National Forestry Inventory
Execution and Capacity Building

RFP No.: # KG - IFEMP/QCBS/NFI-01-2018

Technical Proposal

National Forest Inventory Execution and Capacity Building

Client

State Agency for Environmental Protection and Forestry

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ACRONYMS

EO	Earth Observation
NFI	National Forest Inventory
NFI-FI	Field inventory of the National Forest Inventory
FMIS	Forest Management Information System
FMP	Forest Management Planning
GIS	Geographic Information System
NLCC	National land cover classificaion
PIU	Project Implementation Unit
FAO	Food and Agriculture Organization
NGO	Non-Government Organization
SAEPF	State Agency for Environmental Protection and Forestry
WB	World Bank
FMIS	Forest Management Information System
GDO	Global Development Objective
GIS	Geographic Information System
IFEMP	Integrated Forest Ecosystem Management Project
INRMP	Integrated Natural Resources Management Plans
LCCS	Land Cover Classification System
Leskhoz	State Forest Enterprise
MA	Ministry of Agriculture, Melioration and Water resources of the Kyrgyz Republic
NFI	National Forest Inventory
NFI # 1	1st National Forest Inventory of the Kyrgyz Republic
NFI # 2	2nd National Forest Inventory of the Kyrgyz Republic
NSC	National Statistical Committee of the Kyrgyz Republic
PDO	Project Development Objective
PIU	Project Implementation Unit
S2	Sentinel 2 data
SAEPF	State Agency for Environmental Protection and Forestry
SFF	State Forest Fund
SIKFHIP	State Institution "Kyrgyz Forest and Hunting Inventory and Planning"
SRS	State Registration Service of the Kyrgyz Republic
ToR	Terms of References
TTFI	Technical Team for Forest Inventory
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
WG on NFI	Working Group on Management Processes for the Development of NFI

1 FORM TECH-1: TECHNICAL PROPOSAL SUBMISSION FORM

2 FORM TECH-2: CONSULTANT'S ORGANIZATION AND EXPERIENCE

2.1 A - Consultant's Organization

UNIQUE forestry and land use GmbH

UNIQUE is a consulting firm for sustainable forestry and agriculture, rural development and natural resource management. Our core competencies are providing technical and economic solutions at the intersection of forestry, agriculture and climate change. We work on multi-year implementation projects and offer advisory services for public and private investment funds.

We have more than 20 years of experience providing tailor-made support to our clients in tackling technical, organizational and socio-economic challenges in land-use sectors, from project planning through implementation to evaluation.

Our know-how is in demand worldwide from a broad variety of clients. We work with development banks, multilateral organizations, ministries, municipalities, associations and the private sector.

UNIQUE was established in 1998 and is headquartered in Freiburg, Germany. Offices in Paraguay, Uganda, Vietnam, Kyrgyzstan and representatives in Argentina and the UK are strengthening our regional presence. There are also temporary project offices in Colombia, Serbia, Kenya and Ethiopia. In Paraguay, our subsidiary UNIQUE Wood manages more than 15,000 hectares of FSC®-certified forests (natural forests, plantations and silvopastoral systems).

Since the company was founded, we have successfully completed more than 700 projects in more than 75 countries. The international orientation of UNIQUE ensures that our clients have access to knowledge and experience from all over the world.

Company structure

Our 60-persons team consists of forestry and agriculture experts, economists, policy experts and social scientists. This strong in-house expertise enables us to deliver high quality, timely products to our customers. We also collaborate with a worldwide network of associated experts. Internally, we are organized in four technical divisions, an administrative division and a unit for business development and quality management.

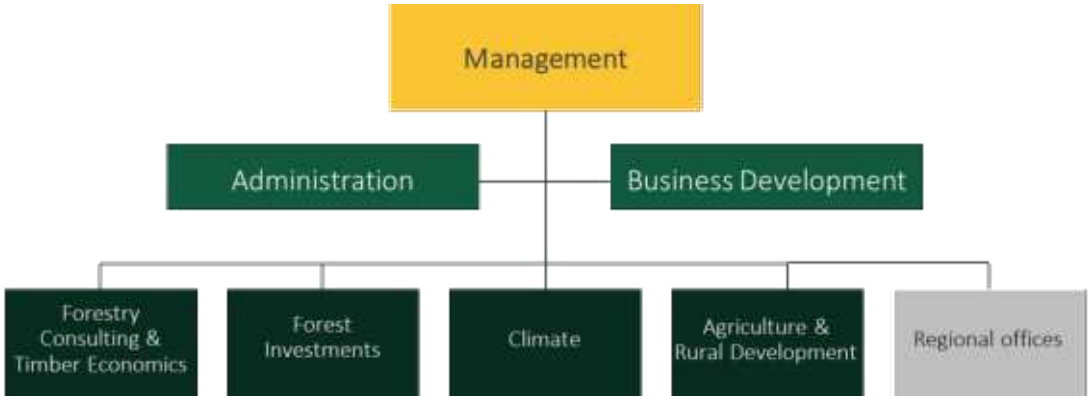


Figure 1: UNIQUE structure, head office in Freiburg, Germany

UNIQUE has four divisions, which cover a broad range of topics. The most relevant field of work for this assignment are:

- UNIQUE offers broad experience in forest inventory, management planning and value assessment of forests. Through ecological planning and mapping, we support the development of economically viable sustainable forest management.
- Support of private and public enterprises to ensure the long-term competitiveness of the forestry and wood industry sector.
- Surviving in the timber market calls for strategic organizational positioning and an in-depth understanding of market dynamics and their interactions. We assess the competitiveness of wood sector enterprises and develop customized approaches for the efficient use of biomass for energy and other bio-products. We also provide policy makers and associations with important decision-making tools, including cluster studies and sector reviews, aimed at sector competitiveness.
- Sustainable intensification of agricultural production (including crop, livestock and integrated production systems)
- Development of inclusive and sustainable business models, innovation systems and value chains
- Climate smart land use, including land-sparing and deforestation free commodity sourcing
- Participatory and community based forest management
- Community based development in rural areas, land use planning and regional rural development

UNIQUE's project related experience

One of UNIQUE's divisions is Forestry Consulting & Timber Economics which has implemented numerous projects on forest management (forest value assessments and analysis of forest enterprises and economic optimization, monitoring of forest funding effects, development of forest owners associations, analysis of forest sector reforms); **forest inventory, remote sensing and forest information system including forestry IT, data management** (planning, conducting and training of forest inventories, implementation of forest information systems); forest planning and conservation (executing forest management planning in private and state forests, gapping forest biotopes and environmental compensation assessments. All our assign-

ments are complemented with **capacity building and trainings components** to ensure the sustainable knowledge transfer within projects.

UNIQUE has a long-standing experience conducing national or regional **forest inventories including capacity-building** component. More than **15 related assignments were conducted** in Georgia, Serbia, Germany, Montenegro, Honduras, Ecuador, Paraguay, Togo, Uruguay (processing forest inventory data with FAO Open FORIS) and Mozambique. Ongoing is a **forest inventory and management planning project for the State Forest Fund (SFF) in Tajikistan**. In this assignment, we developed **methodologies and technical** manuals for forest cover assessment, inventory and stand description and forest management planning jointly with the State Forest Agency.

Since 2012 UNIQUE completed more than 30 assignments in Central Asia with a strong focus on Kyrgyzstan. In 2015 we established our regional office **in Kyrgyzstan**. Our local and international team in Central Asia consists of **forest inventory and management experts,** agricultural engineers, economists and governance experts. We offer a unique pool of 60 in-house expects with a track record of more than 60 World Bank financed assignments. Our team can swiftly, efficiently and professionally respond to our clients' demands in the region. We are managing long and short-term forestry projects in **Kyrgyzstan**. Our team is currently implementing a **World Bank financed** project on developing monitoring, reporting and verification instruments for climate reporting in the **Forestry and Biodiversity sector of Kyrgyzstan**. In Southern Kyrgyzstan UNIQUE is implementing together with the **SAEPF** a "Walnut forest management project" for GIZ, where new participatory forest planning and monitoring tools are developed and applied. Recently, we conducted a **World Bank assignment** on dairy value chains in Kyrgyzstan. At the policy level, we have supported the national delegation of Kyrgyzstan at important climate policy relevant events.

CAREC - Central Asian Regional Environmental Centre

Background

The Central Asian Regional Environmental Centre (CAREC) was founded in 2001 by the Governments of Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan, the European Union (EU) and the United National Development Programme (UNDP) as an **international organization of regional nature**.

Mission

CAREC's mission is to assist in **addressing environmental problems in Central Asia (CA)** through the provision of dialogue platforms for multi-state and multi- sectoral communication, know-how, knowledge and technology exchange, supporting of the development and application of innovative environmental policies, approaches and practices and through the promotion of public participation in environmental decision-making and the exchange of information in the region.

CAREC's service and expertise

CAREC's staff has long-standing experience in the **field of natural resources inventory, including in the first Kyrgyz national forest inventory**. It also has **roster of national experts who are competent in relevant fields (GIS, Remote Sensing, economic and social analyzes**) and are engaged into various projects.

CAREC has been implementing projects related to the sustainable management and use of natural resources in **Central Asia for 15 years**. These projects implied close cooperation with local institutions like **leskhozes** as well as with national ones such as the **SAEPF**. In the field, CAREC has experience identifying, valuing and mapping ecosystem services, including those related to forest ecosystems. It also did extensive work in terms of community mobilization and partnership building between leskhozes and forest users in Kyrgyzstan including **mapping, monitoring and database management**. Further work in Kyrgyzstan focuses on watershed management, addressing such issues as forest and pasture management in all provinces of the country.

CAREC is a dynamically developing organization that links highly professional experts and aims at achievement of tangible outcomes in the spheres of environment and sustainable development. The organization is interested in extending of its partnership and collaboration with international, regional, and local organizations. It has also gained experience in the implementation of environment and development projects focused on overcoming national and regional challenges.

In particular, CAREC can offer the following services, facilities and resources for cooperation:

- Expertise of staff and non-staff experts for regional/national projects;
- Network throughout the region with CAREC country offices;
- Involvement of relevant stakeholders from Central Asian states;
- Involvement of thematic networks (information, education, adaptation, water management, etc.) throughout the region;
- Organization of meetings in any country of the region;
- Providing rooms and facilities, including meeting rooms and technical equipment, for projects;
- Organization of visibility and informational support;
- Implementing operational and financial project management;

CAREC Goals and Objectives

- To assist in the establishment of the inter-sectoral dialogue between the central and local governments, NGOs, local communities, the business sector, and the donor community to ensure environmental sustainability in Central Asian region;
- To create opportunities for use and intake of the international expertise and knowledge, best practices, and advanced technologies available in the field of environmental management and sustainable development by the countries of Central Asia; and
- To enhance the role of civil society in Central Asia's sustainable development activities.

Governance

CAREC's headquarter is in Almaty, Kazakhstan, with country offices in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. CAREC's staff is multinational, represented by staff members from CA countries and from western countries. CAREC's Board of Directors is composed by state representatives and representatives of civil society for each of five countries of CA, of the donor community, international organizations.

CAREC country offices closely coordinate their strategies and activities with governmental agencies and their subordinate organizations. In Kyrgyzstan, this is mostly the **State Agency for Environmental Protection and Forestry and its sub-divisions incl. the Department of Forest Ecosystem Development and Forest Inventory**.

Financing

Since the end of 2010, CAREC is a self-supported organization, which finances itself through project implementation and service provision. CAREC implements projects in cooperation with international development partners, with an average budget of 1.5 million Euros per annum. CAREC has annual audits of both individual projects and of organization at large. CAREC has in place a project management system and other procedures, policies and practices in line with international standards.

CAREC's partners

CAREC is an integrated part of five Regional Environmental Centres network, including those situated in Hungary (covering 15 countries of Central and Eastern Europe and Turkey), in Caucasus (covering 3 countries) and in Moldova.

CAREC works within the framework of the Environment for Europe process (EfE), assists the implementation of the EU Strategy for Central Asia, promotes the Central Asian Initiative for Sustainable Development as a tool for CA countries to participate in the EfE process and supports the Aral Sea Basin Programme. CAREC also assists the realization of the UN MDG, UNFCCC, UNCCD, EU Strategy on Education, Aarhus Convention, Environment and Security in CA, Water Convention, specifically on IWRM, Convention on EIA in a transboundary context, ESPO Convention, UNECE Strategy on ESD (Process for Europe), Kyoto protocol and initiatives: EUWI, Asian-Pacific Regional Initiatives on ESD.

Within Central Asia, CAREC cooperates with the ministries of environment, education, energy, economy, health and culture, with local authorities, basin councils, all levels of the primary, secondary and higher education, NGOs and the business sector.

In recent years, CAREC has cooperated with the European Union, development organizations, such as ADB, ADBI, EC, EEA, GEF, SGP, OSCE, UNECE, UNEP, USAID, USEPA, UNESCO, WB, WBI, business organizations, such as AGIP, BG Group, Chevron, SwissRe, Venice International University, United National University Institute of Advanced Studies, etc.

2.2 B - Consultant's Experience

a) Forest inventory, management planning and capacity building relevant assignments:

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
03/2018 - 06/2019	**Provision of Forest Inventory and Forest Management Planning Services** Information on forest resources in Tajikistan has not been updated since the country's independence from the Soviet Union in 1991. The latest official forest inventory data date back to 1988. With financial support from the KfW, the Tajik Forest Service is up-dating its data on the extent and location of different forest types and their qualitative and quantitative parameters. The consortium UNIQUE-CAI Consulting was contracted to establish a forest monitoring baseline for four state forest enterprises. This included the design and realization of a pilot forest inventory in the state forest enterprise Khovaling and the elaboration of a pilot forest management plan for about 106,000 hectares of forest. UNIQUE conducted the following tasks: • Design a forest cover assessment scheme for Tajikistan. • Assessment of the forest cover of four state forest enterprises. • Design, planning and implementation of forest inventories in the state forestry enterprise Khovaling. • Elaboration of a forest management plan for Khovaling. • Development of a central forest data management system.	Forestry Agency under the Government of the Republic of Tajikistan Tajikistan	430.000 / 430.000	Leading Company
07/2015 - 08/2017	**Development of innovative forest management planning for Serbia** The economic and environmental services of the Serbian forests are threatened by more and more abiotic extreme incidents (Ice break, fire, droughts). The latest example was a disastrous flood in 2014, affecting a large part of the country's forests. In order to reinforce and strengthen forest functions and services, there is the need to develop an improved planning and monitoring methodology for Serbia's forest management. This methodology will pronounce close-to-nature forest management as a guiding principle. The lead institutions of this bilateral project are the German Federal Ministry of Food and	BMEL - German Federal Ministry of Food and Agriculture Serbia	519.000 / 519.000	Leading company

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
	Agriculture and the Serbian Ministry of Agriculture and Environment. UNIQUE was contracted in consortium with Hessen-Forst to support implementation of the project. UNIQUE conducted the following tasks: • Improvement of the forest management planning and monitoring methodology. • Promotion of the bilateral experience exchange between Serbia and Germany. • Preparation of implementation of improved planning and monitoring methodology.			
08/2014 - 04/2017	**National forest inventory and forest rehabilitation** The Republic of Togo intends to reduce emissions from deforestation and forest degradation (REDD+) and to increase the forest carbon stock through a national REDD+ process. The German development cooperation (GIZ) supports REDD+ in Togo by establishing and providing joint financing for periodic national forest inventories. From 2014 to 2016, the first comprehensive national forest inventory was conducted in Togo. This included satellite image analysis as well as broad civil society involvement. Due to the strong experience with REDD+ and knowledge of local circumstances, UNIQUE in consortium with Deutsche Forstservice GmbH (DFS) supported the design and implementation of this inventory. UNIQUE conducted the following tasks: • Inform civil society organizations about the inventory process. • Design and conduction of complementary trainings. • Support the national long-term expert (particularly at satellite image analysis and REDD+ issues). • Backstopping during the inventory data collection and analysis.	GIZ Togo	1.315.000 / 200.000	Partner, in Consortium with DFS
11/2015 - 01/2017	**Support of the forest inventory and management in Eastern Georgia** Despite economic growth, many areas of rural Georgia have high poverty rates. Due to the lack of income opportunities, natural resources are often overused. Against this background, the GIZ supports the national forest administration in reforming the forestry sector. The GIZ commissioned UNIQUE to conduct pilot based planning and monitoring of a forest inventory and the elaboration of a management plan for 3,000 hectares of forest	GIZ Georgia	120.000 / 120.000	Leading Company

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
	in the district of Dedoplistskaro. Additionally, UNIQUE developed an energy wood supply concept. Upon successful completion of the assignment, the experience gained from this pilot project will be applied for the introduction of standardized forest management planning in Georgia. UNIQUE conducted the following tasks: • Inventory planning, trainings and quality control of the inventory implementation. • Elaboration of a ten-year forest management plan. • Analysis of firewood demand and alternative supply models. • Development of an energy wood supply concept.			
09/2015 - 04/2017	**Assessment and preparation of a forest monitoring and information system** Georgia's highly diverse forests fulfill a wide range of social, ecological and economic functions. In order to preserve them, the Georgian government declared its goal to sustainably manage the forests of Georgia in a multifunctional manner. To achieve this goal, forest inventory must be made available to establish a forest monitoring and information system. UNIQUE and ForestEye were assigned to provide professional and technical expertise on the essentials of the introduction and implementation of forest inventories on the national and enterprise level. In addition, the assignment introduced a forest monitoring and information system, as well as the provision of specific trainings for the relevant stakeholders in the forestry sector. UNIQUE and ForestEye conducted the following tasks: • Development of a technical proposal for forest inventory standards on a national and enterprise level. • Proposals for the institutionalization of inventory, monitoring and information. • Implementation planning of a national forest inventory. • Introduction of forest management inventory, set-up of forest information and monitoring system. • Feasibility review of the implementation.	GIZ Georgia	230.000 / 230.000	Leading Company

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
	• Information and trainings for relevant stakeholders.			

b) World Bank assignments

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
02/2018 - 10/2018	**Landscape Level Analysis of Land and Natural Resources Degradation in Kenya, Mal** Land and forest degradation threatens to significantly undermine future productivity growth in the agriculture, forestry and related sectors in vulnerable landscapes in Kenya, Malawi and Uganda. The World Bank supports these governments to design and implement interventions that address land degradation and loss of natural forests. UNIQUE was contracted to lead a team of interdisciplinary experts to analyze land degradation issues with the aim to inform the design of practical strategies at sub-national level. UNIQUE conducted the following tasks: • Spatial analysis of land degradation to develop user-friendly mapping platforms. • Participatory identification of sub-catchments with highest restoration potential. • Identification of cost-effective and timely restoration interventions, including estimated budgets. • Quantification of likely economic and other benefits of restoration interventions. • Integration of proposed interventions to fit with World Bank and other donor portfolios.	The World Bank Various countries in Africa	590.000 / 590.000	Leading company, in consortium with IFPRI, WRI, Development Seed
11/2016 06/2017	**Drivers of Deforestation, REDD+ Strategy Options and Reference Levels** The Government of Cameroon is developing a national strategy to reduce emissions from deforestation and forest degradation (REDD+) to ensure the country's economic development does not compromise sustainable forest management. This national REDD+ strategy will introduce activities that increase the value of forests by transform-	The World Bank Cameroon	450.000 / 450.000	Leading company

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
	ing the forest landscape to a more productive ecosystem that sequesters carbon and safeguards forest benefits. UNIQUE was contracted to conduct a study that informs the design of the REDD+ program. UNIQUE conducted the following tasks: • Comprehensive analysis of drivers, agents and underlying causes of deforestation. • Spatial analysis to stratify country into forest types, relevant for REDD+ interventions. • Detailed analysis of drivers, including opportunity cost assessment, in priority areas. • Capacity building for national counterparts to continue regular updates to the analysis. • Assessment of commodities causing deforestation by using value chain approach.			
09/2014 - 12/2016	**Ethiopia Forest Sector Review** The forest sector plays a central role in Ethiopia's ambitious green development strategy of becoming a middle-income country while achieving climate neutrality. The objective of this assignment was to comprehensively review the forest sector's contribution to development and identify opportunities for enhancing this contribution. Given our knowledge of the sector, UNIQUE was chosen to conduct this review and identify key investment barriers and opportunities to provide strategy advice for national development plans moving forward. • Comprehensive demand / supply analysis of forest products, goods and services. • Model alternative future scenarios to identify opportunities in forests' contribution to green economy. • Analysis of investment climate. • Provide recommendations for enhancing private sector investment in forests. • Prioritize strategic interventions to increase forest contribution to economy in terms of livelihoods. • Engage private sector stakeholders in dialogue with policy makers to inform devel-	The World Bank Ethiopia	280.000 / 280.000	Sole contractor

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
	oping planning.			

c) Other regional assignments

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
08/2015 - 08/2018	**Community based forestry in walnut forests for biodiversity conservation** The walnut forests in southern Kyrgyzstan are of high economic importance for the local population as traditional forest-pasture systems (haymaking, harvesting walnuts and use of natural pastures). Furthermore, forests serve as protection against erosion and avalanches, regulate watershed hydrology and are important for maintaining genetic resources. Due to an increasing population, intensive pasture use and climate change, these forests and their natural regeneration are endangered. UNIQUE was contracted by the GIZ for the implementation of a 3 year project with the aim of maintaining biodiversity, adapting to climate change and safeguarding long-term sustainable income. Sustainable management models should be developed together with the local population and the state forest enterprises and be implemented in selected communities. UNIQUE conducted the following tasks: • Development and implementation of participatory forest pasture management models. • Sustainable use and value adding to biological diversity (forests, pasture, agriculture). • Rehabilitation of forests and fruit production under climate change threats. • Overall project management and implementation with local subsidy contracts.	GIZ Kyrgyzstan	1.382.000 / 1.382.000	Sole contractor

	• Monitoring of biodiversity.			
07/2016- 07/2018	**Framework Contract "Sustainable and Climate Sensitive Land Use" in Central Asia I and II** GIZ's regional „Sustainable and Climate Sensitive Land Use for Economic Development in Central Asia" program is active in all five Central Asian countries. It supports local communities and government authorities in promoting integrated sustainable land management. Promoting reforms to forestry and pasture management are the program's thematic focus, with adaptation to the adverse effects of climate change as a cross-cutting issue. Reforms of planning and investment routines at all levels are another core element. Building on a series of past consultancies in the region, UNIQUE has been commissioned to provide long-term, coherent, flexible technical advice to the Regional Program and its national and regional partners. The consulting services are under a framework contract (extended workbench approach) with a provisional list of assignments. UNIQUE conducted the following tasks: • Technical advice on state incentives enabling private afforestation efforts (Kazakhstan). • Strengthening community-based pasture management (Kyrgyzstan). • Building capacity of local pasture management specialists and technical consultants (Kyrgyzstan). • Technical backstopping to the piloting the forest sector reform (Kyrgyzstan). • Piloting the integrated forest ecosystems management (Kyrgyzstan). • Technical support to the reform of the forest planning, management and monitoring system (Tajikistan). • Advice the integration of regional program experiences and approaches into investment programs (regional).	GIZ Central Asia	445.000 / 445.000	Sole contractor
12/2017 - 10/2018	**Establishment of an Integrated Climate Change MRV System** The NDC Partnership Support Facility of the World Bank is supporting the Government of the Kyrgyz Republic in developing its national climate change Monitoring, Reporting, and Verification (MRV) system for the upcoming Nationally Determined Contribution. In this context, UNIQUE provided guidance and capacity for helping the country	The World Bank Kyrgyzstan	147.000 / 147.000	Sole contractor

	to identify and report on trends in greenhouse gas emission levels, adaptation and the impact and costs of climate measures. This included support for international and domestic climate finance flows. International and domestic policy needs were considered as well as development strategies and plans. Particular attention was given to the national reporting obligations under the climate convention, including national communications and bi-annual update reports. UNIQUE conducted the following tasks: • Review existing MRV systems in the land use sector. • Identify priorities, policies and measures to be tracked by ex-ante estimates and ex-post measures. • Design guidelines and procedures for MRV. • Build on the job capacity to apply guidelines and maintain MRV system.			

CAREC

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
07/2016 - 10/2017	**"Sustainable Management of Mountainous Forest and Land Resources under the Climate Change conditions", Implementation of payments (incentives) of ecosystem services in the pilot area** The introduction of Payment for Ecosystem Services (PES) in the countries of Central Asia is a priority for CAREC. Joint conservation and sustainable use of resources with involvement of the local community is at the head of ongoing reforms in the forestry sector in Kyrgyzstan (2015-2018). As part of ongoing reforms, new mechanisms are being developed or existing mechanisms for cooperation between the local community and leskhozes are being improved. The implementation of the project component of the project was carried out in three phases, the first phase was aimed at identifying the feasibility of implementing the PES pilot leshozes, the second phase of the economic assessment and mapping of ecosystem services, and the third phase was aimed at the introduction of PES in Tyupskiy leskhoz. **Main results:**	FAO Kyrgyzstan	47,019 / 47,019	Sole contractor

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
	• Estimated available natural resources: forests, pastures, water and their use • Works on the economic valuation of ecosystem services • Mapping of natural ecosystems and ecosystem services on an area of 77,200 hectares • Practical recommendations for the improvement of ecosystem services • Implemented PES in the selected site: leshoz and local community			
01\2016 - 09\2020	**Smart Waters Project** Within the Smart Waters Project (hereinafter, also Smart Waters), CAREC aims to build a system to address the knowledge dis-lock in the region, build working relations among water managers and specialists in Central Asia (CA) and Afghanistan, and demonstrate the potential of the basin management approach and cooperation with the academia. **Expected main results:** • Capacity building and academic exchange; • Enhanced water sector cadre potential in Central Asia and Afghanistan; • Trained the new generation of professionals capable for applying Integrated Water Resource Management (IWRM) principles in their everyday work; • Networking & Cooperation • Increased of linkages and dialogue among organizations in the water sector, water professionals and academic communities in Central Asia and Afghanistan; • Focused on a wider acceptance and use of key IWRM principles on all levels of water management in Central Asia and Afghanistan; • Introduced long-term planning in Central Asia and Afghanistan at the river basin level.	USAID\ CAREC	9 500 000 USD	Implementing Company
01/2015 -	**Support towards local initiatives on environmental governance and water re-**	Ministry of the	NOK 7 598 465	Implementing

Duration	Assignment name/& brief description of main deliverables/outputs	Client Name & Assignment Country	Contract value (US$)/ Amount paid to firm	Role
11/2017	**sources management in Central Asia** The project improved human capacities for basin planning, establishment and professionalization of state administrative basin planning processes in the selected river basins and building capacities for the introduction of economic and financial instruments related to river basin planning. CAREC's mission is to assist in Central Asia in addressing environmental issues at local, national and regional level. CAREC provides dialogue platforms for multi-state and -sectoral communication, provides know-how, knowledge and technology, supports the development and application of innovative environmental policies, approaches and practices, promotes the public participation in environmental decision-making and the exchange of information in the region. **Main results:** • Capacity building and dissemination of the knowledge and experience for stakeholders to promote the improvement of environmental governance and enhance regional cooperation in the water sector of CA; • Promoted the concept of water related ecosystem services in Central Asia: assessment of pilot territories land, mapping and economic calculated of the cost of ES; • Strengthening local initiatives in the management of selected transboundary watersheds	Environment of Norway (MoE) \ CAREC		Company

3 FORM TECH-3: COMMENTS AND SUGGESTIONS

3.1 A - On the Terms of Reference

Reassessment of the assumed number of field tracts (~2,500) needed

The tasks of the assignment are in general clearly specified in the ToR. However, based on the information provided we do not understand the calculation of the necessary number of field tracts to achieve the accuracy target in the TOR with the given budget.

The accuracy mainly depends on (1) the inventory methodology and design (2) the variance of the target variable, (3) the error reduction that can be achieved by using auxiliary information and (4) the number of forest and shrubland containing field tracts.

Therefore, we propose in our methodology a stepwise approach to determine the necessary sampling size to achieve the desired accuracy. In the proposal we already provided an initial estimate and based on this estimate we calculated the required field work. In the inception phase we will review the data set from the last national forest inventory (NFI) and any information available to determine the sampling density. Finally, after the first field phase we analyze the achieved accuracy and may need to slightly adjust the sampling intensity to achieve the desired accuracy.

In the ToR it is recommended that the methodology of the last NFI is applied. We have considered this in our methodology to the extent reasonable. However, we suggest slight modifications considering that in the last NFI about 80% of the plots did not contain any forests or shrub vegetation and that there was no stratification to ensure that valuable but less frequent forest types, such as the walnut forests, are well presented. We suggest to stratify the forests with remote sensing and GIS technology and to increase the sampling in relation to the importance of the forest type. This will increase the efficiency of the NFI and the accuracy of the inventory in valuable forest types.

Since the sampling intensity has budget implications, our financial proposal is based on the initial estimate and a transparent description of the costs per field track and field day.

Re-location and re-measurement of clusters

The ToR further provide the following assurance: "*It is assumed that the sample tracts measured under NFI # 1 may be re-located successfully but doing so will not be a critical success factor for the deliverables.*"

Re-location of clusters is always a challenge after approx. 10 years. Nevertheless, we are aware that this may fail in single cases and will consider this accordingly, since re-measurement of plots and trees is fundamental for the assessment of changes as well as growth rates and productivity. We will foresee the utilization of all technical methods that support re-finding the plots and trees.

Proposal of sequence of tasks and outcomes in the time line

The ToR propose a delivery sequence for the outcomes. This sequence was changed to facilitate the start of the fieldwork in 2019 and to enable at the same time the necessary duration for the tasks related to the national land cover classification. To enable this change without compromising the efficiency of the NFI # 2 and future repetitions a technical proposal to apply the necessary stratification within the NFI design was identified and is described in the chapter 0.

3.2 B - On Counterpart Staff and Facilities

TTFI Staff – important partners during the NFI

The consultant team will directly work with the **Technical Team for Forest Inventory (TTFI)**, which will coordinate, manage, and supervise the planning and implementation of the NFI update. It will work closely with the consultants' team including participation in discussions of updated NFI methodology. In mutual understanding with the ToR, we see the TTFI team as the nucleus of a future "Inventory and Monitoring Unit" under the "State Institution Kyrgyz Forest Hunting Inventory and Planning (SIKFHIP)". It shall "ensure continuity in transfer of knowledge and lead to long term sustainability". With this in mind, the focus of the capacity building process is on the TTFI team.

Moreover, the TTFI team is acting as the field supervisory staff. For this activity, UNIQUE-CAREC will cover the expenses related to the NFI project, including travel expenses, although not their salaries.

Temporary field worker

The consultant is fully relying of the envisaged temporary field workers and their experience from their engagement in sample surveys for forest management planning. SAEPF will provide the contacts and names.

We assume that the group of temporary workers includes ca. 20-30 drivers, which are seen as part of the field team of temporary field workers.

Support for the fieldwork

As for the NFI # 1, we need the logistical support and local knowledge of the leskhoz staff. They shall be involved in the surveying of socio- economic variables. As in NFI # 1, we propose that a local forester is guiding the field teams.

Horses may be an advantage in certain types of terrain for the transportation of the field teams. In this case, we are counting on the support from the leskhoz to provide horses for the field teams as partner contribution.

Support of national agencies

For the preparation of the NFI, a comprehensive compilation and analysis of relevant background information, existing forest and research data and map data is necessary.

Here the consultant needs direct support from SAEPF via TTFI and the provision of contacts to other state agencies, which can provide relevant data. Among others the support for the following is asked for:

- Provision of the NFI # 1 data analysis (FAO Excel tool)
- Forest statistics, forest related GIS data sets
- Topographic map layer, DTM, available aerial image from the responsible survey agency
- Access to a GNNS correction service, if existing

Facilities

SAEPF will provide offices for the NFI team, training spaces and conference and meeting rooms. Ideally, the consultant team should have an office space at the SAEPF in order to guarantee a daily communication about the project and thus a permanent technical knowledge transfer.

4 FORM TECH-4: DESCRIPTION OF APPROACH, METHODOLOGY, AND WORK PLAN IN RESPONDING TO THE TERMS OF REFERENCE

4.1 A - Technical Approach and Methodology

4.1.1 Background

Forests and forest cover

Kyrgyzstan is approximately 19.9 million ha, of this, 5.6% is comprised of forests and shrubs (1.12 million ha) and out of this percentage an estimated 677,000 ha are actually covered by forests. Approximately 90% of the forests in the Kyrgyz Republic are located at an altitude between 700 and 3,500 meters above sea level. Despite occupying a relatively small area, the forests are very diverse in species composition.

They can be divided into four main groups: spruce forests, walnut-fruit forests, juniper forests and floodplain forests.

However, The NFI 2010 refined this into six forest types: 1) spruce forests 2) walnut-fruit forests 3) juniper forests 4) pistachio forests, 5) shrubs and 6) broadleaves. This definition will guide our approach on the NFI. Additionally, there are trees outside the forests or SFF, which consist mainly of planted poplar trees and fruit trees. These trees play an important role for communities, but are effectively under an open access regime. There are 277,000 ha of forests outside the SFF on municipal lands, mostly riparian forests and poplar plantations, which have a significant environmental role, but are under pressure from communities sourcing timber and fuelwood.

As a result of over harvesting, by 1966 the forest cover (619,800 ha) of the Kyrgyz Republic was reduced to roughly half the area it covered in the 1930s (1,194,000 ha). In response, the state's policy and the underpinning legislation under the Soviet Union shifted from intensive harvesting towards forest protection. This policy resulted in the forest area rebounding to its 1930s levels and it now extends to an area of just over 1.1 million hectares. The challenge has now shifted to managing these forests in a productive and sustainable manner to allow the population of the Kyrgyz Republic to benefit from this resource. Although forests cover less than 6% of the area of the Kyrgyz Republic, they play a vital economic, social and environmental role and are especially important for the livelihoods of rural communities.

The national survey results of SAEPF and FAO (2010) show that approximately 12.5% of forest in Kyrgyzstan suffer from land degradation. Forest resources are under high pressure due to use as fuel wood, timber and grazing areas. In addition, Kyrgyzstan is predicted to be one of the most severely affected and most vulnerable countries to the impact of climate change due to the accelerated rate of glacier melt.

Socio Economic Importance

Approximately 2.4 million people (or 41% of the total population) live in or near forests and rely on forests not only for timber and fuel wood, but also for pasture and fodder as well as non-timber forest products such as nuts, fruit, berries, mushrooms, and medicinal plants. More than one third of houses in the Kyrgyz Republic rely only on coal and fuelwood for heating and cooking, with many more households relying on wood fuel in combination with other sources of energy. With the rising cost of electricity and gas, as well as supply shortages, many public institutions such as schools and hospitals have been switching to coal/wood-based stoves.

Economic opportunities in remote mountainous areas are concentrated on livestock herding, and subsistence farming. Livestock numbers are increasing, resulting in higher rates of pastureland degradation, which in turn has heightened demand for additional land for grazing and fodder production. This increasing demand is putting further pressure on the already limited forest cover and is leading to subsequent degradation. The main cause of degradation is the combination of grazing inside forests and unregulated removal of firewood and timber.

Environmental Importance

Despite only covering a small area of Kyrgyzstan, forests are of major importance for the environment. They have an important role in prevention of avalanches and mudslides, and for retaining and capturing water and floods. They regulate water flows, prevent soil erosion on steep slopes and capture carbon. In addition, they serve as important habitat for wildlife and rare plant species.

Governance

Forests in Kyrgyzstan are mostly state owned (State Forest Fund Land – SFF) and managed by the State Agency for Environmental Protection and Forestry (SAEPF). Leskhozes (Forest Enterprises), the local State forest management entities, are responsible for managing the State Forest Fund (SFF). The SFF is the land officially designated as forest and includes land allocated for afforestation. Only 26 percent of the SFF is covered by forest, the largest portion (34 percent) is grassland and the remaining land is comprised of hayfields, arable lands, gardens and orchards, settlements, and other type of lands. The current institutional framework for forest management in the Kyrgyz Republic is a vertical hierarchy within the Department of Forest Ecosystems Development, (subordinated to State Agency for Environmental Protection and Forests - SAEPF), tasked with overseeing territorial divisions and ground level State Forest Enterprises, or leskhozes. Government forest policy and management traditionally focused on preserving and increasing the amount of forest cover rather than on the relationship between forests and the surrounding ecosystem and community, including the pressures of the community to utilize forests as a productive asset. However, sector reforms were initiated with strong donor support in the late 1990s. Beginning in 1999, a number of policies and specific legislation were drafted to develop and regulate the forestry sector in the Kyrgyz Republic. This included the Presidential Decree, “Concept of Development of the Forestry Sector”, which had stated objectives of promoting the sustainable development of the forest sector through improved management of the leskhozes, engagement of the population in forest use, and partnership with the private sector. In 2005, the National Forest Program to Support the Imple-

mentation of the Concept of the Development of the Forest Sector (2005-2015) was developed, along with the National Action Plan for the Development of the Forest Sector (2006-2010), and the Forest Code was updated in 2007. Policy implementation, however, was weak due to a low level of commitment from the central government as well as a lack of incentives from all levels of the forest administration structure.

More recently (2015), a **piloting forest sector reform** was initiated by SAEPF in six leskhozes. It intends to support alternative forest management arrangements inclusive of communities and their development priorities, as well as, decentralization and delegation of commercial activities to the private sector. Currently, SAEPF is seeking an extension of the piloting phase, but the extension has not yet been approved by the national Government (September 2018). It is not clear to which extent the SAEPF sees the forest sector reform as their priority.

The piloting is supported by WB, GIZ, FAO, NGOs, JICA and others. A **Steering Committee** comprised of government, development partners, and civil society representatives is guiding the pilot reform efforts. IFEMP World Bank Project has given important impulses to the reform process and has selected 12 leskhozes to form part of the overall piloting. World Bank is also an active member of the steering committee.

Commercial felling in walnut and juniper forests is prohibited under the current legislation, with only very low volumes of wood derived from maintenance/sanitary cutting. During the Soviet era, the Kyrgyz Republic imported around twenty times the current official level of timber production. Timber continues to be imported from Russia, but at much lower levels. Estimates of the volume of legal imports and production, combined with estimates of illegally smuggled timber are four or five times less than the estimated annual minimum demand. Commercial felling is allowed in spruce forests and is strictly regulated. The gap in timber demand is partly filled by poplars harvested on private lands.

Forest inventory is performed by the State Institution “Kyrgyz Forest and Hunting Inventory and Planning” (Государственное учреждение “Кыргызлесоохотустройство”) under the authority of the SAEPF. Its missions are to:

- Monitor and assess forest resources;
- Perform a regular inventory of forest resources and plan measures aiming at their sustainable management;
- Provide documentation related to forestry operations, State Forest Fund use and forest protection based on the results of the forest inventory.

However, this work will be done with no involvement of forest users and little participation of leskhoz staff, resulting in a low ownership of foresters over the management plans developed.

Recent reforms have reorganized the previous Forest Inventory Department into the current State-owned enterprise with the objective to turn it into an organization contracted by leskhozes to perform inventory work and provide them with relevant management plans, technical documentations and maps. It is yet not clear whether this reform led to positive results.

National and international Commitments related to forestry

NFI results will be important for international environmental agreements, such as the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention on Biological Diversity (UNCBD), the United Nations Convention to Combat Desertification (UNCCD) and others.

NDC of Kyrgyzstan states that “Kyrgyz Republic will reduce GHG emissions in the range of 11.49 -13.75% below BAU in 2030. Additionally, under the international support Kyrgyz Republic could implement the mitigation measures to achieve total reduction in the range of 29.00 - 30.89% below BAU in 2030”.

Other commitments stated in the **CBD** include annually planting an area of about 3,000 hectares, establishing new specially protected natural areas and the expansion of existing ones up to 12% of the country's territory.

The new Government program “**Unity Trust and Creation**” 2018-2022, seeks for **green economy** at all stages of planning, decision-making, execution and monitoring. It is necessary to take into account the principles of "green" growth for the revision of the structure of the economy and the transition to development with minimal impact on the natural environment.

The **national afforestation** program foresees reforestation of 1,100 hectares annually.

During the round table of Ministers responsible for the restoration of forest landscapes and the **Bonn Challenge** in the Caucasus and Central Asia in June 2018 in Astana, Kazakhstan, Kyrgyzstan committed the **restoration of 23,200 hectares of forest** and 300,000 hectares of degraded pastureland in the next 10 years.

Other projects have also worked in the forest context. Forest inventory has a history in the country:

- The first forest inventory in Kyrgyzstan was done in 1892-93 in the forests of Jalal-Abad and Naryn regions. The data collected was used for the initial separation of the forest into equal areas for protection purposes.
- 14 forest surveying guidelines were developed during the period of the Soviet Union (up to 1995), and 2 in the post-Soviet period (1995-2008).
- Since 1995 forest surveying is performed by the state forest surveying service of Kyrgyzstan using random taxonomic method. As of today, one cycle has been completed.
- Since 2008 the forest surveys also include new surveying methods – the national forest inventory.
- An EU project, JUMP, conducted an inventory in Batken region. The results of the survey demonstrated that the total area of juniper forest constitutes 422,482 hectares.
- The KIRFOR program (Kyrgyz-Swiss Forestry Support Program), which has been running since 1995, produced a forest map. The project also worked on management plans, forest inventory, joint forest management concepts, formal forest education and other forest related topics.
- FAO is supporting the SAEPF in forest management and reforestation in Naryn and Issyk Kul

Limitations and weaknesses

As stated, an NFI was carried out in 2010 with the support by FAO. **Inventories at the leskhoz level are carried out every 10 years and form the basis for 10 years' forest management planning**. This is done with the inventory department within SAEPF **without participation of the local communities and with little participation of leskhoz staff**. This results in the designation of unsuitable reforestation areas and the top-down planning is not accepted or respected by communities, which eventually leads to a high failure of reforestation.

Other limitations observed in a review conducted by GIZ detected that the NFI inventory data are not used by the inventory department. There is no knowledge on how to store, manipulate, use and apply data. Staff did not have knowledge on where the data is stored, how it can be used and how data can be analyzed. The information elaborated is a data graveyard stored in a computer that does not even have a backup.

Another limitation is that there is no communication between the departments within SAEPF. The inventory department is not willing or able to share data within the institution or outside the institution**. This results in a situation where data from NFI and other sources are not used for planning or monitoring, neither at the local, nor on national level.**

In this context, the IFEMP objective to "*strengthen the capacity of government institutions and communities to improve sustainable forest ecosystem management through investments in management planning, ecosystem restoration, and infrastructure"* is a strategy which tries to overcome the described limitations.

The project therefore comprises four pillars or components:

I - Forest Sector Institutional Reform (USD 0.89 million) with priority activities on capacity building for institutional reform of the policy, legal and regulatory framework for forest sector reform, public/private partnerships, establishment of coordination platforms and community mobilization.

II - Strategic Investments and Piloting of Sustainable Management Approaches with priority activities on leskhoz Integrated Natural Resource Management Plans for selected pilot leskhozes. Experiences in pilot areas supported by GIZ and FAO will help to come up with an agreed strategy.

III - Information and Monitoring and Evaluation. Priority activities include support for technical assistance and capacity building for the establishment, operation and maintenance of the Forest Management Information System (FMIS), which will feed into the Forest Management Planning process within the Forestry Departments.

IV - Project Management, Monitoring and Evaluation.

Conducting the **National Forest Inventory (NFI)** and integration of the NFI results into the Forest Management Information System (FMIS) is part of Component III. The NFI will serve as a baseline to establish the current forest status and for future forest monitoring, as well as for the development of strategic planning and monitoring.

Based on the above, one of the main challenges will be to enable SAEPF not only to carry out the inventory and to analyze the data, but to use the data in a holistic planning, implementation and monitoring cycle. This means that data from the NFI will be used from the national strategic level down to district and leskhoz level – where it will complement the forest invento-

ry conducted in the course of the 10-year management plans. At the same time, data from local level, including the FMP inventory data, is also supposed to feed into the national FMIS.

Therefore, capacity building will form an essential part in our project implementation strategy in order to make sure that the knowledge is embedded in the institution at national and local level. Horizontal data exchange as well as vertical data exchange is essential for knowledge management and integrated planning in the sector since forest, livestock, agriculture and water are closely interrelated.

4.1.2 Project objective and overall approach

4.1.2.1 Steering Structure

Our implementation strategy is focusing on capacity building of SAEPF staff at national and leskhoz level. This is in line with the IFEMP objective (*strengthen the capacity of government institutions)* and will feed into the intended forest sector reform or forest sector institutional reform as anticipated in component I of the project. In order to support changes in an institution, **capacity development** for persons, organizations and institutions is the core strategic tool for change management and sustainability.

The steering structure of our implementation will therefore focus on capacity building with the active participation of staff within the institution to make sure that a **high degree of ownership** of the whole process is guaranteed and that **learning and innovation** will be embedded in the institution. This will make sure that the NFI as an element of learning and innovation is not a onetime exercise carried out by consultants and handed over to the institution. We will make sure in our steering structure that **active participation and active learning** will be a cross cutting element during implementation.

Approach

To make sure that the above mentioned will happen we will involve key partners in decision making and learning spaces. Key partners have been defined within the terms of reference and include the i) TTFI, ii) staff from SIKFHIP, iii) staff from SAEPF and iv) the Working Group on management processes for the development of FMI and NFI. Leskhoz staff will also be involved with learning and innovation processes but to a lesser extent in decision making and steering. The structure is explained in Table 1.

Our approach in this sense is looking at the creation of space for:

➔ Learning space

➔ Room for feedback

➔ Momentum for joint decision making, and

➔ Transparent information management and sharing.

Some elements have been described in the terms of reference. For example, formal training courses, workshops, seminars, communication strategy, newsletter and information materials. Those elements can be found in the overall work plan in chapter 4.2.

In order to strengthen the steering structure, we suggest some additional elements, which will enhance transparent information sharing and clarity on roles and responsibilities. The following table indicates the suggested activities with expected results.

Quality control and information flow

Our quality management focuses on results based management, the timely completion of services and deliverables as well as the proper allocation of resources. Regular monitoring and reporting will be done through our backstopping team to assure the **desired quality in the products.** As part of our quality control we will provide:

- Draft documents for detailed technical inputs
- Draft final documents for validation
- Revised project documents, incorporating the consolidated feedback of the client.

An important element of our implementation strategy will be to maintain an **effective flow of information**. This includes providing high-quality informative materials for dissemination within the communication strategy.

The following table indicates the main elements of our steering structure:

Table 1: Steering, learning and reflection activities

Main activity	Expected results
Skype call before the first mission	▪ Agree on schedule ▪ Clarity about partners and key actors ▪ Assure availability of counterpart staff and partners ▪ Clarify roles
Kick off meeting	▪ Clear understanding of roles and tasks of all members ▪ Clarify tasks ▪ Common understanding of expected results ▪ Common understanding of roles of WG, TTFI, PIU, consultant team and SAEPF) ▪ Define and Establish joint steering team (PIU – UNIQUE – SAEPF) ▪ Agreement on tentative work plan ▪ Kick off report as a basis for a common understanding
Regular meeting with steering team (i.e. monthly)	▪ Update and exchange on progress, difficulties, challenges and barriers ▪ Monitor process ▪ Reflect on indicators and milestones ▪ Decisions to guide the process ▪ Signed minutes of meeting ▪ Adjustments and corrections if necessary
Inception meeting	▪ Agreement on defined methodology, variance, forest types, classification and expected deliverables and results. ▪ Signed inception report (roughly 3 months after start)
Monitoring meetings	▪ Elaborate indicators, milestone and monitoring matrix for steering ▪ Monitoring Matrix with indicators ▪ Reflect on achieved results in a small group ▪ Revise indicators and milestones ▪ Steer according to achieved results ▪ Updated monitoring matrix

Main activity	Expected results
Communication	▪ Communication strategy ▪ Sharing of knowledge and experiences
Workshops	▪ Exchange and learning platform ▪ Workshops as stipulated in the terms of reference and reflected in the work plan ▪ Room for discussion and reflection with partners ▪ Presentation of intermediate results ▪ Feedback to consultants
Training	▪ Trained staff according to terms of reference ▪ Learning and innovation ▪ Knowledge in institution and persons
Seminars	▪ Presentation of results to public ▪ Communication ▪ Feedback to consultants ▪ Enhanced transparency in the process
Newsletter	▪ Quarterly newsletter to inform public on process ▪ Information sharing
Web site	▪ Enhanced transparency ▪ Options for feedback
Information materials	▪ Sharing of knowledge and experiences ▪ Documentation of progress ▪ Learning tool
Reports	▪ Documentation of preliminary and final results

These activities will be an integrated part of the steering structure of our team and shared with the key actors and partners.

The Figure 2 below illustrates the steering structure of the project. The consultant team will directly work with the **TTFI**, which will coordinate, manage, and supervise the planning and implementation of the NFI update. TTFI will work closely with the consultants' team including participation in discussions of an updated NFI methodology, sampling design, field data collection work, quality control, data analysis etc. TTFI itself will report to the **Working Group on management processes for the development of NFI and FMIS**, which in turn provides support and guidance during the preparation and implementation of FMIS and NFI. The Working Group will provide recommendations on decision making to the **World Bank** and the **Heads of SAEPF**.

Ideally, the consultant team should have an office space at the SAEPF in order to guarantee a daily communication about the project and thus a permanent technical knowledge transfer.

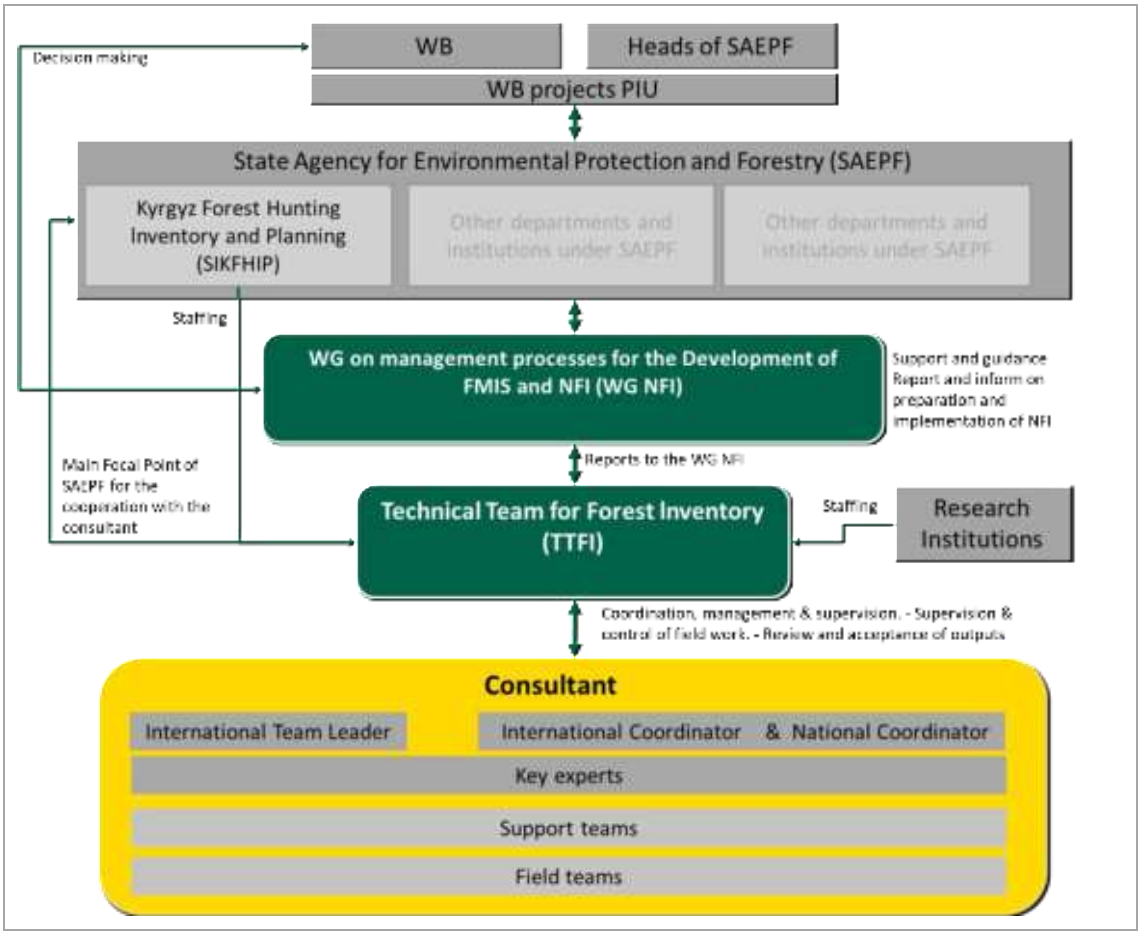


Figure 2: Steering structure of the project

4.1.2.2 Approach to establish the NFI # 2

In order to comply with national and international standards as well as requirements by the client, our consortium will follow several principals, assumptions, considerations and a defined approach.

Technical principles

Technically the NFI # 2 of the Kyrgyz Republic will be comprised of:

- a sample based forest inventory and its analysis will provide statistical results on a national level and analysis subunits that are defined by administrative regions, forest types, forest owner ship and combinations of these; and
- a national land cover map that can be utilized within FIMS by a wide range of users; it will also be used in the context of the sample based forest inventory and its analysis.

Considerations

When developing the methodology of NFI # 2 of the Kyrgyz Republic UNIQUE /CAREC will have in mind the following considerations:

- frame conditions and requirements set out in the TOR
- frame conditions set by the project duration and the indicated financial resources
- critical reflections on the ToR in chapter Form TECH 2.3

- principles for planning and establishment of an NFI and a national forest monitoring system as presented in the FAO report "Voluntary Guidelines on National Forest Monitoring (FAO 2017).
- developing and finalizing the methodology and its implementation in close collaboration with SAEPF, SIKFHIP and particularly the TTFI
- consolidated information needs for NFI # 2
- retain the NFI # I field methodology where reasonable based on a critical reflection of the NFI # I field methodology and the consolidated information needs for NFI # 2
- major precision expectations of the NFI # 2 as specified in the ToR
- proven state of the art technology and methodology
- natural, socioeconomic and specifically the forest sector frame conditions in Kyrgyzstan.

On this basis UNIQUE /CAREC have developed and proposed a technical proposal for the design and characteristics of the NFI including the national land cover map. The major considerations made in this development process are presented below prior to the presentation of the technical proposal.

Our proposal is based on the actual knowledge available on the objectives and scope of the NFI # 2 at the proposal stage and the available data on the previous NFI # 1. The NFI concept needs to be elaborated during the inception phase of the project based on intensive discussions with the client, relevant stakeholders and based on the information needs assessment.

4.1.3 Methodology

4.1.3.1 Introduction

This proposal addresses the implementation of the second National Forest Inventory (NFI) of the Kyrgyz Republic and the objective to prepare and establish the NFI as a permanent process.

Tasks and activities are structured in Work Packages along the six major objectives:

- Objective 01. Review the scope of NFI and adjust the current methodology and sampling design
- Objective 02. Perform a national land cover classification
- Objective 03. Execute the NFI # 2 field survey
- Objective 04. Compile, analyze and report on the survey data
- Objective 05. Build capacity to ensure NFO sustainability
- Objective 06. Communication and Outreach on NFI

The work to be performed and the output to be provided is structured along the six work packages named by their major objective, therein by tasks and activities. The relation of the six Work packages/ Objectives to each other is presented in Figure 3.

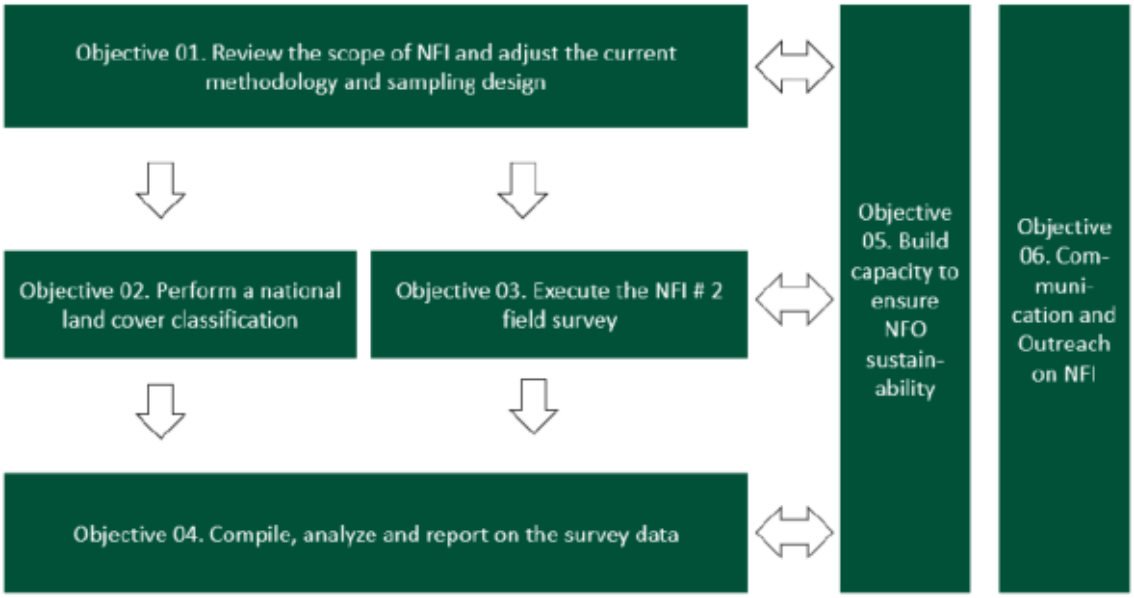


Figure 3: Project structure

Work package "Objective 01. Review the scope of NFI and adjust the current methodology and sampling design" will prepare the ground for all other work packages/objectives tasks. The overall methodology will be the basis for the national land cover classification (NLCC) within Objective 02 and the field survey within Objective 03.

Objective 02 comprises setting up a GIS both for the NCLL and preparatory work necessary ahead of the field survey (Objective 03). Both results will feed into Objective 04, where NLCC and all other field data compiled under Objective 3 will be analyzed.

Objective 05 and Objective 06 are crosscutting issues running in parallel. They are focusing on capacity building and communication. For sustainability aspects these two objectives are essential, since they address the **utilization of the results** within the core target group (SAEPF).

To ensure timely provision of the results within the overall project time frame all tasks are envisaged to start right after project start (see Figure 4). The project schedule is further driven by the fact that this proposal plans two field work periods, one summer in 2019 and one in 2020.

The project is expected to start roughly in January 2019. Thus, all tasks that need to be accomplished ahead of the start of the first field work period in 2019 have to be addressed with a very tight schedule, as can be observed in Figure 4.

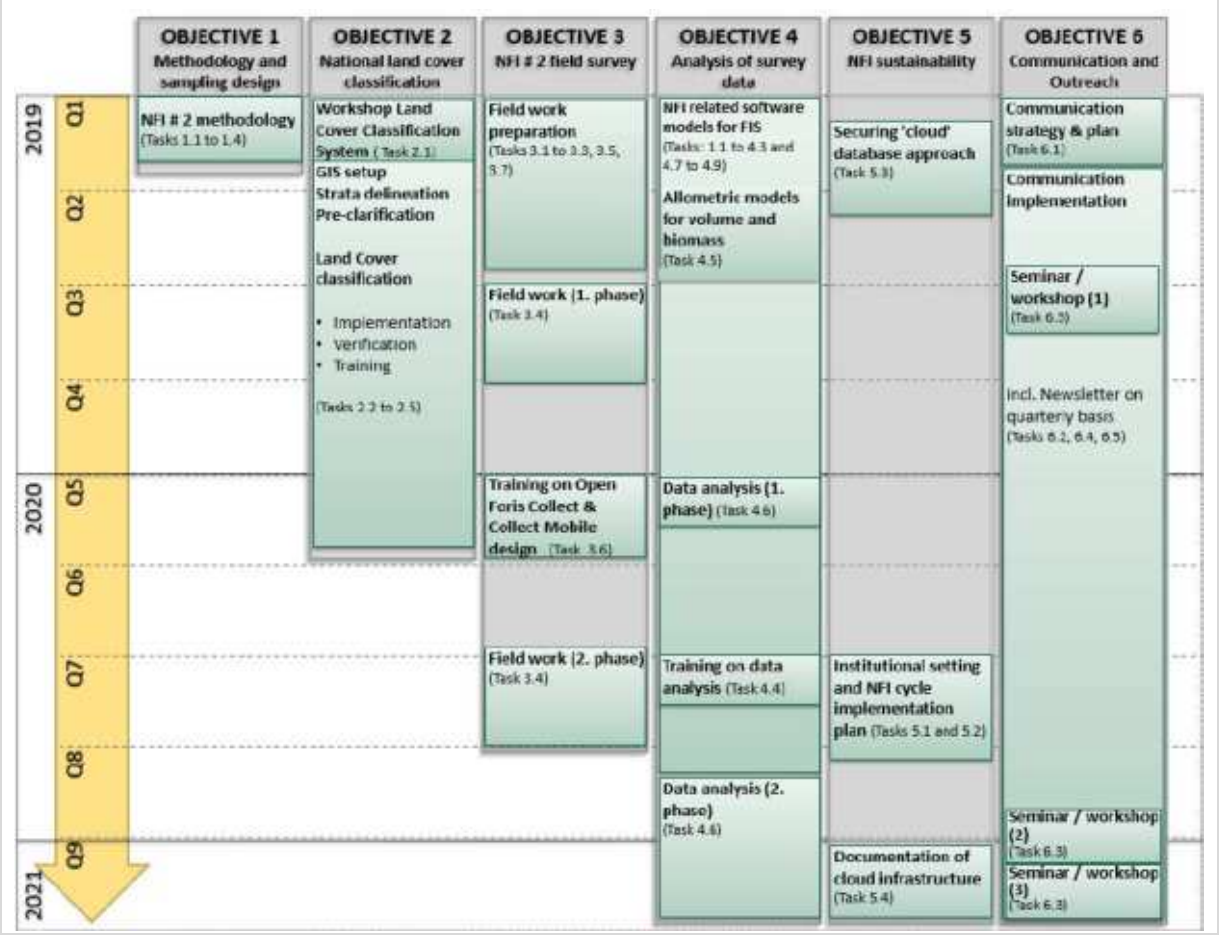


Figure 4: Overall structure of tasks and activities to achieve the overall and the 6 main Objectives

Figure 4 presents for each objective along the vertical time axes major tasks and groups of tasks and thus provides an overview of the work plan. Within all objectives tasks begin already in the inception phase. The tasks of Objective 3 have a strong impact on the project schedule as field work needs to be conducted during the vegetation season. This has a strong impact on the schedule of Objective 2 and Objective 4 since tasks from these Objectives are necessary to implement the field work or depend on the field data collection conducted during the vegetation season.

4.1.3.2 Objective 01. Review the scope of NFI and adjust the current methodology and sampling design

The objective of the NFI is to provide solid and comprehensive information on all forests/shrub lands and with less intensity on other land cover classes that occur in Kyrgyzstan. Mapping and field data collection is associated with substantial efforts. Thus (1) clarity is necessary on the information that needs to be collected and (2) a cost-efficient methodology has to be applied that focuses on that information that is actually needed. To be efficient, this methodology needs to capitalize from all information that has already been collected in and for the forest sector, especially information from FMP, the forest type map 2009 prepared by the

Swiss/Kyrgyz project and the NFI # 1. To be efficient this inventory needs further, more than the NFI # 1 did, to consider the specific spatial distribution of the forests and shrub lands and the relevance of the 6 most important forest/shrub land types. With the methodology of this NFI # 2, continuity needs to be ensured with NFI # 1 in order to enable a solid analysis of changes between NFI # 1 and NFI # 2. In view of future repetitions, the methodology needs as well to ensure that the analysis of future NFI repetitions will provide solid information on changes versus the previous NFI inventory cycle. The most relevant information gains from re-measurements are sound data on growth rates and productivity, survival and dying process, utilization and regeneration.

Assessment and consolidation of information needs

For the NFI # 1 information needs have been assessed considering national policy and international reporting obligations. On this basis the FAO standard inventory design was used that was then customized to the methodology of the NFI # 1.

During the inception phase of this NFI # 2, a thorough information needs assessment will be conducted. The consolidated information needs will then be utilized to identify - from the perspective of the information needs – necessary changes and adoptions of the NFI # 1 methodology towards the NFI # 2 methodology. Since for the NFI # 2 a mapping component the NLCC is foreseen, in addition to the sample based inventory, the information needs assessment will take this into consideration by a differentiation into information needs on statistical information at various spatial levels and information needs on mapped information.

This information needs assessment will focus on analysis of the forest policy and the information needs from major forest sector actors and will include the Forest Code, the National Forest Program, the National Action Plan for the Development of the Forest Sector. Since information on forests are essential for many policy fields, such as agricultural policy, rural development policy, energy policy, nature conservation and biodiversity policy, environmental policy, climate policy and industry policy the information requirements from these sectors will be considered in the analysis as well.

It will be considered that the information from the NFI is needed to define the national forest policy, is essential for the further development of the forest legislation and national forest programs, to intensify inter-sectoral cooperation and to facilitate international reporting, to the FAO forest resource assessment (FAO 2018a, FAO 2018b), the UN Framework Convention on Climate Change (UNFCCC) (IPCC 2003, IPCC 2008, 2006) and others such as the UN Convention on Bio-Diversity (CBD).

Starting with the Kick-Off meeting the information needs will be elaborated based on intensive stakeholder consultations and in close collaboration with the TTFI and will be presented at the "National validation workshop on the outcome of information needs assessment" for discussion, further elaboration.

At this stage – considering our actual knowledge on the country and from our interpretation of the TOR there will be, compared to NFI # 1 a stronger focus on

- the assessment of the major land cover classes as mapped information, including the assessment of forests and shrub land with high mapping accuracy

- the provision of highly accurate information on all six major forest/shrub land types.

This was not addressed by NFI # 1 as the creation of a forest map was not part of the NFI # 1. Secondly, the NFI # 1 applied a systematic tract design with a moderate number of tracts. Both together has resulted in a low number of tracts that covered forests and these six major forest types. Pistachio forests and walnut forests occurred merely by one/respectively two tracts, the remaining four types occurred merely by less than 20 tracts. In total forest/shrub lands where assessed on 113 tracts. With this number of tracts, the NFI # 1 merely could provide information with sufficient statistical error on the total forest/shrub land as a whole. This is also visible from the report on the NFI # 1 that provides information on the statistical accuracy on the forest/shrub land area but not for the other information presented.

These considerations highlight how important the information needs assessment is for NFI#2 and that in anticipation of the intensive use of the outcomes of the NFI #2 and of future repetitions the information needs assessment needs to be done with the strong involvement and engagement of all stakeholders.

Further the information needs need to be provided with the necessary clarity that facilitates a translation into the NFI methodology: The information needs should be expressed specific, well defined and understandable; they need both to address the information content as well as the spatial dimension; the information needs to include precision requirements; and the information needs should consider both the assessment of the status and the assessment of changes from NFI cycle to NFI cycle, final the information needs and the consolidated information needs need to be realistic in terms of the possibility to achieve them within an NFI and the available resources.

NFI # 2 methodological overview

The NFI # 2 methodology will cover two major parts that are closely linked:

- The national land cover classification NLCC - a new element vs. NFI # 1
- The sample based part of NFI, the “NFI field inventory (NFI-FI)” – the methodology to be provided in continuity with NFI # 1

The scope of both, the NLCC and NFI-FI and the corresponding methodology will both be developed on the basis of the consolidated information needs.

With this proposal we present based on the preliminary understanding of the information needs a draft proposal of the core elements of the methodology, whereas the necessary detailed elaboration will take into account the consolidated information needs established during the inception phase.

Technically there are several options to link a NLCC and NFI-FI:

1. The NLCC can be utilized to establish a stratification that is used at the design stage of the NFI-FI, e.g. to apply different sampling intensities in different strata, a vital requirement for the achievement of the envisaged statistical accuracy for the major forest types (expressed as confidence intervals). This **requires** that the stratification derived from the NLCC and thus the NLCC is finalized **ahead of the NFI-FI field work**.

2. The NLCC can be utilized at the estimation stage of the NFI-FI and can also at that stage contribute to a substantial reduction of the sampling error. This option does **not require** that the NLCC is **finished ahead of the NFI-FI field work**
3. The NFI-FI can be utilized for a rigorous verification of the forest/shrub land layer of the NLCC, this will reduce the need for dedicated fieldwork for that important technical step of the NLCC production.

A strong restriction on the choice of these options results from start time of the project, ca. at 1st of January 2019 and the fixed project end at June 2021. To implement the large volume of field work two field work seasons are regarded necessary. Since it is foreseen to have such two field work phases, a first one in 2019 and a second on in 2020, the time to accomplish the NLCC ahead of the field work in 2019 is short and regarded as not sufficient to establish the envisaged high quality and accuracy of the NLCC.

There is an equivalent alternative to establish the necessary stratification (this alternative option will be presented below). When using the NCLL for post-stratification at the estimation stage of the NFI-FI its contribution potential for the reduction of the sampling error vs. a purely terrestrial inventory (such as the NFI # 1) can still fully be utilized, no disadvantage results from using this alternative.

Thus the utilization of this alternative stratification (described further below) is planned, further

- the NLCC will be utilized at the estimation stage of the NFI-FI (details on that see below the section on the choice of the estimator)
- the NFI-FI can be utilized for a rigorous verification of the forest/shrub land layer of the NLCC (details on that see Objective 02 (chapter 4.1.3.3))

Our selection principles for the NLCC method are

- Methodological soundness
- Overall efficiency
    - Use of free RS data
    - Efficient approach to establish reference data
    - Efficient processing and mapping methodology
- Statistical sound verification

The methodology for the NLCC is further presented in the section on Objective 02 (chapter 4.1.3.3).

Our principles for selection of the NFI Field inventory design are

- Methodological and statistical soundness
    - This is fundamental to enable the establishment of confidence intervals for the statistical estimates
- Overall efficiency
    - Achieving a certain result with minimum efforts or with fixed efforts the best results
    - It is specifically important to apply all measures to make field work effective
- Remote sensing integration

- The integration of the use remote sensing can facilitate effective design and can help to reduce field work

In technical terms the questions to be addressed are:

- The statistical design (statistical scheme to select the samples)
- Plot design (size and shape of the plots)
- Attribute selection, definition and assessment method
- Choice of estimators (design based, model assisted)

All these four basic aspects have been addressed by the NFI # 1 already. For the further development of the NFI-FI methodology therefore all these aspects will be critically reflected and analyzed for necessary improvements and modifications.

In general, the re-measurement of NFI # 1 tracts and plots is the best approach to assess changes such as changes in forest area, changes in growing stock, harvesting, mortality and increment and all other information.

A brief analysis of the NFI # 1 database showed that out of the NFI # 1 tracts, merely on ca. 113 forest/shrub land occurred and was assessed. The NFI # 2 will re-measure these tracts, but as the number of tracts in forests/shrub lands need to be substantially increased – the ToR propose a figure of 2500 tracts – almost all tracts will be first time installed, located and measured. That is another good reason and gives space to consider a revision of the methodology for all the tracts that will be established for the first time. The need for a consistent analysis of changes from NFI # 1 to NFI # 2 has to be regarded.

Major aspects of the method review are:

- The need for stratification to address accuracy requirements of all major forest types
- A critical reflection of plot design necessary since an efficient plot design is crucial to facilitate such large number of tracts

Statistical design

It refers (1) to the way how samples are selected and (2) to sample size (=the number of samples). The number of samples have a decisive influence on the costs on the one side and the precision on the other side. As costs are fixed by the overall budget, the work volume is restricted as well.

To achieve an optimal precision, we propose an efficient statistical design using a pre-stratification and post-stratification with a similar number of samples for the six targeted forest/shrub land types. As described below in detail we estimate the total demand to 1,000 – 1,700 tracts.

During the work on the NFI methodology (Task 1-2) and on the anticipated variances (Task 1-4) measures have to be considered for the case that the planned field work volume is assessed as not sufficient to achieve the consolidated precision and a substantially higher number of tracts would be necessary.

In this case we propose a combination of field tracts measurements and airborne data acquisition and mapping via a flight campaign using optical and LIDAR sensors in a two-phase approach.

For the NFI # 1 the statistical scheme to select the sample plots was as systematic grid of tracts, whereas each tract comprised four plots. All tracts and plots have been assessed in the field except for those located in waterbodies and high elevations (>3500m).

Given the fact that the NLCC provides area information on lands other than forest and forest land and that the accuracy requirements expressed in the TOR all address forest/shrub land it is foreseen not to visit tracts and plots that do not cover forest/shrub land (see Table 2).

Table 2 Addressing information on land cover types by NFI # 2

Land cover/use	NFI #1	NFI #2
Forest Shrub land Open wood land	Field inventory	National Land Cover classification NFI Field inventory
Non forest / Non shrub land land use classes	Field inventory	National Land Cover Classification (NLCC)

This first major change vs the NFI # 1 design will facilitate that a huge amount of field work can be avoided by reducing the number of tracts to be re-measured from to ca. 560 NFI # 1 tracts to ca. 113 NFI # 1 design.

It will be ensured by the definition of the land cover classes of NFI #1, NFI #2 and the NLCC that a consistent time series analysis is ensured.

Avoiding field work on tracts and plots located on “Non forest / Non shrub land” land use classes will be secured by a remote sensing and GIS-data based **pre-clarification** (see chapter 4.1.3.3 for the technical implementation). This work-step will ensure that merely clusters and plots are visited in the field that are either clearly forest/shrub land or where the decision is unclear.

Forest and shrub lands in total cover about 5 to 6 % of the area of Kyrgyzstan. The main six forest types/shrub land are not equally distribute but are characterized by concentrations in forest type specific (see Figure 5). Further the six types do not cover areas of equivalent dimension, especially the walnut forests and pistachio forests cover substantially smaller areas compared to the other forest types and shrub land. These two types walnut forests and pistachio forests occurred on only one respectively two of the tracts of NFI # 1 (these numbers are based on an analysis of the NFI # 1 data set provided to bidders).

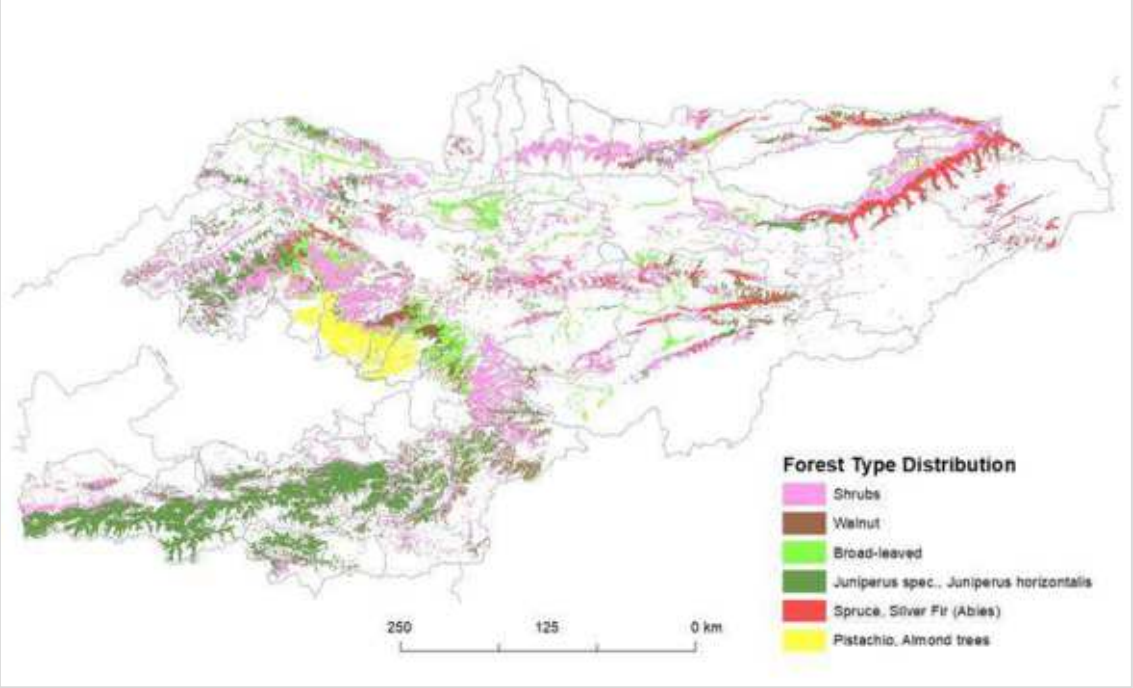


Figure 5: Forest type map as prepared by the Swiss-Kirgizstan project in 2008

In order to achieve the envisaged accuracy requirements for the six forest /shrub land types a **stratified approach** is necessary. Since we assume - at this stage - that the variability of the wood volume of the six types is in a similar dimension, we plan as first assumption to cover all with a similar amount of tracts. This will require different densities of clusters and tracts per stratum.

To implement a stratification, first a **delineation of the strata** is required. As mentioned above the NLCCC cannot be utilized as early as the delineation is needed. Therefore, will use the **forest type map from 2008**. It will be accomplished by additional forest related GIS data and remote sensing data mainly. Figure 6 presents the planned work steps up to the interim result of the NFI strata delineation. This task will be implemented as part of the GIS and remote sensing work of the work package “Objective 02” (Chapter 4.1.3.3).

Technically the 1:250,000 Forest type map from 2008 will first be overlaid with data from forest management plans (FMP) and other pre-existing spatial data, the Sentinel 2 pre-processed time series, free optical VHR images and further GIS data. Based on certain spatial buffering of the forest types polygons (adequate buffer distance identified in the course of the overlay) a first stratification will be prepared. Finally, all data sources mentioned are used to iteratively improve the stratification result.

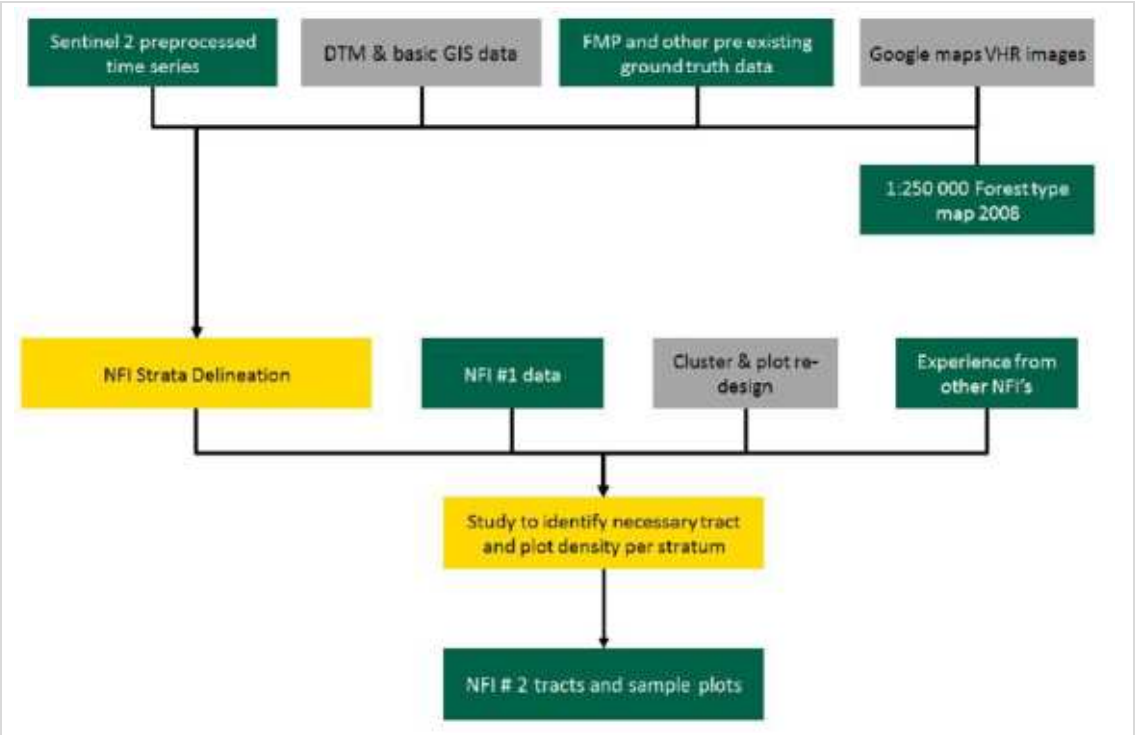


Figure 6: Overall technical concept – Stratified sampling design

Overall seven strata will be identified. One stratum will be the area where no forest occurs. The forest/shrub land strata will, given the fact that some of these types occur in close proximity not be purely contain one forest/shrub land type, but the delineated area will be defined as pure as possible. First priority in strata definition will be given to walnut and pistachio that have a strong regional focus and that have out of the six types the smallest area coverage. The strata will constitute of several single polygons spread over the country as resulting from the spatial distribution of the forest/shrub land types.

The statistical data available from the forest type mapping in 2008 give an indication of the area covered by each stratum (Table 3). This is taken as an indication of the area of the resulting six strata that focus on the six single forest types / shrub land.

Using the **range of variability** observed in other NFIs[1] it is assumed that per specific stratum 300 to 500 tracts are required to achieve the **envisaged precision** per stratum. Using these assumptions, the number of tracts to be visited in the field is in the range of ca. 1720 to ca. 2860 field tracts. Considering the positive effect of post-stratification that is not considered in the observed variability in other NFIs our estimate of the number of field tracts leads to ca. **1,000 to 1,700**. Table 3 is presenting a calculation of the resulting grid density per stratum.

[1] The NFI # 1 report does not provide information on the precision of the wood volume per stratum, within the course of the proposal preparation it was not possible to retrieve the information from the NFI #1 data set, for walnut and pistachio forests it would not even be possible to retrieve it from the NFI # 1 data, since 1 respectively 2 tracts that included these types are not sufficient [see Table 3]).

Table 3: Grid density range per type specific stratum

	Tracts per stratum	Total tracts[1]	Field tracts[2]	6 forest/shrub land types					
				Shrubs	Juniper	Spruce, fir	Other broad-leaved	Walnut	Pista-chio
Area (1,000 ha) (Total: 1,391.1 T ha)				470.9	503.6	149.4	162.6	47.0	57.6
Area % - Forest type map				34%	36%	11%	12%	3%	4%
No of tracts in NFI # 1				19	18	15	19	1	2
Grid width [km]	**500**	3,400	2,860	3,1	3,2	1,7	1,8	1,0	1,1
	400	2,800	2,290	3,4	3,5	1,9	2,0	1,1	1,2
	300	2,200	1,720	4,0	4,1	2,2	2,3	1,3	1,4
Grid width range[3]				3 km to 4 km	3 km to 4 km	1,5 km to 2 km	1,5 km to 2 km	1 km to 1,5 km	1 km to 1,5 km

[1] Assumption: Total for forest type strata plus ca. 400 NFI # 1 tracts in the remaining area

[2] Field tracts are tracts that have to be visited, as result of the forest – non-forest pre-clarifcation. Assumption: Total for forest type strata, considering 95% are field tracts + ca. 10 field tracts in the remaining area outside of the forest type strata.

[3] NFI # 1 grid density: 10 by 10 Minutes, East – West ca. 14.2 km, South-North ca 18.5 km

Experiences about the **work volume per tract** from NFI # 1 showed that tracts where no forest/shrub land occurred resulted in 1–2 days efforts, where forest/shrub land occurred 2-4 days were needed and in single cases up to one week. Considering the revision of the methodology we estimate that the average time per team per tract can be reduced to **1.5 days**.

The resulting quantity structure for the FFI-FI works with the following assumptions:

- Ca. **1,300 field tracts** need to be measured.
- It is performed by **25 field teams**, consisting of **3 field worker** per team plus one driver, recruited from the ca. 100 experienced field staff mentioned in the ToR.

It results in a demand of ca. **1,950 field team work days**.

Sampling scheme

It is foreseen to establish a systematic grid for each stratum. As the necessary grid width that results from the preliminary area estimate is in the range of 1 km to 4 km it requires an adaptation of the tract design vs NFI # 1. The draft proposed design is characterized in Table 4.

Table 4: Sampling design per type specific stratum

Stratum	Grid density	Tract/plot design
Shrub land	4km	3 plot tract - Plot distance 200m plus NFI # 1 tracts
Juniper	4km	3 plot tract - Plot distance 200m plus NFI # 1 tracts
Spruce, fir	2km	3 plot tract - Plot distance 200m plus NFI # 1 tracts
Other broadleaved	2 km	3 plot tract - Plot distance 200m plus NFI # 1 tracts
Walnut	1 km	Single plot design
Pistachio	1 km	Single plot design
Remaining area	NFI # 1[3]	Adjusted NFI # 1

[3] NFI #1 grid density: 10 by 10 Minutes, East – West ca. 14.2 km, South-North ca 18.5 km

As the estimated grid density is denser than in the NFI # 1 (East – West ca. 14.2 km, South-North ca 18.5 km) with distances between 1 km and 4 km it is also foreseen to implement shorter distances from plot to plot. This also influences the plot design that will be presented further below. For strata with a 1 km grid width the transition to a single plot design is suggested. Since this is necessary in Walnut forests and Pistachio forests, where accessibility is on average easier compared to the other types, this is regarded more efficient. The envisaged design is sketched in Figure 7.

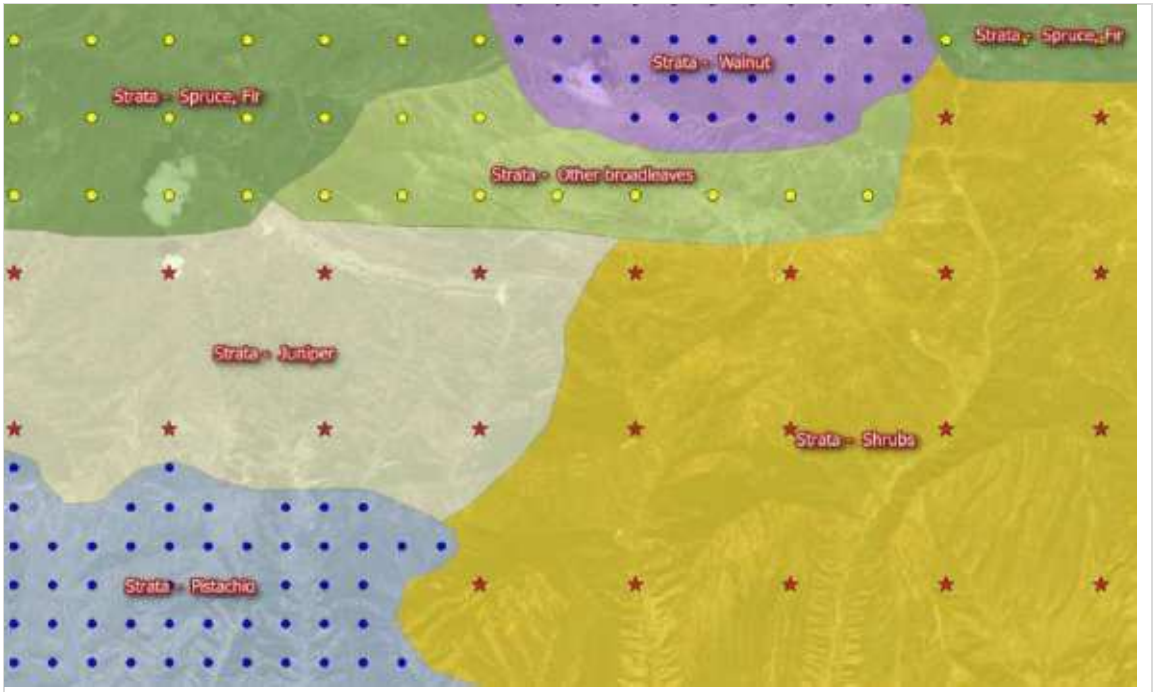


Figure 7: Illustration of the spatial distribution of tracts and plots by strata

To implement a highly efficient approach a transition from a 4 plot to a 3 plot tract for the newly established tracts is foreseen (Figure 8).

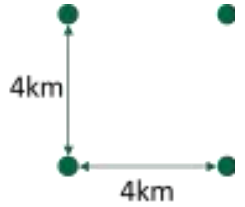
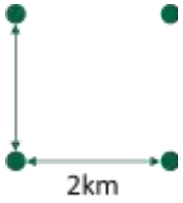
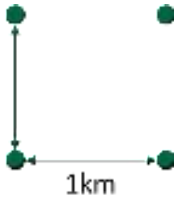
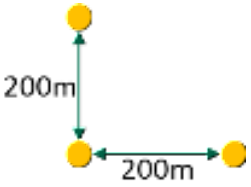
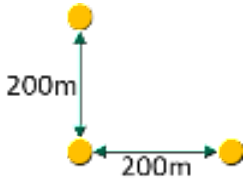
	Strata: Shrubs and Juniper	Strata: Spruce, Fir and Other Broadleaved	Strata: Pistachio, Walnut
Tract distribution			
Tract design			

Figure 8: NFI # 2 – Design of tracts

Option to add airborne data acquisition & mapping

In case that the planned field work volume of ca. 1,300 tracts and the ca. 1,950 field team work days will be assessed as not sufficient to achieve the consolidated precision, we envisage a combination of field tracts measurements and airborne data acquisition and mapping via a flight campaign using optical and LIDAR sensors in a two-phase approach.

We propose ADAM (Airborne Data Acquisition & Mapping) as hardware platform. ADAM is a mobile and flexible remote sensing platform that can be transported in suitcases very easy. The system allows the capturing of Laser scanning (LiDAR) data and aerial photos. LiDAR data is specifically useful for obtaining vegetation height and detailed terrain information. It has been used e.g. in support of the National Forest Inventory (NFI) in Suriname, but also for other applications in Europe and in Pakistan.

With regards to supporting a NFI the data can be used in order to extend the amount of data collected in the field in regard of tree and vegetation data, which can be measured remote. This is specially the case for the relevant variable volume. Our special software allows to segment individual trees and the derivation of height, crown size and volume. In this case, a two-phase approach is applied, where part of the field plots can be replaced without losing overall accuracy. The amount of reduction is dependent on the quality of the regression between the LiDAR derived parameters and the field.

This technique offers the possibility to extend the data collection of the terrestrial field work with moderate additional cost for the additional remote sensing application.

Plot design

Plot design refers to the methods selected regarding observations on the sample plot. It refers to the rules how sample trees are included around the sample point and to the measurement prescriptions for the variables to be observed.

The following two aspects of the NFI # 1 plot design are regarded critical.

1. The NFI # 1 field sampling approach is using a plot size of 20m by 250 m that is marked with one metal stake at one end of the middle line. Tree locations are recorded with reference to the middle line (middle line position and orthogonal distance to the middle line
2. The NFI # 1 field sampling approach includes measuring all trees with a DBH >= 8cm

Aspect (2) results in a huge number of trees on many single land use sections inside the plots, that in many cases exceed 50 (this number is based on an analysis of the NFI # 1 data set provided to bidders)

Aspect (1) in combination with Aspect (2) will lead to problems with re-finding the trees the further away a tree is from the starting point of the middle line due to potential errors in the direction of this line and the more trees occur in a land use section/plot

If we utilize remote sensing based pre-clarification, the huge size of the plot will make it necessary to visit plots that are merely on small parts forest/shrub land. A smaller plot size would lead to higher field efficiency since via the pre-clarification plots that are not covered can be avoided. Thus, with a focus on forest/shrub land and application of a pre-clarification smaller plots are much more time efficient (in view of achievable sampling errors and precision).

The disadvantages of the previous design can be addressed by switching to **sample plots with concentric circles**. Such plots - also for NFI # 1 plots to be re-measured - be allocated close to the starting point of the plot. Alternatively, the NFI # 1 plots could be re-measured on the first 50m of the entire 250m.

On the concentric plots trees will be selected per circle dependent on their diameter to avoid too large numbers of trees per plot; as is applied on the plots that are assessed in the course of the FMP field inventories in a 500 m by 500 m grid. A draft design is illustrated in Figure 9. This design will be made subject for revision and finalization during the inception phase.

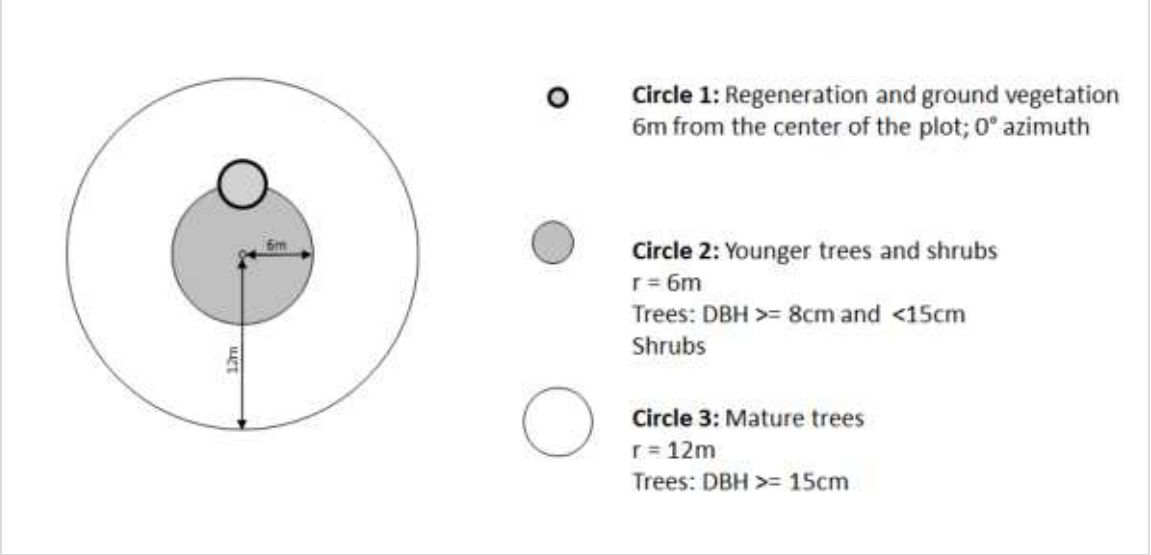


Figure 9: Design of plots to be established for the first time within NFI #2 (initial draft)

Data from the existing FMP related field inventories shall be utilized in addition to NFI # 1 data to identify an optimized plot design for NFI # 2 and future repetitions during the inception phase. This plot design will also include the sub-plots used to assess shrubs and ground vegetation as well as the approach to assess stumps and dead wood.

Attribute selection, definition and assessment method

Attribute assessment, definition and assessment methods will be aligned with the NFI # 1. Merely additions and minor adjustments are planned where necessary to address the consolidated information needs.

Merely for the socioeconomic questionnaire that focused on the use of the forests and shrub land and that was a major element of NFI # 1 an alternative approach is proposed. Considering the substantial increase in tracts the maintenance of this element would require a huge amount of time to conduct this questionnaire in a huge amount of villages. It is thus proposed to replace the questionnaire of local people by a questionnaire to foresters of the leskhoz. Details of this questionnaire will be established during the inception phase.

Choice of estimators (design based, model assisted)

The estimation of sample based estimates from forest inventories requires the selection of adequate estimators. The estimators to be implemented that consider

- The distribution of plots and tracts on strata
- Post-stratification will be applied at the estimation stage to fully utilize the potential of the NLCC for error reduction

Estimators will be necessary, specified and implemented in the analysis software for the estimation of totals, means and ratios.

Steps of design finalization – anticipated variances, the number of field tracts and field work volume estimate

Step 1: This proposal provides, based on anticipated precision an initial estimate of the necessary number of field tracts and of the average time per team per tract/single plot.

Step 2: This initial estimate will be replaced by a first final version of the estimate of these fundamental properties that will be based on the final NFI # 2 methodology, of initial experiences of a test of the field methodology and of the anticipated variances of the statistical estimators for the major target statistics established in the information needs assessment.

Step 3: Since these estimates will still be subject to uncertainty a revision foreseen after the 2019 field phase, then based on the NFI # 2 field and performance data (see task 4-6-1 in Table 10).

Figure 10: Establishment of anticipated variances and the number of field tracts

If as result of each of the three steps the possible field work volume is assessed as not sufficient to achieve the consolidated precision and a substantially higher number of tracts would be necessary, proposal how to technically adjust the methodology will be provided. As described above, we consider to extend the terrestrial data collection by combining it with airborne data acquisition and mapping via a flight campaign using optical and LIDAR sensors in a two-phase approach.

Work plan

The project work plan and quantity structure presented in this proposal is already based on this design proposal and will be updated based in the finalized methodology during the inception phase.

You can find all related activities in the work plan (see chapter 4.1.3.7, Table 7).

4.1.3.3 Objective 02. Perform a national land cover classification

As part of this objective, the consulting team will design a system for an efficient land cover classification; it will acquire, preprocess and finally produce the national land cover map. This will be carried out in close cooperation with the counterpart, as each step of the procedure will be also part of the capacity building in order to ensure a sustainable and independent implementation of the further processes.

The activities related to the national land cover classification are independent of the fieldwork for the NFI, but they are still interconnected and cannot be separated. As a first step in this objective, a GIS project will be setup including all information and data that are required not only for the land cover classification, but for the NFI as well. Furthermore, the land cover classification will produce the input needed for the pre-stratification in the NFI, which is a crucial process in reducing the variation and increasing the accuracy of the whole inventory. Finally, the activities of this objective include the process of pre-clarification for each of the selected clusters and sample points of the NFI.

The overall concept for the production of a national wide land cover map is illustrated in Figure 11.

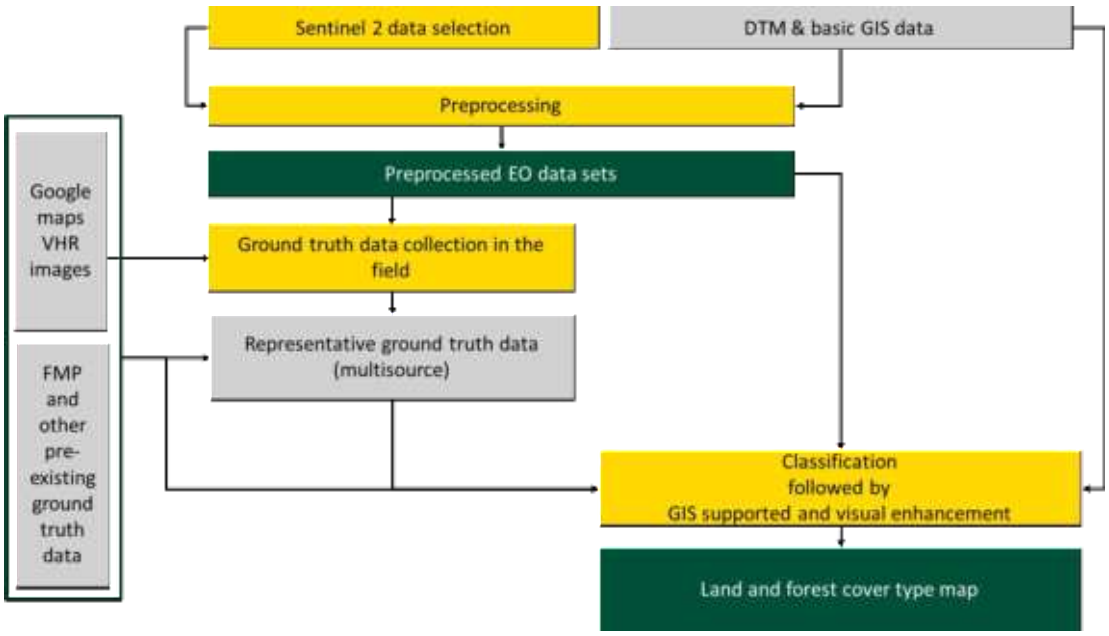


Figure 11: Overall technical concept - National land cover map

Land Cover Classification System

The land cover classification system that will be used has to be designed taking into consideration the already existing systems of land use / cover classes[2] on one side, but also the international standards such as the FAO land use classification system on the other. The technical

[2] "Integrated Assessment of Natural Resources 2008-2010 in Kyrgyzstan"

possibilities in extracting different land cover classes from the satellite imagery are also very important, especially in context of the high level of accuracy, which is set as a target.

In achieving high overall accuracy, it is suggested to concentrate on the main forest types that exist in the country[3]. Related to this is the proposal for land use classification system shown in the following table.

Table 5: Proposed system for land cover classification.

Level 1	Level 2
1. Forest	1. Spruce, fir forest 2. Juniper forest 3. Walnut forest 4. Pistachio forest 5. Other broadleaved forest
2. Other wooded land	1. Shrubs
3. Other land	1. Natural non-forest land (Natural grassland, bare land, glaciers, rocks etc.)
	2. **Agricultural land**
	3. Residential area and roads
	4. **Mines and quarries**
4. Inland water resources	1. Waterbodies (lakes, reservoirs, rivers)

It is important to note that this system outlined in Table 2 is just an initial proposal. During the inception period, the consulting team will, as part of the "Task 1-1 Information needs assessment", assess the specific necessities of the counterpart in respect of the level of details and in the different land cover classes. Based on that input and the further research and review of available literature and maps, as well as consulting local experts on forest typology a draft land cover classification system will be developed. The draft classification system will be presented for approval on the "Workshop on definitions and Land Cover Classification System" where the final adjustments and approval can be made. It is suggested to organize this workshop together with the "National Validation workshop on the outcome of information needs assessment" of Task 1-1.

GIS Setup

One of the first activities in the inception period is to set up a GIS project containing all the necessary data and information needed. For this purpose, the consulting team will gather all the necessary data from the counterpart and through open source GIS software and DBMS Postgres / PostGis to set up a GIS project.

The goal of this GIS Project is to have all the spatial data in one place, to have it accessible for all partners included in the project and to utilize it for each of the project objectives. The data

[3] Map of forest location in the Kyrgyz Republic scale 1:500000; Bishkek 2009

will be stored in a spatial database and/or a central folder structure. The GIS project is the base for all spatial analysis and mapping activities.

A “wish list” of relevant GIS data sets for the NFI # 2 is given in the table below. The data will be stored in vector (shape file, gbd etc.) or raster format (tiff, img, jpg etc).

Table 6: Overview of relevant GIS data sets and data layers for the NFI GIS Project

Information Type	Layers
State Administrative boundaries	▪ State boundary ▪ Region boundaries ▪ District boundaries ▪ Municipal boundaries
State Forestry Agency	▪ Boundaries of State Forest Agency ▪ Ranges ▪ Hunting areas
Infrastructure	▪ Roads ▪ Railroads ▪ Built-up areas
Hydrology	▪ Rivers ▪ Lakes and water bodies
Environmental and nature protection data	▪ National parks / Nature parks / Protected areas ▪ National or regional vegetation maps ▪ Forest type maps ▪ Soil map
Digital Elevation Model	▪ Elevation ▪ Slope ▪ Aspect
Satellite imagery	▪ Mosaic from Sentinel2 imagery ▪ VHR Imagery – Google Earth
NFI # 1 Data	▪ Plot locations and Inventory data
FMP Data	▪ The FMP plots in a 500x500m grid available for the land managed by the state forest agency including the data ▪ Stands boundaries and data

It is important to note that the information given in the table are to be used only as a guide in the data collection. Any existing data that can be used for the NFI will be collected.

For the national land cover classification, the GIS project will help in the data preparation and preprocessing at first. It will also be the central place where the classification will be done and finally illustrated. All processes related to the ground truthing data preparation, field maps and verification will also take place within the GIS Project.

For the NFI # 2 the GIS Project already plays a role in the decision on the strata for the field inventory. The pre-stratification exercise will be conducted using the data from the GIS Project. The GIS Project will be used also as part of the NFI sampling design, where the sample points will be distributed through the country on a preselected grid per strata. Prior to the field work,

pre-classification of each of the clusters and sample plots will be done using the GIS Project, and during the field work all necessary field maps will be created with it.

Taking into consideration the depth in which the spatial data and information have used inside the project it is necessary to make the effort and set up the GIS Project with all relevant information already at the start.

Data to be used

To guarantee a good division of the land cover and land use classes, an appropriate dataset is required. It has to have high temporal and spatial resolution and additional properties that enable improved vegetation monitoring. Additionally, it should be available free of charge, since acquiring imagery that cover the complete territory of Kyrgyzstan would require a significant investment.

At the moment, there are 2 datasets that might be taken into consideration. Both are optical multispectral imagery: Landsat8 or Sentinel2. They are both available free of charge, but Sentinel2 has a higher spatial resolution (10m compared to 30m of Landsat), which gives it an advantage especially considering the possibility for an improved detection of open forest types. Preference is given to the use of Sentinel2 imagery due to the higher spatial and temporal resolution. The higher temporal resolution allows for a higher volume of up-to-date and cloud free imagery available for the analysis that is necessary to provide an accurate and wall to wall national land cover classification.

The acquisition of the imagery will be done in an automated process and would cover the territory of Kyrgyzstan. The imagery foreseen to be used for the analysis will cover the vegetation period of 2018. However, due to the high cloud cover and terrain conditions, it is possible that in some cases imagery from 2017 would need to be added to the analysis.

In addition, VHR (very high resolution) optical images (aerial images, satellites with ≤ 1m pixel size) available in Google Earth will be used for the steps “Reference data collection”, “Classification enhancement” and “Independent verification”. Very high resolution images are available in Google earth for the larger part of Kyrgyzstan. These images can be used to determine information on tree coverage and tree density and thus will play an important role in the mentioned work steps. The use of the VHR images will reduce the need for actual ground truthing on representative examples and cases where the class assignment remains unclear or uncertain when solely VHR images are used.

Figure 12: Examples of forests and forest type from Kyrgyzstan types by very high resolution images in Google earth (dense, open forest/shrubs, plantation)

Ground truthing and Verification / Validation

The figure below presents the general work flow of the ground truthing and verification.

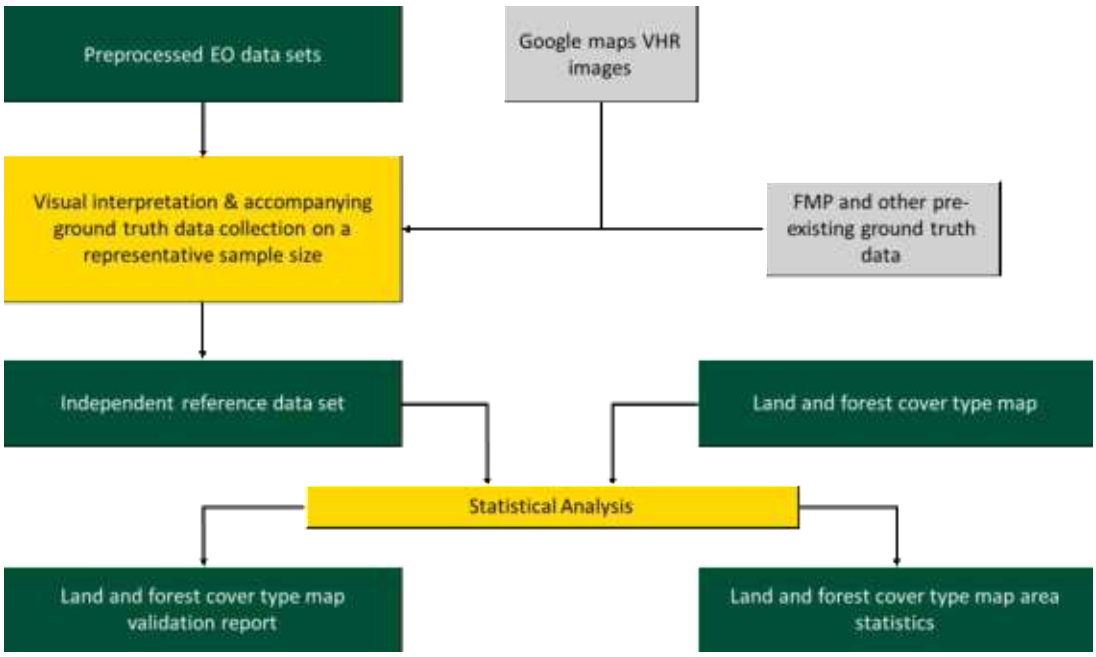


Figure 13: Validation and ground truthing work flow

The final mapping quality can merely be assessed by independent verification. A rigid independent verification that combines field work and desktop analysis using VHR imagery is suggested. This is necessary since boot strapping approaches that are often used in scientific applications cannot be applied when, what is necessary, post processing and visual enhancement is used to improve the classification. Further it allows a higher accuracy for the determination of area statistics. Both verification results and area estimates can, with this approach, be provided with confidence intervals.

To improve the quality of the ground truthing and verification data, the team will also explore the possibility to use other or ancillary data that is available in the country. Such example would be data from Forest Management Planning (FMP) coming from the State Forest Agency which is available for ~13000 plots in the country. In the inception period the consulting team will have a more detailed analysis in order to utilize them for an improved validation of the final map.

The plots from the FMP are distributed in a grid of 500x500m and each of the plots contains information on land use. Furthermore, information exists on level of stands in each of the state forest ranges. This information has been gathered country wide, and can be used as a source for verification and building training areas for the classifier.

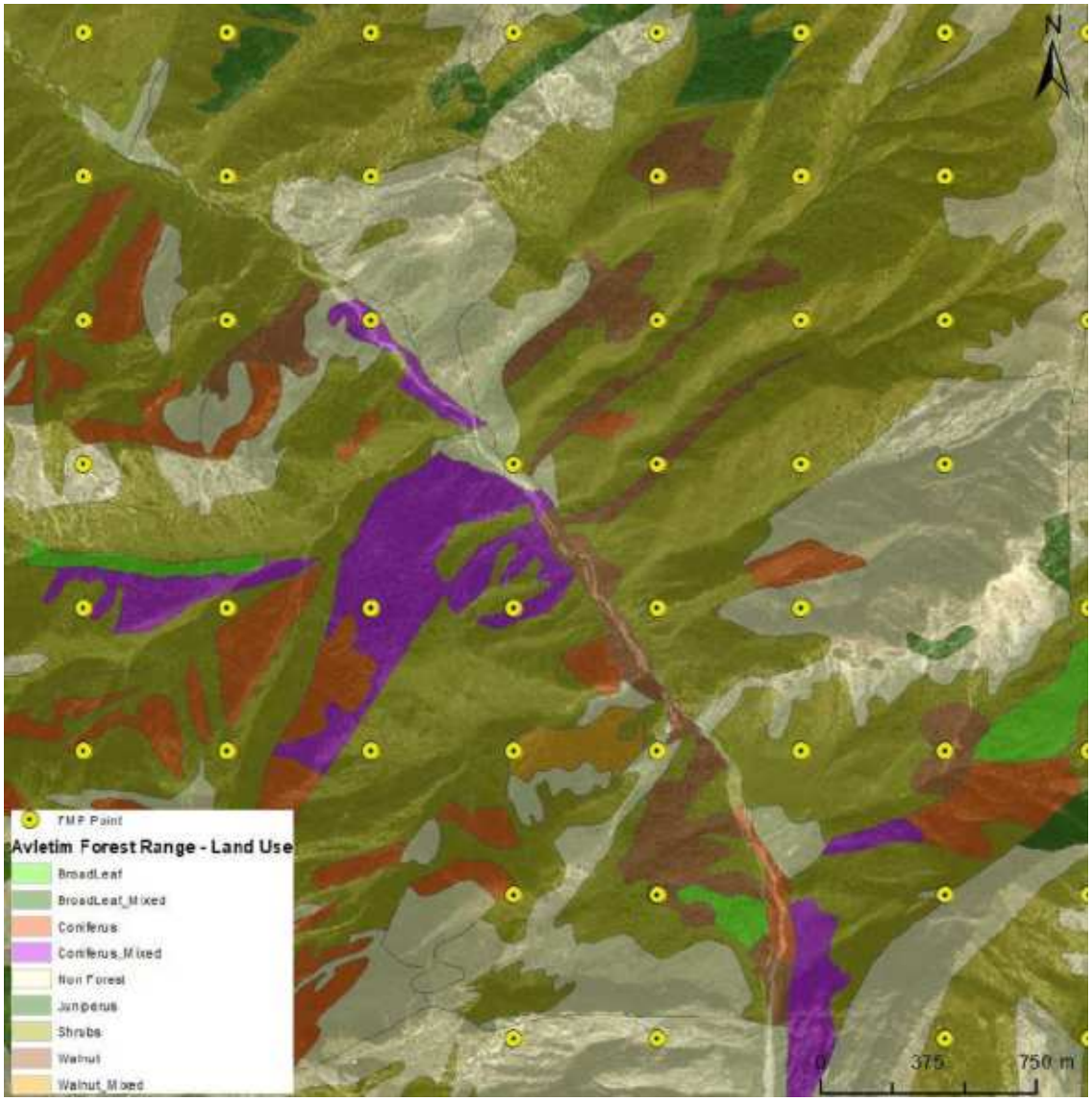


Figure 14: Example of the existing FMP plots and the land use information for the forest stands inside the Avletim Forest Range

The field survey of the NFI # 2 also presents an important source of data that can be used in the scope of the land cover classification. Due to the timeline, however, it will not be possible to use the data as reference in order to create training areas for the classifier. But, the field data from the first year (2019) can be used as a completely independent data source for validation.

Land cover classification

The first part of the land cover classification is the preprocessing of the data. This part includes several steps that require a high degree of automatization in order to get fast and high quality material for the further classification.

The preprocessing includes:

- Download S-2 data for 2018 - the initial analysis for the whole area of Kyrgyzstan showed that the entire territory is covered by 36 granules of 100x100km and there are about 600 granules which fulfill the quality requirements and can be used for the land cover classification
- Download and pre-processing of SRTM DTM
- Processing S-2 raw data to surface reflectance (atmospheric correction)
- Correction of terrain effects or topographic normalization – this is a process where specific algorithms are implemented in order to decrease the topographic effects on the imagery caused by the rugged terrain in the high mountains. In the case of Kyrgyzstan where the topography is very dynamic, with peaks up to almost 8000 m above sea level, the topographic normalization is necessary. An example of these effects is when a shadow is cast on the mountain slopes opposite the sun, which can affect the quality of the analysis significantly if left un-corrected. As with such a strong relief and only the SRTM DEM available, some artifacts and deep shadows might remain after processing, which need to be taken care of manually.
- Cloud masking – the analysis has shown that the average cloud cover per granule in 2018 is about 60%. Only 10-20% of the scenes are cloud free, which means that cloud masking is needed in order to increase and improve the available data.
- Generation of median image and coefficient of variation for all 2018 data sets
- Generation of a cloud free mosaic for the vegetation period of 2018 that will be used in the further steps of the processing as base for the land cover classification.

The atmospheric and topographic conditions, as described above, influence heavily the amount and quality of the data that is available. Due to these conditions, it will not be possible to find 36 cloud free scenes from same or similar period and create a mosaic for the land cover classification. Rather, a more complex procedure will be required and a high volume of granules of Sentinel2 imagery that will create a time series, analyze each pixel separately and produce a cloud free mosaic which is topographically corrected. This exercise is time consuming and has the potential to delay the activities of the field inventory which are dependent on outputs from the land cover classification. In order to avoid any delay and have a solid base for the classification, the consulting team will hire a subcontractor just for the task of preprocessing.

The foreseen subcontractor has a long track record in remote sensing and has developed specific algorithms that enable fast and efficient realization of all the work steps in the preprocessing and has already worked on several projects that cover monitoring of vegetation on large areas. These algorithms are especially efficient in the correction of the topographic effects. The subcontractor is JOANNEUM RESEARCH[4] from Austria. The work of the subcontractor ends with the preprocessing, and the production of the cloud free mosaic for Kyrgyzstan. All the following work steps in the classification will be carried out by the consulting team.

[4] JOANNEUM RESEARCH Forschungsgesellschaft mbH; Steyrergasse 17, 8010 Graz, AUSTRIA; web: http://www.joanneum.at/digital

There exist several established standard methodologies for land use and forest cover type classification and an efficient approach will be selected based on tests and then applied for all images. The proposed approach takes into account the major technical challenges of the land use and forest cover type mapping in Kyrgyzstan and these are:

- The topography leads to strong spectral differences between identical land cover types depending on slope and exposition. At the same time the available terrain model as well as the information on the atmosphere at the single acquisition dates restrict the technical possibilities to correct these effects prior to the classification by atmospheric correction and topographic normalization. To address this the preprocessing will implement specific algorithms for the topographic correction. However, in places with very deep shadow (steep slopes in high mountains) it is possible that there will be some left over shadows, even after the correction. In these cases, a manual correction will be implemented.
- The differentiation of forest types is a challenge since it is expected that the spectral signatures of some of the forest types overlap. To address this, information on the location and sites where the single types occur/ never occur / are unlikely to occur will be considered utilizing information from GIS (e.g. height, slope, proximity to a river).
- The collection of ground truth data in the field requires high efforts, especially in remote areas and in regions with steep slopes. To address this, VHR images from Google maps and information from the old forest plans and maps will be utilized to minimize the need for field visits but still maintaining the necessary quality.
- To achieve the necessary high quality, classification will be followed by a visual enhancement that utilizes regional knowledge and all available data sources.

Pre-stratification

In order to decrease the variance of the measurements of the NFI, and to increase the accuracy of the results a pre-stratification is suggested. This is especially important taking into account the high level of accuracy required.

The pre-stratification is done using available data sets, for example the already existing forest type map or the national land cover classification that is part of this project. However, due to the timeline it would be very unlikely that the national land cover map will be prepared in time for the final establishment of the statistical design and the pre-stratification. Therefore, the alternative dataset will be used which is the already existing forest type map. This map contains sufficient information to identify the main distribution regions of the different forest types. Additionally, data from the FMP can be used to improve the strata delineation.

A draft example of the envisaged stratification can is provided in Figure 15.

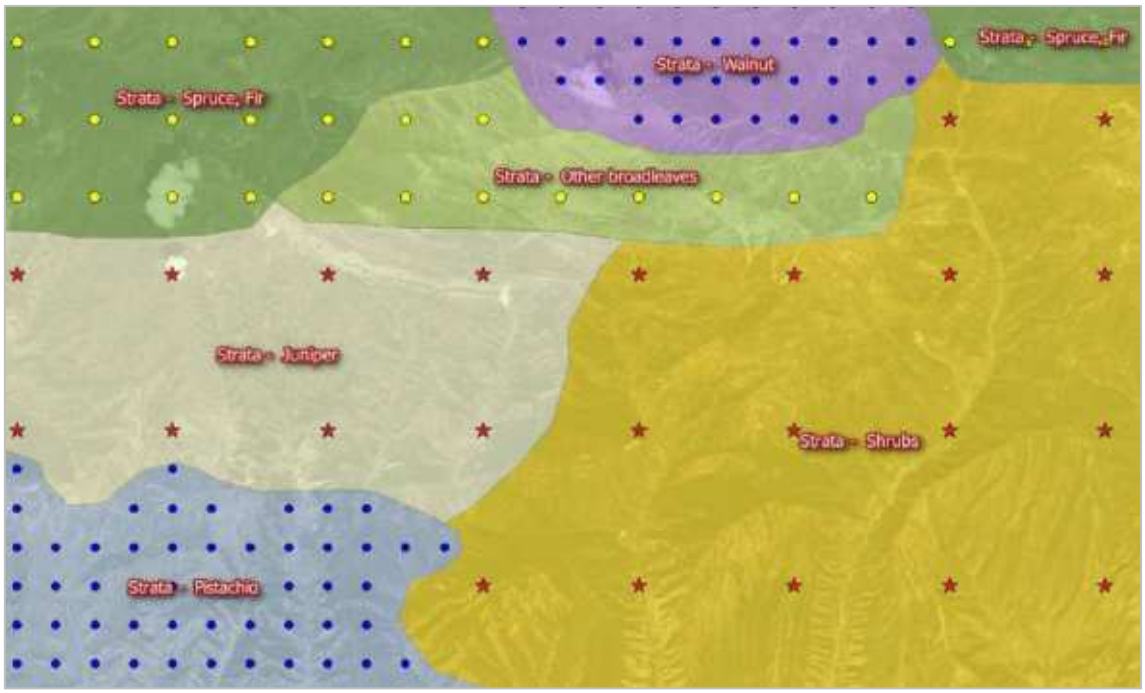


Figure 15: Illustration of the pre-stratification

Pre-clarification

Even with pre-stratification it is still possible that one part of the plots and clusters as part of the NFI are still outside forest. Additionally, a part of the clusters might fall in areas that are not possible to access due to slope or security reasons. In order to avoid spending effort and time in visiting these clusters in the field, it is possible to assess each of the clusters prior to the field work and determine the characteristics of each of them. Based on this, a decision can be made if the cluster will be visited during the field work.

The decision if one cluster or sample point should be visited in the field depends on existing background data and information that are already compiled in the GIS Project.

These data include: DTM, road and infrastructure, Sentinel2 imagery, FMP data, VHR imagery (Google maps).

The illustration below presents the work steps included in the pre-clarification.

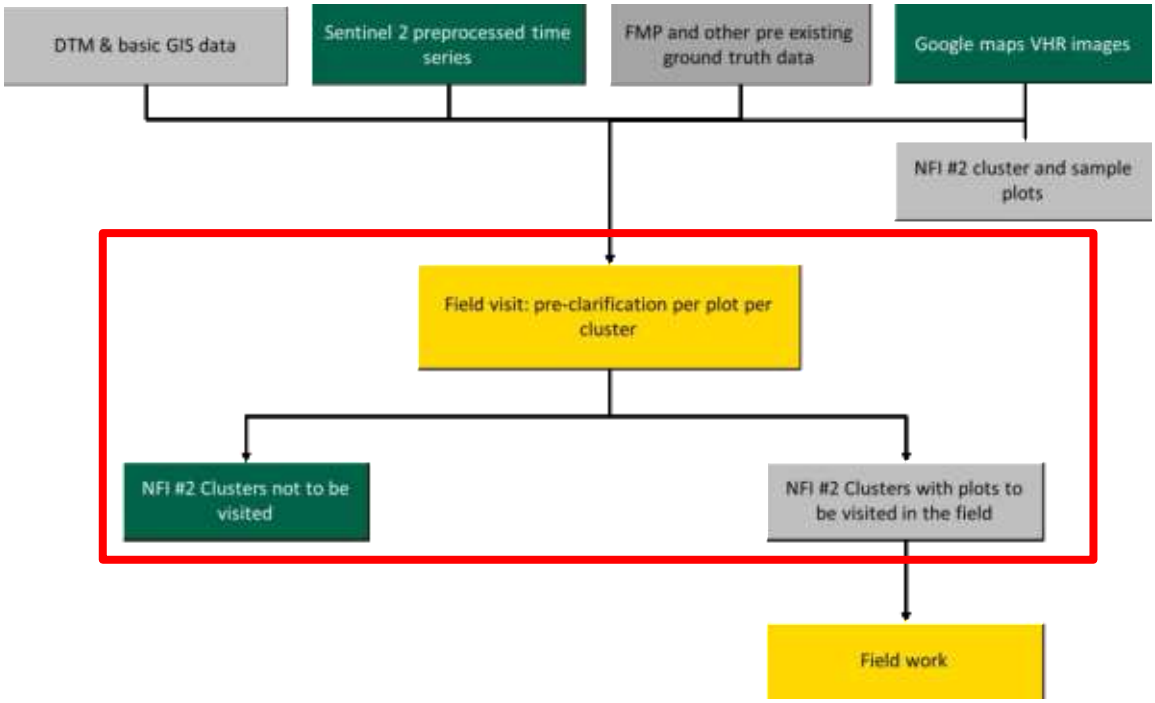


Figure 16: The process of pre-clarification if a cluster / sample point should be visited and measured in the field

All related activities can be found in the work plan (see chapter 4.2, Table 8)

4.1.3.4 Objective 03. Execute the NFI # 2 field survey

This Objective 03 incorporates the preparation and execution of the core field activity of NFI. It deals with the preparation of the logistics, including the field equipment, the travel and work plan but as well the training of the field crews and the implementation of the procedures for a constant quality control. Regarding the timeline, it goes nearly in parallel with the tasks and activities of Objective 04 on data analysis and reporting, in fact the tasks of both objectives are intensively interlinked (see Figure 17). Under this objective 04, the necessary NFI software tools are developed and provided. Those NFI software tools like Openforis Collect mobile dealing with the data collection process in the field are already addressed under Objective 3.

The flow chart below presents the necessary steps that are leading towards the successful field implementation of the NFI # 2 in Kyrgyzstan[5].

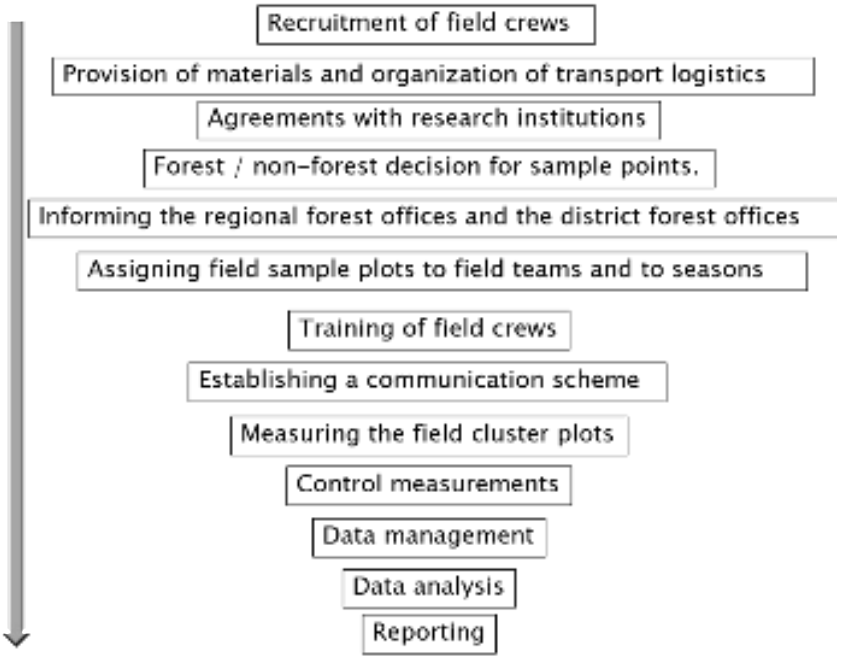


Figure 17: Flow chart of the activities included in Objective 3

To implement the field inventory, the following is required and will be prepared and organized:

- Well trained and equipped field teams
- Well trained and equipped control teams
- An effective and flexible field team management and reporting
- A well-established plan comprising field work, control and contingency measures

[5] The last three steps are grouped under the Objective 04. Compile, analyze and report on the survey data.

Approach

For the **implementation of the fieldwork,** two working periods are foreseen. One in 2019, one in 2020. To facilitate the timely start of the fieldwork in June 2019, the field team training is foreseen for Mai 2019 and all other preparatory tasks have to be finalized by April 2019.

In the chapter 0 of this proposal we have described a draft NFI implementation plan, including an estimate of the time necessary to assess a plot (1.5 days on average), the plan to engage ca. 25 field teams.

Optimal **field equipment and measurement tools** are influencing the performance, the quality and accuracy of the NFI data collection. Moreover, it is relevant for the work safety and motivation of the field teams. We have attached a proposal for a **field equipment list**, which will be in detail presented and discussed during the inception phase to ensure timely procurement of the necessary field equipment (Annex 2 (chapter 0)).

The final **Plan for implementation** and the formats of **quality assurance protocols** will be developed based on the findings and results of tasks under Objective 1:

- NFI # 2 field survey methodology
- NFI Time schedule

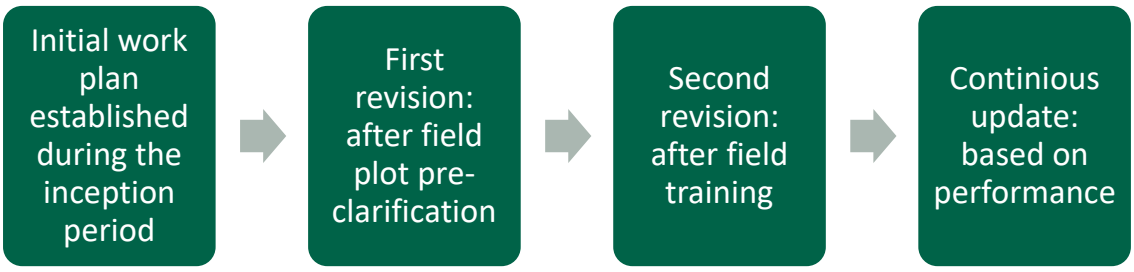


Figure 18: Establishment and update of the field work plan based on improved data input and experience

The Plan for implementation will be developed stepwise: a first draft already in parallel with the NFI # 2 field survey methodology and the NFI Time schedule. It will be re-vised for the fieldwork in 2020, capitalizing on the experiences and time recordings of the fieldwork period 2019.

The development of the necessary **NFI software** is subsumed under Objective 4: on data analysis and reporting (chapter 4.1.3.5)**,** the necessary IT-infrastructure under Objective 5 (4.1.3.6). As **Openforis Collect** and **Collect Mobile** has been selected as tools for the field data collection, the development of the data structure and configuration will go in parallel with the development of the NFI # 2 field survey methodology. With the consequent utilization of plausibility checks and completeness checks, a high level of quality assurance will be achieved. The development of the modules Openforis Collect and Collect Mobile are in detail described as part of Objective 4 (see chapter 4.1.3.5)

Quality assurance and quality control measures are accompanying all steps in the NFI: in planning, in implementation and in analyses and reporting. Quality assurance aims:

(1) at avoiding crude errors (= the true mistakes where something has been done wrongly) and

(2) at reducing random errors (= the residual variability that is present in all empirical studies).

The methodological soundness of the statistical inventory design is also part of quality assurance. Quality assurance and quality control measures further include: i) Field team training, ii) independent control measurements, iii) Data plausibility check procedures and quality assurance in the course of the data analysis. The **reporting on the quality control procedures** will be standardized and issues on bi-weekly basis.

After UNIQUE-CAREC's internal tests in the field of both the Openforis Collect Mobile as well as of the field survey methodology, the central **Training** on **Open Foris Collect** and **Training on the field data collection** will first be provided to the central NFI team (Training for trainer) and then in a second step to the entire field teams. In order to guarantee the sustainability of the process, the consulting team will especially concentrate on the **training** of supervisory staff and SAEFP staff. The training will be done on preselected sites, which will be set up as permanent training sites. In the preparation for the fieldwork, first the teams of UNIQUE/CAREC will be training, a training of trainers. In addition, in the second step the supervisory staff and SAEFP staff will receive training on each step of the NFI, including the data recording and analysis using the modules of Openforis.

The **Field element execution** (including survey and quality control) shall start in June 2019 and be organized in two periods, one in summer 2019 and the second period in spring and summer 2020. The field data collection is accompanied by the regular field control work by the consultant and the TTFI team. In regular intervals and whenever a mobile data connection is available, the data are send to the data analysis team of the consultant. In **Openforis Collect** data are compiled and can be checked for completeness and plausibility a second time. First processing is applied constantly.

You can find all related activities in the work plan (see chapter 4.2, Table 9).

4.1.3.5 Objective 04. Compile, analyze and report on the survey data

The strategy for the compilation, analysis and even the reporting of inventory data already needs to be elaborated before the actual inventory is being implemented. Compilation, analysis and reporting activities rely on NFI software modules, which need to be at hand when starting the inventory. In result, this objective is targeting to i) develop the NFI software modules prior to their utilization as essential tools for all NFI tasks and ii) to develop a data analysis workflow ending up with predefined or user-defined reports in the format of tables, graphs and maps.

Tasks and activities

In consequence, the tasks subsumed under this objective are twofold.

- The first group of tasks are dedicated to the development of several **NFI related software modules** as part of a future Forest Management Information System (FMIS). The establishment of the NFI software modules is a cross-cutting issue.

- The second group of tasks covers the **data analysis** itself, dealing with allometric equations and tasks making use of the NFI software to analyze the NFI data in a predefined workflow.
- As for all work steps of the NFI, the ToR also foresees **capacity building** by providing training courses.

NFI software

Long-term functioning of any forest monitoring system can only be achieved by institutionalization. This is the experience from all countries where such systems are running successfully. Repeated inventory and forest planning work are essential components of any forest monitoring system.

As part of Component III of the IFEMP, better and more accessible information shall be provided to inform policy makers and stakeholders on actions related to natural resource management. The NFI will provide the baseline information on national level for a sustainable forest management. For the data collection process, mapping tasks, data storage, data processing, data analysis, retrieval and reporting software tools and related IT-infrastructure is essential. The NFI software tools themselves are seen as one modular part of a future comprehensive FMIS, allowing managing and monitoring the forests and their development over time. The NFI will provide the basis for continuous and permanent monitoring of forest resource status, including carbon sequestration data.

The role of NFI software modules in a future comprehensive Forest Management Information (FMIS)

A modern, comprehensive and flexible FMIS consists of different - often-decentralized - modules, each compiled into different software products and databases. The modules and respective (spatial) databases support the information flow of different business processes and contain the necessary features and functions. An intensive interaction and interoperability between the modules is necessary to allow data exchange and data analysis on higher levels (data warehousing). Technically, the software modules must be connected by interfaces with predefined standards for data exchange. As most of the objects dealt with in forestry and land use sector have a spatial dimension, software components should allow spatial data handling, storage and analysis.

The following figure shows the modular system structure of a generic prototype FMIS, which might fit for the needs in Kyrgyzstan. The figure gives an overview of relevant software modules, underlying functions and their interfaces.

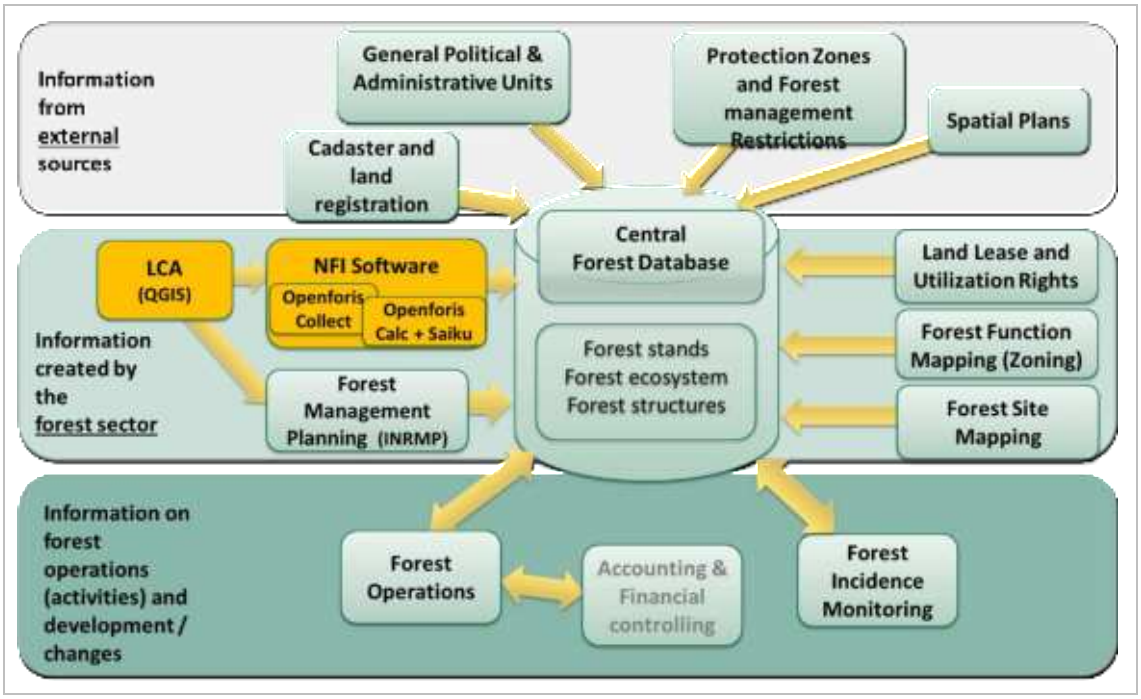


Figure 19: NFI software modules in a future comprehensive FMIS

The categories in which the components were grouped[6] are defined by the origin of the data to be managed. The NFI # 2 project touches only some of the presented FMIS modules, colored in orange, however they should not be seen as independent from other FMIS software modules. A holistic understanding from the very beginning allows a better design of each single module.

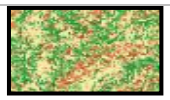
The modules illustrated in Figure 19 are quite generic but cover the most important business processes and information needs of a national wide managing institution like the SAEPF and the Leskoz. In the following, we shortly describe each potential module:

- **Central Forest Database:** Forests and forest structures – but also pasture and other managed land uses – are described in forest stands/pasture as homogenous spatial units and smallest entities for a sustainable management.
- **Cadaster and land registration:** Forest management is based on land parcels expressing ownership or management rights, which need to be defined by the official cadaster and land registration. Land parcels are the basis for all forest maps.
- Stand descriptions for the forests and non-forest areas managed are created during **Forest Management Planning** (part of the Integrated Natural Resources Management Plans), making use of **Forest Inventories** (tree data, point sampling).
- **National Forest Inventory (NFI software):** This process derives point sampled and mapped data for the whole forest area of the country. It provides the overview on the total forest resources of the country. The NFI software itself is split up in several modules – the main ones are presented in the figure (see more details below).

[6] See the 3 frames in the back-ground titled at the left side.

- **Forest Site Mapping:** A central mapping process of soil, terrain and climate allow an evaluation of growth conditions, tree species suitability and risks (erosion, drought, flooding etc.) at each location, where forest grow or might grow.
- **Forest Function Mapping (Zoning):** Legal restrictions occur for forest management from outside the sector (water protection, nature protection) and inside (mountain protection forest, buffer zones might be defined in the forest code). For forest management this information is compiled and decisions on optimal forest land use and forest functions are developed. The process provides zones of all different forest functions allowing the evaluation of the optimal management strategy for all respective forest stands.
- **Land Lease and Utilization rights:** Rights given and referring to certain forest stands or parcels need to be mapped and managed.
- **Forest Operations (Activity Monitoring):** It covers the annual planning based on the FMP data stored in the central forest and pasture database and the 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 accounting system.
- **Forest Incident (and change) Monitoring:** Unplanned, incidental changes of the forest by pests, storm, snow, grazing, fire, illegal logging are observed here. The module makes intensive use of the LCA activities (Task 1). Followed by alert processes, respective contingency planning and sanitary or restitution measures ((7) Forest operations) can be initiated.

Several NFI related software modules have been already addressed in the ToR. The full set of software modules to be used for the NFI # 2 is listed here. They are presented in more detail below.

Module 1	QGIS – GIS and remote sensing software for national land cover classification and mapping	
Module 2	Openforis – software for the NFI sampling inventory	
2 a	Openforis Collect mobile	
2 b	Openforis Collect	
2 c	Openforis Calc	
2 d	Saiku	
Module 3	NFI Website – platform to inform about the project and host the results presented via Saiku	
Module 4	Wiki based project management portal	

Information from external sources – like **General political administrative units** or **Protection zones and management restrictions** 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 sketched FMIS, different user groups shall 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. This should be the central access and retrieval point for all users allowing different levels of access to map and tabular information and incorporate standardized data exchange functionalities (WFS, WMS, bi-directional data exchange with external databases). Spatial data from different modules can be analyzed by intersections and spatial queries flexibly.

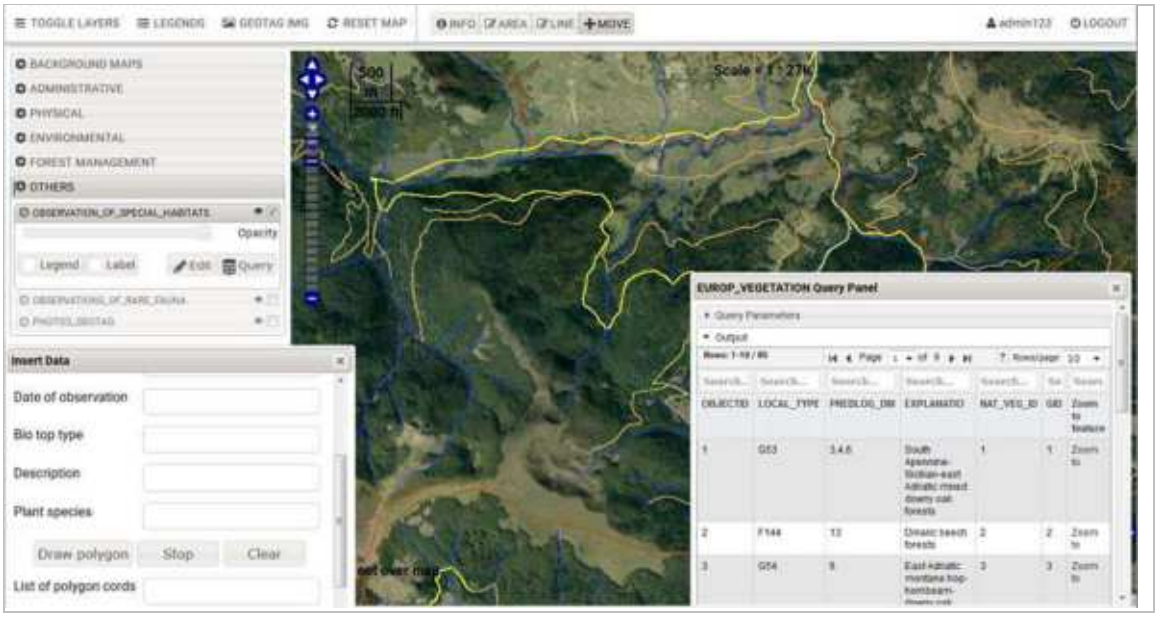


Figure 20: Example of a FMIS Web-GIS portal as central access and retrieval point[7]

Such a FMIS and the entire development, implementation and maintenance need to be coordinated by the FMIS team – optimally a sub-unit of a future "Forest Inventory and Monitoring Unit" under the "State Institution Kyrgyz Forest Hunting Inventory and Planning (SIKFHIP)", consisting of forestry, GIS and database management professionals and information communications technology professionals (see chapter 4.1.3.6).

Module 1: QGIS – GIS and remote sensing software for national land cover classification and mapping

The LCA requires a (spatial) database system and in addition, a platform for spatial and remote sensing (RS) data creation (map production) and analytics like ArcGIS®, QGIS, TerrSet® or ERDAS Imagine. The same software can also be used for all mapping steps related with the pre-

[7] Source: UNIQUE Web-GIS solution for the German-Montenegrin project "Improvement of the ecological information base for sustainable forest management and nature protection Montenegro"

stratification, pre-clarification, work map preparation and finally the reporting of spatial explicit NFI results.

The product QGIS (https://www.qgis.org) has been foreseen in the ToR as GIS and remote sensing software. It will be used for all tasks and activities related with map production, GIS and remote sensing analytics. It is open source, free of charge and combined with a wide range of comprehensive plugins in its features. We will support LCA workflow by development of Python scripts.

We plan to add an android based **Field GIS** application as a module allowing the field team to have all relevant work maps stored on their mobile devices. The field GIS will also improve and fasten the navigation to the cluster, first on public roads, forest roads and finally while walking.

Besides QGIS, we plan to use **Openforis Collect Earth** for the activity of pre-clarification of the NFI cluster locations (see Objective 2). It is a tool of the Openforis family enabling 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.

Module 2: Openforis – software for the NFI sampling inventory

The software products foreseen for the NFI sampling inventory are Openforis Collect, its mobile extension Collect Mobile and Openforis Calc offered free by FAO.

The software bundle is a product of the Openforis 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 2009[8]). UNIQUE-CAREC – and in-personam - our IT expert - have intensive work experience with Openforis in several countries in connection with regional or national inventories (Columbia, Georgia, Ecuador). It allows us to evaluate strengths and weaknesses of the system. As it is a flexible framework to be configured for a specific inventory and as it is still in development, we will recommend to organize an official support contract with the FAO developer team to secure that all actual features and add-ons can be made available for the NFI # 2.

The basic idea of Openforis is to provide open data and the free sharing of data and information to all stakeholders. It has a modular approach, providing components, which may be mixed and matched to best fit to a certain inventory project. Open standards are also applied to allow interoperability (interfacing) with existing systems and infrastructure. The tools are thought to 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.

Openforis 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.

[8] FAO Openforis: http://www.openforis.org/OFwiki/index.php/Main_Page

Openforis 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 web interface, without additional programming. Collect is available in both, standalone (offline) or web-based (online) versions. It is a server-client solution with an application server and a database server in the background (Apache Tomcat, PostgreSQL).

Openforis Calc

- Openforis Calc is a modular browser-based software for analysis and reporting of results of sampling inventories. It allows expert users to write custom R modules to perform inventory-specific calculations. The scripts can be written and debugged using RStudio integrated development environment for R. The input metadata and data comes directly from Openforis Collect.

Saiku

- Finally, it is possible to visualize and analyze the aggregated results through open source software Saiku. Saiku is an open-source software and it comes within Openforis Calc installation package. It offers on-line analytical processing of data as web based solution. It allows the analysis of the final processed NFI data and creating and sharing of table, graphs as reports.

Module 3: NFI Website

At the very beginning of the project, directly after the inception phase and once a hosting server has been identified and accepted, a first project website will be launched. At start of the project it shall serve:

- to inform a wider public about the NFI # 2 project. It is a part of the communication activities
- to offer the access to the below mentioned Wikipedia project management portal

Once the first results of the NFI are available they will be presented here in two forms:

- Web-GIS viewer to present results in thematic maps
- Tables and graphs produced via Saiku as preprocessed information
- Embedding of Saiku to allow expert users to retrieve and analyze data individually

The access to the Wikipedia project management portal is password secured as well as all other presentations of results. For all new content, the user access and the publication is following the agreed data sharing policy (see Task 4-9). The access to every single dataset can be individually restricted to the project team, the stakeholder or finally opened for the wider public.

In general, the NFI website can be used by the future NFI team for the next NFI cycles. However, a repetition in 10 years from now also means that the software technologies might have changed drastically. Therefore, we see the challenge to secure a regular update and maintenance of the Website. Applying modern standards for the website architecture will support this.

Module 4: Wiki based project management portal

The ToR asks for the development and implementation of a "'Wikipedia' type-Website" based on open source tools like MediaWiki[9]. This part of the website will be developed as intranet for the purposes of the NFI project management with exclusive access for the project team. It will be embedded in the above mentioned project website.

We plan the following features in combination of MediaWiki and the open source collaboration tool Next Cloud:

- Central WIKI allowing a smart access to all related document, data sets and as access point for data retrieval.
- Manuals on field work, data processing etc. developed in Wiki format
- File sharing platform
- Project calendar
- Contact board

Data analysis

The data analysis for the sampling inventory data starts with plausibility checks defined in **Openforis collect mobile**. In regular intervals and whenever a mobile data connection is available, the data are sent to the data analysis team. In **Openforis Collect,** data are compiled and can be checked for completeness and plausibility a second time. Once all relevant algorithms to process the field data are defined and implemented in **Openforis Calc**, it will be used to process the sampled cluster data. This data processing can be started during the first field phase, but will mainly be a task for the winter 2019/2020 and 2020/2021.

As mentioned in Chapter 0, after the first field phase in 2019 and timely ahead of the second field phase in 2020 a solid estimate of envisaged precision will be calculated based on the field data and time recording of the field phase 2019. On this basis, if needed, corrective actions will be suggested that could be implemented in 2020 to optimize the outcomes of the NFI # 2.

Reports in form of tables and graphs are essential outcomes and part of the data analysis process produced via **Saiku.**

Where ever spatial aspects of the data are relevant in the data analysis like distribution of cluster, plot or tree data the database content (via coordinates) will be mapped for analysis in **QGIS**. Spatial data and thematic maps will then be presented via the **WebGIS** data viewer.

You can find all related activities in the work plan.

4.1.3.6 Objective 05. Build capacity to ensure NFI sustainability

Capacity building of SAEPF staff regarding a national forest inventory and monitoring cycle is another thematic focus of the assignment. A future "Forest Inventory and Monitoring Unit" shall be able to utilize the results of the NFI # 2 efficiently and exhaustively. This NFI team shall also be able to prepare and implement future inventory cycles.

[9] https://www.mediawiki.org/wiki/MediaWiki

Tasks and activities

Tasks subsumed under this objective will build capacity for ensuring the sustainability of the NFI. The task focuses on two main fields:

- Ensure the **organizational sustainability:** This comprises developing the necessary institutional setting, the organizational structure and the technical capability to implement the NFI in Kyrgyzstan. In order to ensure sustainability, this will already include developing an implementation plan for the third NFI cycle.
- Ensure that the necessary **NFI IT-infrastructure is available** to support the utilization of the NFI results as well as the implementation of a third NFI cycle in the future.

Organizational structure

The long-term functioning of any forest monitoring system can only be achieved by a **solid organizational structure and implementation plan**. Once equipped with a good overview of the different institutions involved, we will work on a proposal for an institutional setting, organizational structure and development of technical capability to implement the NFI in Kyrgyzstan on a sustainable basis. This proposal will contain an **implementation plan** for the third NFI cycle. When delivered in September 2020, there will still be sufficient time to discuss and consolidate the concept before the end of the project.

A key feature of the organizational structure will be an “Inventory and Monitoring Unit”. As foreseen in the ToR, the TTFI team is seen as the nucleus of such an “Inventory and Monitoring Unit” under the State Institution Kyrgyz Forest Hunting Inventory and Planning (SIKFHIP). It shall “ensure continuity in transfer of knowledge and lead to long term sustainability”. With this in mind, the focus of the capacity building process will be on the TTFI team.

We will further recommend to link research on forest inventories and monitoring to the unit by establishing a structural cooperation between the “Inventory and Monitoring Unit” with the Forest Research Institute. Further, a “**FMIS team**” - responsible for information technology, the NFI software and related IT-infrastructure (see below) - should be established as a sub-unit. The NFI software, as part of the future FMIS, plays a constant role in the unit.

The establishment of an “Inventory and Monitoring Unit” is a long-term endeavor. Thus, an adequate institutionalization and sufficient staffing is a “must-have”. The NFI needs staff, which is technically able to manage inventory tasks, databases, remote sensing, mapping and data processing, based on sound forest management and information technology skills. Thus, the unit needs to link together relevant specialists to coordinate and run inventories, planning and monitoring on national and leskhoz levels. Once a special “Inventory and Monitoring Unit” is established, the continuous activities will benefit from institutional knowledge and experience.

IT-Infrastructure

Beside the organizational structure, a suitable IT-infrastructure is necessary to ensure NFI sustainability. In the following, our approach to develop and implement the components of the NFI IT-infrastructure are described (see chapter 4.1.3.5). These tasks are:

- to implement a “centralized, secure 'cloud' database” for data handling, back-up and storage. It has been requested to create the database as a cloud server using standard

protocols, per the e-Government initiative, and to be located on a virtual server hosted within the Kyrgyz Republic, paid for by the consultant for the duration of the project.

- to document the procedure of setting up the cloud infrastructure so that it may be established on a different virtual server,
- to document the server environment, so that a local ICT consultant can establish it on a new server,
- to assist in this transition prior to the completion of the project assuming suitable infrastructure is identified.

As a first step - during the inception phase - the question needs to be clarified of which location in the Kyrgyz Republic is preferred or planned by SAEPF. Optimally, the server platform for all NFI software modules should be placed in a – already existing - central governmental IT-infrastructure and administrated by a central institution. If this is not existing, a professional computing center managed by a reliable hosting and service provider[10] can be selected.

In any case, a professional service team should administer the server, the server operation system, the webserver, the DBMS, security and backups. The experts of the future "Forest Inventory and Monitoring Unit" shall concentrate on the administration of their own NFI software and data only. It can be described as an "IT-infrastructure as a service (IaaS)".

The main features of the recommended IT-infrastructure are:

- One or two central storage servers as the main hardware components. Doubling allows high performance and improves security in a storage cluster.
- For the server software, we propose a Windows Server 2016 Essentials or a Linux server, this mainly depends on the offered system of the service provider. For the webserver software, we have good experiences with either Internet Information Services (IIS), Apache HTTP Server or WampServer.
- Via a virtualization software – like VMware or Microsoft Hyper-V – the different software applications and web services can be distributed to different Virtual Machines, each of which can be controlled and managed separately, allowing a flexible load management, improved security and efficient administration.
- The Virtual Machines (VM) host different kind of services and applications:
    - Virtual File Server – where open source Next Cloud can be used as file server application.
    - Virtual Server for the websites – where the NFI website including WebGIS and the Wiki based project management portal are running.
    - Virtual servers are defined by a combination of the following three parameters.
    - Virtual Application Server – to run Open Foris Collect, Open Foris Calc and SAI-KU plus the respective databases.
- Security: A physically separated backup is necessary. In a regular routine, backups need to be saved outside of the facility (external), services of a professional computing center

[10] For example: (https://hoster.kg/) – Hoster or (http://en.prohost.kg/hosting.html) - ProHost

standard. As security software, we would propose to work with ESET Remote Administrator. Similar systems might be available from the service provider Kaspersky Security or AVG File Server Business Edition.

- Within the IT infrastructure described above the utilization of standard protocols can be secured.

This section described our overall approach for Objective 05, please find related activities in the work plan.

4.1.3.7 Objective 06. Communication and Outreach on NFI

Communication is an important tool to ensure support and acceptance of NFI outputs. It has to be seen within the overall goal of an institutional reform and capacity building. It is part of the project objective to develop a framework that provides the enabling environment for a more decentralized management and planning at the national, leskhoz, rayon, and ayil okmotu administration levels. Therefore, a communication strategy that provides a more transparent management is essential. Thus, our communication strategy will be developed with all relevant stakeholders and include **tools such as seminars, workshops, newsletters, webpages, formal reports and training measures**. Communication is embedded in our steering structure and is part of the projects awareness campaign and social mobilization strategy.

Objective

The objective is to ensure the support and acceptance of NFI outputs and to enhance transparency with regard to management of natural resources.

Target group

The target group for the communication strategy will be persons, organizations and institutions at different levels. Special attention will be given to **gender aspects** as it is important to address women specific topics and enhance equal rights and access to information. Relevant actors include:

National level

At the national level, SAEPF is the main counterpart. In cooperation with SAEPF, approaches will be elaborated for an improved sharing of data and information. Therefore, it is important to address all departments within SAEPF. This will be done mainly through meetings with the Working Group and TTFI as well as inviting other partners on a need-driven basis. Capacity building is also provided for SAEPF staff at different levels and is key to our implementation strategy. Further relevant actors at the national level include:

- **Ministry of agriculture** is an important player since management of pastures is within the responsibility of this Ministry. Key actors will be invited for workshops and seminars.
- **Ministry of Finance** will play a crucial role when it comes to financing approval of the SAEPF and implications for monitoring and next NFI. The ministry will be invited to crucial seminars and workshops.
- **National Statistical Committee** of the Kyrgyz Republic is important for data sharing and information exchange. A digital platform is envisioned, where all data of the country is

available. We will therefore try to get members into the steering structure of the project and not reduce their participation in workshops.

- **The Ministry of Economy** is working on regional development policy. They will also be included in workshops.
- **NGOs** play an important role in civil society. Several NGOs have been contracted by WB to implement the mobilization strategy, such as CAMP Alatoo, RFD, KAFLU. Their participation will improve acceptance and transparency of the process.
- **Donors,** such as GIZ, FAO, JICA, IFAD, do partially form part of the Consultative and Coordination Council (CCC) for piloting the forest sector reform. As members of the CCC, they have access to updated information and participate in the project steering and information sharing.
- **ICRAF** is doing research and capacity building and can support mapping and information sharing activities. Their participation has yet to be defined.
- **Universities** do not play a major role currently but can be an important multiplier of knowledge and information. They should be invited for seminars. Especially the University of Central Asia has good knowledge and is doing research on the ground. They could also be a partner for future inventories.
- **Forest Institute** is doing research in the forestry sector. They will be an important player in the seminars and can possibly play a major role in the future with regard to NFI and FMIS.

Regional and local level

At the regional level, the **local government** structure is important since some of the forest and pastures are under local government jurisdiction (orphan forests, forests outside SFF). In some of the seminars we have to make sure that representatives from local government participate in meetings. **SAEPF** also has representatives at the regional level and will partner in the inventory and capacity building.

At the local level, **leskhoz staff** is the main target group for capacity building and communication. They will be actively involved in the inventory. We will make sure that leskhoz directors from World Bank pilot areas will participate in some of the key workshops. **NGOs** also do work at the local level. They will be included through representatives from the national level. **Forest and pasture user associations** are important when it comes to the implementation of new strategies and in the forest sector reform. Jointly with PIU, it will be decided when and where there will be room for their involvement.

Tasks and activities

The tasks with regard to communication will start with the elaboration of a **communication strategy and plan.** The strategy will be elaborated by UNIQUE-CAREC and presented to the PIU for approval. We foresee the approved communication strategy to be elaborated and approved by February 2019. The strategy will include a work plan with milestones and precise deliverables.

The **implementation** of the communication strategy will start from approval. It will be a cross-cutting activity involving all team members. We will make sure that communication is not done

alone by UNIQUE-CAREC, but that SAEPF assumes an active role to communicate results, outcomes and outreach.

As tools for communication we suggest to implement three **seminars and workshops**:

- Methodology presentation and approval (May 2019). It will focus on the principles of statistically based sampling and the methodology to be implemented
- NFI preliminary results (March 2021)
- NFI result application and use (April 2021)

Exact structure, content and participants will be agreed on the way within our steering structure with partners. As requested by the ToR, it is foreseen that each workshop will be conducted for two different target groups: first target group is SAEPF, including the Working Group and the TTFI, second group consists of leskhozes and protected areas, relevant state agencies (SRS, NSC, MA, Forest Institute), and NGOs.

As further indicated in the terms of references, a **quarterly newsletter** will be produced by UNIQUE-CAREC, where results and challenges will be presented to the public. The target group is mainly at national and regional levels. The newsletter can be in printed or produced in digital format. The newsletter will also give room for NGOs and donors to present their topics and achievements. Universities and other partners may also be interested in presenting their contributions.

Other informational materials will be produced upon demand or request, and uploaded onto the web page. This information may include information on the sampling and inventory methodology, progress reports, challenges encountered, implications for the forest sector reform, training materials and contributions from other partners.

Evaluation

As part of our communication strategy, we will also encourage reserving sufficient space for evaluation and reflection as highlighted in the steering structure section. The above mentioned tools will give opportunities for these type of reflections. An evaluation will be done in each of the workshops, seminars and training sessions. This will help the team to improve content, tools, timing and impact. It is part of our quality assurance and important for our communication strategy.

You can find all related activities in the work plan (chapter 4.2, Table 12).

4.2 B - Work Plan

The following tables summarize the tasks, activities and corresponding outputs taking place in each of the 6 objectives. The listed tasks and activities are ordered as in the ToR, not following the time line. For the time line please see Tech-6. At the presented deadline the output is available. The timeline is assuming the start in January 2019 for the 30 months project duration.

Table 7: Objective 01: Review the scope of NFI and adjust the current methodology and sampling design - Tasks, activities, outputs

Task ID	Task Title	Activities		Output	Deadline
1-1	Information needs assessment	1-1-1	Assess information needs for all users (key line ministries, international reporting bodies, research institutions and other relevant stakeholders), review national policy requirements to be addressed by NFI. Include consolidated expectations on the precision of the NFI statistical estimates and the accuracy of the National Land cover Classification.	Report on information Needs Assessment & enhanced stakeholder appreciation of scope (and limitations) of NFI	Jan 2019
		1-1-2	Conduct a national validation workshop on the outcome of information needs assessment to present and consolidate the information needs for the NFI # 2.		
1-2	Review and update of the NFI # 1 field survey methodology	1-2-1	Review and update NFI # 1 field survey methodology towards a NFI #2 methodology based on updated information needs and on a technical review of the efficiency of the NFI #1 methodology. Consider for the NFI #2 methodology the planned software and maintaining backward compatibility with NFI # 1 and minimize unnecessary changes.	Revised field methodology	Feb 2019
1-3	NFI Time schedule	1-3-1	Propose a time schedule for the required outputs. Consider that outputs have to be approved not later than June 2021. Include realistic timescales for all necessary recruitments, equipment procurements and other critical path items.	Project schedule	Feb 2019
1-4	Anticipated variance establishment	1-4-1	Establish anticipated variance in six main forest types (shrubs, walnut, pistachio, coniferous, juniper and deciduous forests) in NFI # 2 based on the new NFI # 2 methodology, the NFI # 1 data and external information sources, where the NFI # 1 data are not sufficient to derive a solid estimate. Include in this analysis all anticipated vari-	Report on required sample sizes	Feb 2019

			ances for further major objectives agreed during the inception phase.		
		1-4-2	Prepare a report on anticipated variance and a sensitivity analysis for required sample sizes to achieve target precision in each stratum and include proposals for measures in case the planned field work volume is not sufficient to achieve the consolidated precision expectations that are part of the information needs assessment.		

Table 8: Objective 02. Perform a national land cover classification - Tasks, activities, outputs

Task ID	Title	Activities		Output	Deadline
2-1	Workshop on definitions and Land Cover Classification System	2-1-1	Retrieve information needs for land cover assessment from information needs assessment in Task 1-1	Report on definitions and Land cover classification system	Jan 2019
		2-1-2	Workshop on definitions and Land Cover Classification System (combined with National Validation workshop on the outcome of information needs assessment of Task 1-1).		
2-2	Training course on open source tools for GIS & remote sensing	2-2-1	Develop a training course on open source tools for GIS and remote sensing for free available imagery, for example Landsat and Sentinel and other available under Google Earth or Google Engine, and any relevant datasets available in the country.	Training material prepared and report of the attendance of the training	Dec 2019
2-3	Land cover stratification	2-3-1	Develop systems of land cover classification, taking into account the national and international classification (categorization) systems in order to increase comparability with other data (for example, comparability with the data of the KR National Statistic Committee and Convention of Biodiversity data). Considering: 1. NFI # 2 data should be as flexible as possible (goal 2). 2. Ensure that the system for data collection and analysis of NFI # 2 is aligned with this goal and also minimizes the risk of data entry errors. 3. Same approach will be used in future for land cover change detection purposes.	Land and forest cover map and a forest type distribution map	Feb 2020
		2-3-2	Gather all necessary spatial data and layers connected to the NFI and the national land cover classification, and **set up a GIS Project**		
		2-3-3	Implementation of the **pre-stratification** in separate forest types / strata		
		2-3-4	Implementation of the **pre-clarification** for		

Task ID	Title	Activities		Output	Dead-line
			each of the sample locations (clusters), resulting in list to be surveyed in the field		
		2-3-5	**Stratification** of the land cover (per Land-Cover Classification System (LCCS) - wall to wall - (preparing map layers) using free remote sensing datasets and Google Earth Engine or similar.- > providing maps layers for multiple use –> input to and utilization in the estimation stage of the NFI (Field data analysis – means, totals and their sampling error per analysis entity)		
		2-3-6	Implementation of the **classification algorithms** based on the **ground truthing data**, and the production of a **Draft Map** of national land cover.		
		2-3-7	Implementation of the classification and the production of a **Final Map** of national land cover.		
2-4	Verification of the interpretation results	2-4-1	Carry out verification of the interpretation results of activity 2-3-7 (via field or desktop interpretation) and edit, finalize, **validate and reproduce the final land forest map**. Produce confidence estimates for the land cover and provide map accuracy assessment statistics.	Report on verification	Mar 2020
		2-4-1a	Implement the **verification of the Draft Map** using the prepared independent reference data set.		
		2-4-1b	Implement the **verification of the Final Map** using the prepared independent reference data set, including the preparation of the land cover and accuracy statistics		
2-5	Training on the classification and verification processes used	2-5-1	Provide specific training on the classification and verification processes used.	Training material prepared and report of the attendance of the training	Dec 2019

Table 9: Objective 03. Execute the NFI # 2 field survey – tasks, activities and outputs

Task ID	Title	Activities		Output	Dead-line
3-1	Field equipment list	3-1-1	Propose a field equipment list (and quantities) that will be the minimum required to execute the fieldwork.	Finalized hardware list	Jan 2019
3-2	Plan for	3-2-1	Prepare a plan for implementation of field	Work plan for the	Apr

	implementation		survey, logistics, supervision of project activities in the office and field.	implementation of field work developed/updated	2019 with updates in Mai 2019 and for the field phase in 2020.
		3-2-2	Develop an estimate for field team days for field work, taking into account all factors (relief, complexity, distance, forest type) Finalize on this numbers the number of field groups and field equipment		
		3-2-3	Develop the plan stepwise based on the plan presented in this proposal: -first in the course of the inception phase and revise the plan after the finalization of the field plot pre-clarification on basis of the knowledge on the final amount of field survey clusters and plots - revise again after the experiences from the field training preparations and field training on the time needed to conduct the field measurements. - Update continuously with TTFI on the basis of the performance of the field work execution. Consideration of Unique/Carec supervisors and contracted local field staff and SAEPF staff		
3-3	Quality assurance protocols	3-3-1	Define quality assurance protocols that maximize transparency and control over the field data collection process.	Quality assurance procedure produced	Apr 2019
3-4	Field element execution	3-4-1	Execute the field element including field survey with the teams contracted by Unique/Carec	Field data collection completed to specification during 2019 & 2020 field seasons; accompanied by a quality assurance bi-weekly reports and a final field data collection quality and performance report.	Oct 2020
		3-4-2	Implement permanent field control and quality assurance. Prepare on a bi-weekly bases **quality control reports** during the field survey and identify for any issues necessary corrective measures in the report. Apply immediately any needed corrective measures. Compile at the end of the field data collection a field data collection quality and performance report.		
		3-4-3	Preform a quality check of data using the NFI software on bi-weekly basis and integrate the findings in the bi-weekly bases quality control reports and the final field data collection quality and performance report		
3-5	Open Foris Collect Mobile for use in NFI # 2	3-5-1	Configure and test Openforis Collect Mobile for use in NFI # 2 using centralized database storage. Execute this task together with Task 4-3.	Open Foris Collect Mobile project developed	Apr 2019
3-6	Training in Open Foris Collect and	3-6-1	Provide training in Open Foris Collect and Collect Mobile design to central NFI team. Provide this training ahead of the field team	Training material and report of the attendance of the	Jan 2020

	Collect Mobile design to central NFI team		training and again in the final stage in the course of the capacity building for the sustainably of the NFI process.	training prepared	
3-7	Training on data collection	3-7-1	Prepare a permanent set of training sites comprising a sufficient number of tracts in all six major forest types for testing all techniques, field equipment and the mobile data collection software.	Capacity building plan and training courses developed including training materials provided	Jun 2019
			Test the field data assessment methodology and equipment at the permanent training sites		
			Train the Unique/Carec team and TTFI - NFI team, including a training on mobile data collection		
		3-7-2	Conduct the field training for all teams, supervisory staff and SAEFP staff. Include field work training modules on mobile data collection for all teams supervisory staff and SAEFP staff.		

Table 10: Objective 04. Compile, analyze and report on the survey data – tasks, activities and outputs

Task ID	Title	Activities		Output	Deadline
4-1	Plan and design the information system for NFI data collection and analysis	4-1-1	Directly at start of the project a period of ca. 2 month will be used to draft a detailed concept and design of the NFI software modules and their specific adaptations to the needs and conditions in Kyrgyzstan. The concept includes an implementation and financial plan. Envisaged software tools are: Openforis (Collect, mobile collect, Calc, Saiku), for the LCA and mapping QGIS, a Field GIS and Openforis Collect Earth for the activity of pre-clarification will be used.	Design of the information system for NFI data collection and analysis developed	Feb 2019
4-2	System setup for NFI data collection and analysis	4-2-1	The modules will be adapted, configured and implemented step-by step, driven by the needs to use them as tool during the NFI. The NFI website, the wiki based project management portal and QGIS are the first 3 modules, followed by Openforis collect and collect mobile. Parallel to the first field phase 2019 Openforis Calc and Saiku will be configured. Each implementation cycle will include several test loops.	Information system for NFI data collection and analysis in place	Feb 2020
4-3	Open Foris Collect	4-3-1	The language adaptation to localize Openforis Collect and Collect mobile will be per-	Localized version of Openforis	Apr 2019

Task ID	Title	Activities		Output	Deadline
	Mobile in Russian language		formed as part of the software adaptation and in parallel with task 3-5, resulting in a Russian language version.	Collect Mobile tested and accepted	
4-4	Training to SAEFP staff in data analysis	4-4-1	A 3-days training is organized on the data analysis workflow and data management before the final data analysis starts in 2020. Additional training on-the-job for the TTFI will be offered.	Training material and training course for SAEFP staff developed on NFI data management	Sep 2020
4-5	Allometric models for volume and biomass	4-5-1	In the first months existing allometric models for height, volume, biomass and carbon estimations per tree species are reviewed and evaluated	Report on tree species allometric models in Kyrgyzstan and the procedures to generate new ones provided	Aug 2019
		4-5-2	In case of information gaps, support to SAEFP will be provided on how to generate new allometric models combined with the relevant instructions on developing the missing models.		
4-6	Compilation, analysis and reports on the survey data	4-6-1	Along with the field survey, data are checked, compiled and analyzed; Processing and reporting is tested. After each field survey (2019, 2020) data are completely analyzed. The interim analysis of the 2019 survey data will include an analysis of the anticipated variances of the full inventory and will include proposals for corrective measures if indicated. The final analysis in 2020/2021 includes a comparative analysis with NFI#1. FAO terms and definitions per the country reporting process for the Global Forest Resources Assessment 2015 (FRA 2015) are considered.	NFI report completed	Feb 2021
		4-6-2	Test analysis of 2019 field data (in parallel with the software performance test)		
		4-6-3	Final data analysis after second field campaign in 2020		
4-7	Implementation of a Website to host the results (in Russian and English).	4-7-1	The NFI Website shall host the results, but also support NFI capacity building and dissemination. It will be designed with multiple NFI cycles in mind and allow for self-service of NFI results by the public.	Website completed	Mar 2021
		4-7-2	During the first month an initial “Website – Initial” will be established and improved and updated step by step.		
		4-7-3	The “Website-final” includes the final NFI data and retrieval techniques (embedded		

Task ID	Title	Activities		Output	Deadline
			Saiku and Web-GIS)		
4-8	Implementation of project 'Wikipedia' type-site to handle internal documentation	4-8-1	A password secured project 'Wikipedia' type-site to handle internal documentation will be established based on a common server technology such as MediaWiki.	NFI Wiki site established and open for user edits	Feb 2019
4-9	Data sharing policy	4-9-1	Support is provided to SAEPF formulating a data sharing policy for the NFI data and information, including a confidentiality plan to safeguard tract locations.	Data sharing policy document developed	Oct 2020

Table 11: Objective 05. Build capacity to ensure NFI sustainability – tasks, activities and outputs

Task ID	Title	Activities		Output	Deadline
5-1	Institutional setting	5-1-1	Propose the necessary institutional setting, organizational structure and technical capability to implement NFI in Kyrgyzstan on sustainable basis.	Report of proposal supplied	Sep 2020
5-2	Implementation plan for the third NFI cycle	5-2-1	Develop an implementation plan for the third NFI cycle (to be executed on a continuous basis).	Plan for NFI # 3 supplied	Sep 2020
5-3	'Cloud' database for data handling, back-up and storage	5-3-1	Implement a centralized and secure 'cloud' database frame for data handling, back-up and storage using standard protocols as per e-Government initiative. It shall be located on a (virtual) server hosted within Kyrgyz Republic, paid for by the consultant for the duration of the project.	Cloud server environment implemented	Apr 2019
5-4	Documentation of the procedure of setting up the cloud infrastructure	5-4-1	Document the procedure of setting it up the cloud infrastructure so that it may be established on a different virtual server. Assist in this transition prior to the completion of the project assuming suitable infrastructure is identified.	Server environment documented that it can be established by a local ICT consultant on a new server Assistance given in transition	Apr 2021

Table 12: Objective 06. Communication and Outreach on NFI – tasks, activities and outputs

Task ID	Title	Activities	Output	Deadline

6-1	Communication strategy and a plan	6-1-1	Develop a communication strategy and a plan to ensure support and acceptance of NFI. The strategy will include a work plan with milestones and precise deliverables.	Communication strategy developed and approved.	Feb 2019
6-2	Implementation of a communications plan	6-2-1	Implement a communications plan. The plan includes tools such as: seminars, workshops, newsletter, web page, formal reports and training measures as agreed worth the main partners.	Report on outreach activities implementation	Apr 2021
6-3	3 seminars and workshops		Organize 3 seminars on project achievements and methodological issues, emphasizing the principle of a statistically sound sample based inventory. Each Workshop should be conducted for two different target groups: ▪ SAEPF staff including the Working Group and the TTFI ▪ Leskhozes and protected area managers, relevant state agencies (SRS, NSC, MA, Forest Institute) and NGOs-	Seminar/workshop proceedings	Apr 2021
		6-3-1	Hold a seminar on the principles of statistically based sampling and the methodology to be implemented.		
		6-3-2	Hold a conference presenting the results of the NFI # 2.		
		6-3-3	Hold a workshop to focus on NFI application and use of NFO results for monitoring, reporting and planning.		
6-4	Newsletter on a quarterly basis	6-4-1	Develop and issue a newsletter (informational bulletins) on a quarterly basis on the NFI issues and deliverables. Results and challenges will be presented to the public	Quarterly newsletter	Apr 2021
6-5	Information materials	6-5-1	Prepare draft information materials and provide it to the TTFI for further dissemination and website maintenance.	Information uploading to the website; NFI website is regular updated\maintained	Apr 2021

4.3 C - Organization and Staffing

4.3.1 Team composition

For this assignment, we have brought together a strong team that firmly meets the requirements of this assignment. The consortium of UNIQUE and CAREC combine long-standing international forest expertise with in-depth knowledge of the Kyrgyz forestry sector. Regarding the composition, we have placed great emphasis on complementary expertise and experience. The following Figure 21 presents the team split up by functional groups, their profile, position and roles. Specific importance was given to build on national experience provided by CAREC and

national forest experts combined with in depth technical knowledge of international experts. Several experts were involved in the previous forest inventory and are familiar with SAEPF processes and administration. The local national forest experts will guide the field work with up to 25 teams, while the international experts will guide the technical expertise such as forest inventory methodology and statistics, IT, GIS and remote sensing. Communication will be a crosscutting issue. The following figure gives an overview on the suggested team composition.

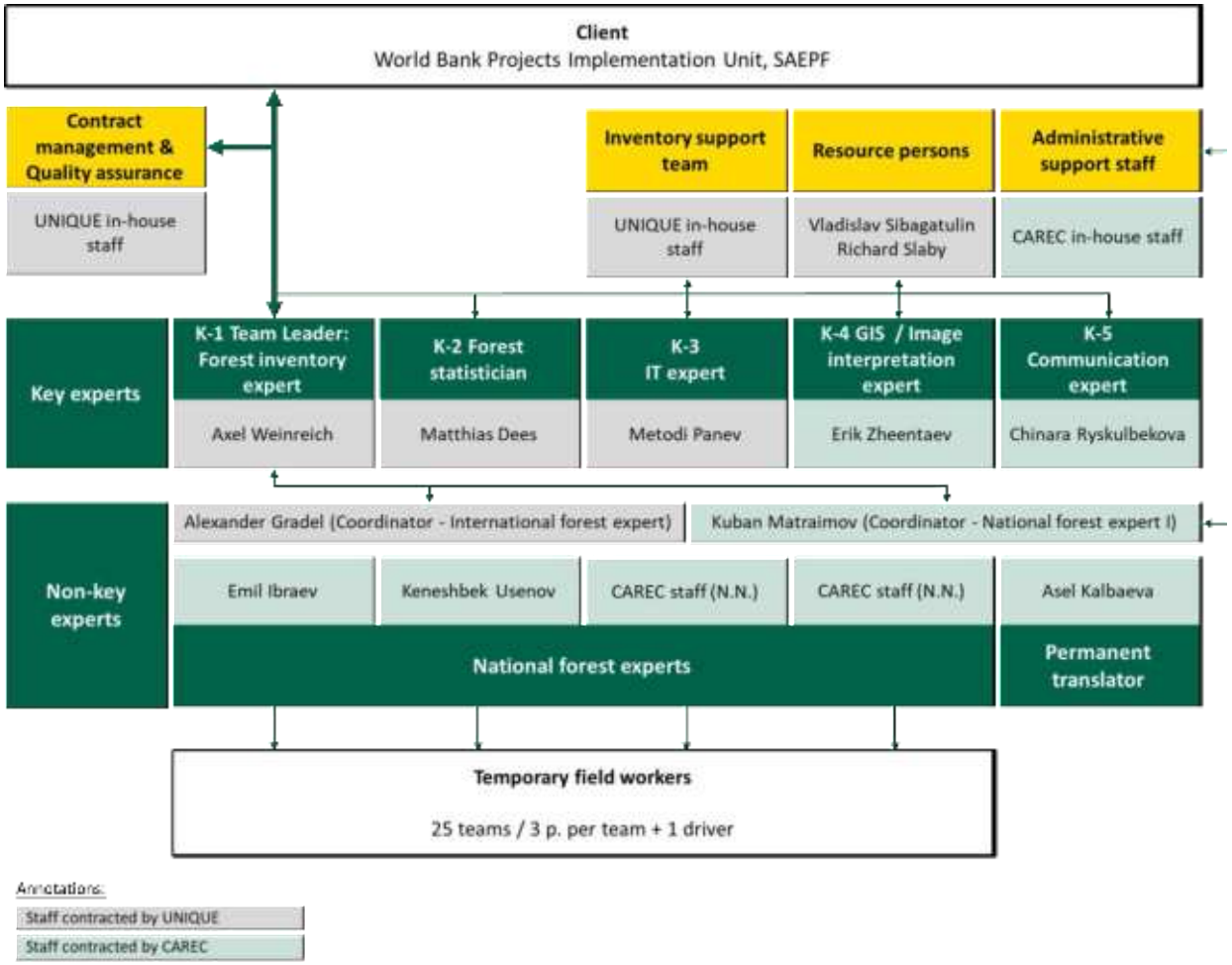


Figure 21: Team Composition

The team of key experts

As illustrated in Figure 21, UNIQUE will provide three key experts: The Team Leader Axel Weinreich (K-1), the Forest statistician Matthias Dees (K-2), and the IT-expert Metodi Panev (K-3). All three experts are members of the UNIQUE in-house staff and coordinate on a daily basis. They jointly implemented a considerable number of assignments in relevant topics in Central Asia and Eastern Europe for the World Bank, GIZ and and KfW. This includes, for instance, the National Forest Inventory in Georgia and Forest Inventory and services for Forest Management Planning in Tajikistan (see project references in section 2.2 - B). CAREC will provide two key experts, including the GIS and Image interpretation expert Erik Zheentaev (K-4) and

the Communication expert Chinara Ryskulbekova (K-5). Both experts maintain a long-term work relationship with CAREC. Both firms maintain long-term work relationships with the experts ensuring fluid communication and cooperation processes additional to the technical expertise.

The team of non-key experts

For the team of non-key experts, UNIQUE provides the International forest expert Alexander Gradel. He will be responsible for the on-site coordination and a constant point of contact for PIU, SAEPF, the working Group, and the national forest experts. He will be based in the Kyrgyz Republic during the fieldwork phases. CAREC provides in-house staff to fill the positions of the five national forest experts. Kuban Matraimov, who will be the coordinator of the national forest expert's team, will take the lead. He will work closely with Alexander Gradel, the International forest expert provided by UNIQUE. Emil Ibraev and Keneshbek Usenov will be two further national forest experts provided by CAREC on a continuous basis. For the intensive fieldwork phases, CAREC will provide two further national forest experts on a part-time basis. The team of national forest experts will directly coordinate the temporary field workers provided by SAEPF. Moreover, CAREC provides the permanent translator Asel Kalbaeva. Communication will be safeguarded by the communication expert.

The team of support staff and resource persons

As further shown in Figure 21, the consortium will be responsible for contract management and quality assurance, based at the UNIQUE headquarters in Germany. The consortium has proven experience in managing multi-annual contracts with international donors and subcontracts as well as the quality assurance of service products and processes. The team leader will be the main point of contact for the client, with backstopping services of the UNIQUE headquarters. On technical aspects, the team of key experts can draw on the expertise of the Inventory support team based at the UNIQUE headquarters. Moreover, Vladislav Sibagatulin and Richard Slaby will be available as **independent resource persons. Both have been involved in the NFI # 1 and will contribute valuable experience**. CAREC provides full-time national administrative support staff that will support the national forest experts on contractual matters and will be responsible for the local administrative management of the temporary field workers.

4.3.2 Presentation of team members

Following an approach of close collaboration, each key expert will always be able to access the expertise of the colleagues. This will enable a fruitful exchange of knowledge and guarantees a smooth flow of the project process. As a result, the team of key experts combines strong skills in the organization and implementation of forest inventories, remote sensing and GIS as well as managing and analyzing forest data. Communication and capacity building is seen as a cross cutting issue throughout the whole process

Table 13: Key experts matrix

Required qualifications (as per TOR)	**K-1 Team leader - Forest inventory expert** Dr. Axel Weinreich	**K-2 Forest statistician** Dr. Matthias Dees	**K-3 IT expert** Metodi Panev	**K-4 GIS & Image interpretation expert** Erik Zheentaev	**K-5 Communications expert** Chinara Ryskulbekova
Academic background in forestry	PhD	PhD	MSc Geoinformatics / MSc Forest Ecology and Management	MSc in Geodesy	MA Linguistics
Forest inventories	▲▲	▲▲	▲	△	△
Forest statistics	▲	▲▲	▲	▲	-
Use of virtual servers and database management	▲	▲	▲▲	▲	-
GIS, image interpretation, remote sensing	▲	▲▲	▲▲	▲▲	-
Compile and implement communication strategies	▲	▲	△	△	▲▲
Additional qualifications / assets					
Field data collection	▲▲	▲▲	▲▲	△	-
Forest Information systems – NFI and inventory software	▲▲	▲▲	▲▲	-	-
Capacity building / training	▲▲	▲▲	▲▲	△	▲
Regional experience in Central Asia	▲	▲	▲	▲▲	▲▲
Proficiency in English and German	▲▲	▲▲	▲▲	▲▲	▲▲
International cooperation	▲▲	▲▲	▲▲	▲▲	▲▲

Key expertise: ▲▲ Main expertise: ▲ Support expertise: △

For each position, one key expert has been nominated who can draw on many years of experience in the designated topics. As explained above, the team of key experts will be supported by a number of non-key experts. The following section gives an overview of all experts involved including the key experts, the forest experts and the permanent translator. CVs that are more detailed can be found in the attachment.

K-1 Team leader / Forest inventory expert: Dr. Axel Weinreich

Dr. Axel Weinreich graduated in Forest Management and earned his PhD in Silviculture and Forest Management. Since then he has been responsible for projects covering all aspects of sustainable forest management in natural forests worldwide at national and regional levels. He

has more than 20 years of professional experience. His key qualifications include **forest management planning, forest inventory, business process- and information analysis and re-engineering, GIS and forest information systems**.

As a team leader, he is **supporting the GIZ by designing a forest monitoring and information system in Georgia** since 11/2015. Moreover, Axel Weinreich worked as a GIS and IT consultant for the KfW-funded project "**Forest Inventory and Forest Mapping** Kharagauli Forest**"**.

Since 2005, he has worked in Montenegro as a technical consultant in the FODEMO (Forestry Development in Montenegro) project. Among other things, he supported the Ministry through the introduction of a **central forest database**, the implementation of an operational **monitoring system** and the improvement of forest management planning. The private forest has also been integrated into forest management planning. As an additional component, Mr. Weinreich has been supporting the integration of NATURA 2000 into forest planning and forest management.

With **more than 15 assignments as an international team leader in forest inventory and forest management planning projects**, Axel Weinreich is well-versed in taking over project management responsibilities. Since 2015, he has been the international team leader of the BMEL funded project "Implementation of an innovative forest management planning in Serbia". He leads the coordination of activities with State Forest Enterprises, Forest producer associations, NGOs, local government authorities and communities.

As a capacity building and institutional development expert of approximately 10 assignments worldwide, Axel Weinreich gained in-depth understanding of the adaptation of didactic concepts, considering different target groups and cultural backgrounds.

Besides his long-standing experience in the **cooperation with forest administrations in Georgia**, he gained regional experience as a technical backstopper for forest management planning and monitoring projects in Tajikistan and Kazakhstan.

We are convinced, that with his profound technical understanding of a wide range of aspects relevant for the assignment, his **comprehensive practical experience in implementing forest inventories and forest management planning**, his longstanding experience in working for/with forest administration in post-Soviet contexts and his expertise in project planning and management, Axel Weinreich is the best expert in place as a team leader. Dr. Weinreich is fluent in English and has excellent writing and reporting skills.

K-2 Forest statistician – Matthias Dees

Dr. Matthias Dees is one of the well-recognized international experts on **forest statistics, inventory, remote sensing analyses** and **forest data management**. Since 11/2007, he is associated professor at the Chair of remote sensing and landscape information system at the University of Freiburg, Freiburg, Germany giving regularly lectures on forest inventory, remote sensing analyses and forest data management.

As a freelance consultant, Matthias Dees has successfully completed **more than 30 assignments on forest inventory, remote sensing, forestry statistics, data management** and internet based software solutions. In this context, he has worked for a number of national and international institutions (e.g. KfW, EU DG Research, BMEL, ESA, DLR; IUCN) and private companies.

Currently, Matthias Dees is supporting the BMEL in **Serbia, Ukraine and Cameroon** by adjusting **forest inventory and forest information management systems**. From 2009 to 2012, Matthias Dees was international team leader of the national forest inventory in **Montenegro**.

Due to his profound technical knowledge, Matthias Dees has been announced as work package leader for several operational and research and development projects on forest mapping and monitoring. Currently, he is leading the WP Monitoring Forest Disturbances in the H2020 project DIABOLO that focuses on National Forest Inventory method development.

In **Georgia** in 2017, he was involved in the **planning phase of the national forest inventory implementation**.

Due to his longstanding experience as a lecturer at the University of Freiburg and as freelance consultant, Matthias Dees is well-versed in **designing and implementing training courses** on all tasks related to forest inventories. He has proven that for different target groups and in varying cultural contexts (e.g. by providing training central European countries, e.g. Germany, Eastern and South Eastern European Countries, e.g. Ukraine, Montenegro, Asia, e.g. Pakistan, Indonesia and Cameroon, Africa).

K-3 IT expert - Metodi Panev

Metodi Panev obtained a M.Sc. in Geography in Skopje, Macedonia and a M.Sc. in Forest Ecology and Management in Freiburg, Germany. In addition, he holds a **M.Sc. in Geoinformatics** from the University of Salzburg. Mr. Panev has been working with UNIQUE for nine years.

Metodi Panev has a strong background in **GIS, remote sensing and spatial analysis in forestry and land use** including analysis and modeling and implementation of Geospatial solutions, design of spatial databases as well as image interpretation and land use classification. He has worked on several projects involving the use of remote sense data and their analysis, he conducted spatial analysis and land use classification for several afforestation / reforestation projects in India, Indonesia and Tanzania as well as for REDD+ projects in Ethiopia and Cameroon. Currently, he is working on a project in **Tajikistan** for KfW where his main task is **Forest Cover Assessment (FCA)** with the use of remote sensing techniques.

Mr. Panev is furthermore experienced in **large-scale forest inventory** projects including the design and **implementation of forest inventories**. He was involved in design and implementation of the national forest inventory in Montenegro, the private forest inventory in Luxembourg and national park inventories in Macedonia.

As an integrated CIM expert, he was part of the team working on the National Forest Inventory in Colombia for two years, where his tasks concentrated on methodology development and improvement, data analysis but especially the **implementation of remote sensing data and GIS as part of the inventory and analysis**.

In **Georgia,** Mr. Panev was involved in the KfW project "**Forest Inventory and Forest Mapping** Kharagauli Forest as a basis for sustainable forest management planning in Georgia" where he was involved in the development of the mapping methodology as well as in the implementation of the forest inventory and management software. Metodi Panev has excellent English language, basic knowledge of Russian and reporting skills.

K-4 GIS / Image interpretation expert

Erik Zheentaev graduated with a diploma (with honors) in **Geoinformatics** from the Institute of New information technology, Kyrgyz State University (KSUCTA). The theme of his diploma was **"GIS Project for assessment of territory for reforesting in Kyrgyzstan"**. He further holds a Master Degree in "Geodesy" (Geodetic support construction of engineering structures) from the Department of Geodesy and Geoinformatica of KSUCTA (diploma with honors). Currently, Mr. Zheentaev is enrolled in a PhD program at the National Academy of Science of the Kyrgyz Republic, Institute of Geomechanics and development of mineral resources. The topic of his PhD thesis is: "Application of Remote Sensing Technologies for the Environmental Impact Analysis in Kumtor Gold Mining Company".

In parallel to his PhD program, Mr. Zheentaev works as a **GIS & RS specialist for the Community Development and Investment Agency ARIS** in Bishkek. Here, he is mainly responsible for **geoformation technology (including GIS and RS)** related to pasture inventory and pasture management planning in several projects. Before, he has been working as a teacher at the Department of Geodesy and Geoinformatics at Kyrgyz State University and led seminars in **Geoformation Systems, IT, GPS, Automatization of Surveying, Digital Cartography, WebGIS and Remote Sensing.**

Erik Zheentaev gained **profound experience in the sector of international development** by working as a leading specialist for GIS and RS for **different clients and programs such as UNDP**, **UN World Food Program and USAID**. His work included the creation of Geo-database, digitization of maps and RS based classification of land cover and visual interpretation. Mr. Zheentaev is fluent in English and Russian and has excellent writing and reporting skills.

K-5 Communication expert - Chinara Ryskulbekova

Chinara Ryskulbekova is a Communication Specialist with extensive experience in communication and media. She has more than 15 years of working experiences with **international projects** addressing various development and environmental issues, including **forest management issues in Kyrgyzstan**. For more than 10 years, Ms. Ryskulbekova was a **project specialist for UNDP Sustainable Development Program**, a UNDP Governance project financed by the EU and implemented by five UN agencies and many other projects involving environmental components.

She has **led various advocacy and awareness raising campaigns** at national and local levels to promote the idea of sustainable development and influence the attitudes and behaviors of actors and beneficiaries of projects. Her focus also includes conservation of biocultural diversity and traditional knowledge (she has led a project on facilitation of communication and networking among local traditional knowledge holders) as well as **using digital media and storytelling tools** in addressing environmental problems. She **trained many non-government organizations** to strategize and plan their communication properly and use different social media tools to promote their activity.

International forest expert (Coordinator) – Alexander Gradel

Dr. Gradel holds a Ph.D. in Forest Sciences and Forest Ecology (Göttingen) and Master Degrees in Agriculture and Forestry (Joensuu, Finland) as well as in International Nature conservation (Göttingen, Germany / Lincoln University, New Zealand).

Alexander Gradel looks back on more than 10 years of work experience in the fields of **forest planning and management, inventories, afforestation, silviculture**, forest policy and international cooperation. Most of his work and research tasks took place in the **forest steppe zone and arid mountain areas of Inner Asia**.

He gained experiences from different perspectives on inventory and forest management planning, partly also related to JFM and participatory forestry. Alexander has gathered experience concerning **forest management planning in Tajikistan** (with HessenForst and GIZ) and concerning climate cooperation in Russia (GIZ). In Sachsen (Germany), he conceptualized assessment methodologies for a comprehensive nature forest monitoring and supervised the reassessment of the nature forest reserves. In **Mongolia and Buryatia,** he led the establishment and monitoring **of reference plots and silvicultural monitoring trials** (partly supported by FAO, the European Commission and DAAD-funding and implemented with local staff). He is main author of several scientific publications and regularly contributes to respective conferences.

Alexander Gradel has experience with the wood processing industry sector: in affiliation with the company SCS (Scientific Certification Systems) Global Services he conducts audits as FSC-Lead Auditor (Chain of Custody). Independently from this affiliation he also works as a consultant (e.g. when focusing on sourcing of legal timber trade). In addition to his very good English language skills, he speaks **Russian fluently** and therefore will be able to discuss directly with all relevant stakeholder. This will be an additional asset when it comes to capacity building. As in previous projects, he will ensure that the practical implementation is in compliance with the technical planning objectives.

National forest expert (Coordinator) – Kuban Matraimov

Kuban Matraimov is a specialist in forest management with extensive experience in forest inventory in Kyrgyzstan. He has more than 13 years of experience in forest planning and inventory for forests in the country. He worked 5 years as the head of the Department and 4 years as the Deputy head of the Department of forest management. Mr. Matraimov has participated in the development of cartographic materials and database for forestry enterprises (leskhoz), and forest resources database at the national level. **He was a national technical expert and project Manager during the national forest inventory, conducted for the first time in Kyrgyzstan (2009-2011)**. Mr. Matraimov was closely involved in supervising field works and data processing.

Since 2013, while working in CAREC, he actively promotes the principles of ecosystem services, was the national coordinator for the project on the introduction of Payments for ecosystem services (2013-2014), was **a regional coordinator** of the project on economic assessment and mapping of ecosystem services in Central Asia. Since 2017, in the CAREC team, he has been working in the direction of sustainable use of water and natural resources (basin planning). Now Mr. Matraimov **is the coordinator** of the pilot areas for the Central Asian countries on the project “Smart waters”. Within the framework of the GEF-FAO project "Sustainable management of mountain forests and land resources of Kyrgyzstan in the context of climate change", he was a national expert on the development a business plan for pilot leskhoz.

He is a co-author of several forest inventory guidelines, planning, mapping and data processing at the leskhoz level, National forest inventory guidelines, guidelines for economic assessment and mapping of ecosystem services.

National forest expert (local) – Ibraev Emilbek Bekboevich

Ibraev Emilbek Bekboevich has **30 years of work experience in fields of forestry** and especially protected areas. During his work as a director of the technical department for management of walnut forests, he participated in the development of the **forest management principles** within the KIRFOR project (Swiss Support program).

Between 2008 and 2015, he cooperated with a number of international projects: In cooperation with RDF (Rural development fund), Mr. Bekboevich developed a manual of **natural resources estimation** and the management plan of natural resources for local areas. With his participation, **simplified methods of forest estimating and principles of forest accountings** for local communities were developed. Within the Norwegian forest group project, he took part in the **development of a management plan of community pastures**. Within the GTC project he conducted a feasibility study on processing of a sea-buckthorn for Kochkor leshoz and communities. Within the LKA project, he participated in carrying out sociological researches on questions of consumption of natural resources by local population of the Issyk kul and Tyupsky districts of the Issyk kul region.

He was involved in the development of several NPA acts in fields of **forest regulation and control** of especially protected natural territories. He actively contributed to the updated law "About Especially Protected Natural Territories of KR", in development of management plan of natural parks.

National forest expert (local) – Usenov Keneshbek

Usenov Keneshbek has been a **forester** and topographer in Kyrgyzstan **since 1999.** In the field of forestry, he worked as part of a working group of foresters in several domestic and foreign projects and has **long-standing experience in Forestry in Kyrgyzstan**. In cooperation with foreign colleagues, he worked on the international standard of forest **inventory management**. With the working group in the Uzgen, Kara-Kuldzha and Aflatun (southern Kyrgyzstan) on forestry, he was involved in the Kyrgyz-Swiss forestry support program "Lesik". He then was the coordinator of the field group for the Tien Shan ecosystem development program and the forest assessment of the project for the organization and development of the Besh-Aral State Reserve within the framework of the Transboundary Conservation Project, biodiversity of the Western Tien-Shan under the GEF (Global Environment Facility) project.

Mr. Keneshbek was the head of the group on cadastral survey of agricultural lands in the Alamudun district of the Chui region (northern Kyrgyzstan). He was actively engaged in surveying the earth's surface and establishing boundaries. In this area, he was in charge of one of the groups on border management of rangelands in rural districts of the Chui oblast as part of the **World Bank project**. He took part in geodetic surveys of the cities of Sulukta and Kerben to ensure clean water for the population, together with the German company "Hydroplane" within the framework of the **World Bank project**. In addition, as a mine surveyor, he practiced in the Joint Stock Company "KYRGYZALTYN" and in the state enterprise as well as in many non-governmental projects. Currently he heads the companies of LLC "Ecolesproject" and LLC "Rumb Service".

Permanent translator – Asel Kalbaeva

Asel Kalbaeva graduated **linguistics in Kyrgyz National University**. She worked as a **translator and as a specialist on international projects** and international collaboration of the Kyrgyz National Agrarian University (KNAU). She has **10 years of professional experience.** Her key qualifications include **translation of documents, materials, publications, reports of international projects,** organization and **conducting workshops, conferences, logistics** and is familiar with visa issues. For example, some of her translations have been on:

- Multilevel approach for determining variety change and dissemination of plants by Global Observation Research Initiative in Alpine Environments (GLORIA, Austria).
- Risk of extinction of plants (Isla Burgess, New Zealand)
- Some materials from book "Sacred Ecology" (Dr. Fikret Berkes, University of Manitoba)
- Information on web site of the Biocultural Diversity Center of KNAU

While working for the international collaboration center of KNAU, she conducted numerous negotiations with foreign and local partners at high levels. Additionally, she has English language teaching skills. She worked as an assistant for the international project on traditional knowledge of the Kyrgyz people for three years.

5 FORM TECH-5: WORK SCHEDULE AND PLANNING FOR THE DELIVERABLES

Form TECH-5

WORK SCHEDULE AND PLANNING FOR DELIVERABLES

		Month (2019)												Month (2020)												Month (2021)				Total
Task	Tasks and Outputs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	(Month)
0-1	Kick-Off Workshop																													1,7
Objective 01. Review the scope of NFI and adjust the current methodology and sampling design																														
1-1	Assess information needs	O 1-1																												1,9
1-2	Review and update NFI # 1 field survey methodology		O 1-2																											1,2
1-3	NFI Time schedule		O 1-3																											0,8
1-4	Establish anticipated variance		O 1-4																											0,4
Objective 02. Perform a national land cover classification.																														
2-1	Workshop on definitions and Land Cover Classification System	O 2-1																												1,7
2-2	Training course on open source tools for GIS and remote sensing for free available imagery												O 2-2																	2,1
2-3	Stratify the land cover														O 2-3															9,5
2-4	Verification of the interpretation results															O 2-4														1,0
2-5	Training on the classification and verification processes used												O 2-5																	0,7
Objective 03. Execute the NFI # 2 field survey																														
3-1	Field equipment list	O 3-1																												0,6
3-2	Plan for implementation				O 3-2																									0,6
3-3	Quality assurance protocols				O 3-3																									0,9
3-4	Execute the field element																						O 3-4							35,5
3-5	Open Foris Collect Mobile for use in NFI # 2				O 3-5																									2,0
3-6	Training in Open Foris Collect and Collect Mobile design to central NFI team													O 3-6																0,7
3-7	Training on data collection						O 3-7																							6,0

Objective 04. Compile, analyze and report on the survey data																															
4-1	Plan and design the information system for NFI data collection and analysis		O 4-1																												1,9
4-2	Set up the system for NFI data collection and analysis															O 4-2															5,3
4-3	Open Foris Collect Mobile to use the Russian /Kyrgyz language				O 4-3																										0,6
4-4	Training to the SAEFP staff dealing with the data analysis																						O 4-4								1,2
4-5	Allometric models for volume and biomass								O 4-5																						1,5
4-6	Compile, analyze and report on the survey data, including a comparative analysis with NFI#1.																												O 4-6		10,5
4-7	Implement a Website to host the results																													O 4-7	2,3
4-8	Implement a password secured project 'Wikipedia' type-site		O 4-8																												0,4
4-9	Data sharing policy																							O 4-9							0,5
Objective 05. Build capacity to ensure NFO sustainability																															
5-1	Institutional setting																						O 5-1								0,4
5-2	Implementation plan for the third NFI cycle																						O 5-2								0,3
5-3	Secure 'cloud' database frame for data handling, back-up and storage				O 5-3																										0,8
5-4	Document the procedure of setting up the cloud infrastructure																													O 5-4	0,5
Objective 06. Communication and Outreach on NFI																															
6-1	Communication strategy and a plan		O 6-1																												0,8
6-2	Implement a communication plan																													O 6-2	0,2
6-3	3 seminars and workshops																													O 6-3	5,5
6-4	Newsletter (informational bulletins) on a quarterly basis																													O 6-4	3,5
6-5	Informational materials																													O 6-5	1,9
																														Total*:	105,2

Legend

Tasks - input period

Output - Number O 1-1

*Not including Temporary Field Worker

6 FORM TECH-6: TEAM COMPOSITION, ASSIGNMENT, AND KEY EXPERT'S INPUTS

6.1 Expert's Input per each Deliverable

Form TECH-6
TEAM COMPOSITION, ASSIGNMENT, AND KEY EXPERTS' INPUTS

No°	Name	Expert's input (in person/month) per each Deliverable/Objective (listed in TECH-5)							Total time-input (in Months)		
		Position		O.1	O.2	O.3	O.4	O.5	O.6	Home	Field	Total
Key Experts												
K-1	Axel Weinreich	Team leader / Forest Inventory expert	Home	0,14	0,07	0,36	0,55	0,04	0,28	1,43		4,77
			Field	0,32	0,16	0,83	1,29	0,09	0,65		3,34	
K-2	Matthias Dees	Forest statistician	Home	0,17	0,28	0,37	0,60	0,03	0,16	1,61		5,36
			Field	0,41	0,66	0,86	1,40	0,07	0,36		3,75	
K-3	Metodi Panev	IT expert	Home	0,13	0,37	0,43	0,72	0,06	0,17	1,88		5,36
			Field	0,25	0,69	0,79	1,34	0,10	0,31		3,49	
K-4	Erik Zheentaev	GIS expert	Home	0,11	3,36	0,86	2,14	0,00	0,28	6,75		7,50
			Field	0,01	0,37	0,10	0,24	0,00	0,03		0,75	
K-5	Chinara Ryskulbekova	Communications expert	Home	0,54	0,00	0,00	0,00	0,00	5,60	6,14		6,82
			Field	0,06	0,00	0,00	0,00	0,00	0,62		0,68	
									Subtotal	**17,80**	**12,01**	**29,82**

Non-Key Experts												
INT-1	Alexander Gradel	International Coordinator	Home	0,12	0,07	0,43	0,32	0,05	0,11	1,09		10,91
			Field	1,06	0,65	3,83	2,85	0,45	0,98		9,82	
N-2	Kuban Matraimov	National forest expert 1 (coordinator)	Home	0,65	0,20	4,62	0,96	0,06	0,33	6,82		13,64
			Field	0,65	0,20	4,62	0,96	0,06	0,33		6,82	
N-3	Emil Ibraev	National forest expert 2	Home	0,00	0,00	2,10	0,00	0,00	0,00	2,10		7,00
			Field	0,00	0,00	4,90	0,00	0,00	0,00		4,90	
N-4	Keneshbek Usenov	National forest expert 3	Home	0,00	0,00	2,10	0,00	0,00	0,00	2,10		7,00
			Field	0,00	0,00	4,90	0,00	0,00	0,00		4,90	
N-5	tbd (forester)	National forest expert 4	Home	0,00	0,00	2,10	0,00	0,00	0,00	2,10		7,00
			Field	0,00	0,00	4,90	0,00	0,00	0,00		4,90	
N-6	tbd (forester)	National forest expert 5	Home	0,00	2,53	3,07	0,00	0,00	0,00	5,60		7,00
			Field	0,00	0,63	0,77	0,00	0,00	0,00		1,40	
N-7	Asel Kalbaeva	Translator	Home	1,10	1,25	2,82	2,90	0,31	0,94	9,33		10,36
			Field	0,12	0,14	0,31	0,32	0,03	0,10		1,04	
N-8	Meder Seitkasymov	Political support	Home	0,23	0,23	0,68	0,23	0,23	0,68	2,27		2,73
			Field	0,00	0,00	0,45	0,00	0,00	0,00		0,45	
N-9	Zhyldyz + tbd (logistic)	Admin support staff	Home	0,45	0,45	2,73	0,45	0,45	0,45	5,00		5,00
			Field	0,00	0,00	0,00	0,00	0,00	0,00		0,00	
N-10	Temporary workers for field work	Temporary Field Worker	Home	0,00	0,00	0,00	0,00	0,00	0,00	0,00		307,98
			Field	0,00	0,00	307,98	0,00	0,00	0,00		307,98	
INT-11	NFI inhouse support (Inventory, GIS/RS &	Unique Inventory team	Home	0,00	0,00	0,67	3,60	0,50	0,00	4,77		4,77
			Field	0,00	0,00	0,00	0,00	0,00	0,00		0,00	
									Sub-total	**41,18**	**342,20**	**383,39**
									Total	**58,99**	**354,22**	**413,20**

1 For Key Experts, the input should be indicated individually for the same positions as required under the Data Sheet ITC21.1.

2 Months are counted from the start of the assignment/mobilization. One (1) month equals twenty two (22) working (billable) days. One working (billable) day shall be not less than eight (8) working (billable) hours.

3 "Home" means work in the office in the expert's country of residence. "Field" work means work carried out in the Client's country or any other country outside the expert's country of residence.

6.2 Curriculum Vitae (CV)

CV's of Key experts

K-1 Team leader / Forest inventory expert - Dr. Axel Weinreich

K-2 Forest statistician - Matthias Dees

K-3 IT expert - Metodi Panev

K-4 GIS / Image interpretation expert - Erik Zheentaev

K-5 Communication expert - Chinara Ryskulbekova

CV's of Non-key experts

INT-1 International forest expert (Coordinator) – Alexander Gradel

N-2 National forest expert (Coordinator) – Kuban Matraimov

N-3 National forest expert (local) – Ibraev Emilbek Bekboevich

N-4 National forest expert (local) – Usenov Keneshbek

N-7 Permanent translator – Asel Kalbaeva

K-1 Team leader / Forest inventory expert

Dr. Axel Weinreich

K-2 Forest statistician

Matthias Dees

K-3 IT expert

Metodi Panev

K-4 GIS / Image interpretation expert

Erik Zheentaev

K-5 Communication expert

Chinara Ryskulbekova

INT-1 International forest expert (Coordinator)

Alexander Gradel

N-2 National forest expert (Coordinator)

Kuban Matraimov

N-3 National forest expert (local)

Ibraev Emilbek Bekboevich

N-4 National forest expert (local)

Usenov Keneshbek

N-7 Permanent translator

Asel Kalbaeva

7 ANNEX

7.1 Annex 1: References

FAO (2017): Voluntary Guidelines on National Forest Monitoring.). 88p.
English Version: http://www.fao.org/3/a-I6767e.pdf
Russian Version: http://www.fao.org/3/a-I6767r.pdf

FAO (2018a): Guidelines and specifications. FRA 2020. Version 1.0. FRA Working Paper http://www.fao.org/3/I8699EN/i8699en.pdf.

FAO (2018b): FRA 2020 – what has changed and why. https://www.unece.org/fileadmin/DAM/project-monitoring/7-forestry-and-timber/MSFM/Item_3b-FRA_2020_-what_has_changed_and_why_May17th.pdf

IPCC (2003): Good Practice Guidance for Land Use, Land-Use Change and Forest. Intergovernmental Panel on Climate Change (IPCC). Published: Institute for Global Environmental Strategies, Tokyo, Japan.

IPCC (2008, 2006): IPCC Guidelines for National Greenhouse Gas Inventories – A primer, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Miwa K., Srivastava N. and Tanabe K. (eds). Published: Institute for Global Environmental Strategies, Tokyo, Japan.

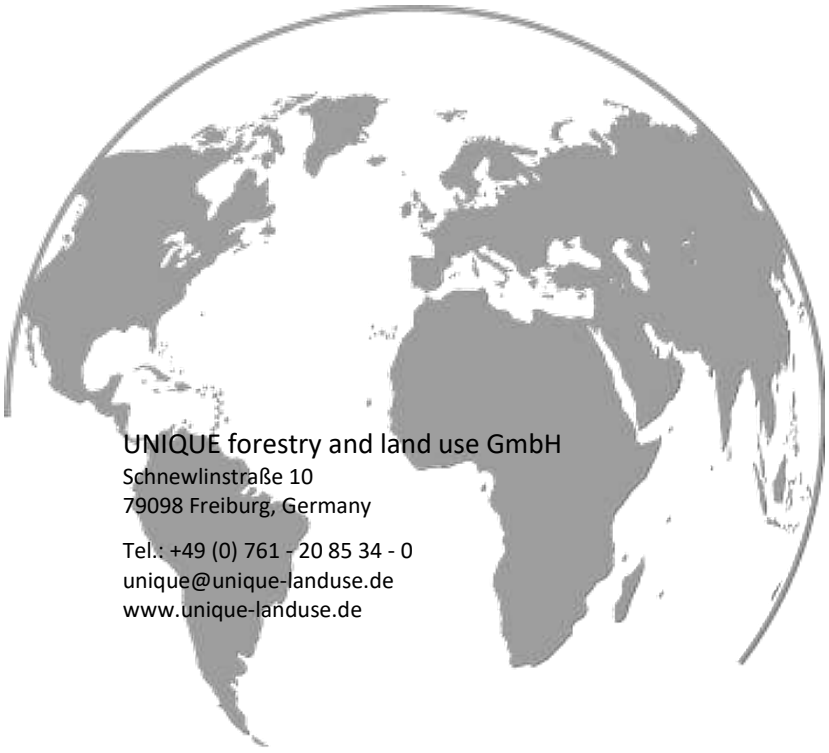
SAEPF and FAO (2008) Handbook on integrated Assessment of Natural Resources of Kyrgyzstan‖ for field works. Bishkek.

SAEPF and FAO (2010) Integrated Assessment of Natural Resources of Kyrgyzstan. Bishkek.

7.2 Annex 2: Equipment list

The following is a list with suggested equipment that can be used as part of the field work for the NFI. The full list will be established during the during the inception period of the project.

- Clothing (shoes, raincoat, etc. in outdoor outfit)
- Camping equipment (optional – in case logistically it is difficult to organize accommodation)
- Clipboard, pencil or pen, blue or black, rubber, ruler for angle measurement (setsquare)
- Backpack (good quality) for the equipment, devices and material, clothes, food, etc.
- Light hammer or axe
- Field tablet with installed OpenForis Collect
- Tally sheets, maps, list of plot coordinates, inventory manuals
- Usually 2-3 travel range poles (non-magnetic, 2m)
- 1 Suunto compass (360°), 1 leg-nonmagnetic (fixation) for compass at the travel range pole
- 1 Vertex (360° transponder fixed at one travel range pole)
- 1 Measuring Tape (20 m (10 m min) for calibration of Vertex)
- 1 Diameter measure tape (5m)
- Chalk and Crayon holder (for tree marking) / or marking tapes
- 1 GPS with accuracy min. 2-5m.
- Metal stakes (min dimensions: 25cm, diameter 12mm) for marking the center of the sample plots
- 1 Metal detector
- Binoculars
- Spare batteries
- Power bank for the Tablet



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