resources Including Biodiverse Hotspots, Surrounding Land Use Pressures, And Land Cover Trends.

Under this theme, USGS works in close collaboration and partnership with CILSS, and its technical service and training institution, AGRHYMET, to produce a detailed baseline, and assessment of the state-of-resources, LULC maps, and geographic overlays of human activity, biodiverse habitats, and wildlife population. This will be central to landscape planning that aims to maintain a viable park and its ecosystem into the future. Several activities are conducted under this theme:

***Activity** 1*: Inventory, Map and Assess Trends and Pressures in and around the Regional Park W; Support long-term management plans for the Park.

Outcomes

Land use and land cover / critical habitat map of the Regional Park W and buffer areas around the Park. The map will show biodiverse hotspots, critical habitats, and land use pressures around the park. It will also integrate a digital elevation model map to show shaded elevation and slope information. The suggested scale is 1:100,000 and will be produced in standard GIS and hardcopy formats;

LULC and critical habitats map, with additional geographic layers showing detailed Park infrastructure, additional critical habitats, charismatic species distribution overlays, wildlife migration corridors to adjacent non-protected areas, and long-term Park management plans;

Monitor the LULC dynamics in and around the Park, and identify key activities with non-governmental organizations (NGOs) and the national park management offices. Graphics of this map will be staged on the EROS and AGRHYMET web sites; and

Inventory, Map and Assess Trends and Pressures in and around the entire Regional Park W – Pendjari National Park corridor.

Theme 4: Monitoring Biodiverse Forests and Protected Areas in West Africa's Upper Guinean Forest Eco-Region.

Under this theme, EROS will work with USAID/West Africa's Sustainable and Thriving Environments for West Africa's Regional Development (STEWARD) project to produce thematic maps of the Upper Guinean Forest. The maps will show the recent extent of the forest from about 25 years ago, and how and where that extent has changed. They will also show where dense forest still exists outside the protected area network. Focus will be in STEWARD priority zones (PZs):

PZ1: Sierra Leone (Outamba-Kilimi National Park) / Guinea (Madina Oula, Soya and Ouré Kaba subprefectures);

PZ2: Guinea and Côte d'Ivoire (Mount Nimba) / Liberia (Nimba Nature Reserve); and

PZ3: Côte d'Ivoire (Taï National Park) / Liberia (Grebo National Forest).

Activity 1: Map, monitor and support biodiversity conservation and agro-forestry activities in the Outamba-Kilimi/Sierra Leone and Madina Oula & Ouré Kaba/Guinea Transboundary Area (Priority Zone 1). Build on recent efforts (2009-2010) which provided detailed image-maps of the Outamba-Kilimi and Madina Oula & Ouré Kaba transboundary area (TBA) in support of biodiversity conservation, agro-

forestry, forest management planning, establishment of a transboundary conservation area, and ecotourism.

Outcome: Complete LULC maps of the Outamba-Kilimi and Madina Oula & Oure Kaba transboundary area (TBA).

Activity 2*:* Map, monitor and support biodiversity conservation and agro-forestry activities in the Mount Nimba (Guinea / Côte d'Ivoire) and Nimba Nature Reserve (Liberia)(Priority Zone 2).

Outcome: Complete LULC maps of the Mount Nimba and Nimba Nature Reserve.

Activity 3*:* Map, Monitor and support conservation and agro-forestry activities in Taï National Park (Côte d'Ivoire) and Grebo National Forest (Liberia)(Priority Zone 3).

Outcome: Complete detailed LULC maps of the current state-of-resources in the Taï National Park and Grebo National Forest TBA. Time-series land use and land cover maps of this TBA area, showing land use trends and external pressure areas around the protected areas.

CILSS/AGRHYMET: AGRHYMET, created in 1974 and based in Niamey, Niger, is a specialized technical support institution of CILSS and provides 13 of the 17 West African countries technical support. The four West African countries not covered by CILSS/AGRHYMET are the Anglophone countries of Sierra Leone, Liberia, Ghana and Nigeria. The purpose of the CILSS/AGRHYMET IL was to carry out activities related to mapping land use and land cover (LULC) and Sahel studies, with the major objective to reinforce environmental information systems for decision-making related to sustainable land use and NRM with the following specific objectives: 1) provide reliable information on LULC and associated trends from 1975 to 2011 for West African countries, and 2) capitalize and promote successes in NRM in support of improved food security, increasing biodiversity and adaptation to climate change.

The specific activities outlined in the 2014 IL and associated work plan include:

Conduct two regional technical training workshops on image analysis for identifying landscape change and significant hotspots and anomalies;

Disseminate information about widely significant hotspots across West Africa in commonly used digital formats and via web sites with data portals, and through USAID outreach channels;

Conduct a regional workshop to roll out the major findings of the LULC mapping and trends program;

Evaluate and document impacts of Farmer-Managed Natural Regeneration (FMNR) or other BMPs in support of improved food security, increasing biodiversity and adaptation/mitigation to climate change (carbon sequestration); and

Implement the "Sahel Studies/Success Stories" communication plan

As a result of these activities, CILSS/AGRHYMET would produce:

Report of field validation of data in four countries;

Stakeholders validation report and maps from 13 countries;

13 national atlases and one regional atlas;

13 maps and 13 hotspot maps; and

At least 50 decision makers informed and sensitized on the outputs of the project.

These activities are in line with, and included in the CILSS five-year work plan (2009-2013), in particular, Axis 2 - "Ensure sustainable natural resources management in a climate change context". The activities also contribute to the implementation of the ECOWAS Regional Agriculture Investment Plan (RAIP[17]) and support the implementation of the Mobilizing Program 2- "Promoting a global environment for regional agricultural development" as well as Component 2- "Adaptation to climate change and integrated management of shared resources", Component 3- "Operationalization of a decision-making aid and information system" and Component 4- "Reinforcement of institutional and human capacities". In addition, the activities are aligned with "Climate Change" as a crosscutting theme of USAID/W Africa's "Feed the Future" Strategy.

II. ASSESSMENT RATIONALE

Assessment Purpose And Audience

The purpose of this assessment is to document progress against the respective activity work plans and to inform USAID on future programming beyond the life of these activities.

USAID/West Africa, USGS and CILSS/AGRHYMET are the primary intended audiences of this assessment. USAID is particularly interested in learning whether there are any critical program issues that can be used to inform future programming, related to capacity building of regional entities. The assessment is expected to provide pertinent information, statistics, and judgments that could help assist USGS/EROS, CILSS/AGRHYMET and USAID/WA to learn what is being accomplished, and what relevant management is required to accomplish the project outcomes, and more importantly lessons learned that can inform USAID future programming.

Assessment Questions

The Assessment Team should focus its assessment around the following questions:

What factors (both internal and external to the program) helped or hindered the achievement of the two projects' expected outcomes as detailed in the USGS/EROS and CILSS/AGRHYMET work plans and agreements.

Are the data, standards and methodology made available to the public and policy makers in a manner consistent with the USG open government initiative?

What lessons can be drawn from USGS/CILSS/AGRHYMET teaming arrangement for capacity building in the region?

[17] In 2005 the ECOWAS Heads of States adopted the ECOWAS Agricultural Policy (ECOWAP), as an instrument for the coordination of the Comprehensive Africa Agricultural Development Program (CAADP), the agricultural component of the New Partnership for Africa's Development (NEPAD), within the region. The implementation of ECOWAS/CAADP is based on the implementation of investment programs at the national level (NAIP) as well as at the regional level (RAIP).

To what extent have the two activities been able to build the capacity of analysts and decision makers in government, civil society groups, and the media to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications?

To what extent has CILSS/AGRHYMET improved the management, sharing and access to time series maps in its member countries?

III. ASSESSMENT DESIGN AND METHODOLOGY

Assessment Design

The Contractor shall provide their conceptual approach to answer the assessment questions. The contractor must focus on actual results and targets, key informant interviews, site visits, and consultations with relevant stakeholders. The contractor will incorporate a site visit to USGS/EROS (South Dakota) as well as CILSS headquarters in Burkina Faso and AGRHYMET headquarters in Niger. The Contractor will propose a cost-effective methodology that shall allow the team to evaluate the capacity of the 17 target countries under these interrelated activities.

The Contractor shall examine the current and past performance of USGS/EROS and CILSS/AGRHYMET from the start of respective activities through the assessment period (October 1, 2011 to date). None of the Assessment Team specialists should have had any connection to the current or past phases of the respective activities. While the assessment should address past performance, the contractor must also provide forward-looking recommendations on possible strategies for improving such future regional programs.

USAID/WA shall participate on some West Africa site visits, such as the visit to CILSS and/or AGRHYMET. However, the Contractor is responsible for their respective planning and shall have the full responsibility for all assessments duties and deliverables.

Data Collection and Analysis Methods

The Contractor is required to evaluate this multi-faceted program in a timely manner across member countries. The contractor shall determine the data requirements, collection methods, and required analyses in collaboration with USAID/West Africa. Consistent with ADS 203.3.1.6 guidance on evaluation methodologies, the Assessment Team must employ a combination of **quantitative and qualitative methods** in data collection and analysis. Details on final datasets, collection methods (including interview questions, questionnaire form and key informants to be interviewed), and analytical framework(s) shall be approved by the USAID/West Africa as part of initial work plan approval. Data must be disaggregated by sex, where relevant.

Suggested data collection and analysis methods and the assessment questions that they are anticipated to help answer are provided in the table below. The Contractor can consider other methods, and forward the same in writing to the COR to be incorporated in the Workplan. This shall not cause any change on the negotiated price.

Data collection and analysis methods	Question(s) to be answered
Desk study: Review existing documents and information listed above. Work with USAID/West Africa to acquire additional documents and information as needed, and prioritize primary data collection where gaps remain.	All
Key informant interviews with CILSS/AGHRYMET	2,3,4, and 5
One-on-One Interviews (Survey) with stakeholders in member countries	2,3,4 and,5

c) *Methodological Strengths and Limitations*

Methods	Strengths	Limitations
Desk study	Provide valuable information on substantive issues and generate a list of questions including key stakeholders that can be used in other methods. Help to focus efforts and prioritize issues and gaps	Time consuming Depends on resource availability Lack of consistent data collection Limited baseline data
Individual interviews: Key informants and one-on-one surveys	Potentially data rich, detailed answers	Might need to interview through translators (possible loss of meaning and data richness) Might have informants' bias

Team Composition

USGS/CILSS Assessment Team shall be comprised primarily of three consultants, as follows:

Team Leader - GIS Expert - Key Personnel

The Team Leader strongly vested in GIS-based capacity building and Land Cover Evaluation projects will be responsible for the overall implementation of the assessment and ensuring that all expected tasks and deliverables are achieved on time and of high quality. S/he must be fluent in English and French and must have at least master's level degree with 7 years of technical experience in the following domain: a) Increase access to geospatial data and information by improving management and access to existing and new data b) Creating user-tailored geospatial products and services (such as decision support tools, applications, models, dissemination, and training) to get information to people who need it to address priority development issues c) Building the capacity of analysts and decision makers in government, civil society groups, and the media to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications.

S/he must have significant professional experience coordinating complex evaluations/assessments, and leading evaluation/t s. USAID may request to see examples of past evaluation/assessment reports under the direction of the proposed Assessment Team leader. The candidate must have exceptional organizational, analytical, writing and presentation skills. S/he shall oversee the overall drafting of the assessment framework, including methodology determinations; organization of calendar/travel/meetings;

overseeing the desk study, interviews, and other data collection; and analyzing the data with input from team members and USAID/West Africa to draft the assessment report.

The Deputy Team Leader

The Deputy Team Leader/Landscape Land Use planner using geospatial information for NRM shall support the team leader in the implementation of the assessment. S/he should have significant professional experience implementing complex evaluations/assessments involving multiple stakeholders and the use of "Land Use and Land Cover time series maps" for decision making. The candidate must have exceptional organizational, analytical, writing and presentation skills. S/he must be fluent in English and French and should have at least master's level degree with 5 years of experience in a relevant analytical evaluation/assessment field. It would be highly desirable to have knowledge and/or experience working with USAID rules, regulations, and procedures. S/he shall contribute to the overall drafting of the assessment framework and participating in the desk study, interviews, and other data collection; and analyzing the data with input from team members and USAID/West Africa to draft the assessment report.

Capability Building Specialist

A Capacity Building Specialist who will distinguish between capacity building and technical assistance to evaluate how USGS/CILSS beneficiaries gained the ability to produce and use by its own geo-spatial data to inform decision in NRM and how to sustain this capacity into the future. S/he must have strong English and French speaking skills and a master's level degree with 5 years of relevant technical knowledge and experience in capacity building assessment.

The Assessment Team

The Assessment Team should provide complimentary skills and together possesses the technical, evaluation/assessment and managerial skills to submit high quality deliverables that meet the objectives of the assessment without requiring significant revisions and substantive/significant input from the Mission.

The USAID COR shall provide the linkage between the consultants and the Mission. Working with the Mission, s/he shall provide strategic direction and guidance throughout the assessment process, including approving the work plan, any data collection tools, and assessment report outline, approach, and content.

Assessment Management

a). USAID management of assessment

The USAID/West Africa point of contact for the assessment is Nicodeme Tchamou. An assessment committee comprised of the USGS/CILSS Contracting Officer's Representative (COR), a representative of the Mission Program Office (Contract Officer Representative (COR) for this assessment contract) and REGO Office Director will be formed to respond to questions from the team, resolve administrative or logistical obstacles, and review the Assessment Team's deliverables.

b). Logistics & Scheduling

The Contractor shall propose the following elaborated timeline to provide a notional presentation of a prospective allocation of level of effort for the assessment.

The assessment is authorized a six-day work week.

Estimated Start Date	Activity	Working Days	Location
	Preparation – Selection of countries to visit and preliminary specification of planned interviews. In-brief with USAID/West Africa staff and Assessment Team members (in person in Ghana). Document review. Finalization of assessment methodological approach(es) and trips schedule. Development of questionnaires and/or other tools to be used in conducting surveys.	6	Anywhere
	Field Work and Data Analysis - Interviews and analysis (including comparative) of performance data. The team may split into two groups at different stages of field work.	15	South Dakota, Niger, and other countries
	Initial synthesis – In-country team work culminating in delivery of Detailed Assessment Report Outline and draft PowerPoint presentation for review by Assessment Committee. Additional meetings and interviews may also be scheduled to validate findings. Debrief CILSS/AGRHYMET and USAID Mission in Burkina.	6	Burkina Faso
	Revision and refinement – In response to comments from Assessment Committee, team will incorporate feedback and other input into finalized PowerPoint presentation and initial full report draft. Presentation to USAID/West Africa and other stakeholders.	5	Ghana
	Final report production – Completion and delivery of final assessment report based on Mission feedback.	13	Anywhere

Total: 45 Working Days

(END OF SECTION C)

Annex II: Assessment Methods and Limitations

Replace this text with the full details of the methods used for data collection and analysis should be presented here. Explain why decisions were made to use certain methods and how those methods were the best available given the evaluation questions and resources. Provide details related to how data sources were selected, including sampling methods. If statistical analysis was used, explain the power calculation to determine the sample size and confidence level. If qualitative methods were used, give details such as whether interviews were structures, how informants were selected, how sites were selected for direct observation, etc.

If an experimental or quasi-experimental impact evaluation, provide detailed information on the methods used to randomize or to define treatment and control groups through other means, and how data was collected from both groups at baseline, midline and/or end line.

Make sure to include a full and transparent discussion on any limitations to the data or conclusions from that data that may be due to the methods themselves, data quality issues, bias, logistical or security constraints, or any other limitations.

Annex III: Data Collection Instruments

NACs (National AGRHYMET Centers) Survey/Interview:

This version was used in both English and French as a questionnaire sent to ALL NACS (the 'general level questions' will also be the guide for the in-person semi-structured interviews

Data source/Interviewee	Collection format
All NACs (countries we visit and do not visit)	Fillable online form - SURVEY (we will call this one the "SURVEY" – survey monkey or Google forms will be used (have to see what's do-able given our internet connection in Niamey) To keep things simple, this is differentiated from the "SEMI STRUCTURED INTERVIEW" (below)
NACs we are interviewing in-person	SEMI STRUCTURED INTERVIEW Interview using semi structured approach (following same question themes as survey using BOLD questions) we will try to use kobo toolbox but if we can't we will record in word documents.
NACs we are visiting in-person: (*where person may not be available for interview or would like a paper version for interview prep)*	Paper questionnaire (main questions in semi-structured interview will be printed out for those who request it)

Introduction to this survey:

Thank you for agreeing to participate in this survey. The goal of our study to learn from your perspective on how two related USGS/EROS and CILSS/AGRHYMET projects funded by USAID functioned in terms of their respective activity and work plans. In addition, we hope to better understand the factors (external and internal to the project) that may have had an effect on the achievement of the respective projects' objectives. We hope that with your help we can identify what future activities and planning might be most beneficial to achieving project objectives.

Specifically, the assessment seeks to answer the following questions:

1. In general, what factors helped or hindered the achievement of the two projects' expected outcomes as detailed in the USGS/EROS and CILSS/AGRHYMET work plans and agreements?
2. To what extent did CILSS/AGRHYMET supported your organization's capacity to manage, share and access land use maps?
3. What lessons can be drawn from USGS/CILSS/AGRHYMET teaming arrangement for improved capacity building?
4. To what extent did the two activities build the capacity of you as analysts and how did the activity help decision makers in government, donors, and NGOs in your country to integrate geospatial data and technologies into their analysis, policy, planning, management, and communications?

5. What, if any, support did you or are you receiving to build open data systems and how do you perceive the importance of open data mechanisms to obtaining the goals of your institution?

PERSONAL INFORMATION: (ALL TEXT BOXES)

Name: **(TEXT BOX)**

Home institution: **(TEXT BOX)**

Title/email/mailing address: **(TEXT BOX)**

How long have you been involved with the USGS LULC mapping project? **(TEXT BOX)**

What is your area of expertise? **(TEXT BOX)**

How did you become involved with this project? (*How were you selected?)* **(TEXT BOX)**

Please describe any previous experience you may have with land use mapping and land use decision-making: **(TEXT BOX)**

Section 1. Provision and use of USGS data

Did USGS provide the data you needed to produce your national map? (Yes or no)

- Please describe what data was provided by USGS for development of your national map: **(TEXT BOX)**
- In what format? (digital format, paper, tiffs?) **(TEXT BOX)**
- Did you have the appropriate software, software licenses, and infrastructure to fully utilize the USGS products? **(Yes/No/Comments)**
- What products were delivered by USGS to your institution **(TEXT BOX)**
- (list or provide an inventory of products received), i.e., screen shot of disk directory listing)
- Were all products that were promised delivered? **(Yes/No/Comments)**
- Were they delivered in a timely fashion? **(Yes/No/Comments)**
- Please rate their quality **(high/medium/low)**
- Was the metadata included? **(Yes/No/Comments)**
- Were the promised hardware, software, and licenses delivered? **(Yes/No/Comments)**
- Were there other equipment needs that were not supplied? **(Yes/No/Comments)**

Section 2. National products

What national-level products were produced as a result of this collaboration? *(I km maps, hotspot maps and studies) please list in as much detail as possible:* **(text Box)**

- Please describe the hotspot approach/methodology as you understand it? **(TEXT BOX)**

- Were there enough hotspots chosen for your country? **(Yes/No/Comments)**
- Were you involved in choosing them? Please describe the selection process **(Yes/No/Comments)**
- In your opinion, was the methodological approach correct? **(Yes/No/Comments)**
- Was it then applied/implemented correctly? **(Yes/No/Comments)**
- Monitoring of Hotspots: are there any ongoing or planned efforts to monitor these or other areas? **(Yes/No/Comments)**
- If yes, how are they being monitored? **(TEXT BOX)**
- Were you able to create any value-added products from those provided by USGS? Do you integrate any of those products with products from other donors and if so, whom? **(Yes/No/Comments)**
- In view of the fact that positive land change (afforestation/re-greening) are known to be associated with agroforestry systems managed by women; were gender dimensions of land change considered in your hotspot case studies? **(Yes/No/Comments)**

Section 3. Working relationship of your NAC with USGS and AGRHYMET (with emphasis on institutional communication and workshop organizing)

Please describe the working relationship of your NAC with USGS and AGRHYMET

- Do you find it easy to communicate with USGS and AGRHYMET? **(Yes/No/Comments)**
- How effective was communication? **(Yes/No/Comments)**
- Do you feel AGRHYMET has improved your access to the USGS products? **(Yes/No/Comments)**
- Are your concerns/questions addressed in a timely fashion? **(Yes/No/Comments)**
- Please describe how you are supposed to work with AGRHYMET and USGS? **(TEXT BOX)**
- How could the USGS-ARC-NAC relationship, network structure, and communications be improved? **(TEXT BOX)**
- Do you rely on other NACS (other project participants) for additional support/advice/exchange between trainings or provide this support to other NACs? *If so, which ones do you work with the most? Why?* **(Yes/No/Comments)**

Section 4. Training, capacity building, and technical support

Did the USGS adequately train participants, in the use of its products?

What follow on training is necessary? Please describe how USGS provided technical support to your national team (this question will guide the semi-structured interview and is broken down below for the online survey)

- Did you and your national team attend the USGS workshops? *If so, what was your impression?*
- Describe the exercises that were prepared by USGS training team? **(TEXT BOX)**

- Did you and/or participants from your NAC gain proficiency in change detection analysis using multi-resolution satellite data and secondary data? (**Yes/No/Comments)**
- Were you able to provide updates to EROS on production of current (2010-11) LULC maps? *(How often?)* **Yes/No/Comments)**
- What additional types of training do you need to make or use the maps? **(TEXT BOX)**
- Would additional training allow you to use more types of maps/imagery? (**Yes/No/Comments)**
- Did you experience problems in allotting time to training and map production given your other institutional responsibilities? (**Yes/No/Comments)**
- Are there other regional- and national-level partners (government agencies, donor organizations, and/or NGOs) who could help to support training and capacity building? In map development or map dissemination? (**Yes/No/Comment**
- Did the USGS/AGRHYMET training increase your knowledge to allow you to support other donor projects or other projects for which you have responsibility in your organization (i.e., MESA or other projects)? (**Yes/No/Comments)**

Section 5. MAP USE:

In this section, we aim to document any 'leveraging' or use of the USGS/national team products (2km & 1km maps, hotspot maps and case studies, any other materials) by national stakeholders such as Ministries, civil society organizations, NGOs; other donor projects; or other USAID projects (for example, in themes such as land use mapping, climate change adaptation, biodiversity, park and protected area planning, sustainable livelihoods and food security planning

How have you and/or your institution been able to use the USGS/NAC products to help stakeholders (NGOs, government agencies, other donor or USAID projects) improve management and planning for land, natural resources, biodiversity, and/or sustainable livelihoods and food security? (This question will guide the semi-structured interview and is broken down below for the online survey)

- Who are the intended/or potential users of the LULC maps in your country? **(TEXT BOX)**
- Have these users had access to the LULC maps? **(Yes/No/Comments)**
- For what purposes are the LULC maps used? **(checkboxes)**
    - Land rights/title/land tenure
        - Concessions: mining, oil, lumber, agro-industry
        - Parks
        - Community holdings
    - Land use planning
        - Agriculture
        - Agroforestry
        - Watershed management

        - Forest degradation
        - Land capability under different uses
    - Economic development
        - Transportation (i.e., are roads influencing land change)
        - Telecoms
        - Infrastructure
        - Tourism/eco-tourism
    - Conservation
    - Health
    - Education
    - Energy
    - Climate adaptation – food security
    - Reporting (conventional and national)
    - Environmental change
        - Meteorology/precipitation/climate change
        - Soil erosion
        - Vegetation

- Did your NAC (or AGRHYMET) ever conduct an assessment under this project of who could be using the map products? **(Yes/No/Comments)**
- Was there any stakeholder strategy by your NAC (or AGRHYMET/USGS/EROS) to enable map dissemination and use? Was it implemented? **(Yes/No/Comments)**
- Were the USGS products integrated at all with products by other providers? **(Yes/No/Comments)**
- Are there additional types of information that you would like to see integrated into the USGS data provision? **(Yes/No/Comments)**
- Can you provide examples where map use resulted in collaboration with other institutions, Ministries, or other organizations? What factors contributed to this collaboration? **(BOX)**
- Can you provide an example (or two) that illustrates how the USGS data has influenced decision-making concerning land use and natural resource management, climate change planning, or other decision-making in support of development/sustainable livelihoods in your country? **(Yes/No/Comments)**
- Are the USGS products relevant to the most pressing geospatial demands of your nation? **(Yes/No/Comments))**
- What additional products and services are needed from AGRHYMET, USGS, or other provider? **(BOX)**

Section 6. Open data/data access

- Are the data and products generated by USGS and your NAC now available to stakeholders/potential users in your country? **(Yes/No/Comments)**
- More broadly, do you have suggestions about how data access could be improved in your country? **(BOX)**
- Have you disseminated products and information produced by the project to other users in your country? *Please describe what you have disseminated and to whom* **(Yes/No/Comments)**

Section 7. Data Platforms/Connectivity

- Does ArcGIS work well with the USGS products? **(Yes/No/Comments)**
- Are your licenses current? How many GIS licenses do you have? **(Yes/No/Comments)**
- What types of data do you use in your GIS? **(Yes/No/Comments)**
- Do you have adequate IT (technical) support? **(Yes/No/Comments)**
- Do you have Internet connectivity problems? **(Yes/No/Comments)**
- Do you feel that Internet connectivity needs to be a discussion issue at the highest level, ministries, donors and the CILSS? **(Yes/No/Comments)**
- What are your biggest constraints in the development and application of GIS? **(TEXT BOX)**

*ANNEX 1: SAHEL STUDIES -- documenting, investigating, and promoting success in NRM and Sahel re-greening (for Niger, Burkina Faso, and Mali)

*Please answer if you are a NAC of Niger, Burkina Faso, or Mali

Did your NAC participate in the mapping, documenting, report presentation) of the Sahel Studies for your country? *Please describe* (BOX)

- Did you or did your institution complete the maps, graphics, and report of the baseline current extent and density of on-farm tree parklands for your country? **(Yes/No/Comments)**
- Did you or did your institution engage with other users/stakeholders (i.e., farmers, park managers, donor organizations, communities) to conduct the work related to the three reports? Who are they? **(Yes/No/Comments)**
- Do these users have access to the map data? **(Yes/No/Comments)**
- Were you or your institution able to document the changes in tree cover, biodiversity, agricultural productivity, and soil conservation as a result of re-greening activities? **(Yes/No/Comments)**

- Were you or your institution able to identify, map, and produce a report on priority candidate regions and sites in your country that are suitable for re-greening activities? Please briefly describe the methodology used to conduct this effort? **(Yes/No/Comments)**
- If you were able to document changes due to re-greening, were you able to also report on the impact of these activities on any of the following topics: crop conditions/yield, food security, biodiversity, and rural livelihoods? **(Yes/No/Comments)**
- Are the results of these studies and associated maps available online anywhere (EROS, CILSS/AGRHYMET and Africa Re-greening Initiative RI websites)? **(Yes/No/Comments)**

ANNEX 2: Monitoring Biodiverse Forest and Protected Areas in the West African Upper Guinean Forest Eco-region (for Cote d'Ivoire, Sierra Leone, Liberia, and Guinea)

*Please **only** answer if you are a NAC or related organization of Cote d'Ivoire, Sierra Leone, Liberia, and Guinea

Survey Results will be submitted separately due to file size limitations.

Annex IV: Sources of Information

Country	Organization	# Individuals Interviewed/# women
Ghana	FAO	6/0
	USAID	3/0
	ASSESS	5/1
	Ghana Forestry Dept	3/0
	Ghana Min. of Env. *	1/0
Niger	AGRHYMET	6/2
	World Bank	1/0
	USAID	3/0
	CNSE (Wata Sama)	1/0
	Ministry of Environment *	1/0
	Presidential Cabinet (Meteo)	1/0
	Minister/High Commissioner 3N	3/0
	USAID 3N Projects	7/0
Mali	Dept of Environment *	1/0
Togo	Dept of Statistics *	1/0
Burkina Faso	Center for Training in GIS	3/0
	SAP Ministry of Agriculture	10/0
	Andre Bassolé, Atlas consultant	1/0
	CILSS	9/1
	USAID	2/0
	CONEDD *	2/0
Cote d'Ivoire	UNDP	2/0
	SODEFOR	5/0
	Cedric Lombard (RS/GIS expert)	1/0
	CURAT	8/0
	PNEDI	1/0
	USAID	2/0
	REOD	6/0
	FAO	1/0
Liberia	USAID	2/1
	USAID GEMS	1/0
	USAID PROSPER	1/0

	USAID L-MEP	2/0
	Forestry Training Institute	3/1
	Forestry Development Authority *	3/0
	Land Commission	2/0
	LISGIS	2/0
	UNMIL	1/0
	UNOPS	2/0
	CDC	1/0
	Min. of Lands, Mines, and Energy *	2/0
	VPA Support Unit	2/0
	EU FLEGT	1/0
USA	USGS	6/2
	World Resources Institute	3/0
Total	45 (7 LULC focal points)	130/6

Annex V: Interview transcripts

INTERVIEWS IN BURKINA FASO

CERPINEDD	
Name	*André Bassolé*
Title	*Directeur General.*
Institution/ Contact information	*+226 76609049* *a_bassole@yahoo.com* *abassole@fasonet.bf* *979 Ave de L'Armée* *Cité An III* *Immeuble J-Espace J28* *Ouagadougou* *Burkina Faso*

Interviewer notes: *Andre has been contracted by CILSS to assemble composite regional atlas.*

André first met Andrew from his time at the Centre Regional de Télédétection de Burkina (a USAID project) (1982).

André is currently working on the formulation team for Global Monitoring For the Environment and Security (GMETS/EU) a paper commissioned by the EU for the next phase of MESA. The project objective is to consolidate the results of MESA and propose the next services or levels of project activities using Sentinel. Project runs from June 2014-15. Andre is the African on the team and is working with three French consultants: Christian Crepo (geographer) and has a lot of experience with EU projects, Corboles (Gestion de Coastal and Marine management) and one other. The 'inception report' context assessment report is complete. Basically the proposed new project will duplicate the proposed SERVIR activities.

- Three themes:
  1) Management of natural resources.
  2) Resources Coastal Marine resources
  3) Water resources

Now they are working with the issue of how they can transfer the data to Africa. There is a satellite receiver in Burkina and then there is a process that allows transmission to each country: African Monitoring for Environment and Sustainable Development (AMESD) ER Metcast. MESA was the first project that started on the European concept of global monitoring for environment and security (MESA) and each country has a monitoring station.

http://www.eumetsat.int/website/home/AboutUs/InternationalCooperation/Africa/AfricanMonitoringoftheEnvironmentforSustainableDevelopmentAMESD/index.html (this group developed the data and communication systems)

The system is composed of receiving stations connected to computers, data is then downloaded into one computer and then a second can produce and disseminate data. The national focal point for the AMESD project) is located in the Ministry of Environment. We don't what kind of data will be transmitted.

2000—LCCS – FAO's land cover classification system and did the GLCN (global land cover network)

The LCCS would allow you to transfer from one land class to another but it requires a load of inputs. So Bassolé started this initiative with a little money and the Italians were also providing funds and we even trained some regional actors.

At the same time the LULC USAID projects had been launched - experts identified in each country and were sent to Niamey for training and so from a conceptual point of view I think the project was very good (at the beginning 15 years ago) even beyond this a friend of mine from Senegal CSE (Amadou Ndeye) even got a fellowship through that program and got a PhD so that was very good.

Then the national teams developed programs for what they were planning to do by themselves to extend the methodology within their countries and did so with varying degrees of success. "You know the difficulties in Africa; you can't keep a person if you don't secure the means so I guess what happened is that some of these issues were why the national teams were not able to deliver results in earlier phases of the project."

The validation workshop in Burkina was in March or April last year – he spoke highly of that workshop but noted that there still is a gap. People who attended the workshops were "experts" from the various ministries. But how do we insure that this message is taken up to the level of the policy makers? This is the big gap!

If you take one of these maps shown by Gray Tappan you see the land change and you cant ignore it. "From my point of view that was a major step forward and should have been the subject of a report to the council of ministers." Someone should have taken and brought it to the cabinet and said 'look where we are going' but that wasn't done.

At CILLS w the Assessment Team should talk to:

1) The executive secretary general etc.
2) The experts the heads of training research (i.e., Amadou Cissé)

Grey is strong in the map-making department but not in the selling part.

PROJECT ATLAS: USGS and CILLS and AGRHYMET are not responding to Bassolé's need for information to assemble the composite atlas. Bassolé was hired by CILSS/AGRHYMET to put together the atlas. But he complained that neither USGS/EROS, National focal points, or CILSS/AGRHYMET were providing the data he needs to complete the work.

Système d'Alerte Précoce (SAP), Ministry of Agriculture	
Name	SAP Team

Spoke to the whole Système d'Alerte Précoce team at the Ministry of Agriculture with the exception of its director (DG Hien Signteny) who was not available.

Andrew provided background on the evaluation and on our desire to understand data needs from those who could potentially use the LULC change products, in this case, for their work with food security. The group had not heard of the LULC project in their work with CILSS

We asked questions about what maps they used to do their work (they cited the vulnerability map created by USAID-Senegal. SAP works often with the statistical service (Nanulalou Leopold) SAP – Africa risk capacity - they do a lot of work with AGRHYMET.

SAP does a territorial (national) evaluation every two months and then there is a food security meeting every month, FEWSNET and we do the evaluation. We don't look at land use when considering the situation of food.

'C'est la maladie du pays' they are supposed to do the crop coverage nationally each year and then are supposed to also project forward 6 months but the issue is that this is difficult to do. There is also the "cadre d'harmonization" to see not just the coverage of crops nationally but also to project forward 6 months.

You spoke about the harmonization but can you describe your diffusion to everyone else? Vis-à-vis CLISS/AGRHYMET and the other donors? **A.** We created an Internet site with the Ministry for a bulletin but then we ran out of money.

Do you send any information/data to AGRHYMET and does AGRHYMET send you anything? Do you use AGRHYMET data? **A:** We use the NDVI that AGRHYMET sends out to alert the national centers, this info helps us to understand the situation.

Went over how the data exchange works with AGRHYMET (they receive data in October and March and 'le decadaire' (10 day Bulletin) also gets sent from AGRHYMET. Then from Meteosat they get rainfall prediction. Since 2010 they also get the vulnerability analysis from AGRHYMET.

Secrétariat Permanent du Conseil National pour l'Environnement et le Développement Durable	
Name	Moussa Ouedraogo, Coordinador Technique des Programmes

As we have not been able to locate the BF focal point, here is the recount of what happened to the FP for Burkina.

The original focal point for BF was : Louis Blanc Traore lbtraore@gmail.com

(he went to OSS) and was replaced by :

M. SIDIBE Norbert, Directeur de Monitoring pour le CONEDD – 70 26 11 78

For the second position, it is M. Toure G Alassane 70 28 61 00 or 50 31 31 66

alassanegtoure@yahoo.fr

DPCIE PF-CCD (who is the focal point for CCD)

CONEDD

Mr. Sidebe is the one who provides the information on the environmental side and I know this is good information for them and I'm sure they work with AGRHYMET in the context of this project and then for some data they work with projects REGIS-ER and others and I know about this project. (he knows because he was trying to become part of Paul's team)

We're in the process of putting together CONEDD's 4 -year report on land utilization so its important that data from the LULC project is used to actualize the maps. The report gathers and synthesizes environmental data from across the environmental agencies. Every year too, we have a meeting with producers and the president and we look at the change in land use; that's very important to us. We are very interested in these products.

CILSS	
Name	Edwige Botoni, Technical Coordinator

Edwige: There was a deficit of communication about the Assessment Team. The mission was announced a long time ago but then just two days ago we learned that you were here.

The CILSS has a new 5-year plan and the structure of CILLS and AGRHYMET is going forward, for a new structure for projects and programs? We also learned that the CILSS executive secretary will not be there this week, as they are all leaving over the weekend for a one week long meeting (Retreat) at AGHRYMET (from where we just came).

Edwige: The new 5-year program doesn't change much but it's designed to work more closely with ECOWAS. But it will be important that AGRHYMET stays strong, the executive secretariat might change somewhat in terms of it's orientation but AGRHYMET will not change as it is a technical institution and everyone has a need for it to feed the policies and then the policies go back to define the technical work. For this reason, in my opinion, AGRHYMET is indispensible.

Assessment team: Asked a question about ECOWAS and how it can be responsive to the particular needs of the Sahel and we discussed the ideas for how national level organizations that are more prepared to do their own work could be structured (i.e. Senegal where there is a national semi-autonomous center {CSE}) as one route.)

Edwige: With the issue of CC it is utopic just to have a national view. With the Senegal case, like CSE, Burkina is not going to get help from Senegal so what you need in that sense is a regional structure. The regional structure has a role to play so that there are the countries that can work together. Both are good, it's important to have both (regional and national perspective) as climate change does not respect borders.

Edwige started with the LULC project in 2011 working on capturing best practices of the project.

Edwige: In terms of the project, there is a huge problem with USAID in general, but we never had a planning period together for this project. We just got the project and it lasted for a period of time, just approved for 1.5 years and then we had another situation where we needed to extend the project until September 2015. Or we just get these little extensions, but we even had one year where we didn't get paid at all for the whole year even though we were working (2010-2011) but in any case it's a project that has suffered from a lack of cooperative planning between the donors and USGS and CILSS /AGRHYMET

Edwige: USGS had their project. But on our side, there was no planning done (CILSS /AGRHYMET with the USGS, but I don't know why if we're going to work in 17 countries,. With the hotspot study it was so poorly planned that we had to figure out how to do these very in depth projects with very little resources. For example, for the Niger analysis the socioeconomic studies were very expensive. We identified lots of hotspots – but we couldn't do all the hotspots so we decided to do two kinds of hotspot. The first kind of hotspot, the 'deep' hotspot, involved six months of study for one location. Then the 'light' hotspots were just a week or two; we just didn't have the money to do more.

The USGS US team talked a lot about the methodology – and we asked how did they do the methodology? WE had to adapt the methodology so we could afford to do the study. So for the light studies we gave 4,200,000 CFAs (Togo) and for the larger ones we gave 6-7 million CFAs. (Niger, Mali, Chad) For the deep studies we really wanted to use the correct data collection protocols and be sure that we were all working in the same way.

Edwige recounted the story of Togo where she went to talk to the Togo GIZ people who are there doing the same thing and then they asked what we used and we said 500 m and they are working at 5 meter! It wasn't SPOT it was something else. But it highlights a problem with this project, and that is that we are not really using the highest resolution stuff and for the regional level that level of data is fine but if we're working with the decision makers and the communities we really need different tools that work at the scale of the communities so in this sense the method is a problem. (She went on to explain the 30% errors when using the dot matrix approach used by the USGS) Even though statisticians are going to say it is valid, when you go to the local level you find that it is not.

A bigger issue in general, is that we didn't get a chance to plan this project. We could have planned and done a 5 year project and we would have completed the maps at the national level and then the commune level but we only got to plan from year to year, we didn't get to plan the whole project and that is a major weakness. They gave us the products and they trained the people and they went to the field to verify but that's it.

Madame Kabre (most recent focal point who worked with CONEDD – Ministry of Environment.)They have done the maps, but 2 km is too big for our decision-making needs. We said that for the countries it needed to be 1km but we decided that at the beginning 2k m is a lot for a regional decision so the first meeting we will do the 2km for the whole region and for the countries 1km or 500 km (just the little ones, e.g., Gambia, Togo). There is a sense (by taking the one km data) that Grey appropriated work that was done by the CILLS for his reports and did not do enough to adequately share with country partners.

Assessment Team: How can the situation be made better?

Edwige: We didn't select people on the basis of their qualifications for the project. The trainees were identified by politicians. Some of them we knew and what their skill level was, but as countries themselves decided whom they sent we had to just go with whom we got. We were trying to build capacity in countries but as there are not many people who are trained at the level that is required for this kind of work we sometimes have to just go with whom we get. There was no protocol with the countries and so even deciding which ministries to sign and work with was challenging. So sometimes we just got functionaries who had other jobs and responsibilities and so didn't even have time to do the work. This was a huge error.

In terms of Gray Tappan, we don't know why he is not giving us what we need to produce the atlas but we feel as if he is not very engaged to help to produce the products and to show everyone what is being done. (Since this interview, Tappan has sent materials to Bassolé who is producing the Atlas)

Assessment Team: What about the Internet bandwidth issue?

Edwige: This is a big problem; there are so many maps at AGRHYMET and we need to develop complementary products such as more platforms for it to be accessible. SERVIR could do that, as we really don't have a decent platform for diffusion. We have the invitation to the SERVIR meeting on May 28-29 at AGRHYMET to plan the SERVIR activities.

Assessment Team: So how to do we get to the decision makers with the information that you all have created?

Edwige: We haven't ben able to get to that point. The problem for the year is that we did the proposal for activities but we don't have funding etc. We would like to do a fine mapping exercise with communities—and we know techniques that can work with this small scale system and so we know how to do that and so for a little territory and we can even say how much it costs but we don't have the money to do it.

Edwige: With USAID I am a bit disappointed. I was recruited to be CILSS coordinator for a climate change program and then after a year they said they didn't want to fund it any more but they didn't plan

long term. These little programs don't give us what we really need to build a vision and have a long lasting sustainable program. We pass all of our time doing planning, and we used to plan with the food security people and now they want it as a part of a different program so it's difficult, we don't know where we're going so it's tiring. There are too many projects and they are always changing names and directions.

In designing the USGS activity, Edwige recommends: The best way to do it would have been to do a global land use land cover program and within that approach define other activities and results that track together and then you know who is responsible for each activity. (the way that the current project is done it was very difficult for them to understand how to implement in a coordinated fashion and who is responsible for each activity as they didn't match up at all).

I am in this USAID program as a team manager but not just that for this project also for the climate change and sustainable land development projects. I am finding myself coordinating three different projects within the food security/desertification area and I'm in charge of so many things.

There is a consultant that will come to help work through the strategy for 2020. Everything is fixed at the strategic level but the planning is not figured out. We are 80 and it is very heavy for the people doing these projects.

Centre Universitaire SIG et Télédétection Adjaratou, Institute Supérieur d'Etudes Spatiales et de Télécommunications	
Name	Patrice Sanou
Title	Chef

Interviewer notes: *Patrice is running a private training center in Ouaga. He has a PhD in Geography from the USA. He was not trained by Gray but knows him and people at the center.*

It's a big gap between the private and public production of GIS data and to do the reports on the environment on drought etc. The situation is getting worse but sometimes we don't even know because we don't have updated data and so following/monitoring is absolutely necessary for the countries of the Sahel.

It's not the question just of drought it's also an issue of floods now too and this is a new phenomenon and there is the issue of soil degradation and the climate change needs to be introduced as a new phase in environmental change. Extreme events are new to this region so we need to work to re-envision and understand what do floods and drought introduce to the environmental situation that we have now? We need a better use of the satellite images we have very high resolution images now we need to use the newest stuff (I used Quick-bird for my thesis in the 1990's, it allowed me to understand how the overall situation as well as the products but also to see the what impact people have had on the environment and we can see that now because of this high resolution imagery (Ikonos, Quick bird) etc. and to be able to see the we need to deepen the research and not stay general.) Because up until now we've just done the general stuff because we didn't have the data that we need but we need to see and identify precise study sites – we can choose particular places within the region and do LULC. Land cover can be better understood with this data. It's true that there was a weakness in interpretation in these kinds of images there were not the specialists to be able to do the interpretation and also when we got the high-resolution stuff it is expensive.. Now we have people who are capable to interpreting the images and letting us know what is the state of land cover and in the theme of formation. I think if we take Burkina and the experts we have and the specialty they have, we have twenty-one new people who have

graduate with the specialty in GIS/geomatics, we can count on them to tell us the state of the environment.

They study 2 years and they have two degrees – .. and then they can do the work here in the country..

Assessment Team: When 21 people get formed in a year, where do they work? Who hires them?

Sanou: They get picked up by NGOS and all kinds of institutions around Burkina once they have their masters. There are 20 of them who are going to come out this year and parents are very committed to getting their kids trained in this subject. I have the impression that things are going faster and there is more of a demand for this type of analysis.

For very high resolution, what products do you use?

We use spot imagery—we use ASTER sometime when we are supported by EROS Data Center with that.

What are your links to EROS data Center? Janet Gritsner (she was part of the staff of this organization too but she is retired but now we connect to Gray Tappan and so when he is here he talks to us?

NASA: We also get NASA who works with us and so within this contact we got some maps too. NASA chose three countries we did a study on the Zone du PAM, the mining areas and gave us maps for evaluation of Quick Bird images (2008).

Assessment Team: We could say that Burkina has very good coverage—better than for other countries and so it's kind of strange that maps for Burkina for LULC project did not get done.

Sanou: What I know is when Gray comes he trains and then he leaves different products for people to work on. He has to work with people that are chosen by the Ministry, not people who actually are formed in this subject. (such as those that are trained at Patrice's university center for SIG). So that's the problem. It's a problem that when the State chooses the people they don't make sure that they have any capacity to do this kind of work.

Assessment Team: when Gray comes here does he take people from this institute that get chosen? I would like to better understand how Gray chooses the people –

Sanou: Gray comes and parachutes in and then I learn that he's here and I find out there has been a training activity but he has never used us. Gray knows me but there are people here in Burkina that don't let him use us. Louis Blanc Traore – Coordinador de Information to the Council of Environment and Sustainable development and you know what he does? When they do it they are the consultants. We do a very solid training here – but they prefer to have their own people in the project… they might invite us to the inception meeting to get our ideas but they don't end up hiring us.

Was he invited to the Validation workshop?

He was invited to the validation workshop (first he said yes and then he said no) and all the products are not pertinent. (And then he said that someone else went). He said; "I'm a teacher and there are positive and negative elements so I think in this case the product isn't quite ready. (The LULC 2 km is useful but for development it's not detailed enough).

Do you know about the SERVIR project that is coming to Burkina?

NO

Assessment Team: Have they ever done any work with AGRHYMET?

(Note: Burkina was never completed by a Burkinabe, they had to get the Togolese guy to finish it.)

Assessment Team: what are other organizations are doing and what is being done?

Sanou: gave a very long and interesting answer about methods and about harmonizing methods across institutes. CILSS should be there to integrate all the data – to have conversations about methods and data collection.. (OSS shouldn't do it) it really should be CILSS.

It's also really important that they start to take environmental considerations into account. You can have economic development in countries that are dying of desertification and dying from climate change. CILSS is not doing enough to effect policy change within this arena. When I say CILSS I also mean AGRHYMET, they are totally useless.

SEMSOC: (2004) Spatially Explicit Modeling of Soil Organic Carbon (**SEMSOC**)

Was a study by USAID (Ghana, Burkina, Niger, Mali) to monitor soil and quality of vegetation. The objective was a land cover land use analysis and to look a bit at the limits of sequestration and equally what was the progress to improve carbon fixation in soils and vegetation.

Assessment Team: You haven't said anything about AGRHYMET.

Sanou: They are in the same situation – there is no technical capacity. There is no scientific rigor at AGRHYMET. If they say that deforestation is like this 'xy' it should be more or less correct, but it's not right. It's not good data If we want CILSS to become productive and useful what CILSS does needs to be of sufficient quality.

INTERVIEWS IN CÔTE D'IVOIRE

Program des Nations Unies pour le Développement	
Yao Bernard Brou Coordonnateur National du Projet sur le System de Gestion de l 'Information Environnementale (SGIE) Bernard.brou@undp.org Mobile: +225 77 80 36 32 +225 07 50 71 70 Skype: brouter	Dr Joseph S. Ezoua Programme Specialist Abidjan, Cote d'Ivoire +225 20 31 74 27 (ex: 7427) Mobile +225 07 01 44 18 Skype: joseph.ezoua1 http://www.ci.undp.org

5 Hotspots already done in CDI: UNDP/Ministry of Environment did a hotspot study with the Dutch. For CDI there were 5 hotspots chosen as places with many competing pressures (agriculture/population) and important resources.

Three main issues identified: Gulf of Guinea projects for the coastal countries

- Coastal erosion
- Pollution
- Degradation of biological diversity

They then chose the 5 hotspots

And the project being undertaken by UNDP is about identifying national capacity to work with the Conventions on land degradation, biodiversity etc.). UNDP has conducted a national level gap analysis (institutional, resources) for CDI.

Sees this as especially important for West Africa because the coastal resources are such a big part of the PIB and the population is primarily on the coast.

In CDI there is the national data/national level information and then we have private information (remotely sensed data) but it is not combined/harmonized in ways that it can be used by decision-makers, so the idea is not to reinvent the wheel but to put everyone on a shared data platform (around coastal resources) with a web portal so that it can be accessed by managers and decision makers.

Still TBD who will manage the web platform to assure good planning process with decision makers but Ministry of Environment will be in charge – the ANDE -- Agence Nationale de L'environnement.

Mr. Ezoua (arrived late): For example, having the land use land cover data for CDI would be very important for the UN REDD program here. Would really benefit for something like this, as FAO/UNEP—are part of UN-REDD and FCPF.

Another reason why the LULC maps would be important for CDI: What is very interesting about this project we're doing a cartographic look at the whole coastal area and we need a very good map of land utilization to use as a discussion document with communities and regions, these tools are very important.

Description of the platform they are developing: There are so many great sources for data – the Ministry of Environment is not equipped and shouldn't have to produce all the data, instead the different

agencies and data providers (i.e. CURAT, Météo) and one uses the data that all the structures have) use the 'platform' to do the work.

Assessment Team: Who is going to supervise and do capacity building etc.? **Ezoua**: I think it would be the PNUD that would do that with GEF/World Bank and we think that is positive and that is the process of setting up a system that we can then leave to the government. We'll accompany and we'll make sure they have the data and the tools and the training and they we 'll leave it all for them.

Assessment Team: Made the point that it's a challenge to get the ministries to share (they acknowledged that and they know it's a challenge and it's something they hope to work on and "really want to make sure that that compartmentalization (cloisonment) doesn't happen."

We have all the data and we need to be able to cross all the data into an Environmental Management Information System.

There was a convergence based on previous studies and development of the (national action plan) PAN (and other documents). The PAN and the sectoral documents and conventions are developed with the PND (national development plan) so there's this convergence between the various priorities. So at the national level we helped a lot with the PAN and so there aren't contradictions with the degradation hotspots we identified in the north. We have a good coherence that makes it so that the arbitrage to deciding these places will be easier. The sectoral stuff we're seeing requires real discussion and the needs are great and the resources are not and so it's really important to make the priorities. Also, its 2015 and there is a new plan being developed for 2016-2020 so they're in the process of defining the whole plan and they'll feed the definition of national priorities.

Assessment Team: If you do a study on this project for the coast, will you also need a series of images to help you understand the changes and project future changes?

Ezoua: We work on the consolidation of existing data but there is also the issue of the data that might be needed and how to guarantee that the new data that is needed that isn't being collected now

Discussion of Internet connections and the CDI E-GOV initiative to improve Internet access in public agencies.

BeDevelopment
Cédric Lombardo Previous: Advisor to the Presidency of CDI, Environment and Space Technologies, Thales Alenia Space, ESCP Europe, Institute Française du Pétrole, ESC Toulouse cedric@bedevelopment.net, http://bedevelopment.net/

Cedric was advisor to the president for 10 years on environmental issues primarily but also has a background in law and technologies and so has done a lot of work in the remote sensing information space.

CDI was a leader in the spatial technologies and has a good base of people who are well trained in various national institutions.

Initially we wanted to have CDI spatial applications center within the presidency, he then described the politics there with Ouattara

Spatial tasks fall within various agencies across the government (BNET- CNTG, CNTIG).

Cedric authored the document reviewing all of CDIs spatial resource institutions and resources that would form the basis of the platform that is being built today

While CDI has great resources and people and we know how to get all of the data, there was too much conflict between the actors, even though everyone was there and everyone had a role, as long as there is not an integrated system they will continue to fight over resources and their competencies will remain separate.

Cedric's proposal: Based on the SST document (see above note) there is a recommendation as to how it could be worked out. They will have a meeting in Yamoussoukro for regional leaders (Mayors etc.) to work out the land change mapping needs.

REDD+ Cote d'Ivoire- Réduction des Emissions de Gaz a Effets de Serre, Issues de la Déforestation et de la Dégradation des Forets	
Adjoint du Point Focal National REDD+	DJA Manan Lucien Cocody, Deux Plateaux les Vallons, Rue des jardins, Abidjan CDI Tel : +225 22 41 06 96 Tel : + 225 05 92 44 88 Email : luciendja@yahoo.fr Skype : lucien.dja
" "	Konan Yao Eric Landry Assistance Technique REDD+ charge de la Stratégie et du Point Focale REDD+ Charge de la évaluation environnemental et social stratégique +225 01 44 20 90/05 92 44 88 Email : luciendja@yahoo.fr
République de Cote d'Ivoire Ministère de l'Environnement, de la Salubrité Urbaine, et du Développement Durable (Programme national Changement Climatique (PNCC) Secrétariat Exécutif Permanant REDD+	Aka Jean Paul Expert REDD+ et filières agricoles Charge de la Stratégie Nationale REDD+ et de l'Engagement du Secteur Prive
	Eduard Kisse Brou Charge de Component « Suivi Spatial de Terres/REDD »
	Kassaï Serge Pacôme REDD+ Cote d'Ivoire Assistant Technique

For us it's very interesting that we've heard a bit about these maps but it's very interesting because we are wondering if this data could help us with the development of our reference scenario

Also we're also very interested in collaborating we're actually collaborating with FAO to put together a regional system of regional forest monitoring. We are going to have someone from FAO who is going to 6 countries (Cote d'Ivoire, Guinea, Benin, Ghana, Togo)

Drivers Study: You also talked about hotspots (in describing the LULC USGS/AGRHYMET project) within our REDD+ activities we've begun a study of drivers of deforestation and we expect to finish it

by the end of the year. The idea is to do 1990 to 2000 and 2010 and see the different drivers of deforestation. It is a combined Landsat-Spot study.

Assessment Team: Who has given you the Landsat images? Normally it's BNEDT and CCT gave us the maps (people were with us this morning).

We are interested in getting the images from USGS because they have the biggest database of this kind. We're also in contact with someone at WRI based in France.

THEY HAD NO IDEA that this project was done and that there might be MAPS FROM USGS might be available for them to use. They are very excited to get access to this data.

Mentioned Cedric's SST document – mapping/RS institutions in CDI are across three groups (according to legislation):

1) Production – BNETD - CCT

2) Training - CURAT

3) CNTIG for production norms etc.

The latter two have some overlap but they both have an important part. For the CNREDD the idea would be to do a bi-annual evaluation of forest cover in the context (bi-annual update report for REDD+)

We've wanted to get back in touch with USAID to see about help with the mapping issue and CDI there is forest but they are not big expansive forests, so we need very good imagery and need to really to understand land use types (cacao/café etc.) so within that context we thought about SST all the platforms that work in the RS etc. and also bring everyone tether (agriculture/forestry etc.) but we don't have a deep contact with USAID but would like to but we'd like to see how we can do more with following forest cover. But globally that's a bit of our vision in terms of forest monitoring.

We've done the RPP

Assessment Team: The ER-PD we have our RPP and we have a project but we have the ER-PIN. FCPF they only have the RPP and they have the pilot project on emissions. ER-PIN…

Majority of team of young experts were formed at the Ecole Superior de Agronomie (Yamoussoukro)

Presentation of their ER program forest area: Cavalley, Nawa, San Pedro, Gbole (that's the biggest are of cocoa in CDI)

(Data is from Global Forest Watch Data – Hansen data set)

There are huge portions of cacao that are in the sun but we're going to try to make those go to shade cocoa – there's enormous potential there

Rubber would be the buffer zone – and then the cacao would be the main zone and then we need to do a national map of high carbon stock to see and identify that with cartography so if they are not --- canopy forests (that's a big debate as to whether rubber (Hévéa) is really forest or not – gallery or savanna forests. We create a forest cover with rubber and so there is a carbon value.

The notion of agroforestry is a very new concept to CDI and so that's what we're starting to talk about.

There is a new forestry law 2014 and the old law was much more about extraction, as we're trying to regrow our forest stocks – our law is now adapted to this new reality…

CODEFOR was 60-70% donor funded before the crisis

Now the funding is mostly state and 'own resources' from CODEFOR

What other donors are supporting you? The Japanese are helping with equipment and other way that they can be supported/ financing from international organization of tropical forest. But not big projects; those are rare.

BNETD - CCT : http://www.bnetd.ci/bnetd/Cartographie-T%C3%A9l%C3%A9d%C3%A9tection

CURAT	
Prof. SALEY Mahaman Bachir	Centre Universitaire de Recherche et d'Application en Télédétection Université Félix HOUPHOUËT-BOIGNY d'Abidjan-Cocody, Boulevard de l'Université 22 BP 801 Abidjan 22, Côte d'Ivoire +225 22 48 84 27 / +225 22 44 52 70 informations@curat-edu.org http://www.curat-edu.org/curat-2/

Overview by Bachir Saley:

We are a University Center that teaches RS and GIS. We use all kinds of images for that work.

In the case of this project in a way CURAT has experience with small scale monitoring of land use land cover change.

Example IRD – land use and monitoring we are there and we have the competence to do it. But what we do in the future of this kind of projects we could do that due to our competence in this manner.

Otherwise one of our students is working (Karim, Togo) in the LULC project with Alfari and at the same time he is actually getting his doctorate here, through CURAT)

They have people in training (3 yr. doctorate) 1 yr. masters

(Students participate from Cameroon, Gabon (2), Niger, and Togo)

And they will have an online program for all of West Africa by next year

Assessment Team questions:

History of CURAT – Agence universitaire française had 5 teams the geographic, the geologists, the mathematicians, the biologists and the doctors, and they wanted to try to understand the use of remote sensing/télédétection together and this is what CURAT is it is. It is an interdisciplinary center for UNFR (the faculty at the university) so this way all the specialists arrive here to work. CURAT was founded in 1997 (18 years), all of the people present at the meeting were all trained at CURAT products of CURAT.

> **An example:** You can have someone who wants to study a health issue and they can work here alongside people from other disciplines on remote sensing. They can go from one subject to another multi-disciplinary (pluridisciplinaire).
>
> **We have M1 to doctorate level:** it's a very interesting group here

What is the value added of our work, given the national capacity of places here, like CURAT? CURAT has experience to do this work and they have experience with doing this at various scales. The lower we go there is more and more data that is needed at the higher resolutions and we train the people that go to work at CNTIG.

CCTT – Centre de Cartographie et Télédétection / Comite National de Télédétection et de Information Géographique (CNTIG)

Usually our work will be in the context of a particular project or for student research. It usually has to be in the context of a project.

The government has a bunch of things going on – CNREDD and all kinds of initiatives and there is lots of energy and the big challenge here is to create synergy throughout the various efforts.

Capacity questions:

The challenge at the national level is to coordinate the various initiatives. There are many things that are done and repeated. For example REDD+ but that doesn't cover land use change just reforestation/deforestation and there is the SST.

All the structures exist but in terms of the methodological approaches uses CURAT is well placed, we have the advantage there.

CURAT faculty have participated in efforts in Italy ISPRA as well as at the JRC (Joint Research Center)

CURAT team wanted to emphasize that they are well equipped technically and otherwise to train students from across West Africa in land cover land use change. (Note that one of the LULC program participants; Karim from Togo is currently doing his Doctorate through CURAT.

Key issue for Cote d'Ivoire is the importance of synergy of action so that the way it's developed works within the national context

Also, if the idea is to form people here in Cote d'Ivoire for the region – What are the technologies and systems we need in place to do that? What technologies should be chosen for training (formation)?

There is a decisions to make at the technical level to decide how to develop the system for training that is the best adapted to the reality

CURAT is currently the focal organization for the MESA marine project. They have a MESA dish where they download data that has been previously processed in Europe. They then process it to a 'second level' and share this data with the government fishery scientists etc., while simultaneously training them to process the data.

How MESA was born. There were three people who had bought the same image three times and each person had exploited the document in a different way (the spot images) and they realized that they needed to develop systems for sharing and disseminating these products nationally.

FAO Côte d'Ivoire	
Eric Renaud Bahintchie Consultant National Gestionnaire Dynamic Atlas	FAO Cocody II Plateaux les Vallons Av. Boga Doudou – rue J75 01 BP 3894 Abidjan 01, CDI (225) 22 40 59 20 Cell: (225) 49 01 85 14/01 05 49 54 eric.bahintchi@fao.org

On the SST: Jan 2014 there was a conference that brought together all the actors working on the spatial issues to get up to date on state of the art practices etc. FAO provided financial support for that meeting and the AFD was also a major contributor, locally the BNETD-CCT was the lead but it was also funded through project support for REDD+.

On having land cover change data for CDI: The FAO specialist, a cartographer said that they use LULC change info in their work and such information would be 'excellent.'

FAO actually just released an RFP for land cover change work (mapping the causes of degradation and deforestation. BNETD and another consulting firm are competing. We have to be able to document the damage, as well as the drivers and cultural dimensions. Study will be eight months

For the implementation of UNREDD FAO, FAO, PNUD is providing $210,000 (this was the RFP that BNETD was referring too)

BNETD does have a land use cover layer using SPOT 4 but this would be a comparison, always good to have a comparison and get an understanding of the current situation 'etat des lieus'.

For REDD+ this will be important, a good interpretation of the maps

In terms of work going on out of the FAO office: they are charged with environment projects (many in agriculture and food security in CDI) but also all the UNREDD+, as FAO is the lead agency for the RPP. Now other donors will add to the REDD fund so that they can move beyond the pilot stage.

Bureau National d'Etudes Techniques et de Développement (BNEDT) Centre de Cartographie et de Télédétection (CCT)	
Institution/ Contact information	N'Doume Claude Thierry Ake Chef d Service Actions Commerciales, Marketing et Gestion des Projets Tel: (+225) 22 48 63 68 Cell: (+225) 01 05 46 44 Email: cndoume@bnetd.ci

Assessment Team Leader: Introduction to the project, explanation of the three phases and how CDI was involved/not involved and why. Also, expressed desire by USAID to understand needs in CDI. What should the project do if there was a future phase? What would your needs be to improve the state of cartography and understanding of land cover change in CDI?

N'Doume:

Atmospheric scientist by training, degree at University of Lille in France, helped launch CURAT (university center at Houphet Boegny) but has been at BNEDT 20 years).

A little history: He started doing remote sensing to examine the café-cacao complex (they have also published on it) and worked on projects such as the aquatic invasive plant that was a problem here at one time. He also did a lot of work on the development of GIS. Parallel, he also did the classic cartography developing the maps, doing the field verification of the maps, and getting base maps developed. In 2003-4 **BNEDT** bought SPOT 4 (2.5 m) coverage of the entire country. This was to produce an electoral map of the whole country and so they made maps of land use for the whole country (using this map that was initially purchased with the aim of developing the electoral map). Now they have 1m (spot) for good parts of the country.

More on the evolution of the CCT-BNETD and description of the institutional constellation of GIS/RS orgs in Cote d'Ivoire:

CCT was the IGCI (Institute Géographique de Cote d'Ivoire) an autonomous center for remote sensing, but then with the recession and the crisis and cartography experienced severe budget shortages

(late 80s early 90s). So we incorporate ourselves into **BNETD** in 1992**. BNETD** was originally the 'Direction de Contrôle General de Grand Travaux' and all of the big projects (i.e., the Autoroute to Yamoussoukro etc. and to have a technical and advising capacity for the president) but then later with agriculture and all kinds of studies economic, agriculture, there was a growing need for maps. We did a forest map at that time and that was done with 1992-94 and then after that were difficult years and they joined BNETD.

CNTIG is separate from us and exists to regulate the production of cartographic materials (maps) and is attached the same way to the Présidence. They have focused more in GIS but they have become a competition for us and so this is hard.

There is a station that is co-directed with NASA at Yamoussoukro.

Several projects/projects in process:

1. **FAO:** The most important project for us is REDD+. USAID finances that through two projects. One is located at FAO. RE: disbursing the money, he couldn't recall whether it's PNUD money or USAID money but they are now responding to an RFP (that he thinks they'll get) This project aims to do last decade for land use change, and comparing deforestation and degradation from the last study for cartography. We will use Landsat since you can't get the images for free unless they are Landsat so we're proposing using Landsat.
2. **Minister Eaux et Forets:** A bigger project will be with (**BNEDT, Ministère des Eaux et Forest, SODEFOR**) This has to be paid for by the government of CDI with a new land cover to do SPOT 6-7 to do 2013-15 full country land cover map. The project is developed, it just needs to move through approval within the government and we hope it gets funded. It's a 2 million dollar project so we'll either do it as one big project, or we'll divide it up into smaller ones: **1)** forestry: to see the real stage of the forest in CDI; **2)** Forest use (because in general the forests of CDI are exploited for cultivation). So we're going to use SPOT 6-7 to get into the details that we didn't have in other maps. So while that's not financed yet but it's in the same line of work that you're interested in and that we're doing. Even the SODEFOR (they do all the work on looking at the Parks and National Forests. They did a project C2D with France – but the project didn't end up happening so SODEFOR brought us in the (BNEDT, Ministere des Eaux et Forets and SODEFOR). It's really important that we do this soon. Most of the cacao production happens in these National Forests? What do we do with these? If they are in National Forests or not in what percentages? (Volet forestier, Volet Agricole et Volet Environnemental). Agriculture has taken over the environment and we need to re-equalize things.
3. Surveillances Spatial de Terre (SST) : This will be with Marcel Yao, CCT, CURAT, SODEXAM, CNTIG and everything would be a part of that piloted with the min of environment) and so within that there are two parts. Formation and equipment and within equipment there are two parts (the images and then the machines with the licenses etc.) to give the capacities to the center but the idea that the center would be at the CCT or that we'd have it in common and everyone could share. But on that point I think that USAID could help us so the at we could have the databases that could be a big help.

- Also in the context of C2D: we are planning the spatial infrastructure (SST) I am the point focal for that work – to see how we're going to go through the SST (System de SIG et Télédétection) so we're working on that now.

Assessment Team: Is capacity building (formation) the thing that they need help with? Or do you need the images? What is it that you need?

For the USA, the CDI and Ghana we are trying to organize us through SST – run by the Ministry of Environment to pull all the various problems together and organizing all, it's a bit like CILSS but it's for us at the national level. So it's an organization. Marcel Yao is the coordinator of both SST and REDD

So the FAO project is funded, the Government project is in process, and the SST is in process

SODEFOR	
Institution/ Contact information	**Présent**
Société de Développement Des Forets (SODEFORE) 01 B.P. 3770 Abidjan	Mamadou Sangaré, Directeur General (+225) 22 48 29 00 (+255) 22 44 02 40 www.sodefore.ci
	Valentin Bile Bah, Directeur (+225) 22 48 29 70 babile@sodefore.ci
	Mamadou Kone, Chef du Département des Systèmes d'Information (+225) 22 48 29 72 konemamadou@sodefore.ci
	Mouhoke Gbanzai (+225) 07 92 96 92 paulgbanzai@sodefore.ci
	Brahima Diomande Chef de Service Cartographie (+225) 05 72 30 20 / 08 22 39 35 ibrahim_diom@yahoo.fr

SODEFOR – *Introduction by the Director General:*

We are a society of the state (Société de L'état) in charge of developing the politics of forest development for the state. In terms of the state's mission, two big categories – protection and 'gestion' (reforestation and other forest management tasks).

'Forets classees' are 4,200,000 (4 million 200 thousand hectares) are the forests we're responsible for managing – and those forest are in a very bad state as you know. If you saw the maps you'd really see it, especially during the period of crisis 1999 – 2002 things got worse and through 2011 practically there was no one the ground. And so now SODEFOR is restarting efforts to understand the state of the forest now.

We are trying to determine: What is the exact situation of forests today? And develop all the strategies that can be put in place where is it severely degraded.

Where do you need to understand that it's totally deforested?

If we could ask for one thing from USAID now today it would be to have the data to understand where we are in terms of forest cover. Since 2013 it's gotten more stable but if you see from 2009-2011 the level of degradation was super fast.

The second component that is super important for us: have the database and the equipment to do monitoring. Once we understand what's happening how do we do the monitoring? How do you anticipate this again or make sure it doesn't happen again? You have to have other methods, as you can't be on all the 2 million hectares at once. We need new technologies to find out when deforestation is happening and be able to stop it or go and send agents.

At the beginning we will need monitoring more often to see if forests are regrowing or not. At the beginning we need to see if the situation is changing or if people are being made aware and if deforestation is slowing and once we see that the situation is stabilized we can then slow the monitoring a bit.

We work with BNET but they charge, so if we have money we can then get those products from them

Assessment Team: Are you part of the SST?

No we are not a part of SST but we work with the CN-REDD team because we'd like some of our forests to be part of the pilot projects.

90% change in forest cover is from conversion to cacao

Forets Clasees --- are where the dead trees are, we don't need to deforest to grow cacao.

And so what strategy do we need to have to go forward? We also need the data to do it.

We have 6 forests mapped now but there are more than 200 to do maps for.

The future of forest in CI are the 'forets classe' if you don't think about that, you are not getting at the essential of the environment here.

Two 'tutelles' (two main 'tasks' of SODEFOR)

- Tutelles technique is Eaux et Forets
- For the financing it's Ministre de Budget

That's also the objective of the President. We need to get the state to understand and engage the organizations that will begin to do that work.

Other notes:

This was a late in the day meeting that went on until about 7pm. The DG called in all of his most senior staff for the meeting as well as took us on a tour of the mapping rooms, where they have their computers and printers set up.

The DG also followed up later that evening/early the next morning with emails requesting the data from Gray Tappan. He is keen to make connections and make use of the data for the purposes of mapping, monitoring, and improving the state of the 'forets classees'.

INTERVIEWS IN GHANA

Analytical Support Services and Evaluations for Sustainable Systems (ASSESS), A program of USAID/West Africa	
Institution/ Contact information All: No. 11, Fifth Circle Road P.O. Box 10727, Cantonments Accra, Ghana +233 (0) 30 278 6475/512 www.assess.org	Abdourahmane Ba, Chief of Party Cell: +233 (0) 30 278 6475/512 aba@assess-wa.org
	Seyram Kofi LOH, GIS Specialist Cell: +233 (0) 540 113080 sloh@assess-wa.org Skype: lohseyram.kofi
	Barbara Arthur, M&E Specialist +223 (0) 540 113076 barthur@assess-wa.org Skype: bsbarbie
	Emmanuel Fletcher, Activity Manager +223 (0) 540 113075 efletcher@assess-wa.org Skype: ekowfletcher

West Africa ASSESS (Analytical Support Services and Evaluations for Sustainable Systems in Agriculture, Environment and Trade)

Description of project by BA: Have not yet started working on GIS land use issues specifically, what it has done so far is on the Trade Hub and Seyram supporting CILLS and trade hub partners on corridors for non-barrier tariffs. Maps are important tools they are simplifying and illustrating what everyone needs to see which is why USAID likes this work.

Now Seyram is designing a web-based platform for CILSS, sponsored by USAID through ASSESS trade hub project which will support it.

Seyram will be the focal point for putting together platform and GIS maps and capacity building and training and GIS and M&E and he will work closely with the regional coordinator to link the GIS information to show the results of USAID West Africa and where else USAID is working with the maps.

He will be working on how to produce maps on policies – land use or trade corridors is easy because you have the GPS coordinates, but if you want to understand something like fertilizer investment in west Africa you need other kinds of data.

We have a GIS specialist in the University of Rhode Island providing support to ASSESS – URI is a leading land grant university and also providing support to ASSESS – (Chris Diamond) and we are working with Delaware State University and Kwame Nkrumah University of Science and Technology in Kumasi that have big departments in NRM – ASSESS is excited to hear we're (?) involved with ecosystem services—mangrove biomass, assessment of ground water use in west Africa and ASSESS is using the translation and so Seyram is working on that .

Moving forward ASSESS will work with agriculture team (USAID WA). ASSESS is also organizing events (i.e. maps in the meeting room showing USGS ecological zones in West Africa) this will be an event with environment team and agriculture team to show and share products with people (i.e. STEWARD). They are organizing the sharing of the midterm STEWARD report and to go beyond evaluation to operational

adjustments or issues that can be solved within the projects so we can produce policy briefs using university experts from all over WA and so we produce short instructional reports.

USDA Washington is working closely with us on food security, natural resource management and in the field and is supporting the universities to produce studies.

The ASSESS staff is employed through the University of Rhode Island, and the local staff is employed through the University of Kumasi.

Important aspect of evaluation is to identify a good team leader and then we in our world we try assess the CV.

We do draft assessment reports and provide tools for data collection and only use the expert at the high analysis level. (Example – we did an evaluation of the West Africa fertilizer program and we wanted a high level expert on agribusiness and so we hired a Belgian expert but he is hired through Univ. of RI, Delaware, and Kumasi but only to do part of the work, we do the rest.)

Assessment Team: There seems to be a proliferation of mapping programs in West Africa. Do you have a procedure to identify who all of these are and assembling them and reporting who all the actors are to USAID? Do you have an inventory of all the actors?

Assessment Team: Do you have any experience with the USGS mapping program? They did not.

Answer: So idea is not to duplicate efforts on data collections – and we have country organizations that need our help. Objective is to understand data collection in West Africa, to identify the indicators, responsibilities etc. and to avoid duplication of efforts, to have data, and to build capacity. Data that involves macro indictors is the responsibility of the regional organization. So, if you need regional data you can get it through CILSS but you build capacity of CILSS to make sure that capacity is available but at the meso level. Or, if you want to know something like specific information on value chains for example, we would need to work with farmers etc. to give them M&E capacity to be able to build meso capacity to get the information.

Open data system – GIS platform for USAID so we just received the data sharing. The recommendations are there how to take into consideration vulnerable areas… and also taking account the gender approach –

WB is developing a regional platform for trade so the coordination can be shared within the specialized products in ASSESS for trade, we will coordinate with WB platform on trade.

FAO Regional Office for Africa	
Institution/ Contact information All: FAO Representation in Ghana/FAO Regional Office for Africa No. 69 Isert Road North Ridge, Accra (+233) 302 610930	Dr. Atse M. Yapi Agriculture and Natural Resource Policy FAO Regional Office for Africa Box 1628 ACCRA atse.yapi@fao.org Tel: 0244-38 33 68
	Aliou Bamba Land and Water Consultant for West Africa, FAO Aliou.Bamba@fao.org
	Dr. Akoijnda Gbamra, Database &GIS consultant FAO/RAF Gbamra.akounda@fao.org Tel: (+233) 242 52 05 07
	Benjamin M. Adjei Program Officer (Fisheries and Aquaculture) Benjamin.Adjei@fao.org (+233) 243 56 21 49

Interviewer notes: *Meeting with 5 people (listed above) FAO. The Assessment Team Leader explained the study asked about if they had seen/used any of the USGS products. AS also spent a fair amount of time going over the potential utility of geographic information to decision-making with the FAO director.*

Dr. Atse M. Yapi:

This is a very interesting issue for me, land-use land-cover, because I am focused in the natural resource policy areas so these are very important projects for Africa and especially for West Africa and especially to have the instruments to make systematic move and enlighten policy decisions. This is what is missing. We make a lot of NRM decisions here in W Africa on gut feelings. This is not healthy we need really data.

Several years ago I was involved in a policy debate where Cameroon was considering to banning export of rare species and they were going to ban it but then we had a group to evaluate the soundness of policy and it was very interesting because when you want to make policy lets make policy based on scientific information not on gut feelings.

Benjamin -- Developing a monitoring and reporting system for land degradation in Ghana – CERSGIS/Environmental Protection Agency

Aliou Bamba -- Maps are the best where we can assess where the forest is where the water is where the crops are. It's extraordinary; we can arrange all, but the question I ask myself with the GIS and all of that can we do something dynamic? How long is a map like this valid? How can you keep it valid? How can you use it two or three years so you can do real-time actualization (up-dating) of the map this is very important where were can go online and putting it all together what was the agriculture like at some moment in time.

I have worked for the last 5 years in FAO to change a little bit the way that we work on land information. We have to know where the stuff is. Since we've started we have developed land information at the national FAO office country level and we can structure a way of doing the work. We need to have a regional database as well.

The map and project you are discussing here (referring to the USGS project) is useful for decision-making. It takes time and resources. Every country needs the data but they want to make their own maps too.

Benjamin (FAO) SOLA – We need to use Remote Sensing software for land administration and linked to GIS. I think we collaborated with the ministry of science and technology but now it is adapted to the local systems but other than that we have been looking developing a GIS and RS to capture agriculture across Africa – trade, fisheries etc. and to capture the coordinates with GPS and agriculture and productive points.

NASOM – National Agriculture Sectoral Overview Maps. Take the points coordinates and the quadrants and uploaded to Excel and then with that information and the production data we upload to Google Maps and so with that we are able to see agriculture points in Google maps.

As to your project, I could probably use your maps before going to the field I could do queries of what kinds of systems that we have – 1km maps

Benjamin - EPA-GHANA CERGIS came to me recently to enquire about: "Developing a monitoring and reporting system for land degradation and Ghana for which we would produce maps on land use for agroforestry that has been degraded and when it has happened. We have been trying to talk to UNDP and other colleagues to see whether we can get the project funded.

Started in 2014 and 2016—FAO take away – they thought about doing a land change-monitoring project but it doesn't really fit (it was too big) for the FAO funding pipeline.

FAO really wants the data and we are using the software and we need to get this kind of information to do a process like this we don't have the capacity to generate the information but we have the capacity to use it – if it is free to use we can use it.

Where is the data site? If it is all online for agencies to get – FAO can use it. We can even do work to advertise that this data from USAID is available for use. We can pay the costs and efforts of dissemination if we coordinate.

FAO IS GOOD AT DISSEMINATION – we are the best at that – this can be done – if it is free -- FAO does this very efficiently and Benjamin and people from our team could go and train partners.

FAO is really thinking about the landscape approach (water land fisheries etc. together and it makes the job you are doing very relevant.)

We have a memorandum of understanding with the CILLS -- what could be the role for FAO? – How can we help with this? As it is extremely important work!

Name	**Emmanuel Tachie-Obeng, National Focal Point**
Title	Senior Programme Officer, Environmental Protection Agency
Institution/ Contact information	Ministry of Environment- Environmental Protection Agency

Interviewer notes: Mr. Tachie-Obeng was on his way to Ethiopia for a meeting but stopped in to have an interview with us.

Background/Experience with the LULC project: Emmanuel has had relationship with the USGS and with LULC program for 15 years. He was nominated from EPA Ghana to participate and through that, went to USGS in South Dakota and trained from November 2005 - March 2006. I supported the map that that we are doing for Africa and at that time too I was preparing for my PhD and so that's the

link with USGS. Since then I've done more climate change and land use and socioeconomic related projects with USGS.

Mapping discussion: The mapping had a great methodology where we started with 2 km but with the objective of getting to 1Km. So we did the supervised classification and so we would map using the dot grid method. We realized the map was too coarse so we went to 1km. It's all manual and so it's very intensive. Ghana has completed it and so have four other countries

The two focal points in Ghana are me, at EPA, and the other FP at the University of Ghana.

Is the mapping related to any aspect of environmental protection what's the main focus of the effort? We wanted to see the trends in LULC; how land cover has moved from one stage to another. After we completed the 1km map, three places were selected for fieldwork. We chose two positive hotspots in the north, where there was improvement in vegetation and one mining site. We also looked at 1) small dams areas (+); 2) areas that have forest plantation agroforestry related crops. We also conducted a detailed socioeconomic analysis and will share it with the Assessment Team. The negative (-) spots were in cities in Ghana – Kumasi its in one of the forest zones in Ghana, an urban area that has spread into the forest, extending out from 2004 onwards and associated urban drivers. (The Assessment Team Leader asked about mining concessions and other anthropogenic land uses). Emmanuel says they are actually doing mapping of the open pit mines (assume this is EPA?)

More hotspots should be done and this will help creating better maps. We have a 10 year hotspot map for Ghana where you can see the areas that you can see the below and above 0 change.

How did you choose the hotspots?

1) We did the 1km mapping
2) From there we used the negative and positive and through a satellite NDVI index as compared to 2000 satellite images to do the NDVI.

Assessment Team:

Where was the threshold in choosing the hotspots? A: Continuous scale –the intensity of the negative and the positive was considered.

Issue of time and effort for the project for FPs?

The major constraint of this project the time. We didn't consider this a National Project. We were allotted no time, no money and no office. We met in Niger, did the training but when we came back to Ghana, we had to do this work in addition to what ever else we are supposed to be doing and the field work. For example, in the adaptation fund where I'm the focal point, I have time allotted and so we have some small funds to help one to have the appetite to do the work. Everything is for the regional level when it comes to the national there is nothing.

Does your agency profit from the work that you are doing?

We did a TV program on the LULC and so nationally it is good and well received. We are interested in doing more but we need to do it as a project at the national level; that would be efficient. But if it's somebodies little work we can't do it; it's just a small thing that we are doing but this is very intensive.

Did you get any support equipment computers?

We have one computer for two institutions and two people. For the field work we hired a geographer and economics etc. it was 5 people for 3 months.

AGRHYMET: The project has built my capacity at different levels apart from the GIS. I was also a part of the climate change unit EPA-Ghana. Through that interaction with AGRHYMET I can truly say that I have my PhD because of that relationship and because of that training. ARC has been a broader frame and we now work very close and I was able to do this with a little French. Through USGS we developed a project sponsored by USAID that was the beginning of my PhD. Through USGS and USAID I have been able to get my degree.

About the Future: What is the project doing? Where should the project go? How do you see your role? Most of the attention should be placed at national level. The project should come to focal point and the program should work laterally through the projects so people will know the projects and make use of the data. A lateral network will reach and impact more stakeholders, and then the network is better and will benefit more people and will put more emphasis at the country level and there will be time effort etc. and for MESA and for LULC cover(?).

When we did the validation here we recommend that we go to the locations where the projects were done and make presentation for people locally to know this project. We should go to the people and go to stakeholders in the next phase and then you go to decision makers after you got to the local level and then you get the district agencies, private sector district government and then for the medium term plans in Ghana then there will be implantation – i.e., the dams. This is a fantastic example so we need to go to that level so that medium term development plans can be developed because the district will adopt it. For now we have it in the report in my office...but we need to get to the next level.

What the Assessment Team should get:

- Hotspot map for Ghana
- Sheet on the methodology for choosing hotspot
- Validation workshop report with list of participants.
- Field study of two hotspots for Ghana.
- Hotspot report.

Process of map development: We got the NDVI and you can see the country and the hotspot level so clearly and then you choose the areas that you think you need to go and do an assessment and then you can go and see. So we did the NDVI as an exercise and then a land cover change red to green and that became the basis for the hotspot collection then we went to do the verification and then we did

Assessment Team: Ghana has a dialogue with UNREDD and member of FCPF etc. Do you have a relationship with them? **E.** -There is a strong relationship with this project. We are doing a lot on the climate change and REDD projects in the EPA and here in Ghana and with the Forestry Commission so all this data is Intended as a nationally determined contribution (INDC) after Lima one of the directions that were taken. (This time each country preparing it's own based on your emission and then you take to Paris and then 2015 it will go to Paris and then it comes back we will prepare action plans for implementation.

Forestry Commission GHANA		
Name	Robert K Bamfo, Head, Climate Change/REDD+ Secretariat Yaw Kwakye, Head, Climate Change Unit** Kwame Agyei, MRV - FC	
Institution/ Contact information	Robert Bamfo Forestry Commission West Legon Kisseman-Legon Road Near GIMPA Junction www.feghana.org ; email: bamforobert@yahoo.com Tel: +223 302 401210 +223 302 7010033 Cell: +233 (0) 28 9516504 +223 (0) 8237777	Yaw Kwakye (Same info) email: ykwakye.hq@fcghana.org beemayaw@gmail.com Cell: +233 (0) 244769874 Kwame Agyei kwameagyeikyei@yahoo.com (responsible for MRV for FC)

Interviewer notes: *Meeting with 3 people (listed above) forestry commission. The Assessment Team Leader explained the study asked about if they had seen/used the USGS AGRHYMET products and asked them to elaborate on/describe their LULC data needs.*

Mr. Bamfo:

Two objectives for UN REDD – quantifying forest degradation, forest resources

Support from Germany and Japan to improve national forest monitoring system – Japan gave us a lot of data based on the IPCC methodology and benchmark maps produced by Japan were widely separated 1990 -2000 -2010 with those wide margins we are not able to monitor degradation so we thought if we can monitor this between those years then we could create an understanding of degradation and deforestation.

Yaw is working w/Tim Pierson (Winrock) w/ support from IUCN – and Kwame so we have been estimating emissions from selective logging -- two activities in Ghana and selective logging and illegal logging and fire. They are helping out with the selective logging but there will still be gaps with fire and illegal logging and how these contribute to degradation.

Who is paying IUCN Winrock? As far as this year German and Japanese funding are supporting the estimate reference level and construction of the MRV system.

Certain reference levels with the sub-national analysis. 2000 to 2010 would be the reference level.

Emissions reduction from cocoa landscape – jurisdictional landscape REDD with the carbon fund (see more on this in interview with Rebecca Asante later in the week)

Ghanaians are doing the ER-PD and they just had their kick-off ER-PD meeting of the Ghanaian group today.

Forestry has their own GIS and mapping department

Assessment Team: Tell us about concessions and land use planning framework

Bamfo: We do it with our own expense and a mapping unit in the forestry department**.** Land use bill is before parliament right now. Concessions are not digitized. Daniel Benefu has been the person that they work with the most between EPA and forestry Emmanuel Tachi-Obeng. They worked on this project

together: the 2009-2010 Biomass map EPA/ NCRC/ forestry commission mapping unit and the University of Kumasi w support Gordon and Betty Moore Foundation.

Yaw got the forest information from the Kumasi Forestry Division (up until now government forest mapping resources have been concentrated there -- headed by Mohammed Yakubo).

Climate change unit needs more capacity for GIS and other reference emissions level and so Kwame is MRV specialist.

And then we have identified someone who will join the unit soon so we are growing and he will work on decision making with government.

Growing demand for mapping and services for Ghana's REDD work: We are constrained. We have issues with space and for the moment we have some support form FAO but we don't have space to put the equipment FAO has just given us. We are working to build a structure that is adequate for housing a full-fledged national REDD secretariat for Ghana.

Collaborating with Cocoa board (public) and then we will do the same with Shea butter landscape in the north (more on all of this in interview with Rebecca Asante (NCRC)

Core interventions of the ER-PIN:

- Strengthen inter-institutional coordination – de-silo
- Land use planning
- Productivity
- Policy reform related to land and tree tenure
- Risk and agriculture climate change

District plans feed in to national plans

Because of REDD we are now monitoring the whole land use sector – land use change -- land and forestry and so we need a system that's bigger than forest land use it has to be integrated with all the other land uses mangroves, grasslands, etc. We need a more integrated database.

For us (Forestry Commission) take-aways: recommendations for USAID policy

- need our own GIS lab'
- need to be providing these services to the country because no one else is offering them.

INTERVIEWS IN LIBERIA

USAID GEMS project	
Name	Jerome Anderson
Title	Concessions Advisor
Contact information	janderson@gemsliberia.com

A key to sustainable economic growth is effective management of concessions for Liberia's extractive industries. Currently, there is a lack of accurate, available documentation of Liberia's natural resource concessions. This leads to duplication and overlap. Moreover, failure to accurately document concessions means that there is no easy way of assessing impact of concessions on land cover, including priority conservation areas. GEMS is a program to improve public administration, and concessions management is a key area. Anderson has developed a roadmap for concessions management and is proposing a $16 million dollar concessions management system. Six million of that would be for mapping Liberia's natural resources. They are using Flexi Cadastre, a South African cadastral mapping product, to map concessions.

We discussed connectivity; Flexi Cadastre works in the "cloud" and this is problematic in Liberia. Presently a team led by NetHope is present in Liberia under the USAID Global Broadband Innovations initiative (Jonathan Metzger, CoP) to undertake a comprehensive assessment of broadband connectivity means, and is working with GEMS.

Anderson discussed the key actors in data for public administration, including the Forestry Development Authority (FDA) and the Liberian Institute of Statistics and Geographic Information Systems (LISGIS). He indicated that LISGIS is frequently uncooperative. For more detail on concessions, he recommended Drayton Hinneh at the National Bureau for Concessions, and Dr. Cecil Brandy at the Land Commission on the long-planned devolution of forest management to communities. He also recommended people working on forest management for EU funded projects (FLEGT and VPA), indicating they have mapping issues and needs, and may have information on other mapping projects. He indicated that a trust fund is underway to fund a land cover change/land use map for Liberia, led by the World Bank, and driven by forest carbon mitigation interests.

Note: while concessions are outside the remit of the regional evaluation, the concessions problem illustrates one major source of demand for improved land use and land cover change maps.

USAID PROSPER Project	
Name	Paul Meadows
Title	Chief of Party
Contact information	paul.meadows@tetratech.com

PROSPER has a GIS staffer, but his capacity is very limited and he has very limited access to map data. Their primary interest is to produce map layers for 6 community forests in which PROSPER works. Most mapping needs now are from donors. He believes that the most logical approach is to subcontract mapping under one of the government agencies, following the World Bank "embedding" model. He also advocates for a two-pronged approach for product and capacity, noting that vastly improved map products are needed before capacity can be built to produce and use such maps domestically. The major constraints to production of good geographic information are brain drain, poor capacity, and poor interagency coordination. Liberia needs knowledge management systems as well as training, through a long-term strategy to build geo-literacy, but there is little appetite from donors for long-term investments. He feels that this is a very high priority because pending legislation will devolve

management of significant parts of the forest estate to communities, which lack basic management tools, including a clear understanding of the resources that they will control. He suggests that an NGO that can work with communities on participatory mapping would be a good way to go. However, nationally, health, education, and water are higher priorities, so finding the political will and donor support will be difficult.

Voluntary Partnership Agreement Support Unit Liberia	
Name	1) Charles Miller, Deputy Director ckmiller@vpasu.org 2) Wolfgang Thoma, Forest Engineer wthouma@vpasu.org

The VPA Support Unit helps to implement the Voluntary Partnership Agreement on forest trade between the EU and Liberia, as part of the FLEGT strategy. Their role is to build capacity to ensure that timber for export to the EU is legally sourced. This involves concessions management and chain of custody work. They are constrained by the poor quality and availability of maps, including land use/land cover change maps. The last time a base map was produced for Liberia was in 1968. VPA has a strong interest in ensuring that there is a land use map for Liberia. The capacity for mapping is extremely low, and they are working to strengthen FDA map use and eventually hope to strengthen capacity for map production. They lack basic shape files on forest units, concessions etc., as well as a forest resource map. Verification criteria require clear concessions boundaries, so this is a constraint for them. They are now negotiating to hire a GIS specialist to work with them on a gap analysis of mapping data. They recommend meeting with the World Bank, to ascertain what its investment plans are.

They also note that forest restoration and post-logging enrichment planting will require high-resolution maps; such maps will also save Liberia 50% of the forest inventory costs (the last national forest inventory was in the 1960s).

FDA is in a dilemma, because they are selling huge concessions without inventories, and the logging companies are complaining that the trees aren't there that they have paid for.

They note that civil society organizations are growing in power and influence, and they want an independent forest monitor, which will also require maps. Transparency in the forest sector would be afforded by widespread distribution of paper maps.

FLEGT Program Liberia	
Name	Abraham Guillen, Coordinator abraham.guillen@theidigroup.com

Guillen first came to Liberia with the Liberia Forests Initiative for the USFS, on the team led by Bob Simpson. He reports that they produced a map based on 2004 satellite images, adding forest concessions in 2007. The Liberia REDD+ program, led by Saah David of the FDA, and supported by the World Bank Forest Carbon Partnership, is planning on a comprehensive map. It has already been ground trothed in 2 counties. This is for the GoL climate change strategy for the forthcoming CoP of the UNFCCC in Paris.

The World Bank is implementing the Norway pledge of $150 million for forest conservation, but that activity is not yet fully designed. The full design is expected to be completed by April 2016. There will be a significant community forest focus, which is still being defined.

There are two major changes under way: a) devolution of management of forests to communities.

It is not clear on how it links to a number of development activities such as the USAID rural electrification/community energy program. The community forestry program will include the development of commercial activities to be managed by/with the communities. There are around 85 identified community forests, of which 65 have submitted documentation. There is a 9 step process for certification of community forests. At this stage, they don't know exactly what they need, but it is clear that they need forest maps in order to practice proper land use in CF areas, including conservation zones. But they lack the clout of concessions to get what they need, so it may take a while. Land use planning is a political tool.

There are currently 27 concession contracts, six of which are operational, and owned by 4 companies, primarily for China export.

b) Civil society engagement

Social controls are becoming stronger.

Viable partners for mapping depend upon the target users – they could be civil society programs or businesses. There are new requirements for REDD and many different clients.

Key actors include:

- USAID
- EU
- World Bank
- GIZ on climate change
- DFID on climate change
- Norway on conservation

Donor coordination is a challenge. USAID is constrained to some extent by biodiversity earmarks that limit its ability to respond to societal needs. It will be necessary to come up with different scenarios to satisfy USAID requirements.

Regional and project level approaches are necessary. Regional plans for agriculture need to be taken into account. There is too much focus on the forest sector – the focus should be on overall land planning. Guillen thinks that because there are GIS capacities in some neighboring countries in the region, he doesn't see the need for a strong focus on national capacity, but having regional capacity is important. It is possible to build on strong synergies between Ghana and Liberia. Basing a strategy on forest gives provides a chance to set priorities, because of the impact of forest loss on neighboring countries. This really hasn't been analyzed as such. Forests could be thought of as a regional asset if there was a common interest in sustainable land management. If jobs aren't created, natural resources will be destroyed with loss of natural wealth.

USAID LMEP Project	
Name	1). Larry Kanwee, GIS Specialist 2). Mulbah Reed, Health Sector Specialist mfreed@liberiamep.com

We discussed data and knowledge management. LMEP works with LISGIS. One of the problems LISGIS has is that has a lot of unverified data, with missing metadata. LISGIS has health and education statistics, but won't share data because it isn't validated. The way data has been collected is problematic. It is often mismatched in geo tags, e.g., data for administrative districts. They have inherited a spatial data infrastructure that is disorganized. Have no capacity to update data, except with donor project support. Problems in spatial infrastructure propagates. Donors (e.g. FAO, will fund initial data collection through surveys, but don't support data upkeep, and often reinvent the wheel with new specifications, adding to existing problems.

In the country, GIS capability is low – mainly certificate level. The USAID LRCFP trained communities in GPS, participatory mapping, and UN Habitat did the same thing.

The few trained people were mainly trained as apprentices, and Immanuel Sherman is a central figure, who has mentored a number of experts. He now has a small private practice. A major constraint to capacity is an uncertain career path. LIPA, an autonomous government agency, trains in public administration, and could be a good place to house a GIS training facility. Privately, STAR provides private training in Sinkor.

LMEP uses ARC Info GIS. Stone Environmental is subcontracted to do web mapping. They use Flex View, a plug in to ARC GIS. Data comes from fieldwork, projects, UNMIL (an Irish contingent did mapping).

Forestry Development Authority	
Name	1). Mitchell Kumbelay, Technical Mgr, Research and Development Department mskumbelay54@yahoo.com 2) Whyman Goyvanator, GIS Technician +231 770 118 814 (mobile)

The FDA representatives expressed frustration with too many donor assessments, and too little direct support. They said that they have outdated equipment and profound needs for capacity building. They are understaffed, but of the existing staff, they have 8 field technicians who retrace boundaries of concessions and reserves to rebuild shape files lost when a sacked administrator, Augustine Johnston, took all the FDA data with him when he left in 2010. They have four lab technicians, two of whom have been trained – the most recent through a one-year program at a Nigerian university. Due to a backlog, they have two technicians who have not yet had formal training.

FDA's GIS lab has a non-functional plotter printer and one desktop computer, as well as some laptops. The use ARC GIS 9.3, with a license purchased by PROSPER but now expired. They produced a map of the planned protected area system in 2007, and with the Ministry of Lands, Mines, and Energy, a forest estate and concession map in 2013/2014. They also claimed a productive relationship with LISGIS.

FDA's Ignitius Jaye, a GIS technician, participated in the USGS/AGRHYMET training in Ouagadougou under the LUDACC project. They claim that this was a poor arrangement and they could not follow up for several reasons, including expired licenses, "buggy software", and the fact that they had to share the laptop with a counterpart at the Ministry of Lands Mines and Energy that was several hours away by public transportation (FDA HQ is far out of Monrovia). (It is more likely, from what we know of how

USGS organized equipment and software, that the laptop was disabled by viruses, a common problem experienced when the recipients disabled or did not keep up their antivirus program).

As with others, they noted that there were big plans under the REDD+ program, but Saah David has not yet returned to the country so we don't have direct information on this.

We discussed the pending transfer of lands to communities. FDA insisted the communities could get a map of their land, if they applied for it properly. However, they admitted they have neither the printer nor supplies to actually comply with a request.

They said that they are working with communities to prepare, using the aforementioned 9-step process, through intensive community awareness education, and that they support the communities through socioeconomic surveys, to assess benefits.

Forestry Training Institute	
Name	1) Jeremiah Karpo, Director 2) Advertus Roberts, Lead Instructor 3) Kaidi Lummeh, Community Forestry Instructor 4) George Keanay, Procurement Officer/Instructor

FTI was initially a regional training center under the Mano River Union. This came to an end after the 1984 coup d'état that brought Samuel K. Doe to power. At the recent summit of the Mano River Union heads of state in Monrovia, the four Mano River Union (MRU) states agreed to take a lead on key development concerns on behalf of the member states. Liberia took the lead on forestry and natural resources. This sets the stage for a potential reemergence of the FTI as a regional facility.

FTI is a residential training facility with 150 students. It produces mid-level technicians and managers. It had until recently some basic GIS capacity and a faculty member who taught an introductory course, it no longer has it, and Karpo feels that it is a major hole in the offerings. He cited several reasons:

- It is essential for managers to know the rate of deforestation in detail
- It is important to identify hotspots of forest degradation where immediate management action is required
- It is important for the management of forest carbon
- The pending devolution of forest management to communities means that communities will require accessible tools to help them to better understand and manage their forest resources
- It is necessary to identify no-go areas for development, including agricultural development and extractive industries.

PROSPER created a community forestry curriculum. FTI is now beginning to train for a community forestry diploma.

A regional approach is important for several reasons:

- Heads of state will be personally invested and it will generate better political will.
- Training on a regional or sub-regional basis will create a peer network and build regional capacity
- A regional approach will facilitate transboundary management, addressing issues such a cross-boundary incursions of slash-and-burn agriculture and illegal logging

Hydrology Department, Ministry of Lands, Mines, and Energy	
Focal point interview - Liberia	
Name	Anthony Kpadeh, Deputy Director, Hydrology Department

Kpadeh was recruited into the USGS by Alfari, with whom he interacted in a LOME 2 Environmental Management System training course, this despite the fact that Kpadeh has no GIS training. Kpadeh in turn recruited Torwon Yanteh, the FDA GIS expert, who subsequently was removed from office and was replaced by Ignitius Jaye. [Kpadeh and Yanteh participated in the first training – Jaye was in the third training session. Kpadeh did not disclose this]

There were problems from the beginning, starting with French language keyboard on the laptop. The Arc View software installed was a trial version that expired soon after they received it. The laptop did not perform well and was exchanged for a smaller, less powerful one midway through the process. That computer cannot run the programs needed to do the work. As a result, they did produce the hotspot study but did not complete the map. There was no further communication after they submitted the hotspot report. Ebola was the final straw.

Kpadeh hopes that Norway will fund a GIS lab. A training package is in the work through the GEF under the National Adaptation Plan of Action for climate change. This is still in the development stage.

Kpadeh answered the structured survey questions, which will be incorporated in the data collected by the evaluation.

GIS and Cadastre Department, Ministry of Lands, Mines, and Energy	
Name	**Cooper Pency, Director**

Liberia was active in the 1960s and 1970s in mapping, but not since, resulting in large gaps. The early mapping was done using aerial photography. In recent times, maps have mainly been done by exploration companies in their license areas. There are a lot of mapping needs. These include:

- A base map
- Land cover/land use
- Elevation
- Geology

The Cadastral Department is mainly focused on concession maps. They shared their concession shape files and maps with the team. Their priority is keeping shape files up to date.

Training in Liberia is mainly through education abroad or through local apprenticeship. In the past, a geology company also provided training. A former Assistant Minister for Exploration is a leading GIS expert and has trained a number of people as well. There is a strong need for continuing education. The University of Liberia has a dedicated space for GIS training, but it has not yet been developed with equipment and faculty.

They have some DVDs with geospatial scenes obtained through internal data sharing. They also get data through personal professional networks with mappers for the mining companies.

Their major success in map impact on policy is showing the overlaps between mining, forestry, and *agriculture* concessions. An interagency memorandum of understanding was achieved last year on the integration of data between government agencies, which has resulted in a joint concessions map.

Their hardware is five years old and near the end of their service life. It is very slow and their storage is full. They have no bandwidth. They are locked in to ARC GIS 9.1. They too have been using Flexi Cadastre, by the South African firm Spatial Dimension.

Liberian Institute for Statistics and Geographical Information Systems (LISGIS)	
Name	1) Dr. Edward Liberty, Director 2) Tom Davis, GIS Expert

LISGIS's primary function is the collection of primary data, such as census data. To their knowledge, they are the only collector of openly available primary data in Liberia. LISGIS also has responsibility for data archiving, maintenance of legacy data, data distribution, and the development of products based on the data for users.

LISGIS conducts large coverage surveys, often for other departments. They conducted the 2008 census, collected forest inventory information, and worked with UTA. During the war, LISGIS, did "black mapping" to create street address maps so aid could be delivered.

2018 is the next census although pre-census, 2016 satellite data is required. For 2017, there is the notion that biometric IDs will be implemented for the election and this will help with the census. It is unclear whether donors are onboard with this.

The duties of LISGIS can conflict with one another, resulting lack of productivity. This problem can be addressed through the centralization of data warehousing, with mirrored links to major data users, and up and down links to other significant data partners. This will require sustained connectivity between stakeholder nodes within the government.

The tendency of individuals and institutions to hoard data must be addressed through an open data policy requiring data sharing in exchange for data access and technical support.

Review and cleaning of legacy data sets is an important, ongoing process. It can be conducted by entities other than LISGIS, according to agreed national standards.

The LISGIS equipment is worn out. The team observed salt damage to hardware as a result of the proximity of the LISGIS office to the ocean. They have only one working plotter out of an estimated 5, and no working scanners. LISGIS needs a new lab and new location. LISGIS also needs sustainable software licenses. The US furnished 3-month trial licenses during the Ebola crisis but that was not enough. Connectivity is also an issue, as is offshore or cloud website hosting. They currently have a problem with too many visitors. Finally, they have a problem with consistent clean electricity.

They need spatial data for the census. They have software to automatically draw and assign census tracts based on imagery. This process requires building and infrastructure discrimination. Current Landsat imagery is sought. High-resolution imagery is required to reach addressing goals that are connected to delivery of aid, resources to the whole country. Improved imagery will also help resolve disputes in concessions assignments. It will also be forward looking, as addresses will be permanent

The last land cover map was done in 2004 with an update in 2008 (partial) by FDA.

LISGIS's vision is to become a regional leader in data management. A national capacity strategy has been developed. Dr. Liberty is sending the report. The goal of the strategy is to produce reliable, comprehensive, statistically valid, timely, spatial data for all Liberia. The key needs identified by LISGIS include on-the-job and continuing education training, and graduate and undergraduate programs in statistics and related fields, and infrastructure, including the security of facilities, data, and data gatherers (an important need identified by LISGIS).

A move out of the central city to the new campus of the University of Liberia is contemplated.

Forestry Development Authority, REDD+ Program	
Name	David Saah, REDD+ Coordinator fawasa@gmail.com

Saah discussed Liberia's migration to environmental monitoring, REDD+ and its accompanying requirements for land cover and land use. As a baseline for geospatial analysis, the FDA is having a consultant produce a percent tree cover and land cover map. Its production started in 2014 but Ebola delayed delivery.

Liberia lacks a carbon and a REDD policy. After policy work is addressed, Liberia's REDD work will focus on pilot projects and policy revision. There is a large quantity of REDD funding, donated by Norway and administered by the World Bank. The World Bank's earth observations team, supported by Swedish mapping firm Metria, has just completed mapping land use mapping and forest baselines to provide accurate assessment of deforestation trends, for forest management and national land use reform.

David Saah broke down Liberia's imminent geospatial requirements into three categories: basic geospatial information, software, increased capacity (largely LISGIS). He recommended training take place at the community college level - this was distinct from other interviewees. In addition, he mentioned the massive issue of connectivity but, interestingly, connectivity re. REDD projects will be addressed via the imminent Norwegian REDD funds.

Land Commission	
Name	Ounzuba Kemeh-Gama, Consultant Ernest C B Jones, former Deputy Minister and current National Consultant for Land Administration for the World Bank/Land Commission Project

Kemeh-Gama is working for the Land Comission on a lands administration that requires use of the Liberian base map, which was created in 1968 and has not been updated. Work is now underway on a new base map with World Bank funds. According to Kemeh-Gama and Jones, the work will be funded through a multi-donor trust fund, to which the World Bank has pledged 10 million dollars and USAID 3 million. A meeting was held with the World Bank and USAID on harmonizing efforts, which led to the World Bank stepping up efforts.

In addition to the base map, their project also involves capacity building in land reform issues such as deed registry.

They identified two major issues to be addressed:

1) Getting a standard base map at the right scale with the right details. He wants a topo with parcel boundaries for urban areas at 1:2500, with 1:5000 for rural towns, and 1:10000 for the whole country.

2) National spatial data infrastructure is needed. No one is sharing data, creating significant difficulties. There is a need for common standards for open data. An inter-ministerial concession committee reviews all concessions, but is ineffectual without such infrastructure. FDA, MLME, MoAg, and EPA have a memorandum of understanding to share data now, but interestingly, the National Bureau of Concessions is not involved.

Kemeh-Gaba and Jones believe that their program will address both of these issues. Cartographic services are ignored and dying in Liberia, he says. The national cartographic office, once an independent body, has been made a subsidiary of the Ministry of Lands, Mines and Energy, and is no longer able to function as an independent service.

The Land Commission was established as a five-year long land reform activity. It has no judicial or administrative functions; its role is to reform the process of land administration. It is now proposing a central agency pulling together all land matters within government in a single organization. Legislation has been proposed.

The Community Land Law is still pending. Legally required stakeholder consultations have been undertaken, but it is not clear what the final law will look like. It is important to look at its implications because it reflects a widening gap between supply and demand for mapping. Will deeds be provided to communities once the law is passed? This requires maps. They will need to know their metes and bounds. Poor communities that are titled land are likely to use it as collateral, become indebted, and lose resources. At the same time, there are plans to bring agricultural concessions for palm oil up to 500,000 ha2 by 2020.

The Public Works Institution (PWI) has a training center, which includes vocational training in surveying. PWI's training center is proposed as a candidate for a national GIS training center.

Name	Julius Mathai, GIS Specialist, juliusm@unops.org Grainger Laffan, Communications and Reporting Officer, garnettl@unops.org
Institution/	UNOPS Liberia

As part of the work on the Ebola response, UNOPS provided training to LISGIS, whose capacity was low but the demand was high. They are not well-supported by government.

UNOPS is working with the Centers for Disease Control (CDC). With UNDP and UNICEF, they organized a GIS awareness workshop on April 26th (report pending). In the MRU subregion, the countries don't have NRM data. UNOPS is integrating health and other sectors. It will be a long-term process to create geographic literacy and a national spatial data infrastructure. They have established a GIS integration technical working group involving WHO, LISGIS, the University of Liberia, UNOPS, and UNDP. They also note that at the intergovernmental level there is talk of a pan-African information infrastructure, but this isn't going anywhere yet. The CDC, NASA, and USGS should come together with them on the National Spatial Data Infrastructure.

At the workshop in April, there was a breakout discussion on open source data. In Liberia, there is a national standards bureau that should be able to set standards to support open data, but they have not connected with LISGIS on this.

Dr. Edward Sherman, mentioned by others as a key figure in training GIS experts in Liberia, has, in addition to his own small business, an appointment to the Geography Department at the University of Liberia. They have a dedicated room for a GIS lab at the new campus (nearby to FDA) but it is not yet equipped. They believe that Sherman can provide the leadership to create an effective training program in Liberia.

Within the region, there is a growing need for land use data. At the regional level, countries are largely reliant on UN maps. Cadastral maps are also lacking. Work to fill the gaps is proceeding in only a piecemeal fashion. REDD+ is a driver for better mapping due to the need for MRV, but there has been a lot of institutional demotivation due to chronic lack of support internally and externally for Liberia's mappers. UNOPS is there for the long-term, and believe that because GIS is a tool for data integration and analysis, it is a strong driver for capacity building writ large.

Arcellor Mittal Liberia (AML)

Name Wing-Yunn Crawley, Biodiversity Manager

(Skype conversation as Crawley is based in Nimba).

ArcellorMittal Liberia (AML) has a major iron mining operation in Nimba County, and is undertaking biodiversity offsets, so is particularly interested in land use and environmental protection in areas adjacent to the concession. Crawley advised that there is a discussion underway about forest classification. People involved include Borwen Sayon of Conservation International and Darlington Tuagben of FDA. Joel Gamys of Global Forest Watch, World Resources Institute, is also involved.

AML is working on the identification of high value biodiversity areas for offsets, and recommended follow up with Jessica Junker, who is conducting a national chimpanzee survey and has ideas about the protected area system, as well as Arcellor/Mittal's ESIA zoologist, Ben Phalan. Finally, she suggested contacting Sally Johnson, a consultant to the World Bank who recently did a report on aggregated offsets in Liberia.

In terms of local capacity, she recommends a firm called Earthtime that has GIS capability. Wassim Hamdan is the Managing Director, and Nabil El Masri is the GIS analyst.

UNMIL - UN Mission in Liberia (UN Peacekeeping Force)

Name Mr. Thompson, GIS Specialist

There was insufficient time to go to visit the UNMIL GIS specialist, who is based in their camp on Bushrod Island. In a phone conversation with " Mr. Thompson", he said that UNMIL's main interests are the census and identification of infrastructure necessarily for security and for relief operations. They are using Open Street Map and working with community groups to map buildings and roads, and are not focused on natural resources directly at the moment. UNMIL has played a key role in the Liberia forest reform process that led to the lift of the UN timber export embargo, and has a historic interest in strong management in the forest sector, but is not directly involved in mapping.

INTERVIEWS IN NIGER

AGRHYMET Center	
Name	**Alfari Issifou** i.alfari@AGRHYMET.ne
Title	Chef de la Division

Interviewer notes: This was an informal session with M. Issifou to determine whom we should speak with and to facilitate contacts for our work in Niamey.

Assessment Team: [*of the LUDACC project ('project LULC') as people refer to it here*]. We would like to get an idea how AGRHYMET is evolving [especially under the new Directeur General (DG)] and talk to as many people as possible. And we want to tell you about the assessment project as you may have heard about it from Nicodeme Tchamou. Explained that we are assessing the two 'inter-related' projects – the USGS/EROS component and the AGRHYMET/CILLS component. We want to understand how both project worked, and answer questions such as: Did the money get used? How did it get used? Where do we go from here? What are the ideas that AGRHYMET has going forward in this subject/theme.

Assessment Team: We'd like to speak to the CONACILLS representative [the 'NAC' person as Integra team has referred to them thus far.] Or the Focal Point (FP) as referred to from here on in.

[We learn in the process that they are not CONACILLS, rather they are referred to as national focal points or 'Points Focales'.]

Alfari: CONACILLS represents the Secrétaire Exécutive of CILSS in each country, in this sense the 'Meteo" (Direction de la Météorologie in each country) is the AGRHYMET focal point but not for this project. For this LULC project, we worked with the Ministries of Environment and Institutes of Geography in each country.

- LULC Focal Points from Togo and Mali are here doing their land use land cover maps. (Togo person is helping with the other countries as he is very capable and has already finished the Togo maps; he is helping to finish the Burkina map.)
- Alfari can give us the names and info for everyone who is involved on the project. (adb note: this was provided – however the available products from each team **were not** adequately provided)

Assessment Team: Shared that we have developed a questionnaire for the project participants (Focal Points) and we would like to share this questionnaire with Alfari and the DG and then send together with AGRHYMET. Also expressed that we would like to understand how the LULC project relates to other projects going on at AGRHYMET. Want to understand how it relates to other projects. We would also like to understand the arrangement of the structure of AGRHYMET and who is concentrating on the training. Did the training happen? Who of the Focal Points performed well? Who did not? Some training happened here at AGRHYMET, some of it happened in other places (Ouagadougou). Also, We're not going to countries where a lot of work was done (Senegal) so we'd like to see some of that work.

[We also requested the files on the last four years of the project (2011-2015) but of note, Alfari gave a huge drive of files, with many documents being repeats (3-4 copies of the same files

within subfolders). He did not a lot of documents from the last phase of the project; most of the documents predated 2008.]

Alfari (some history of the project…)

We conducted the workshop here on Sahel studies

We had training seminars and we have participant lists (Alfari will provide)

For Cote d'Ivoire there was no focal point. One came in 2001 but then after that they did not come so we don't have a focal point there **(!)**

LULC project started in 1999 with four countries [Niger (two sites, Maradi and Mayahi), Burkina (two sites), Gambia (pop growth) and Mali].

We sent two people to the USA to learn the 'training of trainers.' One person was from AGRHYMET and the other from Niger, but he left the project a long time ago. Then we did the USGS workshops with Gray – the workshop lasted about two weeks. (From the Team Leaders perspective this effort was basically a failure.)

Then, in 2001 we had our first activity with our countries. We had a workshop with the national teams in how to interpret the images and use the software. We provided a computer and the software. At that time, ArcGIS did not exist.

The national teams (at the time there were four) were tasked with interpreting the images and coming up with the land cover types. That was done for the 1975 maps with the four countries.

In 2001, Liberia, Sierra Leone, and Cote d'Ivoire were not included but the project was extended to all West African countries.

At that point we were still working with the 1975 data land use land cover maps and tracking land change for the 1975-2001.

Citing the examples of Chad and Nigeria, Alfari noted that some countries were very difficult to do – getting the right people at the right time is a challenge. Often a person that was trained would then change institutions and leave the project. Some people arrived and were poorly prepared to do the training and weren't given any payment so they were also poorly motivated.

We validated maps for 6 countries: Guinea-Conakry, Burkina Faso, Mali, Ghana, Niger, and (missing one).

Assessment Team: Were there any arrangement to talk to the people's home institutions to make space to do the work or to institutionalize the work?

Alfari: We lost many people like that. For Niger, we've had 6 people – and then we lose them when they get better positions. Other examples: Ghana, Niger, Mali – they got new jobs because they know GIS. In Burkina, we had 5 different people work on this project (someone named 'Dembele' (and then another guy from the GDT (?), he also left. It's like a conveyer belt. (This suggests that USAID must be prepared to pay people and have a contractual arrangement that will obviate this type of process)

Assessment Team: how were hotspots selected?

Alfari: Hotpots were selected using NDVI!

<u>Materials Alfari agreed to share:</u>

- PPT presentation of the first phase,

- Socioeconomic studies of the 6 countries, socio political studies of the 4 countries.
- Ateliers and trainings.
- Last phase: get the AGRHYMET agreement
- Second phase eco-region maps
- ATLAS – outline
- Reports to USAID – every three months
- DG reports on the seminars and trainings
- Links to the data that exists

Three project phases:

1999-2000:

- Four countries -- Gambia, Mali, Burkina, and Niger [and then the 6 studies of socioeconomic determinants of natural resource use in 6 countries. (Institut du Sahel and WRI did the six country socioeconomic studies] Where are these studies?
- 4 studies (and where are these studies) that were about the socio political institutional on LULC and what is the impact on the country politics. What is the country doing to change this politics? Study was then given to the countries but nothing changed.
- Burkina example – 1) internal movement to more fertile areas, 2) cotton production was encouraged – subsidies, 3) degradation and land change were the result.

Assessment Team: How was USGS involved? **Alfari:** Data and software and main trainers were from USGS. Training was conducted in various places, sometimes here and sometimes there…

2000-2008: **Alfari**: This was the first time we were able to see how things changed – you could start to see that and then we tried to explain why.

Assessment Team: At that time what was the process for disseminating the information?

Alfari: First we made the maps, then we validated them, and then we did workshops with farmers and people who lived in those areas (say 20 people). We showed people the maps and then we discussed with them and so stories emerged – i.e., Burkina: they got loans to do particular projects and then they got the cotton credits and then buying fertilizer etc. and didn't know they had to give it back and then at some point, then the system fell apart. Regional decision makers were brought in but nothing was acted upon. What can we do when we meet with decision makers? We can show them what happens, but we can't make them make decisions in a particular way. We have told this to USAID/WA Accra. Since 2003 we have been talking about this.

Assessment Team: How does the relationship with USAID/WA work?

Alfari: the issue is that you need to do the same thing for all countries – but not all the countries need the same inputs. They don't have the same issues and problems (e.g., Togo and Gambia don't need a vegetation map). This is a big challenge that we face, but the politics dictates that we do the same thing for each country. The regional USAID is in Accra, and we are working with AGRHYMET and it is a regional institution. It's normal that we would work with the regional office but the USAID national office is easier to work with. We can get to them faster and get to what we need to do on the ground working nationally, but doing the work through regional office of USAID is much more difficult.

Over the three phases we went one or two times to share the results etc. in Accra, and when Buzzard was in charge in Accra he participated in workshops etc. and he knows more what was going on than other people. Buzzard designed the PAPA and then he changed responsibilities. Then who took over from Buzzard was Nico.

The natural resources people in Accra managed this project and the food security person was Oliveira but the food security people use our land use land cover maps

Issues with teaming agreements: (Alfari)

We had a contract as AGRHYMET and then USGS has a their contract and we never knew what each other's responsibilities were. So, we would say we need to do x or y and they would say we don't have time to do that etc. We never knew what the actual contract was with EROS. We never saw the agreement. Normally this third phase (for AGRHYMET) was supposed to end last September (2014) but at the same time the EROS contract goes until this September 2015, and we don't have the same speed of work so AGRHYMET goes one way and Eros goes the other.

The whole time from 1999 onwards there has been separate proposals. Everything we do in Africa is paid for by the AGRHYMET agreement (travel, trainings, etc.). EROS is paid then for their work (and doing the trainings etc.).

2008-2011: Second phase

- **Ecoregions Map:** The ecoregions were completed, and we had a report for each country.
- The ecoregion maps then were used to do change analysis and to see the change within ecoregion between the two time periods. For border regions the countries would piece the maps together and discuss trouble spots…

2011-2014: Third phase

- Our main goal was to come up with the ATLAS because then everyone could know what we're doing.
- Then some partners said "we are spending money on natural resource management but we are not seeing any output from you" – and it was hard because it takes time to see the changes. But then now that we have 10-15 years and we know there are some good things going on i.e. NRM – "hotspots—hope spots"
- To see the patterns of what is good and then to have some money to have a project. The hotspots were good for indicating where to invest.

Assessment Team: Who is responsible for the Atlas? Our interviews in SD suggested that Gray said that the Atlas was AGRHYMET's responsibility — Alfari: Yes! it was our responsibility but now that it's getting late in project timeline, Gray is just saying that the atlas is our business but there a lot of inputs that are still needed from EROS. (According to A. Bassolé in Burkina, this is true. Since then Bassolé has advised the team leader that USGS has sent out some material.)

What is inside the atlas? There, USGS should provide input to this Atlas. This is where the hotspot imagery is needed since USGS has the imagery, they should be providing it about these hotspots. And also since USGS has lots of experience in Gambia, Senegal, Mali and Niger, EROS was to provide the input for the hotspots.

Assessment Team: Is there an outline of the atlas Can we have it? (***note***: Alfari gave us the outline; it had not been updated since 2013)

Edwidge is the contact for the socioeconomic aspects of the maps.

There was a regional validation workshop in March and they presented the draft of the atlas. There was a discussion about the inputs but USAID does not agree on some of the outputs. So what happened was since the project was supposed to end on 3/15. We were trying to get it done as fast as possible and there are some countries where we don't have the LULC maps for the three periods 1975 2000 2013. (i.e., Nigeria, Sierra Leone, Cote d'Ivoire).

USAID did not want to see a map with any countries missing!!! so they refused the outline

Assessment Team: How did they resolve the issue? Gray, the AGRHYMET DG, Alfari and Jody had a discussion and extended project to September 2015. Even this week I need to have USGS provide maps to USAID in Accra so they can send us the maps.

Alfari went on to say that Silvia's question was why we need to understand the goal of the project: Do you want capacity building? Or do you only want to have maps? If you want maps you can hire consultants and get maps… no problem. If you want to build capacity then that's something else. The people who are gaining capacity are leaving to new jobs and then more people are trained. This is good but when people get the new jobs then they slow the output of this project.

Assessment Team: Brain drain is a constant problem. Our job is to figure out who went to your activity – who these people were – what's their story at the national level. For the future maybe all these national people who leave the project to go have another career but maybe they should all have a career with AGRHYMET? So they get promoted and then they can keep their jobs and keep working? How many people trained through this project are still in the AGRHYMET system?

Alfari: Not many, I would leave also but Grey told me not to go.

Alfari: We should help the countries make the maps. But I like say again, AGRHYMET can make the maps easily but that is not the goal. The goal it is to train people in country to do the job by themselves now.

For me what is important is that they are getting trained. It is not directly to this project

Question Did AGHRYMET make reports on the training? A: Yes.

Assessment Team: Did you send them to USAID?

No because we did not have an obligation

<u>Teaming arrangements notes:</u>

Because EROS had it's own agreement with USAID and AGRHYMET another agreement they never actually knew what each other's roles and responsibilities were, according to Alfari this was the situation over the entire life of the project. (1999-onward)

Data Availability:

Assessment Team: Is the data available? Where how do you find the data? Alfari: This is AGRHYMETs responsibility. That is our weakness. There is good work going on but we are not good at putting it all up online.

Ministre Haute Commissaire	
Name	Dr. Ouendeba Botorou
Title	Ministre Haute Commissaire Présidence de la République Haute Commissariat a l'Initiative 3N
Contact information	B.P. 13 446 Niamey-Niger Email: bouendeba@yahoo.com Cell: +227 9696 66 37/ 90 32 15 82 Tel bur: +227 20 72 39 39

Interviewer notes: *Steve Reid (SAREL-Sahel Resilience Learning Project) set the meeting up for us and we were accompanied by Steve and Bill Stringfellow; also present was Mr. Botorou's right hand man, Hassane Mamoudou, (senior technical adviser) as well as the whole Assessment Team (AS, AdB, and JvDL) and USAID-Washington rep (Silvia Petrova)*

** *synopsis on 3N: http://www.theguardian.com/global-development/2012/nov/13/niger-funds-nigeriens-nourish-agriculture*

Steve Reid spoke first to just let the Minister know that SAREL had met with the Assessment Team and that thought that the Minister would be interested in learning more about the assessment and the LULC project. **AS** then gave a description of the assessment and provided background on LULC project and asked the Minister to speak a bit about their current data needs in terms of LULC and if/how they might be able to use data such as this in the future.

M. Botorou: We are thinking about how to building database now and it's very important for us, as a part of the 3N Initiative to have land use and spatial data on all the projects. Especially because we are doing so much work with food security and we need to have a way to assess the data at the different stages of the projects and at higher scales. As well it would be helpful to know what the different donors are doing in different areas of the country and we could analyze across the various projects. The advantage of the images are many you can use the maps to identify problems and help make decisions but it is very complex to build these systems.

I have seen some land use map but I'm not sure if they are from this project as they described the evolution of climate change **(we explained that that was not this project and not us reiterating that we are just doing an assessment)** We talked a little bit about RNA (farmer assisted natural regeneration) and told him what we heard from the Niger Focal Point about the Baobab-Millet agroforestry and he exclaimed a bit of surprise because Baobabs only grow in certain kinds of soil and Niger doesn't have a lot of them ***[side note: this was interesting – as it raises the question of whether the hotspots (positive or negative) are very representative and a question of relevance as Alfari and others have expressed that the value of the + hotspots is to show what can be done in other places]***

Three levels of interest to the high commissioner:

1. If we could have the images for free it would give us a good start. It would be a good gain to be able to say 'this is the state of the environment and this is where we need to focus our efforts'
2. It could help us to the **proof of concept** for the projects that we're doing. And with all the efforts for adaptation to CC it would provide evidence and data on the methods (re-greening) that are working or not working. It might allow us to do some monitoring at a scale that is not possible given our current field resources.
3. **Planning:** This could really help with the planning and figuring out what we are going to do going forward.

We are responsible to do the monitoring of the 3N project here at the High commission we need to be able to confirm that the thing are going right.

Field missions are very important to complement the remote sensing work so we can really see what is happening. We need to know what crops are best (and he gave us a whole list of things that they need, what agricultural areas are planted etc.). [Many things beyond the scope of the current effort]

Andrew went on to explain how GIS systems can work for decision makers and how important that is for them giving them orientation into what kind of systems they would want to build. What can we do with these maps? Etc.

Minister asked us to say in the evaluation that people want information; they want data on desertification and on food security.

AGRHYMET Center	
Name	Bouafou Koame Guy Marcel
Title	Directeur General de AGHRYMET

Interviewer notes: *We learned from the DG that the focal points for the LULC are at AGHRYMET and we'll be able to interview them*

Assessment Team Leader introduction:

What are the benefits and the problems with the LULC program? We really want to learn a bit more about the administrative role of AGRHYMET in the context of the two projects that are being financed by USAID: the USGS project that was guided by Gray Tappan and the second project that is being financed by USAID to CILSS/AGRHYMET. Yesterday we had amazing interviews with the two LULC focal points for the project (from Togo and Mali) and today we'd like to know a bit more about your vision.

DG: Offered warm welcome. Explained a bit of the AGRHYMET structure. There are regional program directors but they are at the HQ in Burkina. Alfari is part of the leadership of the Department of Research and Information.

- Department de Information and Research—then within that there are two divisions:
    - Combatting desertification -- and then within that (go back to this section)
    - Formation of bases/this is to do the training – there are master's students and people who are getting diplomas in Météo etc.
- Department of technical support: (IT for the whole unit and maintenance)
    - The database support and logistics are within this department of technical support and a third
- Valorization de domain: [it's 72 ha of land and they are taking care of that – the buildings for students etc..

Other units:

- Human resources (GRH)
- AFC – Accounting and grants management
- Unité de Suivi et Évaluation - Monitoring and Evaluation
- Unité de Coordination Scientific (everything we do here has a scientific purpose so there is one unit is charged with giving a scientific value to what we do here)

- Unité de communication, information, et documentation. (Communication, Information and documentation)

** And then the DG has a technical assistant ('he is European and he gives me consultations on all the decisions that I have to make in running the organization and his specialty is food security and climate change and now we have given him to responsibility for food security and then there will be another new assistant coming who will also do climate change' (France pays for these two people).

Going back, these two people train people within the first two divisions (1. research and 2. training)

There is a meeting in Italy on food security and the Mme Maty Ba Diao (head of the first division – of research) and the DG and the DG's technical assistant for food security will go.

AGRHYMET	
Name	Maty Ba Diao
Title	Chef du Département Information et Recherche
Contact information	BP: 11011 Niamey- Niger Tel: +227 20 31 53 16 Fax: +227 20 31 54 35 Email: m.badiao@agrhymet.ne

Interviewer notes: *Mme Ba Diao came to speak with us in the DG's office after we had our first morning meeting with him. He allowed us to use the space to speak to several people that morning while he worked on other tasks at his desk.*

Assessment Team Leader went over the purpose again of our study emphasizing that we want to learn more about how things can be done better in future phases. How USGS has done in terms of their performance (on time? Correct? Did they send what was promised? etc.) Was it efficient? What was missing? How could it be improved? And lastly, in terms of the project CLISS- USAID, what is your perspective? What you hoping for? What can be improved?

Mme Ba Diao observations and talking points:

Alfari is the contact with the national teams and he is the one that can give you the real details, as I am not in contact with people.

CILSS Ouaga is in charge of all the politics and the multi-country projects. AGRHYMET has the mission of producing the important information.

AGRHYMET has to train all the people from the countries to do the work – politics strategies, climate change, and all other issues, in this manner we work so that the Executive Secretariat has the information that they need for the elaboration and putting into practice of policies and actions regarding food security.

Department of Research and Information has three main areas: **1)** food security and market access**; 2)** Environment/desertification/water (LULC is in this area) The first division works a lot with the USAID Projects and the following the border issues, and other ….(missed the third)

Then there are the three CILSS and we each have different responsibilities:

Musa Cisse (INSA) secretariat food security and is in charge of all the market and trade issues – commercialization etc. and the trans border flows of food etc. and the problems with the roads and etc.

Assessment Team: it would be interesting to understand how these two projects that you just described that are not directly within our project scope – how the USGS project would or could integrate with their data and how this LULC data contribute or give value added to these kind of projects **(?)**

Mme Diao:

The land use land cover maps are so important for understanding the population, urbanization, and agricultural land that gets taken by urbanization and its very important that we see the evolution. Every time we go we shouldn't just be seeing the food security issue from the perspective of drought, but also there problems of population, and urbanization and it is very important to see the other aspects.

If the lands are degraded we can't have a good production. These maps could be shown to states to say "LOOK WE HAVE A PROBLEM HERE AND WE NEED TO DO SOMETHING FOR THESE AGRICULTURAL LANDS if we don't have policies for stopping degradation, or understanding the dynamics of urbanization and what lands we have available for production then we are not meeting our food security goals.

AS: This is very important information for us. We really want to know how you have employed this information and how you have used it within the context of decision-making **(?)**

Mme Ba Diao: We speak directly of the land use land cover project, and we need to finalize the project. There are countries that are behind in the finalization of the maps etc. and there needs to be text that explains the issues (e.g., the hotspots) and that helps countries better plan their territorial development and show them the places where they need to develop the policies for action.

Assessment Team: This is a wonderful description of what needs to be done and helps me better understand how agriculture, environment and food security can be integrated. The key for us is understanding how that capacity can be constructed and the links between you and the national organizations; for example the two young men to whom we spoke yesterday (focal points). It was interesting how in every country the focal point for the LULC project is in a different institution. For some it's the university, some it's the ministry of environment. What is the best model? We are trying to understand what would work best. Maybe there's a model and Gray gave us a little evaluation of which countries did better or worse but right now it's not clear which model is best. And we are really trying to get the best lessons learned so that USAID can build an approach suitable for the next phase.

Assessment Team: Internet connectivity question

What about having this information online? You have an excellent website in terms of food security information and training, but you have very little information about the capacity of the center to produce any maps at all of information of any kind at all – this isn't there – the USGS WEB site is not really much better. They are also missing so much maybe because products are still missing.

Also curious to know how much you are able to work with other projects. We found four people in the airplane one in Météo, one in 'Authorite Basin de Niger,' and the Ministry of Environment and another one from the Presidency and we want to learn more about how they can use this data. In short, everyone is interested in your products! We know you haven't completed the products and maybe the Atlas is the foundation for the diffusion etc. But for us in this evaluation this is a very important part: how will these products be used by other agencies?

Mme Ba Diao: It's true that these are very important questions. Have you talked to the technical support unit? It's true that we are research and information. So for that question you need to go to the other division. If there are issues with the technical issues then that goes with them. Here at the center

we have serious problems with the connectivity and we have some capability here to receive the information from Gray but there are challenges in updating the databases. There is an option to purchase a VSAT and we are trying to see if it will work better – we are in the testing phase of the V-Sat station. But yes, the Internet is a big problem and if we want to stay as the regional center for information we must have this fixed. AGRHYMET has purchased a V-Sat Internet connection. It doesn't work yet and they are having a team in to repair the malfunction.

We have a database here but we can't put it online because we don't have the good enough connection to do it. People outside of this center won't take us seriously if they can't see the maps. We have a bunch of information online already about the food security issues but we can't get things up online for people to use, even for validation we can't use the internet often we have to send the things by personal email but we can't upload the databases.

We, with PAM and FAO and the other big NGOs have good regional working relationships (i.e. OXFAM) and so what we produce in terms of monitoring of biomass, and Alfari's LULC products etc., these are all information that FAO and others want and we have regional forums to share the information (such as the Dispositives 'action plan' Régional de Prévention et de Gestion de Crise Alimentaire).

[note: Mme went onto tell us that AGRHYMET produces all kinds of maps for these meetings – biomass and precipitation etc.. and that they are planning to use these LULC maps at future meetings to identify re-greening activities etc.

Direction des Aménagements Forestiers et Restauration des Terres Ministère de l'Environnement	
Focal point interview - Niger	
Name	**Abdou Nouhou**
Title	Chef Division Inventaires Forestiers et Cartographie
Institution/Contact information	Direction des Aménagements Forestiers et Restauration des Terres Ministère de l'Environnement - BP 578 Niamey- Niger (+227) 96 98 2523 / +227 20 72 34 44 Email: nouhoua@yahoo.fr

Interviewer notes: Mr. Nouhou seems to have benefited from being in Niamey so close to AGRHYMET and is in regular contact with the staff there. We did not have to travel to Niamey to his office and interviewed him in the Director General's office at AGRHYMET

Background/Experience: Mr. Nouhou is a geographer, works on GIS and RS. Experience with the LULC project

I have been with the LULC project ("le Projet Land Use Land Cover" as all the FPs we met call it) since late in the 'first phase' (2010) and for the entire second phase (2011-2015)

What are the factors that helped or hindered your work with the project?

We received the information that helped us to make the maps. It was a very new thing for us to learn and they gave us materials and computers (but just one computer for two people) to do the work with the software. Then the training were two short courses in Ouagadougou of about two weeks each and another training here in Niamey in RLCM. The RLCM tool is to help us make the 1km maps. Maybe I can open a bit of a parenthesis? ***(we reply yes, of course)***

Up until now a map of land use land cover at the national level for Niger has not existed and having a map of land use for the entire country is important. This last year in Ouagadougou at the decision makers meeting the Secretary of his Ministry (Environment) was able to get up and say, we now have

this map for Niger and this is the official reference data for Niger. So that was good. This map will be an official source and this is a big advantage for our country and for my office in particular.

Now about the problems: the problem with this project is that there are two Institutes from Niger involved, there is the Institute Geographic du Niger (where my partner is) and there is me at the Division des Forestiers et Cartographie, and there are two and there is ONE COMPUTER!!! Even for the first phase it was one computer. And for the second phase it was the same deal and so how do you do this kind of intense work with one license and one computer? And on top of that we had big problem with the ArcGIS license. The problem with the license was that it was expired and it expired before we finished the work. So we had to stop for three months until we got a new license. The finally sent us a new one but that was a problem.

Secondly, we organized the field validation missions but the locations that we were supposed to validate were not accessible with a vehicle. For the socioeconomic study, we needed to pay people who were not a part of the team to help us. All of those efforts needed to be covered better—there wasn't enough money for the fieldwork. We brought in two experts (one forester and a sociologist both Nigerien).

3 hotspot sites for Niger: **Goure (-)** (après Zinder), **Maradi (-),** and **Tamu (+ RNA** *Regeneracion Naturale Assiste*)

Study design issues: Now we need to talk about the hotspots and the points for the RLCM verification. We didn't have enough money or resources to do them separately so we combined the validation of the RLCM for the 1km maps and the hotspot analysis.

Assessment Team: ***How did you identify the hotspots?*** 1) We used ASTER and our own work/knowledge to define the hotspots and, 2) Used NDVI to verify the decisions.

SilviaP?: ***Why not NDVI maps?*** Agrhymet didn't give them to us but maybe it's because we didn't ask for them, and we also used our own knowledge of these places.

Assessment Team: ***What were you given/what did you receive for the project in terms of maps/data/software/hardware? What products were sent to you from Agrhymet?***

We were given the ArcGIS license but that stopped working. We were given an external disk drive but that only worked for a short while, the two computers (one in the last phase (2008 and another in the second phase 2011 but they are both old now). AGRHYMET helps us with resolving problems and provided us virus software etc.; they were very helpful.

Assessment Team: Were there problems with the metadata? Metadata was good. We ask this question about the data on our images and it's helpful to know the information on each scene and that is working.

Hotspot conversation: ***Describe how you conducted the hotspot analysis for Niger***

First, it's very important to recognize our own understanding/knowledge of these places.

We used the 1975 aerial photos then we ourselves did the treatment of Landsat images and the different zones and we also did the year 2000 and so we saw that the difference between 1975-2000. Then we brought in the 2010 Landsat images and the ASTER images and that allowed us to do the analysis "treatment," not automatic but visual. And we did a visual inspection/interpretation and we made visual polygons of areas of interest.

After we compared the different years and saw that our experience was confirmed by the images, we went to the field with the other two experts and did the questions (surveys) with the local population. The two experts developed questionnaires for the population, which allowed them to look at the socioeconomic situation of these various sites (for example the assisted natural regeneration case).

Baobab/Millet agroforestry: Here there were Baobab trees were planted in the millet fields and the economic expert looked at how the sale of the Baobab leaves raised incomes from what would have just been income from millet. The year of harvest the farmers could get **1,400,000 CFAs** for the leaves from baobab, whereas he would only get about **400,000 CFAs** for the millet in the same field. So this is a huge income generator. We could see that in the 1975 images the fields were empty but now they are full of trees—the vegetation is just developing year after year in these areas. You can start to see the trees coming in in the 2000 images, this is real local agroforestry (RNA) and we capitalized on all of those RNA studies.

Assessment Team: ***Do different people in the family manage different parts of the agricultural system?***

The women are the ones that manage the baobab trees and leaves principally.

Validation workshop for Niger: We held the validation workshop for Niger in Niamey. People came from all over the country to participate. We wanted to show people the work and make sure that people helped us identify the problems. People wanted to leave with the study and we had to say, "No, it's still just a project and we have to do the 'restitution' (approval) at the regional level first before we can give it to you," even though they all wanted it right away.

Assessment Team: This kind of problem exists everywhere and is a hindrance to the expansion and success of the project and any other project. (No open source)

So the point is that the work was appreciated. The decision makers (décideurs) are the people in Ouaga and so I told the Minister of course we will get this to you but first we need to bring it to the West African level and get it approved.

Comments on the focal points' progress, training, and capacity building:

We always felt guided during the project; it was a pedagogical approach that was applied. But the person (focal point) really needed to be able to go through the whole process and learn bit by bit along the way…this is how you gain the capacity.

Assessment Team: **Was it AGRYMET that helped guide and choose the teams or was it at the national level who decided who became the participants?**

Abdou didn't know but said that for Niger figured out who would participate by considering who was going to use the results. The Institute de Géographie National du Niger, (IGNN) is in charge of developing all administrative maps for the country of Niger and anyone who produces geographic info for Niger has to have it validated by the IGNN. The land use land cover is the responsibility of the Ministry of Environment so that's more or less how we were chosen.

Team?: Were there any problems or issues with USGS getting information to you or helping you with problems you had? No not at all, we had a permanent contact with the trainers and they would respond right away – the same day they would respond.

Assessment Team; Did you have problems with finding time to do this project, as you have these other responsibilities? Was the hotspot analysis and making the maps etc. too much work?

We did not have those problems because my Director made sure that all of my other responsibilities were put aside so I could work on this project. The only drawback to this was that while I had my small salary to do this work (given to me by my ministry it would have been good to have received a little more money for that etc.). Additionally, because I was assigned to this project I could not

simultaneously benefit from other projects (for example if another paid assignment for the EU or someone else came into our unit).

Assessment Team: *Were you able to use these maps for other purposes?* (GIS)

We have the base but all kinds of information must be added. We would like to add many more layers and hope we can do it with future phases. The products are here. What do we do with them? That is the question. We need to know how to utilize them. We want to continue with making the products and products for the next phase and make it a regular analysis; something we do on a continual basis. We will need to go to finer scales and learn better techniques to perfect the work. Also, making the team bigger and continuing to train and expand the team would be important.

Status of deliverables for Niger:

Hotspot mapping analysis/identification: YES

Hotspot socio-economic studies: YES

1km maps: YES

Direction Générale de la Statistique et de la Comptabilité	
Focal point interview - Togo	
Name	Issa Abdou-Kérim BINDAOUDOU
Title	Géographe - Cartographe
Institution/ Contact information	Nationale – Immeuble CENETI, rue de la Kazah – BP 80351 – LOME Tel. : + 228 90 30 62 27 Email : kerimoss2000@yahoo.fr

Interviewer notes: *Mr. Bindaoudou was at AGRHYMET to support completion of the Burkina 1 KM map and the AGRHYMET atlas product. We were fortunate enough to have overlapped with him during our time in Niamey.*

Background/Experience: I am a GIS and RS specialist and I am a 'doctorate' at CURAT (Centre Universitaire de Recherche en Application de Télédétection. I work at the Direction Générale de la Statistique and I am in charge of environmental statistics.

Experience with the LULC project: I joined the project recently. We had other people who retired (Combate?), he is another RS specialist and with the two of them we did the workshop in Ouagadougou in 2011 and we got all the information and had a good training.

Togo experience: For Togo, because it's so small Gray decided that we had to do 500 meter instead of 1km. For the interpretation of MODIS and NDVI it was Stephanie Hermann who assisted us, and for the Landsat it was Gray. AGRHYMET was there also to help. (not clear whom)

Hotspot conversation: We chose a 'success' story (a positive hotspot) and a negative hotspot. We found four hotspots and that was different than in the other countries. There were two positive ones in the north (one very far north and one in the north-central region) and two in the southwest (one negative and one positive).

The hotspots were chosen based on the MODIS and NDVI images and then we used Google Earth and the Landsat images and then we needed to explain how they became the "Hotspots" that they were and we had identified. He discussed the various sites but it was confusing.

1. Northernmost Hotspot: Here we thought that people practiced community forestry and so we thought that we were seeing re-greening in a savanna area on the MODIS images and so we did a field mission to see what had happened and we found when we got there that what we had seen on the image was not community forestry at all, it was rice paddy! So we had go back to the drawing board and we looked nearby and not far away we found a natural/regenerated forest that was there because there is a NGO there called RAFFIA – and they had the supported the local population to do reforestation and they had successfully built up the natural forest area. They also practice beekeeping and sell the honey as an additional benefit.
    - **Assessment Team:** How did this rice mistake happen? **Answer**: It was we, the Togo team, which made the mistake, there was so much going on and so much to learn.
    - Did the forest show up on the MODIS image? Answer: Not at all, they found it by accident when they were in the area on the field visit to the rice paddy. [Kerim went on to explain that they knew that there was a sector that had been in protection or regeneration for a while but savanna forests don't look the same as other kinds of forests on a map and we were also in the rainy season.] In that sense, about 90% percent of the hotspot methodology was followed. It's sometimes the 'reality of the terrain' or 'ground truthing' that dictates adjustments to protocol.
2. Tchamba - 'FCA o forest clase de Abudulai': (+) This site was a historic forest, and people there were starting to commercialize the cashew (company is called 'Cajou Espoir) people cultivated in the forests - maize and other crops and were causing deforestation but once they started to cultivate the cashews and commercialize them the forests started to come back. (They used corona imagery to do a bit of the analysis)
3. Amu (near Palime): (-) Negative hotspot in the extreme southwest along the border with Ghana. It is a café-cacao growing region the forest is almost gone because of population growth since the period of democracy in Africa.
4. Zone de Palime (+) positive hotspot: also a café and cacao region -- it is the 'forets classe de Misauweh' more intact because of the steep topography and not as much forest pressure also the shade of trees is good for the coffee. It is really a forest zone. There we did NDVI and MODIS analysis and used Landsat imagery. When we did the verification we didn't have images from way back but our knowledge of the history of the zone really helped us to understand what was happening. We did a change analysis with the director of the agriculture department for the Palime and so that helped a lot.

Hotspot study summary: We did two types of analysis, 'light'(shallow) and 'deep' hotspot studies – the light studies just had a socio-economist, the 4 consultants and the two cartographers to do the study. The deep study was done just at the cashew hotspot and was conducted at very fine scale.

The RLCM: Gray has done the tour of Togo to do the verification. Gray is very meticulous. When he did the hotspot analysis and verification he came and so did Alfari. All of these have been validated, the people have seen it with their own eyes. But one issue is that the best practices often stay in the capital. But we did this differently, in December 2013 we did presentations to the 4 communities where we conducted the hotspot analysis. We did the RLCM validation along with the hotspot analysis (using the four sites) and so this was also validated in presence of Gray and some of the Ministers.

Leveraging of products produced for Togo: In my service, we are about to put all of this information online where it will be hosted at the national level. People want this information, and because I am responsible for environmental statistics I need to figure out how best to make sure people can access the data. Actually, someone came to me from the soils department and needed information and I had it on my machine! He was so surprised! And I said well, it's a public service!!!

For the dissemination process: He worked with the villages, and they invited local/regional people 'who speak and that people listen to' to help them share the findings.

Issue of funding of hotspot analysis: CILSS gave him money to do the work and explained that all the countries were paid to do the work and the validation etc. Payment was given when products were delivered. Mali could not get the same money because CILSS/AGRHYMET gives the money when you finish, and if you don't finish then you don't get the money. Togo finished all the products.

ADB?: Who else got to that level?

Answer: Senegal, Niger, Benin, and Togo. Cote D'Ivoire did not actually participate because there was the war and they did not get to be involved.

Using products for decision-making: 3 -7 de Avril 2014; we brought decision-makers of the various states to see the work we've done and to try to share what political decisions could be made for each country. [When we asked him if he had been there he explained that it had been a meeting for decision makers but the actual technicians who know all the work were not invited. He suggested that it might be useful to allow technicians to communicate with decision makers.

Two final recommendations:

1) You have to do two different tasks (hotspots and 1Km maps) with two different people with one computer. There needs to be two computers or a computer per person.
2) The images are not as good as they need to be. I got maps that were of very poor quality for the areas that I was working and that fact changes the results and it handicaps us a bit.

Side note: He was invited to the UNFCC meeting in Togo by Jane Parcher (the new contact with USGS 30 meter program. DOI/ GHG)

Université de **BAMAKO - Fac d'Histoire**	
Focal point Interview - Mali	
Name	**Abdou BALLO**
Title	Enseignant Chercheur Professor of Social Sciences and Management
Institution/ Contact information	BP E228 Tel. : + 223 20 22 19 33 / 76 42 37 99 Fax : + 223 20 22 92 52 Email :balloabdou@gmail.com

Interviewer notes: *Mr. Ballo was at AGRHYMET to complete his RLCM training and complete his mapping products. We were fortunate enough to have overlapped with him during our time in Niamey.*

Background/Experience: I started work in the Rural Economy Institute -- Institute de Economy Rural (IER) of Mali in 1999. I worked there for 10 years under contract and it was there I learned about USAID. (He worked under a soils CRISP ICRISAT) at an Ag research station outside of Bamako (JvDL please fill in 'Sotiba'). USAID financed two projects: the sequestration carbon project and also soil fertility with University of Hawaii. It was then that I did my first training with AGRHYMET under the soil sequestration project in 2003. It was the FAO and USAID together that funded the training in GIS and remote sensing. We then implemented the carbon sequestration project and I did the cartography.

Experience with the LULC project: 2010-2011-2012. It was through the LULC project that Agrhymet invited me to participate in the technical seminars and training in use of the RLCM tool. We were trained in Ouagadougou with Stefanie Hermann.

I joined the project in the third phase sometime Jan-Feb 2011. Before me there was Mohammed Maiga, University de Bamako and Keita, and Diahkite who worked on the first and second phases. The other Focal Point is Mme Zinab Sidibe/ with CIFOR and worked in the Ministry of Environment. She did the forestry work and she is still there. We did the positive and negative hotspots and the mapping together and she has done a lot but I have been the one with the computer. We also accompanied the others to do the inventories.

Assessment Team: You did the seminar with M. Alfari? **Answer:** Yes, and the representative of the CILLS was there, Edwige, as was Gray.

Hotspot conversation: So after the Ouaga meeting to learn how to do the hotspots we (M. Sidibe (the other Mali FP) identified hotspots in Mali and showed them to Gray. He had found a negative hotspot I had not seen. I had chosen the positive one, a village called 'Andi.' It was a reforestation RNA natural assisted regeneration that started in 1990 and that it had started to colonize the zone with *cumbretum* (a low shrub/massive bark species). I made my three choices but there was a positive zone that I hadn't seen but Gray found a positive hotspot.

Ballo presented two negative hotspots:

1) Baoule (-), 2) Bandiagara (+) 3) Gray chose a third, Baratoggou (+)

The order of the methodology was to use NDVI to choose the hotspot. I had thought Baule would be a positive hotspot but it became a negative one.

Issue of funding of hotspot analysis: Mali team received 4,200,000 CFA from CILSS/AGRHYMET to do all of the hotspot work. With that kind of money there was no way to do all the work. They did the field verification for one site but there was no way to do all three hotspots with that budget. The other hotspot was also an issue because it was very mountainous and far away so they chose the one they judged as feasible. The hotspots were chosen using NDVI and Google Earth and the Landsat images, there was no consideration of cost/distance/feasibility/program criteria etc. At the time we chose the hotspots I don't think we had a full understanding/knowledge that we would have to do the socioeconomic studies at that level.

After we chose the three hotspots there was the coup d'état in Mali (2012). Mali was suspended from funding by USAID and AGRHYMET had to suspend funding to the Mali team. We rejoined the effort in July 2013. At that point CILLS/Ouaga sent the money for the socioeconomic studies. Once you had the money you had two months to do the (socioeconomic) study but we were not able to do the validation. Not enough money, so the hotspot validation was not carried out.

Did they receive the data on time from USGS? We always got the data from USGS when we needed it as the data came loaded with the computer.

Is the data that produced for Mali somewhere public? No, the data was presented to my institute, the Institut de Economie Rural (IER), and to the University and we have published university papers but there is no website. The EIR has a website but they have not put it on. Ballo can bring things to the EIR and they can publish it. It is published in the local journal that is in all of Mali. (note request made on May 13th via email). Mali did not establish any system for promulgating their results outside of the geography institute and the EIR. They have also not shared them with AGRHYMET. The hotspot analysis has been turned in. There is no requirement for this project to do 'bulletins' (he compared this to MESA where he does have to do bulletins.)

There is the, CONACILLS, lodged in Mali's Ministry of Rural Development. Ballo then described how if the Minister comes and asks him for the hotspot analysis he would prepare a PowerPoint and go and explain the analysis that they have done and he would prepare a presentation for the minister to take to Paris (a regreening example to the climate meetings for example).

Status of deliverables:

- **1KM maps: not complete for Mali** as they were suspended for two years from the project. It is for this reason he is visiting AGHRYMET (for a two week stay) so he can complete the RLCM mapping exercise and finish his map (Togo FP was also at AGRHYMET for the two weeks)
- 2km 1975: complete
- **2km 2000: complete but not validated**/ Agrhymet has it for 2013 but not all is done.
- They are ready for validation and have asked Gray to come but he hasn't answered.
- **Follow- on:** (we have been told not to sell the maps but we can sell the value added products.

Ballo's question: You have come to evaluate the LULC project but why did you not come to Mali ? He added : What are the possibilities for Mali?

Assessment Team: What is your opinion on how to build national capacity for Mali to produce data on deforestation, food security, mining, etc.? And how, with this capacity, can we support decision-makers when they are making national policies? (Mali person did not have a real answer)

Interview/Meeting: REGIS teams - Niger

Present – REGIS/SAREL	John Hermanns – REGIS-ER (COP) Cecilia Polansky – REGIS-ER (reporting/forest monitoring) Paul DeLucca – REGIS- AG (COP) George (blank) – REGIS –AG (Finance) Steve Reid – SAREL (COP) Bill Stringfellow - REGIS-ER

Interviewer notes: *Met with REGIS people informally evening before at the Grand Hotel du Niger, briefed them on LUDACC. COPs of the projects proposed meeting in their office to exchange further about issues related to mapping and the USGS products.*

Three big points:

- Gray was hired by RISE (as a buy-in) to develop products under the Sahel studies Activity (maybe also under the Senegal activities) but has yet to deliver what they needed.
- The actual 1km Niger map has not been shared with them either and is likely not of the resolution they need to carry out their work at the commune level
- The 3N (NNN Nigériens Nourrisse Nigériens) presidential initiative would benefit from these products ; it would be important to visit with them and learn about data needs. *(note : Steve Reid set a meeting up with Haut Commissionnaire and technical advisor for more info see interview.)*

John Hermanns:

- We are here to provide any info the Assessment Team needs in terms of thinking about future information demands. For us we're working with land use planning at the commune level, it is very detailed, very intense and the land use plans are translated into action documents with laws. The communities come up with the action plans and these are then integrated into the PDCS (official government plans).
- Idea is to take plans (water for example) and then do a diagnostic for water issues and determine the subdivisions that are needed and the laws that are associated etc. Every theme has different legislative controls, reglementations: pasturage, soils, water, etc. and the plateaus have certain legislations (regulations), as well as the 'glacies and the bafonds'..

1) Land use plan: we start with images and then do the ground truthing
2) Règlementation (legal framework for new land uses)

From beginning USAID said we could get support from Gray and so we made an agreement with him but there have been serious delays. Nov 2013 he gave us some work he had done with ASTER but we found the resolution was not good enough. Lawandee is from the university they have a full time cartographer on the project. So we've been doing it ourselves with Google earth maps. Cecilia also has a forestry mapping background and we have a big printer so we print out the maps and we need to make land use maps, then ground truth the villages, infrastructure, and roads. At that point we have a series of maps and we take a look at the local conventions and you can see how the whole thing fits together.

We had this problem with Gray: He comes out Nov 2014 and it's part of the whole REGIS project and deliverables etc. – it's in the management plan – and he shows us examples of Tondicainia and the various land uses. And there are these 'couloire de passage' (passages between fields for pastoralist to move cattle through) - conflict management – 'gestion de conflits', to make passages for the rangelands and mitigate conflicts between grazing and farming ---

95 percent of the conflicts in Niger are between the grazers and the farmers.

Whole thing is linked to decentralization some villages aren't even sure what commune they are in.

We made requests to Gray for better maps…

Once the maps are done we sit down with mayors etc. and then these are validated/ signed by the Prefect --- doing the plan is the easiest part.

Implementing the plan is the hardest part.

We have radio programs – straightening out land tenure issues, training people in LT laws and what they are etc. It's a continual process. One strategy has been to focus on the zones where there is conflict every year and then focus on those points – there are NGOs dedicated to working on that

So when Gray came out in Nov 2014 the plan was to figure out what needed to be done because most of what USGS was supposed to deliver they haven't delivered yet…

"USGS wanted to do a lot of things but they didn't get around to completing it"

Soil and water erosion study – and John H thinks Gray got distracted into these water projects.

Gray's forte: he is amazing at looking at what the past looks like as compared to today – He was the one that found the FMNR (RNA) before anyone else did.

The idea was that at some point he was going to be able to tell us where the best places were to begin to do the FMNR projects going forward in the REGIS study areas.

What's left out of all of it is the natural forest management; there are still forests near Maradi, beautiful natural forest. John feels like before we talk about re-greening we should be keeping the forests that we have going.

You have the FMNR as an issue but another issue is the **run off from the plateaus**. With the commune mapping there is a map that is developed if you look at the commune you can see the issues. Flooding is becoming a huge problem.

We have 6 sources of funding in this project – the whole global change office in DC is making things very difficult. There are so many climate change initiatives and there's another approach and another tool and what they want from us is an assessment on how farmers think about climate change before and after the projects (john H described how he felt that the questions from the climate program office were 'inane')

Cecilia was focusing on soil productivity and they though that Gray's soil maps were going to help direct the FMNR but haven't seen anything yet.

A lot of work left to do in this project -- 25 communes left to do. Just putting the maps together and formatting the docs and making sure the French is correct etc. takes a huge amount of time and so we need the institutional support to do this quick easy and fast and well.

We need to be able to get to that point and support from the outside.

Africa Re-Greening Initiative (part of Sahel studies)

They had 14 sites 'best practice sites' and Gray went and looked at them and a lot of then were defunct, which didn't surprise most people on the ground

Our project only has 4 staff people and the component is to build capacity of 3N (presidential initiative 'Nigeriens Feed Nigeriens' – 3N) to develop monitoring and capacity to answering those questions. But USAID hasn't asked us to spend more time with these people and figure out how to help them.

USGS could be building the capacity of these institutions to do that work of being able to do mapping for the right projects.

RISE (all three projects are a part of RISE) and that was just announced after REGIS started. RISE → initially SAREL REGIS –ER and REGIS –AG but we were also told that northeast Burkina Food for Peace zone will be included —so also Mercy Corps, Save the Children, CRS -- those who are trying to diminish chronic vulnerability

SAREL—task was to bring NNN up to speed and it's not as political. The NNN was a promise made by President in 2011. It was controversial that it came into being because it replaced the rural development infrastructure that had been built up for years by the donors. While some donors don't see it as good or bad, it still has a strong political tinge because it was put into place by the president.

AGRHYMET Center	
Name	**Issifou Alfari (2nd Interview)**
Title	Chef du Projet LULC
Institution/ Contact information	AGRHYMET i.alfari@agrhymet.ne

Interviewer notes: *This was our last meeting with Alfari at AGRHYMET, topping off a week of interviews of various staff and focal points associated with the LULC project. We attempted to get a sense of his broader perspective about what was learned through the project and his view on potential next steps.*

Description of the LULC project:

The 'Land Use Land Cover' project (as it is known by all the focal points and everyone who is associated began in 1999. It was always a very interesting project as the big objective was to build capacity that would allow not just us here at Agrhymet, but others within the countries, to work with land use land cover and earth observation data. People from the countries themselves would be in contact with the earth observation data, they would learn how to use it to do resource monitoring, whether it was vegetation, forest, or environment. We learned how to interpret the images, and in this sense the training was the important thing. This all happened because of the good support of Gray Tappan. So really, thanks to EROS and Gray, the trainings were a success. There is now a cadre of people who have the capacity to do image analysis and this is all because of the project.

At the level of the knowledge of the region and our context, for a few years many organizations (for example FAO and others) are saying that Africa is undergoing desertification without any proof. And so what was amazing out about this project is that it allowed us to show some proof, and to understand what happened. For example using the Corona data (1960) up until 2013 at any moment now you can see what you need to know. We are sought out by many projects that want data about land change. On top of that it has permitted us to prove to technical partners etc., that the African countries have been trying since 1980 s to do reforestation and because of this project we know that there have been

improvements [referring to FMNR (farmer-managed natural regeneration) or RNA (régénération naturelle assisté)] this project made that possible.

If I remember well, there was a year when Gray came here and the data that he brought with him was shown to the then president of Niger. The pictures were of the Niger-Nigeria border and you could see what we had done and what the Nigerians had done and that what we had done was working. We did not used to have the ability to see this change but now we can and so a lot of organizations are interested (mentioned CARE international and others).

What else is really important is educating policymakers and politicians. If we can show them the truth, good or bad that's very important.

I will tell you a little story. In August 2009 we went to Maradi for some field verification. Before we left we printed out our NDVI maps and when we got to Maradi we went to see the Prefect (Head of one of Niger's 8 administrative departments) and showed him the images of the terrain. He thought everything was fine but we were able to say, "M. le Prefect, it is not all fine, there is deforestation here and here and here." It's moments like that that we realize that what we are doing is being taken into account by decision-makers and if they are not taking it into account we have to understand why.

Assessment Team: When you did this trip did you go as Agrhymet/CILLS? Or did the 'Point Focal' (focal point person for Niger) also go with you? No in this case it was an Agrhymet team. Part of the problem is that we don't have enough funding to do this and bring them out to every activity. This was an activity at the end of the 'campaign' (it was with FewsNET)

Everything is good we have the data; we have people in each country that can do the analysis.

Assessment Team: If you have the responsibility to diffuse the information to decision-makers, shouldn't the focal point also have the responsibility to communicate information to national decision-makers?

A: Yes, we are very conscious of this. It depends on the country and it depends on the structure of the country where the focal point is located. As you know, politicians picked the project participants and environmental structures in the country are important and they have a lot to do. So within that context, what does the LULC project bring to their budget? Next to nothing, it just funds the work that needs to be done and not even that. So those responsible in the government don't give the focal points permission to do things because it brings nothing to the budget. Togo has had a good experience and has been allowed to do good work but this is not always the case.

Assessment Team Many people whom we've interviewed have spoken of the Centre de Suivie Ecologique (Senegal) as a model for maintaining a highly capable center on their own budget. Can you see Agrhymet doing something like that? Producing products and deliverables to benefit to many organizations?

Alfari: Yes, if our LULC person had been at the CSE for Niger (see interview by Andrew) they would have had more power because they have the responsibility of building results. This is different than where our focal point for Niger is now (in forestry and cartography) because they don't have to generate their own income. If it had been located in a place where they were a little more free and autonomous they could maybe do more things such as present projects and people would maybe be able to sell it. [Alfari added that he doesn't know how the CSE for Niger is doing but he thinks it would be a better place].

Assessment Team: What should be done next? If there was another phase, what do you think should be done? There's a lot of work that's been done but now it seems like what's important is for people to use the products and there needs to be diffusion – base communities, decision makers, government minsters… [note: he never mentions the other donors (EU, FAO, WB etc.. NGO's etc.]

Alfari: The project will next target the community level. The work that we've done has been at the regional, or national level but now we're moving forward to work at the community level, we now want to go to understanding what is actually happening in the hotspots and finding out what their needs are.

Assessment Team: AGRHYMET has capability to do products at the national level but should it be the national people who should work at the community level?

Alfari: It would surprise me if the national people would have time to do this kind of work. This is what I think we need to create. For example, in Burkina—we've been trying to show them that they have been destroying the soils with cotton. We presented to the 'responsables' but no decision was taken. Sometimes then we have the decision maker meetings and the decision makers send technical people who cannot make the decisions.

We had a discussion with Alfari about next steps as he was saying that the next phase was about working with communities. Andrew and Ariane asked Alfari why he was moving to that level of work if the national and regional work of product diffusion and messaging has not yet been accomplished (also as AGHRYMET is the technical arm for CLISS (a regional decision making body). **Alfari**: The report from Ghana national team says exactly that: national teams/orgs should carry out diffusion.

Assessment Team: Should it be Agrhymet coordinating that or others? What resources are available for the Point Focal to do this work? Alfari: The national people should be doing the work of sharing the products. Gray feels that they did what they were supposed to do, Agrhymet says they did what they are supposed to do but sometimes you need to go further.

[Note: there was an interesting discussion about attribution, where we talked about the use of USGS/LULC project maps in other contexts. Alfari explained that sometimes the products have been used but they are not attributed.]

Diffusion and communication: We are very conscious of the gaps in the diffusion aspects – There could be a whole project just for diffusion. And we need to make sure we update the webpage so all the information is there but for now the connection is so bad we can't even open our own attachments.

Defining roles in the project (ALFARI): In principle **Agrhymet** is in charge of making the maps. That is our role. Everything that is biophysical is our work: the statistics, the cartography, etc. **CILSS/INSAH (Institute for the Sahel) – Bamako** was supposed to do the socioeconomic analysis. If the forests have reduced by 23% then the Bamako people are supposed to figure that out. (*Andrew Stancioff: This is absolutely wrong. INSAH is meant to work on statistics that relate to populations and health*). **CILSS political unit** is supposed to do the political part. There is a problem with land use? Who needs to know about it? What is the impact? It is their responsibility to go the country and say "Mr. Minister, here is what's happening. This is what you need to do. That's Ouaga's (CILSS's) job. We do it together but how many people work on this project in CILSS? It's just Edwige who is supposed to do all of that, and she is not even paid by USAID! So what is she supposed to do? Is she supposed to work on this? Will this be her priority? No, her priority will likely be on the project that she is paid for. So that's the deal. If AID wants to see results they need pay the right people."

Assessment Team: What should the next phase look like?

Alfari: Are you paid as a part of the project? What are you going to do next? There is a reorganization of CILSS and USAID knows about it, so we will need to define what we want to do. We will need to define the project objectives and the results, and then decide how many people we need to get this done and we make the project. Does USAID want this to be representative project in the region? One person in each country is not a project. The fault is USAID's. If USAID even shared the USGS agreement with us this would have been good. We never know what the USGS is even doing. *(There is a lack of communication between Gray and Alfari)* If Gray has a report of what he is doing in the field that would be good. We don't even know. A month ago he was in Burkina. He arrived two weeks before

hand to do other work and we didn't even know about it. I think it would be good that in the next phase USGS, USAID, and Agrhymet sit down and figure it out.

Assessment Team: Do you know the agenda for SERVIR meeting at Agrhymet? (*We were informed by the DG that there would be a SERVIR meeting at Agrhymet May 28-29)*

Alfari: I don't understand the relationship between the LULC project and SERVIR. I know that USAID and NASA are part of SERVIR but I don't know how those things fit together. Maybe during the meeting we're going to learn more. I've asked them to send me the meeting agenda. They've asked each institution to present what they are doing. SERVIR – USAID/Washington, ICRISAT, everyone will be there.

Annex VI: USAID/USGS PAPA

"LAND USE DYNAMICS AND ADAPTING TO CLIMATE CHANGE IN WEST AFRICA"

Prime Partner: US Geologic Survey/Earth Resources Observation and Science Center (USGS/EROS)

Mechanism: Participating Agency Program Agreement (PAPA) N° 624-P-00-08-00060-00 with a current program completion date of 30 September 2011.

Purpose of PAPA: *The activity will provide forest, land use and land cover, and large-scale remote sensing imagery at site-specific and landscape scales in the Mano River region (Guinea, Ivory Coast, Sierra Leone, Liberia), and other selected geographical areas like the Ghana/Ivory Coast trans-boundary area and more broadly across West Africa. The imagery and associated technical assistance will be used to monitor and describe measurable impacts associated with USAID-supported agriculture, biodiversity and natural resources management (NRM) field interventions over time.*

Environmental Determination (22CFR216): Categorical Exclusion as per PAPA Section F2. "Environmental Regulations".

Action: Amend PAPA to:

i) Extend the end date of the PAPA to September 30, 2015 to support a follow-on four-year program focusing on "Land Use Dynamics and Adapting to Climate Change in West Africa";

ii) re-designate the WA-Regional Office of Environment and Climate Change Response (ROECCR) as the technical office responsible for the PAPA at USAID/West Africa;

iii) increase the life of program amount of the PAPA to accommodate follow-on programs of USAID/W-Afr and those of bi-lateral Missions. For WA-ROECCR this is a four-year Program with a Total Estimated Cost of $3.2 million. For USAID/Senegal this is a three-year follow-on valued at $520,000; total = $3.72million; and

iv) allow the continuation of 'buy-ins' to the PAPA by other USAID Missions whose proposed programs align with the purpose of the PAPA.

The Development Context in West Africa

The countries of West Africa are experiencing unprecedented changes at several levels – in the human dimension; *i.e.,* one of the world's fastest growing populations, and in the condition of land and water resources. Over the last 50 years general trends in the 'health' of ecosystems have been disturbing with significant losses in forest cover, biodiversity and a general degradation of ecosystems. This degraded natural base is increasingly vulnerable to climate change. Most climate models predict significant changes in temperature (mainly increasing in West Africa), variability in the amount and timing of rainfall, increases in the frequency of extreme weather events and rising sea levels. The drivers of change are very complex, and while we have some insights into the causes, the state of knowledge of West Africa's land resources – the state and extent of its forests, the diversity of its habitats, the condition of its soils and the land use and land management practices – is limited. Land degradation is believed to be widespread, but its extent and severity are not well known. Conversely, information about where ecosystem processes are intact or recovering is equally scarce. In both cases, there is urgent need to document trends and examine 'drivers of change'. Findings must be made known to regional and national policy makers and then used to inform plans for conservation action to address threats or to scale up local successes.

Relevance of mapping and monitoring land cover

One of the best ways to monitor and assess the impacts of human and climate-related impacts and trends in the condition of land resources is by tracking changes in land cover. Land cover is a useful indicator of the region's diverse and evolving resources, and it is considered an essential climate variable by the Global Climate Observing System (GCOS) – the climate observing component of the Global Earth Observation System of Systems (GEOSS). Land cover analyses are part of national forest inventories which are linked to GhG inventories. Interpreting and understanding changes in land cover datasets assist countries develop national policies, strategies and activities for reducing emissions from deforestation and forest degradation (REDD+). It is the 'policy dimension' of REDD+ that is the primary focus of USAID's approach mitigating global warming. The secondary focus, of course, is support for activities that actually sequester carbon and reduce emissions of GhG. Estimates of land cover serve as important baselines for tracking and measuring the contributions of forests in national REDD+ action plans.

Scaling-up Environmental Successes

While West Africa and the Sahel are facing unprecedented pressures on land resources, not all change is negative. Surprisingly, the semi-arid Sahel is the scene to some of the biggest successes in land management, resulting in an improved environment and better living conditions for large numbers of rural people. In Niger and Burkina Faso, hundreds of thousands of farmers have transformed large swaths of the region's arid lands into a greener landscape, improving food security for about 3 million people. Once-degraded and denuded landscapes have been restored to open parklands that provide a much-improved environment for crops, livestock and people. Sahelian farmers achieved their success through innovations that modify traditional agroforestry, water and soil management practices. This agro-environmental transformation has led to increases in biomass, carbon, biodiversity, and food and fodder production. It is a prime example of adaptation to climate change. Specific knowledge of the extent and impact of such a transformation, and of its driving factors will enable USAID to work with national and regional policy makers to begin scaling up such successes, thereby reducing the vulnerability of people and their livelihoods to the negative impacts of climate change and improving the resiliency of the natural resource base.

Buy-ins from other USAID units

The extension of the current PAPA will enable 'buy-ins' from other USAID technical units; *e.g.,* other technical offices of USAID/WA and bi-lateral Missions in the region. USAID/Senegal is currently (2009-2011) supporting efforts in southeastern Senegal to strengthen biodiversity conservation and land use planning through detailed assessments of land cover, biodiversity and human pressure (mining, expanding cultivation) in the country's last remaining wilderness, including the transboundary Niokolo-Koba National Park (bordering on Guinea's Badiar Park). The Mission intends to continue its relationship with USGS/EROS through a 'follow-on', three-year 'buy-in' to this PAPA valued at about $520,000. That activity will scale-up the baseline mapping and monitoring of forest and agricultural resources in other regions in Senegal under its Biodiversity and Feed the Future programs. The USAID/Senegal concept accompanies this Program Description.

U.S. Geological Survey/EROS Experience in Africa

The USGS/EROS Center has been active in international activities since its creation in 1972, providing timely remotely sensed imagery and geographic analysis tools to users worldwide. EROS holds one of the world's largest collections of images of the Earth's land surface. Indeed, next year, the USGS and its partners worldwide will celebrate 40 years of continuous observation of the Earth's land resources through the Landsat satellite series. EROS scientists manage and distribute these data, acquired by civilian satellites and aircraft, to scientists, policy makers, and educators worldwide. EROS science programs have been pioneers in the application of these data to a wide range of natural hazards, global environmental change, and economic development and conservation issues. For 25 years, the EROS science branch has been particularly involved in the application of remote sensing and GIS

technologies in Africa, especially in the fields of famine early warning, real-time monitoring of agricultural and pastoral systems, documentation of success stories in land management, hazard assessments and mitigation, promotion of international spatial data infrastructure, carbon assessments for mitigation and adaptation, and long-term mapping and monitoring of land resource trends.

EROS' strategy with regard to the application of these data in developing countries emphasizes capacity-building and technology transfer. The Science Branch brings together a multidisciplinary team that has geographic information science as its cross-cutting theme, with a special focus on the exploitation of remotely sensed image data from Earth observing satellites. While working in application areas that deal with sustainable development, humanitarian assistance and land resource monitoring and mapping, the team approaches these challenges by working closely with counterparts in the host countries. Formal and informal training is at the core of carrying out these efforts. In West Africa, USAID missions have recognized two important impacts of EROS technical support – i) raising awareness among high-level government officials and decision makers and ii) building the capacity of national institutions responsible for environmental monitoring and natural resource management programs. The goals of the EROS Center's international activities include:

- Apply the unique resources and expertise of EROS to meet U.S. foreign policy objectives for sustainable development, humanitarian assistance, environmental monitoring, technology transfer and capacity building;
- Expand capabilities of EROS and its partners in data development and information delivery, and facilitate access to geospatial data in developing countries;
- Work with national and regional partners to document land cover changes, to develop an understanding of the forces driving these changes, and to expand our abilities and those of its partners to monitor spatially explicit changes in land cover performance in real time and in the archival record;
- Emphasize scientific activities that result in better management of land resources and sustainable development including: training, capacity building, needs assessments, and personnel development; and
- Continue to transfer the techniques and processes developed in international activities to national applications, especially in the monitoring and the projection of surface processes and land cover performance

EROS Project Experience in sub-Saharan Africa

EROS scientists have worked in West Africa and across the continent continuously since 1982. The following summarizes EROS' activities in sub-Saharan Africa, starting with on-going and recent projects.

- Providing technical support to the USAID/Senegal's Agriculture/Natural Resources "Wula Nafaa" Project working with local communities in Senegal's forest zone. EROS supports baseline monitoring and community planning of forest management by providing detailed image-maps to local communities and forest service staff. Funding: USAID/Senegal (2009 to 2011, through a buy-in to PAPA with USAID/WA); and International Resources Group (2002-2004, through a CRADA).
- Working with Senegal's Centre de Suivi Ecologique, the Senegalese Forestry Department and the Parks Department to map the country's last wilderness – the Kedougou Region, including the vast Niokolo Koba National Park. The maps and spatial database provide a clear picture of the extent of forest resources, biodiversity, critical habitats, and the growing external pressures from gold mining, cotton farming and other activities on this region's unique ecosystem. This project is being expanded to include national assessments of agriculture (in support of Feed the Future) and forest resources. Funding and timeline: USAID/Senegal, 2009 to 2011, through a buy-in to PAPA with USAID/WA).
- With support from USAID/Guinea, EROS partnered with the Sustainable and Thriving Environments for West Africa Regional Development (STEWARD) Program to help assess, map and monitor forests and high biodiversity transboundary areas in the Upper Guinean Forest Ecoregion. EROS worked with partners in four countries to monitor land cover, biodiversity, deforestation, and a variety of land management practices that aim to strengthen NRM and sustainable livelihoods. Other major partners include the Mano River Union,

national forestry departments, the US Forest Service, the World Agroforestry Centre and the USAID/Sierra Leone-funded PAGE project. Funding and timeline: USAID/Guinea & Sierra Leone, 2008 to 2011, through a buy-in to PAPA with USAID/WA.

- From 1987 to the present, EROS has been a major partner of the USAID/Famine Early Warning Systems Network (FEWS NET) Program which is sponsored by the USAID Office of Food for Peace. FEWS NET identifies the times and places where aid is required by the most insecure populations in many African countries and in other regions of the world. Since climate station networks are sparse, FEWS NET traditionally relies on satellite observations to support the food security assessment activities of analysts in Africa and beyond. Vegetation, rainfall and evapotranspiration are among the variables monitored. With its extensive experience in GIS, remote sensing and satellite-derived products, EROS has provided critical support to FEWS NET and its partners. The West African Sahel has been the focus of continuous FEWS NET monitoring efforts. (http://earlywarning.usgs.gov). Funding and timeline: USAID/Washington/Food for Peace, through a series of PASAs; from 1986 to present.

- EROS environmental scientists are currently providing technical support and capacity building to USAID/Uganda. One of the main objectives is to develop a methodology for answering strategic and management questions under the Mission's Feed the Future Initiative. EROS is also providing training in geospatial technologies to Mission staff. Funding and timeline: USAID/Uganda, 2011 to 2012 through a PASA with USAID/Uganda).

- With support from NASA, EROS scientists recently teamed up with counterparts from the Regional Centre for Mapping of Resources for Development in Nairobi and the SERVIR-Africa Project to bring the experience of time-series land cover mapping from West Africa to East Africa. The primary goal was to build capacity among environmental institutions in East Africa to use Landsat and other imagery to map and monitor land cover through time. This effort culminated in a training workshop and LULC time-series products. Funding and timeline: NASA/SERVIR-Africa through an Interagency Agreement; 2009-2010.

- With support from USAID/W/EGAT, EROS examined changes in the performance of land resources in the Sahel. A major objective was to distinguish human impacts from climate-driven influences and variability. This was an initial attempt to define and approach and obtain results that identified anomalies in land productivity, particularly due to successes in NRM. This effort resulted in a number of published case studies that provided clear evidence that at local to sub-regional scales environmental conditions have improved for parts of the Sahel. This study was featured in USAID's Nature, Wealth, and Power framework for revitalizing rural Africa through emerging best practices. It also led to the major discovery of a human and environmental success story of agro-environmental transformations across millions of hectares of Niger and Burkina – a story that has since been followed closely by the international and US media. (http://lca.usgs.gov). Funding and timeline: USAID/W/EGAT; 2001 to 2008.

- Under a collaborative program called "*West Africa Land Use/Land Cover Trends*", with support from USAID/WA, EROS and the AGRHYMET Regional Center, 12 participating country teams used historical and recent satellite imagery to map and quantify changes in the environment as seen through shifts in LULC. Using 25 years of satellite imagery, the country teams mapped changes in LULC, the first such exercise at such a vast scale, and provided unique insights into land resource changes. For most countries, this was the first definitive effort to visualize and quantify LULC changes at national levels. The maps and the trends are vitally important for showing the rapid pace of environmental change, especially in this region where the human population growth rate is among the highest in the world, and where drought and declining rainfall is having an impact on human and natural ecosystems. Furthermore, there is already keen interest and use of the maps by environmental scientists for climate modeling and for carbon sequestration research. This project provided unprecedented information on LULC trends, patterns and driving forces (http://lca.usgs.gov). Funding and timeline: USAID/WA and USGS; 1999 to 2008.

- EROS environmental scientists pioneered research in carbon sequestration in West Africa, with support from USAID/EGAT and the USGS. EROS organized workshops in Senegal, Mali and Ghana and at the AGRHYMET Regional Center in Niger to define the needs and approaches to evaluate climate impacts and carbon sequestration. This resulted in an integrated project in which EROS, Senegal's Center for Ecological Monitoring and the University of Arizona teamed up to study carbon sequestration (2000-2003). A Senegal carbon team conducted much of the filed work, facilitated multi-national proposals to the BioCarbon Fund at

the World Bank, co-authored numerous papers in a special publication in the Journal of Arid Environments, resulted in at least three Ph.D. awards and achieved an approach that was extended with support from USAID to other countries. National carbon teams were assembled in four countries and national reports on the status of land use and carbon were completed. EROS has successfully maintained its support of climate change and carbon studies in Africa by playing active roles in the Global Carbon Project, a project which extends its support to Africa. (http://lca.usgs.gov). Funding and Timeline: USAID/EGAT, USGS and USAID/Senegal, 2000 to 2004.

- EROS participated in GDEST (Global Dialogues for Emerging Science and Technology), an initiative of the US Dept. of State/Office of Science and Technology. GDEST conducted a series of bilateral and multilateral studies to examine advanced science and technology. In 2008, EROS participated with a GDEST science team to explore the interest in geospatial technologies in Africa in support of sustainable development, and West Africa was one of two focus regions. Funding and timeline: US Dept. of State, 2008.
- With support from USAID/Niger and USAID/Africa Bureau, EROS partnered and mentored the AGRHYMET Regional Center from 1989 to 1993, providing technology transfers and capacity building. One of the main contributions was the transfer of computer hardware, image processing and GIS software and training to build the capacity of AGRHYMET to monitor crop and rangeland growing conditions across the Sahel in a real-time basis. Beginning in 1989, with EROS assistance, AGRHYMET installed a NOAA-AVHRR satellite receiving station, and developed the capability to process the raw imagery into useful products such as NDVI or greenness maps that directly track the vegetation growth and development in croplands and pastoral regions across the CILSS member countries. To this day, these products are the core of AGRHYMET's monthly environmental and food security bulletins. The reports are the primary source of information used by decision-makers at CILSS on food security and environmental concerns. Funding and time-line: USAID/Niger and USAID/Africa Bureau, 1989 to 1993, with intermittent assistance between 1994 and 1999.

Other projects: EROS scientists and their counterparts in West Africa have led a number of other projects since 1987. These include using remote sensing to monitor desert locust activity by monitoring ecological conditions suitable for locust breeding, feeding, and migration; a project to develop and implement a long-term monitoring framework in Senegal with CSE; a remote sensing needs assessment for Africa's major regional remote sensing centers; cropland area mapping in support of FEWS NET.

USAID/W-AFR ACTIVITY

"Land Use Dynamics and Adapting to Climate Change in West Africa"

Prior Approvals

ROECCR Portfolio Review, 10 June 2011

USAID/WA Operational Plan, approved 2 August 2011, IM # 41216

PROGRAM DESCRIPTION

1.0 SUMMARY

The countries of West Africa face major challenges, including high climatic variability, a rapidly growing population, and human and climate-driven land use and land cover changes that result in considerable pressure on the limited and fragile resource base. Under this amended PAPA, USAID/West Africa and USGS/EROS propose a four-year project (**end date of September 30, 2015; total estimated cost = $3.2 million**) that will capitalize on a wealth of time-series remote sensing imagery and the EROS Center's considerable experience in mapping, monitoring and capacity building to monitor the state of West Africa's natural and agricultural resources. This project is an extension of a current USAID/EROS partnership that is mapping and monitoring land use and land cover in biodiverse target areas, and it aims to conduct more focused studies and applications on other regions of high biodiversity and critical habitats that are at risk from human pressures.

2.0 PROPOSED FOUR-YEAR PROJECT

The proposed activity will support the achievement of ROECCR's Assistance Objective - ***"Strengthened Resilience of the Natural Resource Base to Climate Change in Target Areas"*** – by contributing to the following Intermediate Results (IRs): **1.1** - Expanded NRM Skills and Technical Knowledge; **1.2**- Expanded Environmental Awareness by Households, Government Agencies and Businesses; **4.1** - Increased Technical Capacity of Regional and Sub-regional Institutions; **4.2**- Increased Availability of Climate-Relevant Information. Plus, an additional IR is suggested as an outcome of USGS/EROS' work: **IR 5.1-** Innovative, Problem-focused Research Applied.

To these ends, the project will serve as an 'ecological monitor and a capacity builder of regional institutions'. It will work closely with the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) and its regional center, AGRHYMET. It will also provide spatial analysis support and time series ecosystem monitoring to other ROECCR projects that aim to: i) improve conservation practices and reduce pressure on some of West Africa's critical forested water catchments, protected areas and wilderness (STEWARD III); ii) increase agricultural productivity through the application of 'climate-smart' management in the region (Feed the Future Multi-year plan); and iii) contribute to policy reforms that promote sustainable NRM and the mitigation of global warming from greenhouse gas (GhG) emissions (CILSS/AGRHYMET and WA Climate Change Facility).

2.1 Partnerships with ROECCR Programs

1. CILSS' Land Use/Land Cover (LuLc) and 'Sahel Studies' initiative – an African-led response to the changing environmental conditions in the Sahel. USGS/EROS will partner with CILSS, its technical regional environmental monitoring institution – the AGRHYMET Regional Center – and its member countries to use powerful combinations of time-series remote sensing, GIS and ground-based documentation of biophysical data coupled with socio-economic studies to fill information gaps. CILSS scientists will bring results of the geospatial analyses to the table and target stakeholders and policy-makers at regional, national and local levels raising awareness, providing input to policy reviews and assisting CILSS and ECOWAS member states to formulate national strategic plans on biodiversity conservation, land use planning and mitigating impacts of climate change.
2. Sustainable and Thriving Environment for West African Regional Development (STEWARD) Phase III - In selected, biodiverse habitats in transboundary zones within the Upper Guinean Forest Ecosystem, USGS/EROS will help monitor and inform the development of agroforestry practices that aim to strengthen NRM and sustainable livelihoods. Important partners include sub-regional organizations such as the Mano River Union in addition to national forestry departments, the US Forest Service (USFS), the World Agroforestry Center (ICRAF), and the Wild Chimpanzee Foundation (WCF). The imagery and associated technical assistance will be used to monitor and describe measurable *impacts* associated with USAID-supported programs in sustainable landscapes, biodiversity and adaptation to climate change.

2.2 Themes and Activities

The following sections present four major themes along with their activities and planned outcomes. All include elements of land resource monitoring and strengthening local capacities in the use of geospatial technologies. Partners will use the information to advance sustainable NRM practices, to conserve biodiversity and to influence and shape national land use and natural resource policies. Themes 1, 2 and 3 are geographically situated in the semi-arid Sahel Region. Theme 4 focuses on priority zones within the Upper Guinean Forest Ecosystem.

THEME 1: MAP LAND USE AND LAND COVER AND ASSOCIATED TRENDS FROM 1975 TO 2011 FOR 16 WEST AFRICAN COUNTRIES

Overview and Partnership with CILSS

CILSS has the mandate and responsibility for monitoring West Africa's land resources and for generating information that can be used to maintain ecological balances and ecosystem services that safeguard the region's natural areas and provide food security for millions of people. CILSS' principal service in this regard is policy support. CILSS uses geospatial data to promote awareness among national and regional decision-makers of the ECOWAS states on natural resource, food security and climate trends. CILSS strives to heighten their awareness to assist them formulate sound and sustainable policy responses, leading to improved NRM, conservation, food security and human wellbeing.

USAID and USGS/EROS will work in close partnership with CILSS and its technical arm, the AGRHYMET Regional Center, to produce information and apply it to address the twin problems of environmental degradation and increased vulnerability to climate change. Under this amended PAPA, USGS will support ROECCR's recently-funded LuLc project with CILSS and AGRHYMET and prepare the ground for a longer-term NRM and Climate Change Program. The results will be shared with West Africa's political leaders, environmental decision-makers and the broader scientific community in countries throughout the region to improve decision-making in the use and management of water and land resources and to ensure that ecosystems and landscapes are managed in a sustainable way.

Approach

Mapping LuLc at several points in time had never been attempted for the vast West African region, owing to problems of data availability, and the immense area, cost, and technical hurdles of reliably mapping LuLc change. The *West Africa Land Use/Land Cover Trends* project described above (p5) designed a mapping approach to produce spatially-detailed time-series LuLc maps of the 12 participating countries, without incurring the high cost and lengthy data preparation time associated with either manual or computer-assisted mapping methods. In partnership with AGRHYMET and the national teams, that earlier project used two time periods of imagery - Landsat multispectral scanner (MSS) images with a nominal date of 1975 (imagery from 1972 to 1978 were used), and Landsat enhanced thematic mapper (ETM+) images with a nominal date of 2000 (using images from 1999 to 2001) – to produce raster-format (i.e. image or pixel-based) LuLc maps. Theme #1 below is a continuation of that effort, and will map and monitor LuLc status and trends across CILSS and numerous ECOWAS countries. Outputs from Theme 1 activities will provide CILSS and its member institutions with the environmental and agricultural information to help it fulfill its mandate.

Activities and Outcomes

Activity 1: Produce LuLc maps of current (2010-2011) timeframe for 18 Sahelian and coastal countries in collaboration with AGRHYMET and national teams

1.1 Upgrade the AGRHYMET Regional Center's satellite data holdings of West Africa with recent satellite image data from Landsat and ASTER satellite systems

- Acquire new imagery and retrieve from the EROS Center's archive recent Landsat and ASTER satellite imagery covering West Africa and transfer the collection to AGRHYMET. The new imagery will significantly update AGRHYMET's data archive and provide the necessary imagery to work with national teams to update the LULC maps to the 2009-2012 timeframe. AGRHYMET's data archive will be organized into national and regional collections which will greatly facilitate their use by country teams in GIS and image analysis programs. EROS input: transfer to image data and organization of data archive into national and regional collections

1.2 Prototype a revised and improved version (version 2) of the Rapid Land Cover Mapping (RLCM) tool using Mali as an example in collaboration with AGRHYMET and the Mali National Team

- Mali is singled out in Year 1 to produce prototype LULC products that provide a time-series 'view' from 1975 to 2000 to 2011. There are several reasons for selecting Mali. During the first phase of

the LULC project, the Mali team was unable to complete the time-series and derive change maps and statistics. This activity will help the Mali national team complete the time-series and change assessment. Second, Mali is a country where re-greening on agricultural lands (farmer-managed natural regeneration or FMNR) is significant but largely undocumented. Thus, it is an important target country for CILSS and its "Sahel Studies" Program to assess the biophysical and socioeconomic impacts of FMNR. Third, Mali will be the pilot for testing and improving the Rapid Land Cover Mapping (RLCM) tool country. The enhanced RLCM ver2 will be readied for the much larger task of mapping the remaining countries. EROS input: testing and improving RLCM tool to ready it for the larger task of mapping LULC in 18 countries

1.3 Produce LULC maps of current (2010-2011) timeframe for 18 Sahelian and coastal countries in collaboration with AGRHYMET and national teams.

Conduct at least two (2) training workshops at AGRHYMET with the national teams from the 18 participating countries[18]. Introduce the revised RLCM tool. LuLc maps will be prepared, based on the latest available Landsat and ASTER satellite imagery, primarily from the years 2010 to 2012. The LULC maps will build upon the 1975 and 2000 period maps already produced for these 12 countries, under the earlier phase. This effort will serve to update the maps to provide a clear picture of the current LULC extent and patterns, and to assess the types, rates and magnitudes of change over the past 10 years. Trends and statistics on LULC change will be derived for each country, and for the region as a whole. The 18 participating countries were listed in the Result above. Four countries did not participate in the earlier phase (Nigeria participated but completed only a small area of the country), and thus do not have earlier LULC datasets to build upon. For these four (Nigeria, Cape Verde, Liberia, and Sierra Leone), the primary effort will be to complete a current (circa 2011) LULC map. As time allows, we will work with the country teams to produce LULC maps of earlier periods and derive trends. For Nigeria, the focus will be on the northern one-third of the country. If time and effort allows, we will work with the team to complete the remaining regions of the country. The level of map detail, both thematic and spatial, will match the earlier maps to provide direct comparison of LULC conditions. The methodology will also be the same, using the RLCM tool (as discussed in Overview and Approach). The EROS team will facilitate the production of the LULC maps, but much of the production work will be done by the national teams, with assistance from AGRHYMET staff, as part of a capacity building exercise. EROS will provide all of the imagery needed, technical guidance and support, technical training in image analysis and mapping, quality control and review, and map accuracy validation.

This effort will also require providing the national teams with a minimum level of hardware and software to ensure every team has the latest tools to perform the required image analyses and mapping. AGRHYMET will provide new PC computers. EROS input: GIS software, updated version of the RCLM tool, training and technical guidance, transfer of image data and software to national teams, all historical and current image datasets, external hard drives to store the massive image data collections within the participating national institutions and quality control of mapping procedure and output (= capacity building)

[18] The 18 participating countries are (the CILSS countries are underlined): Chad, Niger, Mali, Burkina, Senegal, The Gambia, Mauritania, Cape Verde, Guinea Bissau, Guinea, Sierra Leone, Liberia, Ghana, Benin, Togo, Nigeria N & Nigeria S (2 'countries) and Cote d' Ivoire.

1.4 Conduct a regional workshop, coordinated and hosted by CILSS and AGRHYMET, to roll out the major findings of the LULC mapping and trends program

The activities described above will have generated one of the most important and fundamental environmental datasets ever assembled on this vast region. The importance of LULC as a fundamental geographic layer for assessing woody biomass and landscape carbon will be shown.

Work with CILSS headquarters and AGRHYMET management to organize and hold a high level regional "restitution" workshop to present and discuss all significant results from the LULC time-series mapping of the 12 original participating countries. This workshop will provide a unique opportunity to present the maps and significant trends, by country, and for the CILSS Region, spanning 35 years (1975 to 2011). The goal of the workshop is to promote awareness and use of land cover and environmental trends among national and regional decision-makers, and engage them in important discussions about future scenarios that will help them formulate sound and sustainable policy responses leading to better natural resource management, wildlife and wilderness conservation, food security and human well-being. Some of the most important decision-makers and practitioners in agriculture, environment and wildlife conservation in the region will be invited. The workshop will target high level users of environmental and food security information, including agency directors, and national and regional environmental and natural resource policy-makers. Workshop participants will gain a much better understanding of LULC changes in each country, and the implications for these changes. The resulting datasets are key inputs to climate change modeling, as well as carbon accounting programs.

EROS input: training in uses of LuLc products and education on their importance as fundamental layers for assessing woody biomass and landscape carbon. etc.

Outcomes

- Deliver to AGRHYMET complete Landsat and ASTER satellite image coverage of 18 Sahelian and coastal countries with 2009-2011 image acquisitions. Image date sets will be organized by country.
- A spatially explicit raster map of current and historical LULC in Mali using Landsat and ASTER image data from 1975 - 2011 using historical Landsat MSS imagery and statistical analyses of LULC trends. The final products will be delivered to AGRHYMET and the Malian team in digital and hardcopy formats. They will also be placed on EROS and AGRHYMET websites for browsing and downloading.
- A spatially explicit raster map of current and historical LULC of 18 countries in West Africa using Landsat and ASTER image data from circa 2011. Provide: current versions of ArcGIS software as the main mapping platform, hard drives for image data storage within the participating national institutions; quality check on all national mapping efforts to assure a seamless, high quality product within and across national borders. Deliver multi-date LULC maps to AGRHYMET and national partner agencies in digital and hardcopy formats. Place the maps on EROS and AGRHYMET websites for browse and downloading.
- Distribute LULC datasets to regional workshop participants in hardcopy and electronic (e.g. pdf) formats.

Activity 2: Identify and characterize landscape change and significant "hotspots" and anomalies that represent landscape degradation or improvements; conduct two regional technical training workshops on image analysis for identifying landscape hotspots.

During Year 1 in concert with CILSS and AGRHYMET, significant "hotspots" will be identified, categorized and described across West Africa. The driving factors responsible for these anomalies - anthropogenic, climatic or "natural" - will be identified and characterized using recent and historical satellite imagery. For all hotspots in proximity to zones of USAID project intervention, particularly projects involved in sustainable landscapes and biodiversity conservation, the long-term effects of these projects on land use and NRM will be documented. The results from this analysis will help inform future planning, promote and scale up better management practices and provide evidence for documenting successes.

2.1 Conduct two regional training workshops with the national teams at the AGRHYMET Regional Center.

AGRHYMET and the country teams will be provided the most recent Landsat and ASTER imagery of 18 participating countries in West Africa. The identification and analysis of hotspots will be done by the teams, with the assistance and facilitation of AGRHYMET and EROS staff, as part of a capacity building exercise. EROS will also provide technical guidance and support, technical training in image analysis and mapping, quality control and review of map accuracy. If possible, the same teams that completed the initial LULC maps will be involved to build on their previous expertise and experience. Special effort will be made to bring women into composition of national teams (several women were among the key remote sensing and mapping resource people in the earlier LULC effort).

Characterizing hotspots and training workshops will include:

a) Comparing and identifying LULC changes from 2000 to 2011 using Landsat imagery from three periods (1990 to 2000 to 2011);

b) Identifying the most significant regions of recent change as seen through LULC conversions (e.g. deforestation, agricultural expansion);

c) Delineating and highlighting the regions of change on the existing LULC map of West Africa, from the previous EROS-AGRHYMET mapping effort;

d) Identifying, highlighting and characterizing at least 50 "hotspots" using multi-resolution and multi-date remote sensing sources across the West Africa (in the 16 countries) representing significant landscape changes, positive and negative. Examples of positive anomalies or "hotspots" include: highly biodiverse habitats that appear threatened by human pressure, areas of high agricultural productivity, identification of landscapes with significant NRM practices and positive impacts, significant on-farm tree density showing FMNR, expansion or contraction of major wetlands and natural corridors linking wilderness areas between areas of high human pressure. Negative anomalies include: areas of degraded soils, areas of low agricultural productivity, significant deforestation, significant cropland expansion into semi-natural landscapes, shrinking wetlands, significant degradation of highly biodiverse habitats like gallery forests and the expansion of "badlands" (highly eroded areas);

e) Defining the "hotspots" in terms of their biophysical characteristics and conditions or values that relate to their impacts on agriculture and the environment, categorizing the "hotspots" into their major types, preparing a graphic database and narrative on each "hotspot", with a commentary on probable causes and driving factors, and separating highly visible, uncontroversial "hotspots" (both positive and negative) from less well-defined ones; and

f) Identifying and prioritizing the most significant of the 50 "hotspots" to be further documented and studied using field teams (who will share their findings for preparation of the "Sahel Studies"). Emphasis will be on positive and negative anomalies that show significant impacts on agricultural production, livelihoods, improving food security, sequestering carbon on the land,

reducing vulnerability to shocks like drought and climate change, degraded soils, areas of low agricultural productivity, significant deforestation and significant cropland expansion into semi-natural landscapes. Significant "hotspots" (positive or negative) will be identified within the first 4 to 6 months of this activity to guide the CILSS research teams toward those areas. An important criteria or "filter" for selecting "hotspots" will be their geographic proximity to USAID project activities (e.g., land use under agricultural development, NRM and conservation, humanitarian assistance, etc). USAID has had and still has agriculture/natural resource projects in the region, particularly in countries with bilateral USAID Missions. If geographic correlations are detected, more detailed assessments will be undertaken to identify probable causes of the "hotspots". Documentation of the long-term effects of these USAID projects on land use and NRM (e.g., agroforestry, co-forest co-management, sustainable agriculture), climate change adaptation and livelihood resiliency, biodiversity conservation, deforestation and food security must be improved to inform future planning, promote better management practices or to guide corrective actions in the case of negative trends. These detailed assessments will be undertaken in the "Sahel Studies" discussed below.

EROS input: provide the national teams with a minimum level of hardware and software to ensure that every team has the latest tools to perform the required image analyses and mapping. Provide training in land cover mapping, land cover trends, identification of landscape anomalies (climate-related, human-related, and natural).

Outcomes

- A map and narrative description of at least 50 hotspots or anomalies across West Africa. These will be characterized by type, and those proximate to USAID project intervention sites will be identified. Longer-term project impacts on biodiversity, land use and NRM will be documented where possible.
- 18 national teams proficient in change detection analysis and research into potential driving forces of change using multi-resolution satellite data and secondary data

Activity 3: Conduct specialized seminars at the AGRHYMET Regional Center. Seminars will be offered on a variety of topics in the fields of advanced remote sensing for environmental assessments and monitoring, detecting anomalies in land productivity, using new satellite image data sets for vegetation monitoring, and themes related to climate change. They are designed to strengthen the capacity of AGRHYMET staff in state-of-the-art environmental monitoring science. They will also be open to participants from all CILSS member countries, and participants from ECOWAS countries who are directly involved in the activities proposed here. EROS is prepared to begin with the following specialized seminars in the first two years of the project, subject to the approval and interest by AGRHYMET and the member country institutions. Specific seminar titles for Years 3 and 4 will be proposed later according to the needs and priorities in the region, incorporating the latest concepts in sustainable landscapes climate change science.

3.1 Seminar 1 - eMODIS NDVI for vegetation monitoring and analysis

Description: This workshop will involve the introduction of a new data set for vegetation monitoring at the regional and national level. The focus will be on introducing participants to the eMODIS data set, discussing the operational production of temporally smoothed time series, and evaluating a series of applications for agricultural modeling and analysis. Applications of eMODIS data for characterizing growing season outcomes will build on previous efforts to assess the 2009 and 2010 seasons in Niger with the idea that these methods would be applied throughout the Sahel. Additional applications include ecosystem performance anomaly detection, vegetation water balance modeling using the VegET model (Senay, 2008), and seasonal productivity analysis.

3.2 Seminar 2 - estimating Actual ET using the Simplified Surface Energy Balance (SSEB) Model

Description: This training will focus on the estimation of spatially explicit evapotranspiration (ET) using the SSEB model. The model uses remotely sensed land surface temperature data, global potential evapotranspiration (PET), and elevation inputs to estimate actual ET. Actual ET estimates can be used to assess vegetation water use, crop performance, and drought. The workshop will involve a conceptual overview of the model, exercises that familiarize participants with the remotely sensed data inputs, and implementation of the model for a specified region. Output will be evaluated and related to other crop performance indicators.

3.3 Seminar 3 - Integration of climate variables into land cover change analyses

Description: The training will show techniques for integrating climate variables into land cover change analyses: correlation and regression analyses using time series of NDVI and gridded rainfall estimates

3.4 Seminar 4 - Use of remote sensing for assessing land degradation, land rehabilitation, and detecting "hot spots" or anomalies in land productivity.

Description: The training will review methods for using various satellite systems to assess land degradation in the Sahel. It will also show how we recognize areas of land rehabilitation, landscapes that are undergoing re-greening and other improvements, and the challenges of separating climate based land anomalies from human-driven impacts.

3.5 – 8 Seminars 5, 6, 7 and 8

Additional seminars will be identified and organized in Years 3 and 4 to address the evolving interests and needs of AGRHYMET and its partners in the fields of climate change, environmental monitoring, sustainable landscapes, biomass and carbon accounting, natural resource management, and mapping LULC change. We expect to provide at least 2 seminars per year.

Outcome

Enhanced ability of AGRHYMET scientists and key partners from national institutions to perform environmental mapping and monitoring tasks

THEME 2: SAHEL STUDIES: DOCUMENT, INVESTIGATE AND PROMOTE SUCCESSES IN NATURAL RESOURCE MANAGEMENT AND IN THE RE-GREENING OF THE SAHEL'S LANDSCAPES IN SUPPORT OF IMPROVED FOOD SECURITY, INCREASING BIODIVERSITY AND ADAPTATION TO CLIMATE CHANGE.

Overview

The Sahel is known for its harsh environment. Low annual rainfall, poor soils, locusts and drought are all problems faced by millions of farmers who strive to produce enough food to feed a growing population. Many environmental scientists are also concerned about the possible effects of climate change on this region. Recent models suggest increases in temperature and decreases in rainfall over the course of this century. Such changes have tremendous implications for the environment, and for human livelihoods. Over the past thirty years, however, hundreds of thousands of farmers in Burkina Faso and Niger have transformed large swaths of the region's arid lands into a greener landscape, improving food security for about 3 million people. Once-degraded and denuded landscapes are now transformed into open tree parklands that provide a much improved environment for crops, livestock and people. Sahelian farmers achieved their success through innovations that modify traditional agroforestry, water, and soil management practices. Having lived through the terrible droughts of the 1970s and 1980s, farmers are adapting to climate change by taking new approaches to farming – encouraging natural regeneration of on-farm tree cover, and diversifying production.

With support from USAID/West Africa and USAID/Washington, EROS scientists teamed up with African and European geographers and ecologists from 2001 to 2008 to document and study the re-greening of the Sahel's landscapes. The EROS team used time-series high resolution remote sensing and field studies to map the extent and impact of the agro-environmental transformation, including increases in biomass, carbon, biodiversity, and food and fodder production. The team's findings suggest a human and environmental success story at a scale not seen anywhere else in Africa. This is a primary example of a sustainable landscape practice – and an excellent candidate for an agro-environmental process that should be scaled up.

Approach

Theme 2 requires close collaboration and partnership with CILSS, and its technical service and training institution, AGRHYMET. Work under this theme builds on earlier efforts through close collaboration with scientists and program managers from CILSS, AGRHYMET, with European partners (particularly the Africa Re-greening Initiative (ARI)), the Famine Early Warning Systems Network (FEWS NET) and the World Agroforestry Center (ICRAF) to better understand the driving factors of re-greening, and to seek ways of promoting the adoption of these practices into other regions still plagued by land degradation. This is part of a new vision for agricultural landscapes across Africa – conservation farming that integrates trees with annual food crops – and referred to by some as "Evergreen Agriculture". The objective is to build a healthy soil environment to enhance food crop production, increase household income, increase on-farm biomass and carbon and increase resilience of agricultural communities to climate change. EROS expertise in remote sensing and other geospatial tools will play a role in monitoring the extent and impacts of Evergreen Agriculture and for effective targeting of investments to expand it.

A series of focused studies are proposed under this theme that build on the knowledge and successes already documented under earlier "Sahel Studies/Success Stories" effort coordinated by CILSS. While each study or activity presented below represents an effort of documentation and investigation, there are concrete actions that will be proposed and implemented as well.

Activities and Outcomes

Activity 4: Document, map, and prepare a detailed geographic baseline on the current extent and density of on-farm tree parklands in Niger, Burkina and Mali. This study is the starting point for the three that follow (activities 5, 6 & 7). It will identify particularly dense areas of tree parklands, and identify soil, land use and population density conditions that are associated with these special areas. Many areas that are experiencing landscape re-greening are still undiscovered because medium and coarse resolution satellite imagery often misses the re-greening transformation owing to insufficient spatial resolution (image detail). To address that problem, recent high resolution satellite imagery from US commercial satellites, as well as a suite of coarse to high resolution imagery from MODIS, Landsat and ASTER satellite systems will be used. This effort will examine the entire swath of agricultural lands across the three countries. It will also identify driving forces – human and climatic – associated with these parklands and undertake an inventory and initial assessment of farmer adaptation to climate change. The resulting database and maps will be a key layer for subsequent studies that seek to measure increases in vegetation biomass, biodiversity and carbon accrual.

Activity 5: Work with CILSS, AGRHYMET and the Africa Re-Greening Initiative (ARI) to monitor increases in on-farm vegetation cover, tree density, biodiversity, and their impacts on local food production and livelihoods. ARI are already working with dozens of farming communities in the Central Plateau of Burkina, in parts of Mali and Niger, to facilitate and support the increase by local farmers of the numbers of trees on agricultural land. By doing so, they are contributing to reversing the effects of desertification and soil degradation, thus improving rural livelihoods in both countries. ARI are already engaged in promoting the widespread adoption of simple,

low cost and sustainable tree management practices which farmers have already successfully demonstrated in some areas. CILSS/AGRHYMET will to use geospatial technologies to quantify the increases in vegetation cover, increases in biodiversity, and the positive impacts of these changes due to re-greening on local agricultural productivity, soil conservation and food security.

The specific study zones will be determined by the communities in Burkina and Mali that are already under study by the ARI, plus communities that are identified by CILSS/AGRHYMET. Baselines on land cover and state of the natural resources – especially the tree cover – will be established in Year 1 for each of these communities. In Niger, ARI are targeting communities in the Dogondoutchi area. It is proposed that CILSS/AGRHYMET will collaborate with the ARI/Niger team, and with CRESA (Centre Régional d'Enseignement Spécialisé en Agriculture, Université d'Abdou Moumouni) in these studies of the impacts of re-greening.

Activity 6: Identify regions across the Sahel that are suitable for developing re-greening activities. The preceding activities will have developed a fairly clear picture of the biophysical and anthropogenic conditions that are associated with landscape re-greening. For example, sandy textured soils and areas of high rural population density are two important conditions usually associated with re-greening. There are many areas across the Sahel region with these characteristics, but for various reasons, practices that lead to the impressive tree parklands and all their benefits have not been adopted. With this study remote sensing, existing thematic maps and GIS will be used to identify specific areas in the Sahel that seem to be good 'candidates' for investments in actions that will promote farmers to adopt agro-forest management practices. This is a key step in "scaling-up" best practices including FMNR.

Activity 7: Determine the effectiveness of Re-Greening activities on crop conditions and food security. There is a need to determine the effectiveness (i.e., success rate) of re-greening activities (particularly farmer-managed natural regeneration) in the Sahel region (in general) and in Niger (in particular). We will build upon previous work which analyzed seasonal vegetation condition (using 250 m MODIS NDVI) and extensive field information on crop conditions to provide insight into specific areas of Niger which experienced food insecurity due to reduced crop yields in 2009. The analysis will be extended to include additional years in the time series (2000-present), additional climate and soil variables and additional field information. Climate and soil variables will include satellite-derived rainfall estimates enhanced with extensive rain gauge data, evapotranspiration derived from land surface temperature data, and/or modeled soil moisture. Additional field information from both visual assessment (via photographs) of crop condition, and from farmer interviews, will be used to both calibrate and validate the analyses. Seasonal vegetation performance (as measured by NDVI) will be correlated with enhanced rainfall and soil moisture estimates to determine the influence of local and regional re-greening activities on crop yields. Such analyses will be performed for all years in the time series to monitor changes in the vegetation and land use that are due to re-greening efforts. In addition, temperature changes and trends over the past 30-50 years may provide insight into additional benefits of re-greening efforts.

Outcomes

- Maps, graphics and a report that present a baseline on the current extent and density of on-farm tree parklands in Niger, Burkina and Mali.
- Semi-automated approach developed for extracting tree cover which can be applied in other regions
- Documentation of changes in tree cover, biodiversity, agricultural productivity and soil conservation as a result of re-greening activities

- Maps, graphics and a report of priority candidate regions and sites in the Sahel which are suitable for scaling up re-greening activities. All methods, underlying data and assumptions about how the suitable areas were selected will be presented.
- Report presenting the impact of re-greening activities on crop conditions/yields, food security, biodiversity and impact on rural livelihoods.
- Satellite-derived data products staged on EROS, CILSS/AGRHYMET and ARI websites

THEME 3: THE REGIONAL PARK W: AN ENVIRONMENTAL ASSESSMENT OF ITS NATURAL RESOURCES INCLUDING BIODIVERSE HOTSPOTS, SURROUNDING LAND USE PRESSURES, AND LAND COVER TRENDS

Overview and Approach

The Regional Park W covers some 10,000 km² and preserves some of the last intact expanses of Sudano-Sahelian flora and fauna in West Africa. It is largely uninhabited by humans, although important archaeological sites found in this area attest to the presence of settlements during prehistoric times. It is a unique tri-national park, spanning parts of Niger, Benin, and Burkina Faso. It is governed by the protected area authorities of the three countries. The Park traces its status back to 1926 when it was designated as a "Parc de Refuge du Moyen-Niger". The Park was created by decree in 1954, and since 1996 has been listed as a UNESCO World Heritage Site. In 2002, it was designated Africa's first transfrontier Biosphere Reserve. This protected area holds a particularly important place in the conservation of global biodiversity because tropical dry woodlands and forests (Sahelo-Sudanian) are underrepresented in protected area networks, and the Regional Park is one of the few places where they are preserved in West Africa. Surrounding the regional park are contiguous buffer zones of 'total and partial reserves' and hunting areas. The Parks and their buffer zones consist of nearly 20,000 km² in total.

The vegetation types are diverse, dominated by wooded savanna, and the southernmost extension of tiger bush in Niger. Highly biodiverse habitats also occur, especially in the gallery forests that follow the major drainages such as the Niger, Mekrou and Kpako rivers. The Park is known for its large mammals – roan antelope, buffalo and some of West Africa's last wild African elephants. Bird life is also diverse with over 350 species identified.

When West Africa's protected areas were created, they were largely the domain of ecologists, forestry and park officials, and a few adventure travelers. Today protected areas such as the Regional Park are expected to directly contribute to national development and poverty reduction. Managing protected areas in developing countries presents profound challenges, given widespread conditions of poverty, rapid population growth, and political instability.

Time-series satellite imagery from EROS shows a dramatic increase in land use pressures surrounding the park. Deforestation outside the Park, but adjacent to the Park boundary, has been occurring rapidly. Thus far, the integrity of the park is well preserved, but pressure from expanding rainfed agriculture is growing. The park also faces threats from climate change, competition between humans and wildlife, and poaching. Under this theme, USGS will work with AGRHYMET, the national park authorities and possibly conservation NGOs to conduct a detailed inventory and map of the Park's natural resources, focusing on the land cover and vegetation types, and its biodiverse habitats.

To the southwest, just beyond the Regional Park W lies the Pendjari National Park in northern Benin. It was created in 1961, and covers about 2,750 km². It is physically linked to the Regional Park W through two protected areas: Réserve Partielle de Faune de la Kourtiagou; Zone Cynégétique de l'Atakora. They share a common boundary, with the former situated in Burkina, while the latter lies in Benin. A number

of additional parks and reserves provide even further contiguous extensions to the Pendjari to the west. Taken as a whole, the Regional Park W – Pendjari National Park complex provide a series of connected corridors that merit detailed baseline assessments, mapping, and long-term monitoring. This activity proposes to extend the baseline mapping of land cover, biodiverse habitats and surrounding land uses of the greater protected area complex in years 2, 3, and 4 of this program. The products from this effort – a detailed baseline, an assessment of the state-of-resources, LULC maps, geographic overlays of human activity, biodiverse habitats, and wildlife population – will be central to the type of landscape planning that aims to maintain a viable park and its ecosystem into the future.

Activity 8: Inventory, Map and Assess Trends and Pressures in and around the Regional Park W; Support long-term management plans for the Park. EROS and AGRHYMET scientists will team up to inventory and map the Regional Park W's land cover, including the numerous vegetation types, as well as the land use pressures surrounding the Park and its adjacent reserves and buffer zones. We will work closely with the national park authorities in Burkina, Niger and Benin by providing detailed maps of the current and past land use and land cover for communities that they will be working with, the buffer areas around them, and the corridor linking the Regional Park to the Pendjari Park. The maps will also help with mitigating human/wildlife conflict, to be used as a planning document to help understand and document animal movement, and areas of conflict. Our baseline analyses will provide current, detailed information about the state of the Park's vegetation and habitats, and problems of encroachment and other pressures. Proposed products include a current map of the Park's land cover, including highlighted biodiverse habitats and water points (suggested map scale: 1:100,000); land use and land cover change maps from 1965 to 2011, using historical and recent satellite imagery; a map specially designed for use by tourists, showing the park's diversity and most scenic areas, and infrastructure including roads, guard stations, camp grounds, etc., and a map of the park's elevation and slopes.

Outcomes

Year 1: a first draft of a land use and land cover / critical habitat map of the Regional Park W and buffer areas around the Park. The map will show biodiverse hotspots, critical habitats, and land use pressures around the park. It will also integrate a digital elevation model map to show shaded elevation and slope information. The suggested scale is 1:100,000 and will be produced in standard GIS and hardcopy formats. Year 2: finalize the LULC and critical habitats map, with additional geographic layers showing detailed Park infrastructure, additional critical habitats, charismatic species distribution overlays, wildlife migration corridors to adjacent non-protected areas, and long-term Park management plans. Years 3 and 4: continue to monitor the LULC dynamics in and around the Park, and identify key activities with NGOs and the national park management offices. Graphics of this map will be staged on the EROS and AGRHYMET web sites.

Activity 9: Inventory, Map and Assess Trends and Pressures in and around the entire Regional Park W – Pendjari National Park corridor

Beginning in Year 2, EROS and AGRHYMET scientists will take the same approach as defined under Activity 11 above to extend the baseline and time-series analysis of land cover to the Pendjari Park, and the corridor of protected areas that joins it with the Regional Park W. This will provide an integrated, regional picture of the network of transboundary protected areas in the northern Benin, eastern Burkina and southern Niger tri-state region. Teams will work closely with the national park authorities in the three countries by providing detailed maps of the current and past land use and land cover for communities that they will be working with, the buffer areas around them, and the corridor linking the Regional Park to the Pendjari Park. The maps will have the same characteristics, and provide the same unique benefits as outlined in the Result on the Regional Park W. This activity will be implemented during years 2, 3 and 4.

Outcomes

Year 2: A first draft of a land use and land cover / critical habitat map of the Pendjari Park, buffer areas and corridor linking it to the Regional Park W. The map will show biodiverse hotspots, critical habitats, and land use pressures around the park. It will also integrate a digital elevation model map to show shaded elevation and slope information. The suggested scale is 1:100,000 and will be produced in standard GIS and hardcopy formats. Year 3: Finalize the LULC and critical habitats map, with additional geographic layers showing detailed Park infrastructure, additional critical habitats, charismatic species distribution overlays, wildlife migration corridors to adjacent non-protected areas, and long-term Park management plans. Year 4: continue to monitor the LULC dynamics in and around the Park, and identify key activities with NGOs and the national park management offices. Graphics of this map will be staged on the EROS and AGRHYMET web sites.

THEME 4: MONITORING BIODIVERSE FORESTS AND PROTECTED AREAS IN WEST AFRICA'S UPPER GUINEAN FOREST ECO-REGION

Overview and Approach

The Upper Guinean Forest is a high global priority for biodiversity conservation. It extends through parts of Guinea, Sierra Leone, Liberia, southern Côte d'Ivoire and southern Ghana into Togo. These Upper Guinean forest blocks represent an important center of endemism – places where species are found nowhere else. It is also a region of strategic importance in terms of peace building, extractive industries, and as a source of valuable ecosystem services including water resources, fisheries, timber, food, medicines, and commodities such as rubber, cocoa and oil palm. The Forest is fundamental to the welfare of West African societies, has great cultural importance and has a climate mitigation value as well. Guinea, Sierra Leone and Liberia are included in the Guinean Forest 'Hotspot' region, which ranks first in mammalian diversity among the world's twenty-five identified 'hotspots'. This 'Hotspot' is also one of the two highest priority regions in the world for primate conservation.

Despite its ecological importance, the Forest is under threat from a range of unsustainable practices and land use pressures. Perhaps the greatest driver of deforestation and loss of biodiversity is slash-and-burn agriculture. Other important causes include logging for timber, fuel wood, mineral exploitation and civil conflict. Owing to the rapid LuLc changes occurring in this Forest, many endemic species are becoming endangered or extinct due to their shrinking habitat.

The West African region has the highest deforestation rates in Africa and one of the highest in the world. Current estimates place forest loss at over 80 percent of its original extent, and the forest is highly fragmented. In Guinea, for example, a recent LuLc mapping effort using Landsat satellite images showed that dense Guinean forests are restricted to a few remaining patches in southern Guinea, with a total area of 9,964 km², or only 4.1 percent of Guinea's land area. Similarly, a recent estimate of the forest area in Sierra Leone found only 5% of the nation's land area in forest. It is thought that Liberia was the only country in West Africa once entirely covered with rain forest. Today, while the coverage of mature dense forest in Liberia is significant at around 43%, the current rate of deforestation, estimated at 3% per year, is of concern. Existing maps of the forest extent are quite general, and the location, condition and rates of forest change are neither well-documented nor mapped. Furthermore, much of the remaining forest area is not under protected area status. A true gap analysis that assesses the actual extent and condition of today's Upper Guinean forests and evaluates biological and land management data to identify critical gaps in protection is needed.

Collaboration with STEWARD III

USGS/EROS has consulted with the US Forest Service, the prime implementer of the "Sustainable and Thriving Environment for West African Regional Development" (STEWARD) Phase III Program to

continue the mapping and monitoring studies it began under Phase II. Activities under this theme will provide forest, land use and land cover, and remote sensing imagery at broad landscape and site specific scales within three priority zones (PZs) in Mano River region (Guinea, Côte d'Ivoire, Sierra Leone, Liberia). It will also provide training in GIS and remote sensing to significantly increase the capacity of partners to use geospatial data in support of monitoring and documenting change in landscapes and ecosystems. The imagery and associated technical assistance will be used to monitor and describe measurable *impacts* associated with USAID supported agriculture, biodiversity and natural resources management (NRM) field interventions over time.

Geographic Scope and List of Target Areas

The geographic scope of this activity is the Mano River Region, defined by the countries of Guinea, Sierra Leone, Liberia, and Côte d'Ivoire. Areas of particular focus consist of three transboundary areas along borders between the Mano River countries. We will work closely with STEWARD III and will focus on the same geographic priority zones defined by that program. This will allow for considerable synergy between the two programs.

Three priority zones (PZs) have been identified under STEWARD III and are listed below. Although we expect these zones to remain priority areas during the four-year program, if the STEWARD Program should shift its geographic focus, we plan to adjust our plans accordingly, supporting STEWARD activities wherever the geographic foci may occur.

PZ1: Sierra Leone (Outamba-Kilimi National Park) / Guinea (Madina Oula, Soya and Ouré Kaba subprefectures)

PZ2: Guinea and Côte d'Ivoire (Mount Nimba) / Liberia (Nimba Nature Reserve)

PZ3: Côte d'Ivoire (Taï National Park) / Liberia (Grebo National Forest)

Partners

The following is a partial list of key partners. We expect this list to grow as STEWARD and USAID formulate agreements with implementing partners.

STEWARD (the main partner); Mano River Union Technical Teams; AGRHYMET Regional Center, World Agroforestry Centre (ICRAF) and Center for International Forestry Research (CIFOR); Wild Chimpanzee Foundation (WCF); Nature Conservation Research Center (NCRC); National Direction of Forests and Fauna/Sierra Leone; Forestry Division/SL; Office Ivoirien des Parcs et Réserves (OIPR); Société de Développement des Forêts (SODEFOR); Promoting Agriculture, Governance, and the Environment (PAGE)

Expected uses of geographic datasets and maps for biodiversity conservation

We expect multiple uses of the image-maps and LULC maps. They are one of the starting points for assessing what is left of high biodiversity forests within the Upper Guinean Ecological Region. In particular, these maps will show the recent extent of the forest from about 25 years ago, and how and where that extent has changed. They will also show where dense forest still exists outside the protected area network. These patches are often the most vulnerable to a variety of human pressures. They will also show other critical land cover types, including gallery forest, Sudanian type dry woodlands, and wetlands. The following is an illustrative list of expected uses for the maps:

- assess current extent of remaining dense biodiverse forest cover
- assess 25 years of dense forest trends including where the changes have been most prevalent
- Identify dense forest patches outside the protected area network
- Identify most suitable candidate areas for future protection
- Identity forest and surrounding communities suitable for forest co-management projects

- Support land use planning for integration of biodiversity conservation and agro-forestry development
- Establish baseline for future forest cover monitoring
- Support wildlife corridor planning
- Support community level land use planning
- Provide time-series imagery for use by the media
- Provide time-series imagery and maps for use by partners in reporting the geographic extent and impacts of their activities
- Support STEWARD efforts to estimate, report and monitor carbon sequestration in community-managed forests
- Set the stage for forest resource baselines and monitoring for REDD+ and carbon finance strategies

Definition of Image-Maps and Land-Use and Land-Cover Maps

Image-Maps: Image-maps are, by definition, a geographic product (paper or electronic formats) that integrate satellite images with conventional map information. Because of their highly practical uses, we propose the production of image-maps for use by partners, government authorities and local stakeholders. Image-maps combine recent medium or high resolution satellite imagery (ranging from 1 to 15 meters) with geographic features superimposed on the imagery, including all administrative boundaries, classified forest boundaries, village and town names, and subtle grid marks representing lines of latitude and longitude as aids in field navigation with a global positioning system (GPS). The hardcopy versions of these image-maps will be at large scales, typically 1:10,000 to 1:100,000, depending on areal extent. To facilitate their use and understanding by local stakeholders, we can include a pictorial legend on some image-maps that identifies the diversity of landscape features visible in the imagery. The image-maps will be prepared in French or English as appropriate for the country.

Land-Use and Land-Cover maps: LULC maps depict and characterize the natural and human elements found on landscapes worldwide. Land-cover refers to the attributes of a part of the Earth's land surface, including biota (flora/vegetation cover & fauna), soil, topography, water, and human structures. Land-use refers to the purposes for which humans exploit the land cover (e.g. forestry, agriculture). LULC maps are usually constructed from recent or historical imagery, using semi-automated and expert human interpretation approaches to identify and map the various land resources represented in the imagery. LULC maps are fundamental geographic datasets that provide a historical or current record of natural surface resources, ecosystem processes, and the many ways in which humans (and climate) are modifying the land. They are indispensible in land use planning, from local to national and regional levels. They also serve to monitor and assess the impact of human activity, including development projects.

Activities and Outcomes

Under each of the following activities, EROS will work with the STEWARD and its implementing partners to conserve biodiversity and to promote and enhance sustainable livelihoods among communities adjacent to forests and protected areas in the three priority zones.

Activity 10: Map, Monitor and support biodiversity conservation and agro-forestry activities in the Outamba-Kilimi/Sierra Leone and Madina Oula & Ouré Kaba/Guinea Transboundary Area (Priority Zone 1):

Build on recent efforts (2009-2010) which provided detailed image-maps of the Outamba-Kilimi and Madina Oula & Ouré Kaba transboundary area (TBA) in support of biodiversity conservation, agro-forestry, forest management planning, establishment of a transboundary conservation area, and ecotourism. We will build on the existing image-maps to produce land-use and land-cover (LULC) maps

providing a detailed, current baseline of landscapes including areas of high biodiversity (e.g. primary forest, gallery forest, wetlands), and all significant indicators of human activity. We will tap into the extensive EROS archive of ASTER satellite imagery, as well as high resolution commercial imagery from various US commercial satellite sources to feed the LULC mapping process. These detailed, recent images and resulting LULC maps will provide a baseline for monitoring the impacts of STEWARD and its partners on the ground. We will work with the STEWARD technical field teams from Guinea and Sierra Leone to provide training in remote sensing and GIS technologies, and to help them produce geographic baselines and LULC maps in their intervention areas. Training in these geospatial technologies will focus on applications in agroforestry, land use planning, preparing local conventions for land management, biodiversity assessments and conservation, and NRM activities.

Outcome:

Year 1: Complete LULC maps of the Outamba-Kilimi and Madina Oula & Oure Kaba transboundary area (TBA), building upon the image-maps already constructed. Prepare new, very detailed image-maps of STEWARD Program's community focus areas to help assess baselines and project impacts in natural resource management and co-forest management. Work with Guinean and Leonean technical teams to improve GIS skills through one-on-one technical training and joint exercises. Year 2: Prepare and deliver detailed LULC maps and NRM impacts assessments on the community-based focus areas. Continue to support the GIS and remote sensing needs of STEWARD and its technical teams. Years 3 and 4: continue to support GIS and remote sensing mapping and analysis needs of the STEWARD Program and its local partners. Schedule training workshops in GIS and remote sensing, with applications tailored to the supporting the ground-work in the priority zones. Annual work plans will be prepared and submitted to USAID for review and approval at the beginning of each fiscal year.

Activity 11: Map, Monitor and support biodiversity conservation and agro-forestry activities in the Mount Nimba (Guinea / Côte d'Ivoire) and Nimba Nature Reserve (Liberia)(Priority Zone 2)

Work with STEWARD technical teams from Guinea, Côte d'Ivoire and Liberia, and implementing partners to monitor, map and assess the extent and condition of this TBA's ecosystems, including biodiverse hotspots, the diversity of land cover, and to assess and map land use change since the 1980s, including deforestation. We will prepare a detailed LULC baseline, with thematic overlays to help local and national authorities and STEWARD implementing partners "see" the land resources, currently and through time. Specifically, we will:

(A) Produce LULC maps, building on recent efforts to produce detailed image-maps cover maps of Mount Nimba and Nimba Nature Reserve in support of strengthening biodiversity conservation, agro-forestry, forest management planning, better NRM practices, and public awareness of a critical nature area. The LULC maps will be formatted like those described above (see PZ1). They will be based on medium-high resolution recent ASTER imagery, and will be produced at 1:50,000 scale, subdividing this transboundary area into several quadrangle sheets. We will produce overlays of geographic features including protected area boundaries, international boundaries, place names, latitude-longitude grid, biodiverse habitats, infrastructure, and other features.

(B) Acquire and provide high resolution images as complimentary products to the image-maps described above. These will be provided on an as-needed basis, covering special focus areas, particularly in support of agro-forestry and forest co-management activities. These detailed, recent images will provide a baseline for monitoring the impacts of these activities in the near future. Specific areas will be defined in discussions with partners.

Outcome: Year 1: Complete LULC maps of the Mount Nimba and Nimba Nature Reserve, building upon the image-maps already completed. In addition, provide high resolution imagery to the STEWARD

team and implementing partners on the Program's community focus areas to help assess baselines and project impacts in natural resource management and co-forest management. Years 2, 3 and 4: continue to support GIS and remote sensing mapping and analysis needs of the STEWARD Program and its local partners according to their evolving needs. Annual work plans will be prepared and submitted to USAID for review and approval at the beginning of each fiscal year.

Activity 12: Map, Monitor and support conservation and agro-forestry activities in Taï National Park (Côte d'Ivoire) and Grebo National Forest (Liberia)(Priority Zone 3)

(A) Build on current efforts to produce increasingly detailed and customized LULC maps of the Taï National Park and Grebo National Forest TBA in support of strengthening biodiversity conservation, agro-forestry, forest management planning, better NRM practices, and public awareness of a critical nature area. The LULC maps will be formatted like those described for the other PZs. They will be based on medium-high resolution recent ASTER imagery, at a suggested scale of 1:100,000, subdividing this TBA into several quadrangle sheets. We will produce overlays (additional GIS layers) of important geographic features including protected area boundaries, international boundaries, place names, latitude-longitude grid, and other features. We will work with chimpanzee conservation organizations to ensure that the LULC classes correspond to the vegetation and land cover types they are familiar with in the field, and promote ease of use by conservationists.

(B) Time-series forest and LULC maps: inventory and map remaining dense forest cover, producing a dense forest map and other LULC types of this critical TBA. Dense forest and LULC maps will show the land cover for two periods in time: mid-1980s and the near recent period (2006 to 2009). We will tap into the extensive EROS archive of Landsat satellite imagery for the historical period, and the extensive ASTER image archive for the recent period. ASTER imagery proved its considerable value to detect and reliably map forest patches down to 5 hectares or less. We will produce hardcopy and digital versions of these maps for key STEWARD and EROS partners working in this TBA. The maps will provide an unprecedented historical and current assessment of the remaining patches of Upper Guinean Forest in the TBA. Spanning the border of Côte d'Ivoire and Liberia, these lowland forests form the largest block of relatively intact tropical rainforests in West Africa.

(C) Support planning and establishing corridor zones between the Taï National Park and Grebo National Forest in support of biodiversity conservation, with emphasis on chimpanzee habitat conservation and wildlife corridors. We will coordinate our interventions closely with STEWARD, working with WCF, SODEFOR, and OIPR. High resolution imagery and the LULC maps produced will provide considerably more detail and landscape analysis to this critical exercise. We envision data exchanges so that we can help prepare overlay maps that show chimpanzee group locations and other wildlife distributions.

Outcome: Year 1: Complete detailed LULC maps of the current state-of-resources in the Taï National Park and Grebo National Forest TBA. Year 2: Prepare and deliver time-series land use and land cover maps of this TBA area, showing land use trends and external pressure areas around the protected areas. Years 3 and 4: continue to support GIS and remote sensing mapping and analysis needs of the STEWARD Program and its local partners according to the evolving needs. Annual work plans will be prepared and submitted to USAID for review and approval at the beginning of each fiscal year.

Table 1. Four-Year Timeline Overview for Main Results

Year	FY2012				FY2013				FY2014				FY2015			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Result																
1. Upgrade AGRHYMET satellite image collection	x	x														
2. Produce LULC maps of Mali		x	x	x												
3. Identify and characterize "hotspots" and anomalies	x	x	x	x												
4. Produce LULC maps of 16 countries					x	x	x	x	x	x						
5. Specialized seminars at AGRHYMET		x		x		x		x		x		x		x		x
6. Regional "restitution" workshop with CILSS										x						
7. Prepare geographic baseline on on-farm tree parklands (re-greening)		x	x	x	x	x										
8. Monitor and assess impacts of re-greening			x	x	x	x	x	x	x	x	x	x	x	x	x	x
9. Identify suitable re-greening regions & scale up					x	x	x	x	x	x	x	x	x	x	x	x
10. Determine effectiveness of re-greening on crops and food security					x	x	x	x	x	x	x	x				
11. Map and assess LULC in and around the Regional Park W & support management plans	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
12. Map and assess LULC across Park W and Pendjari Protected Network					x	x	x	x	x	x	x	x	x	x	x	x
13. Monitor and support activities in the OKNP-Madina Oula & Oure Kaba TBA	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
14. Monitor and support activities in the Mount Nimba/Nimba Nature Reserve	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
15. Monitor and support activities in the Taï and Grebo protected areas	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

3.0 Monitoring and Evaluation

- The plan for monitoring Landuse Dynamics and Climate Change in West Africa's effectiveness in achieving intended results will include both input-output and outcome indicators. These indicators will form the basis of the performance management plan (PMP) prepared by USGS-EROS and the final form submitted within 30 days of start of agreement implementation.
- USGS-EROS will develop and submit with the annual work plan, an overall performance monitoring and evaluation plan (M&E) to the AOTR at USAID/West Africa for review and approval. The M&E plan will track standard indicators of the Foreign Assistance Framework, other project specific performance indicators, indicator targets and milestones, baseline information and data quality assessment plans.
- USGS-EROS will be responsible for collecting and submitting to USAID/West Africa all applicable indicator data on a semi- annual basis and will be included in the semi-annual report due on April 30 and included in the annual report due on October 15. The semi-annual updated M&E plan will be an indispensable part of the project's annual workplan.
- All annual work plans are due no later than August 31 of each calendar year. Work plans should include detailed financial reporting for expenditures during the first year as well as projected expenditures for the remaining years. The work plan should include detailed activity plans and a clear identification of results to be achieved that year.
- ILLUSTRATIVE INDICATORS
    - Number of hectares of detailed monitoring activities
    - Number of hectares of improved biophysical conditions in the last ten years
    - Number of people with increased biophysical benefits derived from sustainable NRM and farmer-managed natural regeneration
    - Number of people with increased economic benefits derived from sustainable NRM and farmer-managed natural regeneration
    - Number of people who received training in environmental monitoring technologies
    - Number of people who received training in remote sensing for land cover trend monitoring
    - Number of people receiving training in NRM and sustainable landscape activities
    - Number of stakeholders using NRM and land cover information in their decision-making as a result of USG assistance
    - Number of national institutions with improved capacity to monitor land resources and land management practices
    - Number of institutions with improved capacity to address climate change issues as a result of USG assistance

4.0 GENDER CONSIDERATIONS

Gender is a social category referring to the roles and responsibilities of both men and women in a given society. It is one of many social categories that shape social behavior.

This program is largely about land resource assessments and environmental monitoring. It is also about using state-of-the-art geospatial tools and imagery for mapping and monitoring the earth's changing physical and human landscapes. Thus, a cross-cutting theme is training and capacity building. We will make every effort to ensure that both men and women participate in project activities, and that both

benefit from the capacity building and technology transfer components. We will also ensure that inputs provided are not gender-biased.

In the course of carrying out program activities, we will be interfacing with many development partners in the field – working directly with rural people who make daily decisions impacting land use and NRM. In West Africa, men and women typically access, manage and control natural resources in different ways due to traditions, status, and responsibilities. We are fully aware that activities that seek to affect the use of natural resources must incorporate strategies that recognize the different behaviors, roles and responsibilities of men and women. This program, like nearly all USAID supported activities, will require keeping track of benefits to men and women, including capacity building and training opportunities.

During the earlier regional project to map LULC and quantify trends in partnership with AGRHYMET, a number of women played major roles in leading the national team efforts. Women played leading roles in the teams from Guinea, Mauritania, Cape Verde, and Chad. In the years since this mapping effort, we have maintained contact and provided technical guidance to these women, and expect to involve them and many others in this important environmental monitoring effort.

5.0 ENVIRONMENTAL COMPLIANCE

The activities described for this program justify Categorical Exclusions, pursuant to 22 CFR §216.2(c)(1) and (2), for which an Initial Environmental Examination or an Environmental Assessment are not required because the actions do not have an effect on the natural or physical environment. Program interventions noted above fall into the following classes of action: 22 CFR §216.2 (c)(2)(i) education, technical assistance or training; (iii) analyses, studies, academic or research workshops and meetings; (v) document and information transfers; and (xiv) studies to develop the capability of recipient countries to engage in development planning. Per ADS 204.5.4, the AOTR will: i) actively monitor the implementation of the *Land Use Dynamics and Adapting to Climate Change in West Africa* program and regularly evaluate whether activities remain within the bounds of the recommended Categorical Exclusion; ii) ensure that adequate time and resources are available to maintain all activities in states of compliance with the requirements of this recommended Categorical Exclusion; and iii) modify or end activities that are not in compliance. No activities other than those categorically excluded will be conducted prior to receiving approval of an amended IEE by USAID.

6.0 SUPPORT FOR 'USAID FORWARD' PRINCIPLES

This project will advance the following principles:

1. Innovation
2. Science and Technology: Many development solutions are based on the appropriate, timely application of science and new technologies in a manner that accelerates problem solving and scales up effective solutions. We will emphasize new scientific and technological applications for development, and support research that is targeted to the needs of the communities where we work.
3. Support and capacity-building for local & regional institutions; Strengthening the capacity of national and regional institutions to equip them to effectively and efficiently store, analyze and interpret satellite imagery and dataset to aid decision making at the national and regional levels will be a key component of this project. To this end, the project will seek to upgrade the regional satellite data holding capacity for AGRHYMET, provide an improved Rapid Land Cover Mapping (RLCM) tools (remote sensing, GIS) in collaboration with regional and national teams, and conducting workshops and meetings to roll out findings of LuLc mapping and trend program.

7.0 Branding and Marking

All trainings, workshops and reports will be co-branded and co-marked with the USAID and USGS EROS logo appropriately in accordance with the terms of the interagency agreement.

Annex VII: USAID/CILSS Implementation Letter #1

The fully executed Implementation Letter 1 is on the following page.

USAID | WEST AFRICA
FROM THE AMERICAN PEOPLE

Professor. Alhousseini Bretaudeau
Executive Secretary
Permanent Inter-States Committee for Drought Control in the Sahel (CILSS)
03 BP. 7049
Ouagadougou, Burkina Faso

Subject: Strategic Objective Grant Agreement No. 624-A21-11-01 (the "Agreement")
Implementation Letter No. 1 – FY 13
Earmarking and Programming Activities.

Dear Professor Bretaudeau (Executive Secretary):

This Implementation Letter (IL) No. 1 is issued in accordance with the above referenced Agreement signed by CILSS and the Government of the United States of America, acting through the United States Agency for International Development (USAID) dated October 3, 2011, as amended.

I. Purpose

The purpose of this IL is: (i) to earmark and commit 710,628.13 US$ (approximately 330,442,080.45 Fcfa, using an exchange rate of $1 to 465 Fcfa) for CILSS activities related to mapping trends in land use and land cover (LULC) from 1975 to 2011. The major objective is to reinforce environmental information systems for decision-making. by(i) providing reliable information on LuLC and associated trends from 1975 to 2011 for West African countries, and (ii) disseminating and promoting successful NRM practices in the Sahel to improve food security, increase biodiversity and allow for adaptation to climate change

The terms and conditions of the Agreement remain in full force and effect. To the extent the terms of this IL are inconsistent with the terms of the Agreement; the terms of the Agreement shall prevail.

II. Program Activities for FY2013/2014 Agreement Funding USAID and CILSS hereby approve the following allocations for CILSS:

Professeur Alhousseini Bretaudeau
Secrétaire Exécutif
Comité Inter-Etats de Lutte Contre la Sècheresse au Sahel (CILSS)
03 BP. 7049
Ouagadougou, Burkina Faso

Objet : Lettre d'Exécution No.1 – pour l'année fiscale 2013, de l'Accord de Subvention d'Objectif Stratégique No. 624-A21-11-01 (« l'Accord de Subvention »).
Réservation et Programmation d'Activités.

Cher Professeur Bretaudeau (Secrétaire Exécutif) :

La présente Lettre d'Exécution (LE) No.1 est élaborée en accord avec le ci-dessus mentionné Accord de Subvention signé entre le CILSS et le Gouvernement des Etats-Unis d'Amérique, à travers l'Agence Américaine pour le Développement International (USAID) en date du 3 octobre, 2011 ainsi amendé.

I. Objet

Le but de cette LE est : 1) de réserver et d'engager dollars 710,628.13 US$ (approximativement 330,442,080.45 Fcfa au taux de change de 465 FCFA pour 1 dollar américain) pour les activités du CILSS liées a la cartographie des tendances de l'utilisation et la couverture du sol de 1975 à 2011. L'objectif principal étant de renforcer le système d'information environnementale pour la prise des décision à travers (i) la mise en disposition des informations fiables sur les modes d'utilisation des terres et la couverture du sol et les tendances qui en découlent de 1975 a 2011 en Afrique de l'ouest, et (ii) disséminer et promouvoir les succès en pratiques de gestion des ressources naturelles dans le sahel to l'amélioration de la sécurité alimentaire, gestion de la biodiversité et adaptation aux changements climatiques.

Les termes et conditions de cet Accord demeurent en vigueur. Si dans la durée, les termes de cette LE sont inconsistants avec les termes de l'Accord, les termes de l'Accord feront foi.

II. Programmes d'activités de l'Accord de Financement pour l'année Fiscale 2013/2014
L'USAID et le CILSS approuvent les allocations suivantes pour le CILSS.

Regional Office of Environment and Climate Change Response – Biodiversity pillar
710,628.13 USD from FY11 and FY 12 funds. Two activities will be conducted as part of the 2012/2013 work plan associated with this PIL. These activities will be carried out by CILLS/AGHRYMET in close collaboration with EROS/USGS. The first program is titled "Cartography of Land Use and Cover' and will produce reliable information about current trends in land use and vegetation cover from 1975 to 2011 in 13 countries in West Africa with highlight on biodiversity hotspots. The second program is titled 'Sahel Studies' and will be conducting research, documenting and promoting successes in the greening of the Sahel landscapes in response to improved natural resource management interventions that promote harmony with biodiversity, food security and adaptation to climate change.

Bureau Régional de l'Environnement et la Réponse au Changement Climatique – Financement : Pilier Biodiversité de l'an 2011 et 2012 (710,628.13) dollars américains).
Deux activités sont prévues dans le plan de travail (2012/2013) associé avec cette LE. Les deux seront mises en œuvre par CILSS/AGRHYMET en étroite collaboration avec le Centre Scientifique de Surveillance et Observation de la terre des Etats-Unis d'Amérique (EROS/USGS). Le premier programme est intitulé « Cartographie de l'Utilisation et Couverture de la Terre » et produira des informations fiables sur les tendances de l'utilisation et couverture végétale de la terre de 1975 à 2011 dans 13 pays de l'Afrique de l'ouest avec un accent mis sur les sites prioritaires de conservation de la biodiversité. Le deuxième programme, nommé « Etudes Sahel », sera chargé de faire la recherche, la documentation et promouvoir les réussites dans le reverdissement des paysages sahéliens en réponse à l'amélioration de la gestion des ressources naturelles dans les systèmes paysans et en rapport avec la croissance de la biodiversité, la sécurité alimentaire, et l'adaptation au changement climatique.

Expenditures are authorized from April1, 2013 through April 31, 2014.

Les dépenses sont autorisées du 1 Avril 2013 au 31 Avril 2014.

III. Advances

Advances shall be limited to the minimum amounts needed to meet current disbursement needs (generally 30 days) and shall be scheduled so that the funds are available to CILSS as close as is administratively feasible to the actual disbursements by the organization for program costs. Advances made by the recipient to sub-recipients or the recipient's field organizations shall conform substantially to the same standards of timing and amount as apply to cash advances by USAID to the recipient.

III. Avances

Les avances doivent être limitées aux montants minimums nécessaires pour correspondre aux besoins réels de décaissements (généralement 30 jours) et doivent être programmées de sorte que les fonds puissent être mis à la disposition du CILSS aussi proche que cela soit administrativement possible par rapport aux décaissements réels effectués par l'organisation pour faire face aux coûts des programmes. Les avances faites par le bénéficiaire aux sous bénéficiaires ou aux organisations sur le terrain doivent être sensiblement conformes aux mêmes normes de calendrier et montant que celles qui s'appliquent aux avances de fonds faites par l'USAID au bénéficiaire.

Advance Procedures – After receipt of the initial advance, the recipient shall submit a Standard Form 1034 for each upcoming month (30 day period), with the statement "Request for Advance" printed at the top of the form. The recipient may submit a set of these forms on a quarterly basis (i.e. submission of three SF 1034s one for each month in the

Procédures pour l'avance de Fonds - Après réception de la première avance, le bénéficiaire doit soumettre un formulaire de type SF 1034 pour chaque mois à venir (période de 30 jours), avec la mention "Demande d'avance" mentionnée en haut du formulaire. Il se peut que le bénéficiaire soumette un ensemble de ces formulaires sur une base trimestrielle

Regional Office of Environment and Climate Change Response – Biodiversity pillar
710,628.13 USD from FY11 and FY 12 funds. Two activities will be conducted as part of the 2012/2013 work plan associated with this PIL. These activities will be carried out by CILLS/AGHRYMET in close collaboration with EROS/USGS. The first program is titled "Cartography of Land Use and Cover' and will produce reliable information about current trends in land use and vegetation cover from 1975 to 2011 in 13 countries in West Africa with highlight on biodiversity hotspots. The second program is titled 'Sahel Studies' and will be conducting research, documenting and promoting successes in the greening of the Sahel landscapes in response to improved natural resource management interventions that promote harmony with biodiversity, food security and adaptation to climate change.

Bureau Régional de l'Environnement et la Réponse au Changement Climatique – Financement : Pilier Biodiversité de l'an 2011 et 2012 (710,628.13) dollars américains).
Deux activités sont prévues dans le plan de travail (2012/2013) associé avec cette LE. Les deux seront mises en œuvre par CILSS/AGRHYMET en étroite collaboration avec le Centre Scientifique de Surveillance et Observation de la terre des Etats-Unis d'Amérique (EROS/USGS). Le premier programme est intitulé « Cartographie de l'Utilisation et Couverture de la Terre » et produira des informations fiables sur les tendances de l'utilisation et couverture végétale de la terre de 1975 à 2011 dans 13 pays de l'Afrique de l'ouest avec un accent mis sur les sites prioritaires de conservation de la biodiversité. Le deuxième programme, nommé « Etudes Sahel », sera chargé de faire la recherche, la documentation et promouvoir les réussites dans le reverdissement des paysages sahéliens en réponse à l'amélioration de la gestion des ressources naturelles dans les systèmes paysans et en rapport avec la croissance de la biodiversité, la sécurité alimentaire, et l'adaptation au changement climatique.

Expenditures are authorized from April1, 2013 through April 31, 2014.

Les dépenses sont autorisées du 1 Avril 2013 au 31 Avril 2014.

III. Advances

Advances shall be limited to the minimum amounts needed to meet current disbursement needs (generally 30 days) and shall be scheduled so that the funds are available to CILSS as close as is administratively feasible to the actual disbursements by the organization for program costs. Advances made by the recipient to sub-recipients or the recipient's field organizations shall conform substantially to the same standards of timing and amount as apply to cash advances by USAID to the recipient.

III. Avances

Les avances doivent être limitées aux montants minimums nécessaires pour correspondre aux besoins réels de décaissements (généralement 30 jours) et doivent être programmées de sorte que les fonds puissent être mis à la disposition du CILSS aussi proche que cela soit administrativement possible par rapport aux décaissements réels effectués par l'organisation pour faire face aux coûts des programmes. Les avances faites par le bénéficiaire aux sous bénéficiaires ou aux organisations sur le terrain doivent être sensiblement conformes aux mêmes normes de calendrier et montant que celles qui s'appliquent aux avances de fonds faites par l'USAID au bénéficiaire.

Advance Procedures – After receipt of the initial advance, the recipient shall submit a Standard Form 1034 for each upcoming month (30 day period), with the statement "Request for Advance" printed at the top of the form. The recipient may submit a set of these forms on a quarterly basis (i.e. submission of three SF 1034s one for each month in the

Procédures pour l'avance de Fonds - Après réception de la première avance, le bénéficiaire doit soumettre un formulaire de type SF 1034 pour chaque mois à venir (période de 30 jours), avec la mention "Demande d'avance" mentionnée en haut du formulaire. Il se peut que le bénéficiaire soumette un ensemble de ces formulaires sur une base trimestrielle

V. Environmental Requirements

Environmental Monitoring and Compliance

The two activities are **Categorically Excluded** from initial environmental examination as no environmental impacts are expected as a result of these activities. All are excluded per the following citations from Title 22 of the Code of Federal Regulations 216 (22 CFR 216), subparagraph 2(c)(2):

(i) Activities involving education, training, technical assistance or training programs except to the extent such programs include activities directly affecting the environment (such as construction of facilities, etc.);

(ii) Activities involving analyses, studies, academic or research workshops and meetings;

(iii) Activities involving document and information transfers; and

(iv) Studies, projects or programs intended to develop the capability of recipient countries and organizations to engage in development planning.

V. Conditions Environnementales

Contrôle et Conformité aux Normes Environnementales

Les deux activités sont de la **Catégoriquement Exclu** de l'examen environnemental initial et aucun impact sur l'environnement n'est attendu comme un résultat de ces activités. Toutes les activités sont exclues par les citations du titre 22 du Code de Régulation Fédérale 216 (22 CFR 216), sous paragraphe 2 (c) (2) :

(i) Activités sur l'éducation, formation, assistance technique ou programme de formation à l'exception si ces programmes prévoient des activités qui peuvent affecter l'environnement (tels que construction de bâtiments etc.) ;

(ii) Activités impliquant analyses, études académiques ou séminaires de recherche et réunions ;

(iii) Activités impliquant documents et transfert d'informations : et

(iv) Etudes, projets ou programmes pour développer les capacités des pays récipiendaires et organisations engagées en planification pour le développement.

VI. Results Reporting

CILSS should submit quarterly reports on July 15, 2013, January 15, 2014, a comprehensive report on October 15, 2013 and a final report in April 15, 2014 together with all deliverables (see work-plan attached). Under the second activity, CILLS/AGHRYMET will submit the workshop report two weeks after its completion.

All international travel outside of the West Africa region and all increase of salaries funded under this IL must have prior authorization from USAID/WA.

CILSS will be reimbursed for all cost incurred in carrying out the activities set forth in this IL which are determined in accordance with applicable cost principles to be reasonable, allocable and allowable, and consistent with the attached budget. Payments will be made by periodic advances and will be requested through the submission of SF 1034 supported by information that allows the determination of the grantee's advance requirements and the monitoring of the status of expenditures by

VI. Rapports de Résultats

CILLS soumettra des rapports trimestriels dus le 15 Juillet, 2013 et le 15 Janvier 2014, avec un rapport compréhensif le 15 Octobre 2013 et un rapport final le 15 Avril, 2014 y compris tous les produits (voir plan de travail en annexe). Sous la deuxième activité, le CILSS/AGHRYMET soumettra un rapport de l'atelier deux semaines après celui -ci.

Tout voyage international en dehors de la région de l'Afrique de l'ouest et toute augmentation de salaires financés sous cette LE doivent avoir l'autorisation préalable de l'USAID/WA.

Le CILSS sera remboursé pour toutes dépenses encourues dans l'exécution des activités stipulées dans cette lettre d'exécution, activités qui ont été déterminées en conformité avec les principes de coûts applicables comme étant raisonnables, attribuables et admissibles et avec le budget approuvé ci-joint. Ces demandes d'avance doivent être formulées sur un formulaire SF 1034 et doivent être accompagnées de toute information permettant à l'USAID de déterminer

USAID. CILSS is authorized to make adjustments up to 10% in individual line items without further approval by USAID, provided such adjustments do not cause CILSS to exceed the total approved budget.

The Office to which advance requests and liquidation vouchers should be submitted is:

USAID/WA
Office of Financial Management
Internet address : Accra-cont@usaid.gov
Accra, Ghana

Copies to:

TCHAMOU Nicodeme – ntchamou@usaid.gov

VII. Concurrence

To record your concurrence to the programming of funds for the activities described above, please sign both original copies of this IL. Retain one copy for your records and return the other copy to USAID.

Sincerely,

les besoins d'avance du bénéficiaire et de suivre l'état de ses dépenses. Le CILSS est autorisé à apporter des ajustements de l'ordre de 10% entre les lignes budgétaires sans un accord préalable de l'USAID à condition que ceux-ci n'entraînent pas un dépassement du budget total alloué.

Le bureau auquel les demandes et justificatifs d'avance devront être soumis est le suivant:

USAID/WA
Bureau de Gestion Financière
Adresse Internet : Accra-cont@usaid.gov
Accra, Ghana

Copies à :

TCHAMOU Nicodème – ntchamou@usaid.gov

VII. Accord

Si ces dispositions vous conviennent, nous vous saurions gré de bien vouloir indiquer votre accord en signant cette lettre et en retournant l'original au bureau de l'USAID/Afrique de l'ouest.

Nous vous prions de croire, Monsieur le Secrétaire Exécutif, à l'assurance de notre haute considération.

Carleene Dei
Mission Director
USAID/West Africa

Date: 04/16/2013

Pour Approbation

Prof. Alhousseini Bretaudeau
Executive Secretary
CILSS

Comité Inter-Etats de Lutte contre la Sécheresse dans le Sahel - Ouagadougou

Date: 04/18/2013

Clearance page for Implementation Letter No. 1 – FY 13

Drafted by Jorge Oliveira: signed Date: 3/17/2011

EO: Anne Dix Date 03/28/2013

PRM: Julie Nenon Date 4/3/13

CONT: Stephen Ike Date: 4/2/13

RLA: Chris Krafchak Date: 4/12/13

DDIR: Bradley Wallach Date: 4/15/13

BBFY: 2011
EBFY 2012
FUND: DV
DIST: 624-M
PE: A085
PA: A18
AMT: $710,628.13
DOC #: 624-13-A21-CLSS-IL#1

FUNDS AVAILABLE
ENTERED: DATE 3/28/13 INITIALS CA
CLEARANCE AKM 3/27/2013
APPROVAL SE 4/2/13

PHOENIX POSTED SC
Approved by 3/28/13
Processed by
Date 3/02/13

See attached for more details.

Annex VIII: Review of technical products under theme 1

Tools: Rapid Land Cover Mapper Description and Review

The Rapid Land Cover Mapper (RLCM) is a toolset that was initially designed as a basic plugin to ArcGIS. It is entering its third versioning and has expanded in functionality to include experimental web deployments. The RLCM is a combined vector/raster toolset to map landcover. RLCM represents a supervised (or hybrid/supervised) approach to land cover mapping. It was initially designed to operate with Landsat data but can work with different types of input data, e.g. Corona, ASTER. It was also adapted for use at 1m/2.5m resolutions. Similarly, the output resolution of the RLCM is not limited to the resolutions represented in the main 2km and 1km products.

RLCM uses a supervised classification system based on a standardized dot grid method. Dot grid estimation was popularized in forestry, including for percent forest cover estimation. Dot grid methodology has been in use since the early 20th century and has been a mainstay of professional forestry. In the RLCM, each dot is interpreted at a scale of 1:80,000 and contains 4-5 pixels. The surrounding area is "context."

Highlights from the RLCM process include:

- Overlay of a standardized (not randomized) dot grid on the input imagery
- Attribution and classification of the dots.
- Generalization to 2km classified grid and rasterization.

RLCM emphasizes land cover change. To this end, it has functionality specifically designed to assist with registration. It also supports pixel-to-pixel change differentiation. While this approach necessitates attention to detail in the initial classification, and allows for the possibility of error propagation, it also allows expeditious and accurate change analysis. **(Figure 4)**

During the classification process, if an analyst feels uncertain about a pixel value, the tool has the ability to allow him to reference Google Earth, side-by-side. This uncertainty relies on qualitative expert judgment and does not relate to a quantitative threshold.

Speed is a significant factor in the classification process. According to USGS, the RLCM product can be applied and used to classify 1-2 scenes per day, per expert trained user. One Landsat scene, as represented, is 90 by 90 dots and, on average, one scene can be classified per day. The bulk of the work is on the first time series, and then the analysis is focused on "what has changed?" Answering this question is less intensive than the initial scene classification.

During the capacity building exercises in Africa, trainees using the RLCM product were given appropriate data and training materials, including a manual. There is a USGS website outlining the RLCM, accessible at: http://edcintl.cr.usgs.gov/ip/rlcm/index.php.

RLCM fulfills its objective of providing an intuitive, accessible approach to land cover classification (Fig.19). However, issues related to its performance include:

- Omission of key steps in the image classification process (also referred to as "the classification chain" (Schott, 2007), including generation and integration with interim products such as Normalized Difference Vegetation Index (NDVI) (Tucker 1979, 1985), transforms (Boardman and Kruse 1994; Huang, 2002, 2002, 2003; Kauth and Thomas 1976), automated classification (Coppin, 1994, 1995; Hansen, Defries et al. 2000, Tou and Gonzalez 1974).

- Lack of support for alternative classification methods, e.g. supervised, unsupervised, decision tree, object-based (Milne, 1988). Inclusion of alternatives is warranted in the product development cycle because certain geographic concerns and certain types of imagery perform better under certain types of classifiers. The RLCM has equivalents in ERDAS, ENVI and other remote sensing software packages. A quality comparison should be conducted followed by a needs/cost analysis for future work, given that users would not be locked into just one methodology.

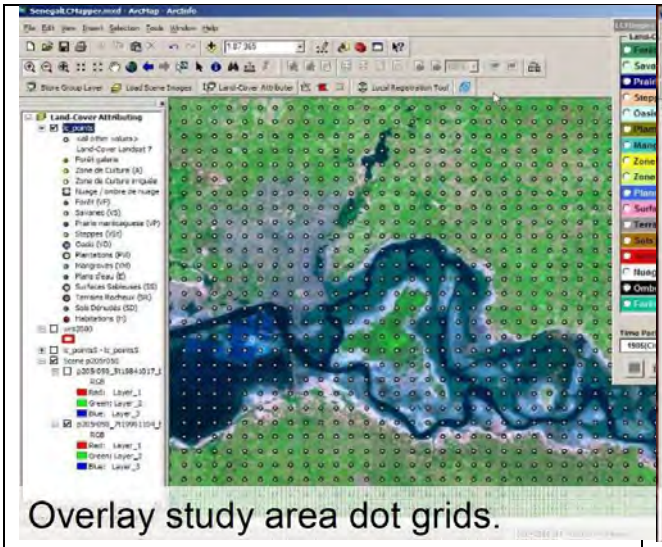


Figure 1: Initial overlay of the dot grid on the image. (USGS, 2007)

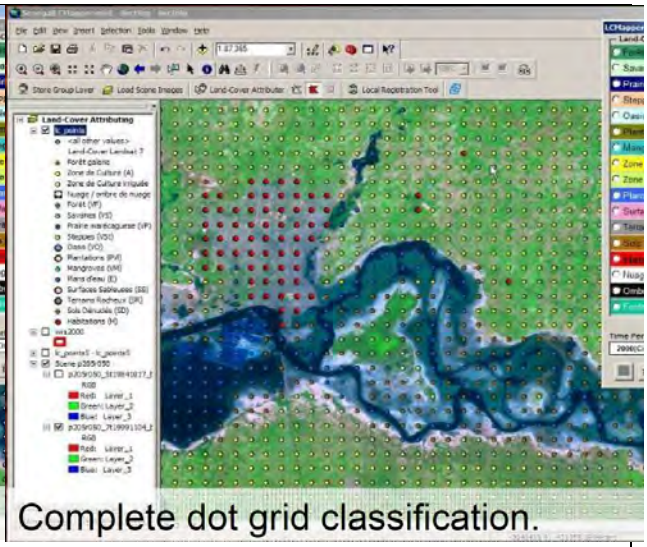


Figure 2: Classification of ubiquitous land cover class. (USGS, 2007)

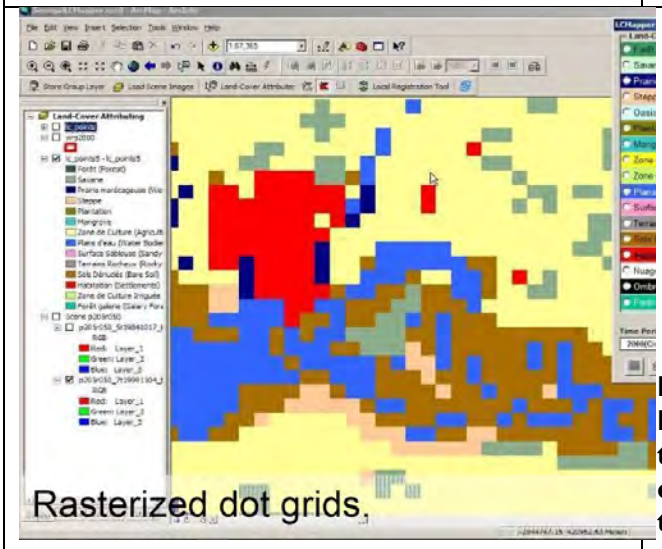


Figure 3: Multi-class, rasterized classification.

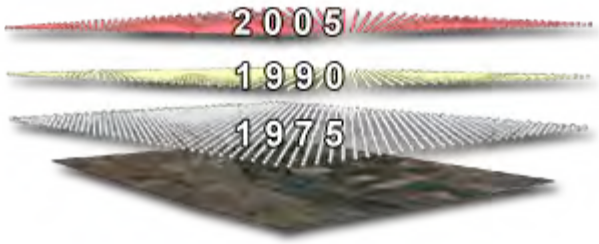


Figure 4: Multiple time periods managed by RLCM. The original classification provides the basis for subsequent change pixels. Non-change pixels retain their original values and therefore expedite the classification process.

- Claims by the USGS that products derived from RLCM outperformed other approaches to land cover classification would not be supported by quantitative evidenct. However, significant anecdotal evidence was provided.
- The RLCM tool can deliver products at multiple resolutions: from the 2km product (USGS) to 1km (the NACs) to 30m (the hotspots) to 1m (the tree cover research). This feature makes it attractive to practitioners across disciplines.
- The products generated by USGS, at 2km in time series, are useful at a very general level. USGS stated that decision makers found them useful and in many cases they provided insights into aspects of LULCC that no one was aware of.

Data Products Description and Review

2km Land Cover

The 2km land cover maps are one of the primary deliverables for USGS under Theme 1 of the PAPA, "Map Land Use and Land Cover and Associated Trends from 1975 to 2011 for 16 West African Countries." The USGS has generated a series of land cover layers for the Sahel and West Africa (Vogelmann, 1998). These cover the Sahel and West Africa for 1975, 2000, 2013. In places where imagery was cloudy or unavailable, imagery dates varied somewhat. The classification follows the Yangambi classification and resulted in 2km cells with no gaps between. The latter implies that no edge matching needs to be done. Stakeholder feedback by NGOs and decision makers (March, 2015), has generally been positive.

Individual countries participated in trainings and were supposed to follow-up to map their own countries and present at a central ARC meeting. For the moment, all countries are on track to be completed by Sept. 2015. USGS stated that, by the end of May 2015, Sierra Leone, Liberia, and Côte d'Ivoire should be completed.

During the interview process at USGS, the Integra team found that an enormous amount of labor and precision had been put into the land cover product, with expert attention to cloud cover, instrument resolution and adaptation of the Yangambi classification scheme to meet local needs. However, the product lacks formal error estimates and it is hard to review the 2km land cover product in a quantifiable fashion. Product training and error estimation is feasible, though (DeFries, 1998).

With 1km or better resolution imagery being the standard for most regional to global land cover products, the USGS 2km guide land cover product is questionable. Currently, there are a wide variety of 1km products that have been peer reviewed and validated (including Brovkin, 1997; Hansen, 2000, 2000, 2003, 2003, 2005, 2006; Homer, 2004; Justice, 1998, 2002; Lambin, 2006, Loveland, 2000; Olson, 2002; Stuckens, 2000; White, 1976, 1993; Zhan, 2000). Improvement of the 2km end-product resolution is appropriate and was affirmed in the USGS interview process.

The product's use of RLCM and a hybrid/supervised classification approach, as opposed to largely unsupervised alternatives, does not innately take away from its quality. Reliance on the expert knowledge of mappers, combined with use of Google Earth or other ancillary imagery, can lead to excellent land cover products (Dweyer, 1996).

The pixel-to-pixel registration process, along with the use of phytogeographic classification system, make the product appropriate for the assessment of large-area land cover change assessment (Colwell, 1981; Coppin, 2004; Hall, 1991).

As acknowledged by USGS, a shortcoming of the product is its lack of ability to adequately portray sub-canopy dynamics. Further research needs to be done on this and could be accomplished in tandem with the NACs.

Further land cover research could also be conducted into landscape or other scale fragmentation (DeFries, 2005). Of principal concern are the relationship between fragmentation and species (Laurance, et al. 2002). Potential avenues for research include information on habitat viability by correlating patterns of fragmentation with the spatial requirements of categories of species linked area or dispersal-limited species (DeFries et al., 2005; Noss, R.F. 1997). In addition to assessing the impact of fragmentation on *types* of species, on *specific* species (Bierregaard, et al., 2001).

1km Land Cover

The project was designed so that, after attending USGS training workshops, NAC attendees would return to their countries and would begin work on high quality local products. ARC is tasked with facilitating the 1km product. The 2km product will likely be included in the Atlas as the 1km product will not be ready.

The review of the 1km land cover products found that:

- The target entities for capacity building varied dramatically in their initial abilities and willingness to learn, therefore a pre-screening of participants would have been ideal.
- Due to lack of funding, there was a reported lack of incentive on the part of some NACs to continue the mapping process. Others were enthusiastic and integrated the mapping into their national mapping processes.
- Countries varied in their ability to consume the training. Some lacked fundamental computer or geography skills.
- In some cases, NACs experienced turnover.
- In many cases, candidates required more training than could be provided in the time allotted.

The end result was that the 1km products vary greatly in their quality. The impact, then, is that the potential for bi-directional feedback to USGS is lost. In addition, this variance negatively affected the hotspot process and the Atlas.

Regional Satellite Baseline Imagery

In line with the requirements of the PAPA, USGS delivered the Landsat remote sensing imagery to ARC and to the NACs at the training sessions. According to USGS, they also delivered ASTER and Corona imagery free of charge.

Hotspots

The hotspots were meant to compliment the wall-to-wall mapping by drilling down to more local scales. The hot spots gave a narrative for land use land cover change anomalies. USGS worked with the NACs to develop 2 positive hotspots and 1 negative hotspot per country. The rational was that it is easy to detect negative hotspots but positive ones are relatively difficult and hold important lessons. However, what constituted "positive" and "negative" remained largely undefined.

For the positive hotspots, the goal was to answer the question of why the success stories are working. What does this look like in the imagery? A big example is the regreening of southern Niger.

The structure for the hotspot collection was as follows:

1) The NACs would identify two positive hotspots and one negative hotspot per country. This was driven by expert change narrative, not formal monitoring and assessment. USGS did not look

for economic success but biophysical success, one constraint then being they could not see health or economic indicators. The NAC participants built on their personal experience for the narrative development.

2) Three hot spots per country yielded approximately 50 overall. This was too many hotspots for field validation so the 50 hotspots were addressed using desktop analysis. USGS and their partners then picked three hotspots in the region for intensive study to provide scalable lessons for use elsewhere in Africa. The three hotspots chosen were:
    a. Cape Verde cloud forest – USGS
    b. Ghana – CILSS
    c. Togo – cashew production – NAC

The workflow for the 50 hotspots was as follows:

1) Collective knowledge e.g. the resilience of nature to come back.
2) Procure the Landsat.
3) The guide maps (for 2 periods min).
4) Change masks.
5) The MODIS 250m mean of the annual maximum, 2001 to 2013 was used to approximate phytoproductivity. Alternatives such as NPP, EVI, fPAR were not evaluated.
6) The NACs said they thought "these are the hotspots we think are useful".
    a. Gray's team helped narrow this down to 3.
7) Some of the teams did the follow-ups.
8) Cape Verde was one of the in-depth hotspots. USGS took the lead on this. Ghana was led by CILSS (this was related to the use of water and dams and irrigation, they did not address the negatives of damns). The Togo team took the lead on the third (tapping cashew production).
    a. The Cape Verde hotspot is unique but could be scaled up to the other islands.
9) The major inputs from above were collective knowledge, Landsat and anecdotal.

As part of the hotspot assessment,

1) There was text discussion of drivers, narratives collected from the national teams.
2) A social scientist was hired to help with the questionnaires for the three major hotspots.
3) There is no GIS data for the hotspots.
4) There are paired image outputs.

Currently, there are hotspots done for 10 countries and the 3 major ones are finished. There are, however, several major issues with the manner in which the hotspot products were developed:

Definitions: The word "hotspot" is not adequately defined in the context of the project. There are many definitions of a hotspot, across multiple scales, in the literature, e.g. a "hotspot is defined as existent or potential change to a region or area through land cover and land use change that has regional to global implications" (UMD, 2015).

Traditional, contemporary hotspot studies would focus on the following areas (Lambin, 2006, UMD, 2015):

- Afforestation/Reforestation/Deforestation (Lepers, 2005; Skole, 1994; Verchot, 2007)
- Infrastructure
- Agriculture (Carreiras, 2006)
- Dryland Degradation (Bai, 2007)
- Glacial Retreat (IPCC, 2001)
- Wetlands Loss (Cowardin, 1979; OECD, 1996)
- Urbanization (Todd, 1977; UNFPA, 2007)
- Protected Areas (Chape, 2005; Cole, 1997)
- Biodiversity Loss (Noss, 1987)
- Fire and Burned Areas (Roy, 2002)
- Floods and Other Disasters

Use for Decision making: As proposed by USGS, hotspots can be effective to illustrate change and impact to decision makers (Aspinall, 2008). This requires strict attention to biophysical processes and, at the regional scale, the ability to integrate across a wide variety of hotspot types. With USGS, there is no explicit attention to this issue and to the enormous body of literature and methodology on fire, agriculture, classification of ARD hotspots, biodiversity hotspots etc. A sophisticated, standardized approach to hotspots is necessitated. While some decision makers may find the hotspots useful in the short-term, there is a responsibility to be methodological.

Scalability: The goal of the hopespots was to identify lessons learned that are scalable to other areas within Africa. There is no evidence to support this use of positive hotspots, although that is not to say it isn't feasible.

Objectivity and Representativeness: The methodology for identifying, assessing and scaling hotspots is arbitrary and not supported in the literature. Furthermore, given the diversity of types of hotspots, there is no standardized sampling of the hotspots or strategic focus on particular types of hotspots.

Metrics and Measures: Some of the components in the process emphasize qualitative over quantitative assessments and others, such as the use of max NDVI, are not sufficiently justified relative to their alternatives such as NPP or LAI. The remote sensing "chain" involved in the hotspot identification process does need to be revised for future use (Schott, 2007).

The hotspots were at their highest levels identified as "anomalies". However, there was no quantitative threshold that defined an anomaly.

Data Record: There are, however, no spatial data elements for the change areas. These need to be generated for the long-term change record but this activity is currently not in-scope. When done properly, the hotspots are extremely valuable at the regional level and it is recommended that the knowledge gathered to date be extended to include geospatial data. The hotspots could also be extended to relate to land management methods.

Value: What innovation has USGS bought to the hotspot approach? USGS asserted that it was the demonstration that knowing the field really helps.

Conclusions concerning the hotspots include:

- An upfront, representative, objective and defensible set of definitions would have benefited the analysis.

- The USGS hotspots are not hotspots in the conventional sense. This is not necessarily bad requires sufficient justification.
- The hotspot selection was not based on scientific performance metrics but rather of qualitative development goals. This was not stated upfront.
- Potentially, the hotspots **could** scale and be useful as development tools. The degree to which this is true needs to be determined. Additional ENRM research is warranted.
- Some countries lacked the capacity for in-depth hotspot analysis.
- The hotspots need standardized geospatial data layers.
- The input remote sensing methodology for the hotspots is arbitrary. It is unknown where the effect (known regreening) was put before the cause (developed an arbitrary RS model to prove the point)?

The recommendation is to address the above concerns. For example, the hotspot thresholds need to be quantitative, with proven methods and the uncertainty as to the scalability of the findings needs to be addressed.

General Review Comments

Input Data

USGS made use of the best available input Landsat data for its project. Landsat L1T (Irish, 2000) was the primary input data although Corona, Google Earth and high resolution imagery were also used. In certain cases, ASTER and MODIS (for the hotspots) were also used. Standard Landsat L1T data has the following characteristics:

Correction level - L1T*

- Pixel Size - 15, 30, 60 meters for panchromatic, VNIR/SWIR, and thermal
- Resampling kernel - Cubic Convolution (CC)
- Map projection – UTM with Polar Stereographic projection used for Antarctica scenes
- Ellipsoid - WGS84
- Image orientation - north up
- Output format – GeoTIFF (GeoTIFF is notable because it opts for usability and compatibility with ArcGIS over the more sophisticated data stacking and integration options found in HDF and other formats)

Resolution and Scale

The USGS learned an important lesson in that it had mapped its product at 2km when most users required maps at 1km or higher resolution. Currently, there are a wide range of high quality, validated 1km global land cover products, e.g. DeFries, Hansen, Townshend, & Sohlberg, 1998; Hansen, DeFries, Townshend, & Sohlberg, 2000; Loveland et al., 2000, Sayre, 2013. As supported by application studies using the previous products, 2km and coarser resolution products are constrained by inadequate resolution. USGS does acknowledge the need for a 1km product and that it should have been identified in the early stages of the project.

The statistical conclusions derived from the USGS 2km land cover product should, however, be consistent with those derived from higher resolution products. Nevertheless, a higher resolution product is both viable and desirable.

In addition to higher resolution, the USGS maps could have made use of integrated resolutions. For example, the RLCM could potentially be extended to integrate multi-resolution and multi-theme inputs that would address climate and ecosystem issues, e.g. the global, regional and local scale products integration effort below. The downside of more sophisticated data synthesis approaches to land cover mapping is that user training becomes more complex and a dichotomy develops between map quality and mapper quantity.

Yangambi Classification Description

To this day, there remains a need for a standardized classification system. There have been multiple efforts to this end and, for reasons outside the scope of this paper, none of them completely harmonize or scale.

The Yangambi classification (Aubréville,1957; Trochain, 1957) was applied to all of the USGS land cover products. The Yangambi classification system is a, phytogeographic classification system. It is structural, as opposed to functional. It is designed to portray regional land cover in tropical West Africa and the geography of its plant species, e.g. number and height of stratified woody tree density.

Participants were given a guide book developed by the USGS and designed to help trainees apply the classification system to their countries. Local adaptations of the system were provided, alongside image examples. The system draws distinction between rain-fed and irrigated agriculture, fallow ground, fruit tree crops, market gardening, fire, etc. All of these can be particularly challenging to remote sensing interpretation at the introductory level.

For its time and in its region, the Yangambi classification represented a best-effort attempt to standardize landcover in tropical West Africa and, to a large extent, it does so. However, when extended beyond its intended geographic and ecological scope, some of its classes become superfluous or fail to address salient land cover dynamics. The phytogeographic regions change dramatically beyond the West African project area. (White, 1983).

The Yangambi standard predates satellite remote sensing. As such, some of the classes were found to be spectrally ambiguous (Anderson, 1976; Di Gregorio, A. & Jansen, L.J.M., 1997; Kottek, 2006; Lambin, 1997, 2006; Prentice, 1992; Running, 1993). As a result, multiple classes were combined and multiple other classes added, e.g. bamboo and mangroves.

Having a robust set of principles to guide differentiation between land cover and land use is necessary to support comprehensive and unconvoluted mapping. A criticism of the Yangambi classification system is that, within the context of the project, little guidance is provided into rule-based divisibility of land cover classes.

The Yangambi classification includes a number of classes of regional relevance. The delineation of a thicket class is unusual (although this is included in the FAO LCCS (DiGregorio, 1997) and is valuable for examining afforestation, reforestation and deforestation (ARD), biodiversity and aboveground biomass. Another class of regional significance is the gallery forest class, with gallery forests representing some of the region's richest forest biodiversity.

In sum, is the land cover classification optimized to meet the needs of the project? The classification is intended for use mainly in tropical West Africa. The PAPA stretches outside this region and the classification should be harmonized to work for all CILSS countries. The Yangambi classification should also be harmonized with other contemporary classifications (Hibbard, 2010; Loveland, 1999; Sayre, 2013; White, 2002; Zhu, 2013). No quantitative measures are given to spectrally or statistically delineate land cover classes.

Error and Uncertainty

A significant shortcoming of the 2km and derivative products is that to date no formal error or uncertainty analysis has been conducted. Foody points out that accuracy assessment of large scale land cover products is a necessity and is, in many cases, lacking (Foody, 2002; Loveland, 1999).

It is normal for professional remote sensing products to have an accompanying error estimate (Khorram, 1999; Song, 2003). This is often reflected as a root mean squared error (RMSE) although other options, such as a confusion matrix are also available (Foody, 2002; Smits, 1999; Stehman, 1997).

The lack of firm RMSE or other scientific error quantification prevents comparisons to other products or methodologies. USGS did state they have begun planning for publication of their 2km product and that an error estimate would accompany it. However, this should have been scoped for in the initial product design. It is highly probable that such additional work would have come at increased cost to the project.

The lack of formal error and uncertainty measures does not make the product useless; it merely means that the product results will always have to be accompanied by the statement that the product is based on qualitative field observations and anecdotal comment. It also implies that the methodology used to generate the product cannot be quantitatively demonstrated to yield comparable or superior results to other mapping approaches, e.g. other hybrid or unsupervised classification systems.

Uncertainty and error measurements frame the reliability of statistics derived from land cover products. If the error estimates were given, the USGS product could quantitatively be used to enhance accuracy of decision support systems. This is essential to ensure the effective application of the product to decision making.

Recommendations include:

- It will be useful to facilitate an error and uncertainties estimation effort.
- This effort should address the issue of not just errors/uncertainties inherent in present products but also study implications for future application of the RLCM tool.
- Error estimates should be conducted not just for each spatial and temporal product, but also for each land cover class.
- Different error estimation metrics should be compared, for example RMSE or a confusion matrix.

Metadata

Product metadata followed standard ESRI ArcGIS ISO metadata standards and is compliant with the 19115-2 standard. In order to accommodate the widest range of users possible, it may be worth providing multiple metadata formats, e.g. FGDC, ISO.

Science Review Questions

Context and Introduction

Is the product introduced in such a way that individuals not familiar with the immediate field may utilize it in their application area or decision making process?

The RLCM pixel training sessions, along with the USGS FAQs (USGS, 2015), provides an excellent introduction to trainees and decision makers alike. That said, additional product documentation in the form of a extended manual and summary for decision makers would be helpful (Williams, D., 2005).

Are the reasons for performing the study clearly defined?

Land cover products may be interpreted and applied in multiple ways, and it is important to understand their strengths, limitations and intents. An example would be the misapplication of an inventory product to a climate product. The study objectives were well defined in the PAPA, but they evolved during the

course of the project. In addition, confused objectives resulting from the overlapping mapping and capacity building mandate led to confused project execution.

Methods/Rigor

Are the methods used appropriate to the aims of the study?

The methods used were suitable for the study and training sessions. However, issues related to expiration of software licenses, limited hardware resources and poor connectivity compromised the use of RLCM. Additional findings include:

- The Yangambi classification system should be revised and adapted as appropriate in contemporary needs (Sayer, 2013).
- The use of a supervised classification system is not necessarily preferable to an unsupervised classification system and is, in some cases, preferable, e.g. speed, incorporation of expert knowledge, etc.
- Training session participants reacted largely favorably to the RLCM.

Are the Input Data Appropriate for this Investigation?

USGS Assessment	Finding
Is the data relatively cloud free?	Didn't use a cloud cover threshold. It was best available. They did a lot of fill-in.
Is there missing data in the time series and if there is, have appropriate substitutions been made or identified?	There were some areas with multiple image acquisitions used for fill. Landsat MSS was the worst quality.
Is the data at the best possible resolution for the product? Are the recommendations for the future?	ASTER and Landsat were used with high resolution in some cases (RISE more so). The **Input** imagery was adequate, but the 2km output cells are severely degraded.
Are there input data that would improve the classification?	There are alternate data sets that could improve the analysis. See the section on high-resolution imagery.
Are the input sensors capable of detecting land dynamics in the area?	Not all of them. For example, the use of Landsat results in some aspects of the land system being hard to detect. For example, land reflectance is easy to calculate, but assessing vegetation fluorescence is not.

Is the Land Cover product of sufficient quality?

USGS Assessment	Finding
Is the land cover classification consistent with contemporary methodologies?	No. Gray's method is qualitatively compelling, but it does not have a rigorous method for quantitatively demonstrating its superiority relative to other methods. Indicating Error/uncertainty levels would help remedy the situation.
Is the land cover classification consistent with internationally accepted standards and are these documented?	The standard is an accepted standard from the 1950s, agreed upon by local governments. Standard: Yangambi
Is class membership defined within sufficient confidence levels?	An error analysis. USGS completed an error analysis independently against hi-resolution. This was just well done. There is no report on it. When this goes into peer review then the accuracy has to be addressed. The plan is to: take a random selection of points across west Africa. Then verify it with high-resolution.
Are error margins well documented?	No, these will be completed prior to publishing.
Is class membership well validated in the field?	No. However, image pairs were used along with land use imagery.
Is class membership well reviewed by experts?	Specific to Senegal: The Senegalese LULC classification is based on video, imagery, experts. The Senegalese original maps were published in peer reviewed pubs. Incl. the special issue.
Are the classification algorithms well documented?	Yes.
Is the choice of the classification training algorithms representative of best available methods?	There is no publication comparing it to unsupervised classifications. USGS understands this is a weak statement. He will publish on the RLCM tool, perhaps twice. One paper on method, one on the results.
Was the classification done in a cost effective and efficient manner?	Assuming a cost-benefit approach, it is very cost effective. Because: accuracy of supervision outweighs cost. Inaccuracy of unsupervised is not cost effective. USGS has been able to do 3 time periods.

Was the classification done in a way that built capacity with ARC and CILSS member countries?	USGS stipulated in the affirmative. As an initial capacity building exercise, it was a "lessons learned" experience. A sophisticated comprehensive approach to capacity building is recommended for subsequent efforts.
Is land cover and land use sufficiently parameterized and differentiated?	USGS asserts that they confidently differentiated classes in LU. They would have liked to add more ag sub-classes in production systems and on-farm trees in ag versus not. This is a limitation of the sensor. Secondly, they would have liked to go to a more detailed savannah class set. This assertion is contrary to my findings re. the use of formal land use/cover delineation.
Are the LCLUC maps linked to meaningful statistical findings?	In some cases, yes. Introductory statistics have been provided in the USGS FAQs.
Do the forest land cover classes reflect sub-canopy dynamics?	Not really. This is stated as such. They remind their users there is a lot being done. But they have the image pairs.
Is it possible to infer meaningful information about biodiversity and habitat from the classification?	Yes. Gallery forest is a good example. Fragmentation is a good way to move forward.

Have the proposed methods been systematically applied to the entire product line?

Is sufficient information provided for a capable researcher to reproduce the product or add to its legacy?

Ongoing support to expand the RLCM and land cover classification user base is necessary. The "train the trainers" program needs to be extended if the project is going to sustain itself into the future. In addition, stakeholders will require data access and product updates. Currently, many of the concepts and subtleties of the system are undocumented. The implementation of a formal knowledge management system is recommended. Licensing restrictions and incremental cost increases could compromise the validity of a long term record. Therefore, a transition to open source applications and open data is also desirable.

Are additional studies required to validate the results?

As discussed above, it is necessary to validate the products through an investigation into their quantifiable uncertainty and error margins. The investigation may use multiple metrics, but the objective should be to provide a basis for comparison with other validated land cover products.

Are quantitative studies available to support product validation, meta-analysis and comparison?

There are a range of studies that have been conducted in the region that would assist in the product validation process. These include an image archive developed by Gray Tappan that carefully depicts land cover change.

Are there additional elements that would improve the quality of the product?

As mentioned, the land cover product is a high quality product. The 1km product varies, and the hotspot product is difficult to evaluate. The Quality of the 2km product could be improved through increased resolution, modernizing the classification system, updated metadata, and scholarly publication and evaluation. In addition, an in-depth comparison and contrast study is required. The quality of the 1km product could be improved by an increase in the competency of mapping participants and an increase in the availability of HICD resources. The quality of the hotspot product could be improved through a reassessment of the design approach. At present, the hotspots are illustrative and prescriptive. A revision could defer to a standardized, systematic approach to hotspot identification and analysis.

Was the methodology periodically revisited and were any issues addressed to USAID and, inversely, to the project?

From the USGS perspective, the methodology was revisited, periodically, in an ad-hoc manner. For example, modifications were made to incorporate QGIS, ArcGIS Online and, in certain cases, classes were modified to fit the needs of individual national concerns. Periodic and systemic re-evaluations of the methodology and science deliverables were absent from the project design. USGS did submit regular status reports to USAID, but a USAID mid-term M&E was not exercised.

Per the conclusions reached in the main report, communications between all parties – USGS, USAID and AGRHYMET – were lacking. In addition to a variety of topical concerns, the now-evident concerns re. the 1km product should have been communicated to USAID.

Are references given where appropriate?

The available PowerPoint literature and FAQs are largely self-referential. The Yangambi training literature lists some seminal references but does reference introductory or background publications on classifications.

Results

Are the results clearly presented and formatted?

The products have been presented in multiple formats and in multiple venues throughout the lifespan of the project. These include in digital land cover products, presentations, training seminars in French and English, as PDFs, paper products, etc. When paper maps were available for the USGS products, they were excellent. (Table 1)

The final products are not complete at this time, and therefore this question is not entirely applicable. It is anticipated that the final products will be presented according to the PAPA requirements and in GeoTiff. Ideally, however, the products should additionally be ingested into both the USGS and USAID data disbursement programs. They should be documented through peer review, and they should be available in multiple formats, e.g. HDF.

Table 1: Cartographic review of USGS paper maps

USGS Assessment	Finding
Do the maps meet cartographic standards?	Yes. USGS standards are very strict and to the point. The legend is exceptional and exceeds expectations. The locator maps are high quality and informative, applicable at the local level. The locator maps can also be used to locate classes e.g. a locator map to look at an infrequent class.

Are the cartographic standards user accessible?	Yes.
Is the map in the right projection for the regional study?	The map is a subset of the lambert equal area. Its metadata is not current and it is a customized projection so metadata needs to be generated for the custom projection. USGS is aware of this and will finish before completion.
Are the maps multi-lingual?	Yes. Some maps destined for an English audience are solely English. But most are both English and Francophone, suitable for workshops.
Are the maps usable by stakeholders?	They are more detailed than usual ones and feedback is positive in this sense.
Is there a good visual hierarchy within the map?	Sometimes, depending on the map. There are non-political boundaries such as protected areas within some of the maps. USGS plans to vectorize and include a significant data set that descripts thousands of inhabited places in Senegal.

Are figures, geospatial products presented in a way that can be integrated into documentation and decision support?

Although the final products have not yet been completed, it is evident that a wide range of derived products would be helpful to the NACs, as well as to AGRHYMET. For example, it would be extremely useful to have value-added statistical information available for decision makers. Figures and illustrations submitted thus far to the Atlas generation process tend to illustrate the agenda that accompanies the hotspots, e.g. *hopespots* over systematic identification of standardized hotspots.

Are there results, graphics, figures, etc. that were omitted or would add value?

Graphics, figures, charts and statistics need to be generated based on the final land cover products.

Have appropriate statistical methods been implemented?

As stated, there is a lack of an appropriate statistical assessment of error. In addition, statistical change findings should be implemented and reported.

Are conclusions well-supported or exaggerated?

In the context of science research, little has been done in the way of drawing defensible conclusions. The hotspots are essentially the conclusions of the land cover change found in the 2km and 1km products. Their methodology remains unclear and requires peer review and, minimally, publication of the Atlas.

Has the data been sufficiently analyzed?

The land cover products require additional analysis. Priority research questions include:

- Is the classification appropriate for application West Africa and, if not, how does the classification need to be adapted?
- What are the regional and local change statistics associated with the products?
- What errors are associated with the classification and, potentially, propagated through the classification system?

- How can the RLCM be improved?
- How can the RLCM be reduced to minimize implications for the HICD process?

Discussion

Are all possible interpretations of the data considered or are there conflicting hypotheses that are consistent with the existing data?

This question is most relevant when taken within the context of land cover change. Once all regions are complete, the change data need to be properly interpreted and causation properly attributed.

In addition, the hotspots (or "hopespots" for hotspots showing positive change through improved management) represent fieldwork by the national entities. It is possible that conflicting hypotheses could be developed for individual hotspots. In one case, a country mission went to investigate a hotspot and determined that its cause was completely different. In the future, hotspot analysis should be systematically assessed for accuracy and representativeness.

Are the findings supported by the published literature?

The final product is unfinished and most of the preliminary work is unpublished. Some internal USGS review has taken place. In addition, the work has not addressed past critiques of this type of work, e.g. FAO 2000.

The USGS has authored a number of FAQs that are detailed in their findings. However, they function as stand-alone products and do not adhere to the same standards as the science literature. The FAQs do, however, make a case for the product, including citations.

What are the product limitations? Are they discussed?

Although not comprehensively, USGS did share limitations of their product:

- Land cover classification limitations
- Single study area project management
- How to manage multiple study areas in a database
- How to manage multiple study areas in an ArcMap project
- Performance issue with large datasets (>200K records)
- Needs some user interface enhancements:
- Image Library Console, Attributer, and more

These limitations pertain mainly to the RLCM. Similar issues and shortcoming need to be identified for the land cover and hotspot products. This is essential to ensure confident use by decision makers. It is, for example, possible that a decision maker might not fully grasp the implications of sub-canopy degradation in land cover change and that this needs to be explicated. This is even more so the case if connections are to be drawn between the regional land cover product and complex issues such as climate change. Finally, the 2km product maps depict change, not necessarily subtle change.

Significance

Does the product make a valuable contribution to USAID development priorities in the region?

Yes. The land cover product is unique in its attention to detail. The 1km products rely on a large amount of in-situ and expert knowledge. Most of all, the product will provide important baselines for future land cover and land use monitoring the Sahelian region (DeFries, 2002, 2005). Furthermore,

although there were issues with the hotspot approach, it represents a novel method of extracting success stories and potentially applying success stories to other areas within Africa.

Does the work represent an advance over past work in the region?

The land cover, especially in time series, and hotspot products are improvements over much of the work in the region and are an alternative to the "broad brush" approach of global data sets. For example, most global products at the 1km resolution do not address highly specific, regional, land cover classes such as gallery forest and do not incorporate local knowledge. That said, some approaches such as that presented by Sayre, 2013, do allow for detailed approaches to regional and ecosystems.

RLCM, however, presents a value-first add-on for ArcGIS. The classification method is not, in itself, novel and comes standard in most remote sensing software. An advance could be made, however, if RLCM were provided as open source to QGIS.

Conclusions and Recommendations

The following conclusions are drawn based on the preceding analysis as well as the report text:

- The geospatial PAPA deliverables seem to be on schedule for delivery but in some cases were hampered by:
- Project design constraints
- Training design constraints
- The 2km USGS product and overall RLCM output products meet with an acceptable level of scientific rigor with the following qualifications:
- Quantification of product uncertainties needs to be determined
- Comparison to alternate methods needs to be conducted
- Open data remains an issue, but a comprehensive open data plan with goals, a timeline, connectivity solutions are required. Without this, most participants do not prioritize open data.
- The image pairs at USGS need to become public domain.
- The NACs require representation in standards-making bodies.
- The relationship between USAID ADS 579 and USGS open data policy needs to be determined.
- Transfer from ArcGIS to QGIS or another open source platform.
- Party-level capacity could be further increased by:
- Social networking, including to a more diverse user group e.g. university, NGOs and out-of-CILSS groups.
- Development of a knowledge base
- Repeated and more intense training
- Outreach and education to decision makers
- Party and regional capacity could be increased by interoperation with intergovernmental science and development efforts.
- Parties are in desperate need for both reliable land use/land cover data and for enhanced geospatial HICD. As such, these deliverables should not be linked or to the exclusion of each other, lest the potential exist for low-capacity Parties to have no access to high quality geospatial products. The

project, as structured, depends on low-capacity countries to produce high-quality products. Figure 13 illustrates an updated approach to this quandary.

- At points throughout the project execution there were breakdowns in the communication between the cooperating entities. This was further complicated by a change in management structure midway through the PAPA execution. In many cases, entities did not share the same development philosophy or even vocabulary. Increased communication between project entities could have positively influenced this. In addition, a PAPA with more concrete deliverables would have made project expectations clearer.
- A regional validation network should be facilitated. This will enable cost-effective error and uncertainty estimates based on in-situ measurements. (Morisette, 2003)
- The data and knowledge accumulated in the project are extremely valuable. It is essential that they be integrated into a knowledge base and become part of the long term record.
- In addition to the previously mentioned fragmentation study activity, it is worth revising the hotspot activity to address specific thematic issues such as biodiversity (Innes, 1998) and degradation (Ayyad, 2003; Johnson, 2007).
- The concept of scaling up findings from positive hotspots for application in other areas merits review and further study. For example, if re-greening activities that were successful in one area could applied elsewhere, the hotspot scaling activity could be an effective tool.

References

Anderson, J., E. Hardy, et al. (1976). "A land use and land cover classification system for use with remote sensor data."

Aspinall, Richard J. & Hill, Michael J. (2008). Land use change : science, policy and management. Boca Raton, FL : CRC Press

Ayyad, M.A. (2003). Case studies in the conservation of biodiversity: degradation and threats, Journal of Arid Environments, 54 (2003), pp. 165–182.

Bai, Z.G., Dent, D.L., Olsson, L. & Schaepman, M.E. 2008. Global assessment of land degradation and improvement. 1. Identification by remote sensing. Report 2008/01, ISRIC – World Soil Information, Wageningen.

Bierregaard, R.O., et al., eds., (2001). Lessons from Amazonia: the ecology and conservation of a fragmented forest. Yale University Press, New Haven, Connecticut. xv + 478 p.

Boardman, J. and F. Kruse (1994). Automated spectral analysis: a geological example using AVIRIS data, North Grapevine Mountains, Nevada, ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN.

Brovkin, V., A. Ganopolski, et al. (1997). "A continuous climate-vegetation classification for use in climate-biosphere studies." Ecological Modelling 101(2-3): 251-261.

Carreiras, J. M. B., J. M. C. Pereira, et al. (2006). "Assessing the extent of agriculture/pasture and secondary succession forest in the Brazilian Legal Amazon using SPOT VEGETATION data." Remote Sensing of Environment 101(3): 283-298.

Chape, S., Harrison, J., Spalding, M. and Lysenko, I. (2005). Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets. Phil. Trans. R. Soc. Lond. B, 360(1454): 443-455.

Clark, D., J. Read, et al. (2004). "Application of 1-m and 4-m resolution satellite data to ecological studies of tropical rain forests." Ecological Applications 14(1): 61-74.

Cole, E.K., Pope, M.D. & Anthony, R.G. (1997). Effects of road management on movement and survival of Roosevelt elk. Journal of Wildlife Management 61:1115-1126.

Colwell, J. and F. Weber (1981). Forest change detection.

Coppin, P. and M. Bauer (1994). "Processing of multitemporal Landsat TM imagery to optimize extraction of forest cover change features." IEEE Transactions on geoscience and remote sensing 32(4): 918-927.

Coppin, P. and M. Bauer (1995). "The potential contribution of pixel-based canopy change information to stand-based forest management in the northern US." Journal of Environmental Management 44(1): 69-82.

Coppin, P., E. Lambin, et al. (2004). "Digital change detection methods in ecosystem monitoring: a review." International Journal of Remote Sensing 25(9): 1565–1596.

Cowardin, L., V. Carter, et al. (1979). Classification of wetlands and deep-water habitats of the United States, US Department of the Interior/Fish and Wildlife Service.

DeFries, R., M. Hansen, et al. (1998). "Global land cover classifications at 8 km spatial resolution: The use of training data derived from Landsat Imagery in decision tree classifiers." International Journal of Remote Sensing 19.

DeFries, R. S., L. Bounoua, et al. (2002). "Human modification of the landscape and surface climate in the next fifty years." Global Change Biology 8(5): 438-458.

DeFries, R., A. Hansen, et al. (2005). "Increasing isolation of protected areas in tropical forests over the past twenty years." Ecological Applications 15(1): 19-26.

DeFries, R., et al. (2005). Analytical Approaches for Assessing Ecosystem Condition and Human Well-Being. In: Millennium Ecosystem Assessment Working Group on Conditions and Trends, R. Schole and H. Rashid (eds.), Island Press, Washington, D.C.

Di Gregorio, A., & Jansen, L.J.M. 1997. A new concept for a land cover classification system. Proceedings of the Earth Observation and Environmental Information 1997 Conference. Alexandria, Egypt, 13-16 October 1997.

Dwyer, J.L.; Sayler, K.L.; Zylstra, G.J. (1996). "Landsat Pathfinder data sets for landscape change analysis," Geoscience and Remote Sensing Symposium, 1996. IGARSS '96. 'Remote Sensing for a Sustainable Future.', International , vol.1, no., pp.547,550 vol.1, 27-31 May 1996

Foody, G. M. (2002). "Status of land cover classification accuracy assessment." Remote Sensing of Environment 80: 185-201.

Hall, F., D. Botkin, et al. (1991). "Large-scale patterns of forest succession as determined by remote sensing." Ecology: 628-640.

Hansen, M., R. DeFries, et al. (2000). "Global land cover classification at 1 km spatial resolution using a classification tree approach." International Journal of Remote Sensing 21(6): 1331-1364.

Hansen, M.C., R.S. DeFries, J.R.G. Townsend and R.Sohlberg (2000). Global land cover classification at 1 km spatial resolution using a classification tree approach. International Journal of Remote Sensing. Vol. 21, No. 6 & 7, pp 1331-1364.

Hansen, M.C., et al. (2003). Global Percent Tree Cover at a Spatial Resolution of 500 Meters: First Results of the MODIS Vegetation Continuous Fields Algorithm. Earth Interactions 2003 7: 1-15.

Hansen, M., R. DeFries, et al. (2003). "Global percent tree cover at a spatial resolution of 500 meters: First results of the MODIS vegetation continuous fields algorithm." Earth Interactions 7(12345678910111131214): 1-15.

Hansen, M. C., J. R. G. Townshend, et al. (2005). "Estimation of tree cover using MODIS data at global, continental and regional/local scales." International Journal of Remote Sensing 26(19): 4359-4380.

Hansen, M., R. DeFries, J.R. Townshend, M. Carroll, C. Dimiceli, and R. Sohlberg (2006). Vegetation Continuous Fields MOD44B, 2001 Percent Tree Cover, Collection 4, University of Maryland, College Park, Maryland, 2001.

Hibbard, K., Janetos, A., van Vuuren, D. P., Pongratz, J., Rose, S. K., Betts, R., Herold, M. and Feddema, J. J. (2010), Research priorities in land use and land-cover change for the Earth system and integrated assessment modelling. Int. J. Climatol., 30: 2118–2128. doi: 10.1002/joc.2150

Homer, C., C. Huang, et al. (2004). "Development of a 2001 national land cover database for the United States." Photogrammetric Engineering & Remote Sensing 70(7): 829-840.

Huang, C. Q., J. R. G. Townshend, et al. (2002). "Impact of sensor's point spread function on land cover characterization: assessment and deconvolution." Remote Sensing of Environment 80(2): 203-212.

Huang, C., B. Wylie, et al. (2002). "Derivation of a tasseled cap transformation based on Landsat 7 at-satellite reflectance." International Journal of Remote Sensing 23(8): 1741-1748.

Huang, C. and J. R. G. Townshend (2003). "A stepwise regression tree for nonlinear approximation: applications to estimating subpixel land cover." International Journal of Remote Sensing 24(1): 75-90.

Innes, J. and B. Koch (1998). "Forest biodiversity and its assessment by remote sensing." Global Ecology and Biogeography Letters: 397-419.

IPCC, Intergovernmental panel on climate change. "2.2.5.4 Mountain glaciers". Climate Change 2001 (Working Group I: The Scientific Basis).

Irish, R. (2000). "Landsat 7 science data users handbook." National Aeronautics and Space Administration.

Johnson, D.L,. & Lewis, L.A. (2007). Land Degradation: Creation and Destruction, 2nd edition, Rowman and Littlefield, Lanham, Boulder, New York, Toronto, Oxford, 2007.

Justice, C., E. Vermote, et al. (1998). "The Moderate Resolution Imaging Spectroradiometer(MODIS): land remote sensing for global change research." IEEE Transactions on geoscience and remote sensing 36(4): 1228-1249.

Justice, C. and J. Townshend (2002). "Special issue on the moderate resolution imaging spectroradiometer (MODIS): a new generation of land surface monitoring." Remote Sensing of Environment 83(1-2): 1-2.

Kauth, R. and G. Thomas (1976). The tasselled cap- A graphic description of the spectral-temporal development of agricultural crops as seen by Landsat.

Khorram, S., G. Biging, et al. (1999). "Accuracy assessment of remote sensing-derived change detection." Photogrammetric Engineering and Remote Sensing: 321-331.

Kottek, M., J. Grieser, et al. (2006). "World Map of the Koppen-Geiger climate classification updated." Meteorologische Zeitschrift 15(3): 259-264.

Lambin, E. and D. Ehrlich (1997). "Land-cover changes in sub-Saharan Africa(1982-1991): application of a change index based on remotely sensed surface temperature and vegetation indices at a continental scale." Remote Sensing of Environment 61(2): 181-200.

Lambin, (2006). Land-Use and Land-Cover Change. Local processes and Global Impacts. Lambin, E.F. and H.J. Geist (Eds). The IGBP Series, Springer-Verlag, Berlin, 2006, 222 pp. (A synthesis of LUCC science)

Laurance, W.F., T.E. Lovejoy, et al. (2002). Ecosystem decay of Amazonian forest fragments: A 22-year investigation. Conservation Biology 16(3): 605-618.

Lepers, E., E. Lambin, et al. (2005). "A synthesis of information on rapid land-cover change for the period 1981–2000." Bioscience 55(2): 115-124.

Loveland, T., et al. (1999). An Analysis of the IGBP Global Land-Cover Characterization Process. Photogrammetric Engineering and Remote Sensing, v. 65, no. 9, p. 1021-1032.

Loveland, T., B. Reed, et al. (2000). "Development of a global land cover characteristics database and IGBP DISCover from 1 km AVHRR data." International Journal of Remote Sensing 21(6): 1303-1330.

Milne, A. (1988). Change direction analysis using Landsat imagery: a review of methodology.

Morisette, J. T., J. E. Nickeson, et al. (2003). "High spatial resolution satellite observations for validation of MODIS land products: IKONOS observations acquired under the NASA Scientific Data Purchase." Remote Sensing of Environment 88(1-2): 100-110.

Myers, N. 1988. Threatened biotas: "hotspots" in tropical forests. The Environmentalist 8 (3):187-208.

Noss, R. (1997). "Hierarchical indicators for monitoring changes in biodiversity."

OECD/IUCN. 1996. Guidelines for aid agencies for improved conservation and sustainable use of tropical and sub-tropical wetlands. OECD, Paris.

Olson, D. M. and E. Dinerstein, (2002). The Global 200: Priority ecoregions for global conservation. (PDF file) Annals of the Missouri Botanical Garden 89:125-126.

Prentice, I., W. Cramer, et al. (1992). "Special paper: a global biome model based on plant physiology and dominance, soil properties and climate." Journal of Biogeography 19(2): 117-134.

Roy D. P., Lewis, P.E. and Justice, C.O. (2002). Burned area mapping using multi-temporal moderate spatial resolution data - a bi-directional reflectance model-based expectation approach. Remote Sensing of Environment, 83: 263-286.

Running, S. and E. Hunt (1993). "Generalization of a forest ecosystem process model for other biomes, BIOME-BGC, and an application for global-scale models." Scaling physiological processes: leaf to globe: 141–158.

Sayre, Roger, Comer, Patrick, Warner, Harumi, and Cress, Jill, 2009, A new map of standardized terrestrial ecosystems of the conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Sayre, R., et. al. (2013). A New Map of Standardized Terrestrial Ecosystems of Africa. Washington, DC: Association of American Geographers. 24 pages.

Sayre, R., et. al. (2014). A New Map of Global Ecological Land Units — An Ecophysiographic Stratification Approach. Washington, DC: Association of American Geographers. 46 pages.

Schott, J. (2007). Remote sensing: the image chain approach, Oxford University Press, USA.

Skole, D., W. Chomentowski, et al. (1994). "Physical and human dimensions of deforestation in Amazonia." Bioscience: 314-322.

Song, C. and C. Woodcock (2003). "Monitoring forest succession with multitemporal Landsat images: factors of uncertainty." IEEE Transactions on geoscience and remote sensing 41(11): 2557-2567.

Stehman, Stephen V. (1997). "Selecting and interpreting measures of thematic classification accuracy". *Remote Sensing of Environment* **62** (1): 77–89. doi:10.1016/S0034-4257(97)00083-7.

Stuckens, J., P. Coppin, et al. (2000). "Integrating contextual information with per-pixel classification for improved land cover classification." Remote Sensing of Environment 71(3): 282-296.

Thenkabail, P., E. Enclona, et al. (2004). "Hyperion, IKONOS, ALI, and ETM+ sensors in the study of African rainforests." Remote Sensing of Environment 90(1): 23-43.

Todd, W. J. (1977). "Urban and regional land use change detected by using Landsat data." Journal of Research by the US Geological Survey 5: 527-534.

Tou, J. and R. Gonzalez (1974). "Pattern recognition principles." Applied mathematics and computation.

Tucker, C. (1979). "Red and photographic infrared linear combinations for monitoring vegetation." Remote Sensing of Environment 8(2): 127-150.

Tucker, C.J., Townshend, J.R.G. & Goff, T.E (1985). African land cover classification using satellite data. Science, New Series, Vol. 227, No. 4685. (Jan. 25, 1985), pp. 369-375.

UNFPA. 2007. State of World Population 2007USGS, : United Nations Population Fund. http://www.unfpa.org/swp/swpmain.htm (last accessed 5 November 2009).

USGS (2015). "Guide des Formations Végétales en Afrique de l'Ouest." USGS/National Center for EROS, Juin 2005. Sioux Falls, South Dakota, USA

Verchot, Louis V., R. Zomer, O.V Straaten, and B. Muys. 2007. Implications of country-level decisions on the specification of crown cover in the definition of forests for land area eligible for afforestation and reforestation activities in the CDM. Climate Change 81:415-430.View, T. O. C. (2000). "Preliminary land surface products from the NASA Moderate ResolutionImaging Spectroradiometer (MODIS)." Geoscience and Remote Sensing Symposium, 2000. Proceedings. IGARSS 2000. IEEE 2000 International 3.

Vogelmann, J. E., T. L. Sohl, et al. (1998). "Regional land cover characterization using Landsat Thematic Mapper data and ancillary data sources." Environmental Monitoring and Assessment 51: 415-428.

White, B. (2002). "Global Forest Cover Assessment and the Problem of Forest Definitions". University of Maryland, College Park.

White, F. (1976). "The vegetation map of Africa: the history of a completed project." Boissiera 24b: 659-666.

White, F., Unesco, et al. (1983). The vegetation of Africa : a descriptive memoir to accompany the Unesco-AETFAT-UNSO vegetation map of Africa. Paris, Unesco.

White, F. (1993). "The AETFAT chorological classification of Africa: history, methods and applications." Bulletin du Jardin botanique national de Belgique/Bulletin van de Nationale Plantentuin van Belgie: 225-281.

Williams, D. (2005). "Landsat-7 science data users handbook." NASA/Goddard Space Flight Center, Greenbeld, MD. Online available: http://ltpwww. gsfc. nasa. gov/IAS/handbook/hand book_toc. html.

Zhan, X., R. Defries, et al. (2000). "The 250m global land cover change product from the Moderate Resolution Imaging Spectroradiometer of NASA's Earth Observing System." International Journal of Remote Sensing 21(6/7): 1433-1460.

Zhang, X., M. Friedl, et al. (2003). "Monitoring vegetation phenology using MODIS." Remote Sensing of Environment 84(3): 471-475.

Zhu, Z. & Wallter, E. 2003. Global Forest Cover Mapping for the United Nations Food and Agriculture Organization Forest Resources Assessment 2000 Program. Forest Science, 49(3), 369-380.

Annex IX: Team Biographies

The Assessment Team Leader is **Mr. Andrew Stancioff**, who offers nearly 30 years experience managing and implementing projects in the areas of remote sensing, geospatial capacity building, and improving the management of environmental data. He has routinely created tailored geospatial products for clients, including during a six-year assignment in which he fully mapped the geologic, mineral, hydraulic and natural resources of Guinea, the Central African Republic, Mauritania, and the DRC (then Zaire). He also offers significant knowledge of the regional meteorological players. As the USAID team leader at AGHRYMET for five years in the mid 1990s, he trained staff and developed GIS methods to evaluate the impact of environmental degradation in West Africa. He previously evaluated a USAID activity supporting AGHRYMET.

Mr. Stancioff has conducted several USAID-funded natural resource assessments and ETOAs, and led an early evaluation of the Famine Early Warning System (FEWS) in the 1980s. Around the same time, he evaluated the USAID-funded regional remote sensing center in Ouagadougou. Mr. Stancioff holds a Masters degree in Geomorphology from the George Washington University, and speaks fluent French and English. His CV, along with those of the other members of the team, is available in Annex 5.

The Deputy Team Leader is **Dr. Ariane de Bremond**, a PhD geographer, agro-ecologist, and University of Maryland professor with over 20 years experience using remote sensing data to study landscape change and land use issues. She offers previous experience with evaluations, and is a dual Swiss-US national is a fluent French speaker.

The Capacity Building Specialist is **Dr. John Lewis**, a veteran of USAID institutional capacity building programs in West Africa who has previously worked on capacity development at AGHRYMET. Dr. Lewis has extensive knowledge of the agro-ecological systems of the western Sahel; he represented USAID to the *Club de Sahel,* and headed USAID's agriculture program in the Global Bureau before retiring. His work in recent years has focused on forest carbon metrics, and he has served as the managing director of a forest carbon mitigation analytics and investment firm. He is fluent in French.

The assessment team also included the following Integra staff:

Mr. Benjamin White, Integra's Staff Geographer, offers 16 years experience in remote sensing and GIS, land use/land use change, and forestry. Mr. White has conducted geospatial analysis for NASA, conducted training workshops on monitoring technologies, and evaluated the FAO's Global Forest Resources Assessments.

Mr. John Waugh, Integra's Director for Climate and Environment, will serve as the Technical Coordinator for this evaluation. Mr. Waugh offers 30 years of experience in biodiversity and natural resource management, planning, and policy. He is an experienced planner and analyst, with experience in conservation finance, rights-based approaches, and conflict mitigation. Before joining Integra, he served as a consultant designing benefit sharing mechanisms, participatory mapping for climate adaptation, and biodiversity planning. In 20 years at IUCN, he led marine policy, managed multilateral relations, and served as a protected area specialist. He has worked in 60 countries, from the village level to addressing the UN General Assembly on conflict and the environment.

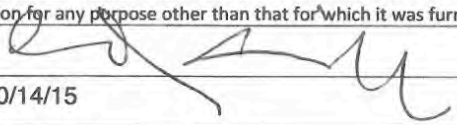
Annex X: Disclosure of Any Conflicts of Interest

Signed conflict of interest statements follow for Team Leader Andrew Stancioff, Deputy Team Leader Ariane de Bremond, John Lewis, Benjamin White, and John Waugh.

Disclosure of Conflict of Interest for USAID Evaluation Team Members

Name	Andrew S Stancioff
Title	Team Leader
Organization	Integra LLC
Evaluation Position?	■ Team Leader ☐ Team member
Evaluation Award Number *(contract or other instrument)*	Contract AID-0AA-I-14-00018, TO AID-624-TO-15-00001
USAID Project(s) Evaluated *(Include project name(s), implementer name(s) and award number(s), if applicable)*	624-P-00-08-00060-00 624-A21-11-01
I have real or potential conflicts of interest to disclose.	○ Yes ● No
If yes answered above, I disclose the following facts: *Real or potential conflicts of interest may include, but are not limited to:* 1. *Close family member who is an employee of the USAID operating unit managing the project(s) being evaluated or the implementing organization(s) whose project(s) are being evaluated.* 2. *Financial interest that is direct, or is significant though indirect, in the implementing organization(s) whose projects are being evaluated or in the outcome of the evaluation.* 3. *Current or previous direct or significant though indirect experience with the project(s) being evaluated, including involvement in the project design or previous iterations of the project.* 4. *Current or previous work experience or seeking employment with the USAID operating unit managing the evaluation or the implementing organization(s) whose project(s) are being evaluated.* 5. *Current or previous work experience with an organization that may be seen as an industry competitor with the implementing organization(s) whose project(s) are being evaluated.* 6. *Preconceived ideas toward individuals, groups, organizations, or objectives of the particular projects and organizations being evaluated that could bias the evaluation.*	

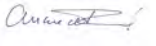
I certify (1) that I have completed this disclosure form fully and to the best of my ability and (2) that I will update this disclosure form promptly if relevant circumstances change. If I gain access to proprietary information of other companies, then I agree to protect their information from unauthorized use or disclosure for as long as it remains proprietary and refrain from using the information for any purpose other than that for which it was furnished.

Signature	
Date	10/14/15

Disclosure of Conflict of Interest for USAID Evaluation Team Members

Name	Ariane de Bremond
Title	Deputy Team Leader
Organization	Integra LLC
Evaluation Position?	■ Team Leader ☐ Team member
Evaluation Award Number *(contract or other instrument)*	Contract AID-0AA-I-14-00018, TO AID-624-TO-15-00001
USAID Project(s) Evaluated *(Include project name(s), implementer name(s) and award number(s), if applicable)*	624-P-00-08-00060-00 624-A21-11-01
I have real or potential conflicts of interest to disclose.	○ Yes ● No
If yes answered above, I disclose the following facts: *Real or potential conflicts of interest may include, but are not limited to:* *1. Close family member who is an employee of the USAID operating unit managing the project(s) being evaluated or the implementing organization(s) whose project(s) are being evaluated.* *2. Financial interest that is direct, or is significant though indirect, in the implementing organization(s) whose projects are being evaluated or in the outcome of the evaluation.* *3. Current or previous direct or significant though indirect experience with the project(s) being evaluated, including involvement in the project design or previous iterations of the project.* *4. Current or previous work experience or seeking employment with the USAID operating unit managing the evaluation or the implementing organization(s) whose project(s) are being evaluated.* *5. Current or previous work experience with an organization that may be seen as an industry competitor with the implementing organization(s) whose project(s) are being evaluated.* *6. Preconceived ideas toward individuals, groups, organizations, or objectives of the particular projects and organizations being evaluated that could bias the evaluation.*	

I certify (1) that I have completed this disclosure form fully and to the best of my ability and (2) that I will update this disclosure form promptly if relevant circumstances change. If I gain access to proprietary information of other companies, then I agree to protect their information from unauthorized use or disclosure for as long as it remains proprietary and refrain from using the information for any purpose other than that for which it was furnished.

Signature	
Date	10/14/15

Disclosure of Conflict of Interest for USAID Evaluation Team Members

Name	John Lewis
Title	Capacity Building Specialist
Organization	Integra LLC
Evaluation Position?	☐ Team Leader ■ Team member
Evaluation Award Number *(contract or other instrument)*	Contract AID-0AA-I-14-00018, TO AID-624-TO-15-00001
USAID Project(s) Evaluated *(Include project name(s), implementer name(s) and award number(s), if applicable)*	624-P-00-08-00060-00 624-A21-11-01
I have real or potential conflicts of interest to disclose.	○ Yes ● No
If yes answered above, I disclose the following facts: *Real or potential conflicts of interest may include, but are not limited to:* 1. *Close family member who is an employee of the USAID operating unit managing the project(s) being evaluated or the implementing organization(s) whose project(s) are being evaluated.* 2. *Financial interest that is direct, or is significant though indirect, in the implementing organization(s) whose projects are being evaluated or in the outcome of the evaluation.* 3. *Current or previous direct or significant though indirect experience with the project(s) being evaluated, including involvement in the project design or previous iterations of the project.* 4. *Current or previous work experience or seeking employment with the USAID operating unit managing the evaluation or the implementing organization(s) whose project(s) are being evaluated.* 5. *Current or previous work experience with an organization that may be seen as an industry competitor with the implementing organization(s) whose project(s) are being evaluated.* 6. *Preconceived ideas toward individuals, groups, organizations, or objectives of the particular projects and organizations being evaluated that could bias the evaluation.*	3.) As a USAID Foreign Service Officer 1987-1994 I played a technical management Role with predecessor projects at CILSS/AGRHYMET predating the one being evaluated by over a decade.

I certify (1) that I have completed this disclosure form fully and to the best of my ability and (2) that I will update this disclosure form promptly if relevant circumstances change. If I gain access to proprietary information of other companies, then I agree to protect their information from unauthorized use or disclosure for as long as it remains proprietary and refrain from using the information for any purpose other than that for which it was furnished.

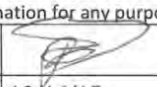
Signature	John Van D. Lewis
Date	10/14/15

2

Disclosure of Conflict of Interest for USAID Evaluation Team Members

Name	Benjamin White
Title	Geographer
Organization	Integra LLC
Evaluation Position?	☐ Team Leader ■ Team member
Evaluation Award Number *(contract or other instrument)*	Contract AID-0AA-I-14-00018, TO AID-624-TO-15-00001
USAID Project(s) Evaluated *(Include project name(s), implementer name(s) and award number(s), if applicable)*	624-P-00-08-00060-00 624-A21-11-01
I have real or potential conflicts of interest to disclose.	○ Yes ● No
If yes answered above, I disclose the following facts: *Real or potential conflicts of interest may include, but are not limited to:* 1. *Close family member who is an employee of the USAID operating unit managing the project(s) being evaluated or the implementing organization(s) whose project(s) are being evaluated.* 2. *Financial interest that is direct, or is significant though indirect, in the implementing organization(s) whose projects are being evaluated or in the outcome of the evaluation.* 3. *Current or previous direct or significant though indirect experience with the project(s) being evaluated, including involvement in the project design or previous iterations of the project.* 4. *Current or previous work experience or seeking employment with the USAID operating unit managing the evaluation or the implementing organization(s) whose project(s) are being evaluated.* 5. *Current or previous work experience with an organization that may be seen as an industry competitor with the implementing organization(s) whose project(s) are being evaluated.* 6. *Preconceived ideas toward individuals, groups, organizations, or objectives of the particular projects and organizations being evaluated that could bias the evaluation.*	

I certify (1) that I have completed this disclosure form fully and to the best of my ability and (2) that I will update this disclosure form promptly if relevant circumstances change. If I gain access to proprietary information of other companies, then I agree to protect their information from unauthorized use or disclosure for as long as it remains proprietary and refrain from using the information for any purpose other than that for which it was furnished.

Signature	
Date	10/14/15

Name	John Waugh
Title	Director, Climate and Environment
Organization	Integra Government Services International LLC
Evaluation Position?	☐ Team Leader ☒ Team member
Evaluation Award Number *(contract or other instrument)*	Contract AID-0AA-I-14-00018, TO AID-624-TO-15-00001
USAID Project(s) Evaluated *(Include project name(s), implementer name(s) and award number(s), if applicable)*	624-P-00008-00060-00 624-A21-11-01
I have real or potential conflicts of interest to disclose.	☐ Yes ☒ No
If yes answered above, I disclose the following facts: *Real or potential conflicts of interest may include, but are not limited to:* *1. Close family member who is an employee of the USAID operating unit managing the project(s) being evaluated or the implementing organization(s) whose project(s) are being evaluated.* *2. Financial interest that is direct, or is significant though indirect, in the implementing organization(s) whose projects are being evaluated or in the outcome of the evaluation.* *3. Current or previous direct or significant though indirect experience with the project(s) being evaluated, including involvement in the project design or previous iterations of the project.* *4. Current or previous work experience or seeking employment with the USAID operating unit managing the evaluation or the implementing organization(s) whose project(s) are being evaluated.* *5. Current or previous work experience with an organization that may be seen as an industry competitor with the implementing organization(s) whose project(s) are being evaluated.* *6. Preconceived ideas toward individuals, groups, organizations, or objectives of the particular projects and organizations being evaluated that could bias the evaluation.*	

I certify (1) that I have completed this disclosure form fully and to the best of my ability and (2) that I will update this disclosure form promptly if relevant circumstances change. If I gain access to proprietary information of other companies, then I agree to protect their information from unauthorized use or disclosure for as long as it remains proprietary and refrain from using the information for any purpose other than that for which it was furnished.

Signature	
Date	10/14/15

U.S. Agency for International Development
Regional Office for West Africa Regional
P. O. Box 1630
Accra, Ghana