

Study to Review and Prepare a Forest Monitoring and Information System, Georgia

Forest Information and Monitoring (FIMS)

- Concept, Institutionalization and Implementation Plan

Reference number: 81189086

Processing code: 05.3506.2-025.00

Executive Summary

Objective

Within the framework of the project "Sustainable Management of Biodiversity, South Caucasus" the German Gesellschaft für Internationale Zusammenarbeit (GIZ) advises and supports the Ministry of Environment, Natural Resources and Protection and the Government (MoENRP) with the declared goal to sustainably manage the forests of Georgia in a multifunctional manner (see chapter 1).

The presented report addresses the development and preparation of a Forest Information and Monitoring System (FIMS) for all main stakeholders of the Georgian forestry sector. The study aimed to develop administrative, institutional and technical solutions concerning the setup of a national forest data management option - or in other words a national FIMS.

Forest Information and Monitoring System (FIMS) – concept and design

The FIMS design took place simultaneously to the conceptual design of the National Forest Inventory (NFI) and Forest Management Inventories (FMI). The software needs for NFI and FMI are very similar and need to cover data collection, data checks, data management, data analysis and reporting. The information demand and priorities of the different stakeholder organizations was analyzed. Most important business processes and information needs within the Georgian forest sector have been compiled and conceptualized into individual FIMS modules. Herewith, software demands for information creation processes on a higher level, thus forest management planning, had been considered as well as the next logical step to compile the forest descriptions of forest management plans (FMPs) in one central forest database – in Georgian forest code called "Forest Register". Furthermore, it includes a harmonization approach and joint development of the FIMS concept between GIZ and GEF funded project measures. The FIMS concept includes the FLUIDS¹ web-portal component of WRI as a central access and retrieval platform opened many synergies and was finally defined mid 2016 in a Memorandum of Understanding between the MoENRP, GIZ and WRI. This memorandum was signed in order to mobilize sources and coordinate activities to support the development and establishment of FIMS, NFMS² and the FLUIDS web based portal in Georgia (see chapter 3).

In order to establish a modern, comprehensive and flexible Forest Information and Monitoring System, FIMS, a set of different software modules are proposed. The modules and respective (spatial)databases are connected by interfaces with pre-defined standards for data exchange. The modules of the FIMS shall cover the most important business processes and information needs in the Georgian forest sector. The main relevant are listed and very shortly described hereafter. The software modules supported by GIZ funds are visualized using underscores and are described in detail in this report:

¹ FLUIDS: Forest and Land-use Information and Decision Support Web based Portal in Georgia

² NFMS: National Forest Monitoring System

- **Cadaster and land registration:** The forest management is based on land parcels, which need to be defined by the cadaster and land registration. These land parcels are the basis for all forest maps.
- **Forests register:** Forests and forest structures are described in stands as homogenous spatial units and smallest entities for a sustainable management. Stand descriptions for the public forests in Georgia are created during **(3b) Forest Management Planning**, making use of **(3a) Forest Management Inventories** (tree data, point sampling).
- **National Forest Inventory:** This process derives point sampled and mapped data for the whole forest area in Georgia, even where no FMP is existing. It provides the overview on the total forest resources of the country.
- **Forest Site Mapping:** A central mapping process of soil, terrain and climate allowing to evaluate growth conditions tree species suitability and risks at each location, where forest grow or might grow.
- **Forest Function Mapping:** Legal restrictions occur for forest management from outside the sector (water protection, nature protection) and inside (mountain protection forest, buffer zones defined in the forest code). The process provides zones of all different forest functions allowing to evaluate the optimal management strategy for all respective forest stands.
- **Utilization rights:** Rights given and referring to certain forest stands or parcels need to be mapped and managed.
- **Forest Operations:** It covers the annual planning based on the stands defined in the forest register and recording of the daily implementation processes creating timber products, NWTP, new forest areas or regenerated forests as result. The costs and revenues as well as business information are managed here and need to be linked to the enterprise accounting system.
- **Forest Incident Monitoring:** Unplanned, incidental changes of the forest by pests, storm, snow, grazing, fire, illegal logging are observed here. Followed by alert processes, respective contingency planning and sanitary or restitution measures ((7) Forest operations).

Within the FIMS different user groups will have different access rights according to modules and databases, allowing them the fulfillment of their daily work and decision-making via one general user-interface build as a Web-GIS-portal using the general spatial analytical potential and monitoring functionalities of the GFW portal. This latter is called “Forest and Land-Use Information and Decision Support” (FLUIDS) system and is foreseen as the central access and data retrieval point for all user groups, combining all relevant spatial and tabular data, spatial analytics and access to the different software modules.

The FIMS concept follows the idea that each institution or department of the forest sector, which is creating and updating information, shall manage the information based on its own special software module (e.g. National Forest Inventory software, Forest Operation software). The related modular databases are under ownership of each institution. The proposed FIMS combines the information from different sources / software systems and makes all of them available via the FLUIDS web-portal. Between software modules the integration of the different data is achieved via standardized interfaces. In addition, FLUIDS allows offering most of the forest information via web-browser to a wider public.

GIZ supported FIMS - software modules

For the GIZ-supported FIMS software modules detailed profiles are presented in chapter 4. For each module the respective purpose and the related business process is described. Moreover,

the main features and the basic entities of the database as well as necessary interfaces to other modules are addressed. The profile presents proposed software solutions (products) and most relevant development needs. It ends with an implementation approach giving recommendations for the next implementation steps for each software module.

Institutionalization

The proposal how to institutionalize the national level forest monitoring in Georgia was focusing on the aspect of the planned implementation of a FIMS combined with the FLUIDS web-portal (see chapter 5). The institutionalization of the National Forest Inventory (NFI) and the Forest Management Inventories (FMI) activities cannot be regarded independently from the establishment and institutionalization of the FIMS activities. As NFI / FMI and the FIMS are elements of a National Forest Monitoring System (NFMS), these proposals have been harmonized (see ForestEye, 2017). A harmonized institutional proposal combines the overlapping needs to setup up a team, which is technically able to manage inventory tasks, huge databases, remote sensing, mapping, data processing based on sound forest management and information technology skills.

When establishing a FIMS & FLUID technology, all involved institutions need to develop capacities to manage the respective software modules. The institutions responsible for a certain software module - like the NFA Inventory department for the FMP software - must be able to have the full “ownership” on it. This means that the software concept must be fully understood as well as all related work processes. This knowledge is obligatory for all users who are responsible for the creation and update of forest related information (NFI, FMI, FMP). In order to achieve this knowledge and understanding of the software and work processes, systematic and advanced trainings have to be provided during the implementation phase.

The information technology support for each software module - regarding hardware, networks and databases - is proposed to be organized as a central service. For the central administrative service like server, databases, networks, IT security, email and intranet, we propose and assume that the MoENRP is building up a specialized department of professional IT specialists – the Information Technology Department.

Implementation and cost estimations

A detailed proposal to set up a FIMS is presented considering time line, staffing, project costs and resulting operational costs (see chapter 6). It reflects the development of an implementation plan mainly for the FIMS software, which serves the NFI, FMI, FMP processes and the development of a central database of forest information, now described in the new forest code as “Forest Register”. As the FIMS project component is working in close cooperation with the GFW partner project, the harmonization of implementation activities has been an additional need. Both projects follow different time lines, have different pilot areas and related institutional partners. However, both are working for the BFPD, FPD and the NFA as main beneficiary. With the establishment of a joint technical working group where all relevant institutions are participating, a powerful and effective structure could be formed to guide and manage the implementation process.

Beside the aspect to implement the “application-software” level of the FIMS, the basic IT infrastructure needs to be implemented in all the related organizations (MoENRP (FPD), NFA, APA). IT infrastructure covers all assets that enable the operation of “application-software” – the FIMS modules. Technically, the IT infrastructure consists of hardware, system software and structural

devices for the operation of the FIMS software modules. The following steps for the selection and implementation of the FIMS IT infrastructure are recommended:

- For a fast start: Ask all software companies for “Software as a service (SaaS)”
- Harmonize the necessary and planned IT infrastructure with the GFW project
- Consolidate the joint technical working group (TWG) where all relevant institutions are participating, as a powerful and effective structure to guide and manage the implementation process
- Assist and foster the definition of a comprehensive MoENRP infrastructure considering the demand of all departments and the synergies of the two current projects dealing with environmental information systems (Biodiversity-Information System, Environment-Information System)
- If a comprehensive IT infrastructure at MoENRP level can be defined: Ask for “Infrastructure as a Service (IaaS)” offering a fast solution to develop the infrastructure based on existing professional services avoiding investments in hardware, server software, webserver, network, security. It also allows to keep the planned FIMS units and the number of IT specialists for a central IT service department on a small level (see the argumentation at “Institutionalization” in chapter 5).

The cost estimations presented here contain costs for implementation (investments) and operational costs for the FIMS software and related IT infrastructure (see chapter 6.4). These cost estimations cover the investments in the different GIZ supported software modules and the related IT infrastructure, meaning server hardware, server software, DBMS costs or the running costs for maintenance and update of all IT components.

- The Investments in software adaptations and interfaces will sum up to ca. 47.000 Euro.
- The annual operational costs – containing the investments – sum up to ca. 207.000 Euro.
- Adding the one time project cost of the implementation process the investments reach ca. 307.000 Euro.
- In all cost estimations the FLUIDS web portal and the costs of the GFW supported FIMS modules are not included.

Tender support

Based on the implementation plan, in close collaboration with the Technical Working Group (TWG) and the responsible stakeholders, detailed tender documents for purchasing packages for FIMS software modules have been elaborated and are presented in chapter 7.

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List of Abbreviations

| | |
|-----------------|---|
| APA | Agency of Protected Areas |
| BD | Biodiversity Department, subunit of BFPD |
| BFPD | Biodiversity and Forest Policy Department, MoENRP |
| CENN | Caucasus Environmental NGO Network |
| C&I | Criteria and Indicators of a sustainable forest management |
| DBH | Diameter at Breast Height |
| DBMS | Database Management System |
| DES | Department of Environmental Supervision |
| DTM | Digital Terrain Model |
| ERP | Enterprise resource planning (software to support ERP) |
| FI Design Study | This project: Study to Review and Prepare a Forest Monitoring and Information System, Georgia |
| FIMS | Forest Information and Monitoring System (for Georgia) |
| FLUIDS | Forest and Land-use Information and Decision Support Web based Portal in Georgia |
| FMI | Forest Management Inventory |
| FMP | Forest Management Planning |
| FPS | Forest Policy Service, former name of the FPD |
| FPD | Forest Policy Department in the Biodiversity and Forestry division |
| GEF | Global Environment Facility |
| GFW | Global Forest Watch |
| GFW Project | The partner project supported by GEF: Global Forest Watch Georgia |
| GIS | Geographic Information System |
| GIZ | Gesellschaft für Internationale Zusammenarbeit GmbH |
| INSPIRE | Infrastructure for Spatial Information in Europe |
| IS | Information System |
| MoENRP | Ministry of Environment and Natural Resources Protection |
| MoU | Memorandum of Understanding |
| NFA | National Forest Agency |
| NFA ID | National Forest Agency – Inventory Department |
| NFI | National Forest Inventory |
| NFMS | National Forest Monitoring System |
| NSDI | National Spatial Data Infrastructure |
| NTFP | Non-Timber Forest Products |
| RS | Remote Sensing |
| WFS | Web feature service |
| WMS | Web map service |
| WRI | World Resources Institute, Washington |

1 Background / Introduction

1.1 Objective

Within the framework of the project "Sustainable Management of Biodiversity, South Caucasus" the German Gesellschaft für Internationale Zusammenarbeit (GIZ) advises and supports the Ministry of Environment, Natural Resources and Protection and the Government in Georgia with the declared goal to sustainably manage the forests of Georgia in a multifunctional manner. By supporting the implementation strategy for the national forest concept, the current project contributes to this objective. The professional and technical expertise delivered by this project should support the identification and collection of base line information and principles for the introduction and implementation of forest inventories as well as a forest monitoring and information system and verifies the overall feasibility. Furthermore, it provides specific trainings and information for various stakeholders and decision-makers from relevant institutions, local / regional forest administrations and government agencies.

The project covered five main areas of activities:

- Forest inventory standards – regarding a National Forest Inventory and Forest Management Inventories
- Forest Information and Monitoring Systems (FIMS)
- Institutional concepts for the NFI, FMI and the FIMS
- Planning of forest inventory projects and FIMS – drafting the implementation concept

1.2 Tasks

This report addresses the development and preparation of a forest information and monitoring system, FIMS, for the different actors of the forestry sector in Georgia. The study was aiming to develop solutions for the administrative and environmental challenges concerning the setup of a FIMS.

In previous studies (i.e. SAVCOR, 2005; Kleinn, 2014) the deficits of existing information and monitoring systems have been pointed out and proposals were made on how to set up a FIMS as a central information technology component allowing a modern and up-to-date information management and forest monitoring to be used on national and regional / local (operational) management level.

Accordingly, the design of the FIMS to be used on national and operational management level considered:

- Existing systems and components in the country (the detailed analysis of systems and components included contacting authors and users of the systems, where applicable)
- Information needs of the responsible stakeholders elaborated within a baseline study within this project (Chapter 2).
- Evaluation developments in neighboring countries (specifically Armenia) with a similar structure of the forest sector and related traditions in forest description and forest utilization.

- International standards and merchantable and applied software systems (i.e. OPEN FORIS System of FAO², MicroForest, DSW2, Fokus2000, OSNOVA 6 and many others) in Europe and worldwide.

Regarding national forest inventories, NFI, and forest management inventories, FMI, the efficient, secure and standardized management of inventory data is a fundamental aspect of the respective FIMS planning.

The development of the design for the FIMS was elaborated simultaneously to the conceptual design of the NFI and FMI. The software needs for NFI and FMI are very similar and need to cover data collection, data checks, data management, data analysis and reporting. On a higher level, software for information creation processes, thus forest management planning, has been considered as well as the next logical step to compile the forest descriptions of forest management plans, FMPs, in one central forest database – in Georgian forest code called “Forest Register”.

However, before these core components of a future FIMS had been addressed a vision and conceptual structure for a comprehensive FIMS has been developed. All relevant modules and interfaces between them were described (i.e. Forest site mapping, Forest management planning, Cadaster database, Property rights management, Forest function Mapping or Forest operations).

Not planned and offered was the harmonization of approaches and joint development of the FIMS concept with the GEF funded GFW Georgia project, implemented by WRI. It resulted in new efforts but opened many synergies. The concept of a FIMS including the FLUIDS³ web-portal component of WRI as a central access and retrieval platform could be jointly developed and discussed.

In a second step the institutionalization of the FIMS system had to be proposed.

Finally the process for the implementation of those FIMS modules, which were selected to be supported by GIZ, were asked to be described (activities, time line, costs).

Based on the implementation plan and definition of software requests and descriptions of the FIMS software modules, tender documents were drafted.

1.3 Overview on the structure of this document

The table below presents the different results, products and milestones for this study, as stated in the ToR. However, it includes solely aspects in regard of the FIMS and points to the concrete chapter in this study presenting the according results.

³ Forest and Land-use Information and Decision Support Web based Portal in Georgia

Table 1: Structural overview

| Partial Results/Products/Milestones as in ToR | Results |
|--|----------------------------|
| Baseline and Capacity Analysis <ul style="list-style-type: none"> Information needs are known, „old“ inventory data is available, technical, personnel and financial capacity of the Georgian stakeholders is known. | Chapter 2 Chapter 3.4.1 |
| Concept for FIS and NFI/FMI Analysis System: <ul style="list-style-type: none"> Has been disseminated to partners. Has been harmonized with partners and is ready for implementation. A training on data input and data analysis for the NFI analysis system has been held. | Chapter 3 Chapter 5 |
| Proposals for Institutionalization: <ul style="list-style-type: none"> Are available for the partners. Have been harmonized with partners and is ready for implementation. | Chapter 6 |
| Planning: <ul style="list-style-type: none"> Implementation plans, which have been harmonized with and disseminated to partners. | Chapter 5 |
| Tender Documents (ToRs): <ul style="list-style-type: none"> Have been disseminated to partners and can be used by the implementing agencies. | Chapter 7 |

2 FIMS Baseline study

2.1 Task and approach

The FIMS baseline study compiles and analyzes the currently applied inventory systems, their respective data and data analysis systems - with regard to the inventory standards and monitoring systems that will be developed. This includes a review of the specific challenges for the inventory design due to inherent natural diversity (diverse forest types, climatic regions and topography) and the specific user needs. As basis for an efficient inventory planning, it is an imperative to clearly define the information needs of users, which are to be met by the generated data. Thus, adjusting the generation of information according to the respective management goal has been an efficient choice of action.

In 2015, the main stakeholders, administrative and non-governmental organizations, received pre-elaborated questionnaires about their information needs concerning the forest sector. The results of this stakeholder information needs study served as a prerequisite for the design of the FIMS concept.

2.2 Result: Institutional profiles and general information needs regarding forests

The following table gives an overview of the surveyed institutions and their reference towards forest information. The following table summarizes the feedback received from each institution.

Table 2: Responsibilities and general information needs of relevant institutions of the Georgian forest sector

| Organization | Forest Policy Department, within the Ministry of Environment and Natural Resources Protection of Georgia |
|---|--|
| Responsibilities of the organization | <ul style="list-style-type: none">▪ Participation in development of state forest policy▪ Management and facilitation of the forest policy implementation▪ Development of forest strategy▪ Facilitator of realization of Strategic Plan▪ Preparation of proposals for the implementation of state reforms in the forestry sector▪ Preparation of the relevant draft legal act within the competence; |
| General information needs concerning forest | <ul style="list-style-type: none">▪ FIMS is necessary for the processes of preparing strategic documents and proposals, in order to enlarge state and public awareness related to forest policy and related fields. |
| Organization | National Forestry Agency - Forest Maintenance and Reforestation Department |
| Responsibilities of the organization | <ul style="list-style-type: none">▪ Development of proposals and recommendations aimed at maintaining forests and reforestation. Development of targeted programs▪ Organization of planning, implementation and monitoring of forest maintenance measures, forest reforestation and planting measures and projects▪ Reconciliation and preparation for approval of forest rehabilitation and planting projects▪ Provision of methodological assistance to the territorial bodies of the Agency in the field of forest maintenance and reforestation/planting▪ Control of forest maintenance, reforestation and afforestation activities▪ Within its competence, project preparation to be issued by the head of Agency▪ Carrying out other duties and responsibilities within its competence established by the forest legislation |

| | |
|---|---|
| General information needs concerning forest | <ul style="list-style-type: none"> No Information given |
| Organization | National Forestry Agency - Forest Use Department |
| Responsibilities of the organization | <ul style="list-style-type: none"> Forest use / management planning Organization of use of forest and timber resources Preparation of legal forest use documents Development / drafting forest use contracts Controlling the fulfillment of conditions specified by the contracts of forest use Coordination of works for social felling Formulation and presentation of recommendations concerning forest use Coordination of activities of Chief forester In case of administrative breaches, draw up administrative minutes according to the rules set by law Planning and agreeing on forestry roads based on established rules Forest use project preparation to be issued by the head of Agency Carrying out other duties and responsibilities within its competence established by the legislation |
| General information needs concerning forest | <ul style="list-style-type: none"> No information given |
| Organization | National Forestry Agency - Inventory Department |
| Responsibilities of the organization | <ul style="list-style-type: none"> Documentation, clarification and/or correction of the boundaries of forest fund areas; Development of cadastral drawings in accordance with the established rule; Development geographical division proposals of the forest fund into forest plots: Forest areas, Forestry districts, compartments and liters (taxation unit). Organization of forest fund area monitoring Facilitation for licensing and transferring for use Organization of forest fund inventories Organization of forest management planning Elaboration of TOR for service providers Carrying out other duties and responsibilities within its competence established by the legislation Update inventory data and high resolution orthophoto plans of new aerial or satellite images |
| General information needs concerning forest | <ul style="list-style-type: none"> No information given |
| Organization | Agency of Protected Areas of Georgia (APA) |
| Responsibilities of the organization | <ul style="list-style-type: none"> Protection of the natural heritage and a healthy environment for the people of Georgia Development of a Protected Areas System |
| General information needs concerning forest | <ul style="list-style-type: none"> More than half of the protected areas are covered by forests. One of the main objectives of APA concerns forest biodiversity protection, restoration as well as sustainable and limited use of forest resources. Thus, attention is paid to the identification, assessment and restoration of woody plants that are in the Red List of species. It is impossible to manage rare forest ecosystems and forests in protected areas in general without forest information systems. |

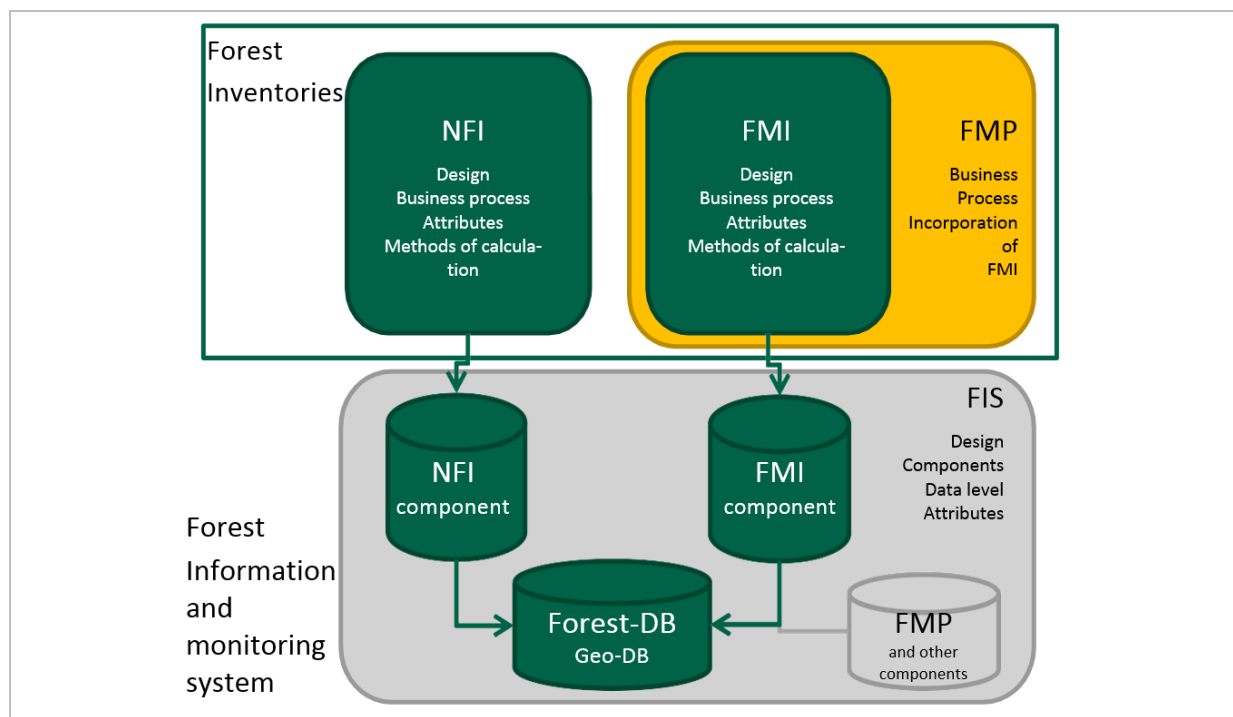
| | |
|---|--|
| Organization | Department of Environmental Supervision, DES - Sub-Agency of the Ministry of Environment and Natural Resources Protection |
| Responsibilities of the organization | <ul style="list-style-type: none"> ▪ State control in the field of environment and natural resources protection |
| General information needs concerning forest | <ul style="list-style-type: none"> ▪ Procedures of state control (inspection) of the forest area (within and outside the forest cuts) ▪ Understanding requirements of normative acts of the forest regulation ▪ Using the proper equipment, required for inspection, reading maps and conventional signs, orientation on a location by using compass and GPS device ▪ Gaining practical skills for working on electronic systems of timber resources ▪ Identification of tree species, common in Georgia ▪ Rules of timber traffic and defined rules regarding responses on law violations ▪ Defining volume of round timber; ▪ Requirement of technical regulation for the primary processing of round timber and supervision over the implementation process |
| Organization | Caucasus Environmental NGO Network (CENN) |
| Responsibilities of the organization | <ul style="list-style-type: none"> ▪ CENN is a non-governmental, regional organization established in 1998 and specialized in the fields of civil society development and institutional strengthening, environmental research and policy, compliance management, education, communication and networking. ▪ Since its establishment, CENN has worked at the local, national and regional levels in the South Caucasus region. CENN believes in networking and cooperation in the context of environmental issues. We have a serious record of joint activities and projects implemented regionally, where all three South Caucasus countries – Armenia, Azerbaijan and Georgia – participated equally to find the solutions to local and regional environmental challenges. |
| General information needs concerning forest | <ul style="list-style-type: none"> ▪ CENN carries out the independent monitoring of forest. Within this processes the local communities and other stakeholders are involved. CENN uses, and will use all type of information which can be in connection with any kind of problems |
| Organization | WWF-Caucasus Program Office |
| Responsibilities of the organization | <ul style="list-style-type: none"> ▪ No information given |
| General information needs concerning forest | <ul style="list-style-type: none"> ▪ Information on forests with High Conservation Values (according to FSC Principle 9) |

3 Forest Information and Monitoring System (FIMS)

3.1 Tasks and approach

As addressed in the ToR the focus of this study has been to provide a concept covering the information creation processes for NFI and FMI, covering as well FMP as a process directly related to the FMI. This includes the compilation of forest inventory and FMP data in a central forest information database. This database allows for an application and integration in forest enterprise management and thus in forest management planning. Figure 1 shows on which components and information creation processes the study had to focus.

Figure 1: Overview of the focal FIMS components – as described in the technical project proposal



3.2 FIMS and FLUIDS development contributions and responsibilities

Within a Memorandum of Understanding, the cooperation between the MoENRP, GIZ and WRI had been defined during spring and summer 2016 in order to mobilize sources and coordinate activities to support the development and establishment of FIMS, NFMS⁴ and the FLUIDS web based portal in Georgia. This - not legally binding document - aims to ensure and clarify the concrete contribution of the participants in the process of elaboration and establishment of FIMS and the FLUIDS web- portal. It aims to facilitate synergies, joining budget and manpower and shall avoid overlapping and repetitive activities. The table below summarizes the contribution terms that the signing parties had agreed upon.

⁴ National Forest Monitoring System

Table 3: Extract of the MoU describing the contribution of the parties

| Overall agreements |
|--|
| <ul style="list-style-type: none"> – The NFMS and FIMS will be developed and established for the MoENRP. – Establishment of the NFMS and FIMS will be guided through the decisions made by the Steering Committee of the Forest Sector Reform. – FLUIDS web based portal will be developed and established to be used by the MoENRP in order to ensure continuous forest related data analysis and monitoring, as well as value-added/advanced utilization of NFMS and FIMS. – Establishment of the FLUIDS will be guided through the recommendations made by the Advisory Board of Global Forest Watch Georgia project, which will facilitate the decisions to be made by the Steering Committee of the Forest Sector Reform and the respective Minister. – Participants will foster synergies through mobilizing all possible sources to effectively provide technical support, as well as coordinate and manage the procurement of necessary equipment, aerial and satellite imagery, spatial data etc. |
| Contribution of the MoENRP: |
| <ul style="list-style-type: none"> – Provide necessary political decisions, the required basic institutional/regulatory and legislative conditions in order to successfully develop and operate the NFMS, FIMS and FLUIDS web portal. – Ensure cooperation with relevant national administrative bodies, especially to guarantee the compliance of NFMS, FIMS and FLUIDS with the National Spatial Data Infrastructure (NSDI) standards. – The Biodiversity and Forest Policy Department (BFPD) of the MoENRP will support and ensure the coordination of the activities applied by the developing partners – GIZ and WRI in the process of developing and establishing the NFMS, FIMS and FLUIDS web portal. – The MoENRP will provide its personnel necessary to participate during the consultation meetings, workshops and trainings for the purposes of achieving intended results/objectives and to support the capacity building. – With its human and technical resources, the BFPD will contribute in organization of such events mentioned in 3.6.4. – The MoENRP will provide the existing conference venues inside the Ministry for conducting workshops, capacity building activities and expert consultations. – The MoENRP will ensure to provide required conditions through allocating sufficient space in the Ministry for: <ul style="list-style-type: none"> a) Project implementing team and the equipment of Global Forest Watch (GFW) Georgia, dealing with developing and operating the FLUIDS web portal; b) Staff and hardware necessary for proper operation of the NFMS and FIMS |
| Contribution of GIZ |
| <ul style="list-style-type: none"> – Provide the conceptual design for the NFMS and FIMS – Provision of components for developing and establishing the FIMS (with the main focus on the elements of the central forest database = “Forest Register”) and the NFMS, including the software for storing and processing of data deriving from National Forest Inventories (NFI) and Forest Management Inventories (FMI). – Support of mobilizing/finding adequate external finance contributions for conducting a first Georgian NFI, as well as implementing the FMIs. – Support of measures to enhance the human capacity of the MoENRP related to NFMS and FIMS. – Support the institutional development of Biodiversity and Forest Policy Department to ensure the long-term sustainability and effectiveness of the FIMS and NFMS. |
| Contribution of WRI: |
| <p>Through the joint project – “Global Forest Watch (GFW) Georgia”, WRI together with the MoENRP is responsible for developing and establishing of the FLUIDS web based portal in Georgia and includes:</p> <ul style="list-style-type: none"> – Creating web-interface with web-GIS functions and a decentralized spatial database. GFW platform/technologies stands as a model, but the project will develop its own national platform that can ingest data from different sources in order to develop the FLUIDS web portal; – Developing and providing necessary software applications, hardware equipment and cloud services according to the Ministry needs and proper functioning of FLUIDS web portal; – Existing forest data, including spatial data will be collected from the MoENRP and other national administrative bodies, as well as, from other open and global sources; – Data consolidation in line with NSDI standards; |

- Assessment of up-to-date forest cover map, land use/forest data and conduct analysis through comparing to baseline data from 2011 provided by GIZ;
- In case of additional data needed for effective functioning of FLUIDS (e.g. research, aerial/satellite imagery, spatial data), this will be developed by the anticipated funds from the GFW project.
- Develop protocols on action based on information of the FLUIDS system
- Develop protocols to inform public, local people, civil society and gender focused organizations
- Prepare publication(s)
- Outreach and capacity building:
 - a) Capacity building trainings on Geographic Information System (GIS) applications and GFW technologies for GFW Georgia project implementing team
 - b) Capacity building trainings for users of FLUIDS system including the GIS applications inside the MoENRP
 - c) Regular workshops with the relevant staff of the MoENRP
 - d) Involvement and training of interns during the project

3.3 Overview of the FIMS Concept

3.3.1 Design and technical layout of a modular FIMS for Georgia

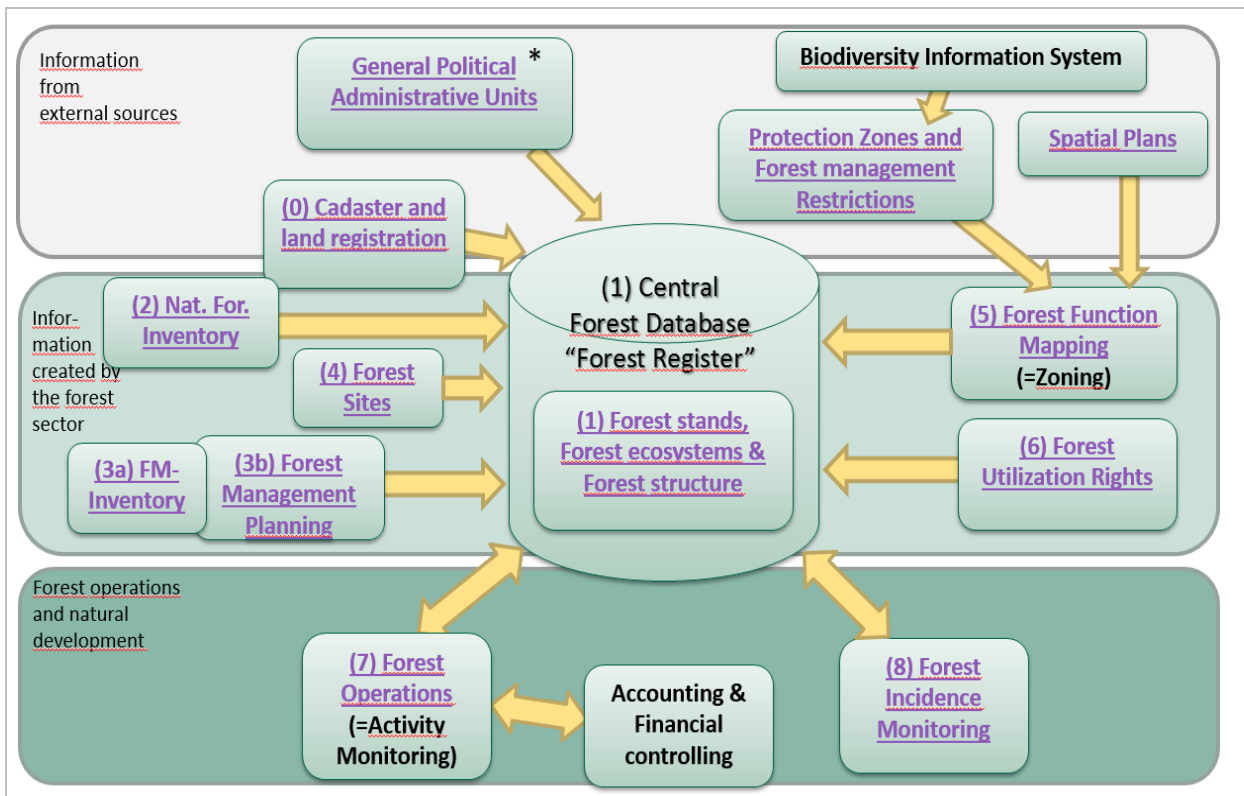
In order to establish a modern, comprehensive and flexible Forest Information and Monitoring System (FIMS), it is necessary to set it up using different modules, compiled into different software products. The modules and respective (spatial)databases are connected by interfaces with pre-defined standards for data exchange.

The following figure shows the modular system structure of the proposed FIMS in Georgia. It gives an overview of the relevant software components and their interfaces. The categories in which the components were grouped are defined by the origin of the data to be managed.

The modules illustrated here cover the most important business processes and information needs in the Georgian forest sector:

- **(0) Cadaster and land registration:** The forest management is based on land parcels, which need to be defined by the cadaster and land registration. These land parcels are the basis for all forest maps.
- **(1) Forests register:** Forests and forest structures are described in stands as homogenous spatial units and smallest entities for a sustainable management. Stand descriptions for the public forests in Georgia are created during **(3b) Forest Management Planning**, making use of **(3a) Forest Management Inventories** (tree data, point sampling).
- **(2) National Forest Inventory:** This process derives point sampled and mapped data for the whole forest area in Georgia, even where no FMP is existing. It provides the overview on the total forest resources of the country.
- **(4) Forest Site Mapping:** A central mapping process of soil, terrain and climate allowing to evaluate growth conditions tree species suitability and risks at each location, where forest grow or might grow.
- **(5) Forest Function Mapping:** Legal restrictions occur for forest management from outside the sector (water protection, nature protection) and inside (mountain protection forest, buffer zones defined in the forest code). The process provides zones of all different forest functions allowing to evaluate the optimal management strategy for all respective forest stands

Figure 2: FIMS concept as a modular, decentralized system



Source: UNIQUE, 2016

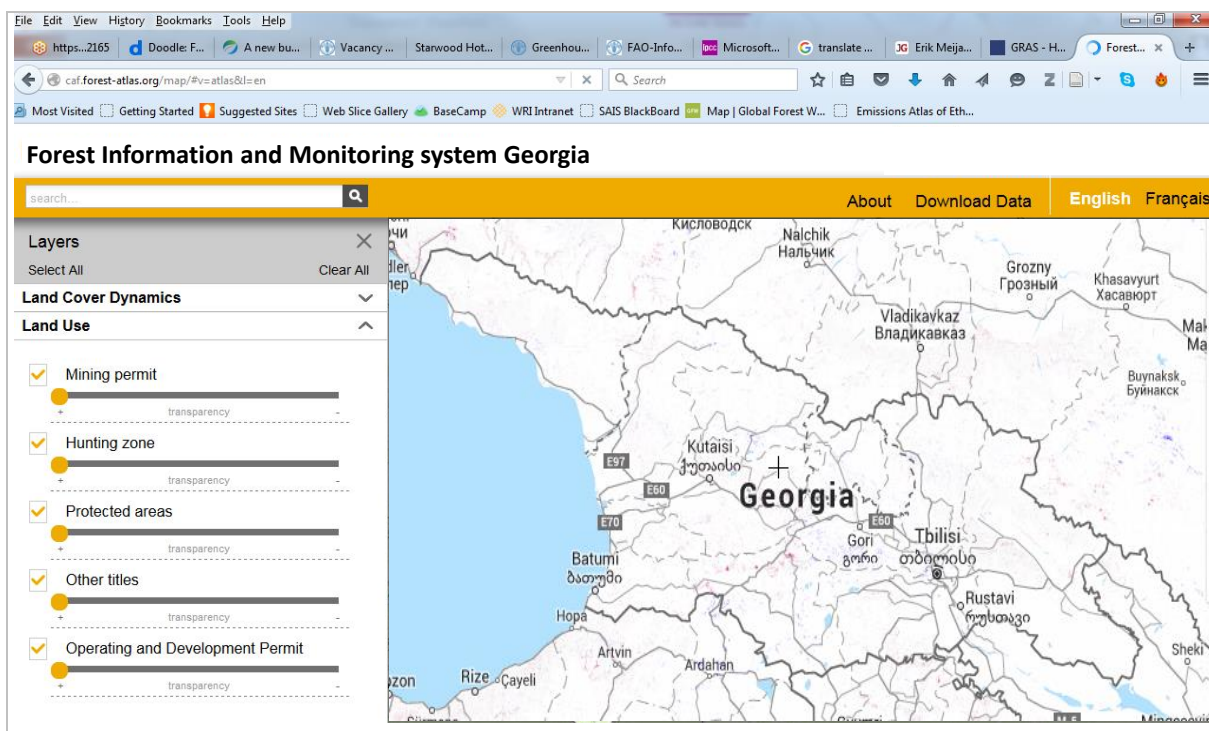
- **(6) Utilization rights:** Rights given and referring to certain forest stands or parcels need to be mapped and managed.
- **(7) Forest Operations:** It covers the annual planning based on the stands defined in the forest register and recording of the daily implementation processes creating timber products, NWTP, new forest areas or regenerated forests as result. The costs and revenues as well as business information are managed here and need to be linked to the enterprise accounting system.
- **(8) Forest Incident Monitoring:** Unplanned, incidental changes of the forest by pests, storm, snow, grazing, fire, illegal logging are observed here. Followed by alert processes, respective contingency planning and sanitary or restitution measures ((7) Forest operations).

Information from external sources are essential for forest managers and shall be provided in the FIMS, even if this data is not created and maintained by the forest sector.

Within the proposed FIMS different user groups will have different access rights according to modules and databases, allowing them the fulfillment of their daily work and decision-making via one general user-interface build as a Web-GIS-portal using the general spatial analytical potential and monitoring functionalities of the GFW portal. This latter is called "Forest and Land-Use Information and Decision Support" (FLUIDS) system and is foreseen as the central access and data retrieval point for all user groups, combining all relevant spatial and tabular data, spatial analytics and access to the different software modules.

Figure 3 shows an example of how a portal like this, elaborated by GFW, may look like.

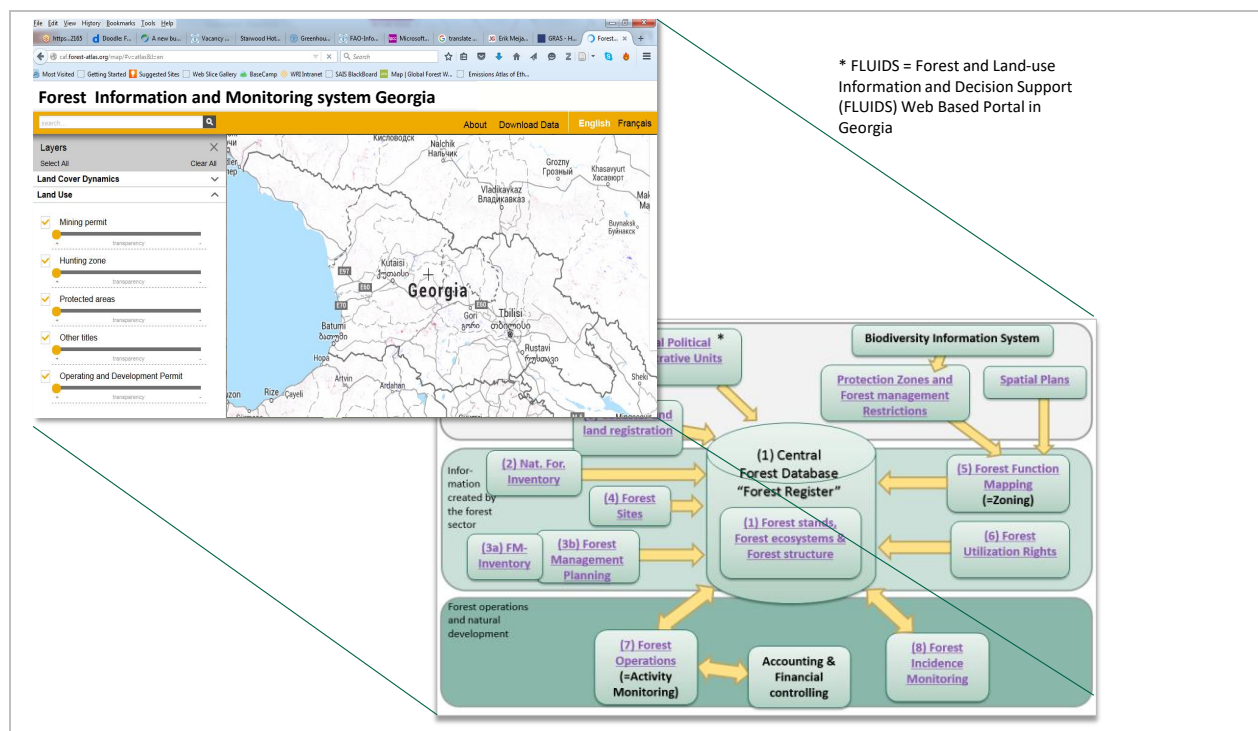
Figure 3: Example of a FLUIDS like web-GIS-portal for Georgia



Source: UNIQUE, 2016

Figure 4 illustrates the special role of FLUIDS as a central access and retrieval platform for the decentral and modular FIMS. Spatial data and tabular data from all FIMS modules will be presented in FLUIDS.

Figure 4: FLUIDS system as an access point to the FIMS



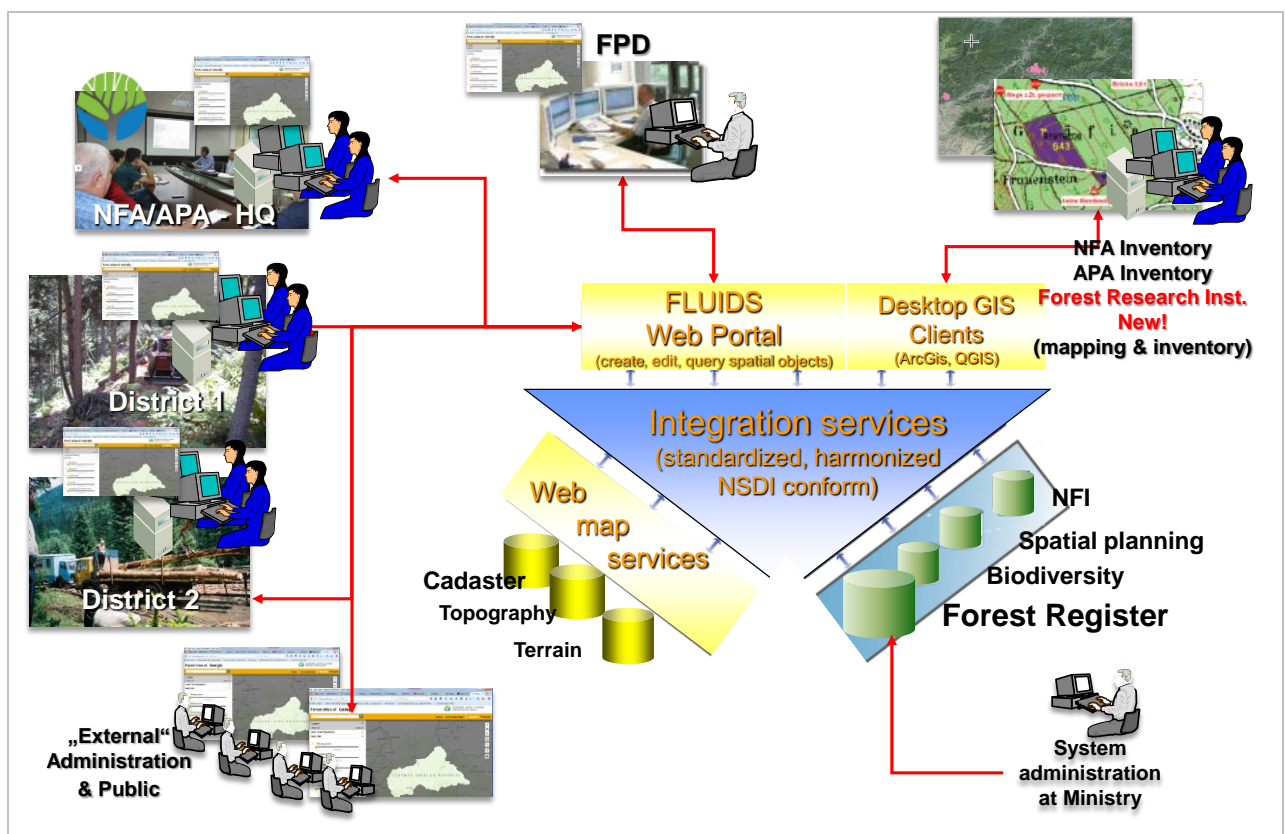
Source: UNIQUE, 2016

Data are provided via standardized interfaces including WFS or WMS⁵. Like in a “spatial data warehouse” information from different FIMS software modules can be combined and analyzed not only via visual interpretation but also using spatial analytics.

The FIMS concept follows the idea that each institution or department of the forest sector, which is creating and updating information, shall manage the information based on its own special software module (e.g. NFI software, Forest Operation software). The related modular databases are also under ownership of each institution. The proposed FIMS combines the information from different sources / software systems and makes all of them available via the FLUIDS web-portal. Between software modules (e.g. FMI software and FMP software), the integration of the different data is achieved via standardized interfaces. FLUIDS also allows offering most of the forest information via web-browsers to a wider public.

Figure 5 below shows the modular system structure and the potential technical approach reflecting only roughly the organizational structure of the forestry sector in Georgia. For more details on the future institutionalization of the FIMS and a National Forest Monitoring System, FMS, please refer to Chapter 5 .

Figure 5: Technical approach of a decentralized FIMS and the central data access via FLUIDS portal



Source: UNIQUE, 2016

⁵ Web feature service and Web map service

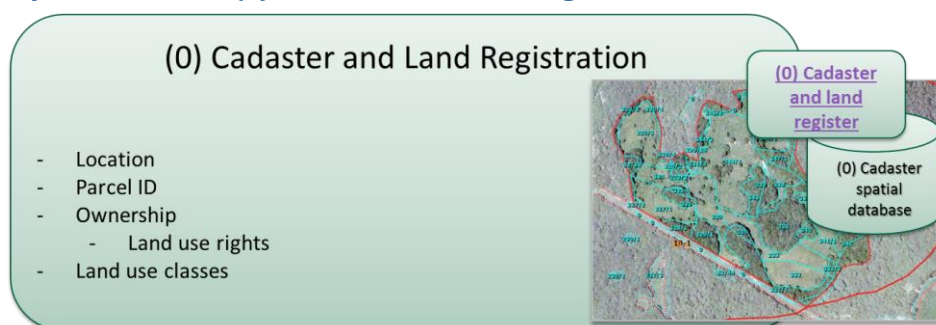
Internal data creation processes are managed in different software modules and databases (green). External processes can be used to add relevant information for forest management. The integration services allow that FLUIDS web-portal can present all relevant (spatial) data for all institutions and on all levels inside of the institutions (user and rights management). Wherever new spatial data are created geographic information systems have to be used to develop new or updated data. Moreover, the web-GIS technology in FLUIDS allows to add and edit specific spatial data without GIS desktop software.

3.3.2 Overview of the FIMS modules

The following section gives an overview of the different software modules, respective datasets, basic entities and functions. Moreover, for each module the results of the information needs assessment are presented. The latter allows to see which institution or department inside of the NFA and MoEARP is relying or interested in certain data, which can or might be provided with the help of the respective software module. The information presented in the information needs assessment tables summarizes the information demand and priorities of the different stakeholder organizations for each FIMS module.

The overview is not restricted to the software modules, which are developed with support of GIZ only. A detailed description of the GIZ supported modules can be found in chapter 4. More information on the distribution of responsibilities can be found in chapter 5.

Software module (0): Cadaster and land registration



The module (0) Cadaster and land registration can be described with the following short profile:

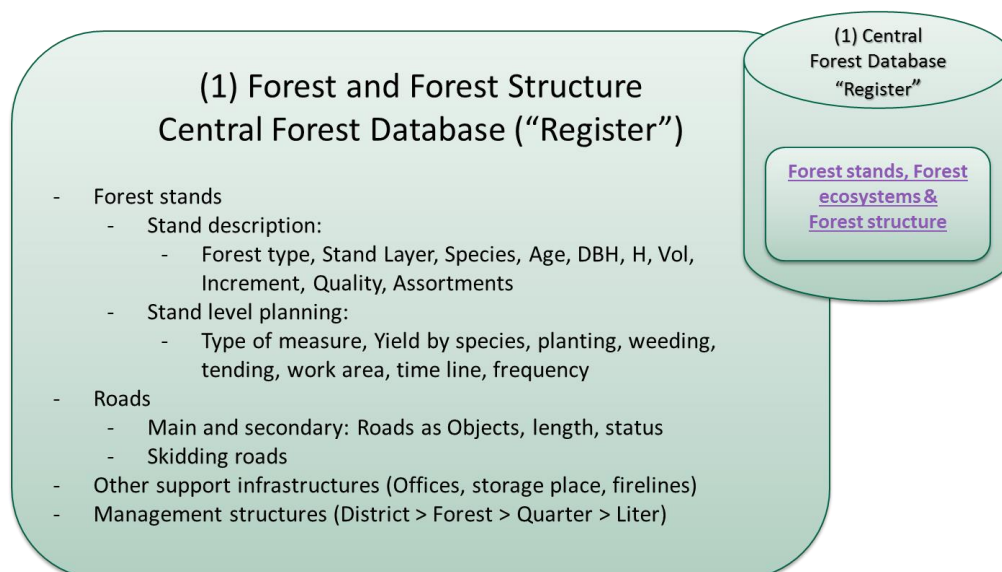
- Contains basic information for land management, political and spatial planning
- Information concerning
 - Where is the forest located?
 - Size / area of the forest?
 - Who is owner?
 - Who manages the forest?
- Data are created by the Land Registration Agency, but shall be taken over and managed as an internal land management module.
- External data provision: All parcels covering forests
- Internal data management: All parcels managed by the specific forest enterprise (NFA, APA)

Table 4: Information needs assessment - Cadaster and Land registration

| Attribute | NFA - ID | NFA-FMRD | NFA - FUD | FPD | DES | APA | WWF | Comments from the participants |
|---|----------|----------|-----------|-----|-----|-----|-----|---|
| Size | 4 | - | - | - | 2 | 4 | 2 | |
| Location | 4 | - | - | - | 2 | 4 | 2 | |
| Ownership | 4 | - | - | - | 2 | 4 | 2 | |
| Forestry / Adjacent entities/ historical and cultural monuments | 4 | - | - | - | - | - | - | Lease, license, agriculture, non-agriculture (NFA-ID) |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (1): - Central Forest Database - "Forest Register"



The module Forest Register can be described with the following short profile:

- Central forest data base and module („Forest Register“ as described in the new forest code) of the FIMS
- Contains the core forest management entities: Compartments and stands.
- Will be regularly updated by the Forest Management Planning, simulation of annual forest growth and actualized triggered by all forest operations changing the structure of forest stands.

Table 5: Information needs assessment - Forest Register

| Attribute | FPD | NFA - ID | NFA-FMRD | NFA - FUD | APA | DES | WWF | Comments from the participants |
|--|-----|----------|----------|-----------|-----|-----|-----|---|
| Forest stand description | 1 | 3 | - | - | 4 | 2 | 2 | Most of the information is available, but outdated (NFA-ID, FPD). |
| Stand level planning | 3 | 4 | 1 | - | 3 | 2 | 3 | FPD would recommend it due to parameter importance. |
| Roads | 1 | 4 | - | 3 | 3 | - | 1 | Preliminary determination of forest roads on the terrain is difficult, so the information will be too general in case of no existing forest roads (NFA - ID). |
| Other supporting forest infrastructure | 2 | 2 | 1 | - | 3 | - | 2 | |
| Management / admin. Structures | 2 | 4 | - | - | 4 | - | 2 | |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (2): National Forest Inventory

(2) National Forest Inventory

- Statistical sound sampling inventory on national level
- Combined with remote sensing based data collection
- Baseline for political decisions in the forest sector and environmental sector
- Data typically provided:
 - Forest area
 - Forest Types
 - Species
 - Per forest type / species: Age, N, BA, V, iV, utilization, mortality, yield, tree quality, damages, dead wood
 - Site information; Ground vegetation
 - Accessibility

(2) Nat. For.
Inventory

(2) NFI -
database



The module (2) National forest inventory can be described with the following short profile:

- The NFI is an forest sector internal core information creation process
- It allows the data collection, data aggregation, analysis and reporting of NFI points sampling data
- Main elements managed are trees, sample points and regeneration
- The smallest unit is a forest type or a tree species (group) in a region or district.

Table 6: Information needs assessment - National Forest Inventory

| Attribute | NFA - ID | NFA-FMRD | NFA - FUD | FPD | DES | APA | WWF | Comments from the participants |
|--|----------|----------|-----------|-----|-----|-----|-----|--|
| Forest description - (from sampling) | 3 | - | - | 1 | 2 | 4 | 2 | Most of the information is available but outdated (NFA-ID, FPD). |
| Road network – (from sampling) | 4 | - | 3 | 1 | - | 3 | 1 | Preliminary determination of forest roads on the terrain is difficult, so the information will be too general in case of no existing forest roads (NFA - ID) |
| Management / admin. Structures – (mapping) | 4 | - | - | 2 | - | 4 | 2 | |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (3a): Forest Management Inventories

(3a) Forest Management Inventories

- Statistical sound sampling inventory on estate level run by NFA or APA
- Combined with remote sensing based data collection
- Part of Forest Management Planning process
- Smallest unit = Stratum
= Forest Type of certain age
- Data are used to describe stands/litra
- Typical data collected:
 - Forest area
 - Forest Type & Species
 - Per forest type / species: Age, N, BA, V, iv, utilization, mortality, yield, tree quality, damages, dead wood
 - Site information; Ground vegetation

(3a) FM-
Inventory

(3b) Forest
Management
Planning

(3a) FMI –
Spatial
database



Module (3a) Forest management inventory can be described with the following short profile:

- The FMI is an internal core information creation process of the forest sector
- The FMI software module allows to collect, aggregate, analyze data and report on the results of the point sampling inventories performed as FMI.
- The module has an interface to feed data to the FMP software module (3 b).

Table 7: Information needs assessment (no special chapter in the survey)

| Attribute | NFA - ID | NFA - FMRD | NFA - FUD | FPD | DES | APA | WWF | Comments from the participants |
|--|----------|------------|-----------|-----|-----|-----|-----|--|
| Forest description - (from sampling) | 3 | - | - | 1 | 2 | 4 | 2 | Most of the information is available but outdated (NFA-ID, FPD). |
| Road network– (from sampling) | 4 | - | 3 | 1 | - | 3 | 1,3 | Preliminary determination of forest roads on the terrain is difficult, so the information will be too general in case of no existing forest roads (NFA - ID) |
| Management / admin. Structures – (mapping) | 4 | - | - | 2 | - | 4 | 2 | |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (3b): Forest Management Planning



The module (3 b) Forest management planning can be described with the following short profile:

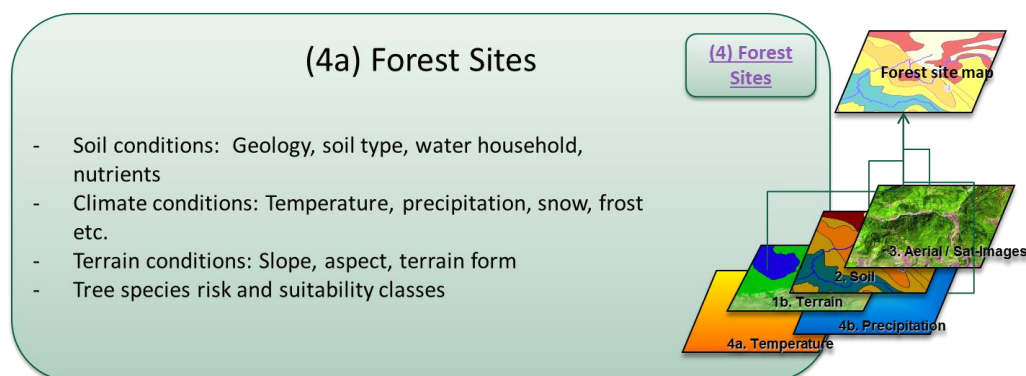
- The FMP software supports the FMP process as important internal information creation process of the forest sector.
- The module is linked with the FMI Inventory module
- The purpose is to update stand data and update forest maps through the FMP process and to define mid-term management measures.
- It is linked to and updates the Central Forest Database „Forest Register“ with the results of the FMP process.

Table 8: Information needs assessment: Forest Management Planning

| Attribute | FPD | NFA - ID | NFA - FMRD | NFA - FUD | APA | DES | WWF | Comments |
|--|-----|----------|------------|-----------|-----|-----|-----|---|
| Forest stand description | 1 | 3 | - | - | 4 | 2 | 2 | Most of the information is available but outdated (NFA-ID, FPD). |
| Stand level planning | 3 | 4 | 1 | - | 3 | 2 | 3 | FPS would recommend it due to parameter importance. |
| Roads | 1 | 4 | - | 3 | 3 | - | 1 | Preliminary determination of forest roads on the terrain is difficult, so the information will be too general in case of no existing forest roads (NFA - ID). |
| Other supporting forest infrastructure | 1 | 2 | 1 | - | 3 | - | 1 | |
| Management / admin. Structures | 2 | 4 | - | - | 4 | - | 2 | |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (4a)



The module (4a) Forest Sites can be described with the following short profile:

- The software supports the internal information process of forest site mapping.
- It is a multisource mapping activity leading to basic ecological information and information on forest productivity and tree species suitability.

Table 9: Information needs assessment: Forest sites

| Attribute | NFA - ID | NFA-FMRD | NFA - FUD | FPS | DES | APA | WWF | Comments |
|--------------------------------|----------|----------|-----------|-----|-----|-----|-----|--|
| Soil | 4 | 4 | - | 3 | 2 | 4 | 2 | FPD would recommend it due to parameter importance. |
| Climate | 4 | 4 | - | 3 | 2 | 4 | 3 | FPD would recommend it due to parameter importance. |
| Terrain | - | 4 | - | 3 | 2 | 4 | 2 | |
| Other e.g. vegetation cover | - | 4 | - | - | - | - | - | Information on plant zones - using special literature (in order to identify these zones). (NFA-FMRD) |

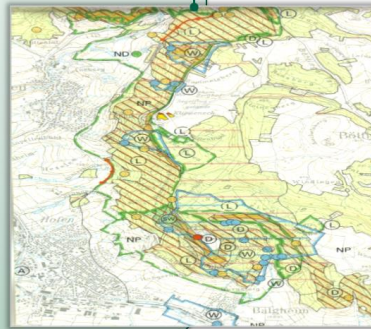
The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (5): Forest Function Mapping

(5) Forest Function Mapping

- Soil an slope protection
- Steep slopes > 35°: Unmanaged
- Water protection:
 - Springs
 - Drinking water protection
 - Buffer zones along waters
- Nature protection:
 - Forest habitat mapping (Fauna and Flora)
- Recreation:
 - City parks
 - Skiing resorts etc.
- ...

Forest
Function
Mapping



The module (5) Forest Function Mapping can be described with the following short profile:

- The software module supports the internal information creation process of forest function mapping or zoning.
- It is a multi-source mapping procedure using external data and partly creates internal, forest sector related information.
- The activity is related with Forest Management Planning, but also an important information source for operational management decisions.
- In a first phase it is stand-alone and long-term mapping project. Once the zoning exists data are regularly updated during FMP projects and based on other spatial planning processes.

Software Module (6): Forest Utilization Rights



The module (6) Forest utilization rights can be described with the following short profile:

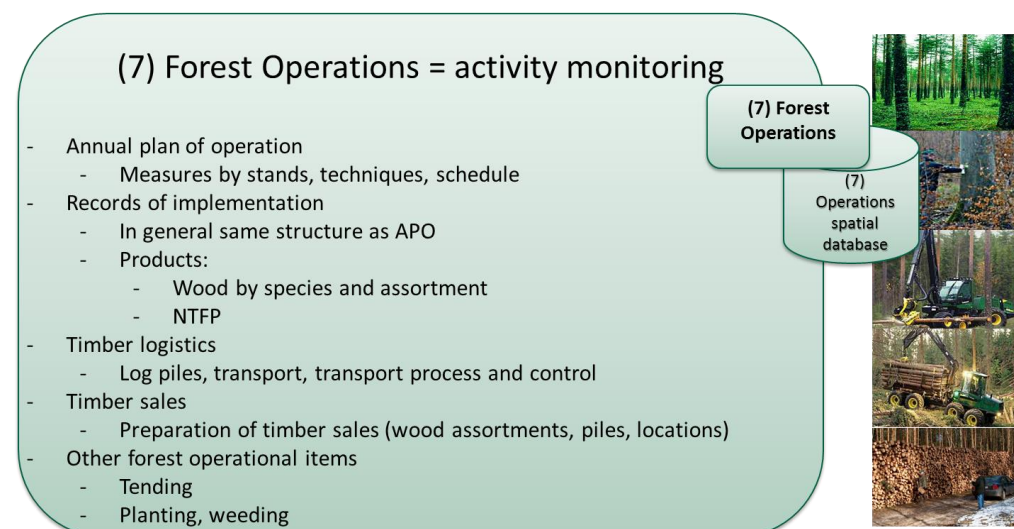
- The software modules manages an internal, forest sector related business process
- The purpose is to manage land use right and related business cases and customer relations.
- The software module is linked to module Land Register as based on parcels.
- As most of the land use rights are utilization rights on forests, the module is also closely related with Forest Operations (see below) and could also be part of a forest operation module.
- In principle, no special software needed. The features are close to the cadaster software or a CRM software.

Table 10: Information needs assessment: Forest utilization rights

| Attribute | FPD | NFA - ID | NFA-FMRD | NFA - FUD | APA | DES | WWF | Comments |
|--------------------------------|-----|----------|----------|-----------|-----|-----|-----|--|
| Fuelwood | 3 | - | - | 4 | 4 | 3 | 3 | Due to lack of inventory data, reliable and precise information concerning timber resources is not available at the agency. This information is urgently needed (NFA-FUD). |
| Bark | 2 | - | - | 1 | 2 | 2 | 2 | |
| Non- Wood Forest Products | 2 | - | - | 3 | 3 | 2 | 1 | |
| Hunting activity rights | 2 | - | - | 2 | 4 | 4 | 2 | Definition of the legal origin of hunted animals, hunting management within and outside of a hunting farm, within the forest fund; control of hunting process (DES). |
| Fishing activity rights | 2 | - | - | 2 | 4 | 4 | 2 | |
| Grazing utilization rights | 2 | 4 | - | 3 | 4 | - | 3 | |
| Bee keeping utilization rights | - | - | - | - | 4 | - | - | |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (7): Forest Operations



The module (7) Forest operations can be described with the following short profile:

- The software supports the daily internal management processes of the managing bodies like NFA or APA
- The forest operation process covers the annual management cycle: The annual operational plan and records the implementing of the planned measures.
- The measures are defined in the FMP, the software module is linked to the Forest Register as it takes over data and updates stand data and activity records in the Forest Register.
- Operations are changing forest stand structures. In result the module is the central element of a monitoring (activity based monitoring of planned measures).

Table 11: Information needs assessment: Forest operations

| Attribute | FPD | NFA - ID | NFA - FMRD | NFA - FUD | APA | DES | WWF | Comments |
|---------------------------|-----|----------|------------|-----------|-----|-----|-----|---|
| Annual plan | 3 | 4 | 3 | 1 | 3 | 2 | 2 | Annual action plan to be elaborated by the local service (NFA-ID). |
| Records of implementation | 3 | 3 | - | 1 | 3 | 2 | 3 | For the purpose of realization of timber, produced by the Agency, it's important to have data on real conditions concerning trade and market in Georgia and abroad. (NFA-FUD) |
| Timber logistics | 2 | - | - | 2 | 2 | 3 | 3 | In order to improve economic conditions and functions of forest management bodies, it is extremely important to have the specific information mentioned above. (NFA-FUD) |
| Timber sales | - | - | - | 2 | 3 | 3 | 3 | |
| Other items | - | - | - | - | 3 | - | - | |

The information need and priorities were rated as follows: 1 – “not important”, 2 – “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Software module (8): Forest Incidence Monitoring

(8) Forest Incidence Monitoring = incidental change monitoring

- Fire monitoring
 - By continuous remote sensing
- Forest cover change: Succession and Illegal logging
 - By continuous remote sensing
- Soil monitoring
 - by permanent monitoring plots
- Changes in the forest ecosystem (flora, fauna...)
 - Mixed approach:
 - By forest inventories PARTLY
 - By special inventories and monitoring (mainly fauna)
- Natural disturbances
 - Biotic disturbances: Insects, fungus, game, cattle
 - Abiotic disturbances: Storm, snow, avalanches



The module (8) Forest incidence monitoring can be described with the following short profile:

- It is part of the Internal information creation process of the forest sector.
- The purpose is the recording of incidental changes in forest area and structure allowing a continuous updating of forest status data in the Central Forest Database (Forest register).
- Sources of information are monitoring by staff on the ground, alert functions allowing inputs from a wide public and remote sensing sources.
- It can be efficiently combined as a “multipurpose monitoring” with nature and environmental protection monitoring activities and software systems.
- It is one of the central modules of the GFW project.
- GFW project will develop or integrate existing monitoring functions based on RS techniques. For example: Fire danger rating system developed by ENVSEC (OSCE) - linked to visualization of risks.

Table 12: Information needs assessment: Forest monitoring

| Attribute | FPD | NFA - ID | NFA - FMRD | NFA - FUD | APA | DES | WWF | Comments from the participants |
|---|-----|----------|------------|-----------|-----|-----|-----|--|
| Fire monitoring | 2 | 3 | - | - | 3 | 2 | 1 | Active crown fire, ground fire (NFA-ID). |
| Soil changes | - | - | - | - | 3 | 1 | 2 | |
| Natural changes – flora/fauna | 3 | 2 | - | - | 4 | 2 | 3 | |
| Other natural disturbances | 2 | 4 | - | - | 4 | 2 | 2 | |
| Biotic disturbances – pests/outbreaks/forest health | 3 | 3 | 4 | - | 4 | 2 | 2 | In each case the information is received through a signal-letter (NFA-FMRD). |
| Abiotic disturbances – contamination | 3 | - | 4 | - | 4 | 2 | 2 | In case of “contamination” the NFA-FMRD understands “blockages” (timber residues) felled trees, etc. (NFA-FMRD). |

| Attribute | FPD | NFA - ID | NFA - FMRD | NFA - FUD | APA | DES | WWF | Comments from the participants |
|-------------------------------|-----|----------|------------|-----------|-----|-----|-----|---|
| Illegal logging | 2 | - | - | - | 4 | 4 | 3 | In order to detect a violation, it is important to define the location of illegal logging; the species of illegally logged trees should be defined; The mentioned data is required for defining the volume, which on its turn is required to calculate the environmental damage, caused by illegal logging (DES). |
| Other forest monitoring items | - | 1 | - | - | - | 3 | - | It should be defined, if a forest cut has been conducted according to the legislation. The information serves as a certain mean of prevention (DES). |

The information need and priorities were rated as follows: 1 – “not important”, 2 – “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

FIMS software modules opening access to external data sources

The following software modules introduced hereafter offer access to external information, not created and maintained by the forest sector. The data will be provided from different resources and different public institutions. In all cases these information is managed in form of spatial databases. The information will be presented as part of the FLUIDS web portal. Related functionality to access and retrieve it in form of maps and reports will be developed by the GFW project.

Module: General Political Administrative Units



The module can be described with the following short profile:

- External information provided by the Land Registration Agency
- Official boundaries and areas of all levels of administrative units

Table 13: Information needs assessment: General political administrative units

| Attribute | FPD | NFA - ID | NFA - FMRD | NFA - FUD | APA | DES | WWF | Comments from the participants |
|----------------|-----|----------|------------|-----------|-----|-----|-----|--|
| Villages | 2 | 4 | - | - | 4 | 2 | 2 | |
| Municipalities | 3 | 4 | - | - | 4 | 2 | 2 | |
| Other | - | 4 | - | - | - | - | - | Forestry, adjacent entities, historical and cultural monuments (NFA-ID). |

The information need and priorities were rated as follows: 1 – “not important”, 2 – “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Module: Protection Zones and Restrictions

Protection Zones and Restrictions

- Nature protection zones: National parks, nature protection zone class 1-5
- Endangered habitats
- Environmental protection zones: Water, soil etc.
- Other existent protections or restrictions items: Military, etc.



The module can be described with the following short profile:

- External information from different institutions related with nature and biodiversity protection
- Content are zone boundaries and related attributes describing the zones, its area, purpose and related legal acts.
- Information is managed as spatial databases forming several layers in the FLUIDS web portal.

Table 14: Information needs assessment: Protection zones and restrictions

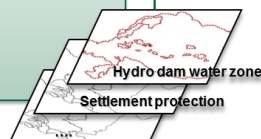
| Attribute | FPD | NFA - ID | NFA - FMRD | NFA - FUD | APA | DES | WWF | Comments from the participants |
|---|-----|----------|------------|-----------|-----|-----|-----|--------------------------------|
| National parks | - | - | - | - | 4 | 1 | 3 | |
| Natural parks | - | - | - | - | 4 | 1 | 3 | |
| Protection zones | - | - | - | - | 4 | 1 | 3 | |
| Forest restrictions | 3 | 4 | - | - | 4 | - | - | |
| Other existent protections or restriction items | 3 | - | - | - | 4 | - | - | |

The information need and priorities were rated as follows: 1 – “not important”, 2 - “nice to know”, 3 – “important” 4 – “essential”. “-”: No rate given. Comments: Directly taken over from the survey. The respective author institution is given with its abbreviation.

Module: Spatial Plans

Spatial Plans

- Zonification related with forest area
- ...
- ...



The module can be described with the following short profile:

- The module allows access to the external information from different spatial planning processes, which are relevant for forest management.

- Managed are priority zones or planned land use classes from any kind of spatial planning, overlapping forest or forest fund land.
- The module manages the data from different spatial databases and allows its access and retrieval via the FLUIDS web portal

3.4 Effects and benefits on decision making and work flows

The discussion about FIMS, facing a complex software structure, high investments and operational costs, leads to questions about the positive effects and impacts on decision-making and daily work flows.

To illustrate the impact and effects of a complex and costly FIMS, several show cases from different business processes shall be described hereafter. These show cases shall highlight the need to combine data – mostly spatially – from many different sources to allow quick and efficient reactions on the wide range of tasks in forest management and forest administration.

3.4.1 Showcase: Inventory data collection

Task: Tree data have to be measured in several sample plots per stand to derive numerical values of tree species and stand structure (N, basal area, volume, “bonitet”, and density).

Traditional approach:

- Subjective location of sample plots; Measurement of diameter and a sub-sample of heights; no documentation of tree and plot data; manual data aggregation; manual data input in FMP software without plausibility checks.

New solution: FMI software combined with the FMP software

- Objective GPS controlled and documented sample plot layout; statistical analysis of precision possible; mobile data collection including plausibility checks in the forest; full tree data storage for analysis on higher level (biodiversity, structural diversity, tree quality, growth and yield); repeated measurements after 10 years allow deriving high precision change information and increment data; automatic import of plot and tree data to the FMP software; automatic calculation of all tree species data in the traditional stand description.

Effects and benefits:

- More information, higher data quality.
- Higher inventory costs, lower data input costs.

3.4.2 Showcase: FMP planning support

Task: During the FMP process, each stand has to be described and evaluated. It is to decide upon a set of optimal measures for stand development in order to fulfil multiple economic and environmental services.

Traditional approach:

- Stand boundaries are mapped in a GIS, based on old forest maps and actual aerial images; stand boundaries are not fitting to the digital cadaster;
- During the field work a paper map is used with the old topographic map in the background; Many spatial data layers are not available such as forest site map, forest function map; data on the utilization of the previous period and the previous strategic decision for this stand; paper forms for data collection are used;
- Decision on measures – especially yield planning - are mainly made back in the office.

New solutions – supported by FMP software, Forest Register and FLUIDS spatial data portal:

- The easy accessibility and the smart overview of all information layers relevant for forest management decision form a key challenge for software systems supporting the planning process. As most of the information is location-based and spatial-explicit, it can be retrieved using a GIS. This is especially valid for the new ecological information compiled in the FIMS and made available in FLUIDS.
- In the near future the planner will have access to the following geo-data layers, on a mobile device (ruggedized tablet computer), which he can combine in a comfortable and fast way using his FLUIDS portal access:
 - Forest Site Map (including tree species suitability and productivity; Potential Natural Forest Vegetation)
 - Layers related to nature conservation such as protected areas or range data of rare and endangered species
 - Erosion or landslide risk maps
 - Accessibility map – terrain data and road network
 - Forest function map
 - Background maps: Topographic features such as waters, buildings, and other land use classes etc.
- Moreover the planner needs direct access to the standard forest maps – now in digital format
 - Forest stand map
 - Forest operation map (results of harvest and other silvicultural activities)
- The planner can now read and interpret several information layers at the same time for a certain stand in his spatial context.
- In the traditional approach, for the task to describe a forest stand and the following derivation of optimal measures it used to be necessary to open several analogue maps, open printed tables and documents one after another. Every time the location “stand” had to be searched for. The number of documents, yield tables, maps, guidelines often led to the situation that most of this information was not at hand, not in the forest and also not at the desk. Decision making was shifted in time and space, thus from the best moment – on site and in the forest stand – to desk days or even weeks later. Moreover, for the data extraction and input in a stand description form or for the selection of management activities in the planning process a manual data input is needed. Both are time consuming and error prone.
- In contrast a GIS based user interface as in FLUIDS allows to keep the location of the stand fixed and open the related information layers very fast.

Effects and benefits:

- More information for decision-making easily accessible, higher data quality.
- Same costs for better and more precise decisions.

3.4.3 Showcase: Reporting on Criteria & Indicators of Sustainable Forest Management

Task: The Forest Planning Department, FPD, shall develop a report on Criteria & Indicators of Sustainable Forest Management – here criteria 1 – to be provided in a 5 years rhythm. Criteria 1

asks for the quantitative and qualitative development and preservation of forests as a natural resource.

1. Criteria 1 – Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles

- 1.1 Forest area - Area of forest and other wooded land, classified by forest type and by availability for wood supply, and share of forest and other wooded land in total land area
- 1.2 Growing stock - Growing stock on forest and other wooded land, classified by forest type and by availability for wood supply
- 1.3 Age structure and/or diameter distribution - Age structure and/or diameter distribution of forest and other wooded land, classified by availability for wood supply
- 1.4 Forest carbon - Carbon stock and carbon stock changes in forest biomass, forest soils and in harvested wood products

Traditional approach:

- Forest area: Old statistical data of forest fund area; updates and actualizations are not monitored; no full matching with new digital cadaster; no actual overview on of the forest area of the country; data is not available in digital format in a FIMS.
- Growing stock - classified by forest type: Old statistical data derived from a mix of older sources; known deviation from reality needs to be ignored, as precise data cannot be retrieved; forest types not flexible defined to meet different international reporting schemes; yield plans exist on the forest area only partially.
- Age structure and/or diameter distribution: Age roughly estimated per stand, only available where FMP exists. Complicated access as stored in paper documents of single FMP, no central database; diameter distribution not available as sample plot data is not stored in the traditional inventory process.
- Forest carbon - Carbon stock and carbon stock changes in forest biomass, forest soils and in harvested wood products: Carbon stock information is not available from traditional FMP; no data on forest soil biomass as no site map is available; only 20% of harvested wood products are traditionally registered; an automatic calculation model to evaluate wood products is not available.

New solutions – based on the NFI database and the Forest register:

- Forest area: Digital forest map is stored in FIMS and available in FLUIDS; Any classification can be calculated via intersection with other spatial layers in FLUIDS.
- Growing stock: Data available from two different sources: NFI data for non-forest fund land and from Forest register for forest fund land (central stand database); The software stores all available FMPs; Stand data is actualized via Forest Operation software and simulation of the growth; Software allows to group data by any types of forest or mix of grouping schemes (example: volume and increment in “Beech forests” by different forest function zones).
- Age structure and/or diameter distribution: Age and diameter distribution available from point sampling inventories (NFI/FMI) centrally and in a digital format, updated in the Forest register for the forest fund land.
- Forest carbon - Carbon stock and carbon stock changes in forest biomass, forest soils and in harvested wood products: Carbon stock information available from NFI and FMP; data on

forest soil biomass available from forest site map; Information on harvested wood products is stored in the Forest register and can be evaluated via calculation model.

Effects and benefits:

- Drastic improvement of data quality and completeness
- Cost savings: Several weeks (traditional method) versus a few hours (new solution)

3.4.4 Showcase: Requests on ownership and forest use rights

Task: The NFA Inventory department or a regional office are asked for the clarification and approval of the ownership, land use status and actual forest use rights on a set of cadastral parcels.

Traditional approach:

- Parcel data is not available and has to be requested separately from the Land Registration agency (NAPR); the data needs to be manually imported in the GIS; the actual land use of the digital cadaster cannot be easily compared with the forest fund data; maps are not stored centrally; many areas are outdated: Digitalization from old forest maps is necessary; Information on land use rights are not at hand and not in a spatial format; the check is time consuming; the reporting needs manual text input and manual embedding of maps and tables from different sources.

New solution – based on the Forest Register, the Forest Operations software via FLUIDS:

- Parcels can be directly filtered in FLUIDS; all overlaying information can be centrally retrieved and compared; the land use rights or land use contracts are spatially available in FLUIDS; in case the format of this request happens in higher frequency: An automatic report will be created in FLUIDS, where the user can get the information in an assisted process.

Effects and benefits:

- Drastic time and cost savings
- Minutes per request (new solution) versus work days (traditional method)
- Capacities of GIS and inventory specialists available for strategic tasks

3.5 Share of FIMS module development between GFW and GIZ

As the FIMS design is based on a modular system, which allows the gradual improvement and extension of functionalities, the development of the operationalization of the various modules, presented in chapter 0, don't have to happen simultaneously. Having this in mind, the responsibilities for the development support of the different modules could be split between GFW and GIZ (see also MoU

Table 3).

The following table summarizes the planned implementation sequence, as well as the distribution of the responsibilities.

Table 15: FIMS - responsibilities for development support

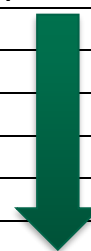
| FIMS and FLUIDS Software Modules | Responsible partner |
|--|----------------------------|
| Web-Portal & Web-GIS (as central access point and GUI) | GFW (GIZ) |
| (0) Cadaster and Land Registration (Integration) | GFW |
| (1) Central Forest Database (“Forest Register”) | GIZ |
| (2) National Forest Inventory | GIZ |
| (3 a) Forest Management Inventories | GIZ |
| (3 b) Forest Management Planning | GIZ |
| (4) Forest Sites | GIZ |
| (5) Forest Function Mapping | GIZ |
| (6) Forest Utilization Rights | GFW |
| (7) Forest Operations (Activity Monitoring) | GIZ |
| (8) Forest Incidence Monitoring (Change Monitoring) | GFW |
| General Political Administrative Units (Integration) | GFW |
| Biodiversity Informations System | (GIZ) |
| Protection Zones and Restrictions (Integration) | GFW |
| Spatial Plans (Integration) | GFW |

3.6 GIZ – supported modules and order of implementation

GIZ takes over the support for the development and implementation of six FIMS modules. The priorities for the development and implementation have been discussed until the end of the study. Finally, the following order of priority has been fixed. Mainly the harmonization with the planned fast start of the NFI and the new pilot projects for FMP lead to these order.

Table 16: GIZ modules and their order of implementation

| GIZ supported module | Order of implementation and development |
|---|--|
| National Forest Inventory software (Open Foris) | 1a |
| FMI Inventory module (Open Foris) | 1b |
| Forest Function Mapping module | 2 |
| FMP Software (component to develop Forest Management Plans) | 3 |
| Forest Register (central forest database) | 4 |
| Forest Operations | 5 |



Each of these software modules is presented in detail in Chapter 4.

4 The “GIZ FIMS - software modules”

The following chapter comprises the detailed profiles of the software modules for FIMS, supported by GIZ in the scope of this project. The order of presentation follows the priority order for their development and implementation.

4.1 FIMS - Information management based on business processes

This chapter reflects on the importance of business processes and their analysis for any information management. Roles, objectives and tasks for state institutions, responsible for forest management and administration are defined within the forestry related legislative framework (laws, regulations, strategies). For management purposes, these tasks are normally structured and described as “business processes”. In public institutions, the according responsibilities and functions are on the highest level defined in laws or bylaws of the sector specific legislative framework.

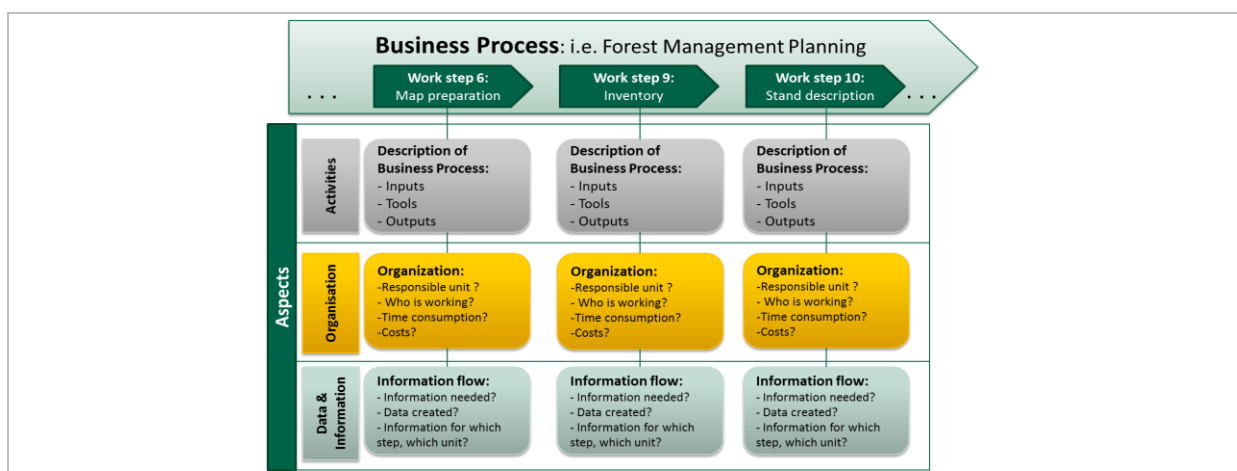
Business processes are structured as a logical chain of work steps aiming to produce services to achieve business goals. They are influenced by the specific organizational framework within every institution. Business processes deal with answering the following questions regarding a business goal:

- What needs to be done?
- What input is necessary?
- What tools are necessary?
- What is the output?

Having this in mind, a FIMS has to create and provide an information flow along the business processes and is influenced by and will influence business processes. A FIMS is an essential tool to run the business, manage information, communicate and apply decision making. Therefore, prior to the development of a FIMS structure, the according business processes should be examined and as a consequence, the FIMS structure should reflect them respectively.

The following Figure 1Figure 6 illustrates how the analysis of a business process can be structured.

Figure 6: Business process and information management



Source: UNIQUE, 2016

Regarding the above visualized example of work steps in the business process FMP, the analysis of activities, organizational aspects and the related data and information flow is running in parallel for each work step.

4.2 Software module: National Forest Inventory

4.2.1 Business Process and Purpose

The development and introduction of a National Forest Inventory module should be the first step within the implementation phase.

Figure 7: National Forest Inventory



Source: UNIQUE, 2016

The National Forest Inventory is an internal core information creation process. A software solution is needed for data collection, data aggregation, data analysis and reporting. The smallest unit for which statistical sound data can be provided following the developed design for the National Forest Inventory⁶ are forest types and tree species (groups) within a region, a district or even within a certain forest function zone.

Purpose

ForestEye (2017) has defined the purpose like follows:

- NFIs are to provide scientifically sound and technically meaningful data and information to support policy processes, policy decision making and forest related policy formulation.
- Georgian National Forest Inventory (...) is planned and designed to be the starting point for establishing a long term National Forest Monitoring System that generates national and regional level forest related information that feeds as one data set into the National Forest Information System.

⁶ ForestEye, 2017: Methodology for the First Georgian National Forest Inventory (NFI) and Forest Management Inventories (FMIs)

Business Process

The legal framework defining the business process in regard of the NFI software module comprises the documents shown in the following table.

Table 17: Legal documents defining the business process for the NFI module

| Legal document | Content |
|---|--|
| Forest code Article 25 - Monitoring | « (...) Forest monitoring is undertaken by forest management bodies on their territories, by their territorial divisions and by other authorized entities and forest users. Forest monitoring can be conducted through <u>national forest inventory on permanent sample plots</u> where the quality and amount is defined by the bylaw on “Rules and Inventory System of Georgian Forests”. » |
| Reg. 179 Article 8 - Selective method of inventory | « The selective inventory (FMI/NFI) is applied to the whole country or on a distinct area. During the selective method for the taxation process forests are measured: Sample plots are taken for the selective inventory. The center of the plot lies on grid points (the distances between points are 100 and more) of a metric grid (this is determined by technical task according to the level of accuracy of the study). In order to delineate forest stands and unify them in strata (collection of homogenous forest stand), orthophotos are used as part of the selective inventory (FMI/NFI) ⁷ method. (...) » |

Beside the definitions defined in legal documents the central source for the NFI business process is the “First draft methodology for the First National Forest Inventory of Georgia (NFI)” (ForestEye, 2017).

4.2.2 Features

To ensure a proper functionality of the module, the following features should be taken into account:

- Relational spatial database for point sampling
- (Mobile) data collection function including plausibility checks and GPS navigation
- Data check, data aggregation and analysis, sample error calculation
- Reporting: Reports as maps and tables shall be available in the FLUIDS web-portal.

4.2.3 Basic entities

Basic entities of the NFI spatial database are:

- Sample points and plots (related stands)
- Soil and site data (eventually derived from spatial overlay in FLUIDS)
- Trees (> 8 cm DBH)

⁷ Stands are not delineated during the NFI.

- Regeneration (< 8 cm DBH)
- Dead wood

The full list of attributes and entities can be found in the NFI methodology (ForestEye 2016).

4.2.4 Proposed software

The software product, recommended for the NFI is Open Foris Collect, Collect Mobile and Calc of FAO. ForestEye delivered a configuration of the software that is specifically adapted to this inventory protocol and that was used successfully in context of the test inventory. This basic configuration was delivered to demonstrate the general suitability of the software as data management and data analysis module. It serves as an example for a productive system that is used as a basis for final development and full implementation. It requires a careful check and further testing. The delivered example configuration should not be used as final productive system before it is intensively studied and tested by NFA and field teams.

The software is a product of Open Foris Initiative established in 2009 by the Food and Agriculture Organization of the United Nations (FAO) to develop, share and support tools and methods for multi-purpose forest assessment, monitoring and reporting (FAO 2009⁸). The following short introduction has been extracted from the Open Foris portal (<http://www.openforis.org/home.html>).

Open Foris supports open data and the free sharing of data and information to all stakeholders. The tools take a modular approach, providing components, which may be mixed and matched to best fit user needs. Industry-standard best practices are followed to maximize quality and usability. Where relevant, open standards are also applied to allow interoperability (interfacing) with existing systems and infrastructure. The tools support a wide range of point sampling inventories and are being built to support the inventory lifecycle, from design, planning, field data collection and processing, estimation, analysis and dissemination.

Components

Open Foris Calc

- Robust, modular browser-based tool for NFI results calculation.

Open Foris Collect

- It provides a flexible solution for field data management, allowing full customization of inventory structure, variables and data checks. Collect promotes data quality through an integrated data entry and data cleansing workflow. All inventories documented in this way may be entered and retrieved through a user-friendly interface, without additional programming. Collect is available in both, standalone (offline) or web-based (online) versions.

⁸ FAO Open Foris: http://www.openforis.org/OFwiki/index.php/Main_Page

Open Foris Collect Mobile

- Collect Mobile is a fast and flexible data collection tool for field-based surveys. This Android app allows the completion of complex data structures, such as biophysical, socio-economic or biodiversity surveys. Its many features include:
 - On-the-fly validation to improve data quality
 - Handling of large lists of species or other attributes
 - Geo-location through embedded GPS
 - Integration with Collect for data management, analysis and export to commonly used formats

Open Foris Collect Earth

- It is a new tool that enables data collection through Google Earth. In conjunction with Google Earth, Bing Maps and Google Earth Engine, users can analyze high and very high resolution satellite imagery for a wide variety of purposes during the mapping phase of the NFI. It is highly customizable for the specific data collection needs and methodologies.

In brief, this FAO „standard“ with a rapid development worldwide, designed for point sampling inventories with components for data collection, data analysis and reporting can be recommended.

4.2.5 Interfaces

In terms of interfaces between the NFI software module and other modules, the following should be taken into account:

- Export of all GIS layer and related tables (Points, plots, stands; Trees; Regeneration) as Web feature service ,WFS, to the FLUIDS web-portal
- Export of all GIS layer (Points, plots, stands; Trees; Regeneration) as WFS for other national Information System (Biodiversity, Spatial planning etc.)

4.2.6 Development needs

The approach using a free and very flexible software solution comes with some disadvantages in a situation, where an organization cannot provide the technical and time capacity to develop and adapt the tools to its own needs. In brief, there are some needs for final adjustments to the needs of the Georgian NFI:

- Final database structure and selection of final set of attributes.
- Definition of relevant standard reports and the development of an end-user friendly data mining tool, which can be embedded in the FLUIDS web-portal.
- Development of the interfaces to other IS and the FLUIDS web-portal.

4.2.7 Implementation approach

The software does not need to be purchased but a steady service of a professional software company is needed and a service provider needs to be selected to secure the following services:

- Final configuration and development (as described above) along the NFI process
- Development of an end-user friendly data mining tool in close contact with the GFW project to be embedded in the FLUIDS web-portal
- Steady support for all professional users in Georgia (second level support)
- Maintenance and update in close contact with the FAO developer team
- Hosting of the software as a service (SaaS)

The following steps for an implementation are recommended:

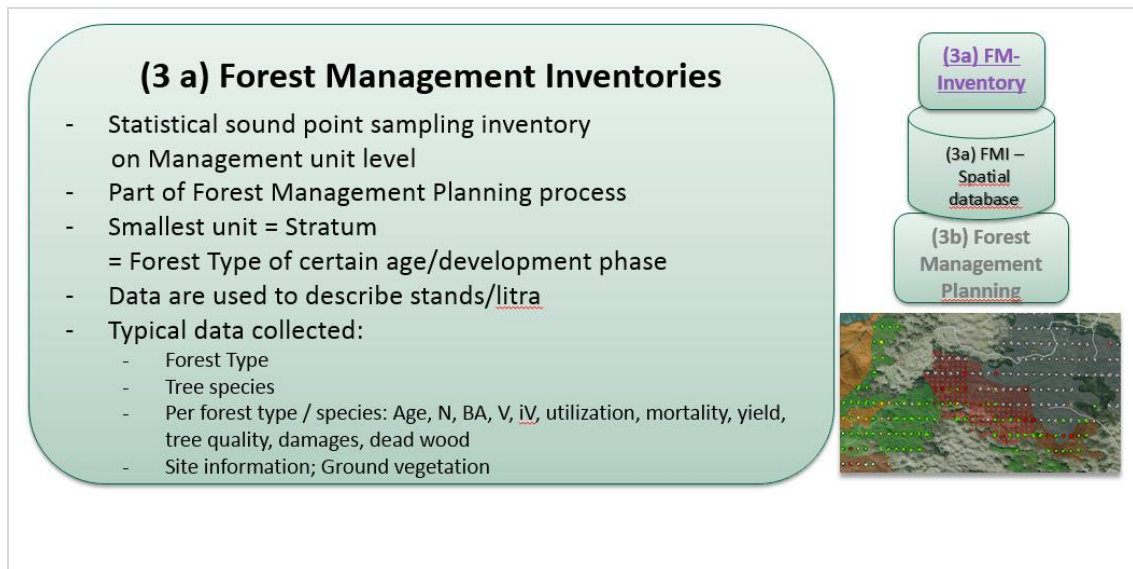
- Step 1: Contact FAO Open Foris support team for information of their own services
- Step 2: Define missing development and adaptation services
- Step 3: Tender adaptation, maintenance and SaaS in Georgia

4.3 Software module: Forest Management Inventory

4.3.1 Business Process and Purpose

The development and adoption of a Forest Management Inventory module should be the second step, named 1b⁹ within the implementation phase.

Figure 8: Forest Management Inventories



Source: UNIQUE, 2016

The Forest Management Inventory is an internal information creation process. The software allows data collection, data aggregation and data analysis for a point sampling inventory. It has an interface to feed stand and strata data into the “FMP Software” module.

Purpose

ForestEye (2016) has defined the purpose like follows: “FMI are to provide scientifically sound and technically meaningful data and information to support planning and decision processes within the forest district where the FMI takes place” (ForestEye 2017).

The FMI is an inherent part of the Forest Management Planning process: “Quantitative and qualitative assessment of forest resources for production” (Article 26, Forest Code).

Business Process

The existing legal framework defining the core business process in regard of the Forest Management Inventories is defined in the following documents.

⁹ step 2 after step 1a and 1b related to NFI as the software is based on the same product

Table 18: Legal documents defining the business process for FMI

| Legal document | Content |
|---|--|
| Reg. 179 Article 8 – “Selective method” of inventory | <p>« The selective inventory (FMI/NFI) is applied to the whole country or on a distinct area.</p> <p>During the selective method for the taxation process forests are measured:</p> <p>Sample plots are measured for the selective inventory. The center of the plot lies on grid points (the distances between points are 100 and more) of a metric grid (this is determined by technical task according to the level of accuracy of the study).</p> <p>In order to delineate forest stands and unify them in strata (collection of homogenous forest stand), orthophotos are used as part of the selective inventory (FMI/NFI) method.</p> <p>(...) »</p> |
| Reg. 179 Article 9 – Method of “detailed inventory” | <p>- « The paragraph describes stand wise point sampling as one of several ways to collect numerical data for a stand description.</p> <ol style="list-style-type: none"> 1. Detailed inventory is based on visual estimations, measuring methods as well as on other methods. 2. Detailed inventory is using visual estimations in the preliminarily delineated stands and by using sample plots in the stands where it decided to harvest timber. 3. The primary level during detailed inventory is the stand. 4. Method of visual estimation and measuring methods are used: <ol style="list-style-type: none"> a) Forest inventory by detailed method is performed by visual taxation of all stand (appraisal in nature) and by taking additional sample plots in forest stand where it is allowed to harvest. On slopes with 36 degrees and more and on difficultly accessible or inaccessible places taxation is made by decoding orthophotos or by observation with optical tools from the opposite slope. b) In forest stand where cutting is allowed a sample plot area should not be less than 3% of the whole area of forest stand and data (copies of field register) of the sample plot is attached to taxation descriptions; c) During detailed inventory, boundaries (...) of forest stand are made based on decoding of orthophoto plans and specification in nature; 5. Forest stand is the primary unit when using detailed method of forest inventory. 6. Depending on forest utilization specifics, other methods also can be used during detailed forest inventory. (...) « |

The existing legally fixed methods describing sampling inventories during the Forest Management planning process foresee two - not connected - point sampling inventory methods: Selective inventory and the sampling during the so called “detailed inventory”. The latter exactly describes the process of a Forest Managing Planning¹⁰.

It is a clear need to define one FMI method to be used in FMP, which provides data on stand level (“detailed inventory”) as well as statistical sound data (“selective inventory”).

The expert team of ForestEye and UNIQUE would like to pronounce: It is possible to develop a logical, efficient and sound business process in order to avoid having two inventory systems as described in the existing regulation 179 in the near future, based on the existing FMI manual

¹⁰ The expression “Forest Management Planning” should be used for the translation of “detailed inventory” into English language.

(ForestEye 2016). This new business process shall link the FMI approach and its data with the need to describe stands and to plan on stand level.

4.3.2 Features

To ensure a proper functionality of the module, the following features should be included:

- Relational spatial database for point sampling
- (Mobile) data collection including plausibility checks
- Data check, data aggregation and analysis, sample error calculation
- Reporting

4.3.3 Basic entities

Basic entities of the NFI spatial database are:

- Sample points and plots including related stands address
- Soil and site data (eventually derived from spatial overlay in FLUIDS)
- Trees (> 8 cm DBH)
- Regeneration (< 8 cm DBH)
- Dead wood

The full list of attributes and entities can be found in the FMI methodology (ForestEye 2017).

4.3.4 Interfaces

In terms of interfaces between the FMI module and other modules, the following aspects should be taken into account:

- Export of point sample data to the „FMP software“. Each point will have information on management unit, compartment, stand, forest type, age/development phase. It allows the aggregation of point data on each kind of stratum and finally on stand level (knowing that the sampling accuracy on stand level is low). It also allows to map point features to support stand and stratum based planning.
- Export of all GIS layer and related tables (points, plots, stands, trees, regeneration) as WFS to the FLUIDS web-portal or any other IS (i.e. Biodiversity-IS).

4.3.5 Potential software solutions

As the purpose and the features are very similar to the one described for the NFI the software toolbox OPEN FORIS is recommended. The advantages are:

- One software for all kind of point sampling inventories with very similar attribute definitions

- Tested already for the NFI and database structure for one FMI test (Pilot Study for Dedoplistskaro (UNIQUE 2016¹¹). Easily adaptable to design the FMI.

For a description of this free and open source software toolbox, please see the description of the NFI software module (chapter 4.2 above) as well the Open Foris portal: (<http://www.open-foris.org/home.html>).

The survey on the Georgian market showed that both of the bigger FMP service provider have also started to develop software solutions for point sampling inventories. Three options could be expected from a tender, if Open Foris is not already fixed as the solution. As the three listed companies also offer software solutions for FMP it is worth to ask for a package solution covering FMI and FMP functionalities when tendering the FMP software:

- Sampling Inventory software developed by GEOGRAPHIC
- Sampling Inventory software under development by Company M³
- OSNOVA software, Serbian software on the market with one license at NFA by GreenFor, Belgrade

4.3.6 Development needs

In case Open Foris is selected:

The approach of a free and very flexible software solution comes with some disadvantages in a situation, where an organization cannot provide the technical and time capacity to develop and adapt the tools to its own needs. In brief, there are some needs for final adjustments to the needs of the Georgian FMI:

- Final database structure and selection of final set of attributes.
- Definition of relevant standard reports and the development of an end-user friendly data mining tool, which can be embedded in the FLUIDS web-portal.
- Development of the interfaces to other IS and the FLUIDS web-portal.

In case another software product has been selected:

- In most cases a spatial database structure is not developed.
- Interfaces to the FMP software have to be developed, if there is not a package offered including point sampling inventory for FMIs and the development of FMP.

4.3.7 Implementation approach

In case Open Foris is selected:

The software does not need to be purchased but a steady and professional software company need to be selected to secure the following services:

- Final configuration and development (as described above) along the FMI process

¹¹ UNIQUE (2016): Forest inventory results and socio-economic forest management concept for the NFA District "Dedoplistskaro". Project report.

- Development of an end-user friendly data mining tool in close contact with the GFW project to be embedded in the FLUIDS web-portal
- Steady support for all professional users in Georgia (second level support)
- Maintenance and update in close contact with the FAO developer team
- Hosting of the software as a service (SaaS)

The following steps for an implementation are recommended:

- Step 1: Contact FAO Open Foris support team for information of their own services
- Step 2: Define missing development and adaptation services
- Step 3: Tender adaptation, maintenance and SaaS in Georgia

In case another software product has been selected:

The following steps for an implementation are recommended:

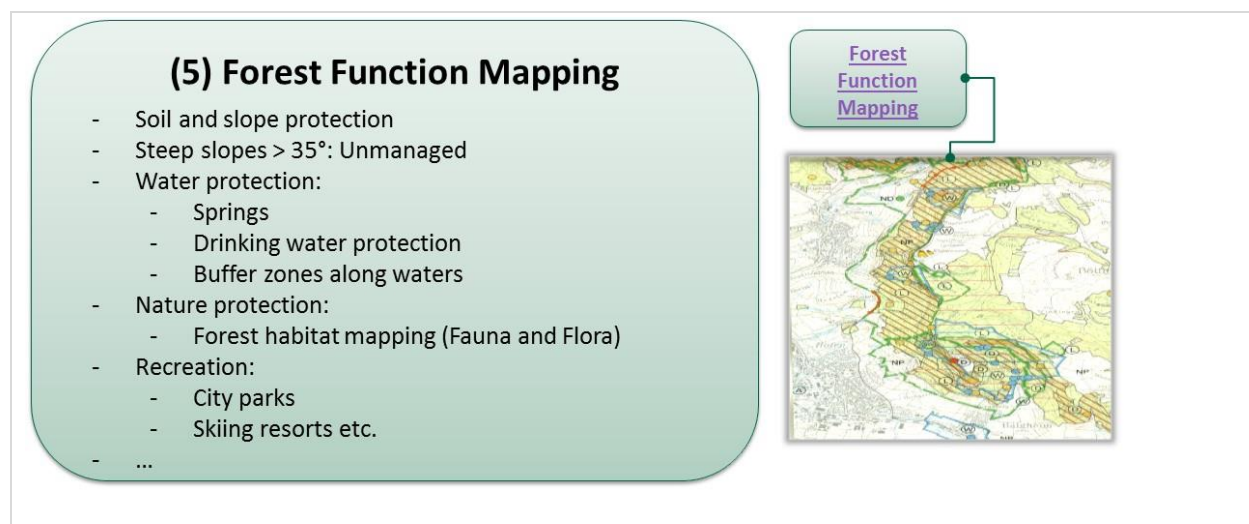
- Step 1: Setup a tender for a FMI software, a FMP software and a combination of FMI and FMP software
- Step 2: Include requests for prices and licenses for any DBM systems (like MS SQL, Oracle, PostGRES)
- Step 3: Include requests for maintenance & update, support and SaaS for each offered product

4.4 Software module: Forest Function Mapping (Zoning)

4.4.1 Business Process and Purpose

The development and implementation of a Forest Function Mapping module should be the third priority (Step 2¹²) within the implementation phase.

Figure 9: Forest Function Mapping



Source: UNIQUE, 2016

The Forest Function Mapping is an internal information creation process applying a multi-source mapping procedure using external and internal sources. Functions or “categories of forest” are partly defined by the new forest law and secondly comprise information, which restrict or influence the management in a certain forest area. Forest functions are basic information for forest management. Planning based on them is an integral part of Forest Management Planning. It should be developed through a singular long term mapping project, with a regular update in case any data sources are changed or the forest management plans are revised. For Georgia it is recommended to split the process in 2 phases:

- Phase 1: Draft zoning based on available GIS/RS data on a national or regional scale – as part of the initial mapping phase in parallel to the NFI implementation. It allows to use the zoning for post-stratification of the NFI data (e.g. Analyze all forests on steep slopes (>35°), analyze all forest in water protection zones).
- Phase 2: Systematic improvements and fine-tuning during each regional forest management planning project.

Purpose

- Zoning or function mapping as one prerequisite for a stratified sampling for the NFI¹³.
- Decision support in forest management planning
- In general important for decision making concerning forest operations

¹² Step 1a and 1b are based on the same software product. It can be seen as one step.

¹³ The zoning allows to analyze NFI data by forest functions zones, which adds an important factor to evaluate forest management options and needs based on the NFI data.

Business Process

The legal framework defining the business process in regard of Forest Function Mapping comprises the aspects shown in the table below.

Table 19: Legal documents defining the business process for Forest Function Mapping

| Legal document | Content |
|--|--|
| Forest code Article 6. Purpose of Categorization of the Forest of Georgia | « ... to : support protection of the ecological functions (...), sustainable use of the forest's economic potential (...), soil protection, water regulating and climate regulating functions of forests (...), touristic and recreational capacity. » |
| Forest code Article 7. Division of Forests into Categories | « Forest of Georgia, (...), is divided into: a) protected forest; b) protective forest; c) resort and recreational forest; d) utilization forest. (...) Division of forests according to their functional designation is carried out in accordance with the "Rules of Categorization and Management of the Forest of Georgia". » |
| Forest code Article 8. Category Protected Forest | « (...) nature reserves, national parks, natural monuments, sanctuaries (...), Forests where a high concentration on a global, regional or national level of biodiversity elements are observed. (...); Natural landscape forming forest (flood plain and arid). (...) Forest comprising endemic and/or relict species. . (...) Emerald Network sites (...) » |
| Forest code Article 9. Category Protective Forest | « Category Protective forest includes: <ul style="list-style-type: none"> ▪ Forest strip with up to 200 meters width located along permanent paths of avalanches and mudflows; ▪ Forest located on the slopes with greater inclination than 35°; ▪ Forest areas of up to 30 hectares located between non-forested plots; ▪ Forest strip of up to 100 meters width located around landslides, eroded slopes, karstic formations (...); ▪ Forest strip of up to 100 meters width located along railways and motor roads; ▪ Forested areas of up to 100 meters width located around rivers, lakes and water reservoirs; ▪ Forest located around landslide, stone fall and rocky areas; ▪ Forest around natural caves; ▪ Forest located in erosion-prone and geologically active sites; ▪ Forest located on erosion-prone slopes; ▪ Subalpine forest; ▪ Forest located within 100 meters radius area around water intake headworks. » |

| Legal document | Content |
|--|---|
| Forest code Article 10. Category "Resort Forest" | «Category Resort Forest includes: a) Forest located in the protection zone of resorts; b) Forest located within 1 km radius area around medical institutions and mineral water springs. c) Forest located within protected landscapes (...) d) Forest located within protected landscapes (...) » |
| Forest code Article 11. Category Utilization Forest | «(...) Category of utilization forest is assigned to a forest which serves the functions of soil protection and regulates water balance. All types of forest use is allowed in this category of forest in accordance with the rules set out in this Code. (...) » |

The final definition of the business process needs to be developed by the GIZ „zoning project“ regarding technical methods and criteria.

4.4.2 Features

To ensure the proper functionality of the module, the following features should be implemented:

- Spatial database containing layers for each forest function
- For each forest function:
 - Import of basic and secondary data (DTM, Forest mask etc.)
 - Spatial analysis scripts / models to derive proposals for forest functions based on given criteria (i.e. slope: Inclination $\geq 35^\circ$)
 - Combined with manual map interpretation and final delineation steps

4.4.3 Basic entities

- GIS-layer describing polygons with locations mapped for each forest function

4.4.4 Interfaces

In terms of interfaces between the Forest Function Mapping module and other modules, the following should be taken into account:

- Some data sets describing a forest function can be directly imported: Nature reserves and water reserves defined by legal acts. The import is possible via WFS¹⁴ or WMS.
- Import of secondary data: In many cases delineation of a forest function is derived from a combination of spatial data sets (i.e. DTM¹⁵ for slope protection forests). Import can take place via WFS or WMS.

¹⁴ WFS = Web Feature Service and WMS = Web Map Service

¹⁵ DTM = Digital Terrain Model

- Export of all GIS layers as WFS for other information systems (biodiversity, spatial planning etc.) in a standard format defined by the NSDI¹⁶ process.

4.4.5 Potential software solutions

Standard GIS software solutions can be used (as ArcGIS, QGIS) as basic software modules. The development comprises the definition of scripts or models, which shall be implemented as new features in the selected GIS product. The new features shall automatize the derivation of indicators for a certain forest function (i.e. buffer along a selected road in a predefined format). The resulting zones of functions are presented as spatial and tabular layer in the FLUIDS platform.

The software module is not expensive as standard GIS software can be used as a base and adapted to the mapping process and mapping criteria defined. Prerequisites are secondary data for the derivation of forest function criteria, which are not fully yet available at the moment:

- Administrative maps
- Cadastral map
- Forest mask
- Digital Terrain Model (DTM)
- Soil map
- Forest cover map
- Risk atlas (erosion, flooding)
- Biodiversity data: Habitats, species ranges
- Spatial plans

Availability and quality of each layer will have to be checked, which is part of the FLUIDS development.

4.4.6 Proposal for the implementation

The following work steps for the software development are proposed:

- 1) The TWG supported by additional experts – depending the forest function – is defining a technical guideline for the mapping of forest functions.
- 2) Based on the existing guidelines the development of Forest Function Mapping Features in a selected standard GIS software shall be tendered.
- 3) The selected company develops the respective scripts and adaptations of the user-interface.
- 4) As the forest function mapping was highly prioritized as part of the mapping process at the start of the NFI, the first mapping phase can be directly used to apply the software, to test it and to improve it step-by-step.

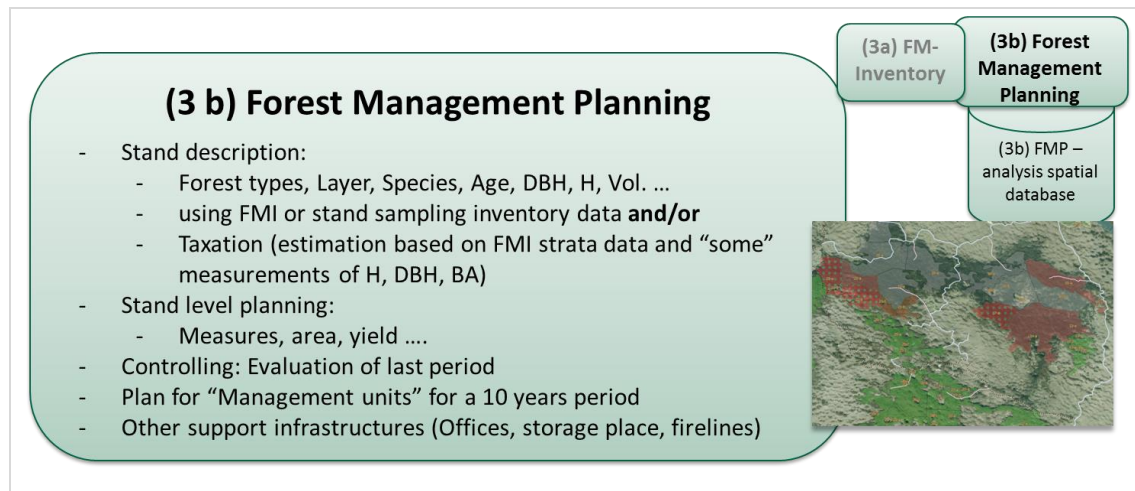
¹⁶ NSDI = National Spatial Data Infrastructure

4.5 Software module: Forest Management Planning

4.5.1 Business Process and Purpose

The development and adoption of a Forest Management Planning module shall be the fourth step (Step 4) in the implementation phase.

Figure 10: Forest Management Planning



Source: UNIQUE, 2016

Forest Management Planning is an internal information creation process, linked with point sampling inventories (see FMI software chapter 4.3). The software shall be used to define and update stand data and forest maps. Completed Forest Management Plans will be uploaded to the central forest database (“Forest Register”) to complete the actual picture of the forest resources of an enterprise or an administration entity (NFA). Typically, the smallest management unit is a forest stand / litter inside a forest district.

Purpose

The purpose is to support the development of Forest Management Plans in all steps:

- Phase 1: Analysis the forest structure (Status)
- Phase 2: Evaluation of the past period (10 years period)
- Phase 3: Definition of planned measures for the next 10-years period
 - Forest stands: Harvest, tending, thinning, regeneration, reforestation
 - Non forest: Afforestation, agriculture, grazing rights, Non timber production rights
 - Roads: Building & maintenance

Business process

The legal framework defining the business process of Forest Management Planning is listed in the table below.

Table 20: Legal documents defining the business process for FMP

| Legal document | Content |
|--|---|
| Forest Code: Article 26 - Forest Planning | <p>"Forest planning (...) is undertaken once in every 10 years.</p> <p>Forest planning actions are:</p> <ul style="list-style-type: none"> ▪ Definition of boundaries of the forest of Georgia; ▪ Internal management organization of forests and preparation of cartographic materials for these forests; ▪ Identification of the forest condition, species composition and age structure; ▪ Identification of endangered, rare, relict, endemic plant species and species with limited habitats; ▪ Identification of forest units where it is possible (necessary) to conduct necessary forest management measures, also to define the types, volumes and methods of those measures; ▪ Taking into account the prevailing functional characteristics of a forest, assigning forest category and protection regime; ▪ Identifying a need for defining or adjusting forest boundaries; ▪ identification of areas for forest use; ▪ Quantitative and qualitative assessment of forest resources for production; ▪ Pathological study of forest. <p>Forest planning materials are reflected in the Forest Management Plan (...).</p> <p>In the forest of Georgia, use of forest resources and forestry activities are carried out on the basis of on Forest Management Plan (...)."</p> |
| Reg. 179: Chapter II: Forest Inventory (= Phase 1) | <p>Including articles 3 to 11:</p> <ul style="list-style-type: none"> ▪ Goal of the forest inventory ▪ Object of the forest inventory ▪ National forest fund categories ▪ Forest inventory work ▪ ... |
| Reg. 179: Chapter V: Forest Monitoring (= Phase 2) | <p>This chapter comprises the articles 23 to 29:</p> <ul style="list-style-type: none"> ▪ The essence of forest monitoring ▪ The goal of forest monitoring ▪ Basics of forest monitoring ▪ ... |
| Reg. 179: Chapter III: Forest Management PLAN (= Phase 3) | <p>This chapter comprises the articles 13 to 17:</p> <ul style="list-style-type: none"> ▪ Basics of forest management planning ▪ Information to be reflected in the forest management plan ▪ Procedure of forest management plan approval ▪ ... |

Note: An improvement and update of the existing FMP business process should be started before the update of the Forest Code and the Reg. 179, consisting out of the following steps:

- First step is the definition of an improved and efficient business process (from the side of BFPD, NFA and APA).
- Second step will be to update the Forest Code and especially Reg. 179.

- The expert team of ForestEye and UNIQUE would like to pronounce: It is possible to develop a logical, efficient and sound business process in order to avoid having two inventory systems as described in the existing regulation 179 in the near future, based on the existing FMI manual (ForestEye 2016). This new business process shall link the FMI approach and its data with the need to describe stands and to plan on stand level (see chapter above).

4.5.2 Features

To ensure proper functionality of the module, the following features should be included:

- Relational spatial database for stands (liter)
- (Mobile) data collection for stand description and stand based planning
- Data check, data aggregation and analysis (i.e. DBH classes per tree species, stand or any other stratum).
- Planning:
 - Group and filter stands by strata
 - Calculate and present model based yield indicators (increment, yield table etc.): As harvesting options are currently defined by Georgian Law on density, this analysis must be possible.
 - Support comparison of model based yield planning and stand based yield planning
- Reporting:
 - Status of forest by forest types, species, age class, DBH distribution, stocking density, volume and others
 - Activity records from the last period
 - Target – actual comparison
 - Planned measures by forest type for harvesting, re-afforestation, roads, NTFP and other plans

4.5.3 Basic entities

Basic entities of the spatial FMP database are:

- Compartments
- Stands (Liter) and its description (ha, N, Basal Area, Volume, Increment)
- Land use classes (forest, non-forest: fields, meadows, roads etc.)
- Tree species (ha, N, Basal Area, Volume, Increment, technical quality, vitality)
- Regeneration layer (< 8 cm DBH)
- Dead wood
- Rare species
- Forest roads and tractor roads
- Other support infrastructures (Offices, storage place, fire lines)

4.5.4 Interfaces

In terms of interfaces between the FMP module and other modules, the following aspects should be taken into account:

- Import point sample data to „FMP software“: Each point will have information on management unit, compartment, stand, forest type, age/development phase:
 - Allowing aggregation on stratum and stand level
 - Allowing mapping of point features and trees to support stand and stratum based planning
- Export of all GIS layer and related tables (Plots, stands, trees, regeneration) as WFS to the FLUIDS web-portal
- Spatial joins with external spatial databases. If the spatial data layers are embedded in the FLUIDS portal spatial joins can be used to automatically fill data (i.e. aspect, sites, forest function).
- Import of activity records from software for Forest Operations (see chapter below)

4.5.5 Potential software solutions

The survey on the Georgian market showed that both of the bigger FMP service provider have developed modern web-based software solutions for FMP (100% fitting to Reg. 179). Three options could be expected from a tender. As the three listed companies also offer software solutions for FMI it is worth to ask for a package solution covering FMI and FMP functionalities when tendering the FMP software.

Moreover, as the database structure and standard features of the Forest Register (see chapter 0) are very close to the one of the FMP software and only a few special functionalities have to be added, it is recommended to ask for both software modules in one tender and package.

- Forest management planning software on the market by GEOGRAPHIC
- Forest management planning software developed by Company M³
- Alternative: OSNOVA software on the market and with one license at NFA from GreenFor, Serbia

All these software solutions are easily available. A fast implementation is possible.

4.5.6 Development needs

From screening the market solution in Georgia, it is obvious that some adaptations are necessary to meet the needs of the FIMS and FLUIDS concept:

- Development of spatial databases
- Forest road management is not part of any software yet
- Development of the interfaces defined above

4.5.7 Implementation approach

The following steps for an implementation are recommended:

1. Setup a tender for a FMI software, a FMP software and a combination of FMI and FMP software as well as the functionalities asked for a Forest Register (see chapter0). The

additional software for FMI shall only be tendered in case that Open Foris was not selected as future FMI software.

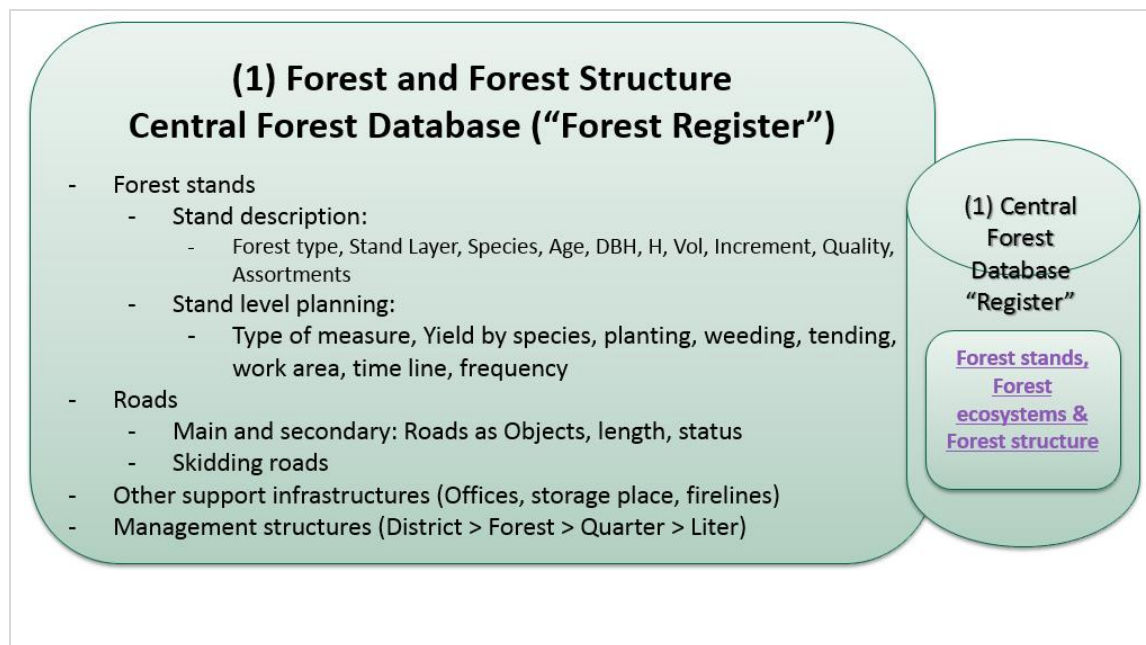
1. Include requests prices and licenses for a necessary DBMS (like MS SQL, Oracle, Post-Gres)
2. Include requests for maintenance & update, support and SaaS for each offered product

4.6 Software module: Forest Register

4.6.1 Business Process and Purpose

The development and adoption of a Forest Register module should be the fifth step in the implementation.

Figure 11: Forest Register



Source: UNIQUE, 2016

The Central Forest Database ("Forest Register") is the central module of the FIMS, the location where basically the forest and the forest structure is described using forest stands as smallest unit. The setting up of a "Forest Register" is a demand described in the Forest Code. It is built on forest stands as the core forest management entity. A regular update is maintained by Forest Management Planning and features to simulate annual growth and changes induced by forest operations (harvesting, re afforestation etc.).

Purpose

The purpose is to deliver a central and up-to-date overview of the forest area, forest structure and forest condition,

- based on Forest Management Plans and
- based on NFI data for forests outside of State forest fund.

Business Process

The legal framework defining the business process to set up and maintain the Forest Register is analyzed in the table below.

Table 21: Legal documents defining the business process for the Forest Register

| Legal document | Content |
|--|--|
| Forest Code Article 27. Register of the Forest of Georgia | <p>Forest Register of Georgia pools and systematizes documents containing information on the forest of Georgia, forest use, its protection and regeneration.</p> <p>Register of the forest of Georgia contains documented information on:</p> <ul style="list-style-type: none">▪ Types of forest ownership;▪ Forest categorization;▪ Forest management units and forest compartments;▪ Qualitative and quantitative information on forest and its resources;▪ Forest protection, restoration and use;▪ Forest boundaries. <p>Information held in the Registry of the forest of Georgia is public.</p> <p>The Forest Register of Georgia is maintained by the Ministry using information received from relevant forest management bodies.</p> <p>Government of Georgia establishes rules for issuing information kept in the registry of the forest of Georgia.</p> |

Note: A definition can only be built on a valid update of the Forest Code and the Reg. 179, according to the following steps:

- 1. step: Define purpose and features of the Forest Register (BFPD, NFA, APA)
- 2. step: Define business processes and data-exchange rules
- 3. step: Update Reg. 179

4.6.2 Features

The database structure and main functions are very similar to the FMP software. A Forest Register software can be derived based on existing software products for FMP (see chapter 4.5 above). To ensure the proper functionality of the module, the following features should be included:

- Relational spatial database of forest stands
- Data import from forest management plans including secure overwriting of outdated stand and management units
- Data check, data aggregation and analysis
- Annual growth:
 - Use increment data per tree species to update stand information annually
- Actualization of stands triggered by activity records:
 - Via an interface to the software for Forest Operation (see chapter 0below) stand data shall be updated using harvesting records grouped by the tree species described in the stand (taken over from the “Electronic System of Timber Resources” (Art. 50 Forest Code))

4.6.3 Basic entities

- Regions, Districts and Management Units
- Compartments
- Stands (ha, N, Basal Area, “Stocking density”, Volume, Increment)
- Land use classes
- Tree species (ha, N, BA, Basal Area, “Stocking density”, Volume, technical quality, vitality)
- Regeneration layer(< 8 cm DBH)
- Dead wood
- Rare species
- Forest roads and tractor roads
- Other support infrastructures (Offices, storage place, fire lines)

4.6.4 Interfaces

In terms of interfaces between the Forest Register module and other modules, the following aspects and possibilities should be taken into account:

- Import from FMP software
- Export of all GIS layer and related tables (Points, plots, stands; Trees; Regeneration) as WFS to the FLUIDS web-portal

4.6.5 Potential software solutions

The software screening on the Georgian market showed, that there are no products fitting 100% to the demands. However, software available for Forest Management Planning can be the base to develop the software features for the central Forest Register. OSNOVA software might be closest to the specific features as it is able to simulate growth as it includes tree diameter increment data. It is already able to integrate activity records.

Overall the three available products might be offered if tendering for a software Forest Register:

- If improved: Forest management planning software, GEOGRAPHIC
- If improved: Forest management planning software, Company M³
- Alternative: OSNOVA software developed by GreenFor, Serbia

4.6.6 Development needs

No software product on the Georgian market is able to fulfill all requests without adaptations. Most obvious adaptations are:

- Features like “annual growth” and “actualization of stands” triggered by activity records – as described above - are not existing in most of the known software products on the market.
- All known software solutions need to be adapted to fit into the concept of the FIMS and FLUIDS. They are not spatial databases yet.
- A test for a multi-user performance is needed, when a large number of users in different offices are using the database at the same time.

4.6.7 Implementation approach

The following steps for an implementation are recommended:

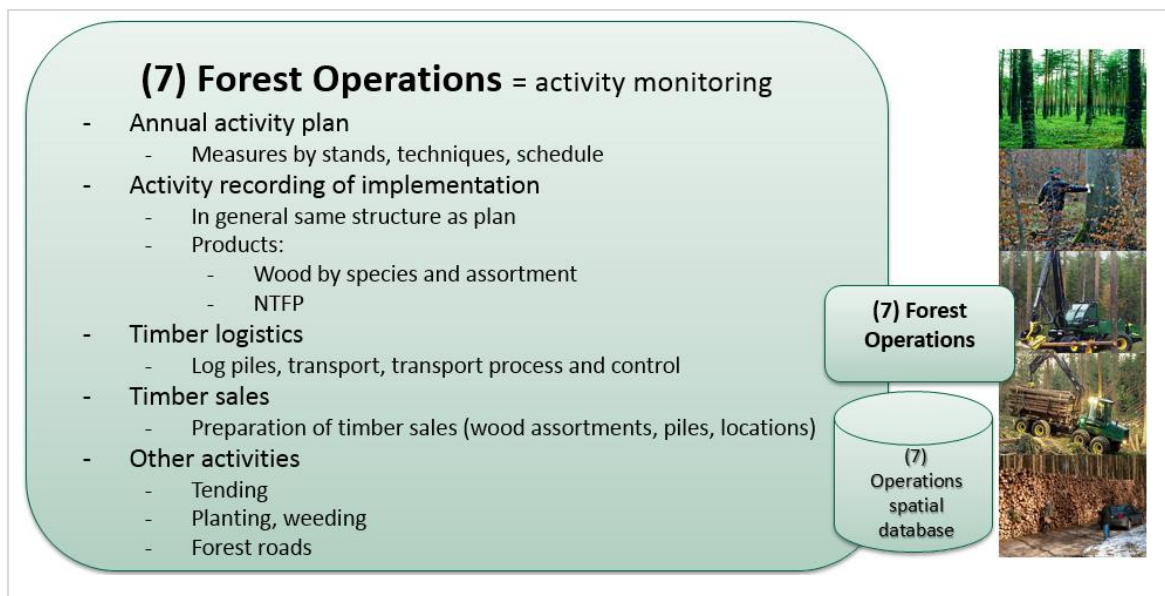
1. Setup a tender for a software solution package, FMP software, a combination of FMI and FMP software as well as the functionalities asked for a Forest Register (see chapters above). The additional software for FMI shall only be tendered in case that Open Foris was not selected as future FMI software.
2. Include requests for prices and licenses for a necessary DBM system (like MS SQL, Oracle, PostGres)
3. Include requests for maintenance & update, support and SaaS for each offered product

4.7 Software module: Forest operations

4.7.1 Purpose

The development and adoption of a Forest Operations module should be the last step (step 6) in the implementation of the GIZ-supported software modules.

Figure 12: Forest Operations



Source: UNIQUE, 2016

Forest Operations happens on an annual or daily level. It comprises the annual planning, implementation, inspection, recording and controlling of all management activities in the forest enterprises. It is an internal management process at NFA and APA, using the results of Forest Management Plans and forest information from the central Forest Register. As each activity in the forest like harvesting, tending or planting is changing the stand structure these changes should be ideally fed back to the stand descriptions in the Forest Register. Thus, this module deal with updating the forest status and an activity based monitoring.

The Forest Operations software can be split into several sub-modules, which could in general be developed independently. However, this is not recommended.

The purpose of the module is to support all management steps on an annual level:

- Planning
 - Annual Action Plan
- Implementation
 - Implementation of (harvest) measures and timber sales (NFA, APA)
 - Implementation of all other measures in a forest stand (planting, weeding, tending)
 - Issuing of timber production tickets (commercial)
 - Issuing of Logging Tickets (firewood)
 - Sale and Management of forest use contracts
- Activity monitoring
 - Activity Recording
 - Timber sales and timber sales statistic

4.7.2 Business processes and features

The business processes subsumed under Forest Operations are described in several legal documents. The legal framework defining the business process is only roughly analyzed in the table below as most of the regulations are under revision at the moment.

It is recommended to first revise and define new business processes for the different management measures (harvesting, thinning, road building, timber sales, tending, planting) and in a second step to adapt regulations and the forest law.

Table 22: Legal documents defining the business process for the Forest Operations

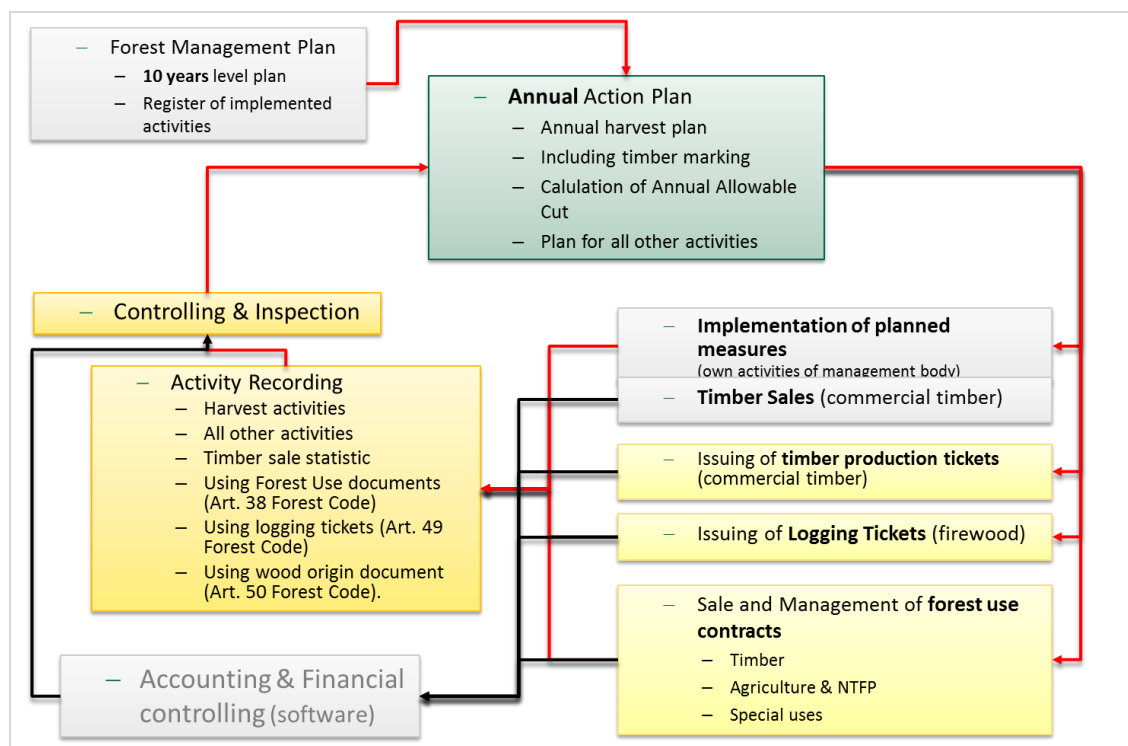
| Legal document | Content |
|---|---|
| Forest Code Chapter V Forest Use | <ul style="list-style-type: none"> – Article 37: Types of special use – Article 38. Rights for Special Use of Forest – Article 39. Forest Use for Sustainable Forest Management Purposes – Article 40. Planned Use of Forest |
| Forest Code Chapter VI Timber Production | <ul style="list-style-type: none"> – Article 44. Logging – Article 47. Annual Allowable Cut – Article 49. Legal Basis for Logging (Timber production ticket and Logging ticket) – Article 50. Wood origin document <p>(...)</p> <p>5. The forest management body created Electronic System of Timber Resources to register forest use, its movement and primary processing activities.</p> |
| Forest Code Other types of special use | <ul style="list-style-type: none"> – Chapter VII Forest farming – Chapter VIII Agricultural Use of Forest – Chapter IX Use of Non-timber Forest Products and Secondary Wood Products – Chapter X Forest Use as a Resort and for Recreational, Sporting, and other Cultural and Health Improving Purposes – (...) – Chapter XIV Forest Use for Scientific Research and Education |
| Regulation 241 | <ul style="list-style-type: none"> – Forest protection measures – Reforestation and related activities |

| Legal document | Content |
|--|---|
| Regulation of Forest Protection, Reforestation and Maintenance | <ul style="list-style-type: none"> – Tending of forest stands |
| Regulation 242 Forest use rules within the territory of the state forest fund | <ul style="list-style-type: none"> – Article 3. Forest Use Types (as in the forest code) – Article 4. Types of Services <p>1. Types of services provided by the Agency are as follows:</p> <ol style="list-style-type: none"> Issuance of the timber production certificates (tickets) Preparation of the licensing objects Issuance of permits for forest use and preparation of the respective documentation Issuance of the forest use certificates (tickets) Preparation of information on land parcels in forest Preparation of cadaster measurement drawing of land parcel Inventory description of the land parcel Drawing up the situation plan Identification of the operation area contours and its inventory description Preparation of information on the land parcels of linear structures Preparation of cadaster measurement drawing of land parcel of linear structures Inventory description of the land parcels of linear structures. Marking of cutting area Issuance of timber origin document form Issuance of special sign board Issuance of the special signboard and/or marking with special sign boards. <ul style="list-style-type: none"> – Article 11. Special Cuts (Fire wood – social cuts) – Article 12 Types of commercial cuts – Article 14 Timber Production tickets (= here defined like “logging ticket” of the new forest code; Only for special cuts only) |

Forest Operations are the only field of activities where a software system is already in place based on a demand defined shortly in the new forest code (Art. 50, paragraph 5): “The forest management body develops an **“Electronic System of Timber Resources”** to register forest use, its movement and primary processing activities.” However, the software system is not covering all relevant business processes yet.

The following figure illustrates the typical work steps in forest operations. It is orientated on the business process definitions of the forest code and regulations 241 and 242. The figure, however, includes steps and features, which are not mentioned and described in the mentioned sources. These missing steps and features would be part of the new software module.

Figure 13: Business processes of Forest Operations and resulting features of the software



Source: UNIQUE, 2016

The process to be supported by the Forest Operation software can be described the following way (see figure from top right):

- Annual action plan:
 - Based on the FMP, stands with planned activities are selected
 - An annual harvesting plan is developed. Harvesting areas are defined, described, and marked. Timber to be harvested is marked and measured.
 - Based on the total harvest areas an annual allowable cut for the managing body (NFA, APA etc.) has to be calculated
 - All other measures are defined in the annual action plan: Planting, tending, etc.
- Along the year implementation of all kind of planned measures follows the responsibility of the managing bodies. In case of commercial cuts, felled timber is registered and offered to customers via the auction portal of the Government. For timber sold and ready for transport a wood origin certificate is issued.
- For all other users of the forest with the right for commercial harvest, the managing body issues timber production tickets.
- For firewood sales for social purposes in form of “special cuts” the managing bodies are issuing “logging tickets”.
- A steady task outside of the annual cycle is the sale and management, inspection and control of **forest use contracts** as well as **timber concessions**.
- Activity recording
 - All implemented activities are recorded together with the application data and the resulting products (timber, NTFP etc.)

- The financial data related with all activities shall be automatically handed over to the financial accounting system of the managing bodies. Same goes for the timber sales process and resulting revenues.
- Financial data and activity recordings can be compared with the annual action plan. What was done, where, when, by whom, for what costs, with what impact and revenue? These are questions to be answered by the controller of the managing bodies.
- In a final step all activities changing the forest stands (harvesting, re-forestation), other managed areas (meadow) or forest roads (repair, maintenance) shall be registered in the central Forest Register. Thus, an update of the forest structure of the respective stands and objects will be documented.

4.7.3 Interfaces

In terms of interfaces between the Forest Operations module and other modules, the following aspects should be taken into account:

- Annual Action Plan
 - Filtering and Import data from FMP software
 - Export of all GIS layer and related tables (stands, harvest area, activity area) as WFS to the FLUIDS web-portal
- Timber production tickets
 - Selection of harvest area and timber marking data from Annual Action Plan
 - Export of all GIS layer and related tables (stands, harvest area, activity area) as WFS to the FLUIDS web-portal
 - Export invoices to Financial Accounting software
- Logging tickets
 - Selection of harvest area and timber marking data from Annual Action Plan
 - Export of all GIS layer and related tables (stands, harvest area, activity area) as WFS to the FLUIDS web-portal
 - Export invoices to Financial Accounting Software
- Forest Use contracts
 - Select and import cadaster data
 - Select and import forest data (area, stand information) from Forest register
 - Link to electronic auction platform
 - Export invoices to Financial Accounting software
 - Export of all GIS layers and related tables (stands, use type: area, volume) as WFS to the FLUIDS web-portal

4.7.4 Software solution

As mentioned above the **Electronic System of Timber Resources** exists to register forest use, its movement and primary processing activities (Art. 50). It is established at the NFA Forest Analytical department and at APA. The web-based software had been programmed by the Ministry

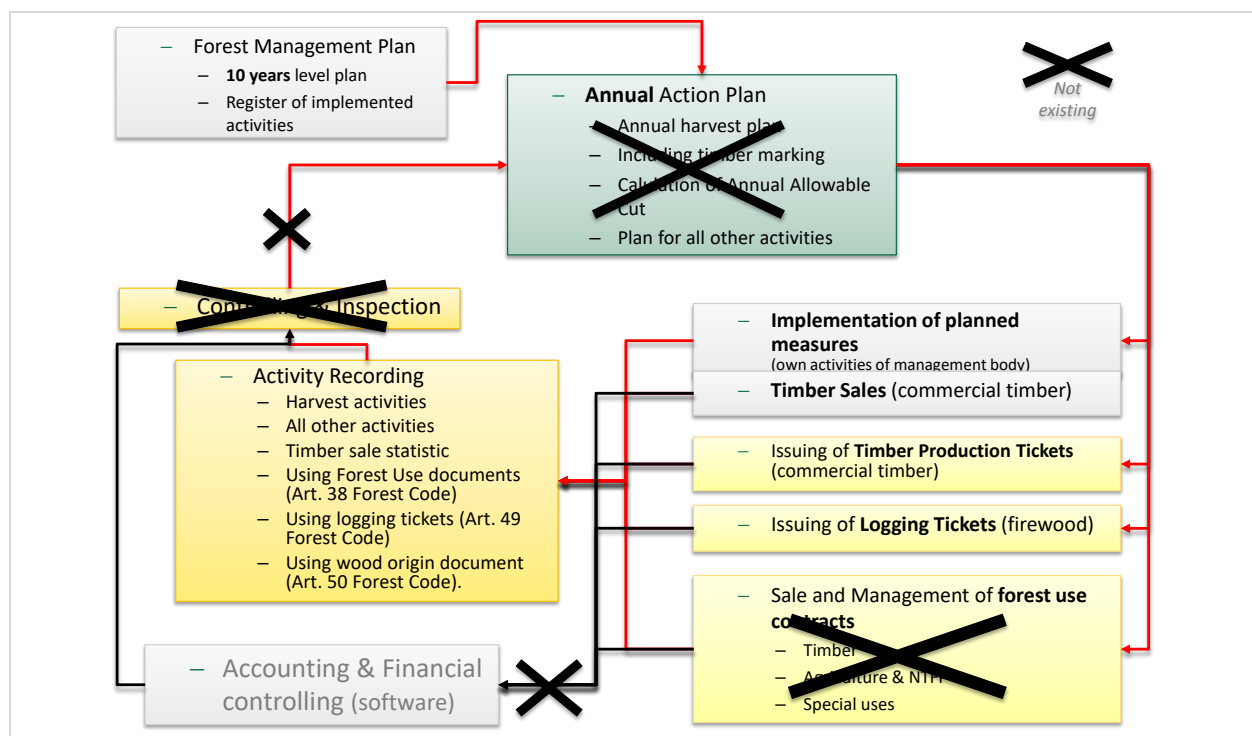
of Finance and is hosted there. The NFA forest use department is responsible for the management activities covered by the software. The software is in use in all regional offices of NFA and APA. For the control of timber transport, the DES is involved and has access to the system.

It seems that the Electronic System of Timber Resources is not used as an information system by other NFA departments, the Biodiversity and Forest Policy Department, BFPD, or any other ministerial body.

4.7.5 Development needs

Several features are not existing yet and a detailed feature description is missing. The following figure illustrates missing work steps and features.

Figure 14: Business processes of Forest Operations. Marked are steps and features, which are not yet part of the existing Electronic System of Timber resources



Source: UNIQUE, 2016

In general the existing software needs to be adapted to fit into the concept of the FIMS and FLUIDS.

- The existing software is not a spatial database yet. However, mapping is possible. Harvesting areas are located with points on a map (google images as background).
- Most interfaces are missing and need to be developed along with the new features and the implementation of related modules like the Forest Register.

4.7.6 Implementation approach

As the development of the existing software and all corresponding services have been in the hands of the Ministry of Finance, the recommendation is to negotiate any improvements and new features with this team. A critical point will be the price for the existing service (SaaS). The monthly

cost of the software of 20,000 GEL/month seems to be not competitive and should be newly negotiated.

The following steps for an implementation are recommended:

1. Establish a commission out of the TWG, including experts from NFA analytical and NFA forest use department together with 2-3 experienced forest engineers working with the system on the regional and district level.
2. Develop an adaptation concept describing the new features and interfaces.
3. Discuss the approved concept with the developer team.
4. Ask for a price offer including prices and licenses for the necessary DBM system (like MS SQL, Oracle, PostGRES) and include requests for maintenance & update, support and SaaS.
5. In case that the price level is like mentioned above, it is highly recommended to tender the full software on the open market.

5 Institutionalization

This chapter presents a proposal how to institutionalize national level forest monitoring in Georgia, focusing on the aspect of the planned implementation of a FIMS combined with the FLUIDS web-portal. The proposal how to institutionalize NFI and FMI is covered by the report of ForestEye¹⁷. As NFI / FMI and the FIMS are elements of a NFMS, these proposals are harmonized and overlapping.

5.1 Task and approach

The institutionalization of NFI and FMI activities are not independent from the establishment and institutionalization of the FIMS activities. All three activities are elements of a national forest monitoring system. Even if the proposals are described in different documents (a) considering NFI and FMI and (b) considering FMIS, the approach is a joint and common one. It combines the overlapping needs to setup up a team, which is technically able to manage inventory tasks, huge databases, remote sensing, mapping, data processing based on sound forest management and information technology skills. We would like to point out that the setting-up of a national forest monitoring system is a long-term endeavor and thus an adequate institutionalization and sufficient staffing is a must for a system to be sustainable and successful. Otherwise, the Government of Georgia cannot be reliably informed about the development of its forest resources and forest ecosystems; information that is essential not only for national policymaking but also in the context of international forest related policy processes (ForestEye, 2017).

The mandate for the implementation of the inventories and FIS, as well as the financial, technical and personnel capacities, have been identified in phase 1 (2015 – March 2016). This mandate, however, has been changed and modified until recently.

5.2 Proposed Institutionalization

5.2.1 Forest Research Institute – a long term goal

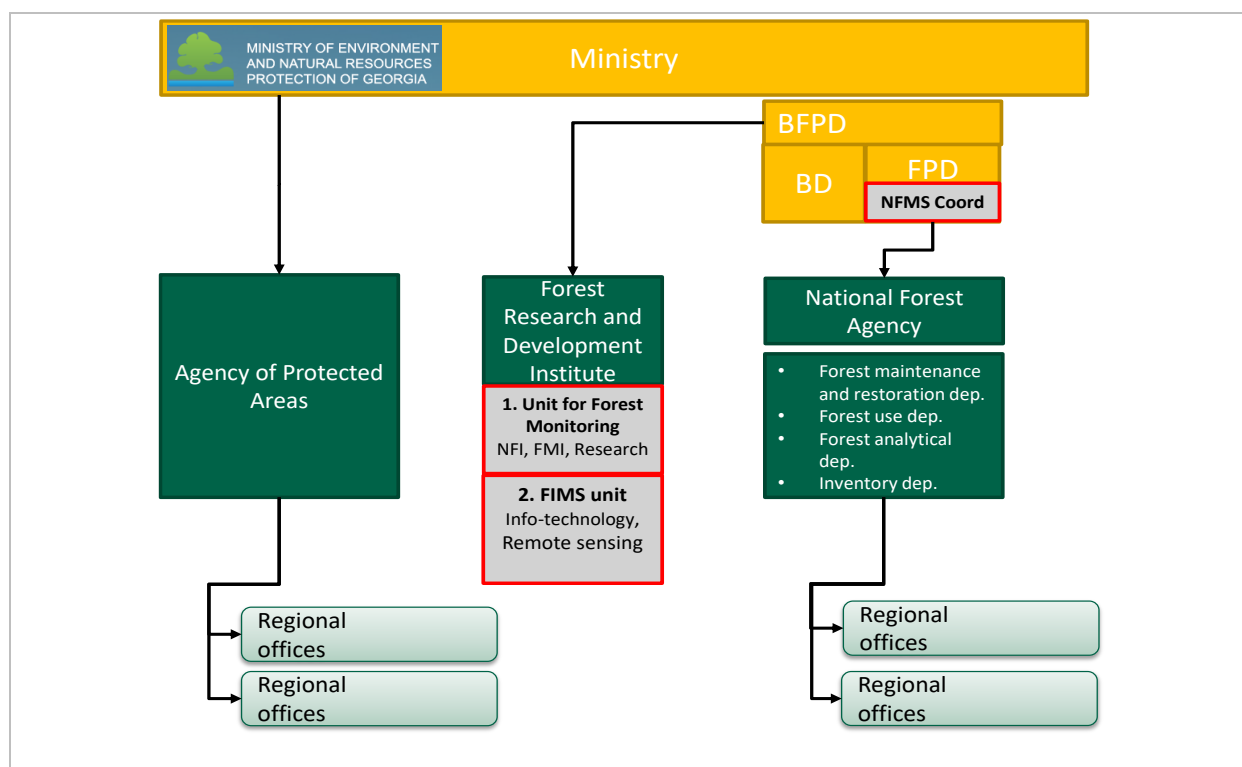
Given the currently still relatively weak presence of NFA in the regions and the insufficient regional staffing and inventory experience a centralized approach in a format of Forest Research Institute with special units responsible for the NFMS seems to be appropriate. This Forest Research Institute should contain the following units:

- Unit for forest Monitoring
- FIMS Unit

The following figure illustrates the organizational set-up of the new institution to manage the NFMS on the long term.

¹⁷ ForestEye (2017): Methodology for the First Georgian National Forest Inventory (NFI) and Forest Management Inventories (FMIs)

Figure 15: Institutionalization – Forest Research Institute as long-term goal



Source: UNIQUE & ForestEye, 2017

At ministry level, the **NFMS coordination** should be located at FPD. The overall coordination should oversee the NFMS work in Georgia, work towards enhancing and securing the legal basis for the NFMS (including funding), should maintain and enhances the links to international processes including donor agencies, and shall report to the minister.

It seems most efficient and is strongly recommended to strengthen research related to forest management and forest policies by re-establishing a powerful **Forest Research Institute**. The newly proposed Forest Research Institute will contain several units, such as:

- **Forest Monitoring Unit:** Responsible for the core of forest inventory design planning, implementation, analysis and reporting. Following the examples from other countries, such a unit might be part of the forest research station, but could be linked initially to a university institute (ForestEye 2017).
- **FIMS Unit:** This unit shall be responsible for the information technology related with the NFMS, the NFI software, the FIM software tools and especially for remote sensing and GIS-services.

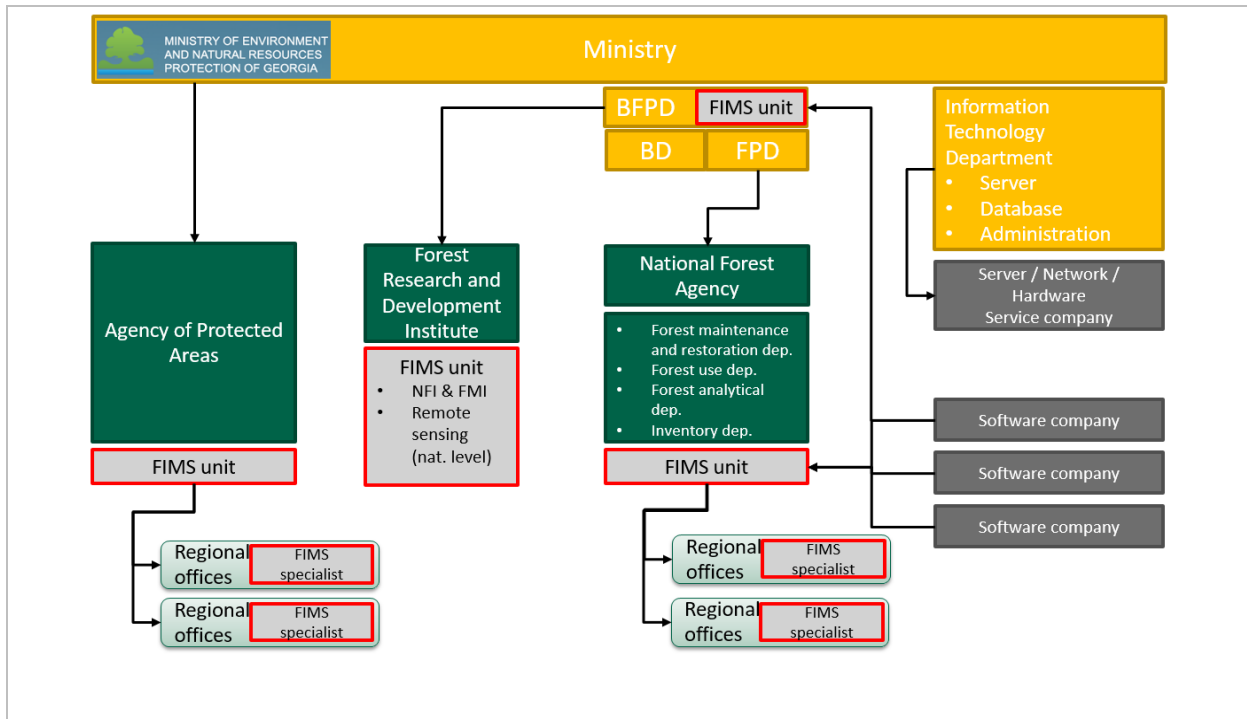
5.2.2 FIMS Units – institutionalization for information technology

When establishing a FIMS & FLUID technology, all institutions need to develop capacities to manage the FIMS software modules. The institutions responsible for a certain software module - like the NFA Inventory department for the FMP software - must be able to have the full “ownership” on it. This means that the software concept must be fully understood as well as all related work processes. This knowledge is obligatory for all users who are responsible for the creation and update of forest related information (NFI, FMI, FMP). In order to achieve this knowledge and

understanding of the software and work processes, systematic and advanced trainings have to be provided during the implementation phase.

The information technology support for each software module - regarding hardware, networks and databases - is proposed as a central service. The following figure illustrates the proposed institutionalization setting for the FIMS units and the central information technology department.

Figure 16: FIMS Units and the central Information Technology Department



Source: UNIQUE, 2017

As for the proposed future “Forest Research and Development Institute”, we propose to establish FIMS units in each organization (NFA, APA, BFPD). The size of the team depends on the number of software modules for which the organization is responsible and the total number of staff. Tasks related with office desktops, hardware, printers or networks could be outsourced or shared as a central task inside of the Ministry. Insofar, the number of FIMS unit experts can be kept small.

For NFA we propose to bundle 4 experts from the Inventory department and Analytical Department who are motivated to foster the FIMS and have experience with software systems. For APA the FIMS Unit should be similar in size.

The FIMS unit at the FPD should manage the central Forest Register and should be responsible for data retrieval and reporting support for the BFPD. The FIMS Unit at FPD should have 2 experts. These experts must have a solid understanding of information technology as well as a very good understanding of the underlying business processes and information flows.

We propose a FIMS specialist for each of the regional offices of NFA and APA.

For the central administrative service like server, databases, networks, IT security, email and intranet we propose and assume that the Ministry is building up a specialized department of professional IT specialists – the Information Technology Department. We recommend a central department as nearly every department under the ministry plus all sub-ordinated organizations

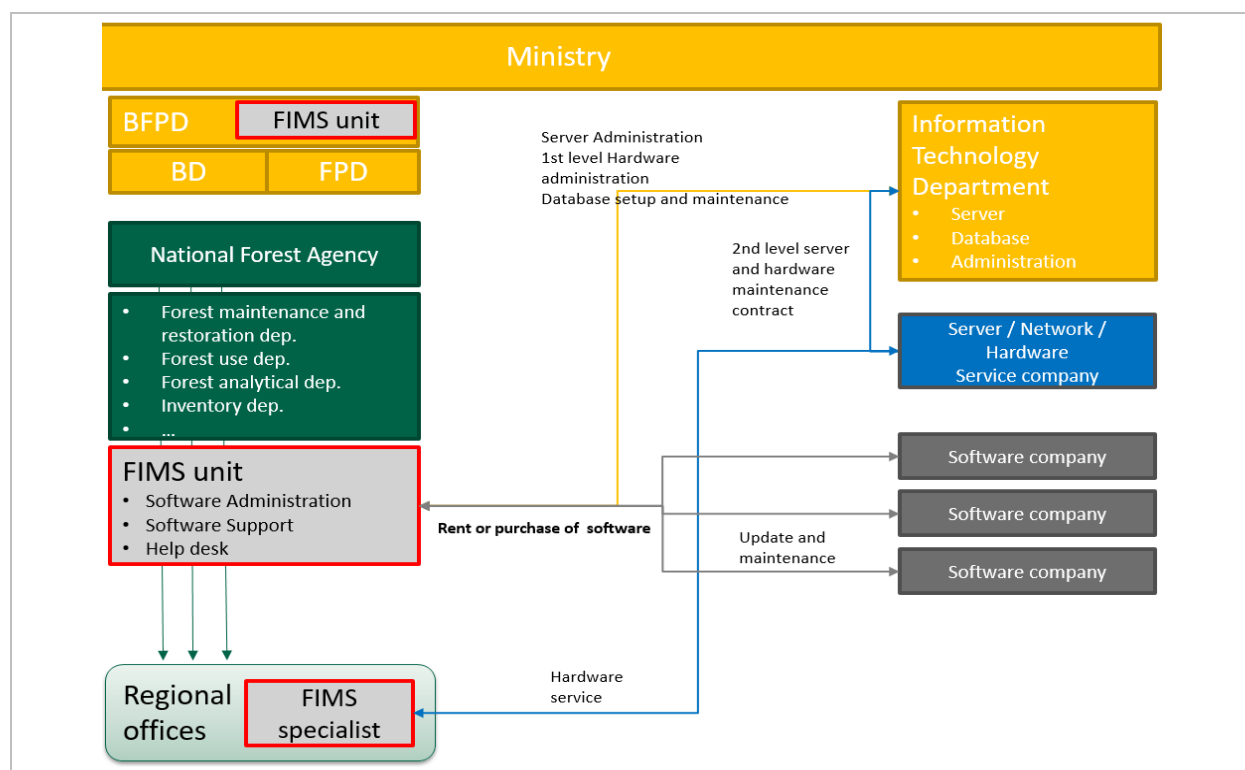
(NFA, APA, DES etc.) will run their own technical software systems beside the standard systems like Email, file storage, office software and websites. At the moment there are four projects dealing with the development of information systems for the MoENRP:

1. **FIMS** as part of the GIZ-IBIS project
2. **GFW project** in partnership working on the FIMS and the central access platform FLUIDS
3. **Biodiversity IS** development supported by GIZ-IBIS
4. **Environmental knowledge platform** (Project: “Harmonization of information management for improved knowledge and monitoring of the global environment in Georgia”) supported by UNDP

These projects offer synergies and push central developments inside of MoENRP. In fact, most of the cost for developing and establishing the Information Technology Department could be divided by four. The size of the department can be kept small, if the physical server hardware and databases are not hosted in the Ministry but purchased as a service from a reliable host-service providing constant 24h-access, system updates, backups and security service at the same time. Only for the needs of the forest sector we propose to calculate with a team of 2 IT professionals for the Information Technology Department. considering that each project could justify 1-2 professionals, the department size could be between 5 – 8 experts.

The following figure illustrates the proposed organizational structure, tasks and responsibilities as well as the relationship between the FIMS Units, the central Information Technology Department and the private sector of software companies and IT-service companies.

Figure 17: FIMS organizational structures - NFA close up



Source: UNIQUE, 2017

We propose that each “FIMS unit” is responsible for the business relation with the corresponding software providers. They “FIMS units” will act as administrators of those FIMS software modules,

which are managed by the respective organization (NFA, APA, FPD etc.). Moreover, they act as administrators for all standard software like office products, intranet, browser software or the web-site. They support the staff in hardware problems and purchase all hardware in the organization. For all FIMS modules they organize the 1st level support and a help desk. The software companies provide second level support. Problems with system software, DBMS or networks as well as security is managed with the help of the Information Technology Department and related service companies.

The FIMS specialists at each regional office will work in close relation with the FIMS Unit. The tasks will be very similar. The specialists shall organize a full service and support for software and hardware in the regional offices and for the local units. Remote support and access to all PC or laptops is essential.

The Information Technology Department will be responsible for central services like server, hardware and software, webserver, database management systems (DBMS), the administration of the server even if these are physically outsourced as well as the DBMS. They support the FIMS units in hardware problems and by central purchasing of equipment. The team will run the business relations and will define the services of external service companies or hosting companies.

The software companies will deliver software as a service. Software shall be rented and not purchased. The company shall be asked for a continuous maintenance and update. The company has to offer a second level support. We recommend as an alternative solution regarding a central server infrastructure – especially at the first implementation phase – to ask for a full hosting service (SaaS). This approach might reduce all kind of infrastructural investments to a minimum. In this case the conditions of the computing center offered by the software company must be clearly defined. It also means that the software company has to offer service for the DBMS as well as the IT security.

In case of a central server approach a service company needs to be hired. They should offer server hardware, software and a webserver. The company must manage the server, support the Administrators from the Information Technology Department and must offer second level support. The computing center should be equipped with a very fast upload connection (100 – 500 Mbit/s) and an up-to-date security infrastructure (firewall). For the different software modules virtual machines are recommended and shall be offered (VMware etc.). Finally a backup service (a) internal and (b) external, outside of the computing center, needs to be secured.

The institutional and organizational setup for the NFMS, the FIMS and FLUIDS described above shall be understood as a result of a mid-term process to be developed during the implementation phase planned in both projects, the GIZ-IBIS project and the partner GFW-project (see chapter 5 for details). In brief, there is a period of about 33 months available, starting in April 2017 and lasting until December 2019, to realize the proposed institutional set up.

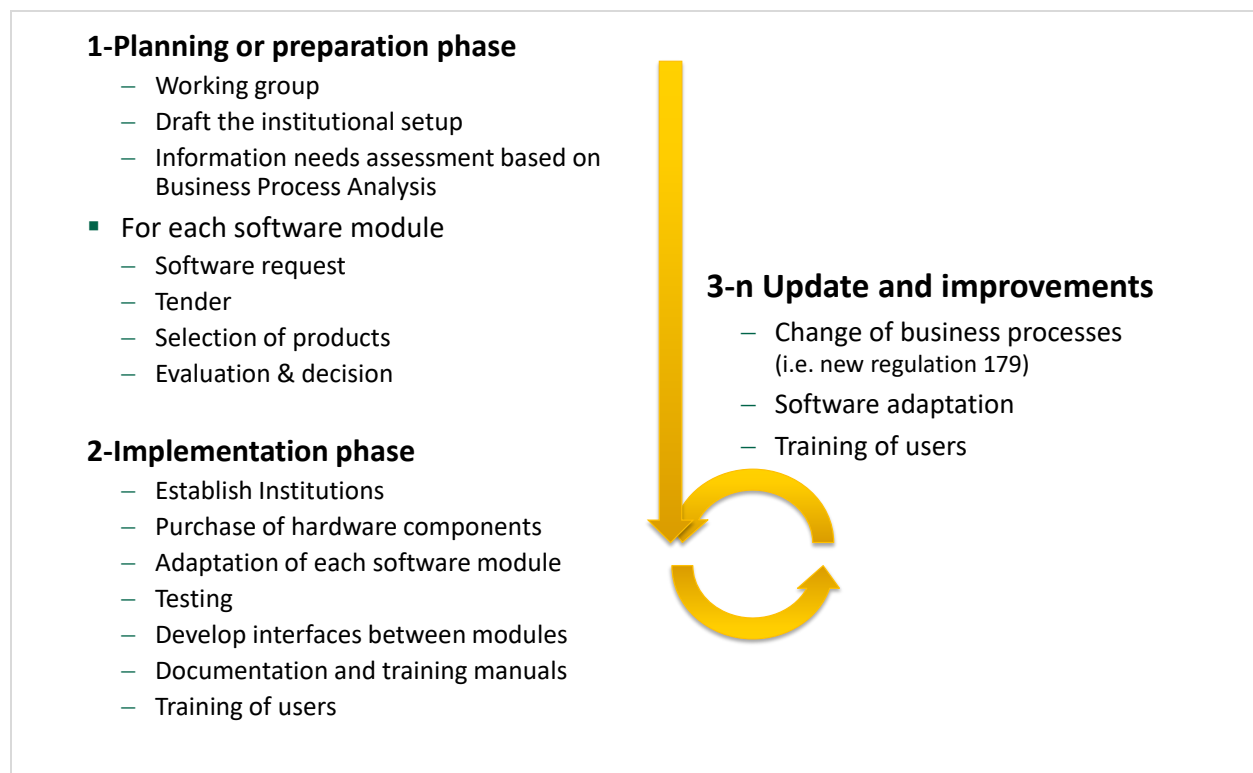
6 The Implementation

This chapter presents the implementation proposal to set up a FIMS. It reflects the development of an implementation plan mainly for the FIMS software, which serves the NFI, FMI, FMP processes and the development of a central database of forest information, now described in the new forest code as “Forest Register”. As the FIMS project component is working in close cooperation with the GFW partner project, the harmonization of implementation activities has been an additional need. Both projects follow different time lines, have different pilot areas and related institutional partners. However, both are working for the BFPD, FPD and the NFA as main beneficiary. With the establishment of a joint technical working group where all relevant institutions are participating, a powerful and effective structure could be formed to guide and manage the implementation process.

6.1 Approach

For the implementation of information technology in any kind of organization three phases and related work steps as illustrated in the following figure should be considered. These three phases concern: a planning or preparation phase, the actual implementation phase and an update and improvement phase. The implementation ends the very day the new product is used, however, the third phase reminds that the organization has to build up sustainable institutional and organizational structures to run and maintain the system continuously.

Figure 18: FIMS implementation process



Source: UNIQUE, 2017

To ensure the efficiency of the process, every phase should start with a kick-off meeting including all involved stakeholders. Moreover, training components should be considered as an integral part of each phase guaranteeing the sustainability and functionality of the FIMS. In order to be

able to integrate running modifications and adaptation steps, testing and fixing steps are necessary to be planned within the workflow.

The table below summarizes all necessary work steps. For all these steps and measures, it is crucial to ensure the feeling of ownership and thus the sustainability of the FIMS through the early participation of the future users from all parts of the organization. Having an outside expert circle defining the expert system, will lead to massive acceptance-problems among the users.

To ensure smooth cooperation between national and international institutions, and consultants working within the project, the assurance of consistent translation services concerning meetings and documentation throughout the entire process is crucial.

6.2 Planning approach

1 - Preparation Phase

The preparation phase comprises the work steps presented in the table below. The table shows as well the status of each step. A detailed description of these steps, as well as the according budget planning is presented in chapter 6.3.

Table 23: Work steps of the Preparation Phase

| No. | Work step | Status* |
|-----|---|---------|
| 1 | Kick-off Workshop and concept draft for FIMS and FLUIDS | Done |
| 2 | Establishment of a working group | Done |
| 3 | Capacity assessment | 70 % |
| 4 | Compiling existing data, maps and databases | 60 % |
| 5 | Drafting the institutional setup | Done |
| 6 | Information needs assessment | 70 % |
| 7 | Drafting the FIMS framework | 80 % |
| 8 | Concept database structure for the modules | 0 % |
| 9 | Evaluation of existing software (Ministry and NFA) | 0 % |
| 10 | Evaluation of existing software (market solutions) | 70 % |
| 11 | Clarification of the user/stakeholder roles | 0 % |
| 12 | Identification of legal bottlenecks | 90 % |
| 13 | Implementation plan (each module) | 90 % |
| 14 | Software requests (detailed each module) | 0 % |
| 15 | Tender (stepwise) | 0 % |
| 16 | Establishment of the planned institutions | 0 % |
| 17 | Server, DBMS and Hardware | 0 % |
| 18 | Product selection, evaluation and decision making | 0 % |

*) Status given in percent of completeness, see chapter 6.3 for more explanations

2 - Implementation Phase

The implementation phase comprises the work steps presented in the table below. A detailed description of these steps, as well as the according budget planning is elaborated in chapter 6.3.

Table 24: Work steps of the Implementation Phase

| No. | Work step |
|-----|---|
| 19 | Adaptation of each software module (stepwise) |
| 20 | Development of interfaces between software modules |
| 21 | Testing phase |
| 22 | Standard operation procedures & Documentation |
| 23 | Help desk and support facility |
| 24 | Training of trainers & developing of training handbooks |
| 25 | Training of users (NFA, APA, BFPD) |

3 - Operations, Update and Improvement Phase

The following work steps should be completed, in order to ensure the constant actuality of the system. A detailed description of these steps, as well as the according budget planning is presented in chapter 6.3.

Table 25: Work steps for the Operations, update and improvements

| No. | Work step |
|-----|---|
| 26 | Annual software management |
| 27 | Annual server, DBMS and hardware management |

6.3 Implementation plan

For the development of the implementation plan the following basic assumptions have been made:

- Start in April 2017 and completion in December 2019 meaning a 33 month period.
- First priority on software modules (1a) National Forest Inventory and as a package (1b) FMI software, prior to (2) Forest function mapping software to be developed for use in 2017.
- Software modules for FMP shall be purchased until autumn 2017.
- The NFI process shall start in April-May 2017, the software for data input shall be completed until end of August 2017 to be in line with the implementation plan of the NFI.
- The implementation plan needs to be constantly harmonized with the GFW project and is still not considering it.
- A plan to hire new staff for the NFA or the Ministry is not realistic. In contrast all new positions need to be filled with existing staff, bundling experts and forming new teams (first step), that can be established as new units during the implementation process (second step).
- The expert teams formed for NFI & FMI as well as for the FIMS unit can be supported by the GIZ project and the GFW project regarding infrastructure, equipment and systematic training.
- A consulting company is hired or at least 1 national and 1 international FIS expert are hired to guide the implementation process in close cooperation with the GFW project team and the GIZ team. They have to be responsible for the professional training and the organization of training measures on the job.

The table below contains the description of activities per work step, the planned costs as well as the time planning. The related planning spreadsheet (MS Excel table) can be found in chapter 9 Appendix 1. The costs presented in the table do not contain investments in the software modules or IT infrastructure, meaning the server hardware, server software, DBMS costs or the running costs for maintenance and update. The investment and running costs of the FIMS are described in chapter 0. The table below describes, thus, the costs of the implementation process considering the institutionalization, external support and advice, and systematic professional training of the FIMS team as well as the training for the end user. It also considers costs and time input of the FIMS design team and the TWG.

Table 26: Overview of the implementation plan

| | | | |
|---|--|---|---|
| 1 | Kick-off Workshop and concept draft for FIMS and FLUIDS Several workshops in GFW and GIZ project framework led to a joint concept of a FIMS using the FLUIDS as central entrance and access point Costs derivation: Done and financed | Duration: 01.01.2016 - 31.01.2017 Sum: 0 EUR | |
| 2 | Establishment of a working group The working group includes a FIMS design team and FIMS management team. FIMS design team is multi-institutional. Engaging the already functioning GFW Advisory Board in this role is recommended. FIMS management team carries the overall responsibility for the implementation. It includes a full time project manager as a facilitator between technical and non-technical stakeholders. Currently TWG has been established to take over these tasks (FLUIDS and FIMS implementation). Costs derivation: Done and financed | Duration: 30.10.2016 01.02.2017 Sum: 0 EUR | – |
| 3 | Capacity assessment The capacities of the responsible institutions in terms of human resources, technical, hard- and software facilities were accordingly assessed. Costs derivation: Evaluation done during design study and GFW project: Output is the proposal for the Institutionalization (see above). Done and financed. | Duration: 01.01.2016 28.02.2017 Sum: 0 EUR | – |
| 4 | Compiling existing data, maps and databases The existing data, maps and databases are compiled. A first phase of this process took place already in the early 2016; the second phase is currently ongoing within the “GFW project”. Costs derivation: At the moment work costs covered by GFW and GIZ project, as data collected by GIZ project have not fully processed for FLUIDS. Open tasks: Spatial data check, and cleaning, metadata; Organize and clean and harmonize all inventory data sets (i.e. Adjara). Costs are for TWG meetings. | Duration: 01.12.2015 31.03.2017 Sum: 250 EUR | – |
| 5 | Drafting the institutional setup The institutional setup for the FMIS implementation and operation was drafted, discussed and agreed among the involved parties. Costs derivation: Costs for 2 x TWG Workshops; 1x FIMS design team; External Support -Study: FPD and MoENRP communicate on options to outsource hosting of server and databases. Objective: Concrete offers. | Duration: 01.01.2017 12.03.2017 Sum: 4,800 EUR | – |
| 6 | Information needs assessment A subsequent information needs assessment was implemented. The survey results are already available. However, the according Business Process Analysis and the revisions still have to be completed as follow up of this project. Costs derivation: Covered by the FI design study and GFW project. Only costs of the TWG. | Duration: 01.12.2015 28.02.2017 Sum: 340 EUR | – |

| | | | |
|----|--|---|---|
| 7 | Drafting the FIMS framework Drafting the FIMS framework based on a modular layout allowing the stepwise implementation of the modules. The data structures will be defined including the exchange standards between FIMS and secondary data sources. Currently, the framework already exists and is nearly approved. Final drafts for the software requests are available for the GIZ supported modules. Costs derivation: Software requests describing purpose and features of the different software modules are only proposed by the GIZ experts. An intensive discussion and feedback is needed before tender documents for purchasing software or requests for programming of software can be completed. Costs are covered by the FI design study at the moment. Cost are planned for TWG meetings. | Duration: 01.01.2016 12.03.2017 Sum: 340 EUR | – |
| 8 | Concept database structure for the modules For every single module, planned within the FMIS the concept of the functionality structure should be drafted with the overall FIMS concept. By the end of this study, this concept is elaborated. ForestEye has developed a DB structure for both of the Inventory modules (NFI, FMI). Costs derivation: Task of the design study is to develop a draft and a coarse technical design concept. As all software modules are already available on the market, there is no need for detailed concept work for each module. | Duration: 01.03.2016 12.03.2017 Sum: 0 EUR | – |
| 9 | Evaluation of existing software (Ministry and NFA) The existing software in Ministry and NFA should be evaluated as task of the FI design study. Result is that at MoENRP there is only one relevant software. Mainly the Forest operations system is relevant ("Electronic System of Timber Resources"). The solution is currently checked but not fully evaluated. Costs derivation: Completed. No additional costs. | Duration: 01.03.2016 12.03.2017 Sum: 0 EUR | – |
| 10 | Evaluation of existing software (market solutions) The existing market solutions and comparison with a new solution and individual programming should be evaluated. This step is nearly completed for the Georgia but can only be completed via the evaluation process after an international tender. At the final end of the FI design study new plans for software development outside of the FIMS ordered by the Adjara region might change the situation on the market for FMP software and Forest Operations software. Costs derivation: Nearly completed. The new software plans from the side of Adjara FA need to be evaluated. Costs for 2 WD Nat. Exp. + 2 WD Int. Exp. | Duration: 01.01.2017 31.03.2017 Sum: 1,800 EUR | – |
| 11 | Clarification of the user/stakeholder roles The roles of the different stakeholders and users should be clarified including an explicit definition of access rights and user groups and their level of access per dataset. Here only a first draft framework is addressed. For each software module it needs to be specified. Costs derivation: Proposal need to be developed by TWG, but needs to be discussed at an early stage with the FPD. Costs for TWG meetings. | Duration: 05.02.207 – 12.03.2017 Sum: 170 EUR | |
| 12 | Identification of legal bottlenecks Legal bottlenecks for information access should be identified, as well as the milestones to overcome them. The NSDI initiative and the UNDP project setting up an Environment IS opens the door for low cost use of many dataset (even non-spatial) in the future. Several meetings were held with the NSDI coordinators. The access to concrete external data "only" needs to be initiated by inter-ministerial agreements. Costs derivation: GFW and GIZ need to support to design the technical part of agreements to organize the online data access for the MoENRP and BFPD. Support by an international IT expert is recommended. As costs for external expertise can be shared among all 4 Environmental IS projects, here only 5 WD and TWG meetings. | Duration: 05.02.2017 15.04.2017 Sum: 4,500 EUR | – |
| 13 | Implementation plan (each module) An implementation plan is elaborated during this study with the TWG including following aspects: | Duration: 15.03.2017 13.06.2017 | – |

| | | | | |
|----|--|---|--|--|
| | <ul style="list-style-type: none"> - Budget planning for the next phase, - Schedule and - The according responsibilities <p>It needs to be approved but also newly developed for each software, product, which is selected for implementation</p> <p>Costs derivation: Here only the development of detailed implementation plan after the completion of the design study are planned. The process needs to be repeated for all 5 modules (NFI, FMI, FMP, Forest Register, Operations). Assumption is that the implementation is further supported by international experts. Costs for 5 WD nat. Exp. + 5 WD Int. Exp.</p> | | | <p>Sum: 4,700 EUR</p> |
| 14 | <p>Software requests (detailed each module)</p> <p>Software requests as the definition of software purpose, features and functions has to be drafted to prepared tender or development of new software.</p> <p>Costs derivation: Drafts are nearly completed. Drafts will be finished during the FIS design study. As next step a clear and exhausting feedback of the Georgian partners and the approval need to be organized stepwise for each module to be implemented before going in a tender procedure. Work here is only calculated for the work after completion of the FI design study. Costs for 30 WD nat. Exp. + 20 WD Int. Exp.</p> | <p>Duration: 15.03.2017 – 30.06.2017</p> | | <p>Sum: 18.759 EUR</p> |
| 15 | <p>Tender (stepwise)</p> <p>Based on these requests a tender document will be initiated. Now 5 different software solutions are planned. NFI and FMI software can be bundled as both could be based on one solution. The recommended system is OPEN FORIS here. The Forest Operations system is existing but a further development needs to be ordered. Eventually the newly planned software for Adjara region, which will be offered by Geographic, can be an alternative system to the one developed by the Ministry of Finance. FMP software and Forest register can also be bundled as the database structure is very similar and many of the features as well as reporting.</p> <p>Costs derivation: Costs for each of the 5 modules. Technical parts of tender documents are drafted during this project based on the software requests. The work is calculated for the support of preparation of the tender procedures in the country. 3 x tender process: NFI & FMI; FMP & Forest Register; Forest Operation. Costs for 20 WD Nat. Exp. + 10 WD Int. Exp.</p> | <p>Duration: 15.04.2017 – 31.08.2017</p> | | <p>Sum: 9.700 EUR</p> |
| 16 | <p>Establishment of the planned institutions via:</p> <ul style="list-style-type: none"> - Forming units with a mandate (system administrators, technical help desk and support) - Hiring skilled staff - Establishing offices <p>Step can be started, if the draft plan for an Institutionalization is approved (MoENRP). A stepwise approach is proposed in parallel to the upcoming work on NFI and the Achmeta FMP pilot. The first team shall consist of ca. 4 p (1 leader in FPD; 3 technical engineers). 1) Small team from inside MAEP, NFA, APA is pulled together. Training on the job in GIS, RS, Computer while producing Forest Function map and forest cover map. 2) Team shall be involved in decision making for software modules as early as possible, guided by the GIZ and external expert team. 3) Training tour to get to know structures in large forest organizations in Germany 4) The team will form the backbone beside the TWG for software testing, training and documentation (see steps below). All steps need to be harmonized with the GFW project, which allows to share costs. Tremendous synergies exist if all 4 environmental IS projects could setup common administrative structures (GFW, FIMS, GIZ BD IS, UNDP Envi IS). In 2017 the number of 4 young and technically skilled experts out of NFA, APA and MoENRP staff is proposed for a financing until end of 2018, an additional 2 experts should be able to be identified and trained to be added from 2018 on. The financial support shall end in 2019.</p> <p>Costs derivation: Basic IT training of the new FIMS team is not covered by this implementation plan. This can be taken over via other projects and training on the job like tasks (mapping for NFI, working on Forest function mapping, analyzing data in GIZ pilot FMPs). The work calculated here is support for identification of the first team and the organization of the establishment (office, software, hardware); Financing the team for 2017; Study tour to Germany; Extended FMIS Team plus 2 new member in 2018. Costs cover experts' inputs as well (20 Nat. + 12 Int. Exp.).</p> | <p>Duration: 01.05.2017 – 31.12.2019</p> | | <p>Sum: 11.300 EUR</p> |

| | | | |
|----|---|--|---|
| 17 | IT- Infrastructure - Server, DBMS and Hardware FIMS related server and database systems: Hardware is purchased through tender; Installation process; training of technical staff and administrators. 2 options: 1) Rent of external server including services or 2) purchase of server hardware and external services. It is not recommended to administer the server, networks, user hardware and database systems internally (NFA, APA, MoENRP); The hardware system needs to be developed in close relation with the GFW project and the 3 other Is under development in MoENRP. It will allow to cut costs drastically. A stepwise installation of user hardware is planned. Costs derivation: Costs for support in negotiations inside the MoENRP; tender preparation; evaluation. Costs for 25 WD Nat. Exp. + 10 WD Int. Exp. | Duration: 01.05.2017 31.08.2017 Sum: 9,700 EUR | – |
| 18 | Product selection, evaluation and decision making Selection of products will follow based on an evaluation scheme (including all future maintenance and update costs). The result of the product evaluation shall be finally approved (contract). Costs derivation: 5 software offers need to be preselected, evaluated. A decision making as well as contract preparation in the Ministry needs to be supported. Costs for 24 WD Nat. Exp. + 12 WD Int. Exp. | Duration: 01.06.2017 30.09.2017 Sum: 12.300 EUR | – |
| 19 | Adaptation of each software module (stepwise) Each of the software modules should be adapted to the according needs. Result of the tender procedure is a list of software adaptations resulting from deviations between software requests and existing software features. In all 5 cases, adaptations can be expected. At this step the details of the new software features needs to be defined by the customer and negotiated and finally contracted with the software company. It is recommended to plan a stepwise adaptation. Costs derivation: Work is estimated for support of the detailed definition of software adaptations for 5 software modules. The software adaptation costs are estimated separately for each module. Costs for 25 WD Nat. Exp. + 15 WD Int. Exp. | Duration: 01.06.2017 01.06.2018 Sum: 13.700 EUR | – |
| 20 | Development of interfaces between software modules Several interfaces between the software modules but always with the FLUIDS need to be developed. The latter has to be performed in close cooperation with the GFW project. Interfaces are needed for each software but there is a chance that the software modules can be combined into only 3 product groups: NFI&FMI; FMP & Forest register; Forest Operations. It depends whether the same basic software is used to form application for different purposes (like OPNE FORIS for NFI and for FMI). Interfaces to the FLUIDS system are obligatory and of highest priority. As standard for a spatial data exchange the web services defined under the INSPIRE frame of the EU will be used. Costs derivation: The definition was already started during the FI design study. It needs to be individually improved after the decision on the 5 software modules. The work is calculated to support the definition in cooperation with software companies and the GFW project. Costs for 25 WD Nat. Exp. + 15 WD Int. Exp. | Duration: 01.06.2017 01.06.2018 Sum: 10.700 EUR | – |
| 21 | Testing phase After a first test installation the software performance and ensured features will be tested by the first FMIS team. This will be repeated for all software adaptations. 2-3 test-loops shall be planned prior to final approval during adaptation programming. The same counts for the interface programming. Costs derivation: Work is estimated for support in defining test scenarios and test documentation as well as training in testing. Costs for 30 WD Nat. Exp. + 25 WD Int. Exp. | Duration: 01.07.2017 01.07.2018 Sum: 14.200 | – |
| 22 | Standard operation procedures & Documentation The documentation tasks includes - Description of the Standard Operation Procedures (business processes); - Development of software guidelines adapted to the SOPs. - . The FIMS team shall be trained on the job to provide SOPs and based on it software handbooks and training material. Support in structuring the documentation and the technical formats (web wiki etc.) is necessary. As the FLUIDS platform is access point, GFW project need to be involved. | Duration: 01.09.2017 31.12.2017 | – |

| | | |
|----|--|--|
| | <p>Costs derivation: The work on the documentation shall be taken over by the First FIMS team based on the existing software documents. Support by experts offers templates for the documentation and joint development of software guidelines for 1-2 modules. Costs for 25 WD Nat. Exp. + 15 WD Int. Exp.</p> | <p>Sum: 13,800 EUR</p> |
| 23 | <p>Help desk and support facility</p> <p>A help desk infrastructure accessible via phone, web and email needs to be organized. A special software system shall be purchased or taken over from other governmental institutions and implemented. There are huge synergies with the information systems developed in parallel under the MoENRP. The access point must be integrated in the FLUIDS platform.</p> <p>Costs derivation: Support is calculated for the definition of a help desk and support system and organization and the selection of a software. Costs for 12 WD Nat. Exp. + 5 WD Int. Exp.</p> | <p>Duration: 01.07.2017 – 26.02.2018</p> <p>Sum: 4,800 EUR</p> |
| 24 | <p>Training of trainers & developing of training handbooks</p> <p>The task of software test and work on documentation will have the automatic effect that the FIMS team can act as trainers for the software modules in the role-out phase of the implementation. Only one special training session shall be arranged with an emphasis on the didactical skills of the FIMS team using the training handbooks. As all software is accessed via the FLUIDS platform, the training need to included FLUIDS and need to be coordinated with the GFW project. A training course for trainers shall be performed as well as the work on training handbooks. During the training for trainers, the handbooks are developed in result giving the full knowledge and ownership to the trainers and future FMIS administrators.</p> <p>Costs derivation: One training course for trainers shall be performed as well as the work on training handbooks. Support by experts offers templates for the documentation and joint development of software guidelines for 1-2 modules. In all cases, trainers of the software companies are also involved. Costs for 25 WD Nat. Exp. + 11 WD Int. Exp.</p> | <p>Duration: 01.10.2017 – 31.12.2018</p> <p>Sum: 10,500 EUR</p> |
| 25 | <p>Training of users (NFA, APA, BFPD)</p> <p>The training of end users forms the last step within the implementation phase (NFA, APA, BFPD). Each software module might be trained after test and approval. As the end user are working via the FLUIDS platform, it needs to be part of the training and the coordinated with the GFW project.</p> <p>Costs derivation: Costs for logistical and technical support of the trainers is calculated here. A software training room needs to be rented or established in the MoENRP. Training modules at start are planned for 2-3 days depending on the complexity of the software and the knowledge level of the user. A training on the job (1-day sessions, also in all of the regional offices) is recommended to repeat essentials, where user have addressed problems to the support team or special users need more intensive training.</p> | <p>Duration: 01.11.2017 – 31.12.2018</p> <p>Sum: 11,000 EUR</p> |

The estimated costs for the Preparation Phase of the implementation process sum up to about 58.000 Euro. The costs for the Implementation Phase are estimated to about 260.000 Euro. In total ca. 320.000 Euro need to be invested from the project side not considering the in-house contribution provided by NFA, APA or MoENRP staff.

6.4 FIMS & FLUIDS – Information Technology Infrastructure

The implementation process described above aims to select and introduce the different software modules and to combine them to a FIMS. The FIMS related information are presented in tables, reports and maps and can be retrieved via the FLUIDS web-portal.

Beside the aspect to implement the “application-software” level of the FIMS, the basic IT infrastructure needs to be implemented in all the related organizations (MoENRP (FPD), NFA, APA). The process step 17 in the chapter above touches this aspect:

FIMS related server and database systems: Hardware is purchased through a tender; Installation process; training of technical staff and administrators. Two options: 1) Rent of external server including services or 2) purchase of server hardware and external services. It is not recommended to administer the server, networks, user hardware and database systems internally (NFA, APA, MoENRP); the hardware system needs to be developed in close relation with the GFW project and the 3 other ISs under development in MoENRP. It will allow to cut costs drastically. A stepwise installation of user hardware is planned.

IT infrastructure covers all assets that enable the operation of “application-software” – the FIMS modules. Technically, the IT infrastructure consists of hardware, system software and structural devices for the operation of the FIMS software modules.

- Hardware includes computing (e.g. computers, storage systems), network technology (e.g. switches, cables), peripherals (e.g. keyboards, screens, printer) as well as devices for operating the hardware (e.g. server racks, server rooms, uninterruptible power supplies).
- An integral part of the IT infrastructure is the system software (e.g. operating systems, server software, webserver software, Data Base Management System (DBMS)).
- In addition, the IT infrastructure includes the facilities specially equipped for information technology (e.g. computer center, cabling and protective technology) as – so called - structural facilities.
- Special organizational units and IT staff is part of the IT infrastructure and has been presented and discussed with the Institutionalization of the NFMS and FIMS & FLUIDS (see chapter 5).

It is obvious, that the decision on the IT infrastructure has a big influence on the costs, the investment in hardware, DBMS, staff, on the operating costs (annual software rent, maintenance & updates, support, server rent etc.) and also regarding the institutional setting.

6.4.1 Business models for the IT Infrastructure

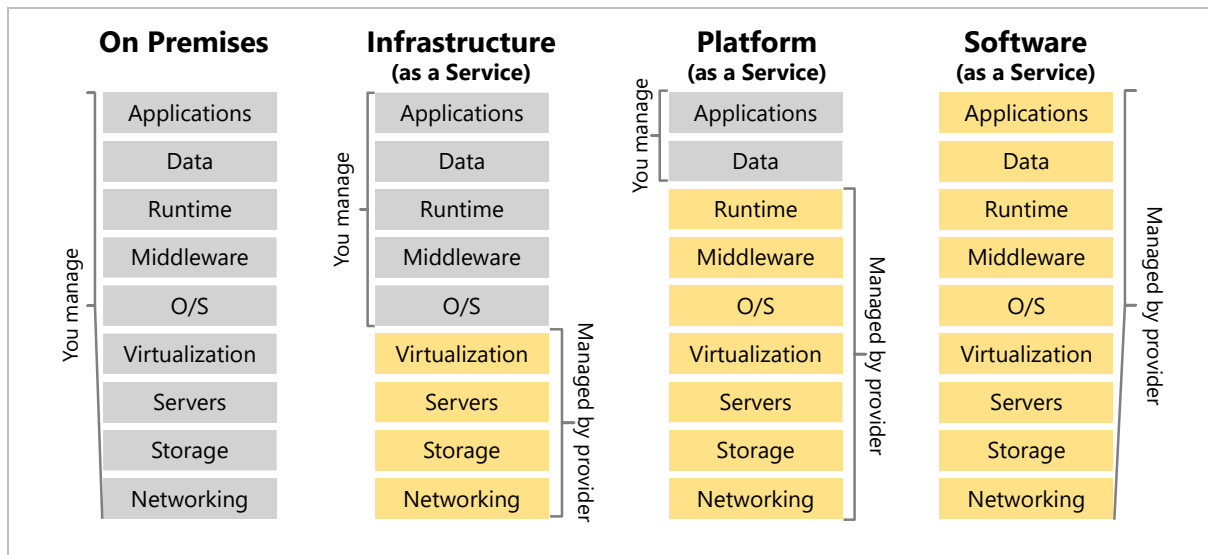
The figure below illustrates different business models to make IT infrastructure available for each institution in the forest sector, which needs to run its own software modules or wants to build up a centralized IT structure allowing standardized and central data, file and document storage in the organization:

- On premises: The past standard was that the infrastructure is fully hosted by the user itself, meaning a huge investment in hardware and software, network capacity plus the investment in IT staff.
- Software as a service: The new and very different solution means that the software application plus the entire IT infrastructure is leased from a service provider, which could be the

software developing company. The user gets access and is administrating his software modules, which are physically located in a computing center. Full services are provided allowing steady and fast access to the software, the related database and a steady maintenance.

- All kind of interim business models are possible where Infrastructure as a service means that the user is leasing server hardware, network components, storage capacity, back up and virtualization technique.

Figure 19: Business models for IT infrastructure



Source: Microsoft (2017)¹⁸

Step 17 also points to as special situation of the FIMS project when discussing recommendations for the IT infrastructure: “The hardware system needs to be developed in close relation with the GFW project”: The GFW project is planning to invest and implement in IT infrastructure at the same time. Not only forced by the MoU the harmonization of the plans for IT Infrastructure is necessary. In addition, there are two more environmental information systems under development (Environmental IS, Biodiversity IS) in different departments of MoENRP. It would allow a drastic cut of costs, if the synergies could be exploited by harmonizing decision-making and by jointly using a future IT infrastructure of MoENRP and related institutions. Unfortunately, it was not possible to support a joint decision making during this assignment.

6.4.2 IT Infrastructure – on premises

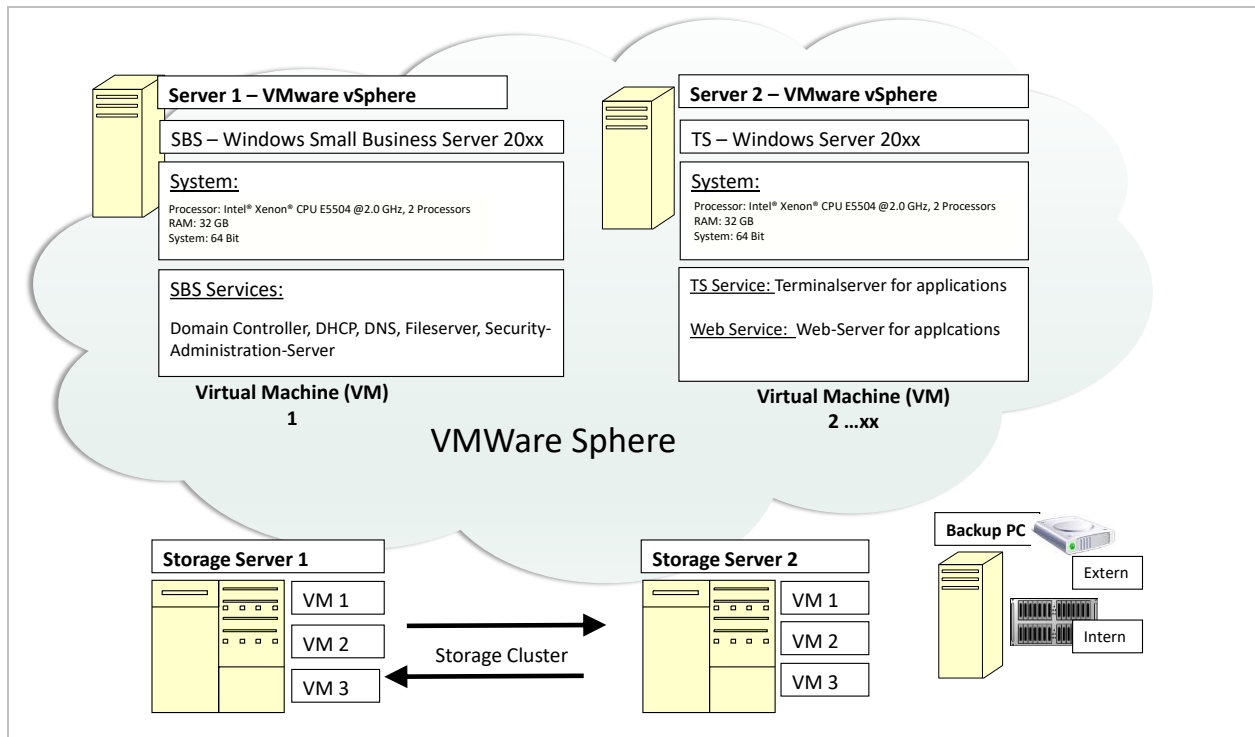
In case that an institution is deciding to run and administer its own IT-infrastructure or in the case that offers for IT infrastructure as a service is offered: In both cases it is necessary to know what kind of hardware, server software and database infrastructure might be useful and recommended.

Hereafter a configuration is described which is able to host and run different kinds of servers. Servers could offer services like email or file service as well as application service like FIMS

¹⁸ Microsoft (2017) : Windows Azure TM : Introducing Virtual Machines (IaaS), Mario Szpuszta, Microsoft Corporation 2017.

software modules for an organization with 50-100 users (2 storage servers and 2 host servers interconnected as a cluster, storage servers are used to store data in the form of virtual machines, host servers are used to run virtual machines). In principle, the configuration is expendable which means that you could use physical servers for each service. However separation of storage and host with regard to server virtualization increases flexibility. Under this configuration it is possible to back up the virtual machine as a whole for example. Furthermore you could easily upgrade server hardware without shutting server down.

Figure 20: Example for a recommended IT infrastructure – on premises



Source: UNIQUE 2017

The main features of the recommended IT infrastructure are:

- The 2 storage server are the main hardware components. They are doubled to allow high performance and security in a storage cluster.
- Via a virtualization software – here the example of VSphere – the different service can be distributed to different Virtual Machines, each of them can be controlled and managed separately, allowing a flexible load management, improves security and allows an efficient administration.
- The Virtual Machines (VM) host different kind of services and applications, VM 1 here is hosting the central network, email and file services, where VM 2 and VM 3 are used for the different FIMS applications, which might be distributed via web service or terminal server.
- A physically separated backup is necessary. In a regular routine backups need also to be saved outside of the facility (external).

This example of a middle sized IT infrastructure shows, that beside the software and the related DBMS many other components need to be considered, if an IT infrastructure on premises shall be implemented.

6.4.3 Recommendations for the IT Infrastructure

Any of the presented business models and any decision on devices (hardware, software) has an implication and interdependency on:

- The Institutionalization (staff, qualification, facilities, network quality)
- Type of costs: Investments versus lease

The situation in the MoENRP and the forest managing bodies under the ministry can be shortly characterized:

- Problems to hire any new and highly skilled IT staff
- Decisions on huge investments are more difficult and time consumptive compared to a lease – operational cost solution
- A central IT infrastructure at the MoENRP and related institutions is not existing at all.
- The existing software for Forest Operations, which is the only used across different APA and NFA departments and even with access for DES, is following the business model of SaaS offered by the Ministry of Finance.
- Each institution can describe its own demand for IT infrastructure, but a study to define and structure the demand at the MoENRP has only just started.

In brief, the following steps for the selection and implementation of the FIMS IT infrastructure are recommended:

1. For a fast start: Ask all software companies for “Software as a service (SaaS)”
2. Harmonize the necessary and planned IT infrastructure with the GFW project
3. Assist and foster the definition of a comprehensive MoENRP infrastructure considering the demand of all departments and the synergies of the two current projects dealing with environmental information systems (Biodiversity-Information System, Environment-Information System)
4. If a comprehensive IT infrastructure at MoENRP level can be defined: Ask for “Infrastructure as a Service (IaaS)” offering a fast solution to develop the infrastructure based on existing professional services avoiding investments in hardware, server software, web-server, network, security. It also allows to keep the planned FIMS units and the number of IT specialists for a central IT service department on a small level (see the argumentation at “Institutionalization” in chapter 5).

6.5 Implementation and operational costs for FIMS and IT infrastructure

The cost estimations presented here contain costs for implementation (investments) and annual, operational costs for the FIMS software and related IT infrastructure. These cost estimations cover the investments in the different GLZ supported software modules and the related IT infrastructure, meaning server hardware, server software, DBMS costs or the running costs for maintenance and update of all IT components.

The costs are estimated based on several of similar projects from UNIQUE plus concrete requests for IT infrastructure services offered by German and central European companies. The license costs of the software modules had to be estimated based on license costs for similar software products, which are on the international market. Price schemes for FIS software products usually combining the number of users and the area of forest managed with the software.

The prices have been reduced assuming that the cost level for IT expertise is lower than on average on the European and international market. Costs are presented as annual cost rates based on the combined cost for investments: adaptation of software, programming of interfaces and the operational cost caused by an annual or monthly software lease. The IT infrastructure and the DBMS was also considered as leased as “Infrastructure as a service”.

The annual costs consider:

- Investments as monthly costs (based on a linear depreciation for 10 years)
- License lease including maintenance and update
- Second level support
- Lease of DBMS (MS SQL, SQL base, Oracle etc.)
- Lease of server hardware and software

The number of users are given as the number of “producer user”: Experts creating new data and administrate software in the respective institution. Users having access to the FIMS modules via FLUIDS were not included when presenting the number of user here.

Table 27: Overview of the implementation and operational costs for FIMS software and IT infrastructure

| Software module | | Explanation | Investment [in 1,000 Euro] | Annual costs [in 1,000 Euro] |
|--|---|---|-------------------------------|---------------------------------|
| 1 a | NFI software & | Open Foris: Software adaptation, maintenance and laaS; 15 - 40 producer user; At NFA, APA, FPD, Inst R&D ¹⁹ | 16,0 | 19.0 |
| 1 b | FMI software | | | |
| 2 | Forest Function Mapping | Component development based on standard GIS software; SaaS; 4-10 producer user; At NFA, APA, Inst R&D | 12.1 | 6.0 |
| 3 | FMP software & | Market software adapted for FIMS and in a 2nd step improved to build Forest Register; SaaS; 15-50 producer user; At NFA, APA, FPD | 19.0 | 103.0 |
| 4 | Forest Register | | | |
| 5 | Forest Operations (Electronic System of Timber (Art. 50)) | Software exists, adaptation and extension needed; SaaS at Ministry of Finance 50-100 producer user; At NFA, APA, DES, FPD | 12.0 | 85.0 |
| Total costs - software and IT infrastructure (without FLUIDS) | | | 47.0 | 207.0 |
| Implementation process | | See implementation process: Inst. Setup; Selection of software; Adaptation and test, Training (see chapter 6.3) | 260.0 | --- |
| Total costs (without FLUIDS) | | | 307.0 | 207.0 |

- The Investments in software adaptations and interfaces will sum up to ca. 47.000 Euro.
- The annual operational costs – containing the investments – sum up to ca. 207.000 Euro.
- Adding the one time project cost of the implementation process the investments reach ca. 307.000 Euro.
- In all cost estimations the FLUIDS web portal and the costs of the GFW supported FIMS modules are not included.

¹⁹ Newly proposed Institute for Forest Research and Development (see chapter 5.2.1)

7 Tender documents

7.1 Task and approach

The ToR had asked for the preparation of tender documents to support a fast implementation of FIMS modules. To implement the FIMS tender procedures for different purposes have to be considered, as packages of IT services, single IT services and components of equipment/software/data. The demand depends largely on the design of the FIMS system, the IT Infrastructure, the selected business model, the institutionalization and the existing capacities. Not for all different cases, tender documents could be prepared in the frame of this study, but for the purchase processes relevant for the implementation of the GIZ FIMS software modules.

7.2 Results

Detailed tender documents for purchase packages for FIMS software modules have been elaborated in close collaboration with the TWG and the responsible stakeholders. The tender documents are attached in Chapter 9 - Appendices.

8 References

- ForestEye, 2017: Methodology for the First Georgian National Forest Inventory (NFI) and Forest Management Inventories (FMIs). Draft GIZ IBIS Report.
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9 Appendices

Appendix 1: Implementation Plan: The planning spreadsheet (MS Excel table)

Appendix 2: Call for EOI for Forest Function Mapping software

Appendix 3: Tender document for Open Foris Service Product

Appendix 4: Tender document for FMP software

Appendix 1: Implementation Plan: Planning spreadsheet (MS Excel table)

The MS Excel spreadsheet has been delivered to this report as a separate document:

- 2017-03-24 NFI-FIMS-FLUIDS implementation time plan_k.xlsx

Appendix 2: Call for EOI for Forest Function Mapping software

Call for EOI for a Forest Function Mapping software

1 Introduction

Within the framework of the project "Sustainable Management of Biodiversity, South Caucasus" The German *Gesellschaft für Internationale Zusammenarbeit* (GIZ) advises and supports the Ministry of Environment, Natural Resources and Protection and the Government in Georgia in the declared goal to sustainably manage the forests of Georgia in a multifunctional manner.

The current project develops solutions for the administrative and environmental challenges, which are occurring within this process. As part of these solutions, one study within the scope of the project, addresses the review and preparation of a Forest Information and Monitoring System (FIMS), as a substantial instrument for the sustainable forest management.

In order to establish a modern, comprehensive and flexible Forest Information and Monitoring System, it is necessary to set it up using different modules, compiled by different software products. The modular system consists of several components and databases connected by interfaces with pre-defined standards for data exchange.

Within the FIMS the different user groups have access to according modules and databases, allowing them the fulfillment of their daily work and decision-making via one general user-interface build as a Web-GIS-portal. This Forest and Land-Use Information and Decision Support (FLUIDS) web-based portal will deliver central access, the spatial analytics and data retrieval combining content of all related software modules.

2 Purpose of the call for EOI

The present document calls for Expressions of Interest (EOI) for the development of a Forest Function Mapping software. This software package should be adapted as a FIMS module and suit the needs of the administration – Ministry of Environment and Natural Resources Protection (MoENRP), Agency of Protected Areas (APA) and National Forest Agency (NFA) especially.

In a first step, we would kindly like to ask the bidders to provide an EOI for the software module. As soon as the technical guideline for the elaboration of Forest Function Mapping is developed, the technical specifications can be defined. As a second step, a tender among the interested bidders will take place. This order of implementation is necessary, as the technical guideline will provide crucial information on the analytical steps for the mapping of each forest function type.

The bidder has to show its ability to develop or adapt a GIS software to support a semi-automatic delineation process based on pre-defined mapping criteria combining different spatial datasets (i.e a digital terrain model, a forest map, soil map and erosion risk map).

The software product to be developed could be based on a standard GIS software (like QGIS, ESRI ArcGIS, TnT Mips, Manifold etc.) and is expected to comprise scripts and models, embedded as macro in a simple and efficient user interface. The steps for the scripts and models developed should be well described and documented.

3 Business processes, information demand and software functions

3.1 Forest Function Mapping (Zoning)

3.1.1 Business Process and Purpose

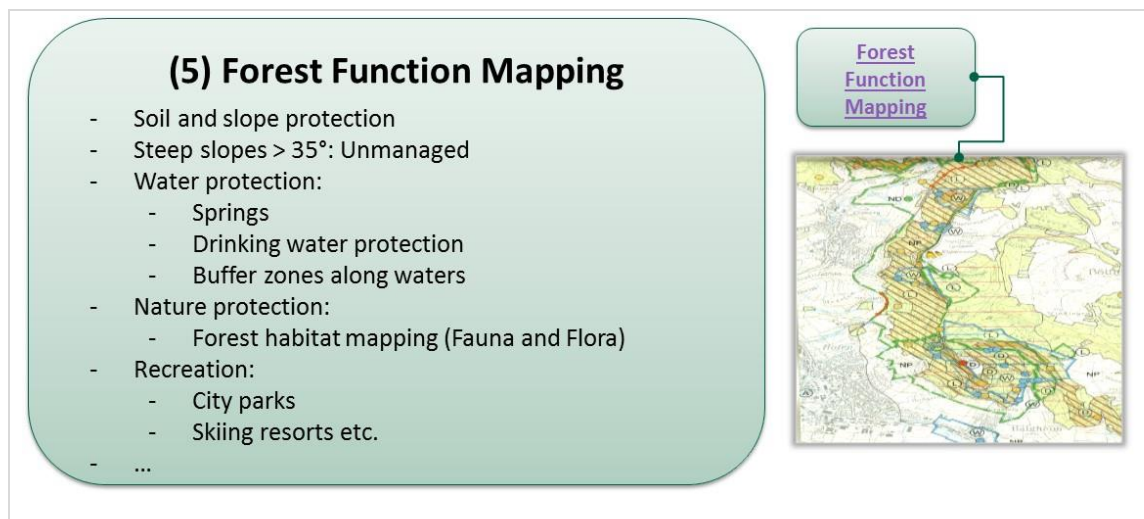


Illustration Forest Function Mapping

The Forest Function Mapping is an internal information creation process applying a multi-source mapping procedure using external and internal sources. Functions or “categories of forest” are partly defined by the new forest law and secondly comprise information, which restrict or influence the management in a certain forest area. Forest function are basic information for forest management. Planning based on them is an integral part of Forest Management Planning. It should be developed through a onetime long term mapping project, with a regular update if any source like other spatial plans are changed or the forest management plans are revised. For Georgia it is recommended to split the process in 2 phases:

- Phase 1: Draft zoning based on available GIS/RS data on a national or regional scale – as part of the initial mapping phase of the NFI.
- Phase 2: Systematic improvements and fine-tuning during each regional forest management planning project.

Purpose

- Zoning or function mapping as one prerequisite for a stratified sampling for the NFI²⁰.
- Decision support in forest management planning
- In general important for decision making in forest operations

Business Process

The Functionality of the Forest Function Mapping should reflect the according business processes embedded within the national legislation. Changes in the legal framework may occur and should be incorporated within the software structure. Legal documents that address the Forest Function Mapping in Georgia are the Forest Code (Art. 6, 7, 8, 9, 10, 11) and Regulation 179 (Art. 5 and 14).

3.1.2 Features

To ensure the proper functionality of the module, following features should be implemented:

- Spatial database containing layers for each forest function
- For each forest function:
 - Import of basic and secondary data (DTM, Forest mask etc.)
 - Spatial analysis scripts / models to derive proposals for forest functions based on given criteria (i.e. slope: Inclination $\geq 35^\circ$)
 - Combined with manual map interpretation and final delineation steps

3.1.3 Basic entities

- GIS-layer describing polygons with locations mapped for each forest function

3.1.4 Interfaces

In terms of interfaces between the Forest Function Mapping module and other modules, the following should be taken into account:

- Some data sets describing a forest function can be directly imported: Nature reserves and water reserves defined by legal acts. The import is possible via WFS²¹ or WMS.

²⁰ The zoning allows to analyze NFI data by forest functions zones, which adds an important factor to evaluate forest management options and needs based on the NFI data.

²¹ WFS = Web Feature Service and WMS = Web Map Service

- Import of secondary data: In many cases delineation of a forest function is derived from a combination of spatial data sets (i.e. DTM²² for slope protection forests). Import can take place via WFS or WMS.
- Export of all GIS layers as WFS for other information systems (biodiversity, spatial planning etc.) in a standard format defined by the NSDI²³ process.

3.1.5 Further product requirements

The software product to be developed could be based on standard GIS software (QGIS, ESRI ArcGIS, Manifold etc.) and comprise scripts and models, embedded as macro in a simple and efficient user interface. The steps for the scripts and models developed should be well described and documented.

Help-Functions should be built in offering access to documentation and/or manuals.

4 Implementation

- What is a realistic time line for development and implementation of your concept of a Forest Function mapping software?
- What is the price for a training day (ca. 8-10 user) and how many days you would recommend?

5 Installation options

Options to install the systems are not decided yet. Beside a server installation at the customer, a hosting on external data center is an option.

Please describe your ability of offering the software as a service (SaaS).

6 Software Service and maintenance

The services asked for are:

- Software as a lease / software as a service (SAAS) including hosting
- Maintenance / Updates
- Support
- Adaptation to user needs at start

Please describe you technical models and business models and references for respective services.

Open questions:

²² DTM = Digital Terrain Model

²³ NSDI = National Spatial Data Infrastructure

- What are typically settings for the first level (user to help desk) and second level support (administrator to help desk) at your customers?
- How is a first and separately a second level support offered by your company? And what is the standard reaction time via email or phone?

7 Company references

- How many people work at your company? How many of them are specifically related to software actualization and / or customer support service?
- How many companies / user are working with your product?
- Could you provide us the contact information of 2 clients working with your product for more than 2 years as reference?

8 Prices

- Please describe the normal range of cost (daily or hourly rate) for a programming service costs.
- Please describe the business model, in case that a customer orders new features.

Appendix 2: Tender document for Open Foris Service Product

Tender document for adaptation and maintenance of Open Foris

1 Introduction

Within the framework of the project "Sustainable Management of Biodiversity, South Caucasus" The German *Gesellschaft für Internationale Zusammenarbeit* (GIZ) advises and supports the Ministry of Environment, Natural Resources and Protection and the Government in Georgia in the declared goal to sustainably manage the forests of Georgia in a multifunctional manner.

The current project develops solutions for the administrative and environmental challenges, which are occurring within this process. As part of these solutions, one study within the scope of the project, addresses the review and preparation of a Forest Information and Monitoring System (FIMS), as a substantial instrument for the sustainable forest management.

In order to establish a modern, comprehensive and flexible Forest Information and Monitoring System, it is necessary to set it up using different modules, compiled by different software products. The modular system consists of several components and databases connected by interfaces with pre-defined standards for data exchange.

Within the FIMS the different user groups have access to according modules and databases, allowing them the fulfillment of their daily work and decision-making via one general user-interface build as a Web-GIS-portal. This Forest and Land-Use Information and Decision Support (FLUIDS) web-based portal will deliver central access, the spatial analytics and data retrieval combining content of all related software modules.

2 Purpose of the tender document

The present document addresses especially the tender for an adaptation, maintenance, hosting and update service for the Open Foris software. This software package should be adapted as a FIMS module and suit the needs of the administration – Ministry of Environment and Natural Resources Protection (MoENRP), Agency of Protected Areas (APA) and National Forest Agency (NFA) especially for the data management of the National Forest Inventory and Forest Management Inventories.

3 Open FoRIS – Tools for forest Inventories

The software is a product of Open Foris Initiative established in 2009 by the Food and Agriculture Organization of the United Nations (FAO) to develop, share and support tools and methods for multi-purpose forest assessment, monitoring and reporting (FAO 2009²⁴).

The tools support a wide range of point sampling inventories and are built to support the inventory lifecycle, from design, planning, field data collection and processing, estimation, analysis and dissemination.

Open Foris Components

Open Foris Calc

- Robust, modular browser-based tool for NFI results calculation.

Open Foris Collect

- It provides a flexible solution for field data management, allowing full customization of inventory structure, variables and data checks. Collect promotes data quality through an integrated data entry and data cleansing workflow. All inventories documented in this way may be entered and retrieved through a user-friendly interface, without additional programming. Collect is available in both, standalone (offline) or web-based (online) versions.

Collect Mobile

- Collect Mobile is a fast and flexible data collection tool for field-based surveys. This Android app allows the completion of complex data structures, such as biophysical, socio-economic or biodiversity surveys.

Collect Earth

- The tool enables data collection through Google Earth. In conjunction with Google Earth, Bing Maps and Google Earth Engine, users can analyze high and very high resolution satellite imagery for a wide variety of purposes during the mapping phase of the NFI. It is highly customizable for the specific data collection needs and methodologies.

4 Development needs

An Open Foris application was design and configured for test of the National Forest Inventory (NFI) in 2016. These test application needs to be further developed and adapted to suit the needs of the user organizations. The following development needs have been identified concerning the NFI module. These are also applicable in regard of the software module for Forest Management Inventories (FMI):

²⁴ FAO Open Foris: http://www.openforis.org/OFwiki/index.php/Main_Page

- Final database structure and selection of final set of attributes.
- Definition of relevant standard reports and the development of an end-user friendly data mining tool, which can be embedded in the FLUIDS web-portal.
- Development of the interfaces to other Environmental Information Systems and the FLUIDS web-portal.

5 Business processes, information demand and software functions

Product description

The service product requested should deliver the adaptation of Open Foris for the following two modules:

- NFI software (see chapter 5.1)
- FMI software (see chapter 5.2)

5.1 Software module: National Forest Inventory

5.1.1 Business Process and Purpose

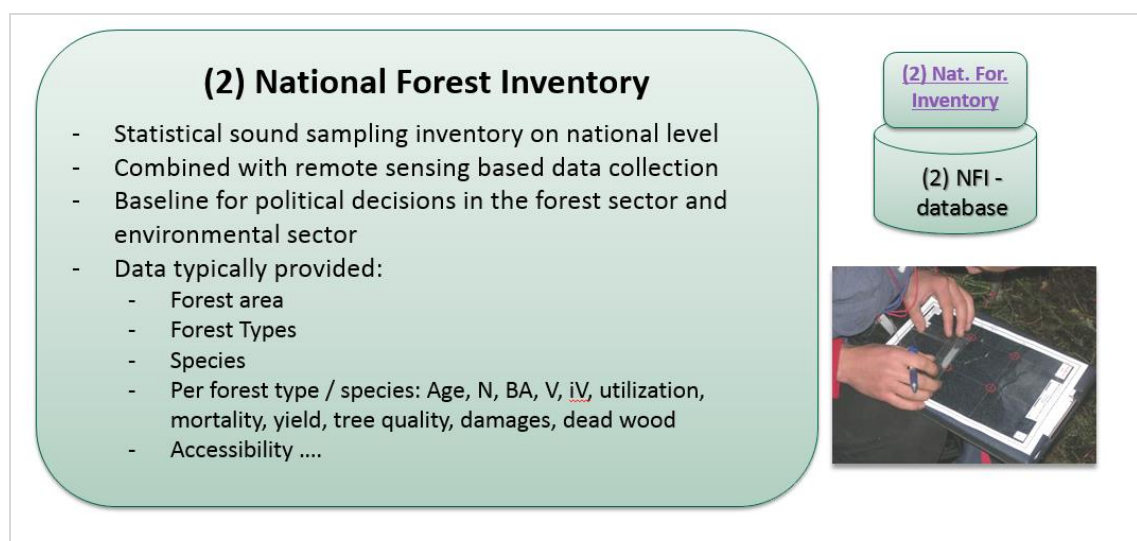


Illustration National Forest Inventory

The National Forest Inventory is an internal core information creation process. A software solution is needed for data collection, data aggregation, data analysis and reporting. The smallest unit for which statistical sound data can be provided following the developed design for the National Forest Inventory²⁵ are forest types, tree species (groups) in a region, district or even for a certain forest function zone.

²⁵ ForestEye (2017): Methodology for the First Georgian National Forest Inventory (NFI) and Forest Management Inventories (FMIs)

Purpose

The purpose can be defined like follows:

- NFIs are to provide scientifically sound and technically meaningful data and information to support policy processes and policy decision making and forest related policy formulation.
- Georgian National Forest Inventory (...) is planned and designed to be the starting point for establishing a long term National Forest Monitoring System that generates national and regional level forest related information that feeds as one data set into the National Forest Information System.

Business Process

The Functionality of the NFI software module should reflect the according business processes embedded within the national legislation. Changes in the legal framework may occur and should be incorporated within the software structure. Legal documents that address the NFI in Georgia are the Forest Code (Art. 25) and Regulation 179 (Art. 8).

Beside the definitions defined in legal documents the central source is the “First draft methodology for the First National Forest Inventory of Georgia (NFI)” (ForestEye, 2016) still to be adopted.

5.1.2 Features of an NFI software module

To ensure to proper functionality of the module, following features should be taken into account:

- Relational spatial database for point sampling
- (Mobile) data collection function including plausibility checks and GPS navigation
- Data check, data aggregation and analysis, sample error calculation
- Reporting: Reports as maps and tables shall be available in the FLUIDS web-portal.

5.1.3 Basic entities of an NFI software module

Basic entities of the NFI spatial database are:

- Sample points and plots (related stands)
- Soil and site data (eventually derived from spatial overlay in FLUIDS)
- Trees (> 8 cm DBH)
- Regeneration (< 8 cm DBH)
- Dead wood

The full list of attributes and entities can be found in the NFI methodology (ForestEye 2017).

5.1.4 Interfaces to be developed

In terms of interfaces between the NFI software module and other FIMS modules, following should be taken into account:

- Export of all GIS layer and related tables (Points, plots, stands; Trees; Regeneration) as WFS to the FLUIDS web-portal
- Export of all GIS layer (Points, plots, stands; Trees; Regeneration) as WFS for other national Environmental Information System (i.e. Biodiversity, Spatial planning etc.)

5.2 Software module: Forest Management Inventory

5.2.1 Business Process and Purpose

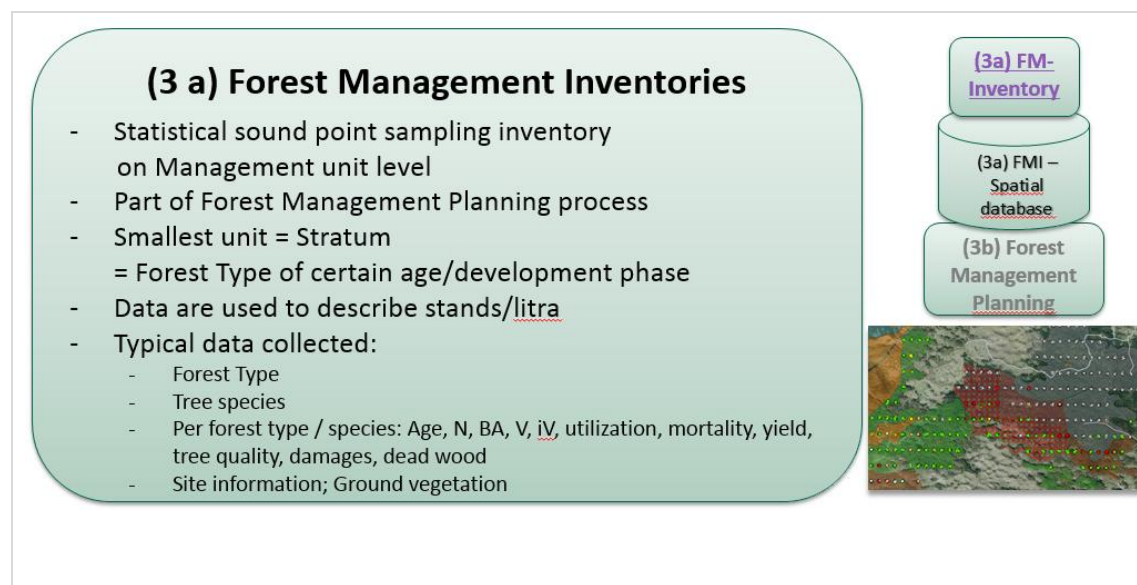


Illustration Forest Management Inventories

The Forest Management Inventory (FMI) is an internal information creation process. The software allows data collection, data aggregation and data analysis for a point sampling inventory. It has an interface to feed stand and strata data into the “FMP Software” module.

Purpose

The purpose can be defined like follows: FMI are to provide scientifically sound and technically meaningful data and information to support planning and decision processes within the forest district where the FMI takes place (ForestEye 2017).

The FMI is an inherent part of the Forest Management Planning process: “Quantitative and qualitative assessment of forest resources for production” (Article 26, Forest Code).

Business Process

The Functionality of the FMI software module should reflect the according business processes embedded within the national legislation. Changes in the legal framework may occur and should be incorporated within the software structure. Legal documents that address the NFI in Georgia is Regulation 179 (Art. 8, 9).

5.2.2 Features of a FMI software module

To ensure to proper functionality of the module, following features should be included:

- Relational spatial database for point sampling
- (Mobile) data collection including plausibility checks
- Data check, data aggregation and analysis, sample error calculation
- Reporting

5.2.3 Basic entities of a FMI software module

Basic entities of the NFI spatial database are:

- Sample points and plots including related stands address
- Soil and site data (eventually derived from spatial overlay in FLUIDS)
- Trees (> 8 cm DBH)
- Regeneration (< 8 cm DBH)
- Dead wood

The full list of attributes and entities can be found in the FMI methodology (ForestEye 2016).

5.2.4 Interfaces

In terms of interfaces between the FMI module and other modules, following aspects should be taken into account:

- Export of point sample data to the FIMS module for the related process of forest management planning: „FMP software“. Each plot will have information on the management unit, compartment, stand, forest type or age/development phase. It allows the aggregation of point data on each kind of stratum and finally on stand level (knowing that the sampling accuracy on stand level is low). It also allows to map of point features to support stand and stratum based planning.
- Export of all GIS layer and related tables (points, plots, stands, trees, regeneration) as WFS to the FLUIDS web-portal or any other environmental Information System (i.e. Biodiversity-IS).

6 User of the NFI and FMI software

Please consider in your offer the following number of future user per core customer organization:

| Organization | Number of users |
|---------------------------|-----------------|
| Ministry of Environment | ?? |
| Agency of Protected Areas | ?? |
| National Forest Agency | ?? |

7 Service and maintenance

The services asked for are:

- Adaptation: Configuration and adaptation of Open Foris components as defined by the customer in close contact with the service provider
- Maintenance and Update service
- Hosting of the application (SaaS) including
 - server management,
 - security services and
 - backup services
- Second level support
- Administrators training

8 Additional Questions

Please describe:

- What are typically settings and conditions for the second level support (administrator to help desk) at your customers?
- How is a second level support offered by your company? And what is the standard reaction time via email or phone?
- Training for Administrators: How many days you would recommend?

9 Company references

- How many people work at your company? How many of them are specifically related to software actualization and / or customer support service?
- How many companies / user are working with your product?
- Could you provide us the contact information of 2 clients working with your product for more than 2 years as reference?
- Describe the offered technique and data center solution for hosting services (SaaS).

10 Project schedule

The start of the software adaptation process is planned for: xx.xx.2017

The OPEN FORIS components shall be available: xx.xx.2017

Please describe in your offer your availability to react in the given time schedule and estimate – roughly – the implementation duration for the adaptation of the following components:

- 1. Priority: Open Foris Calc & Open Foris Collect
- 2. Priority: Collect Mobile

11 Prices

Please describe the prices for the services asked for:

- Adaptation: Configuration and adaptation of Open Foris components
 - Price per developer hour / day
 - Price for concept development at customer (price per hour/day)
- Maintenance and Update service (price per month/year)
- Eventual license costs for the planned DBMS
- Hosting of the application (price per month/year)
- Second level support (price per month)
- Price for a training day (ca. 4 administrators)

Appendiix 3: Tender document for FMP software

Tender for a Forest Management Planning software and the Forest Register

1 Introduction

Within the framework of the project "Sustainable Management of Biodiversity, South Caucasus" The German *Gesellschaft für Internationale Zusammenarbeit* (GIZ) advises and supports the Ministry of Environment, Natural Resources and Protection and the Government in Georgia in the declared goal to sustainably manage the forests of Georgia in a multifunctional manner.

The current project develops solutions for the administrative and environmental challenges, which are occurring within this process. As part of these solutions, one study within the scope of the project, addresses the review and preparation of a Forest Information and Monitoring System (FIMS), as a substantial instrument for the sustainable forest management.

In order to establish a modern, comprehensive and flexible Forest Information and Monitoring System, it is necessary to set it up using different modules, compiled by different software products. The modular system consists of several components and databases connected by interfaces with pre-defined standards for data exchange.

Within the FIMS the different user groups have access to according modules and databases, allowing them the fulfillment of their daily work and decision-making via one general user-interface build as a Web-GIS-portal. This Forest and Land-Use Information and Decision Support (FLUIDS) web-based portal will deliver central access, the spatial analytics and data retrieval combining content of all related software modules.

2 Purpose of the tender document

The present document addresses the tender of a Forest Management Planning software (FMP software), which on a later stage should be further developed to form a central spatial forest database, the "Forest Register". This software package should be adapted as a FIMS module and suit the needs of the administration – Ministry of Environment and Natural Resources Protection (MoENRP) and forest managing bodies: Agency of Protected Areas (APA) and National Forest Agency (NFA).

3 System Architecture

3.1 General requirements

The system should be web-based (with or without a thin-client) and has to work well at remote, low-bandwidth sites.

Multilingualism

The user interface should be built as a multi-lingual system.

Reporting

Easy report generation is required. There should be the possibility to generate prepared reports as well as unique combinations of criteria. Export of reports and data is required.

Beside a printing option there has to be the possibility to export tables to MS EXCEL. Furthermore, reports have to be exported to MS EXCEL and/or MS WORD and/or PDF format.

Adaptation

The system has to be adaptive to user requirements.

4 Business processes, information demand and software functions

4.1 Software module: Forest Management Planning

4.1.1 Business Process and Purpose

Product description

Forest Management Planning is an internal information creation process, linked with point sampling inventories. The software shall be used to define and update stand data and forest maps. Completed Forest Management Plans will be uploaded to the central forest database ("Forest Register") to complete the actual picture on the forest resources of an enterprise or administration (NFA). Typical the smallest unit is a forest stand inside of a management unit.

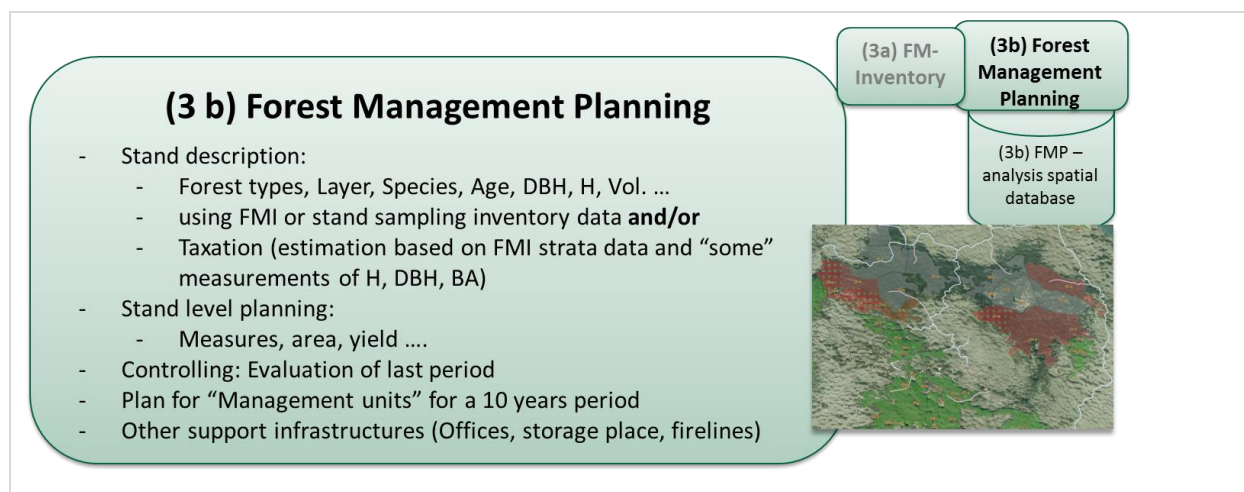


Illustration Forest Management Planning module

Purpose

Purpose is to support the development of Forest Management Plans in all steps:

- Phase 1: Analysis the forest structure (Status)
- Phase 2: Evaluation of the past period (10 years period)
- Phase 3: Definition of planned measures for the next 10-years period
 - Forest stands: Harvest, tending, thinning, regeneration, reforestation
 - Non forest: Afforestation, agriculture, grazing rights, Non timber production rights
 - Roads: Building & maintenance

Business process

The Functionality of an FMP software should reflect the business processes for the Forest Management Planning embedded within the national legislation. Changes in the legal framework may occur and should be incorporated within the software structure. Legal documents that address FMP in Georgia are the Forest Code (Art. 26) and Regulation 179 (chapter II, V, III).

4.2 Features

To ensure proper functionality of the module, following features should be included:

- Relational spatial database for stands (liter)
- (Mobile) data collection for stand description and stand based planning
- Data check, data aggregation and analysis (i.e. DBH classes per tree species, stand or any other stratum).
- Planning:
 - Group and filter stands by strata
 - Calculate and present model based yield indicators (increment, yield table etc.): As harvest options are defined by Georgian Law on density at the moment, this analysis must be possible here.
 - Support comparison of model based yield planning and stand based yield planning
- Reporting:

- Status of forests by forest types, species, age class, DBH distribution, incl. stocking degree, volume, etc.
- Activity records from the last management period
- Target – actual comparison
- Planned measures by forest types for harvesting, re-forestation, roads, NTFP and other plans
-

4.2.1 Basic entities

Basic entities of the spatial FMP database is:

- Compartments
- Stands (Liter) and its description (ha, N, Basal Area, Density, Volume, Increment, yield plan)
- Land use classes (forest, non-forest: fields, meadows, roads etc.)
- Tree species (ha, N, Basal Area, Volume, Increment, technical quality, vitality)
- Regeneration layer (< 8 cm DBH)
- Dead wood
- Rare species
- Forest roads and tractor roads
- Other support infrastructures (Offices, storage place, fire lines)

4.2.2 Interfaces

In terms of interfaces between the FMP module and other modules, following aspects should be taken into account:

- Import point sample data to „FMP software“: Each point will have information on management unit, compartment, stand, forest type, age/development phase:
 - Allowing aggregation on stratum and stand level
 - Allowing mapping of point features and trees to support stand and stratum based planning
- Export of all GIS layer and related tables (Plots, stands, trees, regeneration) as WFS to the FLUIDS web-portal
- Spatial joins with external spatial databases. If the spatial data layer are embedded in the FLUIDS portal spatial joins can be used to automatically fill data (i.e. aspect, sites, forest function).
- Import of activity records from software for Forest Operations

4.2.3 Development needs

Because the tendered product (FMP software) has very tailored specifications, it will be necessary to adapt existing products offered in this tender, in order to meet the needs of the FIMS and FLUIDS concept. Special emphasis hereby should be put on the following aspects:

- Development of a spatial database
- Forest roads as management objects

- Development of interfaces to FLUIDS and other FIMS software modules

4.3 Development to form a Forest and Forest Structure Central Database (“Forest Register”)

4.3.1 Business Process and Purpose

The upgrade option for the FMP software to a Forest Register module should be incorporated within the offered services.

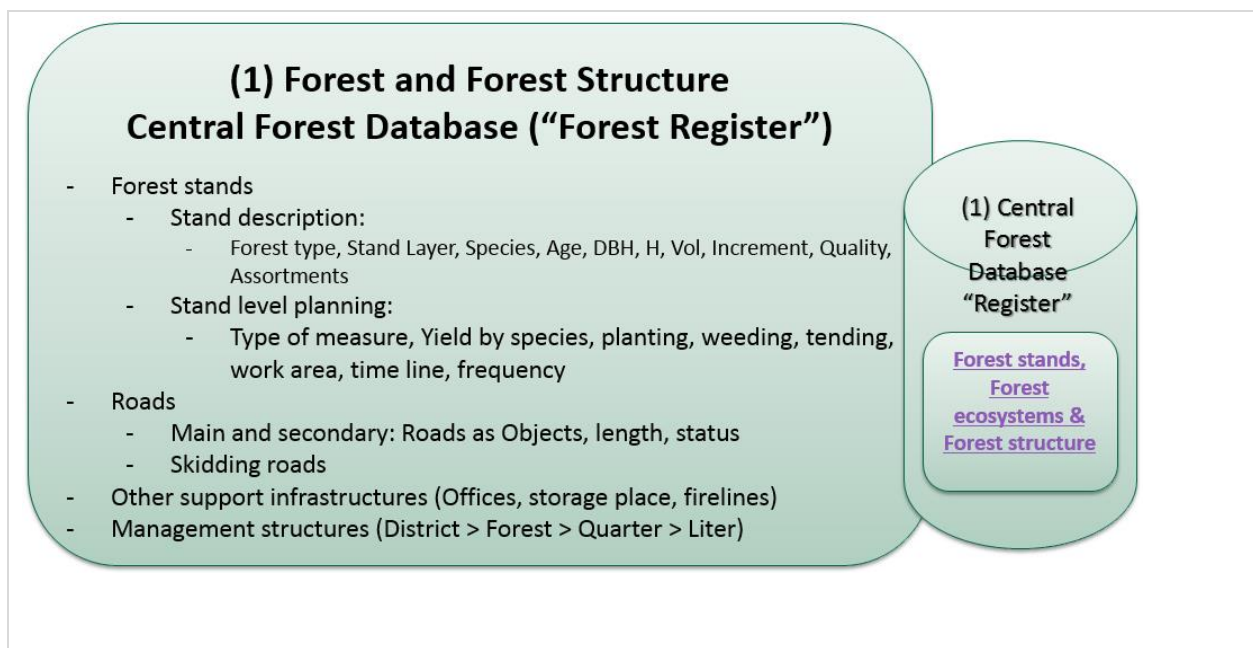


Illustration Forest Register

Description

The central Forest Database (“Forest Register”) is at the same time the central module of the FIMS, the location where the basic elements of the forest and the forest structure is described using forest stands as smallest unit. The setting up of a “Forest Register” is a demand described in the Forest Code. It is built on forest stands as the core forest management entity. A regular update is maintained by Forest Management Planning and features to simulate annual growth and changes induced by forest operations (harvesting, re afforestation etc.).

Purpose

Purpose is to deliver central – up-to-date - overview on the forest area, structure and condition

- based on Forest Management Plans
- based on NFI data for forests outside of State forest fund

Business Process

The Functionality of the Forest Register should reflect the according business processes embedded within the national legislation. Changes in the legal framework may occur and should be incorporated within the software structure. Legal documents that address the Forest Register in Georgia are the Forest Code (Art. 27: Forest Register of Georgia).

4.3.2 Features

The database structure and main functions are nearly identical to the FMP software. A Forest Register software can be derived based on software for FMP (see chapter 4.1 above). To ensure the proper functionality of the module, following features should be included:

- Relational spatial database of forest stands
- Data import from forest management plans including secure overwriting of out-dated stand and management units
- Data check, data aggregation and analysis
- Annual growth:
 - Use increment data per tree species to update stand information annually
- Actualization of stands triggered by activity records:
 - Via an interface to the software for Forest Operation stand data shall be updated using harvesting records grouped by the tree species described in the stand (taken over from the “Electronic System of Timber Resources” (Art. 50 Forest Code))

4.3.3 Basic entities

- Regions, Districts and Management Units
- Compartments
- Stands (ha, N, Basal Area, “Stocking density”, Volume, Increment)
- Land use classes
- Tree species (ha, N, BA, Basal Area, “Stocking density”, Volume, technical quality, vitality)
- Regeneration layer(< 8 cm DBH)
- Dead wood
- Rare species
- Forest roads and tractor roads
- Other support infrastructures (Offices, storage place, fire lines)

4.3.4 Interfaces

In terms of interfaces between the Forest Register module and other modules, following aspects and possibilities should be taken into account:

- Import from FMP software
- Export of all GIS layer and related tables (Points, plots, stands; Trees; Regeneration) as WFS to the FLUIDS web-portal

- Import of activity records and timber harvesting data from the software for Forest Operations to be able to actualize stand descriptions based on implemented measures.

4.3.5 Development needs

In regard of the development of the product to a central forest database, the “Forest register”, following adaptations are planned:

- Function for annual growth and actualization of forest stand data
- Improvement of performance for performant work of more than hundred users
- Interfaces to a software for Forest Operations to be able to update stand information based on activity records in the Forest Operation software (“Electronic System of Timber Resources” (Art. 50 Forest Code))

5 Installation options

The software should be available in the following types of installation:

- Server installation at the customer site
- Server operation in an external or your data center

6 Service and maintenance

The services asked for are:

- Software license / software as a service (SAAS) including hosting
- Maintenance / Updates
- Support
- Adaptation to user needs at start

7 User of the FMP software and the Forest Register

FMP software

The offer shall consider the following number of users and size of managed forest:

| Organization | Number of users | Managed Area [ha] |
|--------------|-----------------|-------------------|
| MoENRP | ? | ----- |
| APA | ? | ? |
| NFA | ? | ? |

Forest register

The offer shall consider the following number of users and size of managed forest:

| Organization | Number of users | Managed Area [ha] |
|--------------|-----------------|-------------------|
| MoENRP | ? | ----- |
| APA | ? | ? |
| NFA | ? | ? |

8 Additional Questions

Help-Functions and documentation:

Could you shortly describe, what Help-Functions do exist and how documentation / manuals are available?

Demo version

Could you provide a time-limited “demo” access? It helps to get an idea of the full set of features, attributes used and the GUI.

Implementation

- Wherever you describe adaptation- or development needs in your offer: Could you please add an estimation of a period for these activities?
- What is a realistic time line for adaptation and implementation of your software at the organizations with the above given size?
- Could you describe, what configuration, settings, attributes could be changed by the user (administrator) or if reports could be configured, developed by the user via standard tools (like crystal reports, Excel interfaces etc.)?

Support

- What are typically settings for the first level (user to help desk) and second level support (administrator to help desk) at your customers?
- How is a first and separately a second level support offered by your company? And what is the standard reaction time via email or phone?

Training for Administrators

- How many days you would recommend?

9 Company references

- How many people work at your company? How many of them are specifically related to software actualization and / or customer support service?
- How many companies / user are working with your product?
- Could you provide us the contact information of two clients working with your product for more than 2 years as reference?

10 Project schedule

The start of the software implementation process is planned for: xx.xx.2017

The Forest Management planning software shall be available: xx.xx.2017

Please describe in your offer your availability to react in the given time schedule and estimate – roughly as information are incomplete – the implementation duration for the adaptation needs described in chapter.

11 Prices

Please describe the prices for the following services asked for:

- Availability and monthly costs for software leasing (price per month)
- Maintenance and Update service (price per month/year)
- Eventual license costs for the DBMS (MS SQL, ORACLE etc.)
- Hosting of the application (price per month/year)
- Availability and monthly costs for software as a service (SaaS) (price per month) including all above listed services
- Adaptation: Configuration and adaptation costs
 - Price per developer hour / day
 - Price for concept development at customer (price per hour/day)
- Second level support (price per month)
- Price for a training day (ca. 4 administrators)