JOINT IMPLEMENTATION LAND USE, LAND-USE CHANGE AND FORESTRY PROJECT DESIGN DOCUMENT FORM
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SECTION A. General description of the LULUCF project

A.1. Title of the LULUCF project:

Bikin Tiger Carbon Project - Permanent protection of otherwise logged Bikin Forest, in Primorye Russia

Version Number 1.0
Date: 09/11/2011
Prepared by GFA ENVEST GmbH (Mr. Martin Burian) and WWF Russia Far East Branch for Tribal Commune Tiger (TCT).

Sectoral Scope 14. The proposed JI project qualifies as 'Forest Management' under activities referred to in Article 3, paragraph 4 of the Kyoto Protocol, as defined in paragraph 1 of the annex to decision 16/CMP.1. The Russian Federation opted to account for sinks and sources from Forest Management.

A.2. Description of the LULUCF project:

Project Objective. The Tribal Commune Tiger (TCT), an economic interest group formed by the local tribe of the Russian ethnic group of Udege people, has leased the Bikin Nut Harvesting Zone (NHZ) and riparian zone of Bikin river (subsequently referred to as "project area") concession from the Forest Department of Primorye. This allows TCT to protect its area of living from any logging activities and thereby ensures the integrity of forest- and carbon stocks in the project area.
The project setup foresees:

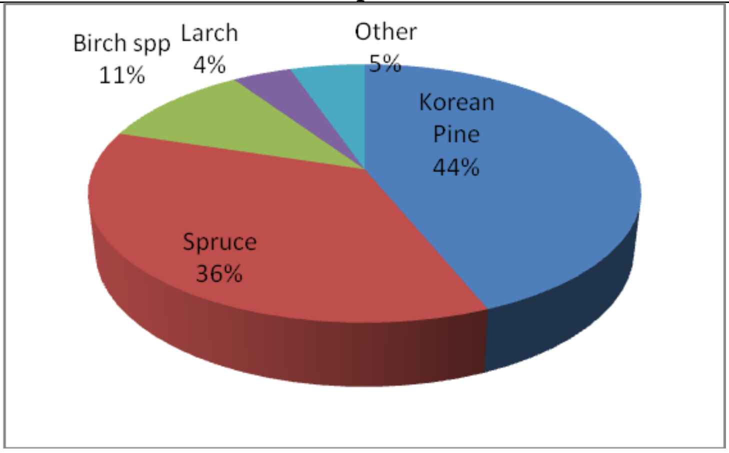
- The protection of the project area from any logging operations as well as the conservation of the existing forest carbon stocks.
- The assessment of the development of forest carbon stocks under a) the baseline scenario (i.e. logging) and b) the protection of the project area from logging.
- The calculation of the difference of carbon stocks of baseline and project scenarios.
- The generation of Emission Reduction Units (ERUs) considering above difference of carbon stocks, project emissions and leakage.
- The ERUs shall be sold in the international emission trading market allowing the TCT in the midterm to pay the annual concession fees to the Forest Department of Primorye and to pay for all necessary conservation measures related to the management plan of the concession.

Situation existing prior to the Starting Date of the LULUCF Project. The project area is pristine forest which has not been commercially logged so far. It is classified as Nut Harvesting Zone (NHZ) and as riparian zones by Decisions of the Council of Ministers of the Russian Soviet Federative Socialist Republic in the 1950ies-1970ies. This was done due to the high share of Korean Pine stands, importance for traditional nature use for game and Non Timber Forest Products as well as high ecological functions of the project area.
The project is located in two concessions, the Bikin NHZ (88% of the total area) and the riparian zone (12% of the total area). Together, the two forest areas sum up to a total area of 461,154 ha. The Bikin NHZ is is by far the largest of all NHZs in Khabarovsk and Primorsky Krai, followed by Vostochnaya NHZ with a total area of 95,303ha (Please refer to Annex 2.2 for a complete list of NHZs in above named krais).
Out of the total area of the two concessions, 456,035ha are classified as forest. This area subsequently is referred to as 'Project Area' for the remainder of the document. As outlined in Table 1, the project area comprises 43.9% of Korean Pine stands, of which 41% have a Korean Pine share of 30% or more by volume. Other major tree species are Spruce (36%), Birch species pluralis (spp.), (i.e. Stony Birch, Yellow Birch and White Birch), Larch (4%) and other species such as Ash, Elm, Fir, Oak and other. The shares of tree species are illustrated in Figure 1.

Table 1: The Project Area Composition by Dominant Species/Stands

Species	Ha	%
Korean Pine	200.199	43,9
Spruce	164.190	36,0
Birch spp	49.034	10,8
Larch	18.844	4,1
Other	23.935	5,2
Source: Bikin Forest Inventory 2010		

Figure 1: The Project Area Composition by Dominant Tree Species



Source: Forest Inventory Unit, 2010, The project area Inventory

In terms of commercial volume, the project area features a total volume of 103.0 million m^3. Most dominant species by volume is Spruce (26.4 million m^3, 25.6%), Korean Pine (24.0 million m^3, 23.3%), Yellow Birch (14.7 million m^3, 14.3%) and Fir (10.8 million m^3, 10.4%). A complete list of commercial volumes by species is found in below table.

Table 2: Summary of the Bikin Inventory Analysis

Tree Species	Volume	Density	AGB	Carbon Stocks
	in m^3	in t.d.m.	in t.d.m.	in tC
Береза бородавчатая - Comon/White birch	3,051,462	1,556,246	2,023,119	971,097
Береза желтая - Yellow birch	14,700,245	7,497,125	9,746,262	4,678,206
Береза каменная - Stony birch	1,004,381	512,234	665,905	319,634
Граб - Hornbeam	77,681	48,939	67,536	32,417
Дуб - Oak	1,960,310	1,136,980	1,591,772	764,050
Ель - Spruce	26,342,402	10,536,961	15,067,854	7,684,606
Ива - Willow	51,180	23,031	31,783	15,256
Липа - Elm	3,672,940	1,579,364	2,132,141	1,023,428
Кедр (сосна кедровая) - Korean pine	24,201,848	10,164,776	14,840,573	7,568,692
Клен - Maple	1,348,232	701,081	967,492	464,396
Лиственница - Larch	3,287,861	1,611,052	2,384,356	1,216,022
Липа - Lime	6,676,642	2,870,956	3,875,791	1,860,380
Ольха - Alder	197,557	88,901	122,683	58,888
манчжурский - Manchurian walnut	12,264	6,500	8,970	4,306
Осина - Aspen	793,596	277,759	366,641	175,988
Пихта сибирская - Fir	10,723,712	4,289,485	5,790,804	2,953,310
Тополь - Poplar	401,430	140,501	193,891	93,068
Чозения - Chosenia (lat.)	870,795	391,858	540,764	259,567

Черемуха - Bird Cherry	2,176	1,066	1,471	706
Ясень обыкновенный - Ash	3,761,556	2,144,087	2,958,840	1,420,243
Sum	103,138,270	45,578,900	63,378,649	31,564,259
Primary Source : Bikin Inventory, (2010); The sources for BEF, CF and density factors are indicated in Section B.				

In terms of total carbon stocks, the project area comprises 31.6 million tC or 115.7 million tCO_2, respectively, and average carbon stocks of 69.2tC/ha or 254.0tCO_2/ha.

Table 3: Carbon Stock Summary	
Total Carbon Stock of the Project Area (in tC)	31,564,259
Total Carbon Stock of the Project Area (in tCO_2)	115,735,616
Average Carbon Stock per Hectar (in tC/ha)	69.28
Average Carbon Stock per Hectar (in tCO_2/ha)	254.03

The project area is a unique ecosystem being home to at least 12 endangered species (i.e. listed as vulnerable, endangered or critically endangered in the IUCN Red List book). One of these species is the Amur tiger. The tiger population in the Bikin is estimated to 30 to 35 animals. Its primary habitat is rocky Korean Pine – mixed broadleaf forests. Korean Pine stands are also an important ecosystem for the tiger's primary prey (deer and wild boar) through provision of nutrition (such as Korean Pine Nuts, KPN) and shelter functions.

Figure 2: Amur Tiger - Panthera tigris

Source: Courtesy of Vasily Solin, WWF Amur Branch

The Bikin is not only home to threatened species, but it is also home for species which are endemic for the Russian Far East (Amur Branch). There are at least 14 endemic species living in the Bikin. Based on the high endemism and based on being habitat to major endangered species, it is concluded that the Bikin is a unique ecosystem on a regional and global scale.

Besides its ecosystem functions the Bikin is also home to indigenous tribe of the Udege. The Udege have been living in the Bikin area for centuries (see "History of social, economical and cultural development of Udege people" by A. Startsev, 2000). They follow a lifestyle which is even today deeply connected to nature which may be connected to the Udege's original belief. In scientific terms, the Udege's spiritual belief is classified as "animism". The Udege believe that they are surrounded by an almost infinite number of nature spirits. So they believe that e.g. each animal and each tree has its own soul. But there is also a vertical hierarchy among these spirits – there are so-called spirits-masters of e.g. rivers, streams, forests, hills, etc. Among these, the important spirits are considered as the ancestors' souls. It is concluded that the project area has a high religious and cultural value to the Udege. As far as the biggest Udege population lives here and very depends from the wilds.
In the project area, the Udege have formed an interest group, the Tribal Commune Tiger (TCT) to pursue the economic and social interest of the tribe under an elected leader.

Baseline Scenario. The most plausible baseline scenario is the logging of the project area under intermediate logging and selective commercial logging schemes. For years commercial forestry enterprises have tried to get access to the valuable timber resources of the area. This scenario was verified based on the analysis of past logging attempts as well as on legal analyses.

- Past logging attempts:
    - Already in 1990, Hyundai, a Korean Logging company tried to lease NHZs in the region including the Bikin for commercial logging purposes The company built a sawmill and a harbour in the bay of Svetly. There was substantial commercial interest in the Bikin in view of its commercial wood stocks.
    - The Udege anticipated that such commercial development of the Bikin forest area would have significant negative impacts on their way of living. Hence they strongly fought against the Hyundai initiative to protect their area of living by all means.
    - Ever since, there have been frequent attempts to lease the Bikin NHZ as a timber concession. The last one occurred in 2011, when the Russian company LesExport proposed an investment project in the Northern Primorsky region including the lease of a concession close to the Bikin and almost all project area (88%).
- Legal analysis
    - As mentioned above the project area was classified as Nut Harvesting Zone (NHZ) and riparian zone by decisions of the Council of Ministers of the Russian Soviet Federative Socialist Republic in the 1950ies-1970ies. This was done due to the high share of Korean Pine stands in the project area, its importance for traditional nature use for game and NTFP as well as high ecological functions of the project area. Respective regulations prohibited any commercial timber logging activities in the area. Instead, only silvicultural treatments such as **intermediate logging** and other non-commercial forms of logging such as **selective sanitary logging** were allowed with the objective that such silvicultural measures are required to ensure long-term stability and productivity of the forest stands.
    - Following the new Forest Code of the Russian Federation coming into force in 2007, a series of new amendments and regulative decrees, rules and regulations was published by the government affecting the former protected status of the project area, as they foresee a different way of management of the area. Based on the new legislation that was signed on the 6th of November 2009 and came into force on 25th of January 2010 (Russian Forest Code, Articles 102, 106, Order of Ministry of Agriculture of RF № 543 from 06.11.2009), it's possible to carry out not only intermediate logging or selective

sanitary logging in water protective forests, nut harvesting zones, forests near water objects, but also selective commercial logging in mature and over-mature forests. Old-grown forest stands with less than 30% Korean Pine (by volume) making up for 59% of the project area qualify for commercial timber harvesting operations. Starting commercial logging activities in the Bikin area would lead to massive biomass/carbon stock losses within a few years as is shown by examples within the region.

  - The reminder of the area having a Korean Pine share of more than 30% and more is still eligible for intermediate logging and selective sanitary logging. Even foreseen as a measure to improve stand quality, it has proven that commonly applied logging practices applied during these silvicultural measures led to significant carbon stock decreases as can be seen in other NHZs in Primorski Krai and Khabarovsky Krai.

- Economic analysis
  - The project area is owned by the state and is administered by the Forest Department of Primorsky Krai. If the project area would not be leased by TCT, the forest department could issue annual felling tickets or logging concessions and generate revenues from stumpage or concession fees. If such felling permissions are not issued, the Forest Department does not realize timber-related revenues from the concession area. In addition, revenues could be obtained from sales of minor forest products such as pine nuts and other NTFP.

Based on the continuous attempts to log the project area as well as on the existing district forest management plan and the change in the legal protection status, it is concluded that very substantial timber logging activities in form of selective commercial logging, intermediate logging and selective sanitary logging would take place in the project area in absence of the project activity.

In order to quantify the logging impacts, the WWF Amur Branch engaged the Russian Far Eastern Forest Research Institute to determine the logging volumes. While being a state agency, the institute is a well-known and acknowledged research institution. It is entitled to develop forest management plans. The findings of the analysis are presented in below table. The complete analysis is attached in Annex II (Baseline Information).

Table 4: Baseline Logging Area and Volumes

Validity		Days	Volume	Area	Merchantable Volume
From	To	d	in m^3/yr	in ha/yr	in m^3/ha
03.06.2009	25.01.2010	236	142,320	3,522	40.41
26.01.2010	31.12.2012	339	399,000	9,287	42.96

- As can be seen in the table above, the logging volume of 143,320 m3/yr was applicable from the project start (3rd June of 2009) up to the 25th January 2010. It was valid for 236 days of the crediting period.
- As can be seen in the table above, the logging volume of 399,000m3/yr was applicable from the 26th January 2010 onwards.
- In order to model the baseline scenario, it was assumed that the rules leading to the lower logging volumes and –areas were in place for one year (i.e. 365 days). This is considered to be conservative.

Project Scenario. The Tribal Commune Tiger will lease the project area and thereby protect the land from logging. At the 3rd June 2009, the Tribal Commune Tiger leased the Bikin concession from the Primorsky Forest Department with the objective to protect the area against logging (Contract of Forest Lease No. 4/34). The concession contract explicitly grants the Tribal Commune Tiger the right to develop an emission reduction project. The concession lease period is 49 years. It is concluded that the project activity protects the project area from logging until 2058.

The protection of the project area will conserve the forest stands and avoid the decrease of respective wood volumes - and related - the decrease of forest carbon stocks.

But the project will also produce emissions. These emissions will arise from subsequent activities:

- The Tribal Commune Tiger will log trees for heating purposes and for the construction of new houses. The impact will be very limited compared to the baseline scenario, but the project will account for the related emissions.
- There will be some fuel emissions arising from the project activity. These comprise the emissions from WWF cars (patrolling the project boundary), flight emissions from project planning and administration and flight emissions of a helicopter, which will be used for fire fighting. The related fuel consumption will be documented and resulting emissions will be accounted for under project emissions calculation.
- Natural disasters such as forest diseases and fires may reduce the carbon stock under the project scenario. The integrity of forest stands will be monitored. If a natural disaster is detected, the related decrease of forest carbon stocks will be accounted for under the project scenario.
- Even though WWF has a team of forest guards patrolling the project boundary on behalf of TCT, illegal logging may occur. The project will monitor the integrity of forest stands. If illegal logging is monitored, the related decrease of forest carbon stocks will be determined and accounted for under the project scenario.

History of the LULUCF Project. The subsequent section outlines the history of the LULUCF project.

- In April 2007, an EU TACIS project was started as the first financial support to the region, supporting the indigenous communities in maintaining their traditional lifestyle including hunting, fishing, trapping, carpentry, handicrafts and setting up simple ecotourism structures. The support also included legal advice to maintain the indigenous rights to the area, and planning for the establishment of a TTNU, all for preventing logging companies from leasing the area.
- Building upon the established partnership with the Tribal Commune Tiger (TCT), a project concept was developed in 2008 by WWF Russia, WWF Germany and TCT to lease 461,500 ha of a forest massif with virgin temperate coniferous broadleaved forest as conservation concession for 49 years, as a strategy for carbon conservation within the framework of the International Climate Protection Initiative (section: “Securing natural carbon sinks and habitats of special significance for adaptation to the consequences of climate change”). For the first time, carbon finance was considered as a means to secure the long-term lease payments.
- In May 2008, WWF Germany applied for financial support from the German Ministry of Environment (BMU) under its international climate change initiative (BMU ICI); the project was accepted and officially started in September 2008. During the inception period the project focused on preparing and lobbying for the land concession, hiring appropriate project staff and assessing the climate relevance of the project through a feasibility study. BMU ICI funding (three years) was used as seed funding to secure the concession and making the first three payments, and to establish the JI project.
- To this end, the carbon consulting company Ecosecurities was hired in February 2009 to assess the feasibility of the project as a forest carbon project. The project was evaluated as feasible, and the JI mechanism recommended as the most promising commercialization option. A final report was created in April 2009.
- In June 2009, the concession for harvesting non-timber-forest products was finally given to WWF’s partner, the Tribal Commune Tiger, and the respective contract was signed on June 3rd 2009, explicitly granting the TCT the right to claim carbon certificates for the protection of the project area. After a long and intensive dispute with the forest department about opening any auction for nut harvesting zones, this was a major success and milestone for the project. It will protect the area from any commercial logging activities, provided that financial sustainability, i.e. annual payment of concession fees, can be secured.

- After conducting an international tender process (end 2009/beginning 2010), WWF contracted GFA ENVEST for the development of the Project Design Document (PDD) and for assisting with the determination of the project and commercialization of the carbon credits.

A.3. Project participants:

Name of Party involved (*)	Legal entity / project participant (as applicable)	Party* involved wishes to be considered as project participant (Yes/No)
Russian Federation*	Tribal Commune Tiger WWF Amur Branch	No
Germany	WWF Germany	No
* (host) indicates a host Party		

A.4. Technical description of the LULUCF project:

A.4.1. Location of the LULUCF project:

A.4.1.1. Host Party(ies):

Russian Federation

A.4.1.2. Region/State/Province etc.:

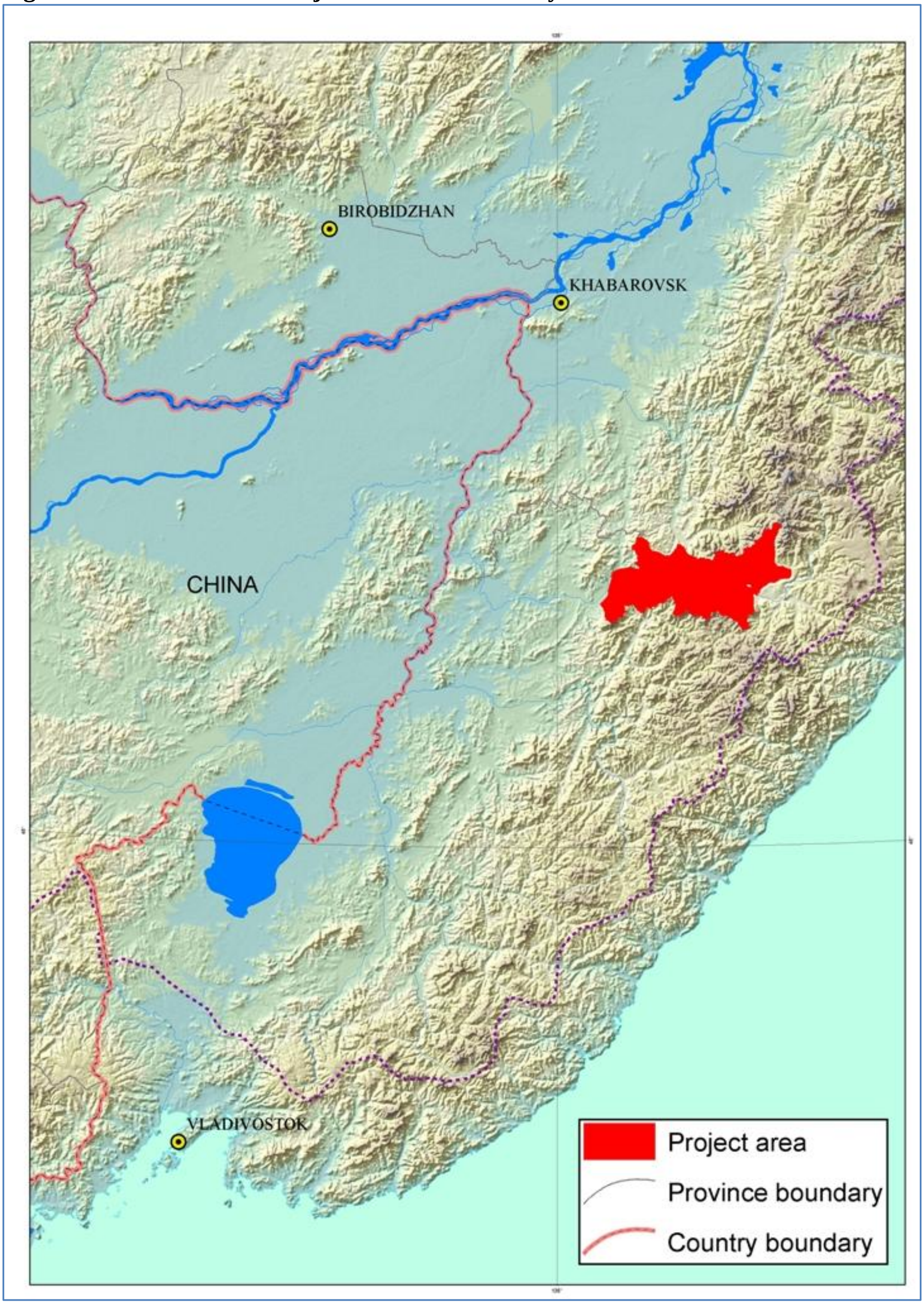
The project is located in Primorsky Krai. Primorsky Krai is located in the Southern Far East of Russia bordering China and North Korea. The exact location of Primorsky Krai is shown in below figure (area marked red).

Figure 3:Location of Primorsky Krai

A.4.1.3. City/Town/Community etc.:

The project is located north to the settlement of Vostok and east to the village of Krasny Yar.

Figure 4: Location of the Project Area in Primorsky Krai



A.4.1.4. Detailed delineation of the project boundary including information allowing the unique identification of the LULUCF project:

The project boundary is delineated by the outer boundary of the Bikin NHZ and the riparian zone comprising the project area. The concessions have a total project area of 461,154 ha, located in the Pozharsky District, Verkhne-Perevalnenskoe Forestry Unit:

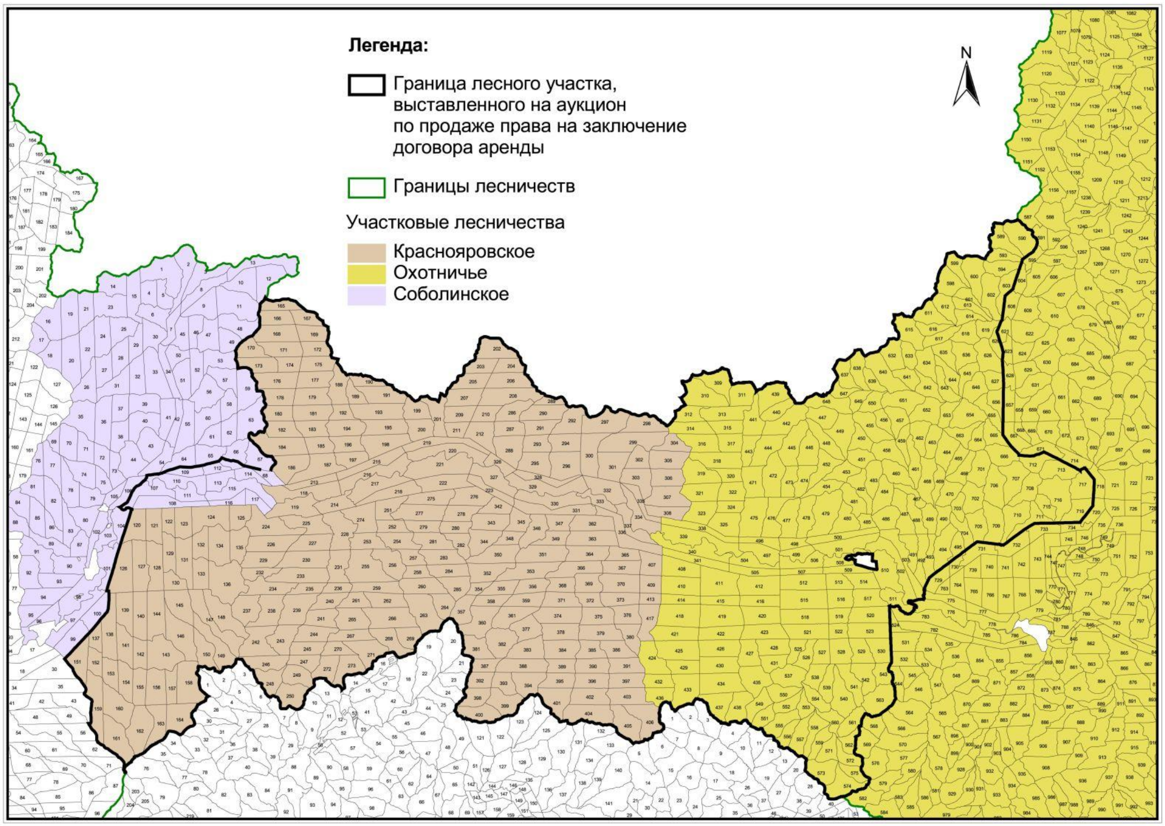
- Sobolinoe Divisional Forestry (compartments 68, 107-117),
- Krasnoyarovskoe Divisional Forestry (compartments 118-308, 326-337, 342-407, 409, 413, 417),
- Okhotnichie Divisional Forestry (compartments 309-325, 338-341, 408, 410-412, 414-416, 418-523, 525-530, 537-543, 549-563, 571-575, 589, 590, 593, 594, 598-603, 611-620, 626, 627, 632-656, 663-666, 701-713, 715-717, 719).

The number of the record on the state forest register is 20/1105006-2009-03. Below map illustrates the location of the compartments within the divisional forest units.

Legend for Figure 5

The boundary of the Project Area
Boundaries of forest units
Krasnoyarovskoye Divisional Forestry
Okhotnichie Divisional Forestry
Sobolinskoye Divisional Forestry

Figure 5: Project Boundary and Location of Compartments by Divisional Forestries



The project boundary is illustrated by the black line surrounding the Bikin Nut Harvesting Concession. Exact GPS positions of all points of the project boundary, as requested by the applied methodology, may be provided to the AIE upon request.

A.4.2. Conformity with the definitions of LULUCF activities:

The host party (DNA Russian Federation) has decided on the following Kyoto forest definition and elections for Article 3, paragraphs 3 and 4, activities in accordance with decision 16/CMP.1[1]:

- A single minimum tree crown cover value of 18% (equivalent to 30%[2] stocking density)
- A single minimum land area value of 1.0 hectare
- A single minimum tree height value of 5 meters

Additionally, a minimum value of forest width of 20 meters applies.

Russia accounts it emissions from sinks and sources for afforestation, reforestation and deforestation (Article 3.3 of the Kyoto Protocol). Moreover Russia elected to account for sinks and sources from forest management under Article 3.4. Russia will account for the chosen LULUCF sinks and sources annually.

Following above definitions, the concession area was compiled by:

- Excluding all sub-compartments having a stocking density below 30% (633 sub-compartments, 5,260.9 ha)
- Excluding all sub-compartments having a maximum height below 5 m (660 sub-compartments, 5,462.2 ha)
- Excluding all sub-compartments having a minimum area below 1 ha (243 sub-compartments with a total area of 124.7ha).

Eliminating the above areas (which are partially overlapping) from the concession area defines the project area, which amounts to 455,989 ha. This area fulfills all of the above criteria and hence qualifies as forest according to the forest definition of the Russian Federation and falls under the elected activity chosen by the Russian Federation.

A.4.3. Technology(ies) to be employed, or measures, operations or actions to be implemented by the LULUCF project:

By declaring the forest as conservation forest, the extraction of timber with accompanying trees and soil damages and the release of carbon emission will be avoided for the time of the project period. There is no further specific technology applied.

[1] Report of the review of the initial report of the Russian Federation. UNFCCC/IRR/2007/RUS of 18.02.2008.

[2] Taken from the first national communication of the Russian Federation to the UNFCCC. Available under http://unfccc.int/files/national_reports/initial_reports_under_the_kyoto_protocol/application/pdf/initial_report_russia.pdf

A.4.4. Brief explanation of how the net anthropogenic removals by sinks are to be enhanced by the proposed JI LULUCF project, including why these enhancements would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The net anthropogenic GHG removals by sinks will be enhanced by allowing the original Bikin forest to continue storing carbon instead of being removed and forced to regenerate from scarce natural seedlings. Moreover specifically, net anthropogenic removals by sinks are calculated as follows:

- $C'_{degradation,t}$ comprise the baseline emissions due to carbon stock decreases, emissions due to the decay of long term harvesting wood products (ltHWP), emissions due to the decay of deadwood, as well as re-growth which would occur in the baseline case after logging operations. The key parameters, the annual allowable cut, and the annual net harvesting area were determined by the federal budgetary institution 'Far Eastern Forest Research Institute (FFRI)'. According to the Russian forest legislation, the FFRI is entitled to develop forest management plans. The calculation of FFRI was confirmed by the head of the forest department of Primorski Krai, Mr. Rybnikov. The calculation itself is provided in Annex 2.1. The Russian and the English translation are provided in Annex 2.3.
- $C'_{emissions,t}$ comprise the baseline emissions due to logging operations, including emission from harvesting, hauling, transport, and processing.
- $C'_{actual,t}$ comprise the project emissions including emissions from illegal logging operations and the degradation of forest stands due to natural disturbances (pests and fire).
- Finally the project accounts for leakage. As leakage due to activity shifting may not take place, leakage comprises only market leakage.

Below table presents the anticipated net anthropogenic removals by sinks for the first ten years of the project activity:

Table 5: Anticipated Net Anthropogenic Removals by Sinks

Year t	$C'_{degradation,t}$	$C'_{emissions,t}$	$C'_{actual,t}$	Leakage	Net Anthropogenic Removals by Sinks
1	72,263	7,513	903	15,949	62,894
2	210,938	21,064	903	46,384	184,634
3	232,087	21,064	903	50,616	201,561
4	251,378	21,064	903	54,476	216,999
5	268,913	21,064	903	57,984	231,032
6	283,296	21,064	903	60,861	242,540
7	293,668	21,064	903	62,934	250,834
8	302,557	21,064	903	64,711	257,942
9	310,045	21,064	903	66,208	263,928
10	316,209	21,064	902	67,432	268,827

A.4.4.1. Estimated enhancements of net anthropogenic removals by sinks over the crediting period:

Following the Russian JI procedures, the project applies a crediting period from 3rd June 2009 up to 31st December 2012. If a follow up agreement to the Kyoto Protocol is ratified, this may eventually be revised.

Table 6: Net Anthropogenic Removals by Sinks over the Crediting Period	
Crediting Period:	3 Years, 7 Months
Year	Ex-ante Estimate of Annual Enhancements of Net Anthropogenic Removals by Sinks (in t CO_2e)
2009	35,669
2010	131,935
2011	194,233
2012	210,316
Total Estimated Enhancements of Net Anthropogenic Removals by Sinks over the Crediting Period (in tCO_2e)	572,153
Annual Average of the Enhancements of Net Anthropogenic Removals by Sinks over the Crediting Period (in tCO_2e)	159,660

Please note, as the project start was 3rd June 2009, the value of year 1 (and all subsequent years) of Table 5 was corrected by a correction factor of 0.58 (212 days in year 2009 divided by 365 days). The remainder of year 1 was integrated added to 2010 and so forth. This sums up to a total of 1,308 days during the crediting period.

A.5. Project approval by the Parties involved:

Written approvals of both parties involved will be attached to the JI PDD after successful determination and issuance of Letters of Approvals.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

The baseline for the proposed JI project activity was defined in accordance with the JISC Guidance on criteria for baseline setting and monitoring (Version 02). Reference is made to the baseline & monitoring methodology "Estimating GHG Emission Reductions from Planned Degradation (Improved Forest Management)[3]" developed under the VCS. This methodology was applied, as the CDM is restricted to Afforestation/Reforestation and hence does not cover Forest Management as stipulated under Article 3.4 of the Kyoto Protocol. Consequently, there is no applicable CDM methodology.

Complementing above methodology, the following tools and guidelines were applied:

- Tool for testing significance of GHG emissions in A/R CDM project activities, Version 1, CDMEB 31,
- Tool for the demonstration and assessment of additionality in A/R CDM project activities, Version 2, CDM EB35, Annex 17.

The project meets the methodology's following applicability criteria:

Table 7: Methodology Applicability Criteria	
Criteria	Description
Project type	The project qualifies as an Improved Forest Management – Logged to Protected Forest project activity. There will be no commercial logging in the project activity.
Condition of the forest	The project area qualifies as intact forest. Forest located in the project area is forest since more than ten years.
Forest Product Type	The project accounts for harvested wood products (HWP)
Driver of Degradation	Legally sanctioned timber harvest
Project Proponent	The Tribal Commune Tiger (TCT) has the control and responsibility for the IFM-LtPF project activity. TCT has leased the concession from the Primorski Forest Department for 49 years.
Baseline Activity to be Displaced	Commercial logging for timber production.
Project Area	• The project area qualifies as a Nut Harvesting Zone (NHZ). NHZs are designed for complex forest use combining harvest with Non-Timber Forest Product (NTFP)-use. As such NHZs are designated and sanctioned for selective logging. • The project provides approved documents, which specify the geographical boundary of the project area. • The project proponent applies the methodology to a single parcel of land.
Greenhouse Gases (GHGs) Considered	• Carbon Dioxide (CO_2) is the principal sink/source. • As the carbon pool soil is conservatively neglected, Nitrous Oxide (N2O) fluxes from/to soils not accounted for. • Still N2O is accounted for in the context of emissions from fuel consumption and for forest fires under the project case. • As the carbon pool soil is conservatively neglected, methane (CH4) fluxes

[3] Withdrawn at 27th October 2011 from http://www.v-c-s.org/methodologies/VM0011

	from/to soils not accounted for. • Still CH4 is accounted for in the context of emissions from fuel consumption and for forest fires under the project case.
Carbon Pools Considered	The following carbon pools are considered • Above Ground Biomass • HWP • Deadwood (DW)
Carbon Pools Not Considered	The following carbon pools are not considered • Below Ground Biomass (BGB) • Soil • Litter

The project does not meet the methodology's following applicability criterion:

Table 8: Methodology Applicability Criteria

Criteria	Description
Type of Forest	The methodology is restricted to tropical forests. Following FAO 1998[4], this comprises Evergreen Tropical Rainforests and Moist Deciduous Tropical Forests with an annual rainfall ranging from 1,000 to 2,500mm. The project area comprises mixed broadleaf and conifer forests. Annual rainfall in Primorsky Krai ranges from 600 to 850 mm. Climate is classified as 'monsoon influenced humid continental climate' (Köppen climate classification) with sub-tropical summers (average temperature in August amounts to 20.6°C) and cold continental winters (average temperature in January decreases to -13.2°C). Consequently the forest does not qualify as tropical forest. This deviation from the methodology was taken into account by choosing applicable default values of forest operations in temperate forests, or calculating actual values wherever required!

B.2. Carbon pools selected:

According to the methodology applied and in consistency with the VCS AFOLU Requirements[5], above living biomass and dead wood carbon pools are included. All other carbon pools have been conservatively disregarded (see table below).

Table 9: Selected carbon pools

Carbon pools	Selected	Justification / Explanation of choice
Above ground biomass (AGB)	yes	Above ground tree biomass is the most important carbon pool to be saved from logging operations
Below ground biomass (BGB)	No	Unlikely to decrease due to the project activity or to increase due to the baseline case. Hence BGB is conservatively neglected.
Dead wood	yes	Dead wood carbon pools can be conservatively disregarded

[4] FAO 1998, Guidelines for the Management of Tropical Forests - The Production of Wood. Available at: HTTP://WWW.FAO.ORG/DOCREP/W8212E/W8212E00.HTM

[5] VCS, 2011, Agriculture, Forestry and Other Land Use (AFOLU) Requirements. Available at http://www.v-c-s.org/docs/AFOLU%20Requirements%20-%20v3.0.pdf

(DW)		because they are on average always larger in old growth preserved forests (project case) than in managed forests with regular harvesting operations (baseline)
Litter	no	Litter carbon pools can be conservatively disregarded for the same reason as deadwood.
Soil organic carbon (SOC)	no	Soil organic carbon pools are equally larger in preserved old growth forests because after logging operations, a period of mineralization diminishes the soil carbon. This development is not overcompensated by the growth of seedlings (and their input in SOC) after logging. Therefore the soil organic carbon pool is conservatively disregarded.

B.3. Specification of the greenhouse gas sources whose emissions will be part of the LULUCF project:

According to the methodology, the following GHG sources are included or have been conservatively disregarded (see Table 10).

Table 10: Emissions sources included in or excluded from the project

Source	GHG	Included / excluded
Forest fires	CO_2	Yes
	CH_4	Yes
	N_2O	Yes
Use of fertilizers	CO_2	Not Included. The use of fertilizers is not foreseen under the project activity.
	CH_4	Not Included. The use of fertilizers is not foreseen under the project activity.
	N_2O	Not Included. The use of fertilizers is not foreseen under the project activity.
Combustion of fossil fuels by vehicles	CO_2	Yes
	CH_4	Yes
	N_2O	Yes

More specifically the project accounts for the following GHGs under the baseline scenario:

Table 11: GHGs Considered Under the Baseline Scenario

GHG	Source (S) or Sink (CS)	Included/ excluded
CO2	Forest Degradation (S)	Included
	Fuel Use of Machinery (S)	Included
	Electricity consumption (S)	Included
	Forest Fires (S)	Conservatively neglected
	Commercially Harvested Firewood (S)	Included
	Fuelwood Collection (S)	Conservatively neglected
	Biomass Burning in the Course of Land Conversion (S)	Unlikely scenario, conservatively neglected.
	Carbon Stored in AGB (CS)	Included
	Forest Regrowth (CS)	Included
	HWP (S and CS)	Included
	Deadwood (S and CS)	Included

CH4	Pestilence (S)	Unlikely scenario, conservatively neglected.
	Biomass Burning in the Course of Land Conversion (S)	Unlikely scenario, conservatively neglected.
	Fuel Use of Machinery (S)	Included
	Deadwood (S and CS)	Conservatively neglected
N2O	Biomass Burning in the Course of Land Conversion (S)	Unlikely scenario, conservatively neglected.
	Fuel Use of Machinery (S)	Included

Moreover the project accounts for the following GHGs under the project scenario:

Table 12: GHGs Considered under the Project Scenario

GHG	Source	Included/ excluded
CO2	Electricity consumption	Included
	Flights	Included
	Ground Travel	Included
	Aerial Surveillance	Included
	Natural Disturbance	Included
CH4	Electricity consumption	Included
	Flights	Included
	Ground Travel	Included
	Aerial Surveillance	Included
	Natural Disturbance	Included
N2O	Electricity consumption	Included
	Flights	Included
	Ground Travel	Included
	Aerial Surveillance	Included
	Natural Disturbance	Included

B.4. Description of how the net anthropogenic removals by sinks are enhanced above those that would have occurred in the absence of the JI LULUCF project:

The latest version of the CDM A/R additionality tool was applied (version 2.0, following CDM EB 35, §17). The steps as outlined in the tool[6] are followed to demonstrate that the proposed JI project activity is additional and not the baseline scenario.

STEP 0: Preliminary screening based on the starting date of the project activity

Evidence of Project Start. The proposed JI LULUCF activity started at the 3rd June 2009. The project area is forest according to the host country's definition of forest, which is documented in section A.4. Evidence may be provided to the AIE in form of an undersigned concession contract between Mr. Dijuk, Head of Primorski Forest Department and Mr. Shirko, Head of the TCT.

Evidence of the Consideration of Carbon Revenues. From its very beginning, the protection of the project area was envisaged to be implemented as a forest climate project. This may be proven to the AIE in the course of determination by above mentioned contract. The concession contract between Forest

[6] Source: http://cdm.unfccc.int/Reference/tools/ar/methAR_tool01_v02.pdf

Department and TCT grants TCT the right to develop a climate project on the concession area, which serves as proof that carbon revenues were considered from the beginning of the project start.

Step 1. Identification of alternative land use scenarios to the proposed JI LULUCF project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed JI LULUCF project activity
Since the lands within the project area are strictly reserved for forestry purposes by government, other land uses are impossible. Consequently, the following alternative land uses are identified:

- **Alternative Scenario A**: The proposed project activity of avoiding any type of logging is undertaken without being implemented as JI LULUCF activity. In this case, the Primorsky Forest Department would not realize any timber-related financial income from the project area.
- **Alternative Scenario B:** Concession would only be granted for intermediate logging and selective sanitary logging activities based on the issuance of annual felling tickets as practiced since decades in other NHZ in the region. No selective commercial logging takes place.
- **Alternative Scenario C:** Following the new opportunities provided by changed legislation extensive timber harvesting operations either under long-term concessions or annual felling tickets would take place, where
    - Forest stands that have a Korean Pine share below 30% would be managed under selective commercial logging complemented by intermediate logging and selective sanitary logging and
    - Forest stands having a Korean Pine share above 30% would be managed under intermediate logging and selective sanitary logging.

    At the 25th of January 2010, a regulation came into force, which avoids the logging of any Korean Pine trees. This regulation is not bound to the forest law as such. Still, the option of logging all other tree species during any type of logging operation would not be affected by this.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations
Alternative Scenario A. It is the decision/assessment of the Forest Department of Primorsky Krai whether a NHZ is leased for any type of permitted timber logging or not. There are no binding laws that force the Forest Department to lease the Bikin NHZ. Hence, Alternative Scenario A is consistent with the forest laws of the Russian Federation.

Alternative Scenario B. Even before the new Forest Code of the Russian Federation came into force after 2007, silvicultural treatments such as intermediate logging and other non-commercial forms of logging such as selective sanitary logging were allowed with the objective that such silvicultural measures are required to ensure long-term stability and productivity of the forest stands. Also the new regulations allow for these types of operations in all stands of the project area with the exception that Korean Pine trees cannot be logged in any case since January 2010. Such logging operations are not regarded as activities aiming at timber harvesting for commercial purposes.
The management of NHZ is governed by three legal documents, the Forest Codex, the Rules Use of Forest with Different Protective Status and the Rules of Wood Harvesting. A legal analysis of the three documents is provided below:

- **Forest Codex** (2007)**.** According to the new forest code, distinct logging operations are related to the different forest areas.
    - Article 10 (Classification of Forests According to Their Designation), §1 of the new forest codex divides forest land into protection forests, exploitation forest and reserve forests.

- Article 12 (Forest Development), §4 specifies that protection forests have the purpose to fulfill environmental functions (water protection etc.). Moreover it specifies that protection forests may be used for logging as long as they fulfill their environmental services.
- Article 102 (Protection Forests and Special Protection Parcels of Forests), §2.2.4.E, §2.2.4.H and §2.2.4.I classifies Nut Harvesting Zones (NHZ) and riparian zones as High Value Forests.
- Article 102, §2.4 states that High Value Forests are classified as protected forests.
- Article 102, §5 states that in protected forests and High Protected Forest Areas[7] activities, which are inconsistent with their purpose (See Article 12, §4), are restricted.
- Article 106 (Legal Regime for High Value Forests), §1 it is noted that in High Value Forests clear cutting is prohibited, except cases specified in Article 17, §4.
- Article 17 (Selective Cutting and Clear Cutting of Forest Stands) §4 allows clear cutting in protected forests only if selective cutting can't secure positive change of forest stands with lost environmental functions to the forest stands with high environmental functions.

It is concluded that NHZs and riparian zones qualify as High Value Forests which are a subgroup of protected areas. Theoretically, the new forest code allows for all kind of loggings (i.e. selective and clear-cut-methods) in protected areas and hence in NHZs and riparian zones.

- **Rules of Use of Forest with different protective Status** (2010), allows selective commercial logging in stands of NHZs that have a Korean Pine share below 30%. This is allowed since the publication of "Features of use of forest with different protective status (also for High Valuable Forests)" came into force on 25th of January 2010 by Order of Ministry of Agriculture of RF № 543[8].
- **Rules of Wood Harvesting** (2007),
  - Article 12 specifies the logging operations in stands having Korean Pine share above 30%. In those stands, commercial (clear cut and selective) logging is forbidden.
  - Article 4 specifies that intermediate, sanitary and other types of logging are allowed in both protection and exploitation forests. Consequently intermediate logging can be implemented in Korean-pine stands too.

Based on above legal analysis it is concluded that it is allowed to conduct intermediate selective logging in NHZs and riparian zones as long as the forest use is consistent with other environmental functions of the forest. Consequently, Alternative Scenario B is in line with forest laws and regulations of the Russian Federation.

Alternative Scenario C. Following the new Forest Code of the Russian Federation that came into force in 2007 a series of new amendments, rules and regulations was published by the government affecting the former protected status of the Bikin NHZ, as they foresee a different way of management of NHZs. Based on the new legislation that was signed on the 6th of November 2009 and came into force on 25th of January 2010 (Russian Forest Code, Articles 102, 106, Order of Ministry of Agriculture of RF № 543), it's possible to carry out not only intermediate logging or selective sanitary logging in water protective forests, nut harvesting zones, forests near water objects, but also selective commercial logging in mature and over-mature forests. Grown-up forest stands with less than 30% Korean Pine (by volume) making up for 59% of the project area qualify for commercial timber harvesting operations. Forest stands having a Korean Pine share of more than 30% and more are only eligible for intermediate logging and selective sanitary logging, but not for selective commercial logging.

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[7] I.e. small forest patches with protection status which can be situated in protected forests, exploitation forest and reserve forests

[8] Please note, the Russian name of the document reads Особенности использования, охраны, защиты, воспроизводства лесов, расположенных в водоохранных зонах, лесов, выполняющих функции защиты природных и иных объектов, ценных лесов, а также лесов, расположенных на особо защитных участках лесов № 543]

In addition to the legal documents cited above the following orders issued by the Russian Ministry of Agriculture (at that time in charge of the forestry sector of Russia) and by the Russian State Forest Agency (to which responsibility was handed over) prove the legal opportunity for selective commercial logging in Bikin in addition to intermediate logging and selective sanitary logging:

- **Order of Ministry of Agriculture of RF # 543 from 06.11.2009** ("About confirmation of features of utilization, protection, safeguard and reproduction of forests allocated in water protection zones, forests with nature protection and other objects with protection functions, valuable forests, and also forests allocated on particularly protective forest areas", valid from 25.01.2010 until 29.01.2011), and
- **Order of State Forest Agency (Rosleskhoz) # 485 from 14.12.2010** ("About confirmation of features of utilization, protection, safeguard and reproduction of forests allocated in water protection zones, forests with nature protection and other objects with protection functions, valuable forests, and also forests allocated on particularly protective forest areas", valid from 30.01.2011), both specify that
    - In state forest protective belts, anti-erosion forests, forbidden forest belts along water reservoirs, spawning-protective forests belts, forests of desert, semi-desert, forest-steppe, forest-tundra zones, steppes, mountains, belt pine forests, and also in nut harvesting zones and forest fruit stands selective commercial logging might be implemented with very low, low and temperate intensity, excluding sanitary logging, which intensity for dying, damaged and low-valuable stands can reach very high intensity, as determined by Logging Rules.
    - Intermediate logging of high and very high intensity can be also implemented in case of needs to form juvenile stands in nut harvesting zones forests and forest fruit stands.
    - In belt pine forests and nut harvesting zones any reconstructive logging types are prohibited.

It is concluded that a mixed scenario (comprising selective commercial logging without Korean Pine and intermediate logging plus selective sanitary logging) would be legally applicable.

This conclusion is evidenced by several facts:

- First, the Forest Department of Primorsky Krai issued a tender for the Olginskaya NHZ[9].
- It is even more confirmed by the letter of the Deputy Head of Primorsky Forestry Department, Mr S.E. Pstyga, to WWF Russia dated 25th of August 2011. This letter states that the calculations of the AAC and annual logging area as calculated by the Far Eastern branch of "Roslesinforg" (accredited forest management planning company) for the project area is accurate and based on Russian forestry legislation valid in 2008 year.
  However, the Head of the Forest Department mentions that the project should also consider commercial selective logging in mature and over-mature forests according to The Russian Forest Code, articles 102, 106, "Features of use of forest with different protective status …" established by Ministry of Agriculture on November, 6th, 2009, №543.
- In the letter from Head of Primorsky Forestry Department, Mr D.A. Rybnikov to WWF Amur Branch, forest officials confirms that all the calculations provided for intermediate, sanitary and commercial selective logging on the project area 399.0 thousand m^3 as AAC on the area 9287.4 ha are correct (letter dated 8th of November 2011).

It is concluded that the Alternative Scenario C is in line with forest laws and regulations of the Russian Federation, as long as it is considered during logging volume and area calculation that:

- Before 25th of January 2010 only intermediate logging and sanitary logging (with Korean pine) was legally possible, and

After 25th of January 2010 until now selective commercial logging + intermediate logging + selective sanitary logging (minus Korean Pine volumes) could be carried out according to Russian forest legislation.

9 Tender documents are available under http://old.primorsky.ru/departments/controls/?s=1436

Outcome of Sub-Step 1. Finally it is concluded that Alternative Scenario A, Alternative Scenario B and Alternative Scenario C passes sub-step 1b. All three are further analyzed in step 2.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method
The proposed project activity generates no financial or economic benefits other than JI related income. Thus option one of the investment analysis is applicable.

Please note the TCT has the right to use Bikin NHZ for the collection of NTFPs such as Korean Pine nuts for commercial purposes (which is mentioned in the concession contract between forest department and the TCT). Still this right is not bound to the lease of the forest concession. Also in absence of the lease of the concession by TCT, the TCT would have had the right to collect NTFPs.

Sub-step 2b. – Option I. Apply simple cost analysis
Project Scenario. The JI revenues shall cover the annual concession fees which, according to the concession contract, TCT has to pay to the Forest Department on an annual basis. Moreover JI revenues from the project shall finance the protection and monitoring measures as well as infrastructure development (investment in more efficient electricity generation) and investment in better education system.
TCT has no other income from the project scenario than JI related revenues.

It is concluded that the project scenario is clearly only feasible if developed under Joint Implementation.

Alternative Scenario A. The Forest Department of Primorsky Krai may not lease the concession for intermediate selective logging. In this case, the forest department would not receive any stumpage fees.

- Average stumpage fees (2010) for Spruce and Fir amount to 40 Ruble/m^3 (low range) and fees for oak rise up to 500 to 1,000 Ruble/m^3 (high range).
- The total commercial volume of the Bikin NHZ amounts to 103.0 million m3.
- If the forest department would allow for intermediate logging of the Bikin NHZ, it may generate significant income.
- If the forest department does not allow for intermediate selective logging, it falls short on the income from stumpage fees.

It is concluded that Alternative Scenario A is not plausible, as the Forest Department would fall short of a significant income source.

Alternative Scenario B. Following the rational outlined in the analysis of Alternative Scenario A, it becomes clear, that allowing for intermediate logging including selective sanitary logging in the Bikin, would generate significant income for the Forest Department. This is considered as a plausible baseline scenario.

Alternative Scenario C. Following the rational outlined in the analysis of Alternative Scenario A and B it is obvious that a combination of selective commercial logging, intermediate logging and selective sanitary logging would generate highest financial revenues for the Forest Department. Therefore, it is considered as the most plausible baseline scenario.

Step 4. Common practice analysis

Bikin is the only project case of its size (i.e. +/- 50%, CDM EB Guidance on the analysis of common practice). As such, the project cannot be considered as common practice.
Still it shall be noted, that some of the smaller NHZs (i.e. Vostochnaya, Melnichanya and Kokcharovskaya) have been leased by large (partially logging companies) in order to protect them from logging activities but use for long-term NTFP management (as part of the companies' Corporate Social Responsibility strategy). This initiative was spearheaded and managed by WWF Amur Branch.

Based on steps 1, 2, and 4 it is concluded that the proposed JI activity is additional.

Baseline Scenario. Following above analysis, logging operations classified as 'Selective Commercial Logging' as well as 'Intermediate Logging including Selective Sanitary Logging' would occur in absence of the project activity. The related baseline emissions are calculated following strictly the formulae of the selected Logged to Protected Forest methodology.

Calculation of Primary Parameters. The annual baseline emissions in tCO_2 are calculated based on the quantification of the annual CO2e emissions arising of forest degradation and the annual $_{CO2}$e emissions of logging operations (i.e. hauling, skipping, transportation, etc.):

$$C'_{baseline,t} = C'_{degradation,t} + C'_{emissions,t} \qquad (3\text{-}1)$$

Parameter	Description	Unit
$C'_{baseline,t}$	Annual total carbon emissions associated with the baseline scenario in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{degradation,t}$	Annual total carbon emissions associated with degradation as a result of the baseline activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{emissions,t}$	Annual total carbon emissions associated with the baseline activity of selective logging operations in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

The emissions of forest degradation are determined based on the quantification of emissions due to the decay of deadwood, the emissions from long-term harvested wood products (ltHWP), growth foregone as well as re-growth after logging operations. The detailed approach is presented in below formula 3.2:

$$C'_{degradation,t} = \left[\llbracket (C \rrbracket_{DW_{decay},t} + C_{ltHWP_{oxidation},t} + C_{regrowth,t} \right) x \frac{44}{12} \Bigg] \qquad (3.2)$$

Parameter	Description	Unit
$C'_{degradation,t}$	Annual total carbon emissions associated with degradation as a result of the baseline activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C_{DW_{decay},t}$	Annual carbon leaving the deadwood pool due to the decay of deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{oxidation},t}$	Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{growth_{foregone},t}$	Annual carbon lost due to growth foregone in the aboveground biomass in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

$C_{regrowth,t}$	Annual carbon increase in the biomass due to regrowth following logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\frac{44}{12}$	The ratio of molecular weight of carbon dioxide to carbon	tCO_2-e tC^{-1}

The average carbon in merchantable logs per ha, per stratum is determined based on detailed forest inventory information. This calculation is based on the actual commercial volumes of 14,765 so-called compartments. For each compartment, the commercial volumes of major tree species were provided. These were combined with tree-specific density and carbon fraction (CF)-coefficients. The quantification follows formula 3.3 presented below.

$$\bar{C}_{merch,j,t=0} = D \; x \; CF_{wood} \; x \; \bar{V}_{merch,j,t=0} \qquad (3\text{-}3)$$

Parameter	Description	Unit
$\bar{C}_{merch,j,t=0}$	Average carbon per hectare in merchantable logs in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
D	Wood density for the forest with corresponding climate region and ecological zone	(t d.m.) m^{-3}
CF_{wood}	Carbon fraction of wood for the forest	tC $(t\ d.m.)^{-1}$
$\bar{V}_{merch,j,t=0}$	Average merchantable logs" volume per hectare in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	m3 ha^{-1}

Table 13: Tree Species, Density Factors and Carbon Fraction

Latin Name	Betula	Betula alleghaniensis	Betula ermanii	Carpinus	Quercus	Picea	Salix	Tilia	Pinus koraiensis	Acer	Larix	Tilia	Alnus	Juglans	Populus tremor	Abies	Populus tremor	Prunus padus	Chosenia	Fraxinus
Russian - English Name	Береза бородавчатая - Comon birch	Береза желтая - Yellow birch	Береза каменная - Stony birch	Граб - Hornbeam	Дуб - Oak	Ель - Spruce	Ива - Willow	Липа - Lime	Кедр (сосна кедровая) - Korean pine	Клен - Maple	Лиственница - Larch	Липа - Lime	Ольха - Alder	Орех грецкий - Manchurian walnut	Осина - Aspen	Пихта - Fir	Тополь - Poplar	Черемуха - Bird Cherry	Чозения - Chosenia (lat.)	Ясень обыкновенный - Ash
Density[10]	0.51	0.51	0.51	0.63	0.58	0.40	0.45	0.43	0.42	0.52	0.49	0.43	0.45	0.53	0.35	0.40	0.35	0.49	0.45	0.57
Carbon Fraction	0.48	0.48	0.48	0.48	0.48	0.51	0.48	0.48	0.51	0.48	0.51	0.48	0.48	0.48	0.48	0.51	0.48	0.48	0.48	0.48

Source: IPCC, 2006, Source IPCC 2006 Table 4.3

[10] Please note, values at 0% Humidity.

The following approach was applied:
Table 4 outlines the merchantable volume for year t=1 and all subsequent years. The first figure amounts to 40.41 m^3/ha, the second to 42.96 m^3/ha.
Following the same approach, the weighted average carbon fraction of the project areas was determined to be 0.4993 tC/t.d.m.
Considering above density and carbon fraction results in an average carbon stock of 8.93 tC/ha, for the first year. For all subsequent years a value of 9.49 tC/ha was applied.

Formula 3-4 proposes an approach to determine the average carbon per ha in merchantable logs. As the calculations of formula 3.3 was already applied for 14,765 sub-compartments, formula 3.34 results in the identical outcome as above, 8.93/9.49 tC/ha.

$$\bar{C}_{merch,t=0} = \frac{\sum_{j=1}^{J} \bar{C}_{merch,j,t=0} x A_{project,j,t=0}}{A_{project,t=0}} \quad (3\text{-}4)$$

Parameter	Description	Unit
$\bar{C}_{merch,t=0}$	Average carbon per hectare in merchantable logs in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$\bar{C}_{merch,j,t=0}$	Average carbon per hectare in merchantable logs in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$A_{project,j,t=0}$	Project Area within each stratum j, (where j=1,2,3 ... J strata) where the IFM-LtPF project activity will be implemented; determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	ha
$A_{project,t=0}$	Project Area where the IFM-LtPF project activity will be implemented; determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	ha

Based on a) the average carbon per ha in stocks which would be removed under the baseline scenario, and based on b) the total annual net harvesting area, presented in Table 4, the total carbon in merchantable logs is calculated following formula 3-15a below:

$$C_{merch,t=0} = \bar{C}_{merch,t=0} \; x \; A_{NHA_{annual},t} \quad (3\text{-}15a)$$

Parameter	Description	Unit
$C_{merch,t=0}$	Annual total carbon in the merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{C}_{merch,t=0}$	Average carbon per hectare in the merchantable logs determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

Following the above approach results in a $C_{merch,,t=0}$ of 31,806 for year 1 and a value of 89,170 tC annually for all subsequent years of the crediting period.

Annual total carbon AGB of the growing stock harvested per year is determined following formula 3-16a below:

$$C_{AGB_{gstock},t} = \bar{C}_{AGB_{gtstock},t=0} \; x \; A_{NHA_{annual},t} \quad (3\text{-}16a)$$

Parameter	Description	Unit
$C_{AGB_{gstock},t}$	Annual total carbon in the aboveground biomass of the growing stock harvested every year in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{C}_{AGB_{gtstock},t=0}$	Average carbon per hectare in the aboveground biomass of the growing stock determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

In a first step, the AGB is determined for 14,465 compartments based on Biomass Expansion Factors (BEF) used in FAO's report on Forest Resources of the Russian Federation. Based on these BEFs, the weighted average BEF was determined, amounting to 1.39.

Table 14: Biomass Expansion Factors

Species (English)	Biomass Expansion Factors	AGB per Species (in t.d.m)	Share of Species in total AGB (in %)	Calculation of the Weighted Average BEF
Larch	1.48	2,384,356	0.04	0.06
Maple	1.38	967,492	0.02	0.02
Ash	1.38	2,958,840	0.05	0.06
Spruce	1.43	15,067,854	0.24	0.34
Korean Pine	1.46	14,840,573	0.23	0.34
Elm	1.38	2,132,141	0.03	0.05
Birch	1.3	2,689,024	0.04	0.06
Yellow Birch	1.3	9,746,262	0.15	0.20
Fir	1.35	5,790,804	0.09	0.12
Manchurian walnut	1.38	8,970	0.00	0.00
Hornbeam	1.38	67,536	0.00	0.00
Alder	1.38	122,683	0.00	0.00
Aspen	1.32	366,641	0.01	0.01
Lime	1.35	3,875,791	0.06	0.08
Oak	1.4	1,591,772	0.03	0.04
Poplar	1.38	193,891	0.00	0.00
Remainder	1.38	574,018	0.01	0.01
Sources: FAO 2005, FRA Russian Federation, Section 6.3			Average BEF	1.39

Combining the BEFs with the commercial volumes, given by the forest inventory data results in AGB volume of 60,419,808 t.d.m. in the project area. The average AGB volume per ha amounts to 133.62

t.d.m./ha. Based on the weighted average carbon fraction, discussed above, this results in $C_{AGB\_gstock,t=0}$ of 62.22 tC/ha.

In a next step, this is combined with the $A_{NHA,\ annual}$ presented in Table 4. This finally results in the calculation of the total AGB carbon stocks of the areas harvested per year, $C_{AGB,gstock,1}$ = 233,227tC and $C_{AGB,gstock,\ n>1}$ = 615,012 tC.

Net Carbon from the Deadwood Pool. Following the guidance of the chosen methodology, the baseline includes the calculation of emissions of the deadwood pool and its decay. The volume of tC leaving the deadwood pool per year is calculated following formula 3-17.

$$C_{DW_{decay},t} = f\left(C_{DW_{in},t}, k_{decay}\right) \qquad (3\text{-}17)$$

Parameter	Description	Unit
$C_{DW_{decay},t}$	Annual carbon leaving the deadwood pool due to the decay of deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
k_{decay}	Rate of decay of the deadwood pool	yr

Formula 3-17 shows that the deadwood decay has to be considered as a function of the dead wood decay parameter and the input of deadwood into the deadwood (DW) pool. The table below outlines the approach for the determination of k.

Table 15: Determination of the Weighted Average Decay Rate			
Korean Pine Share (of total volume, in t.d.m)	k Pinus Koreansis	k Rest	Weighted Average k
0.284	0.015	0.075	0.06
Source: Calculated based on: Mikhail Yatskov, Mark E. Harmon and Olga N. Krankina, 2003, A Chronosequence of Wood Decomposition in the Boreal Forests of Russia, Canadian Journal of Forest Resources, Vol. 33. The k value for pinus koreansis was taken from Table 8, for Khabarovsk. The k value for all other species was deducted from the graph on page 1223, at a mean annual temperature of the project area of 4.8°C.			

In a next step, the input into the DW pool is specified following formula 3-18 below:

$$C_{DW_{in},t} = C_{RSD_t} + C_{branch_{trim},t} \qquad (3\text{-}18)$$

Parameter	Description	Unit
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
C_{RSD_t}	Annual carbon in the residual stand damage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

$C_{branch_{trim},t}$	Annual carbon in branches and trimmings left over from harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

The annual carbon in the residual stand damage and the annual carbon from trimmings are determined in below functions.

The annual carbon in the residual stand damage is specified in formula 3-19.

$$C_{RSD,t} = f_{RSD} \ x \ C_{merch,t} \qquad (3\text{-}19)$$

Parameter	Description	Unit
$C_{RSD,t}$	Annual carbon in the residual stand damage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
f_{RSD}	Factor for residual stand damage, based on the fraction of quantity of carbon damaged in the residual stand to the quantity of carbon in total merchantable logs harvested	dimensionless
$C_{merch,t}$	Annual total carbon in merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (See Equations 3-15a and 3-15b)	tC

The factor of the residual stand damage was determined based on a post felling inventory in the Vostochnaya Nut Harvesting Zone. This value was used based on the two subsequent considerations:

- First, being classified as a NHZ, Vostochnaya has a similar tree species composition as the Bikin.
- Second, the Vostochnaya is directly bordering the Bikin NHZ. As such similar logging practices as under the baseline scenario have been applied.

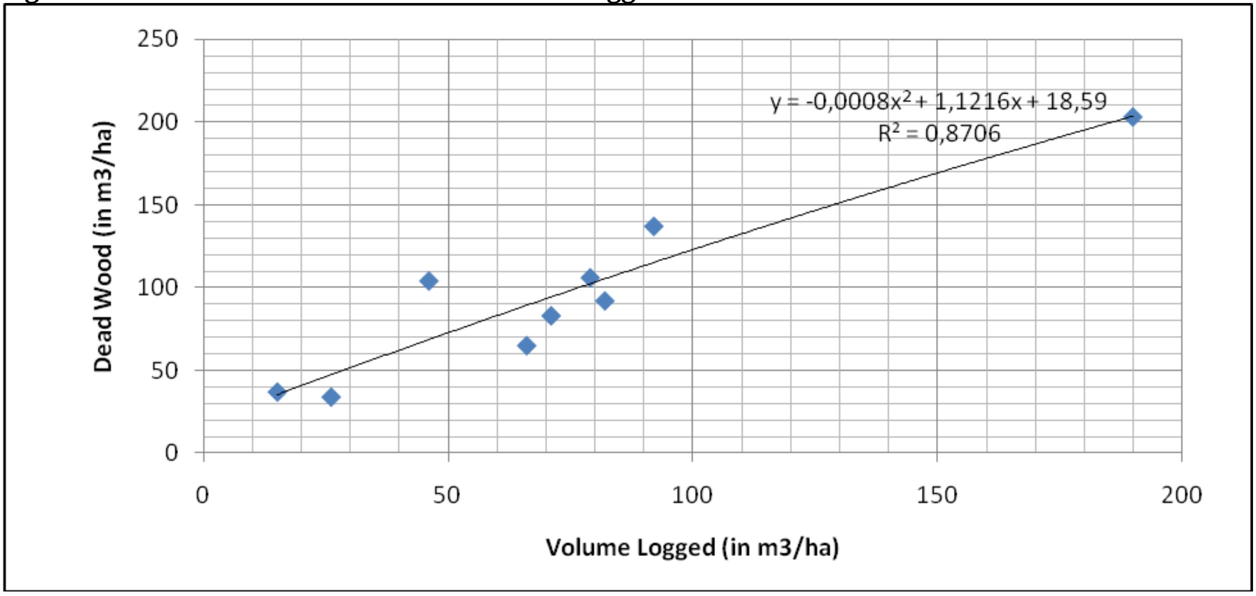
The post felling inventory was conducted by the Far Eastern Forest Research Institute. Nine logging plots have been measured. The findings are presented in below table:

Table 16: Calculation of fRSD

Plot ID	Volume of AGB before Harvest (in m^3/ha)	Volume of AGB after Harvest (in m^3/ha)	Logged Volume (in m^3/ha)	Deadwood Created (in m^3/ha)	fRSD
1	313	279	26	34	1.31
2	278	174	46	104	2.26
3	428	322	79	106	1.34
4	336	199	92	137	1.49
5	250	167	71	83	1.17
6	248	183	66	65	0.98
7	344	141	190	203	1.07
8	313	221	82	92	1.12
9	283	246	15	37	2.47
				Average fRSD	1.47

The findings indicate a strong correlation between deadwood volumes (in m^3/ha) and the volume logged (m^3/ha). Below function features a R^2 of 0.87 and hence offers a high explanatory value.

Figure 6: Deadwood Volume as a Function of Logged Volume



Based on above evaluation, the average fRSD was calculated to amount to 1.47.

Function 3-20 below outlines the approach for determining the annual carbon input into the DW pool based on trimmings and left over from branches.

$$C_{branch_{trim},t} = f_{branch_{trim}} \, x \, C_{merch,t} \qquad (3\text{-}20)$$

Parameter	Description	Unit
$C_{branch_{trim},t}$	Annual carbon in branches and trimmings left over from harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$f_{branch_{trim}}$	Annual total carbon in the merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{merch,t}$	The fraction of branches and trimmings in the aboveground biomass remaining after trimming of the merchantable logs transferred to the DW pool	dimensionless

The following approach was applied:

- The k value as determined under formula 3-19 was used.
- In the absence of specific trimming activities, BEF value was applied. The calculated, weighted average BEF (determined in Table 14) was used.

Formula 3-21 was followed to determine the decay of deadwood volume in the DW pool over time:

$$F_{DW_{remain},t} = e^{-k_{decay} \, x \, t} \qquad (3\text{-}21)$$

Parameter	Description	Unit

$F_{DW_{remain},t}$	Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of decay	Dimension-less
k_{decay}	Rate of decay of the deadwood pool	yr^{-1}
t	1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity	yr

Formula 3-22a was used to calculate the volume of the deadwood pool per year:

$$C_{DW_{pool},t} = \sum_{t=1}^{t*} F_{DW\_remain\_t} \ x \ C_{DW_{in},t} \qquad (22a)$$

Parameter	Description	Unit
$C_{DW_{pool},t}$	Cumulative carbon remaining in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$F_{DW_{remain_t}}$	Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of decay	dimensionless
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Formula 3-23 allows to calculate the accumulated carbon output of the DW pool:

$$C_{DW_{out},t} = \sum_{t=1}^{t*} C_{DW_{in},t} - C_{DW_{pool},t} \qquad (3\text{-}23)$$

Parameter	Description	Unit
$C_{DW_{out},t}$	Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{pool},t}$	Cumulative carbon remaining in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Formula 3-24 finally allows to calculate the annual output (i.e. not accumulated) of the DW pool which are considered as baseline emissions:

$$C_{DW_{decay},t} = C_{DW_{out},t} - C_{DW_{out}t-1} \qquad (3\text{-}24)$$

Parameter	Description	Unit
$C_{DW_{decay},t}$	Annual carbon leaving the deadwood pool due to the decay of	tC

	deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	
$C_{DW_{out},t}$	Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{out},t-1}$	Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t-1, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Table 17: Calculation of the Deadwood Pool

t	$F_{DW_{remain},t}$	Deadwood Pool in tC										$C_{DW_{pool},t}$
1	0.94	55,861										55,861
2	0.89	52,715	156,608									209,323
3	0.84	49,747	147,789	156,608								354,143
4	0.79	46,945	139,466	147,789	156,608							490,808
5	0.75	44,302	131,613	139,466	147,789	156,608						619,777
6	0.71	41,807	124,201	131,613	139,466	147,789	156,608					741,484
7	0.67	39,453	117,207	124,201	131,613	139,466	147,789	156,608				856,337
8	0.63	37,231	110,607	117,207	124,201	131,613	139,466	147,789	156,608			964,722
9	0.59	35,134	104,379	110,607	117,207	124,201	131,613	139,466	147,789	156,608		1,067,004
10	0.56	33,156	98,501	104,379	110,607	117,207	124,201	131,613	139,466	147,789	156,608	1,163,526

Table 17 above presents the calculation of the deadwood pool. It can be seen that the volume stored in the DW pool increases from 55,228 tC in year 1 to 1.15 mio tC in year 10. Based on above calculation and based on above formulae, the annual volume of decomposed deadwood is calculated in below table.

Table 18: Calculation of the Decay of Deadwood

t	$F_{DW_{remain},t}$	$C_{DW_{pool},t}$	$\sum_{t=1}^{t*} C_{DW_{in},t}$	$C_{DW_{out},t}$	$C_{DW_{decay},t}$
1	0.94	55,861	59,194	3,333	3,333
2	0.89	209,323	225,147	15,824	12,491
3	0.84	354,143	391,100	36,957	21,133
4	0.79	490,808	557,053	66,245	29,288
5	0.75	619,777	723,006	103,228	36,984
6	0.71	741,484	888,958	147,475	44,246
7	0.67	856,337	1,054,911	198,574	51,100
8	0.63	964,722	1,220,864	256,142	57,567
9	0.59	1,067,004	1,386,817	319,813	63,671
10	0.56	1,163,526	1,552,770	389,244	69,431

The above table shows the annual emissions from deadwood decomposition accounted for under the baseline. The annual baseline emissions from the deadwood decay increase from 3,333 tC in year one to 69,400 tC in year 10.

Net Carbon from the Harvested Wood Product Pool. In order to quantify the baseline emissions, it is assumed that part of the logged volume (and its carbon content) is stored in the harvested wood product (HWP) pool.
Following the applied methodology, two pools are foreseen:

- Long term Harvested Wood Product Pool (ltHWP), and
- Short term Harvested Wood Product Pool (stHWP).

IPCC 2006 (chapter 12) defines ltHWP as those products which feature a half-life over 30 years whereas stHWP are defined as having a half-life of no more than two years.

The baseline documentation does not foresee logging to cover the demand of stHWP. Hence it is assumed that the total volume of logs will be processed and converted to ltHWP. As stHWP has a higher decay rate as ltHWP this is considered to be conservative and is in line with the procedures of the applied VCS methodology.

The basic approach for the determination of the missions due to the oxidation of ltHWP is laid out in formula 3-25 below:

$$C_{ltHWP_{oxidation},t} = C_{ltHWP_{residues},t} + C_{ltHWP_{net-out},t} \quad (3\text{-}25)$$

Parameter	Description	Unit
$C_{ltHWP_{oxidation},t}$	Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{residues},t}$	Annual carbon due to the immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{net-out},t}$	Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

The residues which occur in the course of the processing of ltHWP are calculated based on formula 3-26 below:

$$C_{ltHWP_{residues},t} = \overline{C}_{merch,p,t} \ x \ \left(1 - f_{lumber_{recovery}}\right) x \ A_{NHA_{annual},t} \quad (3\text{-}26)$$

Parameter	Description	Unit
$C_{ltHWP_{residues},t}$	Annual carbon due to the immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\overline{C}_{merch,p,t}$	Average carbon per hectare in merchantable logs of forest product type p=sawlog, in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$f_{lumber_{recovery}}$	Lumber recovery factor for proportion of merchantable log converted to harvested wood product	dimensionless
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

The below table presents the lumber recovery factor of the Primorsky Krai for the years 2007 - 2009. Following the new regulation on higher taxation of roundwood exports, the last three years have lived to see significant investments in saw mills in the krai. This is reflected by substantial increases of the lumber recovery factor (which are also substantial higher than the default values provided by the methodology).

In order to determine the lumber recovery factor applicable to the baseline, the highest (and most conservative) factor was applied. The data was provided by the federal statistical service of Primorye.

Table 19: Calculation of the Lumber Recovery Factor of Primorsky Krai

Year	Volume of Wood for Processing (in 1000m3)	Volume of Processed Wood (in 1000m3)	Lumber Recovery Factor (in %)
2007	850	341.9	0.40
2008	720	312.7	0.43
2009	755	340.2	0.45
Source: Calculation based on data provided by Primorskstat[11], 2010, Forest industry complex of Primorie.			

The input into the ltHWP pool is determined as stipulated by formula 3-27.

$$C_{ltHWP_{in},t} = \overline{C}_{merch,p,t} \ x \ f_{lumber_{recovery}} \ x \ A_{NHA_{annual},t} \qquad (3\text{-}27)$$

Parameter	Description	Unit
$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\overline{C}_{merch,p,t}$	Average carbon per hectare in merchantable logs of forest product type p, in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC
$f_{lumber_{recovery}}$	Lumber recovery factor for proportion of merchantable log converted to harvested wood product	dimensionless
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

The fraction of carbon which remains in the ltHWP is determined following formula 3-28. Following IPCC, 2006, an annual oxidation rate of 2% was applied for ltHWP.

$$F_{ltHWP_{remain}} = e^{-k_{ltHWP_{ox}} \ x \ t} \qquad (3\text{-}28)$$

Parameter	Description	Unit
$k_{ltHWP_{ox}}$	Rate of oxidation for long-term harvested wood products	yr^{-1}
t	1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity	yr

The volume of the ltHWP is calculated following 3-29a:

[11] Primorskstat is the federal statistic service in Primorskiy krai.

$$C_{ltHWP_{pool},t} = \sum_{t}^{t*}\left(F_{ltHWP_{remain},t} \ x \ C_{ltHWP_{in},t}\right) \quad (3\text{-}29)$$

Parameter	Description	Unit
$C_{ltHWP_{pool},t}$	Cumulative carbon remaining in the ltHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$F_{ltHWP_{remain},t}$	Annual fraction of ltHWP that would remain in the ltHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of oxidation	dimensionless
$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Formula 3-30 outlines the approach for quantifying the accumulated amount of carbon which leaves the HWP pool:

$$C_{ltHWP_{out},t} = \sum_{t=1}^{t*} C_{ltHWP_{in},t} - C_{ltHWP_{pool},t} \quad (3\text{-}30)$$

Parameter	Description	Unit
$C_{ltHWP_{out},t}$	Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere from year t=1 to year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{pool},t}$	Cumulative carbon remaining in the ltHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Finally, formula 3-31 allows for determining the volume of carbon which leaves the HWP per annum:

$$C_{ltHWP_{net_{out}},t} = C_{ltHWP_{out},t} - C_{ltHWP_{out},t-1} \quad (3\text{-}31)$$

Parameter	Description	Unit
$C_{ltHWP_{net_{out}},t}$	Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{out},t}$	Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{out},t-1}$	Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year t-1, (where t=1,2,3 ... t* years elapsed since the	tC

	start of the IFM-LtPF project activity)	

Based on the formulae 3-25 to 3-31, the ltHWP pool was calculated for each year as follows:

Table 20: Calculation of the Long Term Harvested Wood Product Pool

t	$F_{ltHWP_{remain},t}$	Wood Product Pool in tC										$C_{ltHWP_{pool},t}$
1	0.98	14,006										14,006
2	0.96	13,687	39,266									52,954
3	0.93	13,376	38,373	39,266								91,016
4	0.91	13,072	37,501	38,373	39,266							128,213
5	0.89	12,775	36,648	37,501	38,373	39,266						164,564
6	0.87	12,484	35,815	36,648	37,501	38,373	39,266					200,088
7	0.85	12,201	35,001	35,815	36,648	37,501	38,373	39,266				234,805
8	0.83	11,923	34,205	35,001	35,815	36,648	37,501	38,373	39,266			268,732
9	0.81	11,652	33,427	34,205	35,001	35,815	36,648	37,501	38,373	39,266		301,888
10	0.79	11,387	32,667	33,427	34,205	35,001	35,815	36,648	37,501	38,373	39,266	334,291

Based on above findings, the below table shows the calculation of the tC which leave the ltHWP pool per annum, the volume of residues which and finally the total of emissions resulting arising from the HWP pool.

Table 21: Calculation of the Emissions due to Oxidation of ltHWP

t	$F_{ltHWP_{remain},t}$	$C_{ltHWP_{pool},t}$	$\sum_{t=1}^{t-} C_{ltHWP_{in},t}$	$C_{ltHWP_{out},t}$	$C_{ltHWP_{net_{out}},t}$	$C_{ltHWP_{residues},t}$	$C_{ltHWP_{oxidation},t}$
1	0.98	14,006	14,332	326	326	17,475	17,800
2	0.96	52,954	54,512	1,558	1,232	48,991	50,223
3	0.93	91,016	94,692	3,676	2,118	48,991	51,108
4	0.91	128,213	134,871	6,659	2,983	48,991	51,974
5	0.89	164,564	175,051	10,487	3,829	48,991	52,819
6	0.87	200,088	215,231	15,143	4,655	48,991	53,646
7	0.85	234,805	255,411	20,606	5,463	48,991	54,454
8	0.83	268,732	295,591	26,858	6,252	48,991	55,243
9	0.81	301,888	335,771	33,882	7,024	48,991	56,015
10	0.79	334,291	375,951	41,660	7,778	48,991	56,768

As can be seen from the table above, the annual tC emissions amount from 17,800 tC/ha in year 1 to 56,700 tC/ha in year 10.

Carbon in Re-growth after Selective Logging. After having determined the emissions from the oxidation of HWP and the decay of DW, this section calculates the carbon which would be stored due to the regrowth of logged areas.
The model was specifically developed to quantify the increase of commercial volume (i.e. without branches and crowns) after logging. This work was published by A.A. Dorofeeva "Fragments of reforestation dynamics in Korean pine stands after industrial logging", Collection work of the Far East

Forestry Research Institute, edition 12, Khabarovsk, 1974. The data was collected during field works in the south of Khabarovsk krai, quite near to Bikin in the scale of the Far East.

The carbon stock increase after logging is calculated following formula 3-38:

$$C_{regrowth,t} = \left(\bar{G}_{regrowth,t}\ x\ CF_{AGB}\right) x \sum_{t=1}^{t*} A_{NHA_{annual},t} \qquad (3\text{-}38)$$

Parameter	Description	Unit
$C_{regrowth,t}$	Annual carbon increase in the biomass due to regrowth following logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{G}_{regrowth,t}$	Average regrowth per hectare per year of the aboveground biomass after logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	(t d.m.) ha-1 yr-1
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)-1
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)^^	ha

The model itself is presented in below table. It is based on the following rationale:

- The model assesses the re-growth of deciduous- and conifer forests after logging in three time periods (0-5yrs, 6-10yrs and 11-15yrs).
- The annual re-growth per forest type was multiplied with the results of the stratification (85.6% conifers and 14.4% other). This allows calculating the average weighted re-growth after logging, adapted to the tree composition of the Bikin NHZ.
- As the model allows for the calculation of the commercial volume, the output was amended by multiplying it with the weighted average BEF.
- In a next step this was converted to t.d.m. by multiplying the AGB volume with the weighted average density factor.
- Finally the total re-growth (in t.d.m., including branches and crown) was converted to tons carbon by multiplying the weighted average carbon factor.

Table 22: Re-growth Model										
Re-Growth per Forest Type (in m^3/ha)										
Year	1	2	3	4	5	6	7	8	9	10
Re-growth of Deciduous Species (in m3/ha)	1.3	1.3	1.3	1.3	1.3	1.5	1.5	1.5	1.5	1.5
Re-growth of Conifers (in cbm/ha)	1.3	1.3	1.3	1.3	1.3	1.7	1.7	1.7	1.7	1.7
Source: Fragments of reforestation dynamics in Korean pine stands after industrial logging" by A.A. Dorofeeva, Collection work of the Far East Forestry Research Institute, edition 12, Khabarovsk, 1974.										
Calculation of the Weighted Average Re-growth of the Project Area										
% - Re-growth Confers (in m3/ha/yr)	1.11	1.11	1.11	1.11	1.11	1.45	1.45	1.45	1.45	1.45
% - Re-growth Other Species (in m3/ha/yr)	0.19	0.19	0.19	0.19	0.19	0.22	0.22	0.22	0.22	0.22
Weighted Average Re-	1.30	1.30	1.30	1.30	1.30	1.67	1.67	1.67	1.67	1.67

growth (in m3/ha/yr)										
Weighted Average Re-growth including BEF (in m3/ha/yr)	1.81	1.81	1.81	1.81	1.81	2.33	2.33	2.33	2.33	2.33
Weighted Average Re growth (in t.d.m/ha/yr)	0.80	0.80	0.80	0.80	0.80	1.03	1.03	1.03	1.03	1.03
Weighted Average Re-growth (in tC/ha/yr)	0.40	0.40	0.40	0.40	0.40	0.51	0.51	0.51	0.51	0.51

The results show an average re-growth of 0.40 tC/ha/yr for the first five years after logging. Thereafter the re-growth increases to 0.51 tC/ha/yr. In a subsequent step this was multiplied with the annual net harvesting areas. The findings are presented in the table below:

Table 23: Calculation of Re-Growth

Year	$\bar{G}_{regrowth,t}$ x	Re-Growth Value (tC/yr)										$C_{regrowth,t}$
1	0.40	1,410										1,410
2	0.40	1,410	3,717									5,127
3	0.40	1,410	3,717	3,717								8,844
4	0.40	1,410	3,717	3,717	3,717							12,561
5	0.40	1,410	3,717	3,717	3,717	3,717						16,279
6	0.51	1,812	3,717	3,717	3,717	3,717	3,717					20,398
7	0.51	1,812	4,778	3,717	3,717	3,717	3,717	3,717				25,177
8	0.51	1,812	4,778	4,778	3,717	3,717	3,717	3,717	3,717			29,955
9	0.51	1,812	4,778	4,778	4,778	3,717	3,717	3,717	3,717	3,717		34,734
10	0.51	1,812	4,778	4,778	4,778	4,778	3,717	3,717	3,717	3,717	3,717	39,512

As can be seen from the findings of the table above, the re-growth (in tC/yr) increase from 1,410 tC in year one to 39,512 tC in year 10.

Baseline Activity Emissions. The subsequent section outlines the baseline emissions associated with fuel consumption related to logging operations. This includes emissions from

- Harvesting operations
- Log hauling
- Transportation to the next sawmill, and
- Processing of saw logs.

The project participant decided not to include the baseline emissions of:

- Annual emissions related to trimming and cutting of branches
- Annual emissions related to the distribution of processed wood

Both omissions result in an underestimation of the baseline emissions which is considered to be conservative.

Based on above decisions, formula 3-39 outlines the general approach for the quantification of baseline activity emissions:

$$C'_{emissions,t} = E_{harvest,t} + E_{hauling,t} + E_{transport,t} + E_{processing,t} \quad (3\text{-}39)$$

Parameter	Description	Unit
$C'_{emissions,t}$	Annual total carbon emissions associated with the baseline activity of selective logging operations in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{harvest,t}$	Annual emissions due to harvesting operations such as felling and snigging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$E_{hauling,t}$	Annual emissions due to log hauling in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$E_{transport,t}$	Annual emissions due to log transport from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$E_{processing,t}$	Annual emissions due to electricity consumption in sawmill in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e

In a first step the emissions from harvesting operations are determined following formulae 3-40:

$$E_{harvest,t} = FC_{harvest} \times EF_{fuel} \times V_{merch,t} \quad (3\text{-}40)$$

Parameter	Description	Unit
$E_{harvest,t}$	Annual emissions due to harvesting operations such as felling and snigging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$FC_{harvest}$	Fuel consumption of equipment employed for felling and snigging per m3 of merchantable log harvested	kl m^{-3}
EF_{fuel}	Fuel emission factor	tCO2-e kl^{-1}
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3

Klvac and Skoupy (2009)[12] indicate a range of harvester fuel consumption. The default values range from 1.28 l/m3 to 1.73 l/m3. In order to determine the emission of harvesting operations, the lowest fuel consumption rate (i.e. 1.28 l/m3) was applied which is considered to be conservative. The fuel emission factor was derived based on IPCC data. The calculation is presented in below table:

Table 24: Default Emission Factors for Off-Road Mobile Machinery/Road Transport			
Diesel Emissions (in kg/TJ)			
Sector	CO2 (in kg/TJ)	CH4 (in kg/TJ)	N2O (in kg/TJ)
Forestry	74,100	4.15	28.6
Source: IPCC 2006, Table 3.3.1			
		NCV Diesel (in TJ/kt)	43.33
Source: IPCC 1996, Table 1-3			

[12] Characteristic fuel consumption and exhaust emissions in fully mechanized logging operations. Journal of Forest Research, 14 (6), 328-334

Diesel Emissions (in tCO_2/t)			
CO2 Emissions (in tCO2/t Diesel)	CH4 Emissions (in tCH4/t Diesel)	N2O Emissions (in tN2O/t Diesel)	
3.2108	0.0002	0.0012	
Density (in t/kL)		0.83	
Diesel Emissions (in tCO2-, CH4 and N2O/kl)			
CO2 Emissions (in tCO2/kl Diesel)	CH4 Emissions (in tCH4/kl Diesel)	N2O Emissions (in tN2O/kl Diesel)	
2.6649	0.0001	0.0010	
Global Warming Potential			
CO2	CH4	N2O	
1	21	276	
Diesel Emissions (in tCO2e/kl)			
CO2	CH4	N2O	**tCO2e/kl**
2.6649	0.0031	0.2839	**2.9519**

As can be seen in the table above, the default emission factor for off-road mobile machinery amounts to 2.9519 tCO2e/kl. Based on the diesel emission factor, the harvester fuel consumption and based on the logging volumes indicated in Table 4, the harvesting emissions amount $E_{harvest,t=1}$ amounts to 538 tCO2/yr and $E_{harvest,t>1}$ amounts to 1,508 tCO2e/yr.

The emissions for hauling are calculated based on formula 3-43:

$$E_{hauling,t} = FC_{hauling} \ x \ EF_{fuel} \ x \ V_{merch,t} \quad (3\text{-}43)$$

Parameter	Description	Unit
$E_{hauling,t}$	Annual emissions due to log hauling in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$FC_{hauling}$	Fuel consumption of equipment for hauling one m3 of merchantable log	kl m^{-3}
EF_{fuel}	Fuel emission factor	tCO2-e kl^{-1}
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3

In order to determine the fuel consumption for hauling, data from Primorsky GOK was collected. Promorsky GOK is a commercial logging company operating in forest sites next to the Bikin NHZ. Its machinery is well maintained. Primorsky GOK operates a classic tractor (model TT-4M) for hauling. The fuel consumption depends on the season and ranges from 2.061 l/cbm (in summer) to 2.50 l/cbm in winter. The lowest value provided was applied.

For the loading of logs onto trucks, two types of machines are used by Primorsky GOK:
- URAL 4320 with a so-called hydro manipulator, or
- Locomo 990 (which is a modified harvester)

The fuel consumption of URAL 4320 ranges from 1.3 l/cbm (summer) to 1.5 l/cbm (winter). The fuel consumption of Locomo 990 ranges from 2.5 l/cbm (winter) to 2.8 l/cbm (summer). In order to determine the emissions from handling and loading of logs, the lowest value was applied (i.e. 1.3 l/cbm).

Based on these two investigations, the total fuel consumption of hauling was determined to amount to 3.361 l/cbm (2.061 l/cbm for hauling and 1.3 l/cbm for handling/loading). This was combined with the emission factor determined in Table 24, 2.9519 tCO_2e/kl. Following this approach results in $E_{hauling,t=1}$ = 1,412 tCO_2/yr and $E_{hauling,t>1}$ = 1,508 tCO_2/yr.

Formulae 3-44 to 3-46 allow for the quantification of emissions arising from truck transport. Formula 3-44 is used to determine the numbers of truck tours required to transport the merchantable volume to the processing facility.

$$N_{trucks-transport,t} = \frac{V_{merch,t}}{Cap_{truck}} \qquad (3\text{-}44)$$

Parameter	Description	Unit
$N_{trucks-transport,t}$	Number of truck trips required for log transport from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	truck
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3
Cap_{truck}	Truck load capacity	m^3 truck-1

Primorsky GOK, which is again used as a reference, uses trucks of the type KAMAZ 4310 which are common in Russia. KAMAZ 4310 has an average capacity of 22 cbm[13]. Based on the merchantable volume presented in Table 4, this results in $N_{trucks-transport,t=1}$ = 6,469 and $N_{trucks-transport,t>1}$ = 18,136.

The total transport distance of all trucks employed under the baseline case is determined following formula 3-45:

$$km_{transport-total,t} = km_{transport,t} \ x \ N_{trucks-transport,t} \ x \ 2 \qquad (3.45)$$

Parameter	Description	Unit
$km_{transport-total}$	Annual total log transport distance in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km
$km_{transport,t}$	Annual log transport distance from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km truck-1
$km_{transport,t}$	Number of truck trips required for log transport from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	truck
2	Constant, indicating return trip	dimensionless

Following discussions with WWF Amur Branch forestry experts, there would be three reasonable destinations for processing logs stemming out of the Bikin. The options are

- Transport to Vladivostok, or
- Transport to Khabarovsk, or
- Transport to Dalnerechensk

[13] Source: www.lifting-machine.com/en/specteh/lesovozy/tok70.php, accessed at the 2nd November 2011.

Dalnerechensk is a small town, where 'Les Export' constructed a saw mill and a port for exporting the sawn wood to other countries. According to the expert statement of Denis Smirnov and Evgeny Lepeshkin (both WWF Amur Branch) this would be the most likely destination of saw logs. Dalnerechensk is not only the most likely destination, but it is also the nearest destination. The distance between Krasny Yar (village at the entrance into the Bikin) to Dalnerechensk amounts to 218km.
Consequently, the transportation distance was determined to be 218km which is considered to be conservative. Using this value, and applying the merchantable volume laid out in Table 4 results in kmtransport-total,t=1 = 2,820,524 and kmtransport-total,t>1 = 7,907,455.

Finally the emissions of transportation are determined following formulae 3-46:

$$E_{transport,t} = \frac{km_{transport-total,t}}{Eff_{vehicle}} \ x \ EF_{fuel} \quad (3\text{-}46)$$

Parameter	Description	Unit
$E_{transport,t}$	Annual emissions due to log transport haulage from felling location to the collection depot/ sawmill in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$km_{transport-total}$	Annual total log transport distance in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km
$Eff_{vehicle}$	Fuel efficiency for vehicle type	km kl^{-1}
EF_{fuel}	Fuel emission factor	tCO2-e kl^{-1}

Following the information provided by Primorsky GOK, the average fuel consumption by KAMAZ 4310 amounts to 30l/100km. This results in an $Eff_{vehicle}$ of 3,333 km/kl. Following the emission factor determined in Table 24 and applying the findings of formulae 3-44 and 3-45 results in $E_{transport,t=1}$ = 2,498 tCO2e and $E_{transport,t>1}$ = 7,003 tCCO2e.

Formulae 3-47 and 3-48 are used to determine the emissions of wood processing. Formula 3-47 was followed to calculate the annual electricity consumption of wood processing:

$$Q_{processing,t} = V_{merch,t} \ x \ e_{demand} \quad (3\text{-}47)$$

Parameter	Description	Unit
$Q_{processing,t}$	Annual quantity of electricity consumption for processing in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kWh
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3
e_{demand}	Electricity demand for processing per volume processed	kWh m^{-3}

In order to determine the electricity demand for processing wood, no specific data could be collected from Primorsky GOK. The applied methodology proposes three default values ranging from 20 to 41kWh/m3. In order to determine the electricity consumption, the lowest of the three values was applied (i.e. 20kWh/m3). Following the merchantable volume presented in Table 4, this results in $Q_{processing,t=1}$ = 2,846,400 kWh/yr and $Q_{processing,t>1}$ = 7,980,000 kWh/yr.

Formula 3-48 finally allows for determining the actual emissions resulting of the electricity consumption of wood processing:

$$E_{processing,t} = Q_{processing,t} \times EF_{electricity} \quad (3\text{-}48)$$

Parameter	Description	Unit
$E_{processing,t}$	Annual emissions due to electricity consumption in sawmill in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO2-e
$Q_{processing,t}$	Annual quantity of electricity consumption for processing in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kWh
$EF_{electricity}$	Electricity emission factor for the host country	tCO2-e kWh^{-1}

Vladivostok is powered by two coal power plants. Saw mills in remote areas may eventually feature diesel generators to supply electricity or as a back-up. As Diesel features a higher emission factor than coal, the emission factor of coal was used.

Table 25: Calculation of the Grid Emission Factor			
Coal Emissions (in kg/TJ)			
Sector	CO2 (in kg/TJ)	CH4 (in kg/TJ)	N2O (in kg/TJ)
Electricity Generation	98,300	1	1.5
Source: IPCC 2006, Table 2.2			
NCV (in TJ/kt)			18.58
Source: IPCC 1996, Table 1-2, Russia specific value			
Coal Emissions (in tCO2/t)			
CO2 Emissions (in tCO2/t Coal)	CH4 Emissions (in tCH4/t Coal)	N2O Emissions (in tN2O/t Coal)	
1.8264	0.0000	0.0000	
Coal Emissions (in tCO2-, CH4 and N2O/t)			
CO2 Emissions (in tCO2/t Coal)	CH4 Emissions (in tCH4/t Coal)	N2O Emissions (in tN2O/t Coal)	
1.8264	0.0000	0.0000	
Global Warming Potential			
CO2	CH4	N2O	
1	21	276	
Coal Emissions (in tCO2e/t)			
CO2	CH4	N2O	tCO2e/t
1.8264	0.0004	0.0077	1.8345
Electricity Generation			
NCV (in TJ/t)			0.02
Conversion Factor TJ to MWh			277.78
NCV (in MWh/t)			5.16
Average Efficiency for Coal fired Electricity Generation			0.33

Source: NPC,2007, Global Oil & Gas Study - Electricity Generation	
Net Electricity Generation (in MWh/t)	1.70
Coal Consumption for Electricity Generation (in t coal/MWh)	0.59
CO2e Emissions of Electricity Generation (in tCO_2/MWh)	**1.0771**

Following above calculation, the grid emission factor of Primorsky krai amounts to 1.0771 t/MWh. This allows for determining $E_{processing,t=1}$ = 3,066 tCO2 and $E_{processing,t>1}$ = 8,595 tCO2. The total emissions arising from baseline activities are presented in Table 26.

Table 26: Baseline Activity Emissions

Year	$E_{processing,t}$	$E_{transport,t}$	$E_{harvest,t}$	$E_{hauling,t}$	$C'_{emissions,t}$
1	3,066	2,498	538	1,412	7,513
2	8,595	7,003	1,508	3,959	21,064
3	8,595	7,003	1,508	3,959	21,064
4	8,595	7,003	1,508	3,959	21,064
5	8,595	7,003	1,508	3,959	21,064
6	8,595	7,003	1,508	3,959	21,064
7	8,595	7,003	1,508	3,959	21,064
8	8,595	7,003	1,508	3,959	21,064
9	8,595	7,003	1,508	3,959	21,064
10	8,595	7,003	1,508	3,959	21,064

Covering the baseline activity emissions completes the evaluation of the baseline emissions. Table 27 below provides a summary of all baseline emissions. The total of baseline emissions amounts to 78,935 tCO2 in year 1 and thereafter increases to 333,603 in year 10.

Table 27: Summary of Baseline Emissions

$$C'_{degradation,t} = \left[(C_{DW_{decay},t} + C_{ltHWP_{oxidation},t} + C_{regrowth,t})\ x\ \frac{44}{12}\right] \qquad C'_{baseline,t} = C'_{degradation,t} + C'_{emissions,t}$$

Year t	$C_{DW_{decay},t}$	$C_{ltHWP_{oxidation},t}$	$C_{regrowth,t}$	$C'_{degradation,t}$	$C'_{emissions,t}$	$C'_{baseline,t}$
1	3,296	17,593	1,410	71,421	7,513	78,935
2	12,349	49,636	5,127	208,483	21,064	229,547
3	20,893	50,512	8,844	229,390	21,064	250,454
4	28,956	51,367	12,561	248,460	21,064	269,524
5	36,565	52,203	16,279	265,793	21,064	286,858
6	43,745	53,020	20,398	280,011	21,064	301,075
7	50,521	53,818	25,177	290,262	21,064	311,326
8	56,915	54,598	29,955	299,047	21,064	320,112
9	62,950	55,361	34,734	306,448	21,064	327,512
10	68,644	56,106	39,512	312,538	21,064	333,603

Quantification of Project Emissions. In a next step, the project emissions are quantified. The evaluation covers the following emissions:

- Emissions of project planning

The applied VCS methodology features three modules: project planning, project design as well as a module for project monitoring. All three modules All modules feature calculations of the emissions of ground transport as well as the emissions of flight transport.
In order to have a consistent and easily verifiable approach, all emissions of ground transport and all emissions of flight transport (i.e. personnel transport by airlines) are accounted for under the project planning module.

- Evaluation of the emissions of monitoring
  Ground transport- and flight transport emissions (i.e. personnel transport by airlines) are already accounted for under the project planning module. Consequently this module only accounts for flight emissions due to fire fighting and control by a helicopter.
- Emissions of natural disturbance of forest sites located in the project area
- Emissions due to illegal harvesting.

The tool for testing the significance of GHG emissions in A/R CDM project activities will be applied. It will be shown that the emissions of project planning and the emissions of project monitoring may be neglected.

The overall approach for the quantification of project emissions is laid out in formula 4-1:

$$C'_{actual,t} = E_{proj-plan,t} + E_{design,t} + E_{monitoring,t} + \left[\left(C_{nat-disturb,t} + C_{illegal_{harvest},t}\right) x \frac{44}{12}\right] \quad (4\text{-}1)$$

Parameter	Description	Unit
$C'_{actual,t}$	Annual total carbon emissions associated with the project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{proj-plan,t}$	Annual emissions due to administration and project planning in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{design,t}$	Annual emissions from travel for design and set up in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{monitoring,t}$	Annual emissions due to monitoring for field work in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C_{nat-disturb,t}$	Annual carbon losses due to natural disturbance(s) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{illegal_{harvest},t}$	elapsed since the start of the IFM-LtPF project activity)	tC
$\frac{44}{12}$	The ratio of molecular weight of carbon dioxide to carbon	tCO2-e tC^{-1}

Emissions from Project Planning. In a first step, the emissions of project planning are determined. Following formula 4-2, this comprises emissions from administration and emissions from travelling:

$$E_{proj-plan,t} = E_{admin,t} + E_{plan-travel,t} \quad (4\text{-}2)$$

Parameter	Description	Unit
$E_{proj-plan,t}$	Annual emissions due to administration and project planning in year t, (where t=1,2,3 ... t* years elapsed since the start of the	tCO_2-e

	IFM-LtPF project activity)	
$E_{admin,t}$	Annual emissions due to electricity consumption required for administration of the project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{plan-travel,t}$	Annual emissions due to travel for project planning in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

Formula 4-4 allows for the quantification of the emissions due to electricity consumption.

$$E_{admin,t} = Q_{admin,t} \times EF_{electricity} \quad (4\text{-}4)$$

Parameter	Description	Unit
$E_{admin,t}$	Annual emissions due to electricity consumption required for administration of the project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$Q_{admin,t}$	Annual electricity consumption due to administration of the project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kWh
$EF_{electricity}$	Electricity emission factor for the host country	tCO_2-e kWh^{-1}

The project is administered from WWF Amur Branch office which is based in Vladivostok. For simplicity, the office's total annual electricity consumption is considered, even through the office (and its staff) covers also other tasks. This approach is considered to be conservative.
The office's annual electricity consumption amounts to 39,320 kWh for 2009 and 39,160 for 2010. For the ex-ante estimation, it is assumed that the annual electricity consumption amounts to 39,320 kWh/yr.
In order to evaluate the overall emissions form electricity consumption, this figure was combined with the Grid Emission Factor of Primorye. The GEF amounts to 1.0771 tCO2/MWh (Please refer to Table 25).This results in annual total emissions of $E_{admin,t}$ = 42 tCO2e.

The project emissions due to travel will accounted for emissions due to ground transport and emissions due to air travel following formula 4-5:

$$E_{plan-travel,t} = E_{plan-flight,t} + E_{plan-ground,t} \quad (4\text{-}5)$$

Parameter	Description	Unit
$E_{plan-travel,t}$	Annual emissions due to travel for project planning in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{plan-flight,t}$	Annual emissions due to flights in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{plan-ground,t}$	Annual emissions due to ground transportation in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

The emissions for flights will be determined following formula 4-6:

$$E_{plan-flight,t} = \sum_{y=1}^{y} (KM_{plan-flight,y,t} \; x \; N_{plan,flight,y,t} \; x \; EF_{flight,y}) \quad (4\text{-}6)$$

Parameter	Description	Unit
$E_{plan-flight,t}$	Annual emissions due to flights in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$KM_{plan-flight,y,t}$	Annual number of passengers per trip y, (where y=1,2,3 ... Y trips) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	passenger
$N_{plan,flight,y,t}$	Flight emission factor for trip, y (where y=1,2,3 ... Y trips)	tCO_2-e $(passenger.km)^{-1}$
$EF_{flight,y}$	Annual distance travelled per trip y, (where y=1,2,3 ... Y trips), in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km

In order to account for flight emissions, a flight emission log was developed. Standard emission factors for sort-, (i.e. up to 1,000km), medium-, (i.e. 1,001-5,000km) and long-distance travel (i.e. 5,001km and more) have been taken from Miyoshi and Mason, 2009[14], Table 3 (based on Ross, 2007[15]). The highest values for each distance class were applied, which is considered to be conservative. Additionally, the flight log features a link to a website which allows for measuring the distance between two destinations. An example of the flight log is given in Table 28.

Table 28: Flight Emissions due to Project Planning and Administration					
Emission Factors					
Distance Class I (<1000km) in kgCO2/km	0.45	Distance Class II (1001km - 5000km) in kgCO2/km	0.3	Distance Class III (>5001km) in kgCO2/km	0.32
Flight Log					
Name	Origin	Destination	Distance (in km)	Date	Emissions
Lepeshkin	Vladivostok	Moscow	6,423	15.06.2009	2.06
Lepeshkin	Frankfurt	Moscow	2,055	14.07.2009	0.62
Lepeshkin	Moscow	Vladivostok	6,423	17.08.2009	2.06
Lepeshkin	Vladivostok	Moscow	6,423	17.08.2009	2.06
Lepeshkin	Moscow	Vladivostok	6,423	17.07.2009	2.06
Lepeshkin	Frankfurt	Moscow	2,055	14.07.2009	0.62
	Moscow	Frankfurt	2,055		0.62
Kabanets	Moscow	Vladivostok	6,423	16.05.2010	2.06
	Vladivostok	Moscow	6,423		2.06
Zherebkin	Moscow	Vladivostok	6,423	16.05.2010	2.06
	Vladivostok	Moscow	6,423		2.06
Lepeshkin	Vladivostok	Moscow	6,423	03.03.2010	2.06

[14] C. Miyoshi and K., J., Mason, 2009: The carbon emissions of selected airlines and aircraft types in three geographic markets. Journal of Air Transport Management.

[15] D. Ross, 2007: GHG emissions resulting from aircraft travel. Carbon Planet, Sydney

	Moscow	Vladivostok	6,423		2.06
Lepeshkin	Moscow	New York	7,505	05.03.2010	2.40
	New York	Moscow	7,505		2.40
Conversion km to miles		1.852			27.21
Distance Calculator	http://www.geobytes.com/CityDistanceTool.htm?loadpage				
Source: Miyoshi et al 2009, Table 3, based on Ross (2007) (highest value applied)					

The flight log will be filled out for the ex-post determination of flight emissions. For the ex-ante estimate of the project emissions, annual emissions of 40 tCO2/yr were considered.

Formula 4-8 allows for the quantification of the ground emissions:

$$E_{plan-ground,t} + \sum_{y=1}^{y}(V_{fuel-plan-ground,y,t}\ x\ EF_{fuel}) \qquad (4\text{-}8)$$

Parameter	Description	Unit
$E_{plan-ground,t}$	Annual emissions due to ground transportation in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$V_{fuel-plan-ground,y}$	Annual volume of fuel consumed per trip y, (where y=1,2,3 ... Y trips), in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kL
EF_{fuel}	Fuel emission factor	tCO_2-e kl^{-1}

The ground transport will cover emissions of all cars operated by WWF Amur Branch for the project. These are cars running both on diesel and gasoline.
The emission factor of diesel was already determined in Table 24. It amounts to 2.9519 tCO_2/kL.
The emissions factor of gasoline amounts to 2.4612 tCO_2e/kL and is determined based on IPCC default factors in the below table.

Table 29: Default Emission Factors for Gasoline Road Transport			
Gasoline Emissions (in kg/TJ)			
Sector	CO2 (in kg/TJ)	CH4 (in kg/TJ)	N2O (in kg/TJ)
Road Transport	69,300	4.15	28.6
Source: IPCC 2006, Table 3.3.1			
		NCV (in TJ/kt)	44.8
Source: IPCC 1996, Table 1-3			
Gasoline Emissions (in tCO2/t)			
CO2 Emissions (in tCO2/t Gasoline)	CH4 Emissions (in tCH4/t Gasoline)	N2O Emissions (in tN2O/t Gasoline)	
3.0028	0.0002	0.0012	
	Density (in t/kL)	0.735	

Gasoline Emissions (in tCO2-, CH4 and N2O/kL)			
CO2 Emissions (in tCO2/kL Gasoline)	CH4 Emissions (in tCH4/kL Gasoline)	N2O Emissions (in tN2O/kL Gasoline)	
2.2070	0.0001	0.0009	
Global Warming Potential			
CO2	CH4	N2O	
1	21	276	
Gasoline Emissions (in tCO2e/kL)			
CO2	CH4	N2O	**tCO_2e/kl**
2.2070	0.0028	0.2514	**2.4612**

In order to provide a valid ex-ante estimate about the actual diesel- and gasoline consumption, the actual fuel consumption of WWF Amur Branch, for this specific project was collected and an average was determined. The actual fuel consumption amounts to 7 kl diesel and 2 kl gasoline.
Based on above determined emission factors, the total emissions of fuel consumption amounts to 25.9 tCO_2/yr. This is used for the ex-ante calculation of the project emissions due to ground transport.

Table 30: Ex-ante Estimate of Fuel Consumption and Emissions by Fuel Type		
Consumption		
Year	Diesel (kl)	Gasoline (in kl)
2009 and 2010	11	4
per Year	7	2
Emissions (in tCO_2e)		
per Year	20.0	5.9

The total of emissions from project planning amounts to 108 tCO2/yr (ex-ante estimate). This amounts to 0.64% of the project emissions and to 0.1% of the project's overall emission reductions. Based on tool for testing the significance of GHG emissions in A/R CDM project activities, the project emissions from project planning are to be classified as insignificant and may be neglected.

Emissions from project monitoring. As indicated above (beginning of the project emission section), all ground transport- and personnel flight emissions are accounted for under the 'Emissions due Project Planning' module. Hence, the quantification of monitoring emissions is reduced to flight emissions for fire fighting and monitoring.
Tribal Commune Tiger and WWF Amur Branch made an agreement with the Forest Department of Primorsky Krai, that the Forest Department will conduct regular control flights with a fire fighting helicopter. Moreover, if forest fires are detected, the Forest Department will use the helicopter for firefighting purposes. The related emissions are accounted for under formula 4-12:

$$E_{monitoring,t} = E_{monitoring-flight,t} \quad (4\text{-}12)$$

Parameter	Description	Unit
$E_{monitoring,t}$	Annual emissions due to monitoring for field work in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{monitoring-flight,t}$	Annual emissions due to air travel for monitoring team in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

The actual emissions of monitoring activities are constrained to fuel consumption from flights, 4-13:

$$E_{monitoring-flight,t} = V_{firefighting,t} \times EF_{fuel} \qquad (4\text{-}13)$$

Parameter	Description	Unit
$E_{monitoring-flight,t}$	Annual emissions due to air travel for monitoring team in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$V_{firefighting,t}$	Annual volume of fuel consumed per trip y, (where y=1,2,3 ... Y trips), in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kl
EF_{fuel}	Fuel emission factor	tCO_2-e kl^{-1}

These flights are undertaken by:

- Helicopter (Model MI-2) which consumes kerosene, and
- Plane (Model AN-2) which consumes aviation gasoline.

The emission factors of kerosene and aviation gasoline are calculated in the subsequent tables:

Table 31: Default Emission Factors for Kerosene			
Kerosene Emissions (in kg/TJ)			
Sector	CO2 (in kg/TJ)	CH4 (in kg/TJ)	N2O (in kg/TJ)
Flight	71,500	0.5	2
Source: IPCC 2006, Table 3.6.4 and IPCC 2006, Table 3.6.5			
NCV (in TJ/kt)			44.59
Source: www.exxonmobil.com/AviationGlobal/Files/WorldJetFuelSpec2008_1.pdf			
Kerosene Emissions (in tCO2/t)			
CO2 Emissions (in tCO2/t Gasoline)	CH4 Emissions (in tCH4/t Gasoline)	N2O Emissions (in tN2O/t Gasoline)	
3.0981	0.0000	0.0001	
Density (in t/kL)			0.7975
Kerosene Emissions (in tCO2-, CH4 and N2O/kL)			
CO2 Emissions (in tCO2/kL)	CH4 Emissions (in tCH4/kL)	N2O Emissions (in tN2O/kL)	
2.4707	0.0000	0.0001	
Global Warming Potential			
CO2	CH4	N2O	
1	21	276	
Kerosene Emissions (in tCO2e/kL)			
CO2	CH4	N2O	**tCO2e/kL**
2.4707	0.0004	0.0191	**2.4902**

Table 32: Default Aviation Gasoline Emissions

Aviation Gasoline Emissions (in kg/TJ)			
Sector	CO2 (in kg/TJ)	CH4 (in kg/TJ)	N2O (in kg/TJ)
Flight	69,300	0.5	2
Source: IPCC 2006, Table 3.6.4 and IPCC 2006, Table 3.6.5			
		NCV (in TJ/kt)	43.5
Source: www.exxonmobil.com/AviationGlobal/Files/WorldJetFuelSpec2008_1.pdf			
Aviation Gasoline Emissions (in tCO2/t)			
CO2 Emissions (in tCO2/t Gasoline)	CH4 Emissions (in tCH4/t Gasoline)	N2O Emissions (in tN2O/t Gasoline)	
3.0028	0.0000	0.0001	
	Density (in t/kL)	0.721	
Aviation Gasoline Emissions (in tCO2-, CH4 and N2O/kL)			
CO2 Emissions (in tCO2/kL)	CH4 Emissions (in tCH4/kL)	N2O Emissions (in tN2O/kL)	
2.1650	0.0000	0.0001	
Global Warming Potential			
CO2	CH4	N2O	
1	21	276	
Aviation Gasoline Emissions (in tCO2e/kL)			
CO2	CH4	N2O	**tCO2e/kL**
2.1650	0.0003	0.0172	**2.1826**

As can be seen from the table above, the emission factor of kerosene amounts to 2.492 and the emission factor of aviation gasoline to 2.1826 tCO2/kL. The annual volume of fuel consumption for control flights in the project area will be monitored and the related emissions will be accounted for as project emissions. In order to provide an ex-ante estimate, it is assumed that the fuel consumption of the helicopter amounts to 20 kL/yr.
The total of emissions from project planning amounts to 22 tCO2/yr (ex-ante estimate). This amounts to 0.13% of the project emissions and to 0.04% of the project's overall emission reductions. Based on tool for testing the significance of GHG emissions in A/R CDM project activities, the project emissions from project planning are to be classified as insignificant and may be neglected.

Emissions Due to Natural Disturbances. The project will account for project emissions due to natural disturbances such as forest fires or diseases. The annual calculation of the emissions due to natural disturbances follows formula 4-15:

$$C_{AGB-ND,j,t} = \left[\overline{V}_{gstock,j,t=0} \; x \; BCEF_j \; x \left(\sum_{ND=1}^{ND} A_{ND,j,t} \right) \right] x \; CF_{AGB} \qquad (4\text{-}15)$$

Parameter	Description	Unit
$C_{AGB-ND,j,t}$	Annual carbon in the aboveground biomass of the growing stock in the naturally disturbed area in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

$\overline{V}_{gstock,j,t=0}$	Average growing stock per hectare for stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	$m^3\ ha^{-1}$
$A_{ND,j,t}$	Annual area of natural disturbance ND, (where ND=1,2,3 ... ND naturally disturbed areas) in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha
$BCEF_j$	Biomass conversion and expansion factor for converting growing stock to carbon in the aboveground biomass for stratum j, (where j=1,2,3 ... J strata)	(t d.m.) m^{-3}
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)$^{-1}$

The following parameters were used:

- The BCEF was calculated based on the weighted average BEF times the weighted average density factor and amounts to 0.62 t.d.m/m3.
- As discussed above, the weighted average carbon fraction of the project area was applied; it amounts to 0.50 tC/t.d.m.
- As discussed above, the average growing stock amounts to 226m3/ha.
- The annual area of disturbance was taken from below analysis. The historical data on natural disturbances in the project area was provided by the Far East Forestry Research Institute. The table shows that the average annual burnt area amounts to 17.7ha.

Based on this input parameters, $C_{AGB\text{-}ND,t}$ = 1,234 tC/yr.

Table 33: Calculation of Average Annual Forest Fires Losses

Year	Forest unit	Burned Area, ha	Compart-ment	Volume (in m^3/ha)	Area Burnt (in m^3)	Volume Burnt (in m^3)
2008	Krasnoyarovskoe	4.5	118	250	1,125	394
	Ohotnichye	3.0	448	103	309	62
	Ohotnichye	3.5	488	221	774	271
2007	Krasnoyarovskoe	1.5	153	281	422	211
2006	Krasnoyarovskoe	8.0	215	278	2,224	778
	Krasnoyarovskoe	8.0	217	192	1,536	77
	Krasnoyarovskoe	1.5	198	231	347	87
2005	Krasnoyarovskoe	0.9	378	244	220	77
2004	N.A.	0.0	N.A.	0	-	-
2003	Ohotnichye	0.4	704	217	87	30
	Ohotnichye	10.0	499	178	1,780	178
	Krasnoyarovskoe	1.1	372	254	279	168
	Krasnoyarovskoe	1.0	331	268	268	94
	Krasnoyarovskoe	60.0	278	234	14,040	-
	Krasnoyarovskoe	20.0	198	231	4,620	1,617
	Krasnoyarovskoe	0.5	141, 154	285	143	50
2002	N.A.	0.0	N.A.	0	-	-
	Annual Average	17.7			28,172	4,092
Source: Data provided by the Far East Forestry Research Institute					0.145	511.55

In a next step the annual carbon losses of AGB due to natural diseases are determined following formula 4-16:

$$C_{AGB,ND,t} = \sum_{j=1}^{J}(C_{AGB-ND,j,t} \ x \ f_{ND,j,t}) \tag{4-16}$$

Parameter	Description	Unit
$C_{AGB,ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{AGB-ND,j,t}$	Annual carbon in the aboveground biomass of the growing stock in the naturally disturbed area in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$f_{ND,j,t}$	Fraction of the growing stock naturally damaged in stratum j (where j = 1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	dimensionless

The following input parameters were used:

- $f_{ND,t}$ was calculated based on Table 33 and amounts to 14.5%.
- the total carbon stocks of areas affected by forest fires was determined based on formula 4-15 and amounts to 1,234 tC.

Based on the above input parameter, the annual carbon loss due to natural disturbances amount to 179 tC/yr. This value was used for the ex-ante estimation of the project emissions.

Formula 4-17a was followed to estimate the re-growth of areas disturbed:

$$C_{regrowth-ND,t} = CF_{AGB} \ x \sum_{j=1}^{J}\left[\sum_{ND=1}^{ND}(A_{ND,j,t}) \ x \ \bar{G}_{regrowth,ND,j,t}\right] \tag{4-17a}$$

Parameter	Description	Unit
$C_{regrowth-ND,t}$	Annual carbon increase due to the regrowth in the naturally disturbed area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	$tC\ (t\ d.m.)^{-1}$
$A_{ND,j,t}$	Annual area of natural disturbance nd, (where nd=1,2,3 ... ND naturally disturbed areas) in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)^^	ha
$\bar{G}_{regrowth,ND,j,t}$	Average regrowth per hectare per year in the aboveground biomass after natural disturbance in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	$(t\ d.m.)\ ha^{-1}\ yr^{-1}$

In order to provide a qualified ex-ante estimate of the carbon stored due to re-growth after natural disturbances, the findings of Table 22 were used. This was combined with the annual area of natural disturbance. The findings are presented in the table below.

Year	$\bar{G}_{regrowth,ND,t}$ x	Table 34: Re-Growth after Natural Disturbance Calculation										$C_{regrowth-ND,t}$
1	0.40	7										7
2	0.40	7	7									14
3	0.40	7	7	7								21
4	0.40	7	7	7	7							29
5	0.40	7	7	7	7	7						36
6	0.51	9	7	7	7	7	7					45
7	0.51	9	9	7	7	7	7	7				54
8	0.51	9	9	9	7	7	7	7	7			63
9	0.51	9	9	9	9	7	7	7	7	7		73
10	0.51	9	9	9	9	9	7	7	7	7	7	82

As can be seen from the table above, it is expected that in the first year, the re-growth stores 7 tC increasing to 82 tC in year 10.

Formulae 4-18a to 4-20 allow for the quantification of the N2O- and CH4 emissions of forest fires. Formula 4-18a outlines the approach for the calculation of CH4 emissions:

$$E_{CH_4,t} = C_{AGB-ND,t} \; x \; R_{CH_4} \; x \; \frac{16}{12} \qquad (4\text{-}18a)$$

Parameter	Description	Unit
$E_{CH_4,t}$	Annual emissions due to CH4 in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCH_4
$C_{AGB-ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
R_{CH_4}	Emission ratio for CH4	dimensionless
$\frac{16}{12}$	The ratio of molecular weight of CH4 to carbon	$tCH_4\ tC^{-1}$

The following input parameters were used:

- An emission ratio of 0.012 for CH_4 was used (IPCC, 2003, Table 3A.1.15).
- The annual carbon losses in AGB were determined above and amount to 179 tC/yr.

This approach results in an ex-ante estimate of CH_4 emissions of 3 tCH_4/yr.

Formula 4-18b was applied to calculate the emissions from N_2O due to forest fires:

$$E_{N_2O,t} = C_{AGB-ND,t} \; x \; R_{\frac{N}{C}} \; x \; R_{N_2O} \; x \; \frac{44}{28} \qquad (4\text{-}18b)$$

Parameter	Description	Unit
$E_{N_2O,t}$	Annual emissions due to N2O in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tN_2O
$C_{AGB-ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$R_{\frac{N}{C}}$	Ratio of nitrogen to carbon	$tN\ tC^{-1}$
R_{N_2O}	Emission ratio for N_2O	dimensionless
$\frac{44}{28}$	The ratio of molecular weight of N_2O to N	$tN_2O\ tN^{-1}$

The following input parameters were used:

- The annual carbon losses in AGB were determined above and amount to 179 tC/yr.
- Ratio of nitrogen to carbon amounts to 0.01 (IPCC, 2003, Table 3A.1.15).
- The emission factor for N_2O amounts to 0.007 (IPCC, 2003, Table 3A.1.15).

This results in annual emissions of 0.02 tN_2O/yr which was used for the ex-ante estimate of the project emissions.

Formula 4-19 allows for converting the N_2O- and CH_4 emissions into tC:

$$C_{CH_4N_2O,t} = \left(E_{CH_4,t}\ x\ GWP_{CH_4} + E_{N_2O,t}\ x\ GWP_{N_2O}\right) x\ \frac{12}{44} \quad (4\text{-}19)$$

Parameter	Description	Unit
$C_{CH_4N_2O,t}$	Annual carbon from CH4 and N2O emissions in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$E_{CH_4,t}$	Annual emissions due to CH4 in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCH_4
GWP_{CH_4}	Global warming potential of CH_4	tCO_2-e $tCH4^{-1}$
$E_{N_2O,t}$	Annual emissions due to N_2O in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tN_2O
GWP_{N_2O}	Global warming potential of N_2O	tCO_2-e tN_2O^{-1}
$\frac{12}{44}$	The ratio of molecular weight of carbon to carbon carbon dioxide	tC tCO_2-e^{-1}

Using a global worming potential of 1:21 for CH_4 and 1:276 for N_2O (Annex A of the Kyoto protocol) allows to estimate the total ex-ante emissions to 18 tC/yr.

Formula 4-20 finally quantifies the total emissions of natural disturbances.

$$C_{natdisturb,t} = \sum_{t=1}^{t}\left(C_{AGB-ND,t} - C_{regrowth-ND,t} + C_{CH_4N_2O,t}\right) \quad (4\text{-}20)$$

Parameter	Description	Unit
$C_{natdisturb,t}$	Annual total carbon losses due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{AGB-ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{regrowth-ND,t}$	Annual carbon increase due to the regrowth in the naturally disturbed area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{CH_4N_2O,t}$	Annual carbon from CH4 and N2O emissions in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Based on the input parameter discussed above (and using the re-growth of year 1) results in an ex-ante estimate of the total emissions from natural disturbances in the amount of 190 tC/yr.

Finally, the emissions due to illegal logging are calculated based on formula 4-21

$$C_{illegal-harvest,t} = V_{illegal-harvest,t}\ x\ (1 + f_{RSD})\ x\ BEF\ x\ D\ x\ CF_{AGB} \qquad (4\text{-}21)$$

Parameter	Description	Unit
$C_{illegal-harvest,t}$	Annual carbon losses due to illegal harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$V_{illegal-harvest,t}$	Annual volume of wood sold as determined from field surveys in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	m^3
BEF	Biomass expansion factor for converting volume of extracted roundwood to total aboveground biomass (including bark)	(t d.m.) m^{-3}
D	Wood density for the forest with corresponding climate region and ecological zone	(t d.m.) m^{-3}
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)$^{-1}$
f_{RSD}	Factor for residual stand damage, based on the fraction of quantity of carbon damaged in the residual stand to the quantity of carbon in the total merchantable logs harvested	dimensionless

The following input parameters were used:

- The illegal logging was estimated to 70 m^3/yr. This figure was provided by WWF Amur Branch based on the first detections of illegal logging in the project area.
- As discussed above, the residual stand damage factor amounts to 1.47.
- As discussed above, the weighted average biomass expansion factor amounts to 1.39.
- As discussed above, the weighted average carbon fraction amounts to 0.50 tC/t.d.m.

Combining above findings results in annual emissions of 53 tC/yr. This value was used as an ex-ante estimate of the project emissions.

Table 35: Ex-Ante Estimate of Project Emissions

$$C'_{actual,t} = E_{proj-plan,t} + E_{design,t} + E_{monitoring,t} + \left[\left(C_{nat-disturb,t} + C_{illegal_{harvest},t}\right) x \frac{44}{12}\right]$$

Year t	$E_{proj-plan,t}$	$E_{monitoring,t}$	$C_{natdisturb,t}$	$C_{illegal-harvest}$	$C'_{actual,t}$	Leakage
1			192	54	903	15,949
2			192	54	903	46,384
3			192	54	903	50,616
4			192	54	903	54,476
5			192	54	903	57,984
6			192	54	903	60,861
7			192	54	903	62,934
8			192	54	903	64,711
9			192	54	903	66,208
10			192	54	903	67,439

The ex-ante estimate of the project emissions is provided in the above table. A leakage discount factor of 20% of the project's overall emission reduction was applied. The leakage factor is discussed in Section E.4.

B.5. Description of how the definition of the project boundary is applied to the LULUCF project:

In accordance with paragraph 12 JISC 04 Annex 6, the project boundary of the JI LULUCF project geographically delineates and encompasses all anthropogenic GHG emissions by sources and removals by sinks on lands under the control of project participants which are significant[16] and reasonably attributable to the proposed project activity.
The project has a well defined boundary comprising a total forest area of 455,989 ha. This definition is based on the total concession area of 461.154 ha, located in the Pozharsky District, Verkhne-Perevalnenskoe Forestry. The concession comprises the following three Divisional Forestries and related compartments:

- Sobolinoe Divisional Forestry (compartments 68, 107-117),

[16] Significant, i.e., as a rule of thumb, would by each source account on average per year over the crediting period for more than 1 per cent of the annual average anthropogenic emissions by sources of GHGs, or exceed an amount of 2,000 Mg of CO_2 equivalent, whichever is lower.

- Krasnoyarovskoe Divisional Forestry (compartments 118-308, 326-337, 342-407, 409, 413, 417),
- Okhotnichie Divisional Forestry (compartments 309-325, 338-341, 408, 410-412, 414-416, 418-523, 525-530, 537-543, 549-563, 571-575, 589, 590, 593, 594, 598-603, 611-620, 626, 627, 632-656, 663-666, 701-713, 715-717, 719).

The number of the record on the state forest register is 20/1105006-2009-03. Figure 5, in Section A.4.1.4 illustrates the location of the compartments within the divisional forest units.

Within the concession, the definition of forest of the Russian Federation was applied to delineate the project boundary. The host party (Focal Point of the Russian Federation) has decided on the following Kyoto forest definition and elections for Article 3, paragraphs 3 and 4, activities in accordance with decision 16/CMP.1[17]:

- A single minimum tree crown cover value of 18% (equivalent to 30%[18] stocking density)
- A single minimum land area value of 1.0 hectare
- A single minimum tree height value of 5 meters

Additionally, a minimum value of forest width of 20 meters applies.

Russia accounts it emissions from sinks and sources for afforestation, reforestation and deforestation (Article 3.3 of the Kyoto Protocol). Moreover Russia elected to account for sinks and sources from forest management under Article 3.4. Russia will account for the chosen LULUCF sinks and sources annually.

Following above definitions, the concession area was compiled by:

- Excluding all sub-compartments having a stocking density below 30% (633 sub-compartments, 5,260.9 ha)
- Excluding all sub-compartments having a maximum height below 5m (660 sub-compartments, 5,462.2 ha)
- Excluding all sub-compartments having a minimum area below 1 ha (243 sub-compartments with a total area of 124.7ha).

Eliminating the above areas (which are partially overlapping) from the concession area results gives the project area. The project area amounts to 455,989ha. This area fulfills all of the above criteria and hence qualifies as forest according to the forest definition of the Russian Federation and falls under the elected activity chosen by the Russian Federation.

B.6. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

The baseline development was completed at the 4th November 2011.

Mr. Martin Burian, GFA ENVEST, martin.burian@gfa-envest.com
Mrs. Ekaterina Lysun, WWF Russia Far East, kalyok@yandex.ru

GFA ENVEST is not project participant but WWF Amur Branch is project participant.

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[17] Report of the review of the initial report of the Russian Federation. UNFCCC/IRR/2007/RUS of 18.02.2008.

[18] Taken from the first national communication of the Russian Federation to the UNFCCC. Available under http://unfccc.int/files/national_reports/initial_reports_under_the_kyoto_protocol/application/pdf/initial_report_russia.pdf

SECTION C. Duration of the LULUCF project / crediting period

C.1. Starting date of the project:

The starting date of the project is 03/06/2009.

C.2. Expected operational lifetime of the project:

The expected operational lifetime of the project is 49 years and 0 months.

C.3. Length of the crediting period:

According to the Russian JI Procedures, the crediting period comprises only the first commitment period of the Kyoto Protocol. This is 3 years and 7 months.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The monitoring plan features the following elements:

a) Monitoring of baseline emissions
b) Monitoring of project emissions
c) Monitoring of leakage
d) Annual allowable cut (AAC) by whenever new inventory information becomes available

These are summarized in the following section.

a) Monitoring of baseline emissions

This monitoring shall demonstrate that the actual forest protection area conforms with the area specified in the PDD. The project boundary will be monitored annually all through the crediting period by means of new inventory information, and through remote sensing as applicable. If the forest area changes during the crediting period, for instance, because deforestation occurs on the project area, the specific location and area of the deforested land shall be identified and the project boundary shall be rectified accordingly.

b) Monitoring of Project Emissions

The project emissions shall be monitored based on the following monitoring elements:

- Monitoring of natural disturbances
- Monitoring of illegal logging

c) Monitoring of Leakage

As outlined in section E4, leakage is unlikely to occur, as the timber market in Primorski Krai follows the patterns of an inelastic supply function. Still a conservative default value of 20% is applied. I.e. the project will only claim 80% of its emission reductions, as it assumes that 20% will compensate potential market leakage effects. This is considered to be conservative.

d) Monitoring of annual allowable cut (AAC)

The AAC may be adapted if new laws, rules and procedures will be adopted by the Forest Department of Primorsky Krai. If new decisions relating the baseline logging volumes and areas become available, the baseline parameters shall be revaluated and the baseline shall be amended. If this does not occur, the annual baseline logging areas and volumes remain fixed ex-ante.

D.1.1. Sampling design and stratification:

a) Monitoring of baseline emissions

The baseline and related emissions will be fixed ex ante. The quantification of baseline emissions does not require the monitoring of specific parameters and related sampling or stratification.

b) Monitoring of project emissions

The monitoring of project emissions may require sampling and stratification, if natural diseases and/or illegal logging occur. The following approach will be applied to monitor the related emissions:

- For each verification period, a high resolution image of the project are shall be evaluated in order to detect forest disturbances. If the analysis shows that the forest stocks are not negatively affected, then the integrity of the project area was demonstrated.
- If the analysis of remote sensing image shows decreases of forest disturbances, then a field teams will be sent to the affected areas. The field team shall measure the decrease of volume for each sub-compartment. This decrease then will be compared with the volume data of the forest inventory for the respective inventory. This will allow to determine the decrease of forest stocks according to the requirements of the monitoring methodology. The lower boundary of 95% confidential interval will be used for the measurements of the disturbed areas. This will ensure the conservativeness of the calculation of emission reductions.

c) Monitoring of leakage

No sampling or stratification required.

d) Monitoring of annual allowable cut (AAC)

No sampling or stratification required.

D.1.2. Monitoring of the anthropogenic emissions by sources and removals by sinks in the project and baseline scenarios:

D.1.2.1. Data to be collected in order to monitor the changes in carbon stocks in the carbon pools within the project boundary in the project scenario, and how these data will be archived (for each carbon pool and in units of CO_2 equivalent):

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	$A_{ND,j,t}$	*High resolution remote sensing analysis combined with fire fighting control flights by the Forest Department*	*ha*	*m*	*Several times per year*	*100%*	*electronic*	
2	$f_{ND,j,t}$	*Collected by a forest inventory team sent to the disturbed areas identified under (1) above*	*dimensionless*	*m*	*Each time, if disturbed areas are detected under (1) above*	*100%*	*electronic*	
3	$V_{illegal-harvest,t}$	*Collected by a forest inventory team sent to the illegally*	*Cbm*	*M*	*Several times per year*	*100%*	*electronic*	

		logged areas if logged areas are identified under (1) above or are identified by WWF's border patrol tours.						

D.1.2.2. Data to be collected in order to monitor the greenhouse gas emissions by sources within the project boundary in the project scenario, and how these data will be archived (for each gas, source, etc.; in units of CO_2 equivalent):

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
All relevant parameters have been tested for their significance. It was concluded that the related emissions are not significant. Hence the related emissions are neglected and no data will be monitored.								

D.1.2.3. Description of formulae and/or models used to estimate the changes in carbon stocks in the carbon pools within the project boundary in the project scenario (for each carbon pool and in units of CO_2 equivalent):

Changes in carbon stocks within the project boundary in the project scenario cover emissions due to natural disturbances and the emissions related to illegal logging activities within the project boundary. The annual calculation of the emissions due to natural disturbances follows formula 4-15:

$$C_{AGB-ND,j,t} = \left[\overline{V}_{gstock,j,t=0} \ x \ BCEF_j \ x \left(\sum_{ND=1}^{ND} A_{ND,j,t} \right) \right] x \ CF_{AGB} \quad (4\text{-}15)$$

Parameter	**Description**	**Unit**
$C_{AGB-ND,j,t}$	Annual carbon in the aboveground biomass of the growing stock in the naturally disturbed area in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\overline{V}_{gstock,j,t=0}$	Average growing stock per hectare for stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	$m^3 \ ha^{-1}$
$A_{ND,j,t}$	Annual area of natural disturbance ND, (where ND=1,2,3 ... ND naturally disturbed areas) in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha
$BCEF_j$	Biomass conversion and expansion factor for converting growing stock to carbon in the aboveground biomass for stratum j, (where j=1,2,3 ... J strata)	(t d.m.) m^{-3}

CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)$^{-1}$

In a next step the annual carbon losses of AGB due to natural diseases are determined following formula 4-16:

$$C_{AGB,ND,t} = \sum_{j=1}^{J}(C_{AGB-ND,j,t} \ x \ f_{ND,j,t}) \qquad (4\text{-}16)$$

Parameter	Description	Unit
$C_{AGB,ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{AGB-ND,j,t}$	Annual carbon in the aboveground biomass of the growing stock in the naturally disturbed area in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$f_{ND,j,t}$	Fraction of the growing stock naturally damaged in stratum j (where j = 1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	dimensionless

Formula 4-17a was followed to estimate the re-growth of areas disturbed:

$$C_{regrowth-ND,t} = CF_{AGB} \ x \sum_{j=1}^{J}\left[\sum_{ND=1}^{ND}(A_{ND,j,t}) \ x \ \bar{G}_{regrowth,ND,j,t}\right] \qquad (4\text{-}17a)$$

Parameter	Description	Unit
$C_{regrowth-ND,t}$	Annual carbon increase due to the regrowth in the naturally disturbed area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)$^{-1}$

$A_{ND,j,t}$	Annual area of natural disturbance nd, (where nd=1,2,3 ... ND naturally disturbed areas) in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha
$\bar{G}_{regrowth,ND,j,t}$	Average regrowth per hectare per year in the aboveground biomass after natural disturbance in stratum j, (where j=1,2,3 ... J strata) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	(t d.m.) ha^{-1} yr^{-1}

Formulae 4-18a to 4-20 allow for the quantification of the N_2O- and CH_4 emissions of forest fires. Formula 4-18a outlines the approach for the calculation of CH4 emissions:

$$E_{CH_4,t} = C_{AGB-ND,t} \; x \; R_{CH_4} \; x \; \frac{16}{12} \qquad \text{(4-18a)}$$

Parameter	Description	Unit
$E_{CH_4,t}$	Annual emissions due to CH4 in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCH_4
$C_{AGB-ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
R_{CH_4}	Emission ratio for CH4	dimensionless
$\frac{16}{12}$	The ratio of molecular weight of CH4 to carbon	tCH_4 tC^{-1}

Formula 4-18b was applied to calculate the emissions from N_2O due to forest fires:

$$E_{N_2O,t} = C_{AGB-ND,t} \; x \; R_{\frac{N}{C}} \; x \; R_{N_2O} \; x \; \frac{44}{28} \qquad \text{(4-18b)}$$

Parameter	Description	Unit
$E_{N_2O,t}$	Annual emissions due to N2O in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tN_2O
$C_{AGB-ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project	tC

	Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	
$R_{\frac{N}{C}}$	Ratio of nitrogen to carbon	$tN\ tC^{-1}$
R_{N_2O}	Emission ratio for N2O	dimensionless
$\frac{44}{28}$	The ratio of molecular weight of N2O to N	$tN_2O\ tN^{-1}$

Formula 4-19 allows for converting the N2O- and CH4 emissions into tC:

$$C_{CH_4N_2O,t} = \left(E_{CH_4,t}\ x\ GWP_{CH_4} + E_{N_2O,t}\ x\ GWP_{N_2O}\right) x\ \frac{12}{44} \quad (4\text{-}19)$$

Parameter	Description	Unit
$C_{CH_4N_2O,t}$	Annual carbon from CH4 and N2O emissions in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$E_{CH_4,t}$	Annual emissions due to CH4 in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCH_4
GWP_{CH_4}	Global warming potential of CH4	tCO_2-e $tCH4^{-1}$
$E_{N_2O,t}$	Annual emissions due to N2O in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tN_2O
GWP_{N_2O}	Global warming potential of N2O	tCO_2-e tN_2O^{-1}
$\frac{12}{44}$	The ratio of molecular weight of carbon to carbon carbon dioxide	tC tCO_2-e^{-1}

Formula 4-20 finally quantifies the total emissions of natural disturbances.

$$C_{natdisturb,t} = \sum_{t=1}^{t}\left(C_{AGB-ND,t} - C_{regrowth-ND,t} + C_{CH_4N_2O,t}\right) \quad (4\text{-}20)$$

Parameter	Description	Unit
$C_{natdisturb,t}$	Annual total carbon losses due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{AGB-ND,t}$	Annual carbon losses in the aboveground biomass of the growing stock due to natural disturbance(s) in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{regrowth-ND,t}$	Annual carbon increase due to the regrowth in the naturally disturbed area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{CH_4N_2O,t}$	Annual carbon from CH4 and N2O emissions in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Finally, the emissions due to illegal logging are calculated based on formula 4-21

$$C_{illegal-harvest,t} = V_{illegal-harvest,t}\ x\ (1 + f_{RSD})\ x\ BEF\ x\ D\ x\ CF_{AGB} \qquad (4\text{-}21)$$

Parameter	Description	Unit
$C_{illegal-harvest,t}$	Annual carbon losses due to illegal harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$V_{illegal-harvest,t}$	Annual volume of wood sold as determined from field surveys in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	m^3
BEF	Biomass expansion factor for converting volume of extracted roundwood to total aboveground biomass (including bark)	(t d.m.) m^{-3}
D	Wood density for the forest with corresponding climate region and ecological zone	(t d.m.) m^{-3}
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)$^{-1}$
f_{RSD}	Factor for residual stand damage, based on the fraction of quantity of carbon damaged in the residual stand to the quantity of carbon in the total merchantable logs harvested	dimensionless

D.1.2.4. Description of formulae and/or models used to estimate the greenhouse gas emissions by sources within the project boundary in the project scenario (for each gas, source, etc.; in units of CO_2 equivalent):

The emissions of project planning- and moniroting have been tested for their significance. It was concluded that these emission sources are insignificant and may be neglected. Hence no models are required.

D.1.2.5. Data necessary for determining the changes in carbon stocks in the carbon pools within the project boundary in the baseline scenario, and how these data will be collected and archived (for each carbon pool and in units of CO_2 equivalent):

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
The baseline is fixed ex-ante. No monitoring required, not applicable.								

D.1.2.6. Data necessary for determining the greenhouse gas emissions by sources within the project boundary in the baseline scenario, and how these data will be collected and archived (for each gas, source, etc.; in units of CO_2 equivalent):

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
The baseline is fixed ex-ante. No monitoring required, not applicable.								

D.1.2.7. Description of formulae and/or models used to estimate the changes in carbon stocks in the carbon pools within the project boundary in the baseline scenario (for each carbon pool and in units of CO_2 equivalent):

The emissions of forest degradation are determined based on the quantification of emissions due to the decay of deadwood, the emissions from long-term harvested wood products (ltHWP), growth foregone as well as re-growth after logging operations. The detailed approach is presented in below formula 3.2:

$$C'_{degradation,t} = \left[[\![(C]\!]_{DW_{decay},t} + C_{ltHWP_{oxidation},t} + C_{regrowth,t}\right) x \frac{44}{12} \Big] \qquad (3.2)$$

Parameter	Description	Unit
$C'_{degradation,t}$	Annual total carbon emissions associated with degradation as a result of the baseline activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C_{DW_{decay},t}$	Annual carbon leaving the deadwood pool due to the decay of deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{oxidation},t}$	Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{growth_{foregone},t}$	Annual carbon lost due to growth foregone in the aboveground biomass in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{regrowth,t}$	Annual carbon increase in the biomass due to regrowth following logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\frac{44}{12}$	The ratio of molecular weight of carbon dioxide to carbon,	tCO_2-e tC^{-1}

The quantification of average carbon in merchantable logs follows formula 3.3 presented below.

$$\overline{C}_{merch,j,t=0} = D \; x \; CF_{wood} \; x \; \overline{V}_{merch,j,t=0} \qquad (3\text{-}3)$$

Parameter	Description	Unit

$\bar{C}_{merch,j,t=0}$	Average carbon per hectare in merchantable logs in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
D	Wood density for the forest with corresponding climate region and ecological zone	(t d.m.) m^{-3}
CF_{wood}	Carbon fraction of wood for the forest	tC $(t\ d.m.)^{-1}$
$\bar{V}_{merch,j,t=0}$	Average merchantable logs" volume per hectare in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	m^3 ha^{-1}

Formula 3-4 proposes an approach to determine the average carbon per ha in merchantable logs.

$$\bar{C}_{merch,t=0} = \frac{\sum_{j=1}^{J} \bar{C}_{merch,j,t=0} x A_{project,j,t=0}}{A_{project,t=0}} \qquad (3\text{-}4)$$

Parameter	Description	Unit
$\bar{C}_{merch,t=0}$	Average carbon per hectare in merchantable logs in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$\bar{C}_{merch,j,t=0}$	Average carbon per hectare in merchantable logs in stratum j, (where j=1,2,3 ... J strata) determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$A_{project,j,t=0}$	Project Area within each stratum j, (where j=1,2,3 ... J strata) where the IFM-LtPF project activity will be implemented; determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	ha
$A_{project,t=0}$	Project Area where the IFM-LtPF project activity will be implemented; determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	ha

Based on a) the average carbon per ha in stocks which would be removed under the baseline scenario, and based on b) the total annual net harvesting area the total carbon in merchantable logs is calculated following formula 3-15a below:

$$C_{merch,t=0} = \bar{C}_{merch,t=0}\ x\ A_{NHA_{annual},t} \qquad (3\text{-}15a)$$

Parameter	Description	Unit

$C_{merch,t=0}$	Annual total carbon in the merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{C}_{merch,t=0}$	Average carbon per hectare in the merchantable logs determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

Annual total carbon AGB of the growing stock harvested per year is determined following formula 3-16a below:

$$C_{AGB_{gstock},t} = \bar{C}_{AGB_{gtstock},t=0} \ x \ A_{NHA_{annual},t} \quad (3\text{-}16a)$$

Parameter	Description	Unit
$C_{AGB_{gstock},t}$	Annual total carbon in the aboveground biomass of the growing stock harvested every year in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{C}_{AGB_{gtstock},t=0}$	Average carbon per hectare in the aboveground biomass of the growing stock determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

The volume of tC leaving the deadwood pool per year is calculated following formula 3-17.

$$C_{DW_{decay},t} = f\left(C_{DW_{in},t}, k_{decay}\right) \quad (3\text{-}17)$$

Parameter	Description	Unit
$C_{DW_{decay},t}$	Annual carbon leaving the deadwood pool due to the decay of deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

k_{decay}	Rate of decay of the deadwood pool	yr

In a next step, the input into the DW pool is specified following formula 3-18 below:

$$C_{DW_{in},t} = C_{RSD_t} + C_{branch_{trim},t} \qquad (3\text{-}18)$$

Parameter	Description	Unit
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
C_{RSD_t}	Annual carbon in the residual stand damage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{branch_{trim},t}$	Annual carbon in branches and trimmings left over from harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

The annual carbon in the residual stand damage and the annual carbon from trimmings are determined in below functions. The annual carbon in the residual stand damage is specified in formula 3-19.

$$C_{RSD,t} = f_{RSD} \; x \; C_{merch,t} \qquad (3\text{-}19)$$

Parameter	Description	Unit
$C_{RSD,t}$	Annual carbon in the residual stand damage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
f_{RSD}	Factor for residual stand damage, based on the fraction of quantity of carbon damaged in the residual stand to the quantity of carbon in total merchantable logs harvested	dimensionless
$C_{merch,t}$	Annual total carbon in merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (See Equations 3-15a and 3-15b)	tC

Function 3-20 below outlines the approach for determining the annual carbon input into the DW pool based on trimmings and left over from branches.

$$C_{branch_{trim},t} = f_{branch_{trim}} \; x \; C_{merch,t} \qquad (3\text{-}20)$$

Parameter	Description	Unit
$C_{branch_{trim},t}$	Annual carbon in branches and trimmings left over from harvesting in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$f_{branch_{trim}}$	Annual total carbon in the merchantable logs harvested in the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{merch,t}$	The fraction of branches and trimmings in the aboveground biomass remaining after trimming of the merchantable logs transferred to the DW pool	dimensionless

Formula 3-21 was followed to determine the decay of deadwood volume in the DW pool over time:

$$F_{DW_{remain},t} = e^{-k_{decay} \, x \, t} \qquad (3\text{-}21)$$

Parameter	Description	Unit
$F_{DW_{remain},t}$	Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of decay	dimensionless
k_{decay}	Rate of decay of the deadwood pool	yr^{-1}
t	1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity	yr

Formula 3-22a was used to calculate the volume of the deadwood pool per year:

$$C_{DW_{pool},t} = \sum_{t=1}^{t*} F_{DW\_remain\_t} \; x \; C_{DW_{in},t} \qquad (3\text{-}22a)$$

Parameter	Description	Unit
$C_{DW_{pool},t}$	Cumulative carbon remaining in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

$F_{DW_{remain_t}}$	Annual fraction of carbon in the deadwood pool that would remain in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of decay	dimensionless
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Formula 3-23 allows to calculate the accumulated carbon output of the DW pool:

$$C_{DW_{out},t} = \sum_{t=1}^{t*} C_{DW_{in},t} - C_{DW_{pool},t} \qquad (3\text{-}23)$$

Parameter	Description	Unit
$C_{DW_{out},t}$	Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{in},t}$	Annual total carbon input to the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{pool},t}$	Cumulative carbon remaining in the deadwood pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Formula 3-24 finally allows calculating the annual output (i.e. not accumulated) of the DW pool which are considered as baseline emissions:

$$C_{DW_{decay},t} = C_{DW_{out},t} - C_{DW_{out},t-1} \qquad (3\text{-}24)$$

Parameter	Description	Unit
$C_{DW_{decay},t}$	Annual carbon leaving the deadwood pool due to the decay of deadwood in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{DW_{out},t}$	Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

$C_{DW_{out},t-1}$	Cumulative carbon leaving the deadwood pool and emitted into the atmosphere in year t-1, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

The basic approach for the determination of the missions due to the oxidation of ltHWP is laid out in formula 3-25 below:

$$C_{ltHWP_{oxidation},t} = C_{ltHWP_{residues},t} + C_{ltHWP_{net-out},t} \quad (3\text{-}25)$$

Parameter	Description	Unit
$C_{ltHWP_{oxidation},t}$	Annual carbon due to the combined delayed oxidation of long-term harvested wood products and immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{residues},t}$	Annual carbon due to the immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{net-out},t}$	Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

The residues which occur in the course of the processing of ltHWP are calculated based on formula 3-26 below:

$$C_{ltHWP_{residues},t} = \bar{C}_{merch,p,t} \; x \; \left(1 - f_{lumber_{recovery}}\right) x \; A_{NHA_{annual},t} \quad (3\text{-}26)$$

Parameter	Description	Unit
$C_{ltHWP_{residues},t}$	Annual carbon due to the immediate oxidation of long-term harvested wood products residues in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{C}_{merch,p,t}$	Average carbon per hectare in merchantable logs of forest product type p=sawlog, in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC ha^{-1}
$f_{lumber_{recovery}}$	Lumber recovery factor for proportion of merchantable log converted to harvested wood product	dimensionless
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF	ha

	project activity)	

The input into the ltHWP pool is determined as stipulated by formula 3-27.

$$C_{ltHWP_{in},t} = \bar{C}_{merch,p,t} \times f_{lumber_{recovery}} \times A_{NHA_{annual},t} \qquad (3\text{-}27)$$

Parameter	Description	Unit
$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{C}_{merch,p,t}$	Average carbon per hectare in merchantable logs of forest product type p, in the Project Area determined ex ante - before the start of the IFM-LtPF project activity, hence t=0 year	tC
$f_{lumber_{recovery}}$	Lumber recovery factor for proportion of merchantable log converted to harvested wood product	dimensionless
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	ha

The fraction of carbon which remains in the ltHWP is determined following formula 3-28.

$$F_{ltHWP_{remain}} = e^{-k_{ltHWP_{ox}} \times t} \qquad (3\text{-}28)$$

Parameter	Description	Unit
$k_{ltHWP_{ox}}$	Rate of oxidation for long-term harvested wood products	yr^{-1}
t	1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity	yr

The volume of the ltHWP is calculated following 3-29a:

$$C_{ltHWP_{pool},t} = \sum_{t}^{t*} \left(F_{ltHWP_{remain},t} \; x \; C_{ltHWP_{in},t}\right) \qquad (3\text{-}29)$$

Parameter	Description	Unit
$C_{ltHWP_{pool},t}$	Cumulative carbon remaining in the ltHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$F_{ltHWP_{remain},t}$	Annual fraction of ltHWP that would remain in the ltHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) after applying the rate of oxidation	dimensionless
$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Formula 3-30 outlines the approach for quantifying the accumulated amount of carbon which leaves the HWP pool:

$$C_{ltHWP_{out},t} = \sum_{t=1}^{t*} C_{ltHWP_{in},t} - C_{ltHWP_{pool},t} \qquad (3\text{-}30)$$

Parameter	Description	Unit
$C_{ltHWP_{out},t}$	Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere from year t=1 to year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{in},t}$	Annual carbon input to the long-term harvested wood products pool from sawlog in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{pool},t}$	Cumulative carbon remaining in the ltHWP pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

Finally, formula 3-31 allows for determining the volume of carbon which leaves the HWP per annum:

$$C_{ltHWP_{net_{out}},t} = C_{ltHWP_{out},t} - C_{ltHWP_{out},t-1} \qquad (3\text{-}31)$$

Parameter	Description	Unit
$C_{ltHWP_{net_{out}},t}$	Annual net carbon due to the delayed oxidation of the long-term harvested wood products, leaving the long-term harvested wood products pool in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{out},t}$	Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{ltHWP_{out},t-1}$	Cumulative carbon leaving the ltHWP pool and emitted into the atmosphere in year t-1, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC

The carbon stock increase after logging is calculated following formula 3-38:

$$C_{regrowth,t} = \left(\bar{G}_{regrowth,t}\ x\ CF_{AGB}\right) x \sum_{t=1}^{t*} A_{NHA_{annual},t} \qquad (3\text{-}38)$$

Parameter	Description	Unit
$C_{regrowth,t}$	Annual carbon increase in the biomass due to regrowth following logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$\bar{G}_{regrowth,t}$	Average regrowth per hectare per year of the aboveground biomass after logging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	(t d.m.) ha^{-1} yr^{-1}
CF_{AGB}	Carbon fraction in the aboveground biomass of trees for the forest	tC (t d.m.)$^{-1}$
$A_{NHA_{annual},t}$	Annual net harvest area for the Project Area in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)^^	ha

D.1.2.8. Description of formulae and/or models used to estimate the greenhouse gas emissions by sources within the project boundary in the baseline scenario (for each gas, source, etc.; in units of CO2 equivalent):

Based on above decisions, formula 3-39 outlines the general approach for the quantification of baseline activity emissions:

$$C'_{emissions,t} = E_{harvest,t} + E_{hauling,t} + E_{transport,t} + E_{processing,t} \quad (3\text{-}39)$$

Parameter	Description	Unit
$C'_{emissions,t}$	Annual total carbon emissions associated with the baseline activity of selective logging operations in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{harvest,t}$	Annual emissions due to harvesting operations such as felling and snigging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{hauling,t}$	Annual emissions due to log hauling in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{transport,t}$	Annual emissions due to log transport from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$E_{processing,t}$	Annual emissions due to electricity consumption in sawmill in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

In a first step the emissions from harvesting operations are determined following formulae 3-40:

$$E_{harvest,t} = FC_{harvest} \; x \; EF_{fuel} \times V_{merch,t} \quad (3\text{-}40)$$

Parameter	Description	Unit
$E_{harvest,t}$	Annual emissions due to harvesting operations such as felling and snigging in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$FC_{harvest}$	Fuel consumption of equipment employed for felling and snigging per m3 of merchantable log harvested	kL m^{-3}
EF_{fuel}	Fuel emission factor	tCO_2-e kL^{-1}
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3

The emissions for hauling are calculated based on formula 3-43:

$$E_{hauling,t} = FC_{hauling} \; x \; EF_{fuel} \; x \; V_{merch,t} \quad (3\text{-}43)$$

Parameter	Description	Unit
$E_{hauling,t}$	Annual emissions due to log hauling in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$FC_{hauling}$	Fuel consumption of equipment for hauling one m3 of merchantable log	kL m^{-3}
EF_{fuel}	Fuel emission factor	tCO_2-e kL^{-1}
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3

Formulae 3-44 to 3-46 allow for the quantification of emissions arising from truck transport. Formula 3-44 is used to determine the numbers of truck tours required to transport the merchantable volume to the processing facility:

$$N_{trucks-transport,t} = \frac{V_{merch,t}}{Cap_{truck}} \qquad (3\text{-}44)$$

Parameter	Description	Unit
$N_{trucks-transport,t}$	Number of truck trips required for log transport from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	truck
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3
Cap_{truck}	Truck load capacity	m^3 $truck^{-1}$

The total transport distance of all trucks employed under the baseline case is determined following formula 3-45:

$$km_{transport-total,t} = km_{transport,t} \ x \ N_{trucks-transport,t} \ x \ \mathbf{2} \qquad (3.45)$$

Parameter	Description	Unit
$km_{transport-total}$	Annual total log transport distance in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km

$km_{transport,t}$	Annual log transport distance from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km truck^{-1}
$km_{transport,t}$	Number of truck trips required for log transport from collection depot to processing plant in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	truck
2	Constant, indicating return trip	dimensionless

Finally the emissions of transportation are determined following formulae 3-46:

$$E_{transport,t} = \frac{km_{transport-total,t}}{Eff_{vehicle}} \ x \ EF_{fuel} \quad (3\text{-}46)$$

Parameter	Description	Unit
$E_{transport,t}$	Annual emissions due to log transport haulage from felling location to the collection depot/ sawmill in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$km_{transport-total}$	Annual total log transport distance in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	km
$Eff_{vehicle}$	Fuel efficiency for vehicle type	km kL^{-1}
EF_{fuel}	Fuel emission factor	tCO_2-e kL^{-1}

Formulae 3-47 and 3-48 are used to determine the emissions of wood processing. Formula 3-47 was followed to calculate the annual electricity consumption of wood processing:

$$Q_{processing,t} = V_{merch,t} \ x \ e_{demand} \quad (3\text{-}47)$$

Parameter	Description	Unit
$Q_{processing,t}$	Annual quantity of electricity consumption for processing in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kWh
$V_{merch,t}$	Annual volume of merchantable logs in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity) (see Section 3.2.3)	m^3
e_{demand}	Electricity demand for processing per volume processed	kWh m^{-3}

Formula 3-48 finally allows for determining the actual emissions resulting of the electricity consumption of wood processing:

$$E_{processing,t} = Q_{processing,t} \; x \; EF_{electricity} \quad (3\text{-}48)$$

Parameter	Description	Unit
$E_{processing,t}$	Annual emissions due to electricity consumption in sawmill in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$Q_{processing,t}$	Annual quantity of electricity consumption for processing in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	kWh
$EF_{electricity}$	Electricity emission factor for the host country	tCO_2-e kWh^{-1}

D.1.3. Treatment of leakage in the monitoring plan:

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage (for each gas, source, carbon pool, etc.; in units of CO_2 equivalent):

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
A default discount factor of 20% was applied. Please refer to Section E.4 for details. Not Applicable.								

D.1.3.2. Description of formulae and/or models used to estimate leakage (for each gas, source, carbon pool, etc.; in units of CO_2 equivalent):

A default discount factor of 20% was applied. Please refer to Section E.4 for details. Not Applicable.

D.1.4. Description of formulae/and or models used to estimate the enhancements of net anthropogenic removals by sinks by the LULUCF project (for each gas, carbon pool, source, etc.; in units of CO_2 equivalent):

The net anthropogenic removals by sinks by the proposed forest management project is determined following formula 1-1:

$$C'_{IFM-LtPF,t} = C'_{baseline,t} - C'_{actual,t} - C'_{leakage,t} \quad (1\text{-}1)$$

Parameter	Description	Unit
$C'_{IFM-LtPF,t}$	Annual net anthropogenic GHG emission reductions in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{baseline,t}$	Annual total carbon emissions associated with the baseline scenario in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{actual,t}$	Annual total carbon emissions associated with the project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{leakage,t}$	Annual total carbon emissions associated with leakage in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

The net baseline emissions are determined following formula 3-1:

$$C'_{baseline,t} = C'_{degradation,t} + C'_{emissions,t} \quad (3\text{-}1)$$

Parameter	Description	Unit
$C'_{baseline,t}$	Annual total carbon emissions associated with the baseline scenario in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{degradation,t}$	Annual total carbon emissions associated with degradation as a result of the baseline activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C'_{emissions,t}$	Annual total carbon emissions associated with the baseline activity of selective logging operations in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e

The overall approach for the quantification of project emissions is laid out in formula 4-1:

$$C'_{actual,t} = \left[\left(C_{nat-disturb,t} + C_{illegal_{harvest},t}\right) x \ \frac{44}{12}\right] \quad (4\text{-}1)$$

Parameter	Description	Unit
$C'_{actual,t}$	Annual total carbon emissions associated with the project activity in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tCO_2-e
$C_{nat-disturb,t}$	Annual carbon losses due to natural disturbance(s) in year t, (where t=1,2,3 ... t* years elapsed since the start of the IFM-LtPF project activity)	tC
$C_{illegal_{harvest},t}$	elapsed since the start of the IFM-LtPF project activity)	tC
$\frac{44}{12}$	The ratio of molecular weight of carbon dioxide to carbon	tCO_2-e tC^{-1}

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the LULUCF project:

There are no (negative) environmental impacts of this forest project, please refer to Section F for a detailed discussion.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
$A_{ND,j,t}$ *No. 1, Table D.1.2.1*	*medium*	*The analysis is based on two elements complementing/crosschecking each other:* ▪ *Regular control flights by helicopter* ▪ *Annual remote sensing analysis of the integrity of the project area* *The remote sensing analysis will be based on high resolution images. This will ensure a high accuracy of the analysis.*
$f_{ND,j,t}$ *No. 2, Table D1.2.1*	*high*	*The analysis will be based on inventory measurements in the disturbed areas. The upper boundary of the 95% confidence interval will be used in order to be conservative.*
$V_{illegal-harvest,t}$ *No. 3, Table D.1.2.1*	*high*	*The analysis will be based on inventory measurements in the illegally logged areas. The upper boundary of the 95% confidence interval will be used in order to be conservative.*

D.3. Please describe the operational and management structure that the LULUCF project operator will apply in implementing the monitoring plan:

The proposed forest management project activity will be implemented by the TCT with support from WWF Amur Branch.

The actual management of the climate project will be taken over by WWF Amur Branch. WWF Amur Branch engaged a project manager, Mr. Evgeny Lepeshkin, who will be in charge for conducting all related monitoring activities. This will include inter alia:

- Evaluation of new forest regulation with respect to changes to the logging volumes and logging areas,
- Collection of project activity related data (fuel consumption of vehicles & helicopter, personnel air transport data, electricity consumption data),
- Evaluation of illegal logging and natural disturbances resulting in a decrease of carbon stocks under the project scenario.
- GIS data to verify project boundaries (see monitoring plan) and the integrity of the project area.

These activities will be managed and administered by WWF's project manager. Eventually WWF will engage qualified institutions/experts to provide detailed information (e.g. inventory team to determine the decrease of forest carbon stocks due to disturbances or illegal logging). Based on this data, annual monitoring reports will be developed and submitted to an AIE for verification.

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

Mr. Martin Burian, GFA ENVEST, martin.burian@gfa-envest.com
Mrs. Ekaterina Lysun, WWF Russia Far East, kalyok@yandex.ru

SECTION E. Estimation of enhancements of net anthropogenic removals by sinks

E.1. Estimated project net anthropogenic removals by sinks:

Based on the findings of above sections, the project net anthropogenic removals by sinks (i.e. negative) are presented in below table:

Table 36: Estimated Project Net Anthropogenic Removals by Sinks

$$C'_{actual,t} = E_{proj-plan,t} + E_{design,t} + E_{monitoring,t} + \left[\left(C_{nat-disturb,t} + C_{illegal_{harvest},t}\right) x \frac{44}{12}\right]$$

Year t	$E_{proj-plan,t}$	$E_{monitoring,t}$	$C_{natdisturb,t}$	$C_{illegal-harvest,t}$	$C'_{actual,t}$
1			192	54	903
2			192	54	903
3			192	54	903
4			192	54	903
5			192	54	903
6			192	54	903
7			192	54	903
8			192	54	903
9			192	54	903
10			192	54	903

E.2. Estimated baseline net anthropogenic removals by sinks:

Based on the findings of above sections, the baseline net anthropogenic removals by sinks (i.e. negative) are presented in below table:

Table 37: Estimated Baseline Net Anthropogenic Removals by Sinks

$$C'_{degradation,t} = \left[(C_{DW_{decay},t} + C_{ltHWP_{oxidation},t} + C_{regrowth,t})\ x\ \frac{44}{12}\right] \qquad C'_{baseline,t} = C'_{degradation,t} + C'_{emissions,t}$$

Year t	$C_{DW_{decay},t}$	$C_{ltHWP_{oxidation}}$	$C_{regrowth,t}$	$C'_{degradation,t}$	$C'_{emissions,t}$	$C'_{baseline,t}$
1	3,333	17,800	1,426	72,263	7,513	79,777
2	12,491	50,223	5,185	210,938	21,064	232,002
3	21,133	51,108	8,944	232,087	21,064	253,151
4	29,288	51,974	12,704	251,378	21,064	272,443
5	36,984	52,819	16,463	268,913	21,064	289,978
6	44,246	53,646	20,630	283,296	21,064	304,361
7	51,100	54,454	25,462	293,668	21,064	314,732
8	57,567	55,243	30,295	302,557	21,064	323,622
9	63,671	56,015	35,128	310,045	21,064	331,110
10	69,431	56,768	39,960	316,209	21,064	337,273

E.3. The difference between E.1. and E.2.:

The difference between E1 and E2 is presented in the table below:

Table 38: Difference between E.1 and E.2

Year t	$C'_{degradation;t}$	$C'_{emissions;t}$	$C'_{actual;t}$	E.1-E.2
1	72,263	7,513	903	78,843
2	210,938	21,064	903	231,018
3	232,087	21,064	903	252,176
4	251,378	21,064	903	271,475
5	268,913	21,064	903	289,015
6	283,296	21,064	903	303,400
7	293,668	21,064	903	313,769
8	302,557	21,064	903	322,653
9	310,045	21,064	903	330,135
10	316,209	21,064	903	336,292

E.4. Estimated leakage:

Following the VCSD methodology, leakage shall comprise market leakage and leakage due to activity shifting.

Leakage due to activity shifting. The project participant does not hold any other forest concessions. Consequently, there are no opportunities to

- Intensify logging operations in other existing concessions. And to
- Shift logging operations from the project area to any other forest concession within the host country.

Hence, the project does not account for emissions due to activity shifting.

Market leakage. Market leakage refers to the compensation of supply shortfall (due to the conservation of the project area) by other agents in the regional timber market. As the project activity reduces the timber supply, market leakage may occur.

In order to assess market leakage the analysis was constrained to Primorsky Krai. Comprising a total area of 165,900 km^2, the area of Primorsky Krai is comparable to countries like Tunisia, Suriname and Uruguay. Due to large distances, it is not economically cost efficient to e.g. import timber from other krais/oblasts to Primorsky Krai. Hence the Primorsky Krai is considered as a closed market.

Generally there are limited opportunities for market leakage in Primorsky Krai. In 1990ies the timber demands from China sky-rocked. In the subsequent years most of the suitable forest areas were developed and logged. There are no major unlogged forest areas which could be leased as timber concession (which increases the pressure on NHZs). Hence there are limited opportunities for the timber market in Primorsky Krai to compensate the timber shortfall due the logging of new areas and/or the intensification of existing forest concessions. The compensation of supply shortfall is likely to occur in less dense forests. This results in a fairly price-inelastic timber supply function which is demonstrated by below evaluation.

In order to assess market leakage, the market data for Spruce and for Korean Pine were analyzed (other data was not available). Spruce makes up for 25.6% of the total commercial timber volume of the project

area, Korean pine covers 23.3%. These two species are by far the most important tree species in the project area.
There is no general price and volume reporting system in Primorsky krai in place, hence data was gathered from the port custom agency in Vladivostok. The port agency keeps track of exported volumes and prices as these are subject to export taxes. Table 39 outlines the timber volumes and prices for spruce and Korean Pine.

Table 39: Korean Pine and Spruce Volume and Price Data

Years	2004	2005	2006	2007	2008	2009
Korean Pine - Average Custom Prices (in Rubel/m3)	2.872	2.943	2.939	2.836	2.776	3.457
Korean Pine - Timber Volumes (in 1000m3)*	106	108	153	147	147	147
Years	2004	2005	2006	2007	2008	2009
Spruce - Average Custom Prices (in Rubel/m3)	1.725	1.856	1.806	2.351	2.374	2.912
Spruce Timber volumes (in 1000m3)	624	656	656	1.149	1.054	649
Source: Data provided by the Vladivostok Port Custom Agency						
Note: *No Korean Pine volumes available for 2008 and 2009. The value of 2007 was applied, even though the development of Spruce would imply a decrease (conservative).						

The data is analyzed in below figures:

Figure 7: Spruce Price and Volume Data

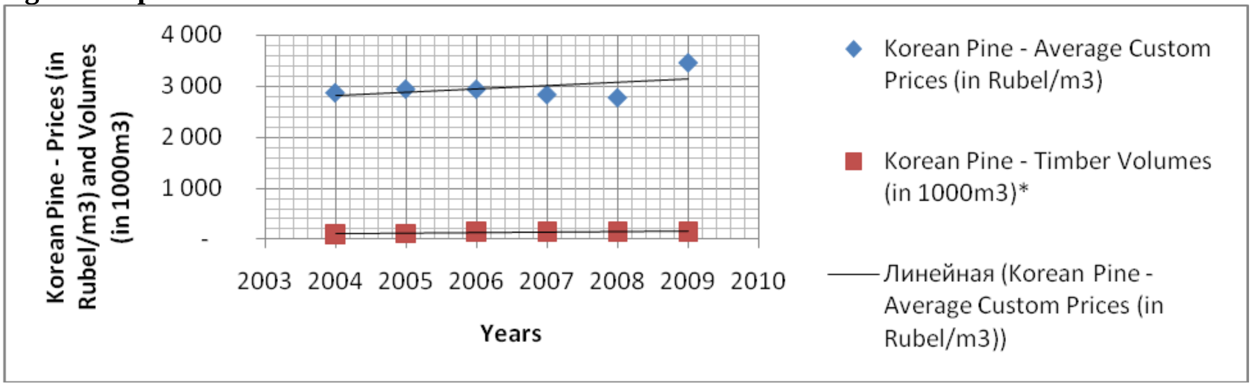
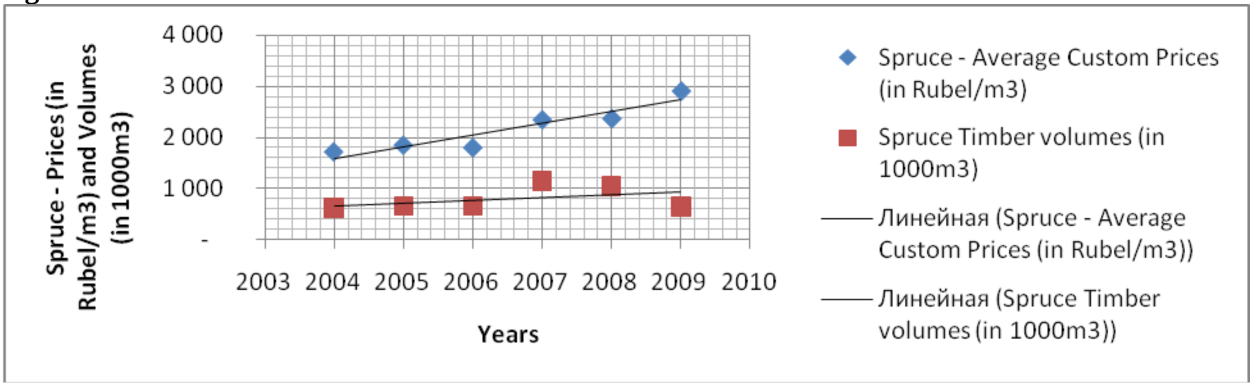


Figure 8: Korean Pine Price and Volume Data



Both Figure 7 and Figure 8 show a significant increase in prices (blue dots and related trend), whereas the increase of volumes is moderate (red dots and related trend). This shows that the market, even though prices increased significantly, cannot cope with the actual demand (i.e. price inelastic supply). Consequently there are limited opportunities in the market to increase the supply in order to compensate the shortfall of timber production due to the protection of the project area.

Table 40: Leakage Emissions	
Year t	Leakage
1	15,949
2	46,384
3	50,616
4	54,476
5	57,984
6	60,861
7	62,934
8	64,711
9	66,208
10	67,439

Following the VCS methodology and the VCS Tool for AFOLU Methodological Issues[19] (p.7f), the project has to account for market leakage. Due to above outlined inelastic timber supply, a market leakage credit discount of 20% was applied.

E.5. The difference between E.3. and E.4 representing the estimated enhancements of net anthropogenic removals by sinks:

The table below presents the net anthropogenic removals by sinks. This comprises the project's increase in forest carbon stocks and leakage, but excludes fossil fuel related emissions of the project- and the baseline case:

Table 41: Estimated Enhancements of Net Anthropogenic Removals by Sinks			
Year t	E1-E2	Leakage	Net Anthropogenic Removals by Sinks
1	77,913	15,787	62,126
2	228,525	45,909	182,616
3	249,432	50,091	199,342
4	268,502	53,905	214,597
5	285,836	57,372	228,465
6	300,054	60,215	239,838
7	310,305	62,265	248,039
8	319,090	64,022	255,068
9	326,490	65,502	260,988
10	332,581	66,721	265,860

E.6. Table providing values obtained when applying formulae above:

Finally, the projects overall emission reductions are presented in below table. This comprises the net anthropogenic removals by sinks, leakage, and the fossil fuel related emissions of the project and baseline case:

[19] VCS, 2008, Tool for Methodological Issues. Available at:
http://www.v-c-s.org/docs/Tool%20for%20AFOLU%20Methodological%20Issues.pdf

Net Anthropogenic Removals by Sinks				
Year	Estimated Project Net Anthropogenic Removals by Sinks	Estimated Baseline Enhancements of Net Anthropogenic Removals by Sinks	Leakage	Estimated Enhancements of Net Anthropogenic Removals by Sinks
t	$C'_{actual,t}$	$C'_{baseline,t}$		$C'_{IFM-LtPF,t}$
1	903	79,746	15,949	62,894
2	903	231,921	46,384	184,634
3	903	253,080	50,616	201,561
4	903	272,378	54,476	216,999
5	903	289,919	57,984	231,032
6	903	304,304	60,861	242,540
7	903	314,672	62,934	250,834
8	903	323,557	64,711	257,942
9	903	331,039	66,208	263,928
10	903	337,195	67,439	268,853

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the LULUCF project, including transboundary impacts, in accordance with procedures as determined by the host Party:

The Bikin NHZ is a unique ecosystem being home to at least 12 endangered species (i.e. listed as vulnerable, endangered or critically endangered in the IUCN Red List book). One of these species is the Amur tiger. The tiger population in the Bikin is estimated to 30 to 35 animals. Its primary habitat is rocky Korean Pine – mixed broadleaf forests. Korean Pine stands are also an important ecosystem for the tiger's primary prey (deer and wild boar) through provision of nutrition (such as Korean Pine Nuts, KPN) and shelter functions.
The Bikin is not only home to threatened species, it is also home for species which are endemic for the Russian Far East. There are at least 14 endemic species living in the Bikin. Based on the high endemism and based on being habitat to major endangered species, it is concluded that the Bikin is a unique ecosystem on a regional and global scale.
Below table outlines a summary of the project's environmental impacts.

Table 42: Summary of Biodiversity Project Impacts			
No	**Without Project**	**With Project**	**Net Effect**
1	Large scale logging operations in the project area would lead to forest degradation and to a decrease of forest dependent species. Unique habitats and nature systems in whole will be lost for the planet.	Only intermediate thinning will be allowed in NHZ, moreover cedar trees will not be cut if not necessary. The diversity of species will stay the same or will even increase.	Positive
2	The main feature of virgin forest will be destroyed – patched forests will be razed to the one-level forest which will not be as stable and resilient as a primary forest and will not be able to feed up the majority of wildlife species.	Patched structure of the forest forms lots of habitat types and livelihood conditions what have a positive effect on breeding and existence of forest- dependent species	Positive

3	Populations of threatened flora and fauna species continue to decline.	Project will leave untouched the areas of threatened species, what will help them to breed and to increase their population.	Positive
4	Road construction will take place all over the NHZ what will cause forest fires, poaching, wildlife disturbance, threatened and common species migration, etc.	Project will forbid any road construction activity.	Positive
5	The livelihood of the native population of Udege people will be disturbed and decreased. Capture will decrease because of increasing activity by alien hunters' (also poaching) and wildlife habitats loss. Fish catch will decrease because of water level decreasing (as a result of forest logging), nut yield will not appear during the next 200 years (because of forest logging).	Project will leave the territory untouched, forest unlogged, and therefore the native population of Udege people will have their livelihoods sustained.	Positive

The above table shows only positive environmental impacts. It is concluded that the JI LULLUCF project will:

- Permanently protect the project area as a natural reserve thereby ensuring the persistence of the old grown ecosystem and avoid strong biodiversity loss,
- Avoid GHG emissions through carbon stock reductions due to clear cutting,
- Serve as a supra-regional lighthouse project for forest conservation;

The project has no negative environmental impacts.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The project is not expected to have significant environmental impacts and the host country does not require an environmental impact assessment. Not applicable.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the LULUCF project, as appropriate:

Identification of the stakeholders. Krasny Yar is the only village located in the project area. It is the key settlement for all related project activities. Krasny Yar is a rather small settlement featuring about 600 habitats, large part of them are indigenous people of the Udege tribe. Since the village is located in a remote area, it was decided to apply a two-phased stakeholder consultation process.

- One event was conducted in the Pozharsky municipal district capital, Luchegorsk (20th October 2011).
- The second event was conducted at in Krasny Yar, in the project area (21st October 2011)

The above described approach was found most applicable to ensure a broad stakeholder involvement.

Submission of Reports. Prior to the given meetings the project was presented to top regional (Russian Far East) economic, forestry and ecological audiences by the presentation of two reports:

- Darman Yu.A., Smirnov D.Yu., Lepeshkin E.A. Biodiversity conservation and sustainable use of natural resources within Amur tiger habitat // Fifth Far Eastern International Economic Forum. Khabarovsk, 4-5 October, 2011.
- Darman Yu.A., Smirnov D.Yu., Lepeshkin E.A. New international economic mechanism for sustainable forestry in Amur tiger habitats // All-Russia conference “Forest and forestry in current conditions”. Far Eastern Forest Research Institute and Far Eastern Department of Rosleshoz, Khabarovsk, 5-6 October, 2011.

The audience included all significant logging companies, key local authorities as well as the general public. Access was free and announcement in regional media has been done in advance. All replies were positive. People highlighted the necessity to conduct sanitary cuts very carefully, conducting only those logging operations that are maximizing conservation of the forest environment.

Stakeholder Meeting in Luchegorsk. Stakeholders consultations in Luchegorsk were widely announced in the local media in advance, access to the hall was open to everyone, at all times. People represented municipal authorities, local Duma (parliament), NGOs (including local Public Chamber), business; political party, the local public and media. The list of key stakeholders is presented below. Additionally, about 10 local citizens and media people, and 5 WWF Russia people took part in the meeting.

In the beginning, there were two presentations (about the Bikin project and about the Kyoto Protocol and JI system), followed by a statement of the project proponent Tribal Commune Tiger. All people were asked for their opinion on the project. There was an active discussion with many questions. Main comments (and all critical comments) are listed and discussed in the below Stakeholder Comments Review Table (Table 45), jointly for both meetings.

Table 43: Stakeholder List - Consultation in Luchegorsk

	Person / Organization / Company	Position/ occupation/ sector of activities
1	Kirpichev V.S.	Chairman of Duma (parliament) of Pozharsky Municipal District
2	Biryukova T.V.	Deputy head of administration of Municipal District Pozharsky
3	Golokha L.V.	Head of the Socio-Economic Development Authority Pozharsky Municipal District
4	Kravchenko T.V.	Chief of Staff of Pozharsky Municipal District Duma
5	Ilyina G.G.	Deputy Chairman of the Public Chamber of Municipal District Pozharsky
6	Borik N.A	Acting Local Secretary of the Political Council of the local branch Pozharsky "United Russia" political party
7	Galkin A.N.	Head of Verkhne-Perevalnensky branch of Provincial Department “Primorskoye forestry”
8	Shirko V.A.	President of the Regional public organization Association of indigenous peoples of the North of Primorsky Province, Chairman of the indigenous peoples enterprise “Tiger” of Krasny Yar village, deputy of Duma of Pozharsky municipal district
9	Uza A.L.	Head of Krasny Yar village
10	Kuchenko I.A.	Deputy Chairman of the indigenous peoples enterprise “Tiger” of Krasny Yar village
11	Tsvetkova M.F.	Head of NGO “Pervotsvet”, Luchegorsk village
12	Zamolodchikov D.G.	Working group of Russia on Kyoto Process, Center of Ecology and Forests Productivity of Russian Academy of Sciences (Moscow)

Stakeholder Meeting in Krasny Yar. The Stakeholder consultation in Krasny Yar was widely announced in the village in advance, access to the room was open. People represented village authorities, local Duma, local teachers, and local businesses. The list of key stakeholders is presented below. Additionally, about 5 local citizens, and 4 WWF Russia people took part in the meeting. In the beginning, there were two presentations (about the Bikin project and about social development of the village) followed by an active discussion with many question. Main comments (and all critical comments) are listed below in the Stakeholder Comments Review Table (Table 45) for both consultations together.

Table 44: Stakeholder List - Consultations in Krasny Yar

	Person/Organization/Company	Position/ occupation/ sector of activities
1	Uza A.L.	Head of Krasny Yar village
2	Shirko V.A.	President of the Regional public organization Association of indigenous peoples of the North of Primorsky Province, Chairman of the indigenous peoples enterprise “Tiger” of Krasny Yar village, deputy of Duma of Pozharsky municipal district
3	Kanchuga G. L.	Member of Duma; School principle
4	Pionka N. N.	Member of Duma; Teacher
5	Ushakova G. N.	Member of Duma; Medical assistant
6	Adyan V. I.	Member of Duma; Hunter of Indigenous peoples enterprise “Tiger”
7	Kuchenko I. A.	Deputy Chairman of the indigenous peoples enterprise “Tiger” of Krasny Yar village
8	Sulyandziga A. V.	Member of Duma; Private entrepreneur
9	Kanchuga G. M.	Member of Duma; Medical assistant
10	Gorunov N. I.	Head of operative brigade of Indigenous peoples enterprise “Tiger”
11	Smirnova S. V.	Member of Duma; Head on non-timber forest products of Indigenous peoples enterprise “Tiger”

Comments Received. People asked to clarify the details of the JI system and the principles of additionality, the role of the Tribal Commune Tiger, and of authorities in Moscow and German organisations. They expressed a positive view on the project as a whole, highlighting the importance of long-term conservation of forests for traditional forest-use without clear cuttings.

Main critical attention was paid to the spending/use of carbon revenues. People critically discussed different options and decided to recommend the following:

- Covering the concession fee for the NHZ and the riparian zone;
- Financing activities against illegal timber harvesting and nature use;
- Financing forest fire protection measures in the project area;
- Supporting infrastructure development for processing non-timber forest products and for support of traditional livelihood of indigenous peoples; and
- Financing social development measures in Krasny Yar village.

The first three items are quite clear for local stakeholders. In infrastructure development, people recommended to the Head of Verkhne-Perevalnensky branch of Provincial Department “Primorskoye forestry” to work out a range of proposals for organizing a fire preventing system for the protection of the middle and upper reaches of the Bikin forest.

After a lengthy discussion, it was decided to compile:

- A social development plan, and
- A development program for the Territory of Traditional Nature Use (TTNU) of the project area

The social development plan should be compiled as soon as possible. The Chairman of the indigenous people enterprise “Tiger” of Krasny Yar village and Head of Krasny Yar village should elaborate the development program for the TTNU and social development of the village.

For making the allocation of funds transparent and considering interests of all parties involved, Adyan V.I. suggested to establish a Supervisory Board including representatives of the indigenous peoples enterprise Tribal Commune Tiger , the Administration, the Duma of Pozharsky municipal district, the Verkhne-Perevalnensky branch of the Provincial Department “Primorskoye forestry”, the Forestry Department of Primorsky Province, the administration of Krasny Yar settlement and NGOs, including local Public Chamber and WWF. People approved the proposal without any objection.

Table 45: Stakeholder Comment Review

	Subject to comments	Stakeholder position
1	**Options to use expected cabon revenues**	Immediately discuss and develop a list of priorities, properly reflect this list in an Investment Declaration to be presented to a Russian top JI authority. Priorities are the following: long term lease of Korean pine nut-harvesting zone; halting illegal timber harvesting and nature use; preventing forest fires in the Bikin River basin; support infrastructure development for processing non-timber forest products and for support of traditional livelihood of indigenous peoples; and social development of Krasny Yar village. Head of Verkhne-Perevalnensky branch of Provincial Department “Primorskoye forestry” should work out a range of proposals for organizing a fire preventing system for the protection of the middle and upper reaches of the Bikin forest.
2	**Use funds for social development of Krasny Yar village**	This was discussed as the last of the options listed above. Priority of the given item is not clear yet. A plan for the social development of the village (responsible person – Head of local administration) will be developed, presented and agreed with the local Duma. The chairman of the indigenous people enterprise “Tribal Commune Tiger” of Krasny Yar village and the Head of Krasny Yar village should elaborate the development program for the Territory of Traditional Nature Use and the plan for social development of the village. Both plans shall be accomplished in advance to receiving carbon revenues
3	**Access to the information on the project implementation**	Information on forest management and practices (activities) of the project is available, but it should be provided on a regular basis. All information about subsequent steps of the project should be published in the local newspaper “Krasny Yar Vestnik”.
4	**Package of complicate documents is not ready**	WWF should complete the PDD and all documents required for presentation to official JI bodies of RF and Germany according to current JI regulation. These documents shall be promoted in the governmental structures of the Russian Federation and Germany.
5	**Acknowledgement of a public opinion**	Establish a Supervisory Board including representatives of the indigenous people enterprise “Tiger”, the Administration, the Duma of Pozharsky municipal district, Verkhne-Perevalnensky branch of Provincial Department “Primorskoye forestry”, Forestry Department of Primorsky Province, Administration of Krasny Yar settlement and NGOs, including the local Public Chamber and WWF. People approved the proposal without any objection.
6	**Environmental impacts:** ▪ Biodiversity conservation ▪ Water resources	No negative environmental impacts were mentioned. All respondents highlighted positive impacts for all listed aspects.

	▪ Soil resources ▪ Air protection ▪ Noise ▪ Forest protection	
5	**Social impact:** ▪ Rights and economic interest of local population ▪ Public involvement	According to the received feedback, the interests of the local population are certainly considered within the project design. The impact on the economic interest of the local population is certainly positive. The overall opinion confirmed a broad interest and involvement of local stakeholders into the proposed project.

Conclusion. It may be concluded that stakeholders have a positive perception of the JI project: No negative comments were received.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

Annex 2.1 Calculation of the Annual Allowable Cut

English Translation of

Determination of allowable annual cut for all cuttings types on territory of
Verhne-Perevalninskii forest district, Sobolinskii subdivision (compartments 68, 107-117), Krasnoyarovskii subdivision (compartments 118-308, 326-337, 342-407, 409, 413, 417), Ohotnichie subdivision (compartments 309-325, 338-341, 408, 410-412, 414-416, 418-523, 525-530, 537-543, 549-563, 571-575, 589, 590, 593, 594, 598-603, 611-620, 626, 627, 632-656, 663-666, 701-713, 715-717, 719) of Primorskii Krai.
Total area – 461154 ha.

Developed by

Federal Forestry Agency
Far Eastern filial agency of forest inventory filial agency of Federal State Unitary Enterprise “ROSLESINFORG” “DALLESPROEKT”
Federal budgetary institution “Far Eastern Forestry Research Institute”

Please note, the original document may be provided to the AIE upon request

1 General information

Determination of allowable annual cut for all cuttings types has been done on territory of Verhne-Perevalninsky forest district, Sobolinsky subdivision (compartments 68, 107-117), Krasnoyarovsky subdivision (compartments 118-308, 326-337, 342-407, 409, 413, 417), and Ohotnichie subdivision (compartments 309-325, 338-341, 408, 410-412, 414-416, 418-523, 525-530, 537-543, 549-563, 571-575, 589, 590, 593, 594, 598-603, 611-620, 626, 627, 632-656, 663-666, 701-713, 715-717, 719) of Primorskii Krai (hereinafter referred to as forest parcel). Total area of forest parcel is 461154 ha.
Determination of allowable annual cut for all cuttings types is based on data of Verhne-Perevalninsky forest management plan of 1992.
Annual permissible volume of timber extraction in middle-aged, premature, mature and over-mature forest stands for purposes of forest tending and sanitary treatments was calculated by Y.E. Pavlov head of forest management planning department of FAR EASTERN FILIAL AGENCY OF FOREST INVENTORY FILIAL AGENCY OF FEDERAL STATE UNITARY ENTERPRISE "ROSLESINFORG" "DALLESPROEKT"; Allowable cuts for purpose of timber harvesting in mature and over mature forest stands determined in Federal Budgetary Institution "Far Eastern Forestry Research Institute" by Ph. D in agriculture A.Y. Alexeenko.
Allowable annual cut for all cuttings types is 9287.4 ha by area, 399.0 thousand m^3 by liquid timber (merchantable timber and firewood) including 239.9 thousand m^3 of merchantable timber.

2 Allowable annual cuts for purpose of timber harvesting in mature and over-mature forest stands
Allowable annual cut for purpose of timber harvesting in mature and over-mature forest stands is calculated on the ground of cutting types, which conform to biological features of trees species, taking into account stands productivity (bonitet), steepness and is provided by "Rules of timber harvesting" adopted by order of Ministry of Natural Resources dated 16.07.2007 #184 and "Rules of commercial cuttings in forest of the Far East" dated 2000, for parts, which do not contradict with "rules of timber harvesting" and "Forest code". Calculations done in accordance with the procedure of allowable cuts calculations, adopted by order of Ministry of Natural Resources of the Russian Federation dated 08.06.2007 # 148.
Allowable annual cut is determine annual permissible volume of timber extraction that is provide multipurpose, rational, continuous, sustainable use of forests, on the assumption of prescribed cutting ages, conservation of biodiversity, water protection, protection and other beneficial functions of forests.
Allowable annual cut is calculated separately for each economic section (coniferous, "Deciduous hardwood" (deciduous hardwood excluding Red Chinese birches), "Deciduous softwood" (deciduous softwood +Red Chinese birches)) with distribution of the total annual permissible volume of timber extraction for each economic section by predominant species.
Selective cuttings are prescribed in all forest formations of protection forests at slopes with steepness up to 30^0.
Changing of allowable annual cut is not allowed without making corresponding changes in forest management regulation of the forest district in accordance with established procedure.
Calculation of allowable annual cut under selective cuttings carried out in accordance with paragraphs 1.2.1 and 1.2.2. of procedure for allowable annual cut calculations based on data of Verhne-Perevalninsky forest management plan of 1992.
Data on calculations of timber harvesting under selective cuttings in mature and over-mature forest stands are given in Table 1. Allowable annual cut is 5944 ha by area, 299 thousand m^3 by total volume (including tops and stumps), including 266.5 thousand m^3 of liquid timber (merchantable timber and firewood) from them 200.4 m^3 of merchantable timber.

Table 46: Determination of the AAC

Indicators	Total		Stand density									
	ha.	thousands.	0,9 and more		0,8		0,7		0,6		0,3-0,5	
		m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3
Designation use of forests – Protection forests Category – nuts harvesting zones forests, restricted forest belts along water bodies, spawning-protective forest belts Economic section – Spruce-fir (Spruce, Fir)												
Total included in calculations			5200	1420,9	11575	3002,0	18787	4409,5	18551	3788,0	19727	2981,9
Average cutting intensity (% of volume)		23		30		25		20				
Harvested volume per cutting	35562	2058,7	5200	426,3	11575	750,5	18787	881,9				
Average recurrence period	25											
Allowable annual cut	1422	82,3										
- Total		82,3										
- Liquid		74,1										
- Merchantable												
Economic section – spruce-broadleaved (Spruce, Fir)												
Total included in calculations			1441	441,5	5741	1679,0	23761	6004,3	23105	5017,9	15365	2549,8
Average cutting intensity (% of volume)		19		30		25		20		15		
Harvested volume per cutting	54048	2505,7	1441	132,5	5741	419,8	23761	1200,9	23105	752,7		
Average recurrence period	25											
Allowable annual cut	2162	100,2										
- Total		100,2										
- Liquid		90,2										
- Merchantable		81,2										
Economic section – High productive larch (1a-3 bonitet)												
Total included in calculations			273	102,6	792	225,7	1878	504,1	3320	772,3	2728	486,3
Average cutting intensity (% of volume)		19		30		25		20		15		
Harvested volume per cutting	6263	303,9	273	30,8	792	56,4	1878	100,8	3320	115,8		
Average recurrence period	25											

Table 46: Determination of the AAC

Indicators	Total		Stand density									
	ha.	thousands. m^3	0,9 and more		0,8		0,7		0,6		0,3-0,5	
			ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3
Allowable annual cut	251	12,2										
- Total		12,2										
- Liquid		10,6										
- Merchantable		9,6										
Economic section – low productive larch (4-5b bonitet)												
Total					123	32,5	634	135,1	824	153,7	1806	223,4
Average cutting intensity (% of volume)		18				25		20		15		
Harvested volume per cutting	1581	58,2			123	8,1	634	27,0	824	23,1		
Average recurrence period	25											
Allowable annual cut	63	2,3										
- Total		2,3										
- Liquid		2,0										
- Merchantable		1,9										
Economic section – Oak												
Total			474	140,1	315	84,5	239	52,5	297	48,3	153	21,9
Average cutting intensity (% of volume)		25		30		25		20		15		
Harvested volume per cutting	1325	80,9	474	42,0	315	21,1	239	10,5	297	7,2		
Average recurrence period	25											
Allowable annual cut	53	3,2										
- Total		3,2										
- Liquid		2,8										
- Merchantable		1,0										
Economic section – Ash-Elm												
Total			319	106,8	1706,1	490,3	4474	1143,3	4307	938,4	3988	656,1

Table 46: Determination of the AAC

Indicators	Total		Stand density									
	ha.	thousands.	0,9 and more		0,8		0,7		0,6		0,3-0,5	
		m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3	ha	Thousands m^3
Average cutting intensity (% of volume)		20		30		25		20		15		
Harvested volume per cutting	10806	524,0	319	32,0	1706	122,6	4474	228,7	4307	140,8		
Average recurrence period	30											
Allowable annual cut	360	17,5										
- Total		17,5										
- Liquid		14,8										
- Merchantable		9,3										
Economic section – Broadleaved (Ribbed birch [betula costata], Erman’s birch [betula ermanii])												
Total			206	77,6	2286	798,9	6158	1893,4	15401	3990,1	11513	2186,3
Average cutting intensity (% of volume)		18		30		25		20		15		
Harvested volume per cutting	24051	1200,2	206	23,3	2286	199,7	6158	378,7	15401	598,5		
Average recurrence period	25											
Allowable annual cut	962	48,0										
- Total		48,0										
- Liquid		42,7										
- Merchantable		13,0										
Economic section – White-birch (Chinese Red Birch, [betula albosinensis]; alder)												
Total			940	235,0	1957	401,3	1826	334	1049	169,1	775	94,7
Average cutting intensity (% of volume)		23		30		25		20		15		
Harvested volume per cutting	5772	263,0	940	70,5	1957	100,3	1826	66,8	1049	5772		
Average recurrence period	15											
Allowable annual cut	385	17,5										
- Total		17,5										
- Liquid		15,1										
- Merchantable		7,9										

Table 46: Determination of the AAC

Indicators	Total		Stand density									
	ha.	thousands. m³	0,9 and more		0,8		0,7		0,6		0,3-0,5	
			ha	Thousands m³	ha	Thousands m³	ha	Thousands m³	ha	Thousands m³	ha	Thousands m³
Economic section – Softwood (aspen, poplar, chosenia, willow)												
Total			186	63,6	1545	432,5	1382	346,8	1181	254,2	687	109,6
Average cutting intensity (% of volume)		21		30		25		20		15		
Harvested volume per cutting	4294	234,7	186	19,1	1545	108,1	1382	69,4	1181	38,1		
Average recurrence period	15											
Allowable annual cut	286	15,6										
- Total		15,6										
- Liquid		14,2										
- Merchantable		5,8										
Total for protection forests												
Total included in calculations	218995	49000	9039	2588	26040	7147	59139	14823	68035	15132	56742	9310
Average cutting intensity (% of volume)		18		30		25		20		15		
Harvested volume per cutting	143702	7229	9039	776	26040	1787	59139	2965	49484	1702		
Average recurrence period												
Allowable annual cut	5944	299,0										
- Total		299,0										
- Liquid		266,5										
- Merchantable		200,4										

3 Annual permissible volume of timber extraction in middle-aged, premature, mature and over-mature forest stands for purposes of forest tending and sanitary selective cuttings

Forest tending thinning aimed to improvement of species composition and quality of forests, enhancing their ecological role and resistance to negative influences. According to the "Rules of tending", adopted by order of the Ministry of Natural Resources #185 dated July 16, 2007, under forest tending treatments felling can be done at forest stands of any age.
This section provides calculation of cuttings volume of timber under forest tending thinning, except pre-commercial thinning (as rule there is no liquid timber harvesting under this type of thinning). Calculation of cutting volume for stands with Korean pine predominance has not been conducted because of adding it to the “list of tree and shrub species are banned to be harvested”.
Allowable annual cut for timber harvesting under cuttings of deadwood and damaged forest stands is calculated in accordance with paragraphs 2.1 and 2.2 of procedure for allowable annual cut calculations. The calculation results are given in Table 2.
Data on calculations of timber harvesting volume under forest tending thinning and sanitary thinning are given in Table 3. Allowable annual cut under tending thinning is 466.8 ha by area, 26.2 thousand m^3 by liquid timber, including 10.7 thousand m^3 of merchantable timber.
Allowable annual cut under sanitary thinning is 2876.6 ha by area, 106.3 thousand m^3, including 28.8 thousands m^3 of merchantable timber.
Cuttings volume under forest roads and timber terminals construction is included to annual volume of timber extraction under all types of cuttings.
Summary for all possible at the forest parcel cutting types is given in Table 4. Annual volume of timber extraction under all types of cuttings is 9287.4 ha by area, 399.0 thousands m^3 of liquid timber, including 239.9 thousands m^3 of merchantable timber.

Table 47: Annual permissible volume of timber extraction in middle-aged, premature, mature and over-mature forest stands for purposes of forest tending

	Indicators	Units	Type of forest tending thinning						Trees felling
			Thinning in young and middle-aged stands	Thinning in middle-aged stands	Late pre-commercial thinning	Reformation cutting	Reconstructi cutting	Total	
1.	Stands in need of tending thinning	Ha	1967,5	3566,8	227,0			5761,3	
		Thousands m^3	30,63	84,97	2,57			118,17	
2.	Recurrence period	years	10	15	7				
3.	Annual volume								
	Area	ha	196,7	237,7	32,4			466,8	
	Cutting volume								
	Total	Thousands m^3	11,71	18,36	1,2			31,27	
	Liquid	Thousands m^3	9,80	16,11	0,4			26,31	
	Merchan-table	Thousands m^3	3,53	7,16	0			10,69	

Table 48: Calculation of Timber Volume under Tending and Sanitary Thinning

Thinning types	In need of tending thinning					Recurrence period	Annual calculated volume												
	Total for object			At reclaimed compartments			Total for object						At reclaimed compartments						
	Area, ha	Volume, tens m^3		Area, ha	Harvested volume, tens m^3		Area, ha	Harvested volume					Area, ha	Harvested volume					
		Total	Harvested					Total	Liquid	Merchantable	Per ha	%		Total	Liquid	Merchantable	Per ha	%	
Late pre-commercial thinning																			
Coniferous																			
Spruce	164.0	1976	692	164	692	7	23.4	989	297		42	35	23.4	989	279		42	35	
Fir	25.0	175	44	25	44	7	3.6	63	19		18	25	3.6	63	19		18	25	
Larch	38.0	418	105	38.0	105	7	5.4	150	46		28	25	5.4	150	46		28	25	
Total coniferous	227.0	2569	841	227	841	7	32.4	1202	362		37	33	32.4	1202	362		37	33	
Standing deadwood	147		882	147	882		21	1260			60		21	1260			60		
Thinning in young and middle-aged stands																			
Coniferous																			
Spruce	1316,2	20852	8157	1316,2	8157	10	131,6	8157	6935	2449	62	39	131,6	8157	6935	2449	62	39	
Fir	60,0	855	342	60,0	342	10	6,0	342	291	103	57	40	6,0	342	291	103	57	40	
Larch	288,0	5760	2016	288,0	2016	10	28,8	2016	1613	684	70	35	28,8	2016	1613	684	70	35	
Total coniferous	1664,2	27467	10515	1664,2	10515	10	166,4	10515	8839	3236	63	38	166,4	10515	8839	3236	63	38	
Standing deadwood	563,3		2222	563,3	2222		56,3	2222			39		56,3	2222			39		
Deciduous softwood																			
Chinese Red Birch	303,3	3160	1199	303,3	1199	10	30,3	1199	959	301	40	38	30,3	1199	959	301	40	38	
Total Thinning in young and middle-	1967,5	30627	11714	1967,5	11714	10	196,7	11714	9798	3537	60	38	196,7	11714	9798	3537	60	38	

aged stands																		
Standing deadwood	563,3		2222	563,3	2222		56,3	2222			39		56,3	2222			39	
Thinning in middle-aged stands																		
Coniferous																		
Spruce	2066,1	51376	16493	2066,1	16493	15	137,7	10995	9679	4399	80	32	137,7	10995	9679	4399	80	32
Fir	307,4	7315	4194	307,4	2435	15	20,5	1623	1428	650	79	33	20,5	1623	1428	650	79	33
Larch	522,7	13247	2435	522,7	4194	15	34,8	2796	2433	1230	80	32	34,8	2796	2433	1230	80	32
Total coniferous	2896,2	71938	23122	2896,2	23122	15	193,0	15414	13540	6297	80	32	193,0	15414	13540	6297	80	32
Standing deadwood	2702,5		6264	2702,5	6264		180,2	4176					180,	4176			23	
Deciduous hardwood																		
Ribbed birch	445,1	10447	3407	445,1	3407	15	29,7	2271	1998	682	77	33	29,7	2271	1998	682	77	33
Deciduous softwood																		
Chinese Red Birch	217,5	2458	2458	2458	968	15	14,5	645	549	194	45	39	14,5	645	549	194	45	39
Alder	8,0	128	128	128	45	15	,5	30	25	9	56	35	,5	30	25	9	56	35
Total deciduous softwood	225,5	2586	2586	2586	1013	15	15,0	675	574	203	45	39	15	675	574	203	45	39
Total Thinning in middle-aged stands	3566,8	84971	27542	3566,	27542	15	237,7	18360	16112	7164	77	34	237,7	18360	16112	7164	77	34
Standing deadwood	2702,5		6264	8	6264		180,2	4176			23		180,	4176			23	
Total tending thinning																		
Coniferous																		
Spruce	3546,3	74204	25342	3546,3	25342	12, 7	292,7	20141	16911	6848	71	34	292,7	20141	16911	6848	71	34
Fir	392,4	8345	2821	392,4	2821	13, 7	30,1	2028	1738	753	72	34	30,1	2028	1738	753	72	34
Larch	848,7	19425	6315	848,7	6315	12, 9	69,0	4962	4092	1914	74	33	69,0	4962	4092	1914	74	33
Total coniferous	4787,4	10197 4	34478	4787,4	34478	12, 8	391,8	27131	22741	9515	71	34	391,8	27131	22741	9515	71	34

Total coniferous standing dead wood	3412,8		9368	3412,8	9368		257,5	7658			27		257,5	7658			27	
Deciduous hardwood																		
Ribbed birch	445,1	10447	3407	445,1	3407	15	29,7	2271	1998	682	77	33	29,7	2271	1998	682	77	33
Deciduous softwood																		
Red Chinese birch	520,8	5618	2167	520,8	2167	12,1	44,8	1844	1508	495	42	39	44,8	1844	1508	495	42	39
Aspen	8,0	128	45	8,0	45	15	,5	30	25	9	56	35	,5	30	25	9	56	35
Total deciduous softwood	528,8	5746	2212	528,8	2212	12,1	45,3	1874	1533	504	42	38	45,3	1874	1533	504	42	38
Total tending thinning	5761,3	118167	40097	5761,3	118167		466,8	31276	26272	10701	67	34	466,8	31276	26272	10701	67	34
Total tending thinning standing deadwood	3412,8		9368	3412,8	9368		257,5	7658			27		257,5	7658			27	
Sanitary selective cuttings																		
Coniferous																		
Spruce	4353,0	107718	31645	4353,0	31645	3	1451,0	105483	68577	21103	73		1451,0	105483	68577	21103	73	
Larch	71,	1882	310	71,8	310	3	23,9	1033	673	203	43		23,9	1033	673	203	43	
Total coniferous	4424,8	109600	31955	4424,8	31955	3	1474,9	106516	69250	21306	73		1474,9	106516	69250	21306	73	
Coniferous standing deadwood	2992,0		12038	2992,0	12038	3	997,3	40127	26090	8027	40		997,3	40127	26090	8027	40	
Deciduous hardwood																		
Oak	143,5	2363	368	143,5	368	3	47,8	1227	800	247	26		47,8	1227	800	247	26	
Ash	58,9	1320	264	58,9	264	3	19,6	880	443	90	45		19,	880	443	90	45	
Valley elm	573,5	16636	2823	573,5	2823	3	191,2	9410	4743	960	49		6	9410	4743	960	49	
Ribbed birch	3429,2	94178	18546	3429,2	18546	3	1143,1	61820	30980	6213	54		191,2	61820	30980	6213	54	
Total deciduous	4205,1	11449	22001	4205,1	22001	3	1401,7	73337	36966	7510	52		1401,7	73337	36966	7510	52	

hardwood		7																
Deciduous hardwood standing deadwood	197,8		790	197,8	790	3	65,9	2634	1323	270	40		65,9	2634	1323	270	40	
Total sanitary selective cuttings	8629,9	22409 7	53956	8629,9	53956	3	2876,6	17985 3	106216	28816	61		2876,6	17985 3	106216	28816	61	
Total sanitary selective cuttings standing deadwood	3189,8		12828	3189,8	12828	3	1063,2	42761	27413	8297	40		1063,2	42761	27413	8297	40	

Table 49: Annual Permissible Volume of Timber Extraction under all Types of Cuttings

Economic section	Annual permissible volume of timber extraction														
	Under cuttings in mature and over-mature forest stands			Under tending thinning in middle-aged, premature, mature, over-mature forest stands			Under sanitary cuttings of deadwood and damaged forest stands			Under creation and tending of rides, and fire-breaks			Total		
	Area	Volume		Area	Volume		Area	Volume		Area	Volume		Area	Volume	
		Liquid	Merchantable		Liquid	Merchantable		Liquid	Merchantable		Liquid	Merchantable		Liquid	Merchantable
Coniferous	3898,0	176,9	163,5	391,8	22,7	9,5	1474,9	69,3	21,3	-	-	-	5764,7	268,9	194,3
Deciduous hardwood	1375,0	60,3	23,2	29,7	2,0	0,7	1401,7	37,0	7,5	-	-	-	2806,4	99,3	31,4
Deciduous softwood	671,0	29,3	13,7	45,3	1,5	0,5	0	0	0	-	-	-	716,3	30,8	14,2
Total:	**5944,0**	**266,5**	**200,4**	**466,8**	**26,2**	**10,7**	**2876,6**	**106,3**	**28,8**	**-**		**-**	**9287,4**	**399,0**	**239,9**

Cuttings volume under forest roads and timber terminals construction is included to annual volume of timber extraction under all types of cuttings.

4 Cutting Ages

Allowable annual cut is calculated in accordance with article 29 of Forest code, on the base of the Ministry of Nature Resources of the Russian Federation order dated 08.06.2007 #148 "About procedure of allowable annual cut calculation". Required calculations is done on the ground of cutting ages of forest stands, adopted by order of Federal Forest Agency "About determination of cutting ages" dated 19.02.2008 #37. Cutting ages data is given in table below.

Table 50: Cutting Ages

Categories of protection forests	Economincal sections and theirs predominant species	Bonitet classes (productivity classes)	Age of cuttings (years)
Protection forest	Spruce-Broadleaved – Spruce, Fir	All bonitets	121-140
	Spruce-Fir – Spruce, Fir	All bonitets	121-140
	Larch – Larch, Pine	III and higher	121-140
	Larch – Larch, Pine	IV – Vb	141-160
	Korean pine – Korean Pine	All bonitets	241-280
	Oak – Oak	All bonitets	121-140
	Ash-Elm – Ash, Elm	All bonitets	121-140
	Broadleaved – Ribbed birch, Бч, Beech, Км	All bonitets	121-140
	Lime – Lime	All bonitets	121-140
	White-birch – Red Chinese birch, Alder	All bonitets	71-80
	Deciduous softwood – Aspen, Poplar, Willow, Chosenia	All bonitets	61-70
	Siberian dwarf pine – Siberian Dwarf Pine	All bonitets	121-140
Production forests	Spruce-Broadleaved – Spruce, Fir	All bonitets	101-120
	Spruce-Fir – Spruce, Fir	All bonitets	101-120
	Larch – Larch, Pine	III and higer	101-120
	Larch – Larch, Pine	IV and lower	121-140
	Korean pine – Korean Pine	All bonitets	201-240
	Oak – Oak	All bonitets	101-120
	Ash-Elm – Ash, Elm	All bonitets	101-120
	Broadleaved – Ribbed birch, Бч, Beech, Км	All bonitets	101-120
	Lime – Lime	All bonitets	101-120
	White-birch – Red Chinese birch, Alder	All bonitets	61-70
	Deciduous softwood – Aspen, Poplar, Willow, Chosenia	All bonitets	51-60
	Siberian dwarf pine – Siberian Dwarf Pine	All bonitets	101-120

Comment: by order of Federal Forest Agency dated 19.02.2008 #37 for Amur cork tree and Manchurian walnut is adopted maturity age of 121 years. For Siberian Dwarf Pine age of cutting that been used in forest management planning was adopted.

Annex 2.2: Nut Harvesting Zones in Primorye and Khabarovsk Krajs

Table 51: NHZs in Primorye and Khabarovsk Krajs				
1. NHZ of Khabarovsk Province				
№	NHZ Name Russian	NHZ Name English	Lesnichestvo	Area (in ha)
1	Бикинская	Bikinskiy	Bikinskoe, Lermontovskoe	28.481
2	Нанайская	Nanayskiy	Gassinskoe	55.522
3	Болоньская	Bolonskiy	Selgonskoe	18.746
4	Аванская	Avanskiy	Kapitonovskoe, Podkhorenovskoe	19.382
5	Гурская	Gurskiy	Pivan'skoe, Selihinskoe, Snezhnoe, Dappinskoe	52.568
6	Мухенская	Mukhenskiy	Sijskoe	14.040
7	Сукпайская	Sukpajskiy	Gornoe	18.742
8	Кур-Урмийская	Kur-Urmijskiy	Inskoe	6.719
9	Уликанская	Ulikanskiy	Niranskoe, Birakanskoe	46.346
10	Комсомольская	Komsomolskiy	Gorunskoe	2.922
11	Оборская	Oborskiy	Sitinskoe, Verkhne-Neptinskoe	5.281
		Sum		268.749
2. NHZ of Primorsky Province				
№	NHZ Name Russian	NHZ Name English	Lesnichestvo	Area (in ha)
12	Бикинская	Bikinskaya incl. riparian zone	Verkhne-Perevalnenskoe	461.154
13	Пожарская	Pozharskaya	Verkhne-Perevalnenskoe	41.192
14	Восточная	Vostochnaya	Roschinskoe	95.303
15	Мельничная	Melnichnaya	Roschinskoe	22.117
16	Кокшарская	Koksharskaya	Chuguevskoe	27.755
17	Ольгинская	Olginskaya	Kavalerovskoe	40.706
			Sum	688.227
			Total 1+ 2 (in ha)	956.976

Annex 2.3: Confirmation of the FFRI calculation

Harmonization of calculations

Un-official English Translation

Dear Yuri Alexandrovich

Forestry administration of Primorsky Province, has examined the determination of allowable annual cut for all cuttings types on territory of Verhne-Perevalninskii forest district, Sobolinskii subdivision (compartments 68, 107-117), Krasnoyarovskii subdivision (compartments 118-308, 326-337, 342-407, 409, 413, 417), Ohotnichie subdivision (compartments 309-325, 338-341, 408, 410-412, 414-416, 418-523, 525-530, 537-543, 549-563, 571-575, 589, 590, 593, 594, 598-603, 611-620, 626, 627, 632-656, 663-666, 701-713, 715-717, 719), performed by Far Eastern filial agency of Federal State Unitary Enterprise "ROSLESINFORG" and Federal budgetary institution "Far Eastern Forestry Research Institute", and further to our latter dated 25.08.2011 # 49-0210/3326 we reporting following.

Presented calculations are done in accordance with 2008th effective legislation in field of forest relations, but taking into account later enactment of forest legislation such as:

a) Order the Russian Federation Ministry of Agriculture, dated 06.11.2009 - "About features of forests use, protection, preservation and reforestation in water protection areas, forests providing protection functions of natural and other objects, valuable forests, and forests located in specially protected forest areas" (came into force 25.01.2010), that allows selective cuttings of mature and over-mature forests in protection forests (category – valuable forests).
b) Order the Russian Federation Ministry of Agriculture, dated 02.08.2010 #271 "About confirmation of list of tree and shrub species which may not be harvested" (came into force 30.11.2010), according to which Korean pine included in list of tree and shrub species, which may not be harvested.

According to calculations allowable annual cut for all cuttings types is 399.0 thousand m^3 by liquid timber (merchantable timber and firewood) and 9287.4 ha by area.

Head of Department D.A. Rybnikov

ОТ:ПРИМОРСКЛЕСХОЗ ТЕЛ:8 4232 388073 9 НОЯ 2011 12:27 СТР1 09 НОЯ 2011

Вх.No. 151

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08.11.2011 № 49-02-10/4363

На № 115 от 27.10.2011

Директору Амурского филиала всемирного фонда природы

Ю.А. Дарману

О согласовании расчетов

Уважаемый Юрий Александрович!

Управление лесным хозяйством Приморского края, рассмотрев представленные полные расчеты ежегодного объема изъятия древесины при всех видах рубок на территории Верхне-Перевальнинского лесничества, Соболиного участкового лесничества (кв.кв. 68, 107-117), Краснояровского участкового лесничества (кв.кв. 118-308, 326-337, 342-407, 409, 413, 417), Охотничьего участкового лесничества (кв.кв. 309-325, 338-341, 408, 410-412, 414-416, 418-523, 525-530, 537-543, 549-563, 571-575, 589, 590, 593, 594, 598-603, 611-620, 626, 627, 632-656, 663-666, 701-713, 715-717, 719), выполненные Дальневосточным филиалом ФГУП «Рослесинфорг» и ФГУ «ДальНИИЛХ, в дополнение к своему письму от 25.08.2011 № 49-0210/3326 сообщает следующее.

Настоящие полные расчеты проведены согласно действующей в 2008 году нормативной базы в области лесных отношений, но с учетом следующих более поздних правовых актов лесного законодательства:

а) приказа МСХ РФ от 06.11.2009 года № 543 «Об утверждении Особенностей использования, охраны, защиты, воспроизводства лесов, расположенных в водоохранных зонах, лесов, выполняющих функции защиты природных и иных объектов, ценных лесов, а также лесов, расположенных на особо защитных участках лесов», разрешившего в защитных лесах

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(категория - ценные леса) проведение выборочных рубок спелых и перестойных лесов (введен в действие с 25.01.2010 года);

и) приказа Минсельхоза РФ от 02.08.2010 г. № 271 «Об утверждении перечня видов (пород) деревьев и кустарников, заготовка древесины которых не допускается», согласно которому кедр корейский (сосна корейская) внесен в Перечень видов (пород) деревьев и кустарников, заготовка древесины которых не допускается (введен в действие с 30.11.2010 года).

Общий ежегодный объем древесины, разрешенный к рубке по всем видам рубок, согласно проведенных расчетов, составляет 399 тыс. кбм в ликвиде, при этом ежегодная расчетная лесосека по площади составляет 9287,4 га.

Начальник управления Д.А. Рыбников

Цегельнюк А.И.
238-79-31

Annex 3

MONITORING PLAN

Please refer to Section D.