

# INTEGRATED ASSESSMENT OF NATURAL RESOURCES 2008-2010

## KYRGYZSTAN - BOOKLET



State Agency for Environmental Protection and  
Forestry under the Government of the Kyrgyz  
Republic



Food and Agriculture Organization  
of the United Nations, FAO

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## Integrated Assessment of Natural Resources of Kyrgyzstan 2008-2010

This publication is the short version of the report of FAO TCP/KYR/3102 (D) *Capacity Building for National Forest and Tree Resource Assessment and Monitoring Project* and contains basic statistical data on the analysis and evaluation of the forest and shrub resources of Kyrgyzstan.

This publication is designed for the forestry staff, government bodies, local authorities of all levels, research and educational institutions, and a broad group of users in order to enhance public awareness about the forests of Kyrgyzstan.

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## Foreword

Forests constitute the key factor, promoting country's sustainable development. Despite the relatively small area, Kyrgyzstan's forests are not only the source of timber, fruits, and other valuable forest products, but they also play extremely important protective and environmental roles.

Since the Earth Summit in 1992, the term *sustainable forest management* has taken hold in the vocabulary of the forest specialists.

*Sustainable forest management* (SFM) implies such forest management and use of forestry resources, which not only enable to maintain forest productivity but also their environmental functions, esthetic and recreational values, biological and landscape diversity.

Unfortunately, in Kyrgyzstan (like in most parts of the world) up to now clear and specific standards of SFM have not been created and recognized at government level. There is only a small number of intergovernmental groups developing "criteria and indicators (C&I) for SFM" – i.e. sets of indicators, which need to be monitored in the control of forests of specific countries (for instance, *area of forests and other wooded land and its changes, changes in the total stock of plantations, total carbon reserve in the forest* and changes in these indicator). Kyrgyzstan is member of the "Middle East" process (development of C&I for SFM in the Middle East). There are many other processes of C&I for SFM, like the *Helsinki process* (development of C&I for SFM in Europe), *Montreal process* (development of C&I for SFM in most other forested countries of the world except the European countries), and others.

Furthermore, none of the C&I proposed by these groups have any specific significance, i.e., for instance, there is a criterion of *area of forests and other forested lands and changes*, but there is no specific figures of acceptable changes in the area of forest lands, where forest utilization can be considered sustainable.

Based on this, the efforts are underway in Kyrgyzstan in the last fifteen years to develop sustainable forest management standards, improve the system of forest surveying works, which enables to obtain timely, reliable, and relevant information. This information will serve as the basis for criteria and indicators of sustainable forest management and formulation of national forest policies and practices.

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## Introduction

Development of forestry surveys in Kyrgyzstan date back to 1995, when the Department of Forestry and Hunting was created with the support of the Kyrgyz-Swiss Forestry Support Program. The improvement of forest planning methods in Kyrgyzstan started from this moment.

Since 2008 the forestry surveys have been organized as 2-level system, i.e. including (similar to most European countries) a new survey activity – the national forest inventory.

The National Forest Inventory (NFI) is compiled according to the Resolution # 145 on *Compilation of the National Inventory of Forests of Kyrgyzstan* of the Government of Kyrgyzstan dated 11.04.2008. It enables to objectively assess the state of forests, their quantitative and qualitative characteristics on national level to support medium-term and long-term planning, and decisions on forest management based on quality information.

In September 2007 a collaboration agreement on support to the Kyrgyz NFI was signed between FAO and State Agency for Environmental Protection and Forestry of the Kyrgyz Republic, and the NFI was implemented by the Department of Forestry and Hunting on behalf of the State Agency.

As a result a monitoring system, based on national forest inventory harmonized to international standards, was established with a network of permanent sample sites (tracts) in all oblasts of Kyrgyzstan.

This brochure is the shorter version of the final report of FAO TCP/KYR/3102 (D) *Capacity Building for National Forest and Tree Resources Assessment and Monitoring* project and contains the major findings of the analysis and evaluation of forest and tree resources of Kyrgyzstan.

Taking this opportunity, the State Agency for Environmental Protection and Forestry of the Kyrgyz Republic, expresses its appreciation for the support in the establishment of a system to monitor the country's natural

resources to FAO Forestry Department, FAO Sub-Regional Office in Central Asia, Kyrgyz-Swiss Forestry Support Programme, Kumtor Operating Company, Jany Jyldyz Gold Limited, Kazakhmys Gold Kyrgyzstan, Republican Fund for Nature Protection and Forestry Development, Issykkul Biosphere Territory, all staff of the State Agency, and particularly FAO's forestry specialists, Dan Altrell; international expert Richard Slaby, national expert Viktor Yakimov, and all staff at the Department of Forestry and Hunting, who were directly involved in the creation of this system.

## 1. KYRGYZ REPUBLIC

The Kyrgyz Republic is a sovereign country, where mountains up to 7,439 meters above sea level (*Victory peak* – the highest point in the country) cover more than  $\frac{3}{4}$  of the territory.

Kyrgyzstan's territory is located within two mountain ranges. Its northeastern (larger) part lies within Tien-Shan, southwestern – Pamir-Alay. Kyrgyzstan's borders with China, Tajikistan, and Kazakhstan lie on the crest of the highest ranges and only in the north and south-west – in the foothills and submontane valleys (Chuy valley, Fergana valley).

Almost the entire territory of the country lies more than 500 meters above sea level, of which more than half is on the altitude from 1000 to 3,000 meters, and approximately one-third – on the altitude from 3,000 to 7,439 meters. Mountain ranges occupy about one-fourth of the territory and stretch in parallel along the latitude. The main ranges of the Tien-Shan merge in the area of Meridian range, creating powerful mountain knot.

The territory of the Kyrgyz Republic measures 19,994,000 hectares (5.6% - forests/shrubs, 3.8% - water, 54.0% - agricultural lands, 36.6% – other lands). Nearly 90% of the territory is covered by the mountains on the altitude over 1,500 meters above sea level. Average altitude above sea level is 2,750 meters, and maximum altitude is 7,439 meters, and the minimum is 401 meters. 58% of residential areas are located on the altitude of 1,000-2,000 meters, where 35% of population lives, whereas 5% of total population lives on the altitude above 2,000 meters (National Report of KR FOWECA, 2005; Integrated Assessment of Natural Resources of Kyrgyzstan, 2008-2009).



**Figure 1. Map of Kyrgyzstan**

Many natural zones are found in the territory of the Kyrgyz Republic.

The country's climate is sharply continental, featuring high-seasonality, and large spatial differences

The Kyrgyz Republic consists of 7 oblasts, 40 districts, 25 cities, and 28 townships by its administrative and territorial division. The capital is the city of Bishkek.

### 1.1. Land Ownership in the Kyrgyz Republic

According to the Constitution of the Kyrgyz Republic, its land is in government, communal, private, or other forms of ownership.

According to the data of the State Registration Service of the Kyrgyz Republic, as of 01.01.2010 the area of land in state ownership is 18,626,840 hectares (93.16%), owned by municipality – 112,150 hectares (0.56%), and private – 1,255,930 hectares (6.28%).

### **1.2. Forests of Kyrgyzstan**

The Kyrgyz Republic features low-forested territories, as the forests mostly consist of mountain vegetation and are quite diverse and rich in variety. Approximately 90% of the forests in the Kyrgyz Republic are situated on the altitude of 700-3,500 meters above sea level.

As of January 1, 2010, the afforested area (forests and shrubs) of the Kyrgyz Republic is 1,123,200 hectares or 5.6% of total area of the country

The forestry of the Kyrgyz Republic is not a major sector in the domestic economy. Its contribution to the domestic economy is insignificant, as the gross output of forestry and game sector is 97.6 million soms (*approx. US\$ 2 million*) or 0.09% of GDP.

The country's forests are mostly located near rural settlements. About one million people from the rural populace, which overall accounts for 65% of total population, live in or near forests, and their welfare directly depends on the forest.

The Kyrgyz forests, because of their unique nature and major environmental significance, are very important in the global processes of regulating the state of the environment and preventing negative climate changes.

Because of this, according to the Forest Code of the Kyrgyz Republic, all forests in the country are environmental, playing environmental, sanitary, hygienic, health, and other protective functions.

The forests of the Kyrgyz Republic consist of four varieties: nuciferous (walnut and fruit-bearing), coniferous (spruce), juniper, and riparian forests.

## **2. THE HISTORY OF FOREST SURVEYS IN KYRGYZSTAN**

Since 1995 forest surveying is done by the state forest surveying service of Kyrgyzstan using random statistical taxonomic method. As of today, one cycle has been completed.

Since 2008 the forest surveys also include new surveying methods – the national forest inventory.

Thus, the system of forest measurement in Kyrgyzstan consists of following separate and complementary activities:

- Forest management inventories;
- National Forest Inventory;

### **2.1. Forestry Management Methodologies in Kyrgyzstan**

Taxonomic assessments and forest inventory are being conducted in the forests of Kyrgyzstan based on the visual assessment and random sampling approaches under forest management initiatives (Matraimov, 2003).

The visual evaluation of forests is based on the filling of inventory assessment cards and designation of appropriate forestry management activities. The assessment of allotments consists of the three activities:

- Assessment of the actual state of allotment;
- Definition of the development purpose of allotment for the period of evaluation;
- Forestry management activities planning.

Since 2000, forest management inventories for operational purposes have been carried out with the aim of achieving minimum assessment errors (i.e. establishment of permanent sample sites, total of 13,352 sample plots were established through the NFI process).

As many research studies demonstrate the accuracy of visual evaluation methods is on average equal to  $\pm 10-20\%$ , whereas random sampling approach allows reaching an accuracy of up to  $\pm 3-5\%$ .

The random sampling approach for forestry assessment is based on establishment of taxonomically stratified circular sample plots, which are spread across the forest area. Their location can be detected through their known coordinates using GPS receivers (Murzakmatov, 2007).

Circular sample sites in the forests and woodlands are distributed using a systematic approach on the reference grid of 500x500m. In coniferous forests there are two nested circular plots (radius 7,98m and 12,62m respectively) at each sample site, while only one circular plot is established in the remaining forest types (radius 12,62m) (Handbook, 2008).

## **2.2. Rationale for the National Assessment of Forest and Tree Resources of Kyrgyzstan**

Forests of the Kyrgyz Republic are managed by a number of state organizations: State Agency for Environmental Protection and Forestry, Executive Office of the President, local administration and local civil self-governance units.

State Agency for Environmental Protection and Forestry regularly monitors its forest fund area, which according to existing registers from forest management inventory constitute 2 676,0 thousand hectares, including 774,0 thousand hectares of area covered with forest and shrub land, and strictly protected areas which constitutes 721,0 thousand hectares, of which 72 thousand hectares is covered by forest and shrub land.

Forest surveys and forest inventory (by species, age, density of plantation etc) are not carried out by the local administration or the civil self-management units, which leads to general inaccuracy of the national data on forest resources.

With this in mind, the National Action Plan on the Forest Development for 2006-2010 anticipated to conduct the **First National Forest Inventory in the Kyrgyz Republic** without discriminating by forest ownership or organizational mandate.

In 2003 Kyrgyzstan started to prepare for the **First National Forest Inventory in the Kyrgyz Republic** soliciting support from FAO Forestry department, and in 2004 a first mission from FAO took place to develop a project proposal and three years later in September 2007 the FAO project TCP/KYR/3102 (D) «Capacity Building for National Forest and Tree Resources Assessment and Monitoring» initiated.

## **3. INTEGRATED ASSESSMENT OF THE NATURAL RESOURCES OF KYRGYZSTAN**

### **3.1. Inception Phase**

During the inception phase the following activities were carried out:

- Mapping and location of the tracts;

For the field data collecting, maps with the tract locations were prepared (Fig.6), including topographical (1:25 000), administrative (1:250 000) and forest maps (1:250 000), using the new forest map developed under the Kyrgyz/Swiss Project in the 2008. The coordinate grid of tract locations is 10x10min.

For the development of the Handbook for fieldwork on Integrated Assessment of Natural Resources of Kyrgyzstan, FAO's Handbook on Integrated Assessment of Natural Resources was adopted and adapted to the local context to conduct NFI in Kyrgyzstan.

Training on the National Forest Inventory in Kyrgyzstan was conducted in two stages:

1. Inception period training.
2. Field work in progress - hands-on training.

### **3.2. Field Work**

Following the 10x10 minutes coordinate grid, there is a requirement to establish 766 sample sites (tracts) systematically distributed over the country, of which 26 tracts fall in inland water, 176 are located at an altitude of 3500m above sea level and therefore without higher vegetation. Thus, the total number of tracts were actual field data should be collected are 564.

Field and control teams were established, where each field team consisted of 5 individuals, including a driver, and each had a team leader. The field teams worked in all 7 regions of Kyrgyzstan and the technical team (control team) supervised them during the field season.

The **Technical team** coordinates, implements, and monitors the assessment of natural resources on national level. **Field teams** are responsible for data collection and recording in the field and further reporting to the Technical team.

Forest inventory covered 766 tracts totaling 14,434,000 hectares nationwide, surveying 72% of country's territory.

### 3.3. **Creation of Database**

FAO/NFMA database was developed jointly with national team for storing and using the field data received from the National Forest and Tree Resources Assessment of Kyrgyzstan. The database runs on MS Access (2000/2003) and consists of two files: database NFI-data\_<KYRGYZSTAN>.mdb and database NFI-<KYRGYZSTAN> v.x.x.mdb.

#### 3.3.1. **Database**

The database management consists of the following steps:

- Installation of MS Access software (2000/2002) NFA;
- Data verification;
- Data input into the database;
- Data check;
- Data processing and analysis.

**3.3.1.1. Software.** The NFA database application was developed in MS Access (2000/2003) by FAO/NFMA and installed on the server of the Department of Forest Management and Hunting.

**3.3.1.2. Data verification** in the field forms is conducted by the field team leaders and then submitted for entry into the database.

**3.3.1.3. Data processing and analysis.** Before the data on the National Forest and Tree resources Assessment of Kyrgyzstan can be analyzed and results produced, the data in the database need to be processed and sorted.

### 3.4. **Funding the Integrated Natural Resources Assessment in Kyrgyzstan**

The following donor organizations provided their support in funding the Integrated Natural Resources Assessment in Kyrgyzstan:

- Government of KR (National Foundation for Nature Protection and Development of the Forest Industry “Issyk-Kul”);
- FAO;
- Kyrgyz/Swiss Forestry Support Project;
- Kumtor operating company;
- Jany Jyldyz Gold Limited;
- Kazakhmys Gold Kyrgyzstan.

The Total cost of all activities came to US\$ 630 thousand, with an average cost of US\$ 1120 per tract and US\$ 3150 per km<sup>2</sup>. The Government of Kyrgyzstan and donors contributed with US\$ 300 thousand (National Foundation for Nature Protection and Development of the Forest Industry “Issyk-Kul”), and US\$ 330 thousand was contributed by FAO.

## 4. **RESULTS OF THE INTEGRATED NATURAL RESOURCES ASSESSMENT IN KYRGYZSTAN**

### 4.1. **Strictly Protected Areas (SPA) of the Kyrgyz Republic**

According to the Land Code of the KR, the strictly protected areas comprise of:

- State Reserves (national parks),
- State National Wildlife Parks (SNWP),
- State Wildlife Preserves (except for the hunting reserves),
- State Nature Monuments,
- State Botanical Gardens,
- State dendrological and zoological parks,
- State natural health retreats/resorts.

Distribution of area of the strictly protected areas according to the forest management data is provided in the Table 1.

**Table 1. Area of Strictly Protected Areas (SPA) of the Kyrgyz Republic**

Region	Total protected area, ('000 ha)	Protected area with forest cover, ('000 ha)
Batken	66.19	0
Jalal-Abad	173.12	27.38
Issyk-Kul	129.20	6.08
Naryn	83.03	7.97
Osh	52.94	7.03
Talas	91.48	10.06
Chuy	125.94	13.63
<b>Total Nationwide:</b>	<b>721.90</b>	<b>72.15</b>

\*Source: Forest surveying materials

Table 1 illustrates that the area of SPA nationwide totals to 721,900 hectares, of which 72,150 hectares are covered with forest.

According to the data of the State Registry Service of Kyrgyzstan, the area of SPA is– 707,400 hectares, whereas according to the forest survey data– 721,900 hectares, i.e. there are differences.

#### **4.2. Forest Lands of the Kyrgyz Republic**

According to the Article 6 of the Forest Code of the KR, all forests and lands in the state, public or private ownership, provided for the needs of forestry sector, comprise the integrated forest area of the Kyrgyz Republic.

According to the Article 8 of the Forest Code of the KR, the forest lands include:

- Forest land, including forests (land covered with forest vegetation) and not covered with forest vegetation (scattered forest stands, plantations, nursery gardens, glades, burned-out forest, open woodlands, vacant plots);
- Non-forest land, which forms integral ecosystem with forests (agricultural and other land plots as well as lands where forest was terminated for construction purposes related to various utility objectives such as roads, fire prevention raptures, power lines and pipelines).

According to the Article 7 of the Forest Code of the KR all forests and lands granted to the forest sector, except those in community and private ownership comprise the state forest fund area.

Data on the state forest fund area (SFA) of forestry and self-funded forestry received as a result of the forest assessment is provided in the Table 2.

**Table 2. Area of the State Forests Fund of Kyrgyz Republic according to existing registers**

Region	Total State Forest Fund area, ('000 ha)	Area with forest cover, ('000 ha)
Batken	493.74	138.77
Jalal-Abad	732.70	297.44
Issyk-Kul	348.21	96.72
Naryn	414.11	95.64
Osh	513.19	103.52
Talas	115.46	24.48
Chuy	59.33	17.32
<b>Total nationwide:</b>	<b>2676.73</b>	<b>773.89</b>

Source: Forest surveying materials

Thus, according to the State Register of KR the area of the SFA was 2613.74 hectares as of 01.01.2010, whereas according to the forest assessment data it was 2676.73 hectares, i.e. there is some discrepancy between them.

#### 4.3. Land Uses and Forest Types in the Kyrgyz Republic

As a result of the National Forest Inventory of Kyrgyzstan, data was obtained on the extent of land use areas (forests, other wooded lands, other land and water resources). Table 3, below, provides the data on the area of these land uses and their percentage in total territory of the country.

**Table 3. Land use areas in the Kyrgyz Republic by land use and forest type**

No	Land use	('000 ha)	% of country's territory
1	<b>Forests</b>	<b>677</b>	<b>3.4</b>
1.1.	<b>Natural forests</b>	630	3.2
1.1.1.	Coniferous	360	1.8
1.1.2.	Deciduous	239	1.2
1.1.3.	Mixed	21	0.1
1.1.4.	Natural woodlots	10	0.1
1.2.	<b>Planted forests</b>	<b>47</b>	<b>0.2</b>
1.2.1.	Coniferous	5	0.0
1.2.2.	Deciduous	35	0.2
1.2.3.	Mixed	3	0.0
1.2.4.	Planted woodlots	4	0.02
2	<b>Other Wooded Land (OWL)</b>	<b>620</b>	<b>3.1</b>
2.1.	Wooded grassland	175	0.9
2.2.	Shrub land	445	2.2
3	<b>Other land</b>	<b>17 763</b>	<b>88.8</b>
3.1.	Natural other land	15 761	78.8
3.2.	Agricultural land	1 590	8.0
3.4.	Built-up area and roads	380	1.9
3.5.	Mines, quarries	32	0.2
4	<b>Water</b>	<b>935</b>	<b>4.7</b>
	<b>Total:</b>	<b>19 995</b>	<b>100.0</b>

\*Source: National Forest Inventory in the KR, 2008-2010

It is visible from the Table 3 that area covered with forests constitutes 677 thousand hectares or 3.4 % of the total land in the Kyrgyz Republic; other wooded land (wooded grassland and shrubs) constitutes 620 thousand hectares or 3.1% of the total land; other land constitutes 17 763 thousand hectares or 88.8% of the total land; the water covers 935 thousand hectares or 4.7% of the total land.

The findings of the remote sensing based on the Aster satellite images have established that the area covered by forests is equivalent to **1,083,400 hectares** that is about **5.4%** of the total land. The data received was the result of complex data analysis in the course of which minimal parameters had been used in order to avoid overestimation of the area covered by forests. Therefore, the data received should be treated as a minimum requirement for establishing the percentage of forest land in the republic (Enio Grisa et.al, 2008).

According to the National Forest Inventory the forested area constitutes **1123.05** thousand hectares or **5.62 %** of the republic.

Therefore, the data on the percentage of forest land in the KR obtained by decoding Aster satellite imagery states the 5.4% coverage; the data received from the National Forest Inventory states the 5.6% coverage. The discrepancy is 0.2

Through the National Forest Inventory statistical data have also been obtained on other woody plants and shrub vegetation.

The data obtained on woody plants indicated that other wooded land area is 3.39% (of the total territory of the country) or 677.25 thousand hectares of which NFR/SPA are 2.5% or 499.33 thousand hectares whereas non-NFR/SPA are 0.89% or 177.92 thousand hectares. Shrubs occupy 2.23 % (of the total territory of the country) or 445.79 thousand hectares of NFR/SPA area – 1.73% or 346.71 thousand hectares and non-NFR/SPA – 0.5% or 99.08 thousand hectares. The standard error is within permissible range and constitutes  $\pm 14$  %.

Other wooded land (OWL) area of NFR and SPA according to the National Forest Inventory comprises **2.6%** or **527.74** thousand hectares, whereas according to the data provided by the Forest Management it is **2.5%** or 499.33 thousand hectares, and, thus, the difference is very small 0.1%.

The acreage of shrub vegetation was assessed in the NFI process, which indicated that the area covered by shrubs according to the National Forest Inventory comprises **1.47%** or **298.89** thousand hectares in the republic, whereas according to the data provided by the Forest Management it is **1.74%** or 346.71 thousand hectares, thus, the difference is insignificant - 0.2%.

As a result of the National Forest Inventory the data on the dominating species of wood plants was obtained (Table 4).

**Table 4. Other Wooded Land areas**

Oblasts	Other Wooded Land (OWL) area		Woody plants with 60 % or more coniferous varieties		Woody plants with 40 % or more deciduous varieties		Mixed woody plants	
	% of country's territory	('000 ha)	% of country's territory	('000 ha)	% of country's territory	('000 ha)	% of country's territory	('000 ha)
Batken	0.61	122.33	0.57	113.83	0.04	8.50	0	0.00
Jalal-Abad	1.21	242.28	0.29	57.21	0.89	178.35	0.03	6.73
Issyk-Kul	0.41	81.97	0.41	81.97	0	0.00	0	0.00
Naryn	0.34	67.80	0.23	45.20	0.11	22.60	0	0.00
Osh	0.53	105.08	0.25	49.62	0.25	49.62	0.03	5.84
Talas	0.18	35.46	0.1	19.45	0.08	16.02	0	0.00
Chuy	0.11	22.33	0.05	10.15	0.03	6.09	0.03	6.09
<b>Total:</b>	<b>3.39</b>	<b>677.25</b>	<b>1.89</b>	<b>377.43</b>	<b>1.41</b>	<b>281.17</b>	<b>0.09</b>	<b>18.66</b>

\*Source: National Forest Inventory in the KR, 2008-2010

From Table 4 it is clear that the total area of other wooded land is 3.39% or 677.25 thousand hectares, including the area with more than 60% of coniferous plants (1.89% or 377.42 thousand hectares); more than 40 % of deciduous plants (1.41% or 281.17 thousand hectares) and mixed (0.09% or 18.65 thousand hectares).

**Table 5. Forested Area of the Kyrgyz Republic**

Oblasts	Forest and OWL area		Standard error ( $\pm$ ), %	including			
	% of country's territory	('000 ha)		SFA and SPA with forest cover		Forested area outside SFA and SPA	
				% of country's territory	('000 ha)	% of country's territory	('000 ha)
Batken	0.83	166.50		0.69	138.77	0.14	27.74
Jalal-Abad	1.90	380.25		1.62	324.80	0.28	55.44
Issyk-Kul	0.72	142.36		0.52	102.80	0.20	39.56
Naryn	0.68	135.60		0.53	103.62	0.16	31.98
Osh	0.93	186.31		0.55	110.55	0.38	75.76
Talas	0.34	67.50		0.17	34.55	0.16	32.94
Chuy	0.22	44.53		0.15	30.96	0.07	13.57
<b>Total:</b>	<b>5.62</b>	<b>1123.05</b>	<b>10</b>	<b>4.23</b>	<b>846.05</b>	<b>1.39</b>	<b>277.00</b>

\*Source: National Forest Inventory in the KR, 2008-2010

#### 4.4. Tree regeneration in Kyrgyz Forests

Information on tree regeneration has been collected in line with the Field Form F4 and is presented below in two categories:

- Tree regeneration with height over 1.3 m;
- Tree regeneration with height under 1.3 m.

##### 4.4.1. Tree regeneration with height more than 1.3 m

Tree regeneration of height over 1.3m is presented by major land use in Table 6.

**Table 6. Tree regeneration >1.3m, as stems per hectare by major land use class**

	Forest	Other Wooded Land	Other Land	Water
Tree regeneration (stems/ha)	721.0	120.0	7.0	0.0

\* Source: National Forest Inventory in the KR, 2008-2010

From Table 6 it is clear that the average tree regeneration >1.3m corresponds to 721 stems/ha in forest, 120 stems/ha in other wooded land, and 7 stems/ha in other lands, respectively.

The data obtained in the NFI process also indicate that tree regeneration >1.3m is 611 stems/ha in the natural coniferous forest, 994 stems/ha in deciduous and 114 stems/ha in mixed forest, whereas in the planted deciduous forest it is 94 stems/ha.

Tree regeneration >1.3m in other wooded land: Wooded grassland – 270 stems/ha, and shrub land – 73 stems/ha.

Tree regeneration >1.3m in other natural land is 8 stems/ha and 2 stems/ha in agricultural land.

The tree regeneration >1.3m by forests type: 67 stems/ha in spruce forest, 991 stems/ha in juniper forest, 250 stems/ha in walnut forest, 675 stems/ha in apple forest, 1763 stems/ha in maple forest, 662 stems/ha in hawthorn forest, 800 stems/ha in other deciduous forest, etc.

##### 4.4.2. Tree regeneration with height less than 1.3 m

Tree regeneration of height less than 1.3m is presented by major land use in Table 7.

**Table 7. Tree regeneration <1.3m, as stems per hectare by major land use class**

	Forest	Other Wooded Land	Other Land	Water
Tree regeneration (stems/ha)	670.0	41.0	4.0	0.0

\*Source: National Forest Inventory in the KR, 2008-2010.

Table 7 illustrates that the average tree regeneration <1.3m is 670 stems/ha in forest, 41 stems/ha in other wooded land and 4 stems/ha in other land.

The data obtained in the NFI also indicated that the tree regeneration <1.3m constitutes 637 stems/ha in natural coniferous forest, 836 stems/ha in natural deciduous forests, and 143 stems/ha in mixed forest.

Tree regeneration <1.3m in other wooded land constitutes: Wooded grassland – 85 stems/ha, and shrub land – 27 stems/ha.

Tree regeneration <1.3m in other natural land is 3 stems/ha, and 6 stems/ha in cultivated lands.

Tree regeneration <1.3m by forests type: 330 stems/ha in spruce forest, 851 stems/ha in juniper forest, 50 stems/ha in apple forest, 1758 stems/ha in maple forest and 354 stems/ha in hawthorn forest.

#### 4.5. Growing Stock Volume in the Kyrgyz Republic

The growing stock volumes were calculated based on the field survey data collected on all land uses. Measurements of the breast-height (i.e. 1.3 m) diameter (Dbh) were made for all trees in the field plots with Dbh $\geq$ 8 cm, as indicated in the Manual for Field Data Collection (2008).

##### 4.5.1. Total Growing Stock Volume in the Kyrgyz Republic

Analysis of the data related to the growing stock disaggregated by land use demonstrated that the growing stock constitutes 48 000 thousand m<sup>3</sup> in forest, 1000 thousand m<sup>3</sup> in other wooded land, 6000 thousand m<sup>3</sup> in other land, and 700,000 m<sup>3</sup> in inland water. The growing stock in natural forest totals 37,600 m<sup>3</sup>, and 3,200 m<sup>3</sup> in planted forest.

The growing stock in wooded grassland constitutes 690 thousand m<sup>3</sup>, and 310 m<sup>3</sup> in the shrub land.

The growing stock is presented by land use in the Table 8.

**Table 8. Total Growing Stock Volume by Forest Type**

<b>№</b>	<b>Forest type</b>	<b>Total Growing Stock ('000 m<sup>3</sup>)</b>
1.	<b>Natural forest</b>	<b>44 800</b>
1.1.	<b>Coniferous</b>	<b>37 600</b>
1.1.1.	Spruce	32 600
1.1.2.	Juniper	5 000
1.2.	<b>Deciduous</b>	<b>4 800</b>
1.2.1.	Walnut	900
1.2.2.	Apple	220
1.2.3.	Maple	1 400
1.2.4.	Hawthorn	50
1.1.5.	Riparian	2 100
1.2.6.	Other deciduous	130
1.3.	<b>Mixed natural forest</b>	<b>2 400</b>
2.	<b>Planted forests</b>	<b>3 200</b>
2.1.	<b>Coniferous</b>	<b>1 800</b>
2.1.1.	Spruce	1 300
2.1.2.	Other coniferous	500
2.2.	<b>Deciduous</b>	<b>1 300</b>
2.2.1.	Walnut	1 000
2.2.2.	Poplar	190
2.2.3.	Other deciduous	110
2.3.	<b>Mixed planted forests</b>	<b>100</b>

\* Source: National Forest Inventory in the KR, 2008-2010

Table 8 shows that spruce forest comprises 32 600 thousand m<sup>3</sup>, juniper forest 5,000 thousand m<sup>3</sup> and walnut forest 900 thousand m<sup>3</sup>.

##### 4.5.2. Growing Stock Density

The analysis of the data obtained through the NFI indicated that the average growing stock density is 52.6 m<sup>3</sup>/ha in forest, 1.19 m<sup>3</sup>/ha in other wooded land and 0.34 m<sup>3</sup>/ha in other land.

Average growing stock density in natural forest is 52.5 m<sup>3</sup>/ha and 53.8 m<sup>3</sup>/ha in planted forest. In wooded grassland the growing stock density is 2.8 m<sup>3</sup>/ha, and 0.5 m<sup>3</sup>/ha in shrub land.

Average growing stock density in natural coniferous forests is 76 m<sup>3</sup>/ha and in natural deciduous forests 14.5 m<sup>3</sup>/ha.

The data on growing stock density by forest type are given in Table 9.

**Table 9. Growing Stock Density by forest type**

No	Forest type	Growing Stock Density (m <sup>3</sup> /ha)
<b>1.</b>	<b>Natural forest</b>	
1.1.	Spruce	163.4
1.2.	Juniper	16.9
1.3.	Fruit and Nut	38.5
1.4.	Apple	8.4
1.5.	Maple	9.0
1.6.	Hawthorn	0.8
1.7.	Riparian plants	31.8
<b>2</b>	<b>Planted forests</b>	
2.1.	Spruce	256.6
2.2.	Other coniferous	230.1
2.3.	Walnut	144.0
2.4.	Poplar	11.0

\* Source: National Forest Inventory in the KR, 2008-2010

#### 4.6. Biomass of Kyrgyzstan

Biomass was calculated for the following types of land use: Forest, Other Wooded Land, Other Land and Water, and comprised a major part of the main report, describing estimates of biomass and carbon stocks in Kyrgyzstan. For calculating biomass and carbon stocks the IPCC guidelines have been used (Guidelines for National Greenhouse Gas Inventory, 2006).

##### 4.6.1. Total Above Ground Living Tree Biomass

Data on the total above ground living tree biomass are presented by major land use in Table 10.

**Table 10. Total Above Ground Living Tree Biomass by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Biomass (million tons)	26.7	0.7	3.7	0.4

\*Source: National Forest Inventory in the KR, 2008-2010.

Table 10 illustrates that the total above ground living tree biomass is 26.7 million tons in the forest, 0.7 million tons in other wooded land, 3.7 million tons in other land and 0.4 million tons in inland water.

Analysis of the total above ground living tree biomass totals 24.7 million tons in the natural forest and 2.0 million tons in the planted forest.

The total above ground living tree biomass in other wooded land is: 0.5 million tons in woody grass land and 0.2 million tons in shrub land.

The total above ground living tree biomass is 1.2 million tons in the other natural land, 0.7 million tons in agricultural land and 1.8 million tons in the built-up areas.

The total above ground living tree biomass is 17.7 million tons in spruce forest, 3.5 million tons in Juniper forest and 0.8 million tons in walnut forest.

##### 4.6.2. Total Below Ground Living Tree Biomass

The data on total below ground living tree biomass is presented by land use in Table 11.

**Table 11. Total Below Ground Living Tree Biomass by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Biomass (million tons)	8.1	0.9	5.3	0.4

\*Source: National Forest Inventory in the KR, 2008-2010

It is visible in Table 11 that the total below ground living tree biomass is 8.1 million tons in the forest, 0.9 million tons in other wooded land, 5.3 million tons in other land and 0.4 million tons in inland water.

Analysis of the data on the total below ground living tree biomass totals 7.5 million tons in natural forest and 0.6 million tons in planted forest.

The total below ground living tree biomass in other wooded land is: 0.2 million tons in wooded grassland and 0.7 million tons for shrub land.

The total below ground living tree biomass in other natural land is 1.8 million tons, 0.7 million tons in agricultural land and 2.8 million tons in built-up area.

The total below ground living tree biomass is 4.6 million tons in spruce forest, 1.4 million tons in juniper forest and 0.3 million tons in walnut forest.

#### 4.6.3. *Shrub Biomass Density*

Calculation of shrub biomass density has been done for shrubs higher than 0.5 m. The data on shrub biomass density is presented by major land use class in Table 12.

**Table 12. Shrub Biomass Density by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Biomass (tons/ha)	1.1	1.6	0.1	0.02

\*Source: National Forest Inventory in the KR, 2008-2010

Table 12 illustrates that the average shrub biomass density is 1.1 tons/ha in the forested lands, 1.6 tons/ha in other wooded land, 0.1 tons/ha in other lands, and 0.02 tons/ha in inland water.

The analysis of the shrub biomass data indicates that the shrub biomass density totals 1.1 tons/ha in natural forests, and tons/ha in the planted forests.

The shrub biomass density is 2.1 tons/ha in the wooded grassland and 11.4 tons/ha in shrub land.

The shrub biomass density in other natural land is 0.2 tons/ha, 0.001 tons/ha in agricultural land, and 0.01 tons/ha in built-up area.

Regarding shrub biomass disaggregated by forest types, the biomass of spruce forest totals 0.5 tons/ha, juniper forests 0.8 tons/ha and walnut forest 1.4 tons/ha.

#### 4.6.4. *Total Dead Wood Biomass*

Data on total dead wood biomass are presented by major land use in Table 13.

**Table 13. Total Dead Wood Biomass by major land use**

	Forest	Other Wooded Land	Other Land	Water
Dead Wood Biomass (million tons)	0.14	0.002	0.70	0.00

\*Source: National Forest Inventory in the KR, 2008-2010

Table 13 illustrates that the total dead wood biomass in forest totals 0.14 million tons, 0.002 million tons in other wooded land, 0.7 million tons in other land, while it is absent in inland water.

The total dead wood biomass in shrub land amounts 0.002 million tons.

Analysis of the dead wood biomass in other land indicates: a total dead wood biomass in other natural land of 0.004 million tons, 0.004 million tons in cultivated land and 0.062 million tons in built-up area.

Regarding total dead wood biomass disaggregated by forest types, the total dead wood biomass totals 0.113 million tons in spruce forest and 0.003 million tons in juniper forest.

#### 4.7. Carbon Stocks of Kyrgyzstan

The analysis of carbon stocks of Kyrgyzstan was one of the major parts of the main report and are presented for the major land use classes; Forest, Other Wooded Land, Other Land and Inland Water. For calculating the carbon stocks the IPCC guidelines were applied (Guidelines for National Greenhouse Gas Reporting, 2006).

##### 4.7.1. Total Above Ground Carbon Stock

The data on the total above ground carbon stock are presented by major land uses in the Table 14.

**Table 14. Total Above Ground Carbon Stock by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Above Ground Carbon (million tons)	13.3	0.3	1.8	0.2

\*Source: National Forest Inventory in the KR, 2008-2010

Table 14 illustrates that the total above ground carbon stock is 13.3 million tons in forest, 0.3 million tons in other wooded land, 1.8 million tons in other land and 0.2 million tons in inland water.

##### 4.7.2. Total Below Ground Carbon Stock

The data on the total below ground carbon stock is presented by major land use in Table 15.

**Table 15. Total Below Ground Carbon Stock by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Below Ground Carbon (million tons)	4.0	0.4	2.7	0.2

\*Source: National Forest Inventory in the KR, 2008-2010

Table 15 illustrates that the total below ground carbon stock amounts 4.0 million tons in forest, 0.4 million tons in the other wooded land, 2.7 million tons in the other land and 0.2 million tons in inland water.

##### 4.7.3. Total Dead Wood Carbon Stock

The data related to the total dead wood carbon stock are presented by major land use in Table 16.

**Table 16. Total Dead Wood Carbon Stock by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Dead Wood Carbon (million tons)	0.071	0.001	0.033	0.0

\*Source: National Forest Inventory in the KR, 2008-2010

Table 16 illustrates that the total dead wood carbon stock is 0.071 million tons in forest, 0.001 million tons in other wooded land, 0.033 million tons in other land, while it is absent in inland water.

##### 4.7.4. Total Litter Carbon Stock

The data on the total litter carbon stock is presented by major land use in Table 17.

**Table 17. Total Litter Carbon Stock by major Land Use**

	Forest	Other Wooded Land	Other Land	Water
Litter Carbon (million tons)	16.5	8.6	0.3	0.0

\*Source: National Forest Inventory in the KR, 2008-2010

Table 17 demonstrates that the total litter carbon stock is 16.5 million tons in forest, 8.6 million tons in other wooded land, 0.3 million tons in other land, while it is absent in inland water.

#### 4.7.5. Total Soil Organic Carbon Stock

The data on the total soil organic carbon stock are presented in Table 18.

**Table 18. Carbon Reserves of Organic Soil by segments of land usage**

	Forest	Other Wooded Land	Other land	Water
Soil Organic Carbon (million ton)	80	75	1161	0

\*Source: National Forest Inventory in the KR, 2008-2010

Table 18 illustrates that the total soil organic carbon stock is 80 million tons for forest, 75 million tons for other wooded land, 1161 million tons for other land and absent in inland water.

#### 4.8. Environmental Problems

Within the scope of the national assessments supported by the Food and Agriculture Organization of the United Nations (FAO) also an assessment of environmental problems in the whole country territory (all oblasts of KR) is carried out. In the Guidelines on “Integrated Assessment of the Natural Resources of Kyrgyzstan” (2008) twenty major types of environmental problems are defined and should be assessed in the field (form F5, Appendix 1).

The results on environmental problems are provided in Table 19.

**Table 19. Distribution of Environmental Problems by major Land Use in the Kyrgyz Republic**

Environmental problem	Forest	Other Wooded Land	Other Land
Reduced water levels in rivers/wetland	4.9%	6.9%	3.9%
Dried up water source	2.5%	1.4%	1.6%
Rainfall variability	8.0%	7.3%	13.5%
Drought	5.4%	11.1%	11.3%
Floods	0%	0%	0.6%
Loss of water quality	0.6%	0%	0.5%
Erosion	12.5%	10.3%	10.1%
Loss of soil fertility	0.9%	4.0%	4.4%
Reduced yields	0%	0%	2.2%
Hail storm	0%	0.1%	0.9%
Wild Fire / Uncontrolled burning	0%	0%	0,8%
Landslide	2.3%	7.0%	1.5%
Wind throw / windfall / wind blow	18.0%	0%	0.1%
Overexploitation of resources	1.9%	3.0%	0.9%
Overgrazing	23.5%	32.8%	22.8%
Loss of habitats	8.5%	5.0%	10.2%
Reduced species diversity	7.9%	3.5%	10.5%
Livestock / wildlife disease and mortality	3.2%	7.5%	2.7%
Plant pest	0%	0.1%	1.3%
Invasive species	0%	0%	0.2%

\* Source: National Forest Inventory in the KR, 2008-2010.

Table 19 indicates that presence of environmental problems in other land (usually agricultural lands) is higher than in forest and other wooded land.

The impact of the environmental problems was registered, based on the following ranking criteria:

- **Low**, when there is no evident signs of problems;
- **Medium**, when there are evident signs of problems, which begin to produce negative effect;
- **High**, when it is evident that problems produce a severe negative effect.

The assessment of environmental problems is carried out by a visual evaluation and is thereby somehow subjective in nature, and the perception of environmental problems may vary a little among the regions of the country, depending on the different forestry experts who are carrying out the assessment.

#### 4.9. Products and Services provided in the lands of the Kyrgyz Republic

During the field survey assessment of the benefits from forests and land use to the communities was carried out through interviews. Information on the major products and services produced locally was collected in the Field Form 6 (Annex 1 of Guidelines on “Integrated Assessment of the Natural Resources of Kyrgyzstan”, 2008)

##### 4.9.1. Products provided in the lands of the Kyrgyz Republic

Results on forestry and other land use products are presented by major land use in Table 20.

**Table 20. Products from Forest, OWL and other Land Use of the Kyrgyz Republic**

Product Category	Forest	Other Wooded Land	Other Land
Timber	3.3%	0%	0.4%
Fuel wood	20.1%	11.2%	1.4%
Plant food	8.8%	1.2%	8.9%
Fodder	2.3%	0%	5.8%
Non-wood Construction materials	0%	0%	0.1%
Ornamentals	0%	0%	0.02%
Fertilizers	4.3%	0%	0%
Livestock	16.4%	30.5%	37.1%
Honey	2.4%	3.6%	0.2%
Bush meat	0%	2.1%	2.1%
Skin/hide	5.8%	1.6%	4.6%
Dairy products	14.6%	6.2%	10.9%

\*Source: National Forest Inventory in the KR, 2008-2010

It is illustrated in Table 20 that the major local products from forest consist of fuel wood (20.1%), livestock (16.4%), dairy products (14.6%), plant food (8.8%), skin/hide (5.8%), fertilizers (4.23%), timber (3.3%), Fodder (2.3%), and honey (2.4%).

The major products from other wooded land comprise the following: livestock (30.5%), fuel wood (11.2%), dairy products (6.2%), honey (3.6%), bush meat (2.1%), skin/hide (1.6%), and plant food (1.2%).

The major products from other land comprise the following: livestock (37.1%), dairy products (10.9%), plant food (8.9%), fodder (5.8%), skin/hide (4.6%), bush meat (2.1%), fuel wood (1.4%), timber (0.4%), honey (0.2%), and non-wood construction material (0.1%).

#### 4.9.2. Services provided in the lands of the Kyrgyz Republic

Results on forestry and other land use services are presented by major land use in Table 21.

**Table 21. Services from Forest, OWL and other Land Use of the Kyrgyz Republic**

Service Category	Forest	Other Wooded Land	Other land
Soil and water protection	7.0%	8.6%	0.6%
Soil fertility	0%	0%	0.7%
Potable water	1.0%	0.4%	0.0%
Climatic control	0.6%	2.4%	0.1%
Shadow	3.0%	8.7%	0.4%
Religious and spiritual	0%	1.5%	0%
Eco-tourism, hunting and fishing	1.0%	1.0%	2.0%
Education/research	0%	0%	0.2%
Employment	19.3%	9.6%	22.2%

\*Source: National Forest Inventory in the KR, 2008-2010.

Table 21 illustrates that forest generate following main services: employment, soil and water protection, shadow, potable water, eco-tourism, hunting and fishing, and climatic control.

The main services in other wooded land include the following: employment, shadow, soil and water protection, climatic control, religious and spiritual services, eco-tourism, hunting and fishing, potable water.

The main services in other land are employment, eco-tourism, hunting and fishing, soil fertility, soil and water protection, shadow, education and research, and climatic control.

#### 4.9.3. Gender balance in accessing products and services

In the course of the field work the studies were conducted with the focus on identifying the proportion of women living in different oblasts with access to various services to produce different types of local products. Analysis of the findings of the studies illustrated that most women are involved in harvesting of plant food, construction materials, and production of dairy products.

#### 4.9.4. Percentage of children involved in generating products and services on the lands

The survey shows that children in the various regions mostly are involved in harvesting plant food products, fodder, raising livestock and poultry, beekeeping, and in production of dairy products.

#### 4.10. Impact on resources

Studies on identification of human and wildlife impact/disturbance on resources were conducted in the course of field work. The findings of this research on the human impact on the resources are presented in the Table 22.

**Table 22. Human Impact on Resources by major Land Use**

Type of impact	Forest	Other Wooded Land	Other Land
No impact; nature reserves and all resources are preserved	0%	9.5%	37.3%
Marginal impact; use of resources and services is carried out within the framework of management plan	10.0%	0%	0%
Medium impact; provision of forest resources is carried out partly within the framework of management plan	81.5%	46.2%	4.4%
Profound impact; provision of products is higher than average annual increase, reduction of biodiversity as a result of intensive farming and overexploitation of resources lead to deforestation	0%	14.3%	58.2%
Other	8.5%	30.0%	0%

\*Source: National Forest Inventory in the KR, 2008-2010

The findings of this research on the wildlife's impact on the resources are presented in the Table 23.

**Table 23. Wildlife Impact on Resources by major Land Use**

Type of impact	Forest	Other Wooded Land	Other Land
No impact	66.8%	58.5%	79.5%
Marginal impact of wildlife on resources	22.6%	22.0%	14.9%
Medium impact of wildlife on resources	9.4%	15.0%	3.8%
Profound impact of wildlife on resources	1.3%	4.5%	1.9%

\*Source: National Forest Inventory in the KR, 2008-2010

## 5. CONCLUSIONS AND RECOMMENDATIONS

Since 2008 the Kyrgyz forest surveys have been implemented in 2-tier arrangement, where the introduction of strategy and policy supporting national level forest survey (similarly with the European countries) – National Forest Inventory (NFI) with numerous sample sites or tracts (cluster of field plots) systematically distributed all over the country territory, regardless of land tenure, and independent from the traditional forest management surveys for operational purposes.

According to the KR State Register, the area of strictly protected areas totals 707.41 thousand hectares and areas of state forest funds 2613.74 thousand hectares. The data from forest management inventories present 721.90 thousand hectares of strictly protected areas and 2676.73 thousand hectares of state forest funds. There are differences between these information systems and it is thus necessary to adjust the data on state forest funds and strictly protected areas between the State Register of the KR and the forest management inventories.

Forest lands of Kyrgyzstan are covered by trees and shrubs, which were assessed through:

- Ground plot-based forest inventory (taxonomy) of the State forest funds and strictly protected areas (forest management inventory);
- Systematic sampling with numerous sample plots or tracts (cluster of field plots) throughout the whole country territory, regardless of ownership (National Forest Inventory);
- Interpretation of remote sensing data (Aster satellite imagery).

According to the findings from the remote sensing survey of the Kyrgyz Republic, the area covered by forest and shrub land was estimated to be **1,084,400 hectares or 5.4 %** (Anio Griza, et.al. 2008).

According to the data of National Forest Inventory, the proportion of area covered by forest and shrub land in the republic represents **1,123,045.2 hectares or 5.62 %** (standard error  $\pm 10\%$ ).

3.39% of the country is covered by forest, of which State forest funds and strictly protected areas together represent 2.5%, outside State forest funds and strictly protected areas – 0.89%. Shrub land covers 2.23%, of which State forest funds and strictly protected areas together represent 1.73%, and outside State forest funds and strictly protected areas – 0.5% (standard error  $\pm 14\%$ ).

It is necessary to submit the findings of NFI on Kyrgyz areas covered by forest and shrub land to the Government of KR for further approval.

Through current National Forest Inventory 277,000 hectares (1.39%) of forests outside of State forest funds and strictly protected areas were identified in Kyrgyzstan and these forest areas are under state ownership. Therefore it is necessary to define who will be responsible for the day-to-day management of these resources.

It is essential to introduce forest management in these forests, determine their borders and distribution among districts, ayil okmotu, etc., and to develop forest management plans for further resources development. Participation of the State Registry of KR in this process is essential.

Appropriate changes should be made in the documents of KR National Forest Policy and forest legislation.

The national forest policy should be revised based on the findings of the national forest inventory, forest management surveys and remote sensing surveys from the last 15 years.

Further improvement of forest mapping through use of remote sensing and GIS-technology should continue.

It is necessary to continue developing of the forest monitoring system at national (republic) level and also elaborate the mechanisms of forest monitoring system on local level (forest funds, conservation areas, protected woodlands...).

Information from the National Forest Inventory and forest management inventories should be used in decision making process on legislative, management, economic and technological issues in the forestry sector.

The findings of from the NFI on identification of ecological problems in *forest, other wooded land* and *other land*, show that the most prevailing issues are soil erosion, landslides and overgrazing. *Other land* (substantially agricultural) is more liable to various environmental problems. The information on environmental problems is assessed visually by forestry specialists, and is somehow subjective and tends to specify ecological issues differently according to the various regions of the republic. Further studies on this are needed and monitoring system and methodologies should be strengthened for the prevention of their implications.

Compiled materials on rare and endangered species will enable mapping of their existence and habitats, and will serve as a basis for further biology and ecology research on rare and endangered plant and animal species.

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## CONTENTS

Foreword.....	1
Introduction .....	1
1. KYRGYZ REPUBLIC .....	2
1.1. Land Ownership in the Kyrgyz Republic.....	2
1.2. Forests of Kyrgyzstan.....	3
2. THE HISTORY OF FOREST SURVEYS IN KYRGYZSTAN.....	3
2.1. Forestry Management Methodologies in Kyrgyzstan .....	3
2.2. Rationale for the National Assessment of Forest and Tree Resources of Kyrgyzstan.....	4
3. INTEGRATED ASSESSMENT OF THE NATURAL RESOURCES OF KYRGYZSTAN.....	4
3.1. Inception Phase.....	4
3.2. Field Work.....	4
3.3. Creation of Database .....	5
3.3.1. Database .....	5
3.4. Funding the Integrated Natural Resources Assessment in Kyrgyzstan .....	5
4. RESULTS OF THE INTEGRATED NATURAL RESOURCES ASSESSMENT IN KYRGYZSTAN.....	5
4.1. Strictly Protected Areas (SPA) of the Kyrgyz Republic .....	5
4.2. Forest Lands of the Kyrgyz Republic .....	6
4.3. Land Uses and Forest Types in the Kyrgyz Republic .....	7
4.4. Tree regeneration in Kyrgyz Forests.....	9
4.4.1. Tree regeneration with height more than 1.3 m.....	9
4.4.2. Tree regeneration with height less than 1.3 m.....	9
4.5. Growing Stock Volume in the Kyrgyz Republic.....	10
4.5.1. Total Growing Stock Volume in the Kyrgyz Republic.....	10
4.5.2. Growing Stock Density .....	10
4.6. Biomass of Kyrgyzstan.....	11
4.6.1. Total Above Ground Living Tree Biomass .....	11
4.6.2. Total Below Ground Living Tree Biomass .....	11
4.6.3. Shrub Biomass Density .....	12
4.6.4. Total Dead Wood Biomass .....	12
4.7. Carbon Stocks of Kyrgyzstan .....	13
4.7.1. Total Above Ground Carbon Stock.....	13
4.7.2. Total Below Ground Carbon Stock .....	13
4.7.3. Total Dead Wood Carbon Stock .....	13
4.7.4. Total Litter Carbon Stock.....	13
4.7.5. Total Soil Organic Carbon Stock.....	14
4.8. Environmental Problems.....	14
4.9. Products and Services provided in the lands of the Kyrgyz Republic.....	15
4.9.1. Products provided in the lands of the Kyrgyz Republic .....	15
4.9.2. Services provided in the lands of the Kyrgyz Republic.....	16
4.9.3. Gender balance in accessing products and services.....	16
4.9.4. Percentage of children involved in generating products and services on the lands.....	16
4.10. Impact on resources .....	17
5. CONCLUSIONS AND RECOMMENDATIONS.....	18
BIBLIOGRAPHY.....	19