Strengthening decision-making to address climate change through the design of an environmental information system in Côte d'Ivoire

CTCN Discussion Paper

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Contents

Acronyms

CTCN:	Climate Technology Centre and Network
EIS:	Environmental Information System
ENDA:	Environment and Development Action
EPA:	Environmental Protection Agency
FAO:	Food and Agriculture Organization
ICRAF:	International Centre for the Research on Agroforestry – World Agroforestry Centre
MINEDD:	Ministère de l'Environnement et du Développement Durable / Ministry of Environment and Sustainable Development
MoU:	Memorandum of Understanding
NDE:	National Designated Entity
NRT:	Near Real Time
PIP:	Public Investment Project
PND:	Programme National de Développement / National Program for Development
PUPSB :	Projet d'Urgence de Production de Statistique de Base / Emergency project for production of basic statistic
SDI:	Spatial Data Infrastructure
UNFCCC:	United Nations Framework Convention on Climate Change
UNIDO:	United Nations Industrial Development Organisation

Forward from M. Remi Allah-Kouadio,

Minister of Environment and Sustainable Development of Côte d'Ivoire

In recent years, environmental statistical data have occupied very little space in Cote d'Ivoire's affairs. Today no one can claim to know the current state of the country in terms of environmental issues. The implementation of solid environmental governance and management requires reliable and near real time statistical data before any action can be taken.

In its desire to become an emerging country by 2020, Côte d'Ivoire must annually assess all development actions implemented by all sectors, including environment. This assessment cannot be done without the production of environmental information establishing a 'picture' of our country, and being the base for any decision.

This matter is one of the priorities of the National Program for Development 2016-2020 (NDP 2016-2020), which requires the collection of reliable and timely data before any decision-making. This political will has led to the establishment of a project entitled *Emergency Project for Basic Statistic Production* (EPBSP), which is relevant to all sectors including the environment, to fill the gap and allow good action planning.

This development strategy called on the Ministry of Environment and Sustainable Development (MINEDD), which as part of its environmental issues' management, has taken the initiative to set up an Environmental Information System (EIS) to guide good policies on sustainable development and promoting an optimal management of environmental issues, and more particularly climate change.

Therefore, the coordination team of the EIS project, composed of members from MINEDD, was encouraged to successfully implement this new system for sharing with the larger public environmental and climate change information coming from several environmental sectors (e.g., energy, agriculture, water, waste management, etc.)

The achievement of this project in the Côte d'Ivoire will be crucial support to decision making and the mobilization of financial resources for sustainable development. This will lead to an environmental, economic and social management of the country, in a context of good governance.

Remi ALLAH KOUADIO

Ministre de l'Environnement et du Développement Durable

Côte d'Ivoire

Forward from Jukka Uosukainen,

Director of the Climate Technology Centre and Network

As the negative impact of climate change intensifies and as investment in climate change increase, it is crucial that rigorous systems are in place for monitoring the impacts of climate change. It is equally crucial that systems are also in place for monitoring the effectiveness of investment made to address these impacts. The extent and effectiveness of investments made for monitoring changing climate will have a defining influence on how well countries are able achieve their development objectives in the near and long term. Fortunately, an increasing number of countries are strengthening their systems for environmental monitoring in general, and climate change in particular. However, there is a range of approaches and methodologies for doing so. Perhaps as a reflection of this increase in activity and assortment of methods, the Climate Technology Centre and Network (CTCN) is increasingly being requested by developing country authorities to share good practices and provide hands on technical assistance in this field. It is hoped that this publication can be a useful resource for government officials and technology practitioners who are designing systems for measuring and evaluating climate change.

CTCN is the implementation arm of the UNFCCC's technology mechanism. It mandated is to promote the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development. CTCN is hosted by United Nations Environment, in collaboration with the United Nations Industrial Development Organisation (UNIDO) and 12 leading independent climate technology organisations. As mandated by the Conference of the Parties, and guided by our Advisory Board, the CTCN provides three core services: (i) technical assistance to accelerate the transfer of climate technologies at the request of developing countries; (ii) strengthening access to information and knowledge on climate technologies; and (iii) fostering collaboration among climate technology developers, users and financiers. These CTCN services are largely implemented by its growing network of over 200 independent organisations located around the globe and focussed on different aspects of climate technology innovation. This publication is a product of technical assistance being delivered by the CTCN at the request of Ivory Coast's National Designated Entity to the UNFCCC Technology Mechanism, which is located in the Ministry of Environment, Urban Hygiene and Sustainable Development (MINEDD), and in close partnership of national stakeholders.

It is my sincere pleasure to thank the Government of Ivory Coast for its leadership and innovation in the field of climate change climate change in general and monitoring in particular. I am also deeply grateful to CTCN Consortium Partners World Agroforestry Centre (ICRAF) and Environment and Development Action (ENDA) for sharing their expertise in delivering this assistance and producing this publication. Together, we can achieve CTCN's mandate of accelerating climate technology innovation and transfer, in support of developing country's climate technology priorities and implementation of the Paris Agreement.

Jukka Uosukainen

Director, Climate Technology Centre and Network

Executive summary

An Environmental Information System (EIS) aims to respond to decision-makers' needs for information on the evolution of the environment, and its impact on people's lives and the natural resources on which they depend. Facing a situation in which available data on the environment is scattered across various national institutions, Côte d'Ivoire, through an initiative led by the Ministry of Environment and Sustainable Development (MINEDD), decided to design and implement a nation-wide EIS using its own governmental funds. This system will support various stakeholders in the country in their environmental decision-making in near real time and will help adapt and mitigate climate change in the country.

In order to accommodate the climate change component into its EIS, Cote d'Ivoire's National Designated Entity (NDE) to the United Nation Nations Framework Convention on Climate Change's (UNFCCC) Technology Mechanism, Mr Kumassi Kouadio Philippe of MINEDD, submitted a request for technical assistance to the UNCFCCC Climate Technology Centre

and Network (CTCN) to seek advice and recommendations from international experts during the design phase of the EIS, with a focus on climate change considerations.

Led by the World Agroforestry Centre (ICRAF) and supported by Environment and Development Action (ENDA), both of which are CTCN Consortium Members, four activities were undertaken to respond to Côte d'Ivoire's request:

- Review and improvement of the existing logical framework of the EIS;
- Review and improvement of the climate change related indicators to be collected through the EIS;
- Recommendations on data collection strategies; and
- Recommendations on the platform hosting the EIS and its data online.

Through the active involvement of national stakeholders through several workshops, and a participatory approach to designing and implementing the EIS, the CTCN assistance was successful in delivering the following outcomes and recommendations:

- Development of a comprehensive logical framework for the EIS including objectives, outcomes and activities;
- A detailed list of indicators relevant to climate change to be developed together with the national stakeholders;
- Suggestions how data needed for the different indicators should be collected, analyzed and reported and by which institution;
- An overall quality control mechanism should be put in place to ensure the reliability of the information; and
- GeoNode (version 2.4) was identified as a suitable application to be used as the building block of the EIS because of the necessary components required for an effective Spatial Data Infrastructure portal, albeit after customization to fully adopt GeoNode into the project's scenario.

Through this assistance, Côte d'Ivoire is better equipped to finalize a sound and efficient EIS that more strategically considers climate change aspects. This assistance serve as example for other countries contemplating developing such a system.

This report presents the context in which Côte d'Ivoire's EIS was created and the technical assistance provided through the CTCN. Following an introductory section, the second section explains the methodology and the results of the 4 activities. The third section describes the lessons learnt from the assistance, relevant good practices used in other countries and final recommendations based on the example of Côte d'Ivoire.

Section 1:

Context of Côte d'Ivoire's Environmental Information System

Why did Côte d'Ivoire decide to create an Environmental Information System?

In Côte d'Ivoire, the negative impacts of climate change are increasingly affecting all levels and sectors of society. For example, these impacts are already seriously hindering water availability, coastal management, agricultural production, and human health, with corresponding damage to economic development and livelihoods. Additionally, the various anthropogenic pressures and the risk of natural disasters are increasing. In search for effective solutions to mitigate and adapt to the effects of climate change, up-to-date data on the state of the environment and national development are key to monitor changes in critical parameters and enable knowledge-based decision making. However, the country still faces a dispersal and lack of data on the state of the environment and the impacts of climate change on natural resources and the economy. This frequently results in delayed or uninformed decision-making, due to the lack of sufficient, timely and adequate information. These conditions do not support effective responses and therefore generate significant physical, human and financial losses. Additionally, the need for information related to climate change by specific economic sectors (agriculture, energy, etc.) is becoming increasingly urgent for an ambitious low carbon and climate resilient development and progress toward meeting Côte d'Ivoire's Sustainable Development Goals.

The Ministry of Environment and Sustainable Development of Côte d'Ivoire, striving to offer a healthy environment and sustainable economic and social development to the whole population, has taken the initiative to establish an Environmental Information System to inform prioritization and decision-making for sustainable development and promote optimal management of environmental resources. Thanks to the Public Investment Project (PIP) 2014-2016, the Ministry of Environment and Sustainable Development (MINEDD) sought and received domestic public funding for the establishment of an Environmental Information System (EIS). Through its different features, the system aims at providing environmental information for a range of sectors and areas that can contribute to environmental monitoring and meet the needs of policy makers for decision-making. Strategic and technical assistance from international experts with proven experience in creating dynamic mapping tools to gather, organize and visualize territorial information related to the state of the environment, natural resources and climate change has significantly benefitted this objective.

Why were climate change considerations not sufficiently embedded in the Environmental Information System from the outset and Côte d'Ivoire decided to approach the CTCN to overcome this challenge?

Being viewed as a cross-cutting topic at MINEDD, the climate change dimension of the EIS project wasn't strongly built during the inception phase of the project. However, given (a) the importance of a successful implementation of such a nationally driven project, (b) the limitations to the availability of in-country technical expertise and national funding and (c) the importance of climate change dimensions in environmental decision-making, it was decided after internal consultation with the MINEDD, to submit a request to the Climate Technology Centre and Network (CTCN) as the operative arm of the UNFCCC's Technology Mechanism, to benefit from international technical support (focused on climate change) during the design phase of Côte d'Ivoire's EIS

The request for this technical assistance was

submitted by Côte d'Ivoire's National Designated Entity (NDE) to the CTCN, Mr. Philippe Kumassi Kouadio of MINEDD, in August 2014 and was rapidly deemed eligible and prioritized to receive international technical assistance through the CTCN. Under the overall direction and guidance of the CTCN headquarters, a team was formed to design the action plan of this technical assistance and proceed with its implementation. This team of international experts was led by the World Agroforestry Centre (ICRAF) in collaboration with Environment and Development Action (ENDA), both founding CTCN Consortium Members, and received the guidance and active engagement of national staff at MINEDD responsible for developing the EIS.

What is the purpose of the Environmental Information System and how is it improving decision-making?

An EIS is an information technology solution for collecting and tracking environmental data as part of an overall environmental management system.

In the case of Côte d'Ivoire, this system was designed to achieve two main objectives:

1. Change individual and collective behaviors, environmental management and implementation of environmental policies
2. Support individual or collective decision-making and the development, monitoring and evaluation of related policies

Côte d'Ivoire's EIS provides an Information Technology platform through which relevant information from various sectors (agriculture, energy, water etc.) is collected, aggregated and stored in an integrated data repository that can be queried using relevant search functions designed to help interpret the information. It includes not only the information itself, but also the actors producing and collecting the information as well the users of the information.

This EIS enables the use and dissemination of environmental data in support of assessing climate and environmental impacts, monitoring emissions of greenhouse gases and other environmental pollutants, measuring economic effects of changing environmental conditions and developing policies and measures to regulate and improve the environmental performance of businesses, sectors and administrative units. Moreover, through its features, users, according to their profile, can (i) lead and share their strategies, policies, and environmental analyses, (ii) monitor the performance and associated actions, and (iii) control the communication (every element communicated is based on accurate and verified data).

Côte d'Ivoire's EIS relies on the collection of environmental data gathered from all national sources holding or producing this information and translates it into indicators that are useful for decision-making. To be adaptive and flexible, eg to be able to incorporate new data sources and formats, this EIS must be equipped with the appropriate tools that characterize a dynamic data collection platform. It also requires guidelines and procedures to manage the production, storage, access, and use of data and information.

The government of Côte d'Ivoire requested CTCN for international technical expertise for the:

- Review and improvement of the logical framework leading to timely and sustainable implementation of the Environmental Information System;
- Development of an updated list of indicators related to climate change in line with international standards, as well as national expectations and needs;
- Development of a sustainable and cost efficient data collection strategy for the climate change indicators; and
- Preparation of recommendations for the choice of a platform capable of hosting the Environmental Information System for online usage.

What support did the CTCN provide?

The main objective of the CTCN technical assistance was to strengthen Côte d'Ivoire's Environmental Information System to improve national and local decision-making and strengthen climate change adaptation and mitigation efforts. Through this assistance, Côte d'Ivoire's EIS Coordination Team has been provided with pertinent tools and technical capacities to continue developing and launching the EIS. The CTCN technical assistance requested by Côte d'Ivoire was organized around four activities:

- **Activity 1**: Orientation and training of national stakeholders on the conceptual approach and logical framework of the EIS
- **Activity 2**: Scrutinizing existing and adding new indicators to ensure the gathering of information germane to climate change mitigation and adaptation
- **Activity 3**: Development of a sustainable and cost-efficient data collection strategy for the matrix of validated indicators
- **Activity 4**: Recommendations of technology options for the design and use of the platform that will host the EIS

These activities led to the production of useful outputs including:

- Recommendations on the consistency of the already developed logical framework related to climate changes
- A review and recommendations of the EIS's indicators related to climate change
- A review and recommendations of the EIS's data collection strategy
- Recommendations for the development of the platform hosting the future EIS

Further information on this technical assistance provided through the CTCN is available here: https://www.ctc-n.org/technical-assistance/projects/establishment-environmental-information-system-eis-capable-guiding.

Section 2:

Methodological design and results of the CTCN Technical assistance

In this section, the four activities undertaken as part of the CTCN technical assistance in Côte d'Ivoire are described. For every activity planned and conducted with national partners, the methodological approach implemented and the results achieved are explained. As anticipated, the results and recommendations provided throughout this technical assistance are being included in the technical implementation of the EIS project.

2.1 - Orientation and training of national stakeholders on the conceptual approach/logical framework of the Environmental Information System (Activity1)

This first activity took place in April 2015, involving understanding theoretical aspects of good practice for a strong and efficient logical framework, and strengthening design of the initial draft of the EIS logical framework. The participants represented the different environmental sectors of Côte d'Ivoire including coastal resources, catastrophes, biodiversity, forests, soil and agriculture, water, wastes, policy strategies, industrial disasters, air/atmosphere and health.

Please see here for more information:

https://www.ctc-n.org/system/files/dossier/3b/livrable_1_final_recommandations_sur_la_coherence_du_cadre_logique_du_sie_en_lien_avec_les_changements_climatiques.pdf

- **Methodology:**

The CTCN technical assistance helped strengthen the overall coherence of the original design EIS logical framework in order to better take into account the strategies, initiatives and policies to address climate change in Côte d'Ivoire.

The CTCN technical assistance developed a succinct action plan of the technical assistance. After presenting it, discussions were organized in order to gain the perceptions of stakeholders on the form and content of the logical framework originally developed by the coordinating team of the EIS project. Good practices applied in similarly structured EIS in other countries were also shared and considered. Thus, the combination of the views of the CTCN experts in situ and the facilitation of the debates involving views of national actors helped to strengthen the initial logical framework and ultimately propose an improved new consensus logical framework which consists of a new composition of the vertical and horizontal lines of the matrix. This new methodological approach allows defining an impact-oriented logical framework and therefore, contributing to better measurement of the performance and expected outcomes of the EIS's project.

Therefore, the CTCN experts were contributing to two distinct but complementary levels:

During the mission

group work and bilateral discussions to shape the new structue of the logical framework

After the mission

Fix inappropriate formulations, non-indicated categories, inconsistencies were identified and modified accordingly. Thereafter, the changes were presented to stakeholders for validation.

- **Results:**

- Stakeholders gained a good understanding of the vertical (from objectives to activities) and horizontal (indicator attributes) axis of the EIS's logical framework.
- The changes were made to the architecture and on the content of the logical framework's matrix. With regards to the form of the matrix, specific changes concern the following specific aspects:
    - The vertical axis of the proposed logical framework reflects the global objective, the corresponding results of each specific objective, their expected outcomes and activities. For example, the preliminary global objective was modified in order to take into consideration climate change dimensions (adaptation and mitigation) and was subdivided into three coherent specific objectives, which are each composed of specific results, outcomes and activities.
    - The horizontal axis of the new logical framework represents the attributes of each indicator. A SMART indicator (specific, measurable, acceptable, relevant, time-bound) is defined for each line of the vertical component of the SIE framework. To effectively measure and monitor each of these indicators, it's necessary to define its attributes: the definition of the indicator, its formula, its observation unit, the appropriate methods of data collection, the tools for the data collection, the responsible for the data collection, the means of verification, the level of disaggregation and the periodicity of data collection.

2.2 - Strengthening the SIE's indicators to ensure gathering and use of climate change mitigation and adaptation information (Activity 2)

Activity 2 took place in June 2015 and involved a second national workshop, with a focus on strengthen the climate change indicators used in the EIS. The original set of indicators were analyzed, revised and improved.

Please see here for more information: https://www.ctc-n.org/system/files/dossier/3b/livrable_2_final_revue_et_recommandations_sur_les_indicateurs_du_sie_en_lien_avec_les_changements_climatiques_0.pdf

- **Methodology:**

A participatory approach was used to identify indicators relevant for the different sectors (energy, water, wastes, health etc.). This was done during a 2-day workshop including plenary discussions and working groups that looked at already existing indicators being collected through other EIS in the country. The final list of the EIS's indicators was developed. For every indicator, details about their definition, description, collection method, means of verification, level of disaggregation and periodicity. Additionally, risks related to collecting the data and measures to mitigate it, were added.

Indicators review process used during the workshop

- **Results:**

The series of indicators previously developed by the EIS coordination team was classified by environmental topic and organized around eight categories:

Environmental topic	Criteria	Environmental indicator	Ground data	Unit	Frequency	Source of data	Observations

Following the work of each group, a new matrix of indicators was developed (see table 2) including the various sections: calculation formula, unit of observation, collection method, tool, person responsible for collecting the data, mean of collection, frequency, disaggregation, risks and assumptions).

The table below summarizes the changes made on the indicators:

Table 1: Summary of the changes made on the indicators during the second workshop

Environmental issue	Changes
Wastes	Two new indicators related to waste re-use added
	The indicators "ratio of household wastes going to landfill" and "quantity of dangerous waste generated per year" were modified at the disintegration level
Policy strategy	A new indicator was proposed "number of legal text related to climate change"
Natural and industrial risks	None
Air/Atmosphere/Climat	11 indicators were added
Health	The number of indicators for this issue doubled to 10
Energy	One indicator related to the rate of electricity coverage was added to the initial indicator for this issue.
Freshwater resources	The number of indicators for this issue increased to10. Three indicators added were related to access to potable water
Marine and coastal resources	This issue had not been elaborated during the first workshop. 10 indicators were identified for this theme.
Soils	The initial indicator on degraded land was divided into three sub-categories based on the type of degradation
	The initial indicator on land use change was divided into three sub-categories based on the type of degradation
Biodiversity	Three indicators were removed, mostly due to rearranging/merging of indicators
Forest	Three new indicators were added

Exploring and identifying already existing EISs allowed the coordination team of the EIS to start working early enough on integrating these initiatives into the project. The last two horizontal categories ("risks" and "assumptions") allowed the coordination team to gain valuable insights on likely future challenges and solutions to mitigate them.

Table 2: Example of indicators selected and described:

	Objective	Indicator wording	Indicator definition	Indicator calculation formula	Observation source	Collection method	Collection means	Organization Responsible	Verification mean	Frequency	Disaggregation	Risks	Hypothesis
Air/Atmosphere	Eliminate ozone-depleting substances (ODS)	Reduction rate of ODS	Reduction rate of ODS's consumption	(Basic consumption –actual consumption) / Basic consumption	National	Survey; regular data handover	Survey form, assessment	Projet Ozone	Reports	Yearly	National	Institutional and socio-political instability; lack of financial resources; lack of equipment	Socio-political environment is stable; the institutional framework is functional; financial resources are available
	Determine the maximum temperature	Maximum temperature	Maximum value of daily temperature on a given period	Determine from a software and/or monthly climatology tables	National	Routine (Information System V SAT)	Thermometer; monthly weather tables; notebooks	Société d'Exploitation et de Développement Aéronautique, Aéroportuaireet Météorologique (SODEXAM)	Monthly weather tables; reports	Monthly; yearly	National; regional; municipal	Institutional and socio-political instability; lack of financial resources; lack of equipment	Socio-political environment is stable; the institutional framework is functional; financial resources
Wastes	Improve waste management	Annual waste production used for energy	Quantity of waste used for energy	Total mass of waste used for energy production per year	Landfill sites	ANASUR's weighing point	Weighbridge	ANASUR	Project monitoring reports	Biannual	National; regional; municipal	Shortage of incinerators; unclear institutional framework	Incinerators meet industry standards
Policies	Improve environmental management related to climate change	Number of institutional partnership agreements for climate change information sharing	Inventory of institutional partnership agreements for the sharing of climate change related information	Number of agreements	List of agreements	Routine surveys	Information forms; reports; studies; communication	MINESUDD/ Judiciary service	Reports	Yearly	National	Lack of communication;	Existence of a steering committee
Soils	Monitor land-use change	Proportion of forest land-use change	Proportion (%) of land-use change on forest land	((Area Year 1 - Area (Year 0))/ Area (year 0) x 100	Administrative centre	Surveys	Survey forms	MINEF- Forestry cadastre	Reports	Yearly	National; district; departmental; municipal	Appropriation of information by data producers	Networking of data producers

2.3 - Development of a sustainable and cost-efficient data collection strategy for the matrix of validated indicators (Activity 3)

The third activity used a similar participatory approach through a 3-days workshop in which the objective was to analyze the performance of the existing information system and databases, and formulate recommendations for the data collection strategy of the EIS.

Please see here for more information: https://www.ctc-n.org/sites/www.ctc-n.org/files/livrable_3_revue_et_recommandations_sur_la_strategie_de_collecte_des_donnees_du_sie_0.pdf

- **Methodology:**

The strategy for the environmental data collection was discussed during a 3-day workshop with the same participants involved in the two previous workshops.

A questionnaire was distributed to the participants requesting them to provide: (i) a brief description of information systems already used in their respective organization and their level of functionality; (ii) a brief analysis of the strengths, weaknesses, opportunities and threats of the information system, (iii) a description of their data collection strategy; (iv) how they fit in the future EIS; and (v)the alternative strategies for the EIS data collection in case of trouble with their own. The final list of indicators developed in activity 3 was validated by the participants during group work and plenary sessions.

An eye-opening presentation of the "Land Health Surveillance Framework" was given as an approach for collecting data and assessing land degradation at the landscape scale. Understanding what would be possible for Côte d'Ivoire was perceived as a good way to familiarize the participants with the topic. The national consultants also presented their work and findings to the audience who provided interesting feedbacks and insights.

A time slot was allocated with a restricted team including key participants, the CTCN experts, and Côte d'Ivoire's coordination team of the EIS project to analyze the outputs of the workshop and formulate solutions to overcome the data collection challenges highlighted during the workshop.

- **Results:**

- Following the workshop activities, the coordination team of the EIS and other national stakeholders had a better understanding of the various information systems already existing in the country. The forest and the biodiversity sectors were especially well represented at the workshop and over 40% of the questionnaires filled were from these two sectors. The energy sector was not represented at the workshop.
- According to the survey that was carried out during the workshop, about one third of the already existing information systems were fully functional, one third were not functional and one third were partially functional.
- The workshop revealed that some critical indicators in the sectors of agriculture and livestock were missing. For example, no indicator dealt with soil pollution or contamination by chemicals used in agriculture, while no qualitative indicator was mentioned for the water sector. It was decided that the EIS coordination team liaise with the stakeholders to fill this gap when implementing the EIS.
- The common data collection methods reported by the participants are surveys and inventories, while the tools are mainly questionnaires. While many institutions and sectors are already using similar methods and tools, the workshop also revealed potential technical, institutional and financial challenges hindering the quality of data collection.
- Most sectors collect their environmental data annually (57%) or quarterly (17%), at the country level (57%) or at the regional level (23%). The major challenges for data collection reported by the different sectors were institutional, technical, financial as well as logistic. According to the participants, the main actions to address these challenges include 1) a clear legislation on the role and responsibility

of the different institutions involved in environmental data collection, 2) the need to develop human and technical capacity for effective data collection, and 3) the need to diversify funding sources.

- The presentations of the national consultants strengthened a common understanding of how the EIS will look like and allowed the identification of potential future challenges and ways to deal with them in an inclusive manner. Indeed, all the stakeholders present at the workshop contributed to the discussions on the best approaches to proceed with the MoUs between the coordination team of the EIS and the stakeholders, the design of the applications as well as the GIS system in a way that takes into account their specific needs.
- The analysis of this participatory workshop outlined the need for additional funds and regular capacity building of the sectoral focal points that are responsible for the monitoring or information systems. Most of the existing sectorial information systems in Côte d'Ivoire are not functioning regularly due to the lack of proper means (financial, technical, organizational, etc.). In addition, they are characterized by weak spatial coverage and, most importantly, the lack of interconnectivity, which is essential for a nationwide EIS. Due to the similarity of their weaknesses, it was agreed that there is substantive opportunity in the case of Côte d'Ivoire for improvement by setting up an appropriate cost-efficient management of the planned capacity building program and the new equipment that is required.

2.4 - Recommendations for the design and use of platform technology options (Activity 4)

In this activity, recommendations were provided on the data and application platform for hosting the EIS of Côte d'Ivoire. As ICRAF is managing such a system for its own Spatial Data Infrastructure (SDI) needs since 2012, the ICRAF team shared their own experiences along with information about relevant approaches being used in other countries.

Please see here for more information:

https://www.ctc-n.org/sites/www.ctc-n.org/files/livrable_4_recommandations_pour_la_creation_de_la_plateforme_dhebergement.pdf

- **Methodology:**

In any project, user requirements are the key factors determining the features and functionalities of the final solution. Especially in Information technology projects, the user requirements translate into software design documents. The key requirements for the EIS were identified to be:

- A web based platform capable of hosting and sharing environmental information
- A platform that can visualize geospatial information in Near Real Time (NRT)

To address the needs of the three main user types of this system (administrators, government departments and development partners) five key criteria were defined to analyze and discuss possible available platforms. Each criterion reflected a key functionality that is required for the Environmental Information System. Features like "user" and "data management" are the core of this system, whereas search functions are required for data discovery. That is why the differing features between the set of platforms selected for comparison was the most important criterion for selection of the platform to be used for the EIS. Support for software was placed as second most important criterion. Good documentation and support can reduce project development/ deployment time. Aspects like "license and software cost" were also considered as they might play a major role in project cost. Finally, know implementation of each platform were also considers an indication of platform stability, thus, included as a criterion.

Following are the five criteria:

1. Features : User management, Data management, Search
2. Support/help : Documentation, Paid technical support
3. Pros and Cons
4. Price/ License
5. Implementation gallery

Platforms selected for comparison were GeoNetwork, Geonode, OpenGeo suite, ArcGIS suite and customized SDI application. It is important to note here that only those platforms were selected because they can support these five criteria.

- **Results:**

- Each of the presented platforms supports direct and indirect customization. Some platforms provide source code, thus, can be customized according to specific needs (for example Geonode can be enhanced or customized). For the purpose of customization, the components (which are the backbone of the presented platforms) were also discussed briefly so that users can have an idea of internal working of mentioned platforms.
- Based on user requirements, the selected platform will require customized modules like data entry and reporting. A single platform cannot provide 100% functionalities required by all end users. Usually the most suitable platform is selected and customized or enhanced according the user needs. As much as possible, customization and enhancements should be decoupled so that future versions can easily be adopted.

Following is a summary of the comparison results.

	User Management			Data Management					Search	Doc.	Price/ License	Expertise
	Self Registration	Admin. Registration	Group	Metadata std.	Data entry form	WMS	Style	View/ download				
GeoNetwork	Y	Y	Y	Y	Y	Y	Y	Y (separate)	Y	Y	GPL	Medium
GeoNode	Y	Y	Y	Y-19115	Y	Y-auto	Y-auto, edit	Y (separate)	Y	Y- not as good as GeoNetwork	GPL	High
OpenGeo Suite	N	Y	Y-GS	Y-GS-	Indirect	Y	Y	Y	Y-GS	Y	-	High
ArcGIS Suite	N	Y	Y	ESRI	Y	Y	Y	Y	Y-GIS app.	Y	Commercial	High
Custom SDI app.	All functionalities have to be developed by the programmers											High

Legend:
Functionalities implemented in a good and successful manner
Functionalities not successfully implemented and/or not in a user friendly way
Functionalities do not exist

- From the above table, GeoNetwork emerged as the first option as it fulfills all the criteria. However, customization according to user requirements (and spatial data visualization needs) might be time consuming and costly. Thus, the second option, GeoNode, was recommended to be the most suitable platform for Côte d'Ivoire as it also satisfies all the criteria. Moreover, GeoNode is developed using the Django framework which is capable of customization in a decoupled manner. Additionally, GeoNode's spatial visualization tool, GeoExplorer, is superior to GeoNetwork's spatial visualization option.

Section 3:

Lessons learned and examples of good practice elsewhere

3.1- Lessons learned from implementation of this CTCN technical assistance

This section provides a summary of key successes and challenges leading to the positive realization of this CTCN technical assistance. The table below summarizes the experiences made in the process of working with national stakeholders in a largely participatory way. Overall, this approach appeared to be useful in building ownership and enabling a constructive discussion, but it was felt that the time available for the process was often too short. Gender aspects were also not fully considered.

Table 3: Lessons from the activities described as either success or challenge

Activity	Lessons learnt
Logical framework	**Successes**
	The methodology used by the CTCN experts throughout the technical assistance ensured consistency of the logical framework already developed by the coordination team of the Environmental Information System project with the new validated version.
	The theoretical presentations on the new approach to developing a strong and robust logical framework as well as the work in four multi-sectorial groups have largely contributed to a good understanding and ownership of the logic behind the different vertical and horizontal sections of the adopted logical framework.
	In addition to the operational aspect covered by this request, the CTCN technical assistance also played a role in stakeholder mobilization and ownership of this new initiative. This should facilitate access and sharing of environmental information related to climate change.
	Indeed, the participatory and inclusive process, at this crucial stage of the project, facilitated the partnership and networking strategy of institutional and technical key stakeholders of the Environmental Information System project.
	Challenges
	Finding the link between climate change and sectorial or cross cutting indicators (health, energy, policy planning, etc.) were very difficult even though national experts are sufficiently skilled.
	Clear understanding and appropriateness of the differences between vertical or horizontal components of the new structure of the logical framework even though national experts are skilled enough.

Indicators	**Successes**
	The new methodological approach allowed adding new attributes of the indicators which constitute the main components of the data collection strategy.
	The addition of the sections "risks" and "assumptions" was very much appreciated by the coordination team to help anticipate some challenges currently not perceived.
	The recommendations made were well received by the national coordination team which was open to changes, and because the project was designed in a flexible way from the outset, making modifications will be feasible.
	Challenges
	The group discussions were interesting but it may have been good to allocate more time to these sessions to gain more insight from the participations. A longer and more interactive plenary session would have allowed the other groups to learn what is being done in other sectors of the environment in Côte d'Ivoire.
	Including the gender aspect in a more interactive way would have been useful to potentially add gendered indicators. To start with, the gender balance of the participants should have been better.
Data collection strategy	**Successes**
	The participatory approach adopted during this activity proved to be successful because it allowed having a consensus on the formulation of the recommendations made, which ensured ownership and will therefore facilitate their implementation. The workshop also allowed comparing the weaknesses and strengths of the existing information systems, in order to design support in a more integrated way. The Environmental Information System can also use this information to build on the comparative advantage of each institution/ sector.
	Challenges
	The workshop was too short and not enough time was allocated to the presentations and the plenary discussions. Moreover, the workshop would have been more fruitful if preparatory work had been done beforehand by each of the participants. This would have allowed a more in-depth diagnostic and better support in the formulation of the indicators and the data collection strategy
	Many participants pointed out that there is no clarity in legislation regarding the responsibility and role of the different institutions with regard to data collection.
Platform suggestions	**Successes**
	The comparison based on five selected criteria worked well. Each software package was vetted and ranked according to its performance and capabilities.
	Challenges
	Detailed analysis documents concerning the EIS of Côte d'Ivoire were not available. Such documentations could have helped in defining better suggestions on customization. For example, specific module level design suggestions could have been created for data entry and reporting modules.
	During the initial phase of this activity, it was discovered that a team of national consultants had already started the development of the environment system. It would have been better if they could have waited until the final report of Activity 4, as this would have saved some development time and effort.

3.2- Examples from other countries strengthening climate change dimensions of their Environmental Information Systems

The architecture, as well as the expected products, of the EIS depend on the types of information needed to address specific problems within the geographical, environmental, economic and political context. While the EIS of Côte d'Ivoire presents certain similarities in the conceptual approach to that of other countries, many of its components differ from EIS developed elsewhere. To provide ideas how EIS have been realized in other contexts, a few examples are presented below. This is intended to provide a broader view of how contextual differences have been resolved in their design. After a brief description of each EIS, the highlights of those examples are presented in the context of the activities of the CTCN technical assistance.

- **REP-SAHEL project (Sahara and Sahel Observatory):**

In response to the challenges of loss of biodiversity, the land degradation and the adverse effect of climate change, the Sahara and Sahel Observatory has initiated and implemented the REP-Sahel project to better monitor and assess the vulnerability dynamics and adaptation strategies of affected communities and natural resources. Implemented in Burkina Faso, Mali, Mauritania, Niger, Nigeria, Senegal and Chad, the environmental monitoring system has been set up throughout a step-by-step approach using the Drivers-Pressure-State-Impact-Response framework (DPSIR) (Figure 2)

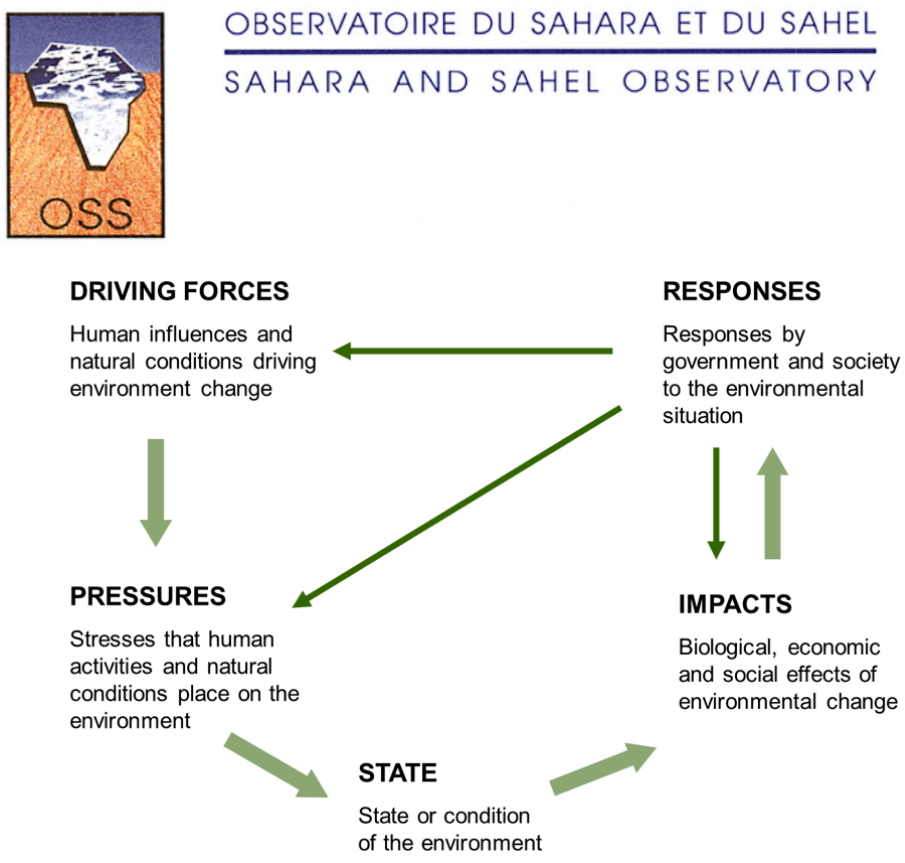

Figure 1: Logical chain of the Drivers-Pressures-State-Impacts-Response framework

Please see here for more information: http://www.oss-online.org/rep-sahel/images/Etudes/Regionales/D%C3%A9veloppement_des_sp%C3%A9cifications_des_syst%C3%A8mes_de_surveillance_au_niveau_r%C3%A9gional_OSS_REPSAHEL.pdf

- **Environmental Protection Agencies' Climate Change Adaptation Resource Center (ARC-X):**

The Environmental Protection Agency (EPA) of the United States of America is taking a number of common-sense steps to address the challenge of climate change. Among its various missions, EPA provides information for a broad audience about climate change, its effects, impacts and ways to adapt to it. EPA partners with more than 40 data contributors from various government agencies, academic institutions, and other organizations to compile a key set of indicators related to the causes and effects of climate change. The indicators are published in EPA's report, *Climate Change Indicators in the United States*, available on the website and in print. A lot of details on the indicators and the way they are collected are available for the public.

Screenshot of the US Environmental Protection Agency's website

Please see here for more information: https://www.epa.gov/arc-x

- **European Shared Environmental Information System (SEIS):**

This example presents the case of the European Shared Environmental Information System launched in January 2013 to improve the collection, exchange and the use of environmental data and information. The goals are to *"create an improved environmental information system for Europe based on a network of public information providers that share their environmental data and information. Their existing systems and processes would be simplified, streamlined and modernized, including being web-enabled. The overall system would be decentralized but integrated. Quality, availability, accessibility and understanding will be improved as a result"*. Decentralized but integrated system means that data is collected in individual countries or regions and then incorporated into the integrated online systems to make the information available to different users. To achieve its goals, the European Shared Environmental Information System has defined seven principles guiding data collection and management strategies

Screenshot of the Shared Environmental Information System website:

Shared Environmental Information System (SEIS)

Change language

Page — Last modified 09 Aug 2016, 03:15 PM

PDF

The "Shared Environmental Information System (SEIS)" was established to improve the collection, exchange and use of environmental data and information across Europe. SEIS aims to create an integrated, web-enabled, EU-wide environmental information system by simplifying and modernising existing information systems and processes.

What is SEIS?

History: In February 2008, the European Commission (EC) Communication 'Towards a Shared Environmental Information System (SEIS)' proposed a solution to Europe's environmental information challenge. Since then, SEIS has become a collaborative initiative of the EC together with the EEA and the 39 countries of the Eionet (European environment information and observation network). In fact, the implementation of SEIS has been at the centre of our work since 2009 and still underpins the 2014–2018 Multiannual Work Programme and our daily work.

Goals: SEIS aims to create an improved environmental information system for Europe. It is a key driver for the growth of our knowledge base and it integrates a wealth of information from the Eionet and other networks and partners, citizen science, crowd sourcing, and new environmental information gathering initiatives such as Copernicus. These goals are underpinned by a network of public information providers that share their environmental data and information. SEIS helps simplify, streamline and modernise their existing systems and processes, and makes them web-enabled. It is a decentralised yet integrated system that improves the quality, availability, accessibility and understanding of environmental information.

SEIS is also about a shift in approach, from individual countries or regions reporting data to specific international organisations, to their creating online systems with services that make information available for multiple users — both people and machines. Such a shift happens in a stepwise way, ensuring that SEIS remains a driver for access to environmental information and its integration in the knowledge-based economy.

Seven SEIS principles: SEIS is based on seven 'principles'. Information should be:

1. Managed as close as possible to its source.
2. Collected once and shared with others for many purposes.
3. Readily available to easily fulfil reporting obligations.
4. Easily accessible to all users.
5. Accessible to enable comparisons at the appropriate geographical scale and the participation of citizens.
6. Fully available to the general public and at national level in the relevant national language(s).
7. Supported through common, free, open software standards.

A key cross-cutting goal of SEIS is to provide access to environmental information, and maximise and expand its use. Information is often created to serve one purpose, but there is usually lots of potential for other uses. Applying the SEIS principles makes that easier. For example, information about floods, while needed to mitigate potential flood impacts, is also extremely valuable for insurance companies and homebuyers to assess property risks.

Technological opportunities: Clearly, SEIS needs to take advantage and foster the development of modern information and communication technologies (ICTs). ICTs are making it increasingly easy to share information, be it among individuals, closed groups or entire web communities. Examples of ICTs include sensors, satellites, interactive map services, web services and mobile applications.

ICTs are particularly valuable in providing real-time data that can be used for immediate decisions — from national governments managing emergencies to citizens planning their day on the basis of information about local weather or traffic conditions.

Reduced costs: A reduction in the administrative burden of public authorities, and the associated cost savings from improved efficiencies, are added benefits of SEIS. For example, automated electronic systems are starting to replace much of the human resources now devoted to exchanging information.

Three pillars: A functional SEIS should be structured around three pillars: content, infrastructure and cooperation. First, the system needs to identify the types of content (data) required, as well as potential sources. Second, an effective, web-enabled technical infrastructure is required that takes full advantage of the most cutting-edge ICTs, including web services (where machines talk to each other without the need for costly or less efficient human involvement). Third, the cooperation and governance structure is required to manage human resources, inputs and networking.

Many applications: Application of the seven principles and three pillars of SEIS is becoming increasingly relevant and necessary for any network based on information sharing, including the EEA's Eionet.

The EEA is modernising its own information system based on SEIS principles. The EEA provides linked data as part of a semantic data service, maintains interactive and collaborative map viewers and generally promotes online and up-to-date State of the Environment information through its website.

Other SEIS related initiatives of relevance today are:

Copernicus - implementing monitoring services offering the potential of Earth observation data

INSPIRE - improving access and standardising environmental data for better integration

ENI – extending SEIS to the European neighbourhood

GEO/GEOSS - building a Global Earth Observation System of Systems

UN-GGIM – providing data and information for the UN Sustainable Development Goals

Please see here for more information: http://www.eea.europa.eu/about-us/what/shared-environmental-information-system-1

- **Food and Agriculture Organisation GeoNetwork Delta Alliance:**

Food and Agriculture Organisation (FAO) GeoNetwork provides access to readily available interactive maps, satellite imagery and related spatial databases maintained by FAO and its partners. Many organization, countries and regions have successfully implemented SDI platforms for data hosting and sharing, for example Dutch National Georegistry, Swiss geodata, Brazilian Institute of Geography and Statistics, IDE-SP (SDI of Sao Paulo state), FAO, INSPIRE, and others.

At present, the project is widely used as the basis of Spatial Data Infrastructures around the world. FAO GeoNetwork allows to easily share spatial data, including those derived from satellite imagery, among different organizations and users. By combining various layers of information decision makers and planners are able to make better informed decisions for sustainable development of land and water systems. Some of FAO's core datasets are Agriculture and Livestock, Climate and Agroclimatology, Fisheries, Forestry, Hydrology and water resources, land-use and land-cover, Population and socio-economic indicators, soil and soil resources etc. By sharing FAO's (and partners) data, the portal helps in decision-making in the field of agriculture, forestry, fisheries and food security. FAO funded the initial development for GeoNetwork.

Screenshot of the FAO's environmental information system website:

Home
About Delta Alliance
Wings - delta networks
Projects
Publications
Documentation
Toolbox
- Agenda Setting
- Problem Analysis
- Strategy Development and Planning
- Implementation
- Monitoring and Evaluation
- Overview of Tools
- Deltas Viewer

News
Events
Search

FAO GeoNetwork for data access

Purpose of the tool

Geographic maps are effective communicational tools to support decision making, to promote multidisciplinary approaches to sustainable development, and to enhance the understanding of geographic information. FAO GeoNetwork's purpose is to improve access to and integrated use of spatial data and information. GeoNetwork allows to easily share spatial data among different organizations and users.

Target group

- Decision Makers: e.g. Sustainable development planners and humanitarian and emergency managers in need of quick, user-friendly, reliable and up to date cartographic products as a basis for action and better planing and monitoring of their activities
- GIS Experts in need of exchanging consistent and updated geographical data
- Spatial Analysts in need of multidisciplinary data to perform preliminary geographical analysis and reliable forecasts to better set up appropriate interventions in vulnerable areas

Tool description

FAO GeoNetwork provides access to readily available interactive maps, satellite imagery and related spatial databases maintained by FAO and its partners (important partners are WFP, UNEP, and OCHA). At present the project is widely used as the basis of Spatial Data Infrastructures around the world. The project is part of the Open Source Geospatial Foundation (OSGeo) and can be found at GeoNetwork opensource.
FAO GeoNetwork allows to easily share spatial data, including those derived from satellite imagery, among different organizations and users. By combining various layers of information decision makers and planners are able to make better informed decisions for sustainable development of land and water systems.
The following categories are used to group the datasets:

- administrative and political boundaries
- agriculture and livestock
- applied ecology
- biological and ecological resources
- climate and agroclimatology
- fisheries
- forestry
- hydrology and water resources
- land cover and land use
- population and socio-economic indicators
- soils and soil resources
- topography

Please see here for more information: http://www.delta-alliance.org/toolboxoverview/FAOGeoNetwork ;

The following three tables detail the main highlights of the above four examples based on the main components of an environmental information system: indicators, data collection strategy and platform. No significant information was found on the logical framework for those examples.

Indicators

REP-SAHEL project (Sahara and Sahel Observatory)	• Drivers: population growth, volume of wood overexploitation, climate change, etc. • Pressure indicators : pastoral charge, areas shifted for agricultural production ; • State indicators: surface water volume, biodiversity structure, etc. • Impact indicators: community vulnerability, biodiversity loss, etc. • Response indicators: restored areas,
EPA's Climate Change Adaptation Resource Center	• Climate change indicators categories: GHG emissions; Weather and climate; Oceans; Snow and ice; Health and society; Ecosystems • For each subcategory, information about the indicator is also provided in sections "background", "About the indicator", "key points", " Indicator notes", "data sources", "technical documentation" • References and publications can be found at the bottom of the page to back-up the indicators description • A view a printer-friendly PDF version of each indicator presented on the website can be downloaded. Each PDF contains all the figures and text associated with a given indicator.
European Shared Environmental Information System	• The indicators are classified as follows: Descriptive indicators (Type A) responding to the question: *What's happening?* Performance indicators (Type B): *Does it matter? Are we reaching targets?* Efficiency indicators (Type C): *Are we improving?* Policy effectiveness indicators (Type D): *Are the measures working?* Total welfare indicators (Type E): *Are we, on the whole, better off?* • Indicators categories: Air pollutant emissions; Climate state and impact (a. progress towards reducing greenhouse gas emissions and b. past and projected climate change, observed and projected impacts of climate change on ecosystems and society); Energy; Land Use and Soils; Marine; Biodiversity; Sustainable consumption and production; Transport; Water; Wastes • Every indicator is presented on a separate page with graphs, data sources, explanation on the evolution of the indicator, definition of the indicator, units, rationale, policy context and targets, methodology for indicator calculation, uncertainties, contacts and ownership • Data used for the graph is accessible in a table
FAO Delta Alliance	• The following categories are used to group the datasets: Administrative and political boundaries; Agriculture and livestock; Applied ecology; Biological and ecological resources; Climate and agroclimatology; Fisheries; Forestry, Hydrology and water resources; Land cover and land use; Population and socio-economic indicators; Soils and soil resources; Topography • The datasets behind the available maps can be downloaded and opened in Google Earth

Data collection strategy

REP-Sahel (Sahara and Sahel Observatory)	• The preparation and conduct of an inclusive and participatory partnership plan which guaranties the commitment of all key stakeholders • The development of the coherent logical framework referring to the Drivers-Pressure-State-Impact-Response framework (DPSIR) • The provision of a platform / observation network and data collection while taking into account the most appropriate approaches which vary according to the types of data (technical, socio-economic, etc.) and to spatiotemporal disintegration scales.
EPA's Climate Change Adaptation Resource Center	The 37 indicators of EPA's report are addressed specifically throughout the following strategy : 1. Indicator description, 2.Revision history, 3.Data sources, 4.Data availability, 5. Data collection (methods), 6.Indicator derivation (calculation steps), 7.Quality assurance and quality control (QA/QC), 8. Comparability over time and space, 9. Data limitations, 10.Sources of uncertainty (and quantitative estimates, if available), 11.Sources of variability (and quantitative estimates, if available), 12. Statistical/trend analysis (if any has been conducted), 13.References
European Shared Environmental Information System	• 7 principles guiding data collection: - Information should be managed as close as possible to its source - Collected once, and shared with others for many purposes - Readily available to easily fulfill reporting obligations - Easily accessible to all users - Accessible to enable comparisons at the appropriate geographical scale, and citizen participation - Fully available to the general public, and at the national level in the relevant national language(s) - Supported through common, free open software standards
FAO Delta Alliance	FAO produces a large number of Geographic Information System (GIS) The spatial data identified as FAO Core Datasets share the following characteristics: - Coarse resolution data, between 30 arcsec and 10 arcmin for the rasters, and between 1:1 million and 1:10 million scale for the vectors - Related to a global, continental or regional level. Countr data are not considered at this stage - FAO as the main producer of the data or with publication rights as partner of a group that released the data - Data release and access is unrestricted (public domain) - Primary (observed, mapped) and modeled data qualify

Platform

REP-Sahel (Sahara and Sahel Observatory)	The purpose of this project was to establish/improve framework of data collection, analysis and dissemination of information to help decision makers and other stakeholders. Details of information products are available at http://www.oss-online.org/en/dissemination-and-sharing. Some examples are Mali's geoportal for Sustainable Land Management (http://ilwac.oss-online.org/ml-ilwac-gn2_10/apps/geoportal/index.html?hl=fre), Desert ecosystems (http://www.oss-online.org/mena-delp/index.php?lang=en), Sahara Aquifer System (http://sass.oss-online.org/) etc.
EPA's Climate Change Adaptation Resource Center	EPA publishes annually the Climate Change Indicators in the United States through its website (https://www.epa.gov/climate-indicators).
European Shared Environmental Information System	European Shared Environmental Information System has categorized information into categories like Agriculture, Air pollution, Biodiversity and ecosystems, climate change, energy, fisheries etc. For each category data, maps and other documents are available. European Shared Environmental Information System is available at http://www.eea.europa.eu/data-and-maps#tab-alldataproducts
FAO	FAO data portal contains ISO data categories like Administrative and Political Boundaries, Agriculture and Livestock, Climate, Forestry, Human Health, Land Cover and Use, Soil etc. FAO data portal is available at the following link http://www.fao.org/geonetwork/srv/en/main.home

3.3- Recommendations for designing and implementing a national EIS

This section summarizes the main decision criteria for designing and implementing a national EIS, based on the activities carried out during implementation of this CTCN technical assistance and on the skills and know-how of the experts required.

National Stakeholders:

- It is crucial for the coordination team of the EIS to collaborate deeply with national stakeholders who hold the data to come up with a harmonized system
- National stakeholders from various ministries and public administrations are the basis of the EIS project. It is crucial they are to involved in the initiative of an EIS development from the early stages and ensure they understand and buy into the objectives so they can contribute pertinently to the elaboration of the project at all stages and see the benefits of investing time and other resources.
- As many of the national stakeholders as possible invited to participate in the elaboration of the EIS should have an good knowledge on the indicators already used in their respective organizations so that they are able to share examples during workshops and there are no challenges related to understanding of different terms due to professional differences

Participary Process:

- The leadership, management and proactivity of the coordination team of the EIS project regarding the interactions with the national partners is key to the success of the implementation of an EIS system
- Gaining the national stakeholders buy-in through the process is crucial
- A participatory process influences positively the overall revision of the existing logical framework sections, indicators and data collection strategy. It enables the inclusion,

at all levels, of the aspects of vulnerability, adaptation of and mitigation to climate change in the EIS.

- Sufficient time needs to be allocated to the participatory process to allow all environmental sectors to be included in the EIS in a successful manner. Carefully selected key stakeholder need to participate to the workshops

The Logical Framework of an EIS:

- Detail the framework of the EIS using vertical axis (global objective, specific objectives, their expected outcomes and activities) and horizontal axis (SMART indicator)
- Ensure that vertical and horizontal sections of the logical framework are understood by the national stakeholders

Climate Change Indicators of an EIS:

- The indicators need to be organized by categories (elements of the environment)
- The indicators have to be extensively detailed: description, unit, calculation formula, collection of the data, data collection strategy, verification means, level of desegregation, and periodicity of the collect.
- Every indicator needs to have information about the associated source of uncertainties and quality. At design level, it is good to involve the national stakeholders regarding the difficulties in collecting those indicators and discuss on ways to mitigate those challenges

Data Collection Strategy of an EIS:

- Quality data collection is key for the implementation of a reliable EIS, and this requires good technical expertise and financial capacity. We therefore recommend entrusting data collection for a given indicator to the institution that has the best capacity. Each selected institution should collect, analyze the data and report them in-a-ready-to-use format before channeling it to end-users. An overall quality control mechanism should be put in place to ensure the reliability of the information delivered. Archiving raw data and data analysis methodologies could for example be considered as part of such a quality control procedure.
- It is important to make good use of the risks identified by the national stakeholders to ensure most of the organizational, political or technical challenges are dealt with rior to the launch of the EIS

Hosting Platform of an EIS:

- A variety of applications can be used: GeoNetwork, GeoNode, OpenGeo Suite, ArcGIS Suite or custom SDI applications
- Based on the user requirements, the platform developer can decide to either go for a combined approach or a build from scratch approach.
- Some EIS can require more customizations and new developments, thus the cost to develop/maintain of such platform should be considered.
- The features to analyze in order to make an informed decision about which application to use for the platform, are the following: Features (User management, Data management, Search), *Support/ help* (Documentation, Paid technical support), *Pros and Cons, Price/ License, Implementation gallery.*

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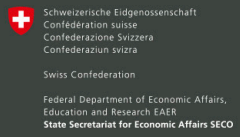

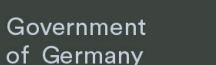

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