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Assessment of Potential Productivity of Tree Species in China, Mongolia and the Former Soviet Union: Methodology and Results

Fischer, G., van Velthuisen, H.T. and Prieler, S.

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Interim Report

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Assessment of Potential Productivity of Tree Species in China, Mongolia and the Former Soviet Union: Methodology and Results

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DISCLAIMERS

Any part of this tree species productivity model and model parameters may be modified in the light of new or improved knowledge and/or new objectives. The model is expected to be expanded and refined with use.

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Abstract

Over the past twenty years, the term agro-ecological zones methodology (AEZ) has become widely used for global regional and national assessments of agricultural potentials. The AEZ methodologies and procedures have recently been extended and newly implemented to make use of the latest digital geographical databases, and to cope with the specific characteristics of seasonal temperate and boreal climates.

This report presents details of a companion model of AEZ that enables assessments of potential productivity of forest tree species. It is referred to as FAEZ.

The FAEZ methodology follows an environmental approach; it provides a standardized framework for the characterization of climate, soil and terrain conditions relevant to forest production and it uses environmental matching procedures to identify limitations of prevailing climate, soil and terrain for a range of tree species and assumed management objectives.

The model for the estimation of biomass increments is based on two well established and robust models: the Chapman-Richard biomass increment model, and the AEZ potential biomass model.

FAEZ includes an inventory of ecological adaptability characteristics as well as an inventory of specific ecological and environmental requirements for 52 boreal and temperate forest tree species. The natural resources inventory is based on the up-to-date LUC-GIS database of climate, soil, terrain and vegetation covering China, Mongolia and former Soviet Union.

Results of potential productivity for tree species in North, Central and East Asia are presented under three different sets of assumptions of forest resources management and exploitation, namely: conservation forestry, traditional production forestry and biomass plantation forestry.

Acknowledgments

This study is a first systematic ecological assessment of land productivity for boreal and temperate tree species for a large area. It covers the territory of China, Mongolia and the States of the Former Soviet Union. The study builds on methodologies and procedures developed by IIASA and FAO for its recently completed Global Agro-Ecological Zones 2000 study. This current study, specifically for boreal and temperate tree species, would not have been carried out at this time without the financial support provided by the New Energy and Industrial Technology Development Organization(NEDO), (IIASA-Contract 99-148, NEDO, Paris, France), and the Netherlands Organization for Scientific Research (NWO), (IIASA Contract 00-140 -- NWO, The Netherlands) and without intellectual support and the facilities made available by IIASA's Land Use Change (LUC) project.

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About the Authors

Günther Fischer is the leader of a major research project at IIASA on *Modeling Land Use and Land Cover Changes in Europe and Northern Asia (LUC)*. A primary research objective of this project is the development of a GIS-based modelling framework, which combines economic theory and advanced mathematical methods with biophysical land evaluation approaches to model spatial and dynamic aspects of land-resources use. He was a member of the IGBP-HDP Core Project Planning Committee on Land-Use and Land-Cover Change (LUCC), and is a co-author of the LUCC Science Plan. He serves on the Scientific Steering Committee of the joint LUCC Core Project/Programme of the IGBP-IHDP, and leads the *LUCC Focus 3 office* at IIASA.

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In 1994 Ms. Prieler joined the IIASA project on "Regional Material Balance Approaches to Long-Term Environmental Policy Planning". In 1997 she joined the IIASA LUC project as a GIS expert. She maintains the large LUC Arc/Info GIS databases, and handles many requests for GIS-related services both from the LUC researchers and outside collaborators. In addition, Ms. Prieler is working on specific LUC research tasks with regard to climatic variability in China and its impact on agricultural production potential.

Assessment of Potential Productivity of Tree Species in China, Mongolia and the Former Soviet Union: Methodology and Results

Günther Fischer, Harrij van Velthuizen, and Sylvia Prieler

Chapter 1 Approach for the Assessment of Tree Species Productivity

1.1 Background

Why do particular trees grow where they do? How do they cope with their environment? How do they respond to change? How productive are they – or could they become? These questions can only be answered if we know how trees and forests function from eco-physiological and environmental perspectives, and the way environmental factors and management (e.g. drought, competition, fertilization, thinning) affect growth and partitioning.

Research in forestry has traditionally been empirical – treatments are applied and results are observed, usually over periods of years (Landsberg, 1986). Forest yield predictions are traditionally based on the site-index method and growth site correlation. The site-index estimation is made on the basis of the height of the dominant and co-dominant trees of a fully stocked and evenly aged stand. The index is estimated for permanent sample plots, which are normally established on sites with varying environmental conditions. Growth-site correlations are based on such sample plots, laid in a substantial number of stands that are well distributed over a range of environments found within an area, and are measured repeatedly over a period of time to obtain growth data. In each of the sample plots, values of land characteristics thought likely to affect tree growth are recorded. In this way, simple or multiple correlations can be established between growth and site factors. Site factors, significantly related to growth, are subsequently surveyed for other parts of the area for which no direct growth data is available, thus enabling yield predictions to be made for the entire study area. These techniques are empirical instruments and do not employ information on tree and forest ecologies.

With an increased emphasis on multiple use forestry, plantation forestry, community forestry, agroforestry, and more recently on forests as renewable energy sources and the role of forests in global CO₂ balances, the scope of quantitative land evaluation for forestry is widening. In land evaluation, the definition of land qualities is generally dictated by the sophistication of the ecological characterization embodied in the land resources inventory. Also, the formulation of land use requirements, in terms of land qualities, depends on the knowledge concerning the processes that govern the growth of trees and forests, and how those processes are affected by the prevailing environmental conditions.

1.2 Ecological Approach

Quantitative and semi-quantitative land evaluation methods in particular the FAO/IIASA Agro-Ecological Zones (AEZ) approach for crop productivity assessment, have been adapted for the development of a companion model that assesses potential productivity of forest tree species, referred to as FAEZ.

Similar to AEZ, the FAEZ methodology follows an environmental approach; it provides a standardized framework for the characterization of climate, soil and terrain conditions relevant to forest production and it uses environmental matching procedures to identify land use specific limitations of prevailing climate, soil and terrain resources, for assumed management objectives.

In its simplest form, FAEZ contains three basic elements as sketched in Figure 1 below:

- (i) Selected production systems with defined management objectives and species-specific environmental requirements and adaptability characteristics. These are termed Land Utilization Types;
- (ii) Geo-referenced climate, soil, terrain and land cover data which are combined into a land resources database, and
- (iii) Procedures for the calculation of potential biomass increments, and procedures for matching forest species environmental requirements with the respective environmental characteristics contained in the land resources database.

1.3 This Report

This report presents the FAEZ methodology and results of potential productivity for tree species in North, Central and East Asia under different assumptions of forest resources management and exploitation, namely: conservation forestry, traditional production forestry and biomass plantation forestry.

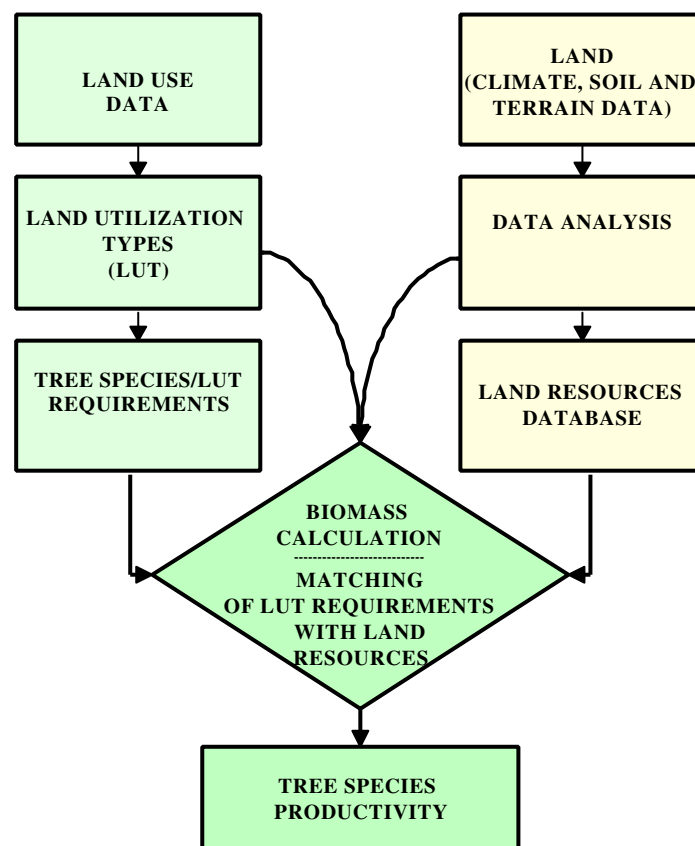


Figure 1 Conceptual framework of methodology

The report includes an inventory of ecological adaptability characteristics as well as an inventory of specific climate, soil and terrain requirements for 52 boreal and temperate forest tree species. It also provides the same details of the LUC-GIS database of climate, soil, terrain and vegetation covering China, Mongolia and former Soviet Union, which constitute the 'backbone' of the study.

Chapter 2 Methodology Overview

Figure 2 presents a schematic overview of the flow and integration as implemented. The figure is explained in Box 1.

The FAEZ procedures are implemented to operate on a GIS grid-cell database. For each grid-cell, first a climatic analysis is performed to derive climatic indicators relevant for matching climate conditions with thermal requirements of tree species. Then, for LUTs passing this thermal screen, a soil moisture balance is calculated and average annual biomass increments are estimated. Subsequently, these are adjusted for limitations due to soil and terrain conditions. The results are stored in a grid-cell LUT database, as input to scenario analysis, mapping and tabulation.

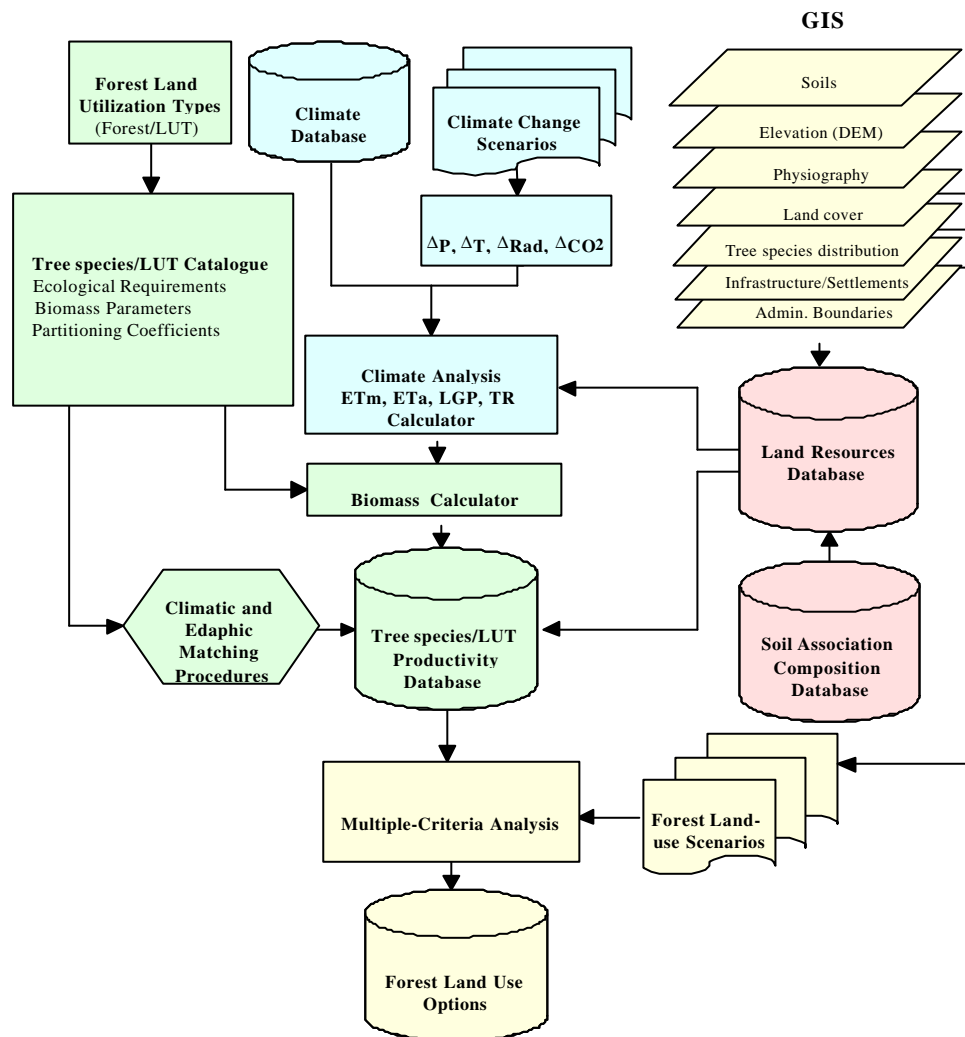


Figure 2 Productivity Assessment for Tree Species

Box 1

Forest Land Utilization Types (LUT)

The forest land utilization types include definitions and descriptions of 52 tree species. The LUT attributes include characteristics of the tree species and information on management practices, inputs and utilization of produce. The LUTs have been defined for three management objectives, i.e., *conservation forestry*, *traditional production forestry* and *biomass plantation forestry*.

Tree species/LUT catalogue

The tree species catalogue database provides a quantified description of LUTs including crop adaptability characteristics such as: rotation length, vegetation period, photosynthetic pathway, photosynthesis temperature relationships, maximum leaf area index, partitioning coefficients, and parameters describing ecological requirements.

Climate database

The climate database with a 5 km grid-cell size contains long-term averages of monthly mean climate parameters. For China the climatic database was expanded with historical data on precipitation and temperatures for the period 1958-1997.

Climate scenarios (not implemented for this initial study)

FAEZ has been set up to allow application of climate sensitivity tests and GCM based climate scenarios.

Land characteristics (GIS)

Soils, elevation (DEM), physiography, vegetation zones, present land use/cover and administrative divisions are kept as individual layers in the geographical information system:

- Soil and terrain data, from the Soil and Physiography database for North and Central Asia. (FAO/IIASA 1999), covering China, Mongolia, and the territory of the former Soviet Union
- Elevation data, from the GTOPO30 data set (EROS Data Center, 1998). Altitude differences of neighboring grid-cells were applied to compile a terrain slope/aspect distribution database in terms of seven average slope range classes.
- Land cover data was derived for China, from the 1:1,000,000 Land Use map of China (Wu Chuanjun, 1991); for the FSU from the IIASA/LUC Agricultural Regionalization and Land Categories databases (Stolbovoi *at al.*, 1997a, b), and for Mongolia from the Vegetation Distribution Inventory for Mongolia (Sitch and van Minnen, 1996).
- Infrastructure information has been derived from the Digital Chart of the World (DCW, 1993). It has been used to create an accessibility inventory for the territory of China, Mongolia and the FSU.
- Tree species distribution in China, derived from the Vegetation map of China, Institute of Botany, Chinese Academy of Sciences in Beijing. For the FSU, from the IIASA/LUC Vegetation database <http://www.iiasa.ac.at/Research/LUC/GIS>

Soil association composition database

The soil association composition database contains occurrences of soil units, soil phases, textures and terrain slope classes.

Land resources database (GIS)

The land resources database includes layers of the digital soil map of North and Central Asia, the slope distribution database, land cover layers, infrastructure and administrative areas and associated attribute databases.

Climate data analysis (ET_o, ET_a, LGP and TR calculation)

From basic climatic data, monthly reference evapotranspiration (ET_o) is calculated according to Penman Monteith. A water-balance model provides estimations of actual evapotranspiration (ET_a) and length of growing period (LGP). Temperature and elevation/aspect data are used for the characterization of thermal regimes (TR) as follows:

- Thermal climates, representing major latitudinal climatic zones;
- Winter and summer temperatures and extreme temperatures;
- Temperature growing periods (LGP_i), and

<ul style="list-style-type: none"> • Accumulated temperatures.
<p><i>Tree species/LUT thermal requirements</i></p> <p>Temperature requirements of individual tree species are matched with temperature regimes prevailing in individual grid-cells. For grid-cells with an optimum or sub-optimum match, biomass increment calculations are performed.</p>
<p><i>Biomass increment calculation</i></p> <p>The FAEZ methodology for the calculation of potential biomass is based on the Chapman-Richard biomass increment model and the eco-physiological biomass and yield model of Kassam. It provides temperature and radiation limited biomass increments of individual tree species.</p>
<p><i>Climatic suitability</i></p> <p>Climatic constraints cause direct or indirect losses in the biomass increment. Climatic constraints¹ are influenced by the following conditions:</p> <ul style="list-style-type: none"> • The variability and degree of water-stress during the growing period; • Constraints indirectly related to climatic conditions (e.g., pests, diseases and invasion of unwanted species or weeds); • The climatic factors which effect the efficiency of forestry operations and costs of production; • The risk of occurrence of late and early frost, and • The risk of forest fire (for conservation forestry).
<p>The climatic constraints for individual tree species - by management objective – have been specified according to the prevailing temperature and moisture regimes.</p>
<p><i>Soil and terrain suitability</i></p> <p>The edaphic suitability assessment is based on matching of soil and terrain requirements of tree species with prevailing soil and terrain conditions. These are management/input specific.</p>
<p><i>Tree species/LUT productivity database</i></p> <p>The results of the matching of tree species/LUT-specific environmental requirements with prevailing climate, soil and terrain conditions is combined with quantified biomass increments. This data is stored in the tree species/LUT productivity database by grid-cell.</p>
<p><i>Forest Land Use Scenarios/Multiple criteria analysis (not implemented for this initial study)</i></p> <p>Forest land-use scenarios are formulated on the basis of actual and desired land-use. These scenarios and the potential productivity for the Forest LUTs serve as input in the multiple criteria analysis tool, which in turn provides selection of individual grid-cells feasible for forest land-use alternatives.</p>

1 At this stage of the methodology development, constraints indirectly related to climatic conditions such as pests, diseases, invasion of unwanted species or weeds and workability, have not been taken into account.

Chapter 3 Land Resources Database

The FAEZ methodology for the productivity assessments of forest species provides a framework for establishing a spatial inventory and database of land resources. The land resources inventory (LRI) includes components of climate, soils, landform, current land cover and accessibility. The individual LRI components are selected, defined and classified in a manner that is as much as possible matching available specifications of ecological requirements of tree species.

The climatic resources inventory is based on the Leemans and Cramer climate database (Leemans and Cramer, 1991), which was enhanced in IIASA/LUC with the help of the Potsdam Institute for Climate Impact Research (PIK). The database offers a spatial resolution of 5 km and contains monthly climate averages which allow quantification of each 5 km grid-cell in terms of thermal climates, summer-, winter- and extreme temperatures, temperature sums, various types of length of growing periods, moisture deficits and surpluses, etc.

The Soil and Physiography database for North and Central Asia (FAO/IIASA, 1999), covering China, Mongolia, and the territory of the former Soviet Union was used. This digital soil map presents soil associations in grid-cells of 5-km resolution. The composition of soil associations is described in terms of percentage occurrence of soil units, soil phases and textures.

Terrain slopes were derived from the GTOPO30 digital elevation data. From this DEM also a terrain-slope distribution database was compiled.

3.1 Climate Resources

3.1.1 Moisture regimes

Monthly totals of reference evapotranspiration (ET_0) are calculated for each grid-cell. A water-balance model, comparing moisture supply from rainfall/snow and storage in soils with potential evapotranspiration provides estimations of actual evapotranspiration (ET_a).

A general characterization of moisture conditions is achieved through the concept of *length of growing period* (LGP), i.e., the period during the year when both moisture availability and temperatures are adequate for plant growth.

The growing period continues beyond the rainy season because of moisture stored in the soil profile. The amount of soil moisture stored in the soil profile, and available to plants varies with depth of the soil profile, the soil physical characteristics, and the rooting pattern of the plant. Depletion of soil moisture reserves causes the actual evapotranspiration to fall short of the potential rate. Soil moisture storage capacity of soils (S_{max}) depends on soil physical and chemical characteristics, but above all on effective soil depth or volume (Fisher *et al.*, 2000). For tree species the maximum effective rooting depth has been assumed to range between 0.5 m and 2 m.

The S_{max} values presented in Table 1 were used to set limits to available soil moisture, enabling calculation of possible extension of the growing period beyond the end of the rainy season by soil unit, soil texture class, and soil phase. Plate 1 presents length of growing period zones in map form.

Table 1 Soil moisture storage capacity classes derived for FAO soil units and soil depth/volume limiting soil phases

Class	S_{max} (mm)	Soils with Lithic Phase (mm)	Soils with Petroferric and Duripan	Soils with Skeletic and Rudic Phases (Revised Legend '90)
1	225 mm	50 mm	115/50 mm	115 mm
2	185 mm	40 mm	90/40 mm	90 mm
3	150 mm	35 mm	75/35 mm	75 mm
4	115 mm	25 mm	55/25 mm	55 mm
5	50 mm	15 mm	35/15 mm	25 mm
6	15 mm	n.a.	n.a.	n.a.

3.1.2 Thermal regimes

Thermal regimes are quantified for each grid-cell in terms of four types of attributes, namely:

- Thermal climates, representing major latitudinal climatic zones;
- Winter and summer temperatures;
- Temperature growing periods (LGP_t), and
- Temperature sums

Thermal Climates

The thermal climates are obtained through classifying of monthly temperatures corrected to sea level (with an assumed lapse rate: $0.55^\circ\text{C}/100\text{m}$). The temperate and boreal belts have been subdivided according to continentality into three classes, namely: oceanic, sub-continental and continental. The subtropics have been subdivided into a summer and winter-rainfall type. Table 2 presents the thermal climate classification used for sub-tropical, temperate and boreal zones. The geographic distribution of the thermal climates is presented in Plate 2.

Table 2 Thermal climates

Thermal climate classification	
Subtropics: One or more months with monthly mean temperatures, corrected to sea level, below 18°C but above 5°C	Subtropics Summer Rainfall Northern hemisphere: rainfall in April - September \geq rainfall in October - March Southern hemisphere: rainfall in October - March \geq rainfall in April - September
	Subtropics Winter rainfall Northern hemisphere: rainfall in October - March \geq rainfall in April - September Southern hemisphere: rainfall in April - September \geq rainfall in October - March
Temperate: At least one month with monthly mean temperatures, corrected to sea level, below 5°C and four or more months above 10°C	Oceanic Temperate: Seasonality less than 20°C^*
	Sub-continental Temperate: Seasonality $20\text{-}35^\circ\text{C}^*$
	Continental Temperate: Seasonality more than 35°C^*
Boreal: At least one month with monthly mean temperatures, corrected to sea level, below 5°C and more than one but less than four months above 10°C	Oceanic Boreal: Seasonality less than 20°C^*
	Sub-continental Boreal: Seasonality $20\text{-}35^\circ\text{C}^*$
	Continental Boreal: Seasonality more than 35°C^*
Polar/Arctic: All months with monthly mean temperatures, corrected to sea level, below 10°C	

* Seasonality refers to the difference in mean temperature of the warmest and coldest month, respectively.

Winter and summer temperatures

Mean temperatures of the warmest and coldest months as well as minimum temperatures of the coldest month were determined. Plate 3, 4 and 5 present the respective isotherm maps.

Temperature growing periods and temperature sums

In addition to thermal climates and temperature extremes, temperature growing periods (LGP_t) have been calculated. For instance $LGP_{t=5}$ of 5°C , i.e., the number of days when mean daily temperature exceeds 5°C , represents the period with temperatures suitable for plant growth. Similarly $LGP_{t=10}$ of 10°C approximates the frost-free period. Lengths, beginning and ending dates of such periods are calculated for each grid-cell and are stored in the attribute database. Plate 6 and 7 present respectively maps of temperature growing periods ($LGP_{t=5}$) and frost-free periods ($LGP_{t=10}$). Accumulated temperatures have been calculated for base temperatures of 0, 5 and 10°C . Plate 8 and 9 present maps of temperature sums with base temperatures of respectively 5 and 10°C .

3.1.3 Aspect and terrain-slope effects on micro-climate

Many studies have shown how micro-climate and forest responses differ on north and south facing slopes. The solar geometry calculations provide a means for computing incident solar radiation to any combination of slope aspects each day of the year (Garnier and Ohmura, 1968 and Swift, 1976). From differences in computed solar radiation aspect related temperature differences can be inferred. For instance a south facing slope would be 1-2°C warmer than flat terrain. A north facing slope however might be 1-2°C cooler than flat terrain. On south facing slopes snow may melt 1-2 months earlier than adjacent north facing slopes of the same elevation.

The terrain slopes data derived from GTOP030 also provide information on aspect. With the help of procedures described by Waring and Running (1998), effects of slope/aspect combinations can be used to modify attributes of the climate database (including solar radiation, temperature, evapotranspiration and growing period parameters). Thus, the forest productivity assessment, in particular in high latitude zones, can take account of micro-climatic effects of prevailing aspect and terrain slope combinations.

3.2 Soil and Terrain Resources

The source of soil information used is the Soil and Physiography database for North and Central Asia (FAO/IIASA 1999), covering China, Mongolia, and territory of the former Soviet Union. This digital soil map presents soil associations in grid-cells of 5-km resolution. The composition of soil associations is described in terms of percentage occurrence of soil units, soil phases and textures. Therefore, each 5 km grid-cell is considered as consisting of several land units.

The soil units, classified according to the revised legend of the FAO/Unesco Soil Map of the World (FAO/Unesco/ISRIC, 1990), are defined in terms of measurable and observable properties of the soil itself. Many of these properties are relevant to the use and production potential of soils. Through linkage with the World Inventory of Soil Emissions Potential (WISE) soil profile database (Batjes *et al.*, 1997) statistics on physical and chemical soil attributes by 'FAO'90' soil unit/topsoil texture combinations were derived for matching soil requirements of the tree species with soil characteristics (Table 3).

Table 3 List of soil attributes derived from WISE soil profile database

Profile identifiers
FAO-Unesco soil unit (1990 Legend)
Topsoil textural class
Attributes (for topsoil and subsoil)
Organic carbon
pH(H ₂ O)
Sum of exchangeable Ca, Mg, Na and K (TEB) [◇]
Ratio of exchangeable Ca/Mg [◇]
Ratio of exchangeable (Ca+Mg)/K [◇]
Effective CEC [†]
CEC _{soil}
CEC _{clay} [◇]
Base saturation (as %)
CaCO ₃ content
Gypsum content
Exch. sodium percentage (ESP) [◇]
Bulk density
Total porosity (as derived from bulk density) [◇]
% sand
% silt
% clay
Available Water Capacity (AWC ₁ ; from pF 2.0 to pF 4.2)
Available Water Capacity (AWC ₂ ; from pF 2.5 to pF 4.2)

[◇] Calculated from other measured soil properties.

[†] ECEC is defined as sum of exchangeable [Ca+Mg+K+Na]+ exchangeable [H+Al], after Van Reeuwijk (1993).

Two sources of geo-referenced terrain slopes are available for use: (i) terrain slopes indicated in the mapping unit expansion tables of the digital soil map, and (ii) terrain slopes derived from GTOPO30 data (EROS Data Center, 1998). The latter terrain-slope database has been generated with a rule-based algorithm to calculate slope distributions in terms of seven slope classes per 5 km grid-cell, based on neighborhood relationships among grid-cells in the 30 arc-second GTOPO30 database (Fischer *et al.* 2000).

Terrain slopes indicated in the digital soil map distinguish three broad slope classes as follows:

- Class a: *level to undulating*, dominant slopes ranging between 0 and 8 percent;
- Class b: *rolling to hilly*, dominant slopes ranging between 8 and 30 percent;
- Class c: *steeply dissected to mountainous*, dominant slopes over 30 percent.

The terrain slopes of the digital soil map apply to the dominant soil unit of a soil association mapping unit. Where two slopes are indicated for a mapping unit (i.e., a/b or b/c), they apply each to 50 percent of the extent of the dominant soil unit. For all associated and included soils, default slope classes (Table 4) are assigned to the individual soil units (FAO, 1978-81) as follows:

Table 4 Default slope classes

Default slope class	Soil Units in FAO'90
a	Fluvisols, Gleysols, Histosols, Planosols, Solonchaks, Solonetz and Vertisols
a/b	Arenosols, Anthrosols, Chernozems, Ferralsols, Greyzems, Gypsisols, Kastanozems, Luvisols, Lixisols, Podzoluvisols, Phaeozems, Plinthosols, and Podzols
b	Acrisols, Alisols, Calcisols, Cambisols, Nitisols and Regosols
b/c	Andosols, and Lepthosols

The slope classes of the digital soil map are very broad and do not reflect the information contained in recent digital data sets. Hence, the above broad slope classes have been refined on the basis of knowledge about soil unit-slope relationships and information derived from GTOPO30. Slopes derived from the 30 arc-second DEM were allocated to soil units occurring within individual soil associations (Fisher *et al.*, 2000).

3.3 Seasonal Wet Sites

High groundwater levels, water-logging and flooding affect the distribution of tree species. These soil wetness conditions are restricted mainly to floodplain areas, water collecting sites and in some cases also to poorly drained flat terrain. Excessive soil wetness conditions are usually due to internal soil drainage characteristics or prolonged frozen condition of soils. In particular in continental temperate and boreal zones, poorly drained or frozen soils in flat terrain frequently become submerged or water-logged in early spring as a result of water accumulation from snowmelt.

Fluvisols and Gleysols

The flooding attributes of Fluvisols are generally controlled by external factors such as a river's flood regime which in turn is influenced by hydrological features of the catchment area and catchment/site relations, rather than by the amount of 'on site' precipitation. The flooding regime in arid and semi-arid zones is often erratic. In some years severe flash floods may occur, while in other years no floods may occur at all. In sub-humid and humid zones flooding is more regular but duration and depth of flooding may vary widely from year to year.

Gleysols are not directly affected by river flooding. These soils are however frequently situated in low-lying water collecting sites and when not artificially drained, Gleysols may be subject to water-logging or even inundation as a result of combinations of high groundwater tables and ponding rainwater. In sub-humid and humid areas Gleysols often remain wet for extensive periods, rendering them unsuitable for tree species sensitive to water-logging.

On the other hand, certain trees species which are tolerant to flooding, water-logging and high groundwater tables may perform well on residual soil moisture available on both, Fluvisols and Gleysols. Therefore, the separate suitability classification for water collecting sites does account for

specific tolerances to excess moisture (high groundwater tables, water-logging and flooding/inundation). Gleysols are mostly but not necessarily subjected to water-logging and inundation, as are the 'natural Fluvisols'. Therefore, Gleysols with terrain-slopes of less than 2% in the model are handled as Fluvisols.

Excess water due to snowmelt

Excessive wetness might however also occur in other soils. For example, in continental temperate and boreal areas, as result of snowmelt at the end of the winter period, large tracts of land tend to become waterlogged or ponded with water. Especially flat terrain with poorly drained soils may be affected by substantial periods of wet conditions (Fischer *et al.*, 2000). Depending on the amount of excess moisture from melted snow, the following assumptions were made for the period of waterlogged conditions² (Table 5).

Table 5 Post-winter period of water-logging due to snowmelt

Excess moisture from snowmelt (mm)	Length of period of water-logging (days)	
	Very poorly drained soils	Poorly/imperfectly drained soils
40	0	0
80	5	0
120	15	10
180	30	20
240	45	30

Note: Drainage classes are according to the FAO Guidelines for Soil Description. (FAO, 1990)

3.4 Land Cover and Accessibility

Prior to the actual productivity assessments, current occurrence of cultivated areas and forested areas and accessibility to infrastructure was inventoried and integrated in the basic land resources database. From data available in the IIASA LUC project, a GIS³ coverage of agriculture and forest land for the territory of China, Mongolia and the former Soviet Union was compiled (Plate 12). This coverage has been used to mask or select areas, that are in use for cultivation, are under forest, or are under other permanent uses such as urban areas, mining areas etc.

Infrastructure information of the Digital Chart of the World (DCW, 1993) has been used to create an accessibility inventory for the territory of China, Mongolia and the FSU. With standard GIS procedures buffer zones⁴ of 10 km around roads and railways were established, i.e., 5 km on each side (Plate 11). The coverage of buffer zones subsequently was converted into a 5km grid, which in turn served as a proxy for accessibility.

2 Periods of excessive rainfall may also lead to widespread waterlogging or even ponding during the vegetation period of trees. Therefore, levels of accumulated excess rainfall have been treated in a similar manner as wetness originating from snowmelt after the winter period.

3 The map showing cultivated areas and forested areas has been compiled from the land categories inventory of the FSU (Stolbovoi *et al.* 1997a), the 1:1,000,000 land use map of China (Wu Chuanjun, 1994) and Vegetation Distribution for Mongolia (Sitch and van Minnen, 1996). These three data sets were combined, a reclassification was applied featuring agriculture and forest, and was transferred to the 5km grid.

4 It has been assumed that a distance of 5km to nearest road or railway would facilitate sufficiently the accessibility required for forest management and logging operations.

Chapter 4 Potential Productivity Analysis

4.1 Land Utilization Types

The suitability of land for trees relates to the performance of the forestry system, which involves two components, the land unit and land utilization type. Land utilization types (LUTs) must be defined before the assessment of the suitability of land. Different LUTs have different requirements for land quality. If the quality of a land unit matches the land use requirement of a defined LUT, its suitability is high. Furthermore, selection and definition of LUTs guides the selection of land characteristics to be represented in the land resources inventory. These characteristics are then used as evaluation criteria in the suitability analysis (FAO, 1984).

In this study, covering boreal, temperate and subtropical part of China, Mongolia and the former Soviet Union, the data used for the definition of LUT includes tree species characteristics such as: rotation height, rotation length, achieved maximum production levels, temperature dependent rates of photosynthesis, partitioning coefficients, moisture stress related yield reduction coefficients, wood density coefficients, and CO₂ sequestration capacities. Further, parameters are included which describe ecological requirements of the individual tree species regarding radiation regimes, thermal regimes, moisture regimes and regarding soil and terrain conditions.

Three kinds of forest resources management and exploitation are assumed. The first type has as management objectives, nature conservation, bio-diversity preservation and limited selective extraction of individual trees, and/or environmental protection objectives such as stabilization of steep slopes, dunes or shifting sand and windbreaks/dust filters. This type is referred to as '*conservation forestry*'. The second type reflects traditional forestry, with main management objectives being maximizing quality and quantity of timber/wood/pulp production. This type is referred to as '*traditional production forestry*'. The third type captures the fully mechanized bio-fuel and pulpwood production for energy generation and industrial application of pulpwood. This type is characterized by short rotations of single stem or coppice systems and is referred to as '*biomass plantation forestry*'.

The LUT data compiled for this study comprises 36 deciduous tree species, 14 coniferous species and 2 deciduous coniferous species (larches).

Conservation forestry

This forestry type consists of mixed forest with multi-aged stands. The management is focused on preservation of a diversified ecosystem; it includes some basic measures for fire protection and extraction of selected dominant and co-dominant trees. Invasion of exotic species as well as occurrences of pests and diseases are monitored and minimized. Stands are generally tending towards climax conditions. Extraction takes place at sub-optimum rotation lengths, generally mature or over-mature individual trees.

Under unprotected conditions in arid and semi-arid environments (aridity index⁵ of vegetation period $P/PET < 0.5$), forest fires occur at intervals as short as 15 years to about 60 years. These zones are dominated by fire-susceptible light coniferous tree species (such as larch and pine) and some small-leaved species (such as *Betula papyrifera*). In moderately dry boreal, temperate and subtropical-winter rainfall zones (aridity index 0.5 - 1.0), characterized by a mix of mainly dark and light coniferous tree species and some broad-leaved species, forest fire intervals occur roughly between 75 and 150 years. In sub-humid and humid zones (including subtropics with summer rainfall) dominated by broadleaved and dark coniferous forest species, occurrences of forest fires are rare (adapted from Shvidenko and Nilsson, 1995). The size of areas affected by individual forest fires in the majority of the incidents is typical less than 5 ha, but in extreme cases in particular in dry boreal environments fires may cover areas as large as 50,000–200,000 ha (Payette, 1992). It has been assumed that the conservation forest LUTs are affected by fire hazards at regular intervals (see Section 4.4).

5 Plate 12 presents the aridity index map (P/PET) covering China, Mongolia and the FSU

The LUT attributes listed in Table 6 form the basis for the tree species suitability assessment for conservation forestry.

Table 6 Conservation forestry LUTs

LUT Attributes	Conservation Forestry
Tree species considered	Birch, Poplar, Willow, Oak, Beech, Hornbeam, Ash, Alder, Lime, Maple, Robinia, Chestnut, Walnut, Larch, Spruce, Pine and Fir.
Produce	Wood for various purposes
Management objectives	Land conservation: Sand dune fixing, slope stabilization, wind break, pollution/dust filters, soil improvement; pest, disease and fire control measures; limited tree extraction.
Capital Intensity	Low
Labour Intensity	Low; nature conservation personnel
Power source	n.a.
Technology	No fertilizer; self-seeding; limited pest, disease control, no fire prevention measures
Productivity	Low
Environmental hazards	It is assumed that natural fires occur at intervals 15-60 years in dry boreal zones and at intervals between 75 and 150 years in moderately dry boreal, temperate and subtropical zones. No fire protection measures are assumed.
Environmental benefits	Stable forest eco-systems: preservation of bio-diversity; carbon dioxide sequestration in stem-wood, roots and soil.
Infrastructure requirement	Access to research information.
Scale of operation	Limited operations at small scales

Traditional production forestry

This type involves the control of forest composition, establishment and growth. Traditional planting/regeneration and harvest methods – clear-felling, seed-tree and shelter-wood in even-age management - are used for the planting/regeneration and subsequent growth of commercially important tree species. Harvest at age of maximum yield (optimum rotation length).

In the productivity assessment for traditional forestry, adequate measures and management are assumed which would prevent from production loss due to natural uncontrolled forest fires. Table 7 presents the main LUT attributes for traditional production forestry.

Table 7 Traditional production forestry LUTs

LUT Attributes	Traditional Production Forestry
Tree species considered	Birch, Poplar, Oak, Beech, Robinia, Larch, Spruce, Pine and Fir.
Produce	Timber/pulp
Management objectives	Commercial timber and pulp production: pure equal-aged stands; optimum rotation lengths; maximization of high quality timber production; clear fell and other clearing systems.
Capital Intensity	High
Labour Intensity	Medium; planting/seeding, maintenance and clearing
Power source	Mechanized
Technology	Good planting material; mechanized planting; start-off fertilizer; proper thinning; pest, disease and erosion control; mechanized clear felling and full fire prevention measures (which may occupy up to 10% of the forest production area).
Productivity	High
Environmental hazards	Soil erosion and nutrient leaching hazards; pest and diseases ; natural fire hazards are assumed minimized through adequate protection measures.
Environmental benefits	Carbon dioxide sequestration in stem wood, roots and soil
Infrastructure requirement	Adequate market accessibility; access to research information and advisory services.
Scale of operation	Large enterprises

Biomass plantation forestry

This special type of forestry is concerned with maximization of wood biomass output per hectare for energy production⁶ from bio-fuel and for the pulp and paper industry. Highly productive pioneer species are grown as monoculture plantations in short rotations. In this assessment only a short duration rotation coppice (SRC) system with willow (e.g., *Salix viminalis*) and short duration rotation single stem (SRSS) systems with suitable poplar, alder and ash species are considered. It is assumed that for the SRC system the first harvest takes place after five years and subsequently every three years up to an age of 20-25 years and for SRSS systems 7-10 year rotations apply. Fertilization, annual weeding and mechanical harvesting are assumed. The density of SRC systems is assumed 2500 surviving stools per hectare (Leave area index = 4). Further, it is assumed that optimum harvest periods are selected and that all harvested biomass is utilized. Table 8 presents main LUT attributes for biomass plantation-forestry.

Table 8 Biomass plantation forestry LUTs

LUT Attributes	Biomass Plantation Forestry
Tree species considered	Selected Poplar, Alder, Ash and Willow species.
Produce	Bio-fuel/pulp
Management objectives	Commercial bio-fuel and pulp production; plantations of fast growing willow in short duration rotation coppice systems and Poplar, Alder and Ash species in short duration single stem rotations; maximizing above ground biomass yields; felling systems with "harvesters".
Capital Intensity	High
Labor Intensity	Low; mainly control of pest, disease and invasion of unwanted species.
Power source	Highly mechanized
Technology	Selected fully treated planting material; fully mechanized planting or coppicing; adequate use of fertilizer, pesticides; fully mechanized planting and clear felling and where required full fire prevention measures (which may occupy up to 10% of the biomass plantation area).
Productivity	Very High
Environmental hazards	Pollution due to fertilization, use of pesticides and chemical weed control.
Environmental benefits	Potential for groundwater quality improvement, e.g., through nitrate extraction by coppice tree crops; carbon dioxide sequestration in roots and soil.
Infrastructure requirement	Adequate pulp/paper industry and/or bio-energy production units or pellet/bricket production industry readily accessible. High level of advisory services and application of research findings.
Scale of operation	Medium and large enterprises

4.2 Ecological Requirements

The ecological requirements of the 52 selected tree species are presented in two parts, namely (a) quantified climate requirements and (b) semi-quantified soil requirements. Main sources used are: Song Zhaomin and Meng Ping (1993); Chartier (Ed.) (1995); Shugart (Ed.) (1992); Kruessmann (1972); Schmidt-Vogt. (1987); Schuett *et al.* (1999); Jansen *et al.* (1995), and Shvidenko *et al.*, (1996a, b).

As part of the climatic suitability analysis, temperature requirements of tree species are matched with actual temperature regimes in grid-cells. When the temperature characteristics in a particular grid-cell

6 Several tree species are currently used for forest biomass production systems. Examples apart from willow include: poplar, eucalyptus, black locust and selected conifers. These species are used in either short rotation coppice systems or in short rotation single stem systems. In boreal and temperate environments mainly willow and to some extent poplar systems are used. The short rotation willow, apart from production of biomass is also being used for purification (nitrate reduction) of groundwater (Perttu and Aronsson, 1995).

It is envisaged to compare potential productivity and energy efficiency of forests biomass production systems with energy crops, such as: rape, sunflower, sugar beet, sweet sorghum, wheat, cystle (*Cynara cardunculu*) and a C₄ perennial grass (*Miscanthus sinensis giganteus*). Recent research with this C₄ grass has shown that per annum dry matter yields of 20-25 t/ha are achievable.

match tree species temperature requirements in optimum or sub-optimum fashion, then this tree species is considered in the biomass increment calculations.

Thermal suitability is assessed through matching thermal requirements of individual tree species/LUTs with average thermal conditions in a particular grid-cell. The thermal conditions considered are; mean temperatures of the coldest and the warmest month, length of frost-free period, length of vegetation period, length of dormancy period and temperature sums during vegetation and frost-free period (Table 9). In case all conditions are met in an optimum fashion, the rating is S1 (optimal conditions). In case one or more conditions only meet range conditions, the rating is S2 (sub-optimal conditions). When one or more conditions fall outside the range conditions, the rating of that particular cell is not suitable.

The moisture suitability analysis is essentially based on the comparison of tree species specific drought tolerances with the moisture conditions during the respective vegetation period. For each of the tree species two thresholds have been set, one between optimum and sub-optimum conditions for growth (parameter κ) and one between sub-optimum growth and not suitable conditions (parameter λ). Further it is assumed that with increasingly dry conditions spacing of trees becomes wider. Therefore in such conditions gradually lower than optimum LAI values (parameter μ) are assumed see Table 11.

Climatic requirements of tree species were expressed in *optimum*, *range* and *not suitable* conditions as presented in Table 9 and include the following parameters:

- (i) Mean temperatures of the coldest and the warmest month;
- (ii) Minimum temperatures of the coldest month;
- (iii) Frost-free period (days with mean temperature $> 10^{\circ}\text{C}$);
- (iv) Periods of biological activity (days with $T_{\text{mean}} > 5^{\circ}\text{C}$);
- (v) Dormancy periods;
- (vi) Accumulated temperatures (base temperatures of 5°C and 10°C);
- (vii) Length of growing periods (days);

Sources: Barnes *et al.*, (1998); Burschel and Huss, (1997); Chartier *et al.*, (1995); Chen, (1999); IIASA-LUC (1998a, b, c); Jansen *et al.*, (1995); (1968), Kassam, (1977); Köstler *et al.*, (1968), Krüssmann. (1972, 1983); Mitscherlich, (1975); Nikolov and Helmisaari, (1992); Perttu and Aronsson, (1995); Schmidt-Vogt, (1987); Schmidt, (1987, 1989); Schober, (1975); Schuett (1999) Shugart, (1992); Shvidenko *et al.*, (1996a, b); Stolbovoi *et al.*, (1997a); Woods and Hall, (1994).

All climatic parameters have been estimated/verified by overlaying species distribution maps and climatic maps.

Table 9 Climatic requirements

OPTIMUM CONDITIONS

Temperate and Boreal Deciduous Tree Species		Tmean Jan (°C)	Tmean July (°C)	Tmin Jan (°C)	LGPT 10°C (days) ⁷	LGPT 5°C (days)	Dormancy break (days)	Tsum 10°C (ddays)	Tsum 5°C (ddays)	LGP (days)
Birch	<i>Betula pubescens</i>	>-40	12-20	-55	>75	>120	>105	>1000	>1400	>120
	<i>Betula pendula</i>	>-40	14-20	-50	>90	>135	>90	>1200	>1600	>135
	<i>Betula verrucosa</i>	>-40	12-16	-50	>90	>135	>90	>1200	>1600	>135
	<i>Betula tortuosa</i>	>-40	12-16	-55	>75	>120	>105	>1000	>1400	>120
	<i>Betula platyphylla</i>	>-30	14-23	-40	>90	>135	>90	>1200	>1600	>135
	<i>Betula papyrifera</i>	>-28	14-23	-40	>90	>135	>90	>1200	>1600	>135
Poplar	<i>Populus nigra</i>	>-30	15-30	-35	>120	>150	>30	>2400	>2800	>135
	<i>Populus euramericana cv rob.</i>	>-30	15-30	-35	>120	>150	>30	>2400	>2800	>135
	<i>Populus alba</i>	>-30	17-30	-35	>135	>165	>30	>3000	>3400	>150
	<i>Populus tremula</i>	>-35	16-26	-45	>90	>120	>75	>1600	>2000	>120
	<i>Populus balsamifera</i>	>-35	15-26	-45	>90	>135	>60	>1800	>2200	>135
	<i>Populus maximowiczii</i>	>-35	15-26	-45	>90	>135	>60	>1800	>2200	>135
	<i>Populus tomentosa</i>	>-15	17-26	-20	>135	>165	>30	>3000	>3400	>150
	<i>Populus euphratica</i>	>-20	20-30	-25	>135	>165	>30	>3000	>3400	>150
Willow	<i>Salix alba</i>	>-30	16-28	-35	>120	>150	>30	>1800	>2200	>135
	<i>Salix viminalis</i>	>-30	16-28	-35	>120	>150	>30	>1800	>2200	>135
Oak	<i>Quercus robur</i>	>-20	15-27	-25	>150	>180	0	>2000	>2400	>150
	<i>Quercus petraea</i>	>-5	15-28	-10	>165	>210	0	>2100	>2500	>150
	<i>Quercus rubra</i>	>-10	16-24	-15	>165	>210	>45	>2100	>2500	>180
	<i>Quercus lanuginosa</i>	>0	20-32	-5	>180	>240	>30	>3000	>3400	>180
	<i>Quercus cerris</i>	>-20	16-27	-25	>150	>180	0	>2000	>2400	>150
	<i>Quercus acutissima</i>	>-10	20-27	-15	>180	>225	>45	>3000	>3400	>180
	<i>Quercus variabilis</i>	>-10	20-27	-15	>180	>225	>45	>3000	>3500	>150
	<i>Quercus mongolica</i>	>-30	16-20	-35	>120	>135	>150	>1800	>2100	>120
Beech	<i>Fagus sylvatica</i>	>-5	16-22	-10	>165	>210	>60	>2200	>2750	>180
Hornbeam	<i>Carpinus betulus</i>	>-20	16-25	-25	>150	>180	0	>2200	>2600	>150
Ash	<i>Fraxinus excelsior</i>	>-8	18-25	-15	>150	>180	0	>2000	>2500	>165
	<i>Fraxinus mandshurica</i>	>-30	16-24	-35	>150	>180	0	>2000	>2500	>165
Alder	<i>Alnus glutinosa</i>	>-20	16-24	-25	>150	>180	0	>2000	>2400	>165
Lime	<i>Tilia cordata</i>	>-25	14-22	-30	>135	>165	0	>1800	>2200	>135
Maple	<i>Acer plantanoides</i>	>-20	16-24	-30	>150	>180	0	>2000	>2400	>150
	<i>Acer campestre</i>	>-8	18-24	-15	>150	>180	0	>2000	>2500	>150
	<i>Acer campbellii</i>	>-15	15-24	-20	>135	>165	0	>2000	>2400	>150
Locust	<i>Robinia pseudoacacia</i>	>-10	16-27	-15	>165	>225	0	>2300	>2750	>135
Chestnut	<i>Castanea sativa</i>	>0	16-22	-1	>180	>225	>60	>2500	>3000	>195
Walnut	<i>Juglans regia</i>	>-20	16-24	-25	>150	>180	0	>2200	>2600	>150

⁷ All temperate and boreal deciduous tree species are confined to areas with winter temperatures at least for some time below 10°C. For optimum levels LGPT10 < 330 days has been used as cut off.

OPTIMUM CONDITIONS

Deciduous Coniferous Trees		Tmean Jan (°C)	Tmean July (°C)	Tmin Jan (°C)	LGPT 10°C (days)	LGPT 5°C (days)	Dormancy break. (days)	Tsum 10°C (ddays)	Tsum 5°C (ddays)	LGP (days)
Larch	<i>Larix gmelinii</i>	> -45	12-20	-55	>75	>120	>165	>950	>1300	>120
	<i>Larix sibirica</i>	> -40	12-20	-45	>75	>120	>165	>1000	>1400	>120

OPTIMUM CONDITIONS

Coniferous Trees		Tmean Jan (°C)	Tmean July (°C)	Tmin Jan (°C)	LGPT 10°C (days)	LGPT 5°C (days)	Dormancy break. (days)	Tsum 10°C (ddays)	Tsum 5°C (ddays)	LGP (days)
Spruce	<i>Picea abies</i>	>-20	14-18	-25	>105	>135	>105	>1150	>1600	>135
	<i>Picea asperata</i>	>-16	14-18	-20	>90	>150	>135	<1100	>1400	>150
	<i>Picea ajanensis</i>	>-30	14-18	-35	>90	>135	>165	>1150	>1500	>135
	<i>Picea obovata</i>	>-35	13-18	-40	>75	>120	>195	>1000	>1350	>120
	<i>Picea koreaiensis</i>	>-20	14-18	-30	>120	>135	>165	>1150	>1600	>150
Pine	<i>Pinus sibirica</i>	>-35	14-20	-50	>75	>120	>180	>900	>1400	>120
	<i>Pinus sylvestris</i>	>-35	14-23	-50	>75	>120	>90	>1000	>1400	>120
	<i>Pinus tabulaeformis</i>	>-13	18-24	-22	>165	>180	>135	>2500	>3000	>165
	<i>Pinus massoniana</i>	>0	24-28	-5	>240	>270	0	>4000	>4500	>240
	<i>Pinus yunnanensis</i>	>0	16-22	-5	>195	>240	0	>4000	>4500	>180
	<i>Pinus koreaiensis</i>	>-20	14-18	-30	>120	>150	>165	>1150	>1600	>135
Fir	<i>Abies alba</i>	> -5	16-20	-20	>135	>180	>120	>2200	>2750	>165
	<i>Abies sibirica</i>	> -40	14-20	-45	>75	>120	>165	>950	>1400	>120
	<i>Cunninghamia lanceolata</i>	>4	24-28	-10	>255	>300	0	>4000	>4500	>270

Table 9 Continued

RANGE CONDITIONS

Temperate and Boreal Deciduous Tree Species		Tmean Jan (°C)	Tmean July (°C)	Tmin Jan (°C)	LGPT 10°C (days)8	LGPT 5°C (days)	Dormancy break (days)	Tsum 10°C (ddays)	Tsum 5°C (ddays)	LGP (days)
Birch	<i>Betula pubescens</i>	>-45	10-23	-60	>60	>105	>90	>850	>1100	>105
	<i>Betula pendula</i>	>-45	12-23	-55	>75	>120	>75	>1000	>1250	>120
	<i>Betula verrucosa</i>	> -45	10-18	-55	>75	>120	>75	>1000	>1250	>120
	<i>Betula tortuosa</i>	>-45	10-18	-60	>60	>105	>90	>850	>1100	>105
	<i>Betula platyphylla</i>	>-35	12-26	-45	>75	>120	>75	>1000	>1250	>120
	<i>Betula papyrifera</i>	>-33	12-26	-45	>75	>120	>75	>1000	>1250	>120
Poplar	<i>Populus nigra</i>	>-35	14-33	-40	>105	>135	0	>2200	>2600	>120
	<i>Populus euramericana cv rob.</i>	>-35	12-33	-40	>105	>135	0	>2200	>2600	>120
	<i>Populus alba</i>	>-35	16-33	-40	>120	>150	0	>2300	>2800	>135
	<i>Populus tremula</i>	>-45	13-28	-55	>75	>105	>60	>1300	>1800	>105
	<i>Populus balsamifera</i>	>-40	13-28	-55	>75	>120	>45	>1500	>1900	>120
	<i>Populus maximowiczii</i>	>-40	13-28	-55	>75	>120	>45	>1500	>1900	>120
	<i>Populus tomentosa</i>	>-20	16-33	-25	>120	>150	0	>2700	>3100	>135
	<i>Populus euphratica</i>	>-30	18-33	-30	>120	>150	0	>2700	>3100	>135
Willow	<i>Salix alba</i>	> -35	15-30	-40	>105	>135	0	>1500	>1900	>120
	<i>Salix viminalis</i>	> -35	15-30	-40	>105	>135	0	>1500	>1900	>120
Oak	<i>Quercus robur</i>	>-25	14-29	-30	>120	>150	0	>1800	>2200	>135
	<i>Quercus petraea</i>	>-7	14-30	-12	>150	>195	0	>1900	>2350	>135
	<i>Quercus rubra</i>	>-12	15-26	-20	>150	>195	>30	>1900	>2400	>180
	<i>Quercus lanuginosa</i>	>-2	18-34	-10	>165	>225	0	>2800	>3200	>180
	<i>Quercus cerris</i>	>-25	15-29	-30	>135	>165	0	>1800	>2200	>150
	<i>Quercus acutissima</i>	>-12	18-29	-20	>165	>210	>30	>2800	>3200	>180
	<i>Quercus variabilis</i>	>-12	18-29	-20	>165	>210	>30	>2800	>3300	>150
	<i>Quercus mongolica</i>	>-35	14-22	-40	>105	>120	>135	>1600	>1900	>105
Beech	<i>Fagus sylvatica</i>	>-7	14-25	-12	>150	>195	>45	>1900	>2400	>165
Hornbeam	<i>Carpinus betulus</i>	>-25	14-30	-30	>135	>165	0	>2000	>2400	>135
Ash	<i>Fraxinus excelsior</i>	> -15	16-30	-25	>135	>165	0	>1800	>2250	>150
	<i>Fraxinus mandshurica</i>	>-35	15-27	-40	>135	>165	0	>1800	>2250	>150
Alder	<i>Alnus glutinosa</i>	>-25	14-26	-30	>135	>165	0	>1800	>2200	>150
Lime	<i>Tilia cordata</i>	>-30	16-26	-35	>135	>165	0	>1600	>2000	>135
	<i>Acer platanoides</i>	>-25	14-25	-35	>120	>150	0	>1800	>2200	>135
Maple	<i>Acer campestre</i>	>-13	16-25	-18	>120	>150	0	>1800	>2200	>135
	<i>Acer campbellii</i>	>-20	13-26	-25	>120	>150	0	>1800	>2200	>135
Locust	<i>Robinia pseudoacacia</i>	>-12	14-30	-18	>150	>210	0	>2100	>2500	>120
Chestnut	<i>Castanea sativa</i>	>-1	14-26	-3	>165	>210	>30	>2300	>2800	>180
Walnut	<i>Juglans regia</i>	>-15	14-26	-30	>135	>165	0	>2000	>2400	>135

8 All temperate and boreal deciduous tree species are confined to areas with winter temperatures at least for some time below 10°C. For range levels LGPT10 > 360 days has been used as cut off.

RANGE CONDITIONS

Deciduous Coniferous Trees		Tmean Jan (°C)	Tmean July (°C)	Tmin Jan (°C)	LGPT 10°C (days)	LGPT 5°C (days)	Dormancy break. (days)	Tsum 10°C (ddays)	Tsum 5°C (ddays)	LGP (days)
Larch	<i>Larix gmelinii</i>	>50	11-23	-60	>60	>105	>135	>800	>1000	>105
	<i>Larix sibirica</i>	>45	11-23	-50	>60	>105	>135	>850	>1100	>105

RANGE CONDITIONS

Coniferous Trees		Tmean Jan (°C)	Tmean July (°C)	Tmin Jan (°C)	LGPT 10°C (days)	LGPT 5°C (days)	Dormancy break. (days)	Tsum 10°C (ddays)	Tsum 5°C (ddays)	LGP (days)
Spruce	<i>Picea abies</i>	>25	12-20	-30	>90	>120	>90	>1050	>1250	>120
	<i>Picea asperata</i>	>18	12-20	-22	>75	>135	>120	<1050	>1300	>135
	<i>Picea ajanensis</i>	>35	12-20	-40	>75	>120	>150	>1000	>1200	>120
	<i>Picea obovata</i>	>40	12-19	-45	>60	>105	>180	>900	>1150	>105
	<i>Picea koreaiensis</i>	>25	12-20	-35	>105	>120	>150	>1050	>1250	>135
Pine	<i>Pinus sibirica</i>	>45	12-23	-60	>60	>105	>165	>800	>1150	>105
	<i>Pinus sylvestris</i>	>45	12-25	-60	>60	>105	>60	>850	>1100	>105
	<i>Pinus tabulaeformis</i>	>15	16-26	-25	>150	>165	>120	>2300	>2800	>150
	<i>Pinus massoniana</i>	>-2	22-30	-8	>210	>240	0	>3750	>4000	>210
	<i>Pinus yunnanensis</i>	>-3	15-24	-8	>180	>225	0	>3750	>4000	>165
	<i>Pinus koreaiensis</i>	>25	12-21	-35	>105	>135	>150	>1050	>1250	>120
Fir	<i>Abies alba</i>	>-8	14-23	-25	>120	>165	>90	>2000	>2500	>150
	<i>Abies sibirica</i>	>45	12-23	>-50	>60	>105	>150	>850	>1100	>105
	<i>Cunninghamia lanceolata</i>	>0	22-30	>-15	>240	>270	0	>3750	>4250	>240

The soil suitability assessment is based on the comparison of soil requirements of tree species and prevailing soil conditions. The soil assessment also reflects constraints imposed by landform and other features that do not directly form a part of the soil but may have a significant influence on the use that can be made of the soil. Distinction is made between *internal* soil requirements of crop/LUTs, e.g., soil moisture regime, soil fertility, effective soil depth for root development, and other physical and chemical soil properties, and *external* requirements related to, e.g., soil slope, occurrence of flooding, and soil accessibility.

In order to safeguard that production be achievable on a sustainable basis, a terrain-slope suitability classification is applied which not only concerns workability and accessibility but also prevents intolerable levels of topsoil erosion and fertility loss. Depending on prevailing rainfall aggressivity, upper limits have been set to slope gradients for traditional production forestry and biomass forestry. Beyond these slope gradients land has been classified *not suitable* for tree production under these management objectives.

A number of soil characteristics affecting growth and production of tree species have been classified in terms of optimum, range and not suitable conditions for the 52 forest tree species considered (Table 10), including the following:

- (i) Soil fertility;
- (ii) Soil texture and structure;
- (iii) Soil internal drainage;
- (iv) Soil depth;
- (v) Soil reaction;
- (vi) Soil stoniness;
- (vii) Soil salinity, and
- (viii) Water-logging/flooding conditions.

4.3 Biomass Increment Calculation

The AEZ methodology for the calculation of potential biomass is based on two well established and robust models: the Chapman-Richard biomass increment model (e.g., see Nilsson, 1983), and a potential biomass model adapted from Kassam (1977) and Kassam *et al.* (1991). Details of the calculation procedures are presented below.

A generalized function for forest stand development

Many practical applications in forestry employ a biomass increment model suggested by Chapman-Richard, expressing stand development in terms of relative yield over relative age. The generalized function is of the form:

$$\begin{aligned}
 y(r) &= \alpha \cdot (1 - \beta^{-r})^\gamma \\
 r &= t / R \\
 B(r) &= y(r) \cdot B^*
 \end{aligned}
 \tag{1}$$

where:

- R ... optimum rotation length⁹
- t ... age of stand
- r ... relative age, i.e., age expressed relative to optimum rotation length
- y ... relative yield, i.e., yield relative to biomass at age of maximum volume production
- $B(r)$... biomass at relative age r
- B^* ... biomass at age of maximum volume production
- α, β, γ parameters of Chapman-Richard function

⁹ Rotation length is taken as the age at 'maximum volume production', and is the point in time when annual increment is equal to the mean increment over the total period since establishment.

Table 10 Soil requirements

Deciduous Trees		Fertility	Texture/Structure		Drainage		Depth (cm)		Reaction (pH)		Water-logging/ Flooding	
			Optimum	Range	Optimum	Range	Optimum	Marginal	Optimum	Range	Optimum	Marginal
Birch	<i>Betula pubescens</i>	low	9-16	6-19	W-I	SE-VP	>100	>30	4.5-7.5	4.0-8.0	F1	F1/F2
	<i>Betula pendula</i>	low	10-16	9-20	W-MW	E-I	>100	>50	4.5-7.0	4.0-8.0	F0	F0/F1
	<i>Betula verrucosa</i>	low	10-16	9-20	W-MW	E-I	>100	>50	4.5-7.0	4.0-8.0	F0	F0/F1
	<i>Betula tortuosa</i>	low	9-16	6-19	W-I	SE-P	>100	>30	4.5-7.5	4.0-8.0	F0/F1	F1
	<i>Betula platyphylla</i>	low	10-16	9-19	W-MW	SE-I	>100	>50	4.5-7.5	4.0-8.0	F0	F0/F1
	<i>Betula papyrifera</i>	low	10-16	9-19	W-MW	SE-P	>100	>50	4.5-7.5	4.0-8.0	F0	F0/F1
Poplar	<i>Populus nigra</i>	high	9-15	5-19	W-MW	SE-P	>150	>75	6.5-7.5	5.5-8.5	F1	F1/F2
	<i>Populus euramericana cv rob.</i>	high	9-15	5-19	W-MW	SE-P	>150	>75	6.5-7.5	5.5-8.5	F1	F1/F2
	<i>Populus alba</i>	high	9-16	6-19	W-MW	SE-I	>150	>75	6.0-7.0	5.5-8.5	F0/F1	F1/F2
	<i>Populus tremula</i>	med./high	9-16	6-19	W-MW	SE-I	>150	>75	6.0-7.0	5.5-8.5	F0	F0/F1
	<i>Populus balsamifera</i>	med./high	9-16	6-19	W-MW	SE-I	>150	>75	6.0-7.0	5.5-8.5	F0/F1	F1/F2
	<i>Populus maximowiczii</i>	med./high	9-16	6-19	W-MW	SE-I	>150	>75	6.0-7.0	5.5-8.5	F0/F1	F1/F2
	<i>Populus tomentosa</i>	high	9-15	5-19	W-MW	SE-P	>150	>75	6.5-7.5	5.5-8.5	F0/F1	F1
	<i>Populus euphratica</i>	high	9-15	5-19	W-MW	SE-P	>150	>75	6.5-7.5	5.5-8.5	F0/F1	F1
Willow	<i>Salix alba</i>	high	9-16	5-20	W-I	SE-VP	>100	>50	5.0-7.5	4.5-8.5	F1	F2
	<i>Salix viminalis</i>	high	9-16	5-20	W-I	SE-VP	>100	>50	5.0-7.5	4.5-8.5	F1	F2
Oak	<i>Quercus robur</i>	medium	9-15	5-19	W-I	SE-P	>100	>50	5.5-7.5	4.5-8.5	F0/F1	F1
	<i>Quercus petraea</i>	medium	9-16	5-20	W-MW	E-I	>100	>50	5.0-7.0	4.0-8.0	F0	F0
	<i>Quercus rubra</i>	medium	9-15	5-19	W-MW	E-I	>150	>75	5.5-7.5	4.5-8.5	F0	F0
	<i>Quercus lanuginosa</i>	medium	9-15	5-19	W-I	SE-P	>100	>50	6.0-8.0	5.0-8.5	F0	F0/F1
	<i>Quercus cerris</i>	medium	9-15	6-17	W-MW	SE-I	>100	>50	5.5-7.5	4.5-8.0	F0	F0/F1
	<i>Quercus acutissima</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	5.5-7.5	4.5-8.0	F0	F0/F1
Beech	<i>Quercus variabilis</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	5.5-7.5	4.5-8.0	F0	F0/F1
	<i>Quercus mongolica</i>	medium	9-15	5-19	W-I	SE-P	>100	>50	5.5-7.5	4.5-8.5	F0	F0/F1
	<i>Fagus sylvatica</i>	medium	9-15	6-16	W	SE-MW	>150	>75	5.5-7.5	5.0-8.5	F0	F0
	<i>Hornbeam</i>	<i>Carpinus betulus</i>	medium	9-15	5-17	W-MW	SE-I	>100	>50	5.0-7.0	4.0-8.5	F0
Ash	<i>Fraxinus excelsior</i>	high	9-15	6-17	W-I	SE-P	>100	>30	5.8-7.5	4.5-8.5	F0/F1	F1/F2
	<i>Fraxinus mandshurica</i>	high	9-15	6-17	W-I	SE-P	>100	>30	5.8-7.5	4.5-8.4	F0/F1	F1/F2
Alder	<i>Alnus glutinosa</i>	high	9-15	5-19	W-I	SE-VP	>100	>30	5.0-7.0	4.5-8.5	F0/F1	F1/F2
Lime	<i>Tilia cordata</i>	medium	9-15	6-17	W-MW	SE-I	>150	>75	5.0-7.5	4.5-8.5	F0	F0/F1
Maple	<i>Acer plantanoides</i>	med./high	9-16	6-19	W-MW	SE-I	>100	>50	5.0-7.0	4.0-8.5	F0/F1	F1
	<i>Acer campestre</i>	med./high	9-16	6-19	W-MW	SE-I	>100	>50	5.5-7.5	4.0-8.5	F0/F1	F1
	<i>Acer campbellii</i>	med./high	9-16	6-19	W-MW	SE-I	>100	>50	5.5-7.5	4.0-8.5	F0/F1	F1
Black locust	<i>Robinia pseudoacacia</i>	medium	9-16	5-19	W-MW	SE-I	>150	>50	5.5-7.5	5.0-8.5	F0	F0
Chestnut	<i>Castanea sativa</i>	med/high	9-15	6-16	W	SE-MW	>150	>75	5.0-7.0	4.0-8.0	F0	F0
Walnut	<i>Juglans regia</i>	med/high	9-16	5-19	W	SE-MW	>150	>75	6.5-7.5	5.5-8.5	F0	F0

Deciduous Coniferous Trees		Fertility	Texture/Structure		Drainage		Depth (cm)		Reaction (pH)		Waterlogging/ Flooding	
			Optimum	Range	Optimum	Range	Optimum	Marginal	Optimum	Range	Optimum	Marginal
Larch	<i>Larix gmelinii</i>	low	9-16	6-20	W-MW	SE-I	>75	>30	5.0-7.5	4.5-8.5	F1	F1/F2
	<i>Larix sibirica</i>	low/med	9-16	6-19	W-MW	SE-I	>100	>50	5.0-7.0	4.5-8.0	F0/F1	F1/F2

Coniferous Trees		Fertility	Texture/Structure		Drainage		Depth (cm)		Reaction (pH)		Waterlogging/ Flooding	
			Optimum	Range	Optimum	Range	Optimum	Marginal	Optimum	Range	Optimum	Marginal
Spruce	<i>Picea abies</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	4.5-6.0	4.0-7.5	F0	F0
	<i>Picea asperata</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	4.5-6.0	4.0-7.5	F0	F0
	<i>Picea ajanensiss</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	4.5-6.0	4.0-7.5	F0	F0
	<i>Picea obovata</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	4.5-6.0	4.0-7.5	F0	F0
	<i>Picea koreaiensis</i>	medium	9-16	6-19	W-MW	SE-I	>100	>50	4.5-6.0	4.0-7.5	F0	F0
Pine	<i>Pinus sibirica</i>	low/med.	9-16	5-20	W-MW	SE-P	>100	>30	5.0-6.0	4.0-8.0	F0/F1	F1
	<i>Pinus sylvestris</i>	low	9-16	6-21	W-I	E-P	>100	>30	5.0-6.5	4.0-8.5	F1	F1/F2
	<i>Pinus tabulaeformis</i>	low/med.	9-16	6-19	W-MW	SE-I	>100	>30	5.0-6.5	4.0-8.5	F0	F0/F1
	<i>Pinus massoniana</i>	low/med.	9-16	6-19	W	SE-MW	>100	>30	5.0-6.5	4.0-8.5	F0	F0/F1
	<i>Pinus yunnanensis</i>	low/med.	9-16	6-19	W-MW	SE-I	>100	>30	5.0-6.5	4.0-8.5	F0	F0/F1
	<i>Pinus koreaiensis</i>	low/med.	9-16	6-20	W-MW	SE-I	>100	>30	5.0-6.5	4.0-8.5	F0/F1	F1
Fir	<i>Abies alba</i>	medium	9-16	5-18	W-MW	SE-P	>150	>75	4.5-7.5	4.0-8.5	F0	F0/F1
	<i>Abies sibirica</i>	medium	9-16	6-19	W	SE-I	>150	>75	4.5-7.0	4.0-8.0	F0	F0/F1
	<i>Cunninghamia lanceolata</i>	medium	9-16	6-19	W	SE-I	>100	>30	4.5-7.0	4.0-9.0	F0	F0/F1

TEXTURE/STRUCTURE	symbol	code	TEXTURE/STRUCTURE	symbol	code	DRAINAGE	Symbol
massive clay	Cm	1	silt loam	SiL	12	Excessively drained	E
massive silty clay	SiCm	2	sandy clay	SC	13	Somewhat excessively drained	SE
very fine clay, vertisol structure	C+60,v	3	loam	L	14	Well	W
very fine clay, blocky structure	C+60,s	4	sandy clay loam	SCL	15	Moderately well drained	MW
clay, vertisol structure	C-60,v	5	sandy loam	SL	16	Imperfectly drained	I
clay, blocky structure	C-60,s	6	loamy fine sand	LfS	17	Poorly drained	P
silty clay, blocky structure	SiCs	7	loamy sand	LS	18	Very poorly drained	VP
clay, oxisol structure	Co	8	loamy coarse sand	LcS	19	WATERLOGGING/FLOODING	
silty clay loam	SiCL	9	fine sand	fS	20	No flooding/waterlogging	F0
clay loam	CL	10	sand	S	21	Occasional floods/waterlogging (short periods)	F1
silt	Si	11	coarse sand	cS	22	Frequent floods/waterlogging (longer periods)	F2

According to the definitions of y , r , and R , the following conditions must hold:

$$\begin{aligned} y(0) &= 0 \\ y(1) &= 1 \\ \frac{dy}{dr} \Big|_{r=1} &= 1 \end{aligned} \quad (2)$$

To fully specify the function, an additional condition is needed. Usually the relative standing biomass at 50% percent of the rotation length, i.e., $y(0.5)$, is estimated at 38%, and this condition can be used to obtain the parameter values of the function. The tabulation below shows parameter values and derived properties of the Chapman-Richard function using a range of values for $y(0.5)$:

$y(0.5)$	α	β	γ	r^*	$y(r^*)$	a_x
0.34	1.5052	10.189	3.9585	0.5927	0.4753	1.4764
0.36	1.5644	8.0876	3.3907	0.5840	0.4782	1.4182
0.38	1.6416	6.3581	2.8967	0.5749	0.4813	1.3601
0.40	1.7471	4.9385	2.4661	0.5651	0.4845	1.3018
0.42	1.9014	3.7781	2.0900	0.5546	0.4878	1.2431

In the above, r^* denotes the relative age at which the maximum growth occurs, and a_x the relative increment at the age of maximum growth,

$$a_x = \frac{dy}{dr} \Big|_{r=r^*} \quad (3)$$

The rate of relative biomass increment $a(r)$ at relative age r can be derived from (1):

$$a(r) = \frac{dy}{dr} = \alpha \cdot \gamma \cdot \ln(\beta) \cdot \beta^{-r} \cdot (1 - \beta^{-r})^{\gamma-1} \quad (4)$$

In order to calculate biomass at age of maximum volume production B^* , we integrate the rate of net biomass production $b_n(t)$ over the entire rotation R :

$$B^* = \int_0^R b_n(t) \cdot dt = (b_n(r^*) / a_x) \cdot \int_0^R a(t/R) \cdot dt \approx R \cdot N \cdot b_{nx} / a_x \quad (5)$$

where N denotes the length of the annual vegetation period (in days) and b_{nx} the daily rate of biomass production at the age of maximum growth $t^* = r^* \cdot R$ (averaged for that year). Following the physiological principles of Kassam (1977) and Kassam *et al.* (1991), we calculate b_{nx} as the difference of maximum rate of gross biomass production b_{gm} and respiration losses s_m ,

$$b_{nx} = b_{gm} - s_m \quad (6)$$

Maximum rate of gross biomass production

The maximum rate of gross biomass production (b_{gm}) is related to the maximum net rate of CO_2 exchange of leaves (P_m), which is dependent on temperature, and the level of atmospheric CO_2 concentration. For estimating biomass production, relationships between temperature and rate of photosynthesis of forest tree species have been established. The forest tree species in subtropical, temperate and boreal climates considered in the study have the C_3 photosynthesis pathway, and rates of maximum photosynthesis (P_m) are in the range 5 – 20 $\text{kg CH}_2\text{O ha}^{-1} \text{hr}^{-1}$ (Landsberg, 1986).

Species are classified according to productivity into three classes, namely class I: $P_m = 5\text{-}10 \text{ kg CH}_2\text{O ha}^{-1} \text{hr}^{-1}$; class II: $P_m = 10\text{-}15 \text{ kg CH}_2\text{O ha}^{-1} \text{hr}^{-1}$; and class III: $P_m = 15\text{-}20 \text{ kg CH}_2\text{O ha}^{-1} \text{hr}^{-1}$. These classes of photosynthesis rates correspond to mean annual total biomass increments (including foliage, stem and roots) of < 10 t/ha, 10-15 t/ha and > 15 t/ha dry weight respectively, or annual wood

Table 11 Rotation and productivity characteristics

Tree Species		Rotation			Density (g/cm ³)	Dry Weight (t/ha)	Class	LAI	Drought Tolerance Parameters ¹⁰ ET _a /ET _o *100			
		Height (m)	Length (years)	Production (m ³ /ha/yr)					κ	λ	μ	Class
Birch	<i>Betula pubescens</i>	32	65	7.0	0.61	4.3	I	3.0	95	85	50	C
	<i>Betula pendula</i>	30	65	7.5	0.61	4.6	I	3.0	85	65	50	A
	<i>Betula verrucosa</i>	20	65	6.0	0.61	3.7	I	3.0	85	65	50	A
	<i>Betula tortuosa</i>	25	65	5.0	0.61	3.1	I	3.0	95	85	50	C
	<i>Betula platyphylla</i>	20	65	6.0	0.61	3.7	I	3.0	85	65	50	A
	<i>Betula papyrifera</i>	30	65	7.0	0.61	4.3	I	3.0	85	65	50	A
Poplar	<i>Populus nigra</i>	35	25	31.0	0.34	10.5	III	4.0	90	80	50	B
	<i>Populus euramericana</i>	35	25	31.0	0.34	10.5	III	4.0	90	80	50	B
	<i>Populus alba</i>	30	25	26.0	0.39	10.1	III	4.0	90	80	50	B
	<i>Populus tremula</i>	30	30	26.0	0.39	10.1	III	4.0	90	80	50	B
	<i>Populus balsamifera</i>	30	30	26.0	0.39	10.1	III	4.0	90	80	50	B
	<i>Populus maximowiczii</i>	30	30	26.0	0.39	10.1	III	4.0	90	80	50	B
	<i>Populus tomentosa</i>	30	25	26.0	0.39	10.1	III	4.0	90	80	50	B
	<i>Populus euphratica</i>	30	25	26.0	0.39	10.1	III	4.0	90	80	50	B
Willow	<i>Salix alba</i>	35	40	27.0	0.41	11.1	III	4.0	95	85	65	D
	<i>Salix viminalis(SRC)</i>	8	3-5/25	27.0	0.41	11.1	III	4.0	95	85	65	D
Oak	<i>Quercus robur</i>	30	75	9.0	0.85	7.7	II	4.5	85	65	50	A
	<i>Quercus petraea</i>	35	75	9.0	0.65	5.9	II	4.5	85	65	50	A
	<i>Quercus rubra</i>	25	45	9.3	0.70	6.5	II	5.0	90	80	50	B
	<i>Quercus lanuginosa</i>	20	40	9.0	0.65	5.9	II	4.5	85	65	50	A
	<i>Quercus cerris</i>	35	70	12.0	0.85	9.9	II	4.5	85	65	50	A
	<i>Quercus acutissima</i>	12	35	7.2	0.70	5.0	II	4.5	85	65	50	A
	<i>Quercus variabilis</i>	25	70	9.0	0.65	5.9	II	4.5	85	65	50	A
	<i>Quercus mongolica</i>	30	75	9.0	0.85	7.7	II	4.5	85	65	50	A
Beech	<i>Fagus sylvatica</i>	36	85	12.0	0.68	8.2	II	5.5	95	85	50	C
Hornbeam	<i>Carpinus betulus</i>	27	70	11.0	0.78	8.6	II	5.0	90	80	50	B
Ash	<i>Fraxinus excelsior</i>	30	40	10.0	0.65	6.5	II	5.0	95	85	65	D
	<i>Fraxinus mandshurica</i>	30	40	10.0	0.65	6.5	II	5.0	95	85	65	D
Alder	<i>Alnus glutinosa</i>	23	60	12.0	0.55	6.6	II	5.0	95	85	65	D
Lime	<i>Tilia cordata</i>	30	65	11.0	0.54	5.9	II	5.0	95	85	50	C

¹⁰ ET_a/ET_o thresholds are as follows: κ represents the threshold value above which full biomass increments are assumed; λ represents the threshold below which **zero** biomass increments are assumed; μ represents the relative LAI at λ (LAI at κ is assumed 100%). Class A-D represent different combinations of κ, λ and μ.

Tree Species		Rotation			Density (g/cm ³)	Dry Weight (t/ha)	Class	LAI	Drought Tolerance Parameters ETa/ETo*100			
		Height (m)	Length (years)	Production (m ³ /ha/yr)					κ	λ	μ	Class
Acer	<i>Acer plantanoides</i>	30	40	8.0	0.67	5.4	II	5.0	95	85	50	C
	<i>Acer campestre</i>	15	40	8.0	0.67	5.4	II	5.0	95	85	50	C
	<i>Acer campbellii</i>	20	40	8.0	0.59	4.7	I	5.0	95	85	50	C
Black locust	<i>Robinia pseudoacacia</i>	25	40	12.0	0.73	8.8	II	3.5	85	65	50	A
Chestnut	<i>Castanea sativa</i>	30	80	11.4	0.63	7.2	II	5.0	90	80	50	B
Walnut	<i>Juglans regia</i>	30	100	8.0	0.64	5.1	II	5.0	90	80	50	B
Larch	<i>Larix gmelinii</i>	25	75	8.2	0.65	5.3	II	3.0	85	65	50	A
	<i>Larix sibirica</i>	27	75	13.0	0.65	8.5	II	3.5	85	65	50	A
Spruce	<i>Picea abies</i>	40	60	26.0	0.44	11.4	III	6.0	95	85	65	D
	<i>Picea asperata</i>	25	60	21.0	0.44	9.2	II	6.0	95	85	65	D
	<i>Picea ajanensiss</i>	30	60	26.0	0.44	11.4	III	6.0	95	85	65	D
	<i>Picea obovata</i>	30	60	26.0	0.44	11.4	III	6.0	95	85	65	D
	<i>Picea koreaiensis</i>	30	60	26.0	0.44	11.4	III	6.0	95	85	65	D
Pine	<i>Pinus sibirica</i>	30	60	10.5	0.51	5.4	II	3.5	90	85	50	B
	<i>Pinus sylvestris</i>	35	55	12.0	0.51	6.1	II	3.5	85	65	50	A
	<i>Pinus tabulaeformis</i>	25	55	9.0	0.43	3.8	I	3.5	90	80	50	B
	<i>Pinus massoniana</i>	24	60	9.0	0.43	3.8	I	3.5	90	80	50	B
	<i>Pinus yunnanensis</i>	15	60	6.0	0.43	2.6	I	3.5	90	80	50	B
	<i>Pinus koreaiensis</i>	25	40	12.0	0.44	5.3	I	3.5	90	80	50	B
Fir	<i>Abies alba</i>	40	90	26.0	0.45	11.7	III	6.0	90	80	50	B
	<i>Abies sibirica</i>	30	90	21.0	0.47	9.9	II	6.0	95	85	50	C
	<i>Cunninghamia lanceolata</i>	30	90	21.0	0.40	8.4	II	5.0	95	85	65	D

Class I: < 6.0 t/ha stem + branch wood biomass or < 10.0 t/ha total biomass
Class II: 6.0-9.0 t/ha stem + branch wood biomass or 10.0–15.0 t/ha total biomass
Class III: > 9.0 t/ha stem + branch wood biomass or > 15.0 t/ha total biomass

≈ Pm = 5-10 kg CH₂O ha⁻¹hr⁻¹
≈ Pm = 10-15 kg CH₂O ha⁻¹hr⁻¹
≈ Pm = >15 kg CH₂O ha⁻¹hr⁻¹

Partitioning:

Soil/LGP rating

VS:

Stem+branch wood/leaves/roots = 60/20/20

S/MS:

Stem+branch wood/leaves/roots = 50/20/30

mS:

Stem+branch wood/leaves/roots = 40/20/40

biomass increments (stem and branch wood) of < 6 t/ha, 6-9 t/ha, and > 9 t/ha dry weight respectively. Table 11 presents rotation and productivity characteristics of selected deciduous and coniferous tree species (Jansen *et al.*, 1995).

For $P_m = 20 \text{ kg ha}^{-1} \text{ hr}^{-1}$ and a maximum leaf area index LAI = 5, b_{gm} is calculated from the equation:

$$b_{gm} = F \times b_o + (1 - F) b_c \quad (7)$$

where:

F = the fraction of the daytime the sky is clouded, $F = (A_c - 0.5 R_g) / (0.8 A_c)$, where A_c (or PAR) is the maximum active incoming short-wave radiation on clear days (de Wit, 1965), and R_g is incoming short-wave radiation (both are measured in $\text{cal cm}^{-2} \text{ day}^{-1}$)

b_o = gross dry matter production rate of a standard crop for a given location and time of the year on a completely overcast day, ($\text{kg ha}^{-1} \text{ day}^{-1}$) (de Wit, 1965)

b_c = gross dry matter production rate of a standard crop for a given location and time of the year on a perfectly clear day, ($\text{kg ha}^{-1} \text{ day}^{-1}$) (de Wit, 1965).

For values of P_m less than $20 \text{ kg ha}^{-1} \text{ hr}^{-1}$, b_{gm} is then calculated according to:

$$b_{gm} = F (0.5 + 0.025 P_m) b_o + (1 - F) (0.05 P_m) b_c \quad (8)$$

Relationships between temperature and rate of photosynthesis ($\text{kg CH}_2\text{O ha}^{-1} \text{ hr}^{-1}$) for deciduous, coniferous and deciduous coniferous (larches) tree species by productivity classes are presented in Table 12. Table 13 shows estimated relationships between temperature regime and growth period for deciduous trees and larches.

Table 12 Relationships between temperature and rate of photosynthesis (P_m in $\text{kg CH}_2\text{O ha}^{-1} \text{ hr}^{-1}$) for adaptability/productivity groups of boreal and temperate tree species

Adaptability/Productivity Class		Day-time Air Temperature (°C)									
		-5	0	5	10	15	20	25	30	35	40
Deciduous Trees											
I	P_m (max): 5-10 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0*	4.5	6.0	7.5	6.0	3.0	0.75	0
II	P_m (max): 10-15 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0*	7.5	10.0	12.5	10.0	5.0	1.5	0
III	P_m (max): 15-25 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0*	12.5	15.0	17.5	15.0	7.5	2.5	0
Deciduous Coniferous Trees											
I	P_m (max): 5-10 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0*	4.5	6.0	7.5	6.0	3.0	0.75	0
II	P_m (max): 10-15 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0*	7.5	10.0	12.5	10.0	5.0	1.5	0
III	P_m (max): 15-25 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0*	12.5	15.0	17.5	15.0	7.5	2.5	0
Coniferous Trees (clear days)											
I	P_m (max): 5-10 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0.5	1.0	2.0	4.5	6.0	7.5	6.0	3.0	0.75	0
II	P_m (max): 10-15 $\text{kg ha}^{-1} \text{ hr}^{-1}$	1.0	2.0	4.0	7.5	10.0	12.5	10.0	5.0	1.5	0
III	P_m (max): 15-25 $\text{kg ha}^{-1} \text{ hr}^{-1}$	1.5	3.0	6.0	12.5	15.0	17.5	15.0	7.5	2.5	0
Coniferous Trees (overcast days)											
I	P_m (max): 5-10 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	0.75	4.5	6.0	7.5	6.0	3.0	0.75	0
II	P_m (max): 10-15 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	1.5	7.5	10.0	12.5	10.0	5.0	1.5	0
III	P_m (max): 15-25 $\text{kg ha}^{-1} \text{ hr}^{-1}$	0	0	2.5	12.5	15.0	17.5	15.0	7.5	2.5	0
* no leaf/needle photosynthesis											

Table 13 Growth periods for deciduous tree species

Tree Species		Growth Period ¹¹		
		Start Conditions ¹²		End Conditions
Birch	<i>Betula pubescens</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
	<i>Betula pendula</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
	<i>Betula verrucosa</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
	<i>Betula tortuosa</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
	<i>Betula platyphylla</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
	<i>Betula papyrifera</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
Poplar	<i>Populus nigra</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
	<i>Populus euramericana cv rob.</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
	<i>Populus alba</i>	I	$\Sigma t=5 > 350$	Tmean <10°C
	<i>Populus tremula</i>	I	$\Sigma t=5 > 350$	Tmean <10°C
	<i>Populus balsamifera</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
	<i>Populus maximowiczii</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
	<i>Populus tomentosa</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
	<i>Populus euphratica</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
Willow	<i>Salix alba</i>	I	$\Sigma t=5 > 350$	Tmean <10°C
	<i>Salix viminalis</i>	I	$\Sigma t=5 > 350$	Tmean <10°C
Oak	<i>Quercus robur</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus petraea</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus rubra</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus lanuginosa</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus cerris</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus acutissima</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus variabilis</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Quercus mongolica</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
Beech	<i>Fagus sylvatica</i> ,,	IV	$\Sigma t=5 > 550$	Tmean <10°C
Hornbeam	<i>Carpinus betulus</i>	IV	$\Sigma t=5 > 550$	Tmean <10°C
Ash	<i>Fraxinus excelsior</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
	<i>Fraxinus mandshurica</i>	IV	$\Sigma t=5 > 550$	Tmean <10°C
Alder	<i>Alnus glutinosa</i>	III	$\Sigma t=5 > 450$	Tmean <10°C
Lime	<i>Tilia cordata</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
Acer	<i>Acer plantanoides</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Acer campestre</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
	<i>Acer campbellii</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
Black locust	<i>Robinia pseudoacacia</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
Chestnut	<i>Castanea sativa</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
Walnut	<i>Juglans regia</i>	V	$\Sigma t=5 > 650$	Tmean <10°C
Larch	<i>Larix gmelinii</i>	II	$\Sigma t=5 > 400$	Tmean <10°C
	<i>Larix sibirica</i>	II	$\Sigma t=5 > 400$	Tmean <10°C

Maximum growth rate at actual LAI

The maximum rate of gross biomass production (b_{gm}) refers to a reference LAI of 5. When actual LAI deviates, adjustment of b_{gm} is achieved by means of a correction factor L , which equals the ratio of b_{gm} at actual LAI to b_{gm} at LAI of 5. As shown in Figure 3, the effect of LAI on b_{gm} is small when LAI is larger than 5 and a near complete ground cover or light interception is achieved.

11 Based on calculations for Bologna (Italy), Vienna (Austria), De Bilt (Netherlands), Stockholm (Sweden), Moscow (Russia), and Kiruna (Sweden).

12 Species-specific thresholds for meeting phenological requirements for bud burst and flushing have been related to temperature sums for mean temperatures exceeding 5°C (Barnes *et al.*, 1998).

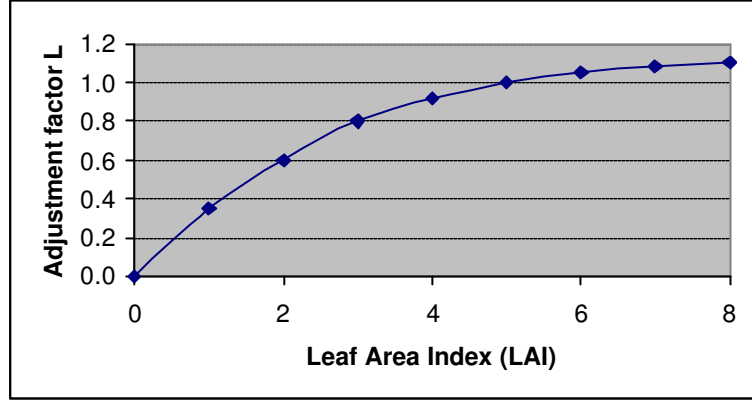


Figure 3 Relationship between leaf area index (LAI) and maximum growth rate as a fraction of the maximum growth rate at LAI of 5

The LAI of individual tree species/LUTs has been adjusted when moisture stress thresholds are exceeded (Table 11). In case ($e = ET_a/ET_o \cdot 100$) falls short of the species specific drought tolerance parameter κ , but is not less than parameter λ , the leaf area index has been adjusted proportionately to the values between 100% and minimum value μ corresponding to position of e with regard to drought tolerance parameters κ and λ . In case e falls short of λ then zero biomass increment (not suitable) is assumed. The adjusted LAI has been calculated as follows:

$$LAI_{adj} = \begin{cases} LAI & e \geq \kappa \\ LAI \left(\frac{e - \lambda}{\kappa - \lambda} + \mu \cdot \frac{\kappa - e}{\kappa - \lambda} \right) & \alpha \geq e \geq \lambda \\ not\ suitable & e < \lambda \end{cases} \quad (9)$$

where:

$$e = ET_a/ET_o \cdot 100$$

Respiration losses

To calculate the maximum rate of net biomass production (b_{nx}), the maximum rate of gross biomass production (b_{gm}) and the rate of respiration (s_m) are required. Here, growth respiration is considered a linear function of the rate of gross biomass production (McCree, 1974), and maintenance respiration a linear function of net biomass that has already been accumulated (B_m). When the rate of gross biomass production is b_{gm} , the respiration rate s_m is:

$$s_m = k b_{gm} + c B_m \quad (10)$$

where k and c are the proportionality constants for growth respiration and maintenance respiration respectively, and B_m is the net biomass accumulated at the time of maximum rate of net biomass production. For both legume and non-legume species k equals 0.28. However, c is temperature dependent and differs for the two species groups. At 30°C, factor C_{30} for a legume species equals 0.0283 and for a non-legume species 0.0108. The temperature dependence of C_t for both species groups is modeled with a quadratic function:

$$C_t = C_{30} (0.044 + 0.0019 T + 0.0010 T^2). \quad (11)$$

Net average annual biomass increment

In order to characterize land productivity, we calculate average annual biomass increments achievable in the longer term. Net average annual biomass increment (B_a) is obtained from (5),

$$B_a = B^* / R = N \cdot b_{nx} / a_x \quad (12)$$

In our simulations it is assumed that the standing biomass at 50% rotation length is 38% of the standing biomass at 100% of the optimum rotation length. In this case, the Chapman-Richard function implies that the maximum rate of biomass increase occurs at a relative age $r^* = 0.575$, that the relative yield $y(r^*)$ at relative age r^* equals $y(r^*) = 0.481$, and that the maximum relative biomass increase $a(r^*) = a_x = 1.360$.

Using (6), (9) and (10) and the parameter values presented above, we calculate the average net biomass production B_a :

$$B_a = ((1 - k) \cdot b_{gm} \cdot L \cdot N / a_x) / (1 + N \cdot y(r^*) \cdot C_t / a_x) \quad (13)$$

and inserting parameter values we obtain,

$$B_a = (0.529 \cdot b_{gm} \cdot L \cdot N) / (1 + N \cdot 0.354 \cdot C_t) \quad (14)$$

where, as before:

b_{gm} = maximum rate of gross biomass production at leaf area index (LAI) of 5 ($\text{kg CH}_2\text{O ha}^{-1}\text{day}^{-1}$)

L = Maximum growth ratio, equal to the ratio of b_{gm} at actual LAI to b_{gm} at LAI of 5.

N = Length of growth period during the year (days)

C_t = Maintenance respiration

Partitioning of biomass

Potential average annual constraint-free wood biomass increment¹³ (B_w) is calculated from B_a using the equation:

$$B_w = H_{i_{wood}} \cdot B_a \quad (15)$$

where:

$H_{i_{wood}}$ = harvest index, i.e., proportion of the net biomass of the species that is stem and branch wood (or in case of coppice systems shoots and twigs).

The partitioning coefficients (wood, branches, twigs and foliage, and roots) are species-specific and are also closely related to soil water availability and fertilization. Reference values for stem wood and branches equal 0.6, for twigs and foliage 0.2 and 0.2 for roots. With fertilization and irrigation the harvest index for wood biomass may increase at the expense of root biomass.

Thus, climate and tree species characteristics that apply in the computation of net biomass increments are: (a) heat and radiation regime over the vegetation period, (b) adaptability/productivity classes to determine applicable rates of photosynthesis, P_m , (c) length of vegetation period, (d) maximum leaf area index, and (e) partitioning coefficients.

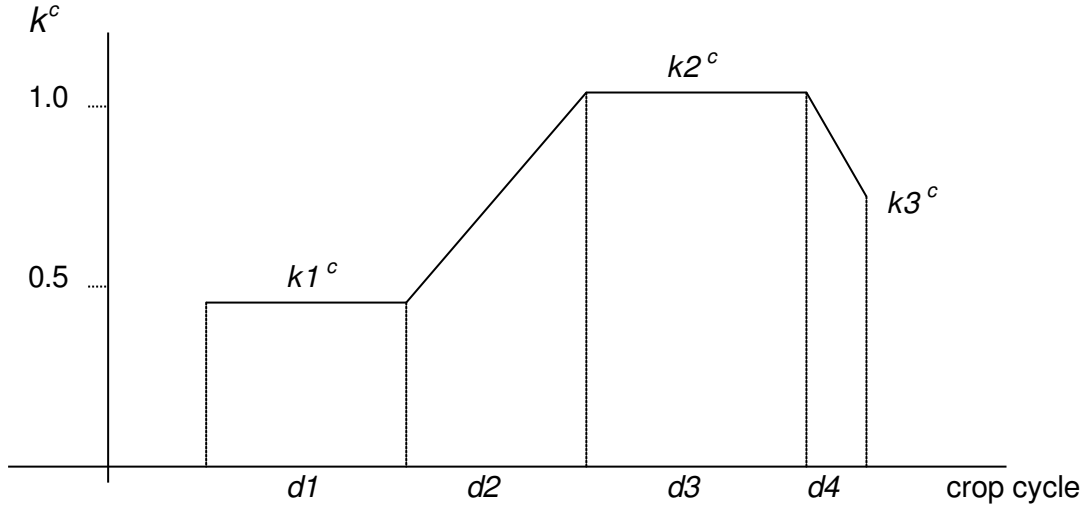
13 Similarly annual potential root biomass increment and annual foliage can be calculated by using the appropriate harvest indexes, $H_{i_{roots}}$ and $H_{i_{twigs \text{ and } foliage}}$, or in case of short rotation coppice systems $H_{i_{shoots \text{ and } twigs}}$

Moisture limited biomass increments

The calculation of moisture limited biomass increments uses the procedures described in FAO (1992) and FAO (1998), known as the CROPWAT method. In this approach, the species-specific potential evapotranspiration ETo^c is related to reference evapotranspiration ETo as,

$$ETo^c = k^c \times ETo \quad (16)$$

where k^c is calculated from a piecewise linear function as sketched below:



The function is parameterized by means of seven parameters. Four coefficients, $d1, \dots, d4$, relate to the characteristics of the seasonal leaf area development for deciduous tree species, denoting the length (in days) of four development stages, namely, leaf flushing, early stage, mid season stage, and late-season stage. Another three parameters, $k1^c, k2^c$ and $k3^c$, define relationship (16) for the individual stages. For non-deciduous tree species parameter $k2^c$ is used for the total period in which photosynthesis is possible.

Let D_1, \dots, D_4 denote the days belonging to each of the four development stages,

$$D_1 = \{j \mid 1 \leq j \leq d1\},$$

$$D_2 = \{j \mid d1 < j \leq d1 + d2\},$$

$$D_3 = \{j \mid d1 + d2 < j \leq d1 + d2 + d3\}, \text{ and}$$

$$D_4 = \{j \mid d1 + d2 + d3 < j \leq d1 + d2 + d3 + d4\},$$

then the value of k^c for a particular day j is defined by piecewise linear functions:

$$k_j^c = \begin{cases} k1^c & j \in D_1 \\ k1^c + (j - d1) \cdot \frac{k2^c - k1^c}{d2} & j \in D_2 \\ k2^c & j \in D_3 \\ k2^c + (j - (d1 + d2 + d3)) \cdot \frac{k3^c - k2^c}{d4} & j \in D_4 \end{cases} \quad (17)$$

Using (16) and (17), species-specific potential evapotranspiration over the four leaf area development stages, $TETo_k^c$, and the entire vegetation period, $TETo^c$ can be calculated:

$$TETo_k^c = \sum_{j \in D_k} k_j^c \cdot ETo_j \quad k = 1, \dots, 4 \quad (18)$$

$$d0 = d1 + d2 + d3 + d4$$

$$TETo^c = \sum_{j=1}^{d0} k_j^c \cdot ETo_j \quad (19)$$

Similarly, applying a species-specific soil water balance, actual evapotranspiration is calculated:

$$TETA_k^c = \sum_{j \in D_k} ETA_j^c \quad k = 1, \dots, 4 \quad (20)$$

$$TETA^c = \sum_{j=1}^{d0} ETA_j^c \quad (21)$$

where ETA^c is determined according to:

$$W_{j+1}^c = \min(W_j^c + P_j - ETA_j^c, Sa) \quad (22)$$

$$ETA_j^c = \begin{cases} ETo_j^c & \text{if } (W_j^c + P_j) \cdot d \geq Sa \cdot d \cdot (1 - p_j^c) \\ \rho_j \cdot ETo_j^c & \text{else} \end{cases} \quad (23)$$

with,

$$\rho_j = \frac{ETA_j^c}{ETo_j^c} = \frac{W_j^c + P_j}{Sa \cdot (1 - p_j^c)} \quad (24)$$

j number of day in year

Sa available soil moisture holding capacity (mm/m)

d rooting depth (m)

p_j^c soil water depletion fraction below which $ETA < ETo$

ρ_j actual evapotranspiration proportionality factor.

Sa and d are defined by the respective values of the soil units in individual grid-cells. The computation of water-limited biomass increment B_l is now easily obtained, following FAO (1979, 1992 and 1998):

$$1 - \frac{B_l}{B_a} = k^y \cdot \left(1 - \frac{TETA^c}{TETo^c}\right) \quad (25)$$

We evaluate (25) in two variants, first over the entire vegetation period and then according to individual growth stages. The more severe of the two conditions determines B_l . The respective reduction multipliers f_0 and f_i are defined by,

$$f_0 = 1 - k_0^y \cdot \left(1 - \frac{TETA^c}{TETo^c}\right) \quad (26)$$

and

$$f_1 = \prod_{k=1}^4 \left(1 - k^y \cdot \left(1 - \frac{TETa_k^c}{TETO_k^c}\right)\right) \quad (27)$$

where the coefficient expressing the sensitivity of biomass increment to moisture deficit, k^y , are based on FAO (1992 and 1998).

Applying (26) and (27) to potential biomass increment from (15), we obtain the final results,

$$B_l = \min(f_0, f_1) \cdot B_a \quad (28)$$

4.4 Climate related Productivity Constraints

Climatic constraints may cause direct or indirect losses of biomass increments. These constraints are influenced by the following conditions:

- Constraints indirectly related to climatic conditions such as pests, diseases and invasion of unwanted species or weeds;
- Climatic factors which affect the efficiency of forestry operations and costs of production,
- Occurrence of late and early frost, and
- Forest fires.

The climatic constraints for individual tree species by management objective are specified for the temperature and moisture regimes in each grid-cell. In particular the climatic constraints are linked to: (i) length of thermal growing period ($LGP_{t=5}$), (ii) length of frost-free period ($LGP_{t=10}$), (iii) accumulated temperatures, (iv) length of moisture growing period (LGP), and (v) seasonal wetness.

Frost risks

Frost risks are accounted for in matching the early and late frost tolerance/sensitivity of individual tree species with prevailing periods during which mean daily temperatures exceed 10°C. These periods are assumed to represent, by and large, the frost-free periods (Table 9).

Forest fire risks

Forests fire risk has been assumed to be related to the following main factors: (i) climate conditions (aridity and wind), forest species susceptibility to fire, and (iii) forest fire prevention measures (access roads and fire protection barriers). Forest species may be listed in decreasing order of fire-susceptibility as follows: (1) light coniferous species, (2) dark coniferous species and (3) broad-leaved species.

Table 14 presents the assumptions we have made for forest fire intervals for unprotected forest resources of respectively broad-leaved, dark coniferous and light coniferous tree species under three distinct aridity conditions (see also Section 4.1, conservation forestry and Plate 12, Aridity Index).

The tentative forest fire intervals presented in Table 14 are applied only for the suitability analysis of conservation forest LUTs. Traditional production forest and biomass plantation forest LUTs are assumed to require full fire protection by means of access roads and fire protection barriers. These measures, however, may take away between 5 and 10 % of potentially productive forest areas.

Table 14 Assumed forest fire intervals for conservation forestry LUTs

	Aridity Index Period (P/PET)		
	< 0.5	0.5-1.0	>1.0
Dominantly broadleaved forest	n.a.	>150 years	>150 years
Dominantly dark coniferous forests	n.a.	100 years	>150 years
Dominantly light coniferous forests	25 years	50 years	>150 years

Indirect climatic constraints

At this stage of the model development, it has not been possible to implement in the climatic suitability assessment other climatically driven constraints such as pests and diseases, invasion of unwanted species or weeds, and limitations of workability and accessibility (due to excessive wetness), which may very well reduce annual biomass increments.

4.5 Soil and Terrain Suitability Analysis

Soil suitability

From the basic soil requirements of forest tree species, a number of soil characteristics have been established which relate to growth and biomass production. For the 52 forest tree species considered, optimal, sub-optimal and marginal/unsuitable levels of these soil characteristics have been established (Table 10).

Beyond critical ranges, tree species cannot be expected to grow satisfactorily and produce biomass. Soil suitability classifications are based on knowledge of requirements, prevailing soil conditions, and applied management. In other words, soil suitability classifications describe in broad terms to what extent soil conditions match tree species requirements under defined input and management circumstances.

Specifically for soil suitability evaluation purposes, a range of quantitative and qualitative attributes have been identified as being required for soil suitability assessments as follows:

- (i) Information that can be inferred from the soil units of legends of the soil maps. This includes: soil drainage, soil depth, gravel content, electrical conductivity, exchangeable sodium percentage, calcium carbonate content and gypsum content.
- (ii) Other attributes require quantitative data and are to be derived from soil profile databases. (see Section 3.2).

In Appendix III soil unit and soil phase suitability ratings are proposed for the 52 tree species considered. Two sets of ratings have been compiled. One set for natural soil conditions, excluding consideration of any inputs or specific soil management. This set of ratings has been used for the soil suitability assessment regarding conservation forestry LUTs (see Table 6). A second set of ratings was applied for traditional production forest and biomass plantation forestry LUTs (see Tables 7 and 8). These latter ratings assume inputs in terms of nutrients and specific management, in particular, in support of juvenile growth. The ratings presented for soil units and soil phases in Appendix III are the following:

S1	(1)	Optimal conditions
S2	(2)	Sub-optimal conditions
S1/S2	(3)	50% optimal and 50% sub-optimal conditions
S1/N	(4)	50% optimal and 50% not suitable conditions
S2/N	(5)	50% sub-optimal and 50% not suitable conditions
N	(6)	Not suitable conditions

Terrain suitability

Sustainable forest production on sloping land is concerned with the prevention of erosion of topsoil and decline of fertility. Usually this is achieved by combining special forest management and soil conservation measures. Slopes with tree stands that are providing inadequate soil protection and without sufficient soil conservation measures, may cause a considerable risk of accelerated soil erosion. In the short term such situation may lead to production losses due to erosion of topsoil. In the long term, this may result in truncation of the soil profile and consequently reduction of natural soil fertility and of available soil moisture.

The terrain-slope suitability rating used in the FAEZ model captures the factors described above, which influence production and sustainability. This is achieved through: (i) defining for the various forest/LUTs permissible slope ranges by setting maximum slope limits; (ii) for slopes within the permissible limits, accounting for likely yield reduction due to loss of topsoil, and (iii) distinguishing among forestry practices ranging from manual to highly mechanized management.

Ceteris paribus, i.e., under similar forest cover, soil erodibility and forestry and soil management, soil erosion hazards largely depend on amount and intensity of rainfall. Data on rainfall amount is available on a monthly basis in the 0.5 degree lat/long climate databases.

To account for clearly existing differences in both amount and within-year distribution of rainfall, use has been made of the modified Fournier index (Fm), which reflects the combined effect of rainfall amount and distribution (FAO/UNEP, 1977), as follows:

$$Fm = 12 \sum_{i=1}^{12} \frac{p_i^2}{Pann}$$

where:

p_i = precipitation of month i

$Pann$ = total annual precipitation

When precipitation is equally distributed during the year, i.e., in each month one-twelfth of the annual amount is received, then the value of Fm is equal to $Pann$. On the other extreme, when all precipitation is received within one month, the value of Fm amounts to twelve times $Pann$. Hence, Fm is sensitive to both total amount and distribution of rainfall and is limited to the range of $Pann \leq Fm \leq 12 Pann$. The Fm index has been calculated for all 0.5 degree grid-cells of the climatic inventory. The results have been grouped in six classes, namely: $Fm < 1300$, 1300-1800, 1800-2200, 2200-2500, 2500-2700, and $Fm > 2700$.

Slope ratings are defined for the seven slope range classes used in the land resources database, namely: 0-2% flat, 2-5% gently sloping, 5-8 % undulating, 8-16% rolling, 16-30% hilly, 30-45% steep, and > 45% very steep. Three suitability-rating classes are employed:

S1	Optimal conditions
S2	Sub-optimal conditions
N	Not suitable conditions

Table 15 presents percentage distributions of terrain-slope ratings for the three forest management types (*conservation forestry*, *traditional production forestry* and *biomass forestry*) for six class ranges of the modified Fournier index Fm ($Fm < 1300$; 1300-1800; 1800-2200; 2200-2500; 2500-2700 and >2700).

Table 15 Terrain-slope ratings (Fm <1300)

Slope Gradient Classes	0-2 %			2-5%			5-8%			8-16%			16-30%			30-45%			> 45%		
Suitability Distribution (%)	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	N	N
Conservation Forestry	100			100			100			100			100			100			100		
Traditional Production Forestry	100			100			100			100			50	50			50	50			100
Biomass Forestry	100			100			75	25			50	50			100			100			100

(Fm: 1300-1800)

Slope Gradient Classes	0-2 %			2-5%			5-8%			8-16%			16-30%			30-45%			> 45%		
Suitability Distribution (%)	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	N	N
Conservation Forestry	100			100			100			100			100			100			100		
Traditional Production Forestry	100			100			100			100			50	50			50	50			100
Biomass Forestry	100			100			75	25			50	50			100			100			100

(Fm: 1800-2200)

Slope Gradient Classes	0-2 %			2-5%			5-8%			8-16%			16-30%			30-45%			> 45%		
Suitability Distribution (%)	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	N	N
Conservation Forestry	100			100			100			100			100			100			100		
Traditional Production Forestry	100			100			100			100			50	50			25	75			100
Biomass Forestry	100			100			75	25			25	75			100			100			100

(Fm: 2200-2500)

Slope Gradient Classes	0-2 %			2-5%			5-8%			8-16%			16-30%			30-45%			> 45%		
Suitability Distribution (%)	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	N	N
Conservation Forestry	100			100			100			100			100			100			100		
Traditional Production Forestry	100			100			100			100			50	50			25	75			100
Biomass Forestry	100			100			75	25			25	75			100			100			100

(Fm: 2500-2700)

Slope Gradient Classes	0-2 %			2-5%			5-8%			8-16%			16-30%			30-45%			> 45%		
Suitability Distribution (%)	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	N	N
Conservation Forestry	100			100			100			100			100			100			100		
Traditional Production Forestry	100			100			100			75	25		25	75				100			100
Biomass Forestry	100			100			50	50				100			100			100			100

(Fm >2700)

Slope Gradient Classes	0-2 %			2-5%			5-8%			8-16%			16-30%			30-45%			> 45%		
Suitability Distribution (%)	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N	S1	N	N
Conservation Forestry	100			100			100			100			100			100			100		
Traditional Production Forestry	100			100			100			75	25		25	75				100			100
Biomass Forestry	100			100			50	50				100			100			100			100

4.6 Suitability Analysis of Seasonal Wet Sites

For assessing the suitability of wetness prone soils, the tree species have been grouped according their tolerance to excess moisture and resulting poor oxygen supply to rooting systems (Shugart *et al.*, 1992):

- Group I** Tree species not tolerant to wetness
- Group II** Tree species somewhat tolerant to wetness
- Group III** Tree species tolerant to wetness
- Group IV** Tree species requiring wet conditions

Group I: *Fagus sylvatica*, *Quercus petraea*, *Q. rubra*, *Robinia pseudoacacia*, *Castanea sativa*, *Juglans regia*, *Picea abies*, *P. asperata*, *P. ajanensis*, *P. obovata* and *P. koreaiensis* are not tolerant to wetness and cannot be grown on seasonal wet soils. All Fluvisols, Gleysols and sites affected by water-logging (Table 5) due to snowmelt are considered **not suitable** (N).

Group II: *Betula tortuosa*, *Populus tomentosa*, *P. euphratica*, *Quercus robur*, *Acer plantanoides*, *A. campestre*, *A. campbellii*, *Pinus sibirica*, *P. koreaiensis* and to some extent *Betula pendula*, *B. verrucosa*, *B. platyphylla*, *B. papyrifera*, *Populus termula*, *Quercus lanuginosa*, *Q. cerris*, *Q. acutissima*, *Q. variabilis*, *Q. mongolica*, *Carpinus betulus*, *Tilia cordata*, *Pinus tabulaeformis*, *P. massoniana*, *P. yunnanensis*, *Abies alba*, *A. sibirica* and *Cunninghamia lanceolata* are somewhat tolerant to wetness and benefit to some extent from high groundwater tables and extra residual moisture available in Fluvisols and Gleysols. In water collecting sites with less than 30 days LGP, it is assumed there is on the average insufficient water to grow successfully trees, especially since the contribution from rainfall is also almost non-existent. At LGPs longer than 120 days trees will grow irrespective additional water. It has been assumed that the Fluvisols/Gleysols are too wet in LGPs over 300 days. Table 16 presents suitability classes for the Group II tree species by length of growing period, accounting for differences in amounts of residual moisture and in periods with water-logging and inundation. Water-logging and inundation affect different parts of Fluvisols and Gleysols differently. Higher parts are much less affected than the lower parts. Areas affected by prolonged water-logging of more than 10 days as result of water from snowmelt (Table 5) are considered **not suitable** (N) for Group II tree species. Areas affected between 5 and 10 days are rated **sub-optimal** (S2).

Table 16 LGP suitability ratings for water collecting sites: Group II tree species

Suitability class	Distribution of suitability classes (%) for water-collecting sites by LGP class														
	0	1-29	30-59	60-89	90-119	120-149	150-179	180-209	210-239	240-269	270-299	300-329	330-364	365-	365+
VS					33	33	33	33	33						
S				33						33					
MS			33		33	33	33	33	33		33				
mS			33	33						33	33				
NS	100	100	34	34	34	34	34	34	34	34	34	100	100	100	100

Group III: *Populus alba*, *P. basamiferas*, *P. maximowiczii*, *Fraxinus excelsior*, *F. mandshurica*, *Alnus glutinosa*, *Larix sibirica* and surely *Betula pubescens*, *Populus nigra*, *P. euramericana*, *Larix gmelinii* and *Pinus sylvestris* are relatively tolerant to wet conditions. These species tolerate prolonged periods of water-logging and some inundation. Table 17 presents suitability classes for the Group III tree species by length of growing period, accounting for differences in amounts of residual moisture and for periods with waterlogging and inundation. Areas affected by snowmelt water are rated as

follows for Group III tree species. Water-logging periods of less than 10 days are considered to pose *no constraint* (S1) to growth of Group III tree species; periods between 10 and 30 days are considered *sub-optimal* (S2), and periods of more than 30 days *not suitable* (N).

Table 17 LGP suitability ratings for water collecting sites: Group III tree species

Suitability class	Distribution of suitability classes (%) for water-collecting sites by LGP class														
	0	1-29	30-59	60-89	90-119	120-149	150-179	180-209	210-239	240-269	270-299	300-329	330-364	365-	365+
VS					33	33	33	33	33	33	33				
S				33								33			
MS			33		33	33	33	33	33	33	33		33		
mS		33	33	33								33	33		
NS	100	67	34	34	34	34	34	34	34	34	34	34	34	100	100

Group IV: Willows, *Salix alba* and especially *Salix viminalis*, are adapted to wet conditions and tolerate prolonged periods of water-logging and inundation. Long periods of water-logging and/or inundation affect growth. Table 18 presents suitability classes for these tree species by length of growing period.

Table 18 LGP suitability ratings for water collecting sites : Group IV tree species

Suitability class	Distribution of suitability classes (%) for water-collecting sites by LGP class														
	0	1-29	30-59	60-89	90-119	120-149	150-179	180-209	210-239	240-269	270-299	300-329	330-364	365-	365+
VS					33	33	33	33	33	33	33	33	33		
S				33	33	33	33	33	33	33	33	33	33	33	
MS			33	33	34	34	34	34	34	34	34	34	34	33	33
mS			33	34										34	33
NS	100	100	34												34

Chapter 5 Preliminary Results of Potential Forest Productivity Assessment

This section describes preliminary results¹⁴ of the FAEZ tree species productivity assessment. The study covers the territory of China, Mongolia and the former Soviet Union (FSU).

Estimations of land suitability/productivity were made involving 52 different tree species and for three assumed management objectives. For biomass plantation forestry and traditional production forestry, results are expressed in terms of annual biomass increments over optimum rotation periods for the *best* producing species. For conservation forestry only land suitability was determined. The basic six suitability classes used in the presentation of the results reflect the performance of the *best* adapted species in each land unit as follows:

Table 19 Suitability classification for conservation forestry

Symbol	Description	Percentage of maximum attainable annual growth for best adapted species
VS	Very Suitable	80-100
S	Suitable	60-80
MS	Moderately Suitable	40-60
mS	Marginally Suitable	20-40
VmS	Very Marginally Suitable	5-20
NS	Not Suitable	<5

The suitability/productivity assessments were carried out for 5 km grid-cells, by matching climate characteristics, calculating gross biomass increments, and subsequently, by matching soil and terrain characteristics of each grid-cell with ecological requirements of each considered tree species by management objective. The results were stored in a large database, containing a distribution of land suitability classes and attainable annual biomass increments by 5 km grid-cell for each of the 52 tree species.

For each grid-cell suitability results are also represented by a suitability index *SI*, reflecting the suitability make-up of a grid-cell in accordance with the definition of suitability classes, namely as:

$$SI = VS*0.9 + S*0.7 + MS*0.5 + mS*0.3 + VmS*0.1.$$

The grid-cell results have subsequently been aggregated by province for China, by individual state of the FSU (for Russia by oblast) and for Mongolia. Table A-1 in Appendix I presents a list of codes and names of the States of the FSU and the oblasts of Russia. (Plate 13 shows a map of the FSU¹⁵ and Plate 14 of China with the boundaries of the various administrative divisions¹⁶).

Depending on management objectives different sub-sets of the 52 tree species were considered as follows:

- (i) Biomass plantation forestry - Poplar, Alder, Ash and Willow species.
- (ii) Traditional production forestry - Birch, Poplar, Oak, Beech, Robinia, Larch, Spruce, Pine and Fir species.
- (iii) Conservation forest - all 52 species.

14 This is the first systematic forest productivity potential assessment in its kind and before publishing final results, substantial verification and validation of methodology and calculation procedures is required (see also disclaimer).

15 The codes in Table A-1 correspond with the codes used in Plate 13.

16 It should be noted that until recently Chengqing Province was a part of Sichuan Province. The results presented for the Sichuan Province include the territory of the new Province Chengqing.

From various data available in the IIASA LUC project, a GIS¹⁷ coverage of agriculture and forest land in China, Mongolia and the States of the Former Soviet Union was compiled (Plate 12). This coverage was used to mask or select areas that are in use for cultivation, under forest or under other permanent use such as urban areas.

Also, a layer has been created to reflect accessibility¹⁸. It records the presence of roads and railroads and marks grid-cells as accessible, that fall at least partly within a 10 km buffer zone around roads and railroads (Plate 11). This coverage was used to mask non-accessible areas (see Section 3.4)

5.1 Assessment Scenarios

To demonstrate and test the application of FAEZ, a productivity analysis for the territory of China, Mongolia and the former Soviet Union has been carried out for seven scenarios, according to the following assumptions:

- Scenario 1:** All land is assessed for biomass plantation, traditional and conservation forestry LUTs regardless accessibility or other current uses.
- Scenario 2:** All accessible land is assessed for both biomass plantation and traditional production forestry LUTs.
- Scenario 3:** As in scenario 1, excluding grid-cells classified as dominantly cultivated land and urban areas.
- Scenario 4:** As in scenario 1, only for areas classified as currently under forest.
- Scenario 5:** As in scenario 2, excluding cultivated land and urban areas.
- Scenario 6:** As in scenario 2, only for areas currently under forest.
- Scenario 7:** As in scenario 3, excluding areas currently under forest.

Results aggregated by administrative units are presented in tabular form in the Appendix II. The results are organized by major LUTs: (i) Biomass plantation forestry (results have been provided separately for Willow (*Salix viminalis*) alone, and for the biomass plantation forestry species combined); (ii) Traditional production forestry (results for the traditional forestry species combined), and (iii) Conservation forestry (results for the conservation forestry species combined). Selected results as provided in the Appendix II are listed below:

Salix viminalis:

- Table A2 All areas.
- Table A3 Accessible areas.
- Table A4 Accessible areas, excluding cultivated and urban areas.

Biomass plantation forestry:

- Table A5 All areas.
- Table A6 Accessible areas.
- Table A7 Accessible areas, excluding cultivated and urban areas.

17 The map showing cultivated areas and forested areas has been compiled from the land categories and the agricultural regionalization inventories of the FSU (Stolbovoi *et al.*, 1997a, 1997b), the 1:1,000,000 land use map of China (Wu Chuanjun, 1991) and Vegetation Distribution for Mongolia (Sitch and van Minnen, 1996). These three inventories were combined, a reclassification was applied featuring areas with dominantly agriculture and forest, and was transferred to the 5km grid.

18 Based on existing infrastructure information of the Digital Chart of the World (DCW, 1993), an accessibility inventory has been created for the territory of the FSU, China and Mongolia. Standard GIS procedures were used to create buffer zones of 10 km around the roads and railways, i.e., 5 km on each side. The buffer coverage was then transferred to a 5 km grid, which in turn was used in this study as mask for accessibility.

Table A8	Accessible areas currently under forest.
Table A9	All areas, excluding cultivated areas, urban areas and areas currently under forest.

Traditional production forestry:

Table A10	All areas.
Table A11	Accessible areas.
Table A12	Accessible areas, excluding cultivated and urban areas.
Table A13	Accessible areas currently under forest.
Table A14	All areas, excluding cultivated areas, urban areas and areas currently under forest.

Conservation forestry:

Table A15	All areas.
Table A16	All areas, excluding cultivated and urban areas.
Table A17	All areas, excluding cultivated areas, urban areas and areas currently under forest.

The individual tables of Appendix II are organized as follows: The first data column (Total area) records how much land is assessed, given the scenario restrictions. For example, in Mongolia under scenario 1 (considering all the land) the total is 156,198 thousand hectares; under Scenario 2 (land that is accessible by road or railroad) the total is 63,130 thousand hectares; under Scenario 3 (land, excluding cultivated and urban areas) the total is 154,858 thousand hectares, under Scenario 4 (land currently under forest) the total is 7,058 thousand hectares, under Scenario 5 (land that is accessible by road or railroad, excluding cultivated and urban areas) the total is 62,805 thousand hectares, under Scenario 6 (land that is accessible by road or railroad and is currently under forest) the total is 1,163 thousand hectares, and finally under Scenario 7 (land that is neither under forest, nor cultivated or urban) the total is 147,800 thousand hectares.

The next group of nine columns presents extents of land variously suitable for tree growth (see for definition of the suitability classes Table 19). In the case of biomass plantation forestry and traditional forestry LUTs a further eight columns follow, presenting production (total annual biomass increments by suitability classes). Finally a last group of eight columns presents per hectare production following the same logic.

5.2 Results for Biomass Plantation Forestry

Table 20 provides extents of prime land for Willow considering respectively: all land, all accessible land, and all accessible land with the exclusion of cultivated and urban areas.

Results for Willow, which is assumed to be grown in short rotation coppice system (SRCS) with rather specific environmental requirements for growth and management, indicate that prime land (VS+S) is quite rare. Some areas exist in mainly the Baltic States, Byelorussia, Ukraine, and Russia. A rather large area is found in China. However, as can be seen in Table 20, when only areas are considered that are accessible and when excluding cultivated and urban areas, then in China, only less than 3 million hectares remain from approximate 12 million hectares of potential prime willow land.

Examples of selected results for Willow (*Salix viminalis*) are presented in map-form as follows:

Plate 15	Productivity of <i>Salix viminalis</i> (t/ha biomass yield).
Plate 16	Productivity of <i>Salix viminalis</i> in accessible areas, excluding cultivated and urban areas (t/ha biomass yield).

Table 21 presents results in the same format as Table 20, but now combined for all biomass plantation species considered (Poplar, Alder, Ash and Willow species). The pattern observed with the Willow only, remains in tact. Major tracts of potential prime land are found in Byelorussia, the Ukraina, Russia. The largest extents are found in China. However, when we confine to accessible areas and take away cultivated and urban areas, the extents generally reduce approximately three quarters. From this study it appears that seven of the countries investigated have virtually no potential prime land at all

for biomass plantation forestry. These countries are: Mongolia, Armenia, Azerbaijan, Kazakstan, Kirghiztan, Tajikistan and Turkmenistan.

Examples of selected results for the biomass plantation species combined are presented in map-form as follows:

Plate 17 Suitability index for biomass plantation forestry (excluding cultivated and urban areas).

Plate 18 Suitability index for biomass plantation forestry of current forest areas.

Plate 19 Suitability index for biomass plantation forestry in accessible areas (excluding cultivated and urban areas).

Table 20 Very suitable and suitable areas for biomass plantation with Willow (*Salix viminalis*)

	Total area	VS+S Total areas		Accessible areas		VS+S Accessible areas		VS+S Accessible areas, excluding cultivated land and urban areas	
	(1) (000ha)	(2) (000ha)	% of (1)	(3) (000ha)	% of (1)	(4) (000 ha)	% of (3)	(000 ha)	% of (4)
Mongolia	156,198	0	0	63,130	40	0	0	0	-
Armenia	2,690	0	0	2,025	75	0	0	0	-
Azerbaijan	7,868	0	0	6,095	77	0	0	0	-
Byelorussia	20,348	640	3	17,955	88	549	3	184	34
Estonia	3,938	137	3	3,365	73	112	3	74	66
Georgia	6,523	6	0	4,763	73	6	0	1	17
Kazakhstan	268,445	1	0	165,068	61	1	0	1	100
Kirghiztan	19,548	0	0	10,428	53	0	0	0	-
Latvia	6,313	284	4	5,573	88	245	4	91	37
Lithuania	6,420	582	9	6,018	94	543	9	176	32
Moldavia	3,000	16	1	2,848	95	15	1	1	7
Tajikistan	9,013	0	0	4,775	53	0	0	0	-
Turkmenistan	45,390	0	0	22,535	50	0	0	0	-
Ukraine	57,570	634	1	51,955	90	573	1	77	13
Russia	1,674,521	3,014	0	503,616	30	2,274	0	704	31
Russia West of Urals	389,947	1,353	0	244,894	63	1,173	0	158	13
Russia East of Urals	1,284,574	1,661	0	258,722	20	1,101	0	546	50
China	937,041	12,421	1	416,566	44	8,408	2	2,950	35

Table 21 Very suitable and suitable areas for biomass plantation Forestry

	Total area	VS+S Total areas		Accessible areas		VS+S Accessible areas		VS+S Accessible areas, excluding cultivated land and urban areas	
	(1)	(2)		(3)		(4)			
	(000ha)	(000ha)	% of (1)	(000ha)	% of (1)	(000 ha)	% of (3)	(000 ha)	% of (4)
Mongolia	156,198	0	0	63,130	40	0	0	0	-
Armenia	2,690	0	0	2,025	75	0	0	0	-
Azerbaijan	7,868	0	0	6,095	77	0	0	0	-
Byelorussia	20,348	6,048	30	17,955	88	5,375	30	1,589	30
Estonia	3,938	567	14	3,365	73	525	16	199	38
Georgia	6,523	114	2	4,763	73	97	2	12	12
Kazakhstan	268,445	5	0	165,068	61	4	0	3	75
Kirghiztan	19,548	0	0	10,428	53	0	0	0	-
Latvia	6,313	831	13	5,573	88	712	13	192	29
Lithuania	6,420	1893	29	6,018	94	1,757	29	876	50
Moldavia	3,000	190	6	2,848	95	182	6	14	8
Tajikistan	9,013	0	0	4,775	53	0	0	0	-
Turkmenistan	45,390	0	0	22,535	50	0	0	0	-
Ukraine	57,570	8,732	15	51,955	90	7,973	15	816	10
Russia	1,674,521	23,110	1	503,616	30	18,488	4	6259	3
Russia West of Urals	389,947	17,483	4	244,894	63	14,622	6	4515	31
Russia East of Urals	1,284,574	5,627	0	258,722	20	3,866	1	1744	45
China	937,041	39,729	4	416,566	44	27,362	7	10,415	38

5.3 Results for Traditional Production Forestry

Table 22 provides extents of prime land for traditional production forestry. To enable easy comparisons of results, Table 22 addresses the same categories as were provided for biomass plantation forestry in the Table 20 and 21, namely: all land, all accessible land and all accessible land with the exclusion of cultivated and urban land.

The results presented are based on all species considered for traditional production forestry combined, i.e., Birch, Poplar, Oak, Beech, Robinia; Larch, Spruce, Pine and Fir species. The relatively wide environmental tolerances of especially Pine, Spruce, Birch and Larch is the foremost reason for the large areas of prime land that we have estimated, about four times more than for the biomass plantation species. The slope limitations imposed for fully mechanized planting and harvesting assumed for the biomass plantation LUTs explains another part of the differences found. Countries with over one million hectares of potential prime land which is accessible and not already used for cultivation or urban purposes are: Byelorussia (more than 3 million), Lithuania (more than 1.4 million), Ukraine (more than 1.8 million), Russia (more than 68 million) and China (more than 46 million hectares).

Examples of selected results for the traditional production forestry species combined are presented in map-form as follows:

- Plate 20 Suitability index for traditional production forestry (excluding cultivated and urban areas).
- Plate 21 Suitability index for traditional production forestry of current forest areas.
- Plate 22 Suitability index for traditional production forestry of accessible areas currently forested.

Table 22 Very suitable and suitable areas for traditional production forestry

	Total area	VS+S Total areas		Accessible areas		VS+S Accessible areas		VS+S Accessible areas, excluding cultivated land and urban areas	
	(1)	(2)		(3)		(4)			
	(000ha)	(000ha)	% of (1)	(000ha)	% of (1)	(000 ha)	% of (3)	(000 ha)	% of (4)
Mongolia	156,198	96	0	63,130	40	9	0	9	100
Armenia	2,690	53	2	2,025	75	47	2	39	87
Azerbaijan	7,868	63	1	6,095	77	49	1	45	92
Byelorussia	20,348	10,413	51	17,955	88	9,261	52	3,047	33
Estonia	3,938	1,735	44	3,365	73	1,543	46	547	37
Georgia	6,523	404	6	4,763	73	351	7	91	26
Kazakhstan	268,445	814	0	165,068	61	495	0	385	79
Kirghiztan	19,548	53	0	10,428	53	43	0	28	65
Latvia	6,313	2,226	35	5,573	88	1,951	35	609	31
Lithuania	6,420	2,900	45	6,018	94	2,719	45	1,479	54
Moldavia	3,000	805	27	2,848	95	778	27	26	3
Tajikistan	9,013	0	0	4,775	53	0	0	0	-
Turkmenistan	45,390	0	0	22,535	50	0	0	0	-
Ukraine	57,570	20,665	36	51,955	90	18,794	36	1,827	10
Russia	1,674,521	204,248	12	503,616	30	123,126	24	68,967	56
Russia West of Urals	389,947	113,377	29	244,894	63	84,497	35	40,271	48
Russia East of Urals	1,284,574	90,871	7	258,722	20	38,629	15	28,696	74
China	937,041	129,701	14	416,566	44	80,347	19	46,120	57

5.4 Results for Conservation Forestry

For the assessment of suitability for conservation forestry all 52 species considered in this study are used. The selection of tree species is based on criteria other than biomass production, as used for biomass plantation and traditional production forestry. For conservation forestry, the tree species with the best ecological adaptation (highest suitability index) has been selected irrespective of its productivity. The results are presented by suitability class (Appendix II Table A15-17 and Table 23).

Table 23 provides results in terms of extents of land that is at minimum marginally suitable for at least one species. The results are presented for (i) all areas; all areas, but excluding cultivated and urban areas, and (iii) all areas excluding cultivated and urban areas and areas currently already under forest. The fact, that no slope limitations are imposed when assessing suitability for conservation forestry, a large number of species spanning a wide range of ecological adaptability are considered, and all land with at least marginal suitability is reported, resulted in large extents of suitable land in the majority of countries investigated. Very large shares of potential suitable land (more than 70% of total area) were found in Byelorussia, the Baltic states, Moldavia and the Ukraine. Low shares (less than 10 %) were found in Mongolia, Kazakstan, Tajikistan, and Turkmenistan. When discounting land in cultivated or urban use or already under forest, then the highest shares (as percentage of total land) of land potentially suitable for conservation forest are found, in Armenia (16%), Azerbaijan (10%), Lithuania (21%) and China (11%). In absolute terms, the largest areas are found in the biggest countries, namely in Russia, more than 81 million, in particular in Russia east of the Urals with more than 65 million, and in China almost 100 million hectares.

An example in map form of suitability results for conservation forestry is presented in Plate 23: Suitability index for conservation forestry (excluding cultivated and urban areas).

Table 23 Areas suitable for conservation forestry

	Total area (1)	VS+S+MS+mS Total area		VS+S+MS+mS Excluding cultivated and urban areas		VS+S+MS+mS Excluding cultivated land, urban areas and areas cur- rently under forest	
	(000ha)	(000ha)	% of (1)	(000 ha)	% of (1))	(000 ha)	% of (1))
Mongolia	156,198	8,843	6	8,774	6	8,074	5
Armenia	2,690	688	26	499	19	429	16
Azerbaijan	7,868	1,495	19	1,110	14	783	10
Byelorussia	20,348	19,061	94	7,014	34	1490	7
Estonia	3,938	2,742	70	1,069	27	261	7
Georgia	6,523	2,067	32	1,191	18	511	8
Kazakhstan	268,445	22,058	8	10,982	4	9,616	4
Kirghiztan	19,548	2,191	11	1,330	7	1,009	5
Latvia	6,313	5,708	90	2,056	33	198	3
Lithuania	6,420	5,853	91	2,986	47	1,365	21
Moldavia	3,000	2,596	86	89	3	6	0
Tajikistan	9,013	762	8	511	6	8	0
Turkmenistan	45,390	31	0	26	0	8	0
Ukraine	57,570	45,761	79	4,907	9	530	1
Russia	1,674,521	518,789	31	387,013	23	81,613	5
Russia West of Urals	389,947	240,535	62	1239,849	36	16,289	4
Russia East of Urals	1,284,574	278,245	22	247,164	19	65,324	5
China	937,041	374,584	40	248,019	26	99,412	11

Chapter 6 Concluding Remarks

This study confirms in quantitative manner the uneven distribution of potentials for tree growth and therefore to a large extent also the uneven distribution of the production potentials of renewable forest biomass resources within China, Mongolia and the FSU. The results indicate that the concentration of potential areas for the production of woody biomass is mainly located in the European part of the FSU and China.

The results obtained through this exercise, in absolute terms, should be treated in a conservative manner at appropriate aggregation levels, which are commensurate with the resolution of basic data and the scale of the study. Relative results, i.e., the comparison of absolute results at sub-national level in China and the FSU, are likely more robust, when noting that for the entire study area procedures and data were uniformly applied.

The study revealed that in order to obtain a more complete picture of potentials for forest production in particular of China, additional tree species should be included. In particular, species should be included that are specifically adapted to warm sub-tropical climate prevailing in Southeast China. It is expected that the FAEZ procedures and model parameters will be benefiting from scrutiny with further use.

Limitations

The FAEZ results presented are based on 5 km resolution environmental data sets of North, Central and East Asia. While representing the most recent data compilations for this territory, the quality and reliability of these datasets is known to be uneven across the region.

Also silvicultural data, such as data on environmental requirements of individual tree species, contain assumptions and generalizations necessary for the scale of the study. In particular, further work is required to quantify occurrence and severity of constraints indirectly related to climate conditions that

adversely affect growth and productivity of tree species. These constraints include impacts due to pests, diseases, invasion of unwanted species or weeds, workability, and forest fires.

Various types of land degradation may very well affect forest suitability and productivity. Land degradation information could not be considered in the present FAEZ assessment. In a future version soil degradation data available in the LUC-GIS database for North, Central and East Asia will be reviewed for use in FAEZ.

For the above reasons the results obtained from this first implementation of FAEZ should be treated in a conservative manner at appropriate aggregation levels, which are commensurate with the resolution of underlying basic data and the scale of the study.

Next steps

The compatibility of the FAEZ approach with the methods for agriculture (AEZ) allows for consistent integration of agriculture and forest sector assessments. It provides key inputs in region specific applications of the IIASA/FAO multi-criteria model analysis (MCMA) tool which is targeted to provide better assistance for decision making for rural development planning at national and regional levels. Applications using the North, Central and East Asian LUC-GIS data sets have been started. With the already initiated integration of pan-European data sets, also further FAEZ/AEZ/MCMA applications are becoming possible. For Europe the LUC project focus will be initially on countries envisaged for the EU eastward enlargement.

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PLATES

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- Plate 4 Mean temperatures of warmest month.
- Plate 5 Mean minimum temperatures of coldest month.
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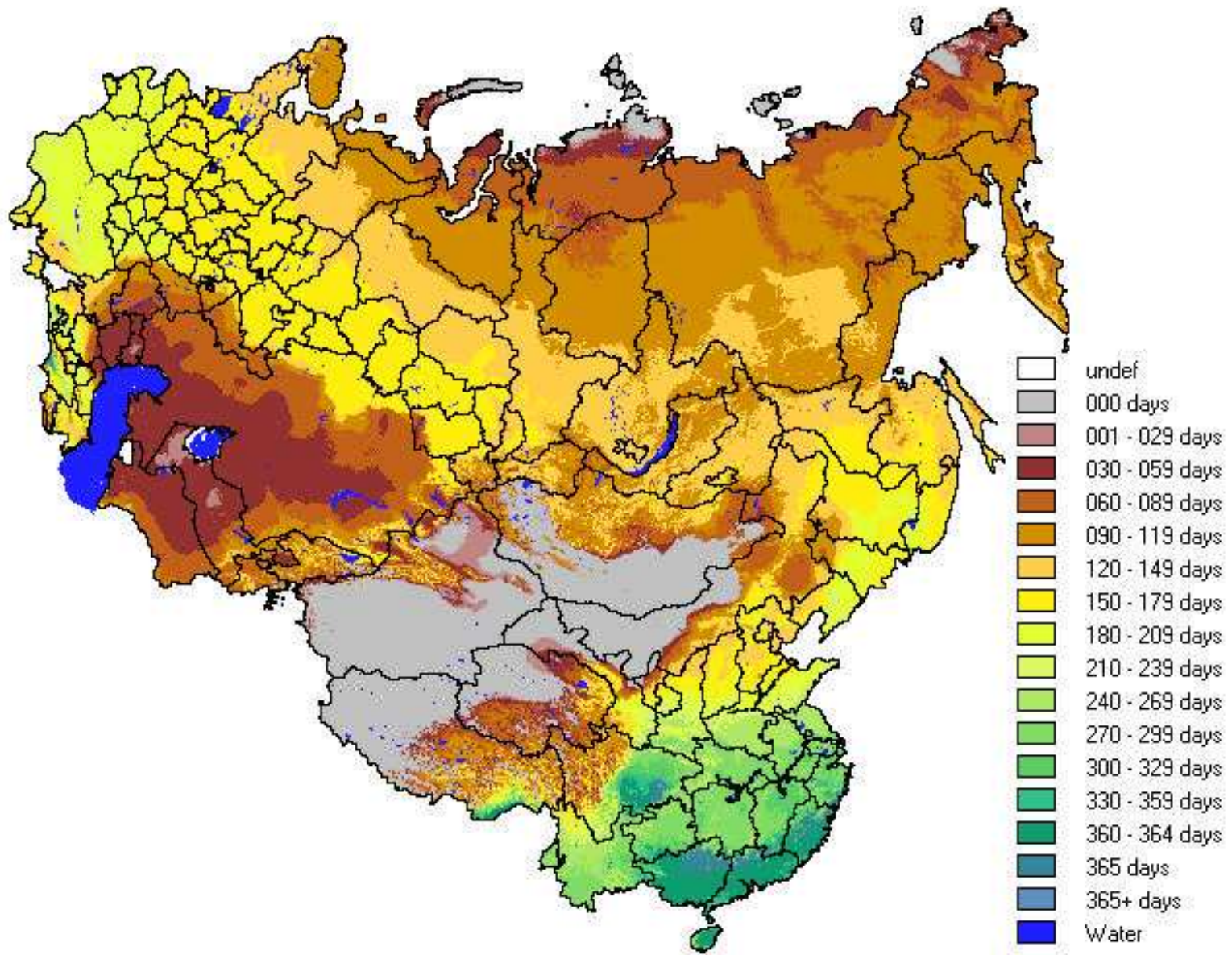


Plate 1 Length of growing period

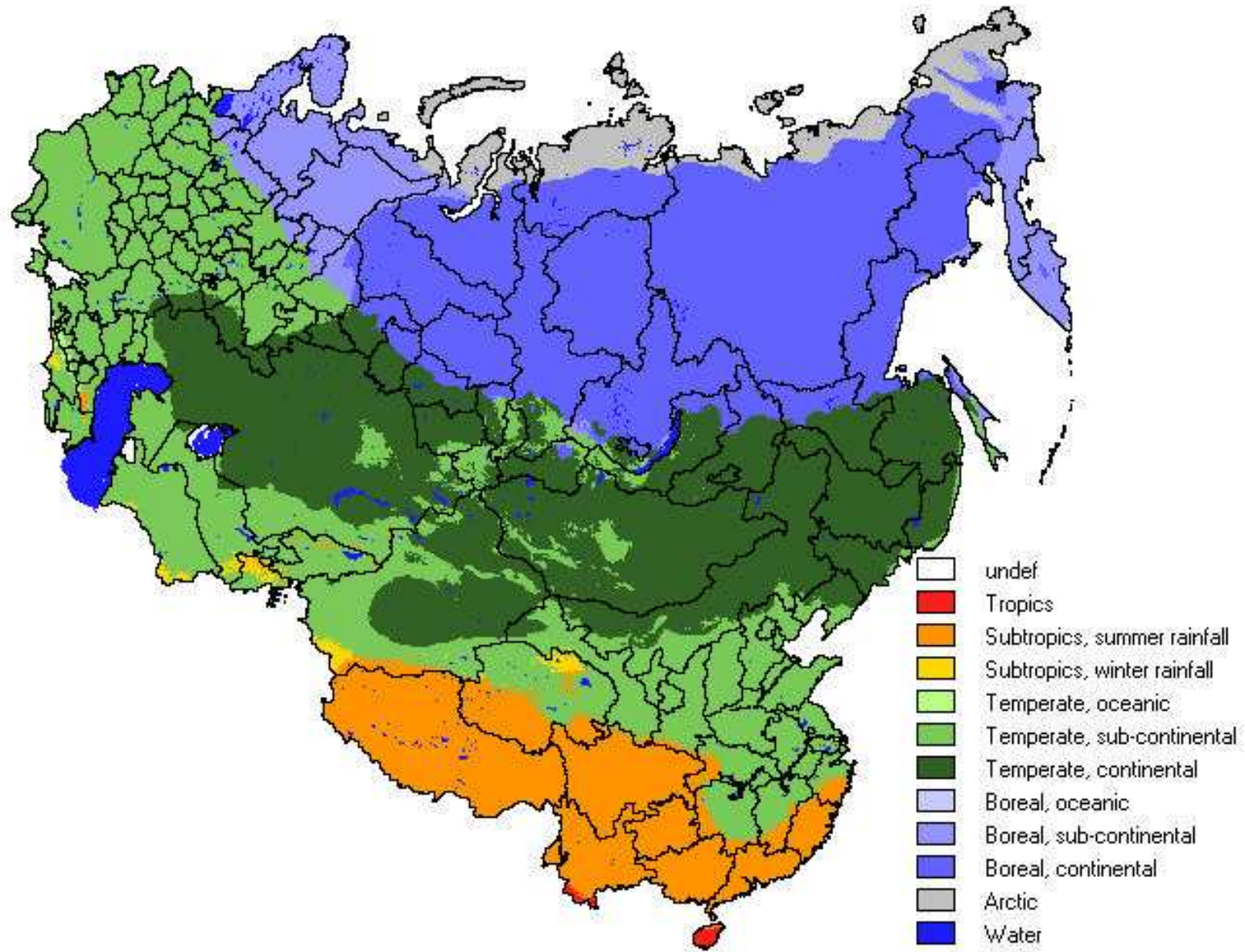


Plate 2 Thermal climates

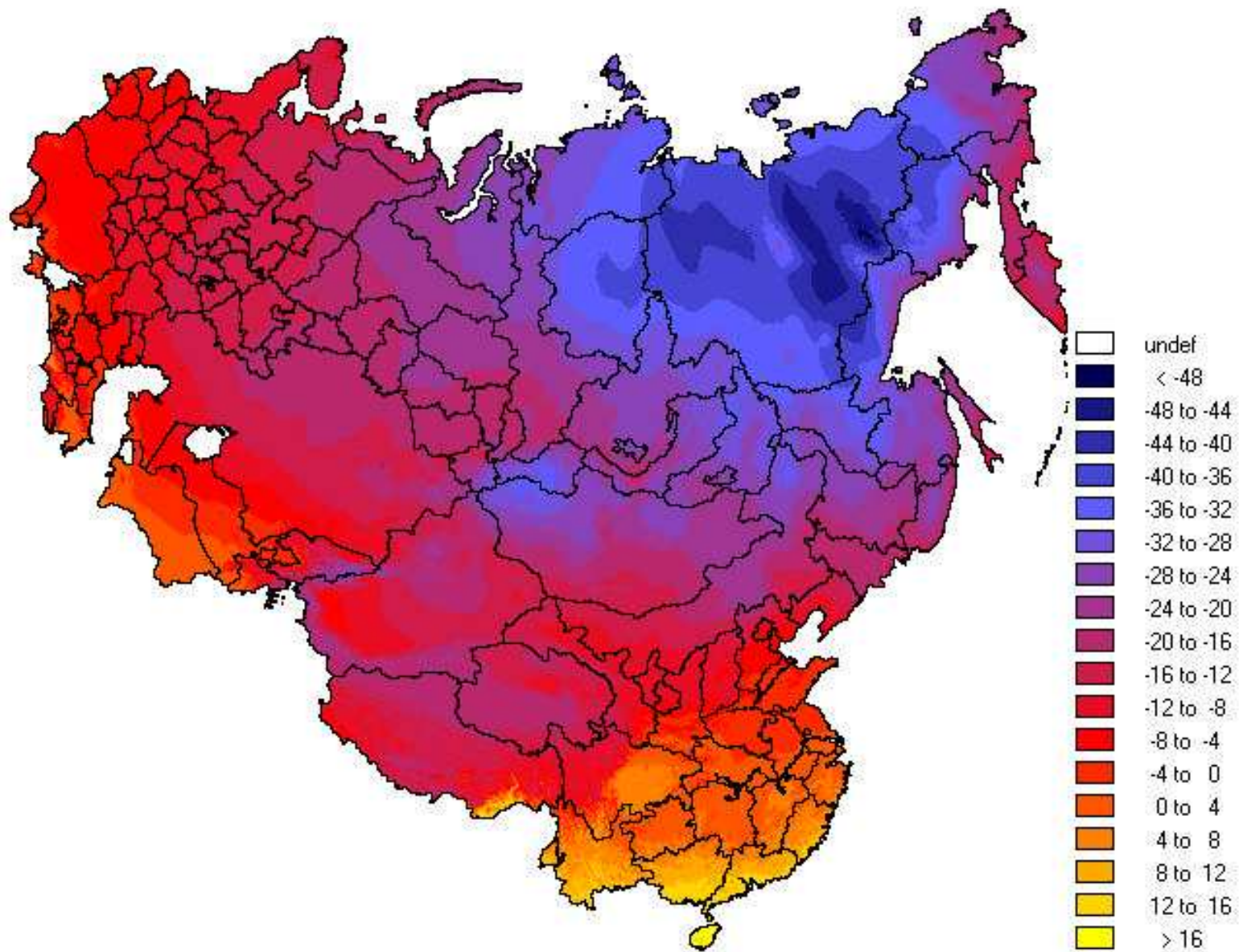


Plate 3 Mean temperatures of coldest month

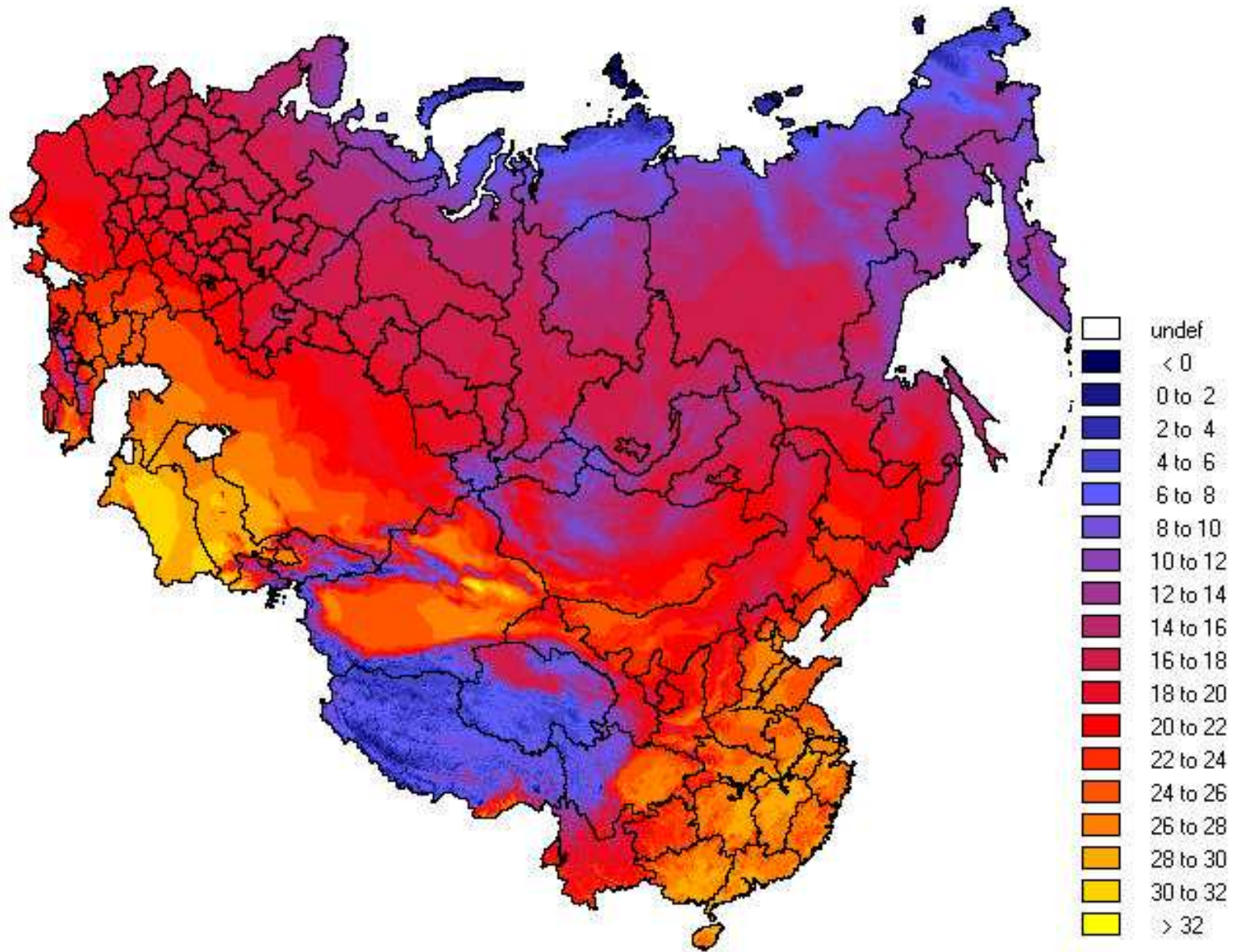


Plate 4 Mean temperatures of warmest month

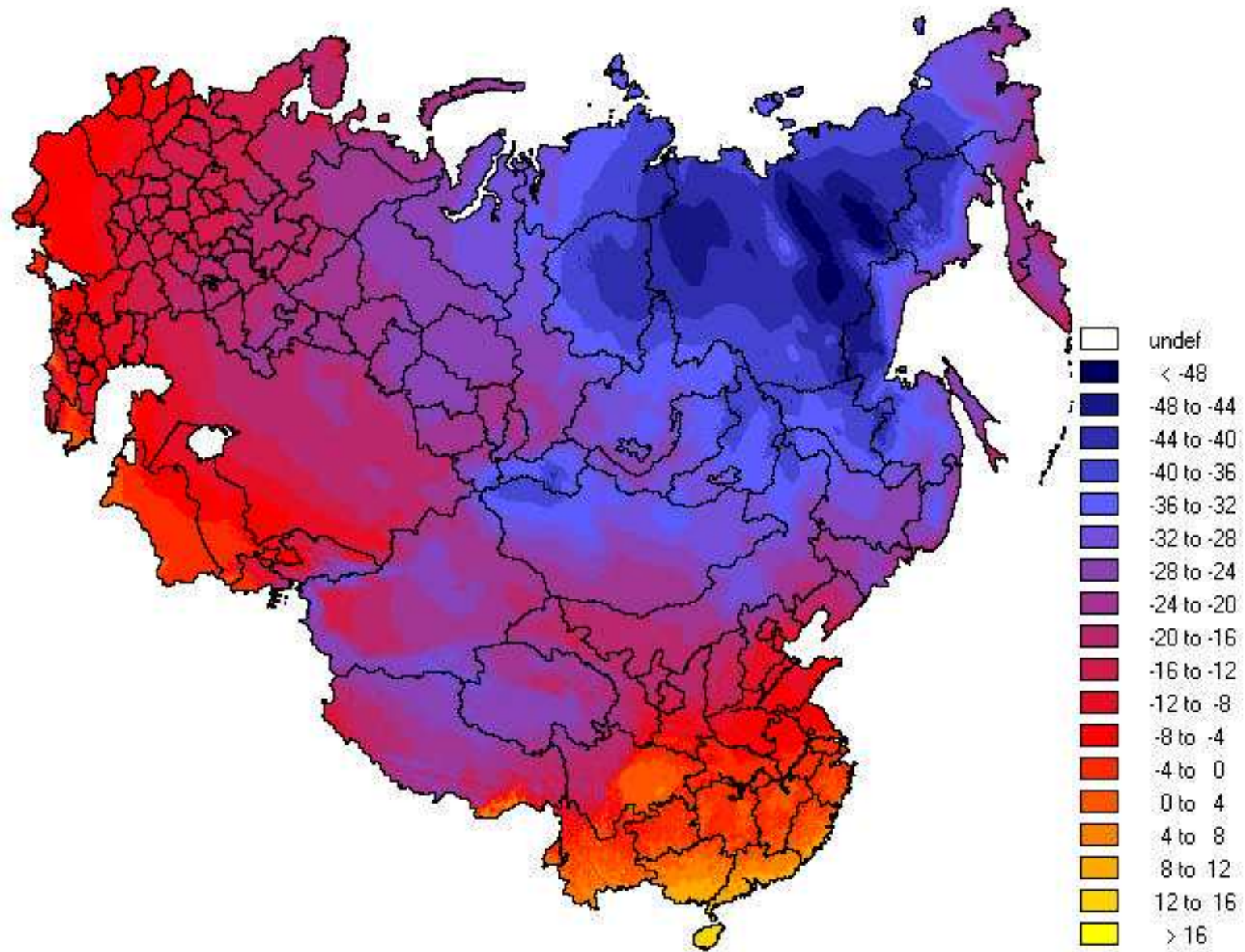


Plate 5

Mean minimum temperatures of coldest month

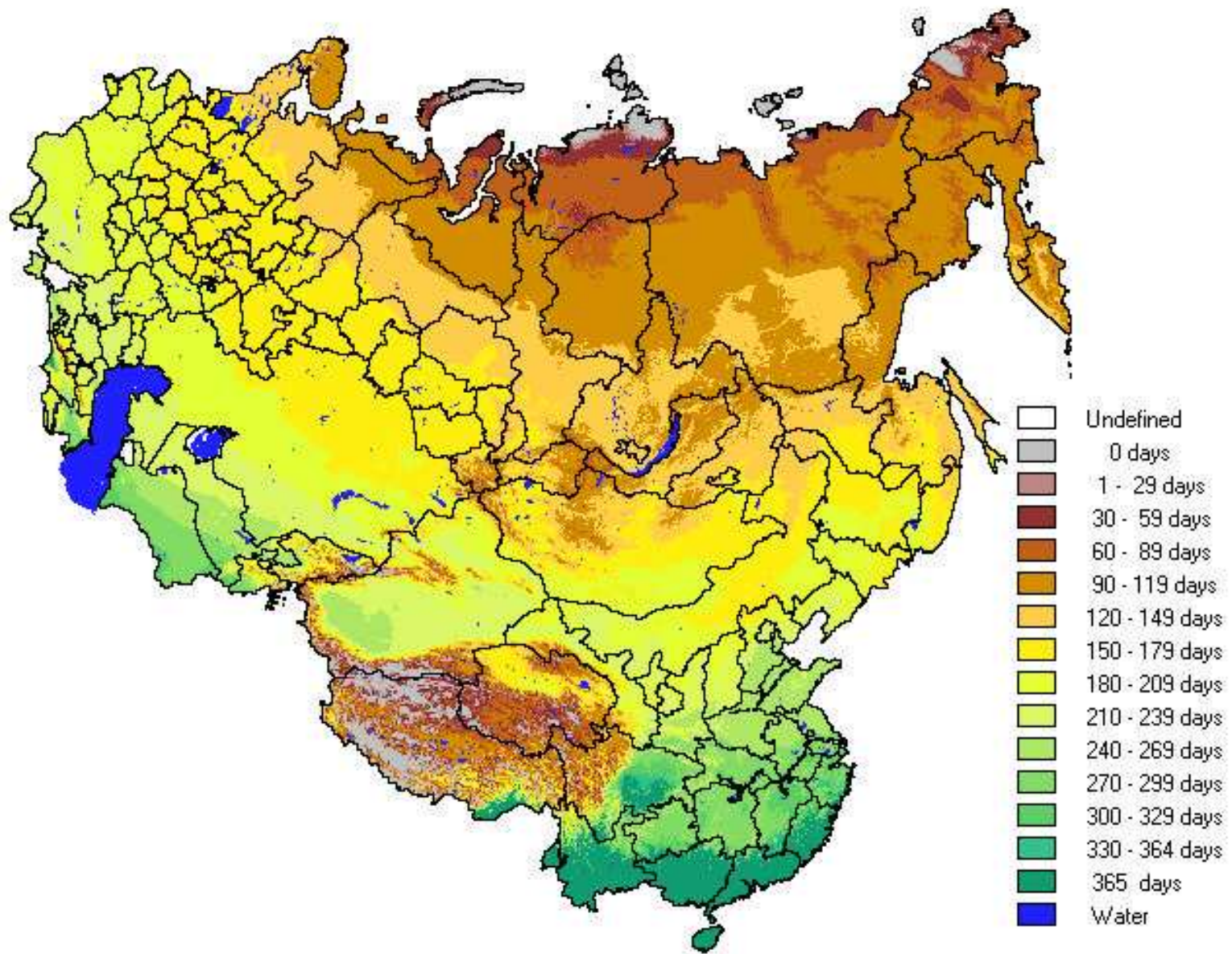


Plate 6 Temperature growing periods (LGPT=5)

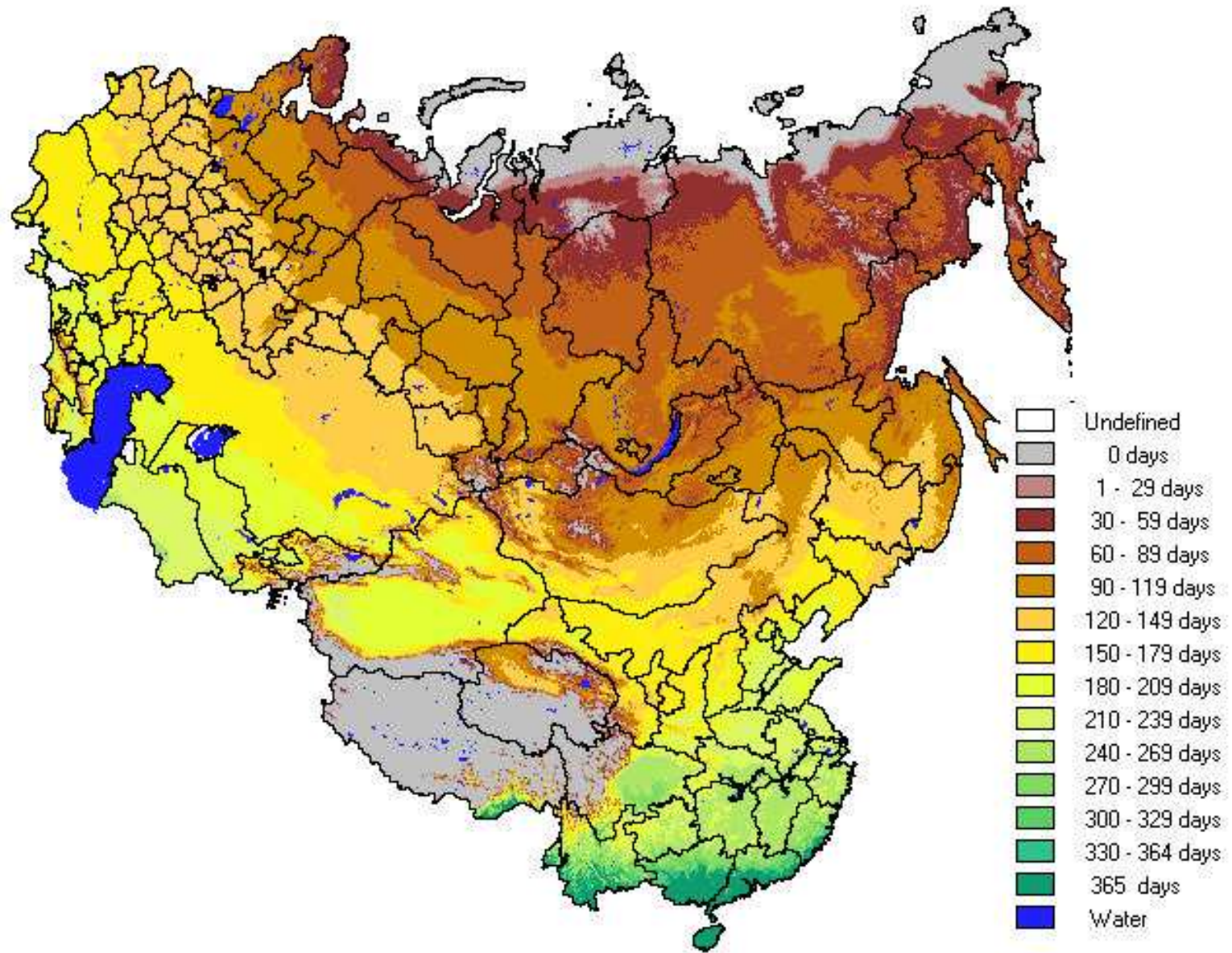


Plate 7 Frost-free periods (LGPT=10)

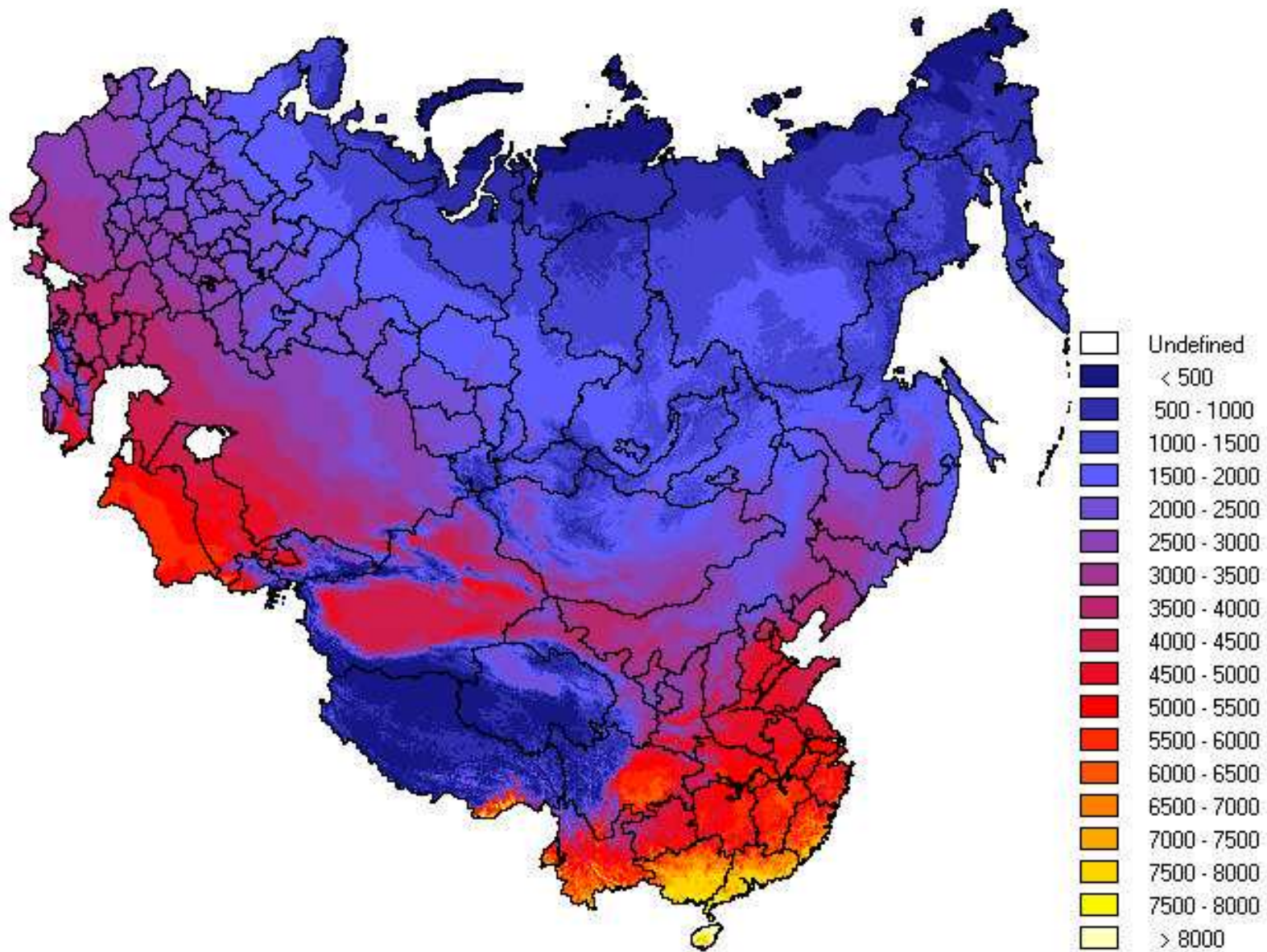


Plate 8 Accumulated temperatures ($t > 5^{\circ}\text{C}$)

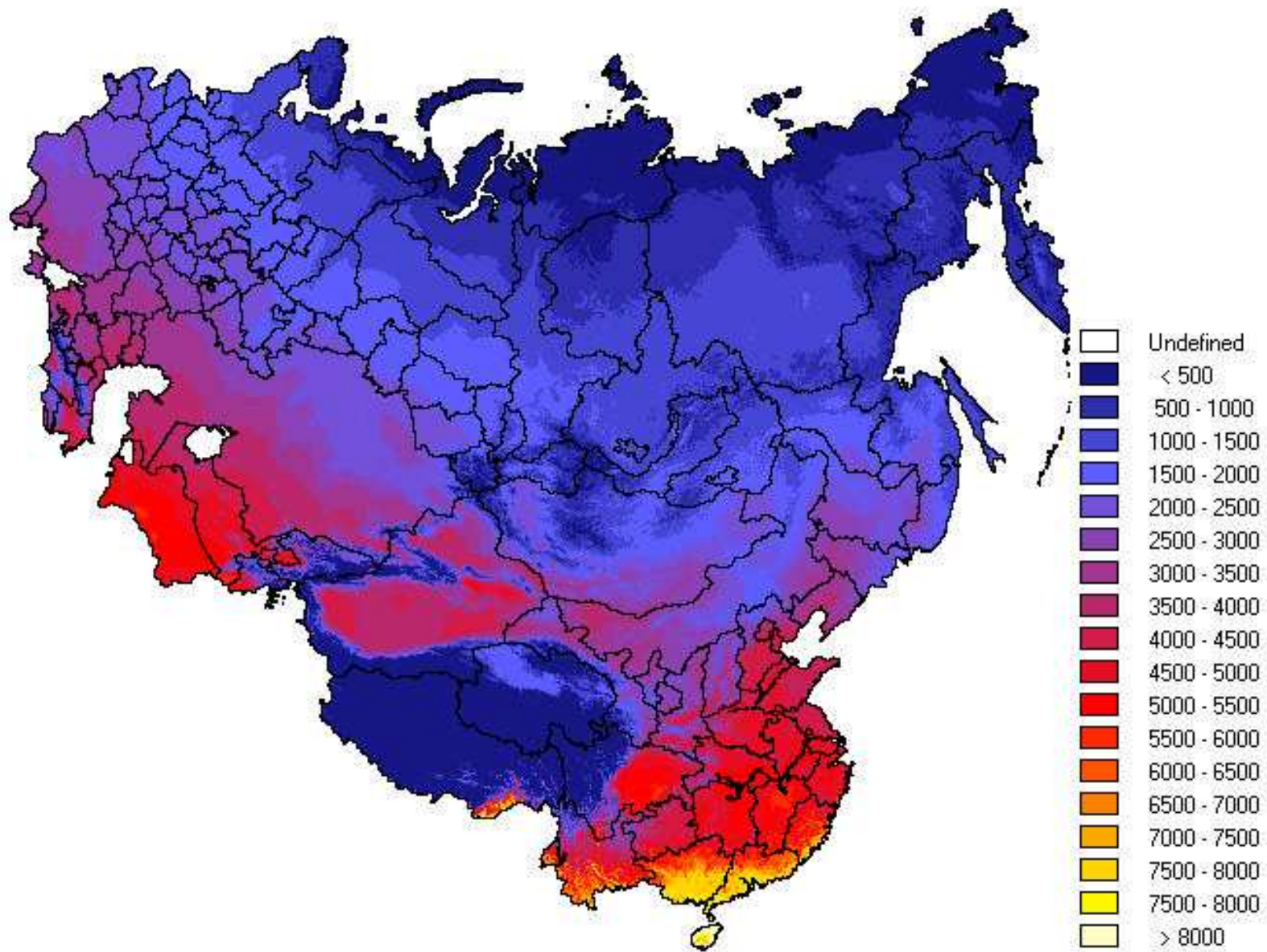


Plate 9 Accumulated temperatures ($t > 10^{\circ}\text{C}$)

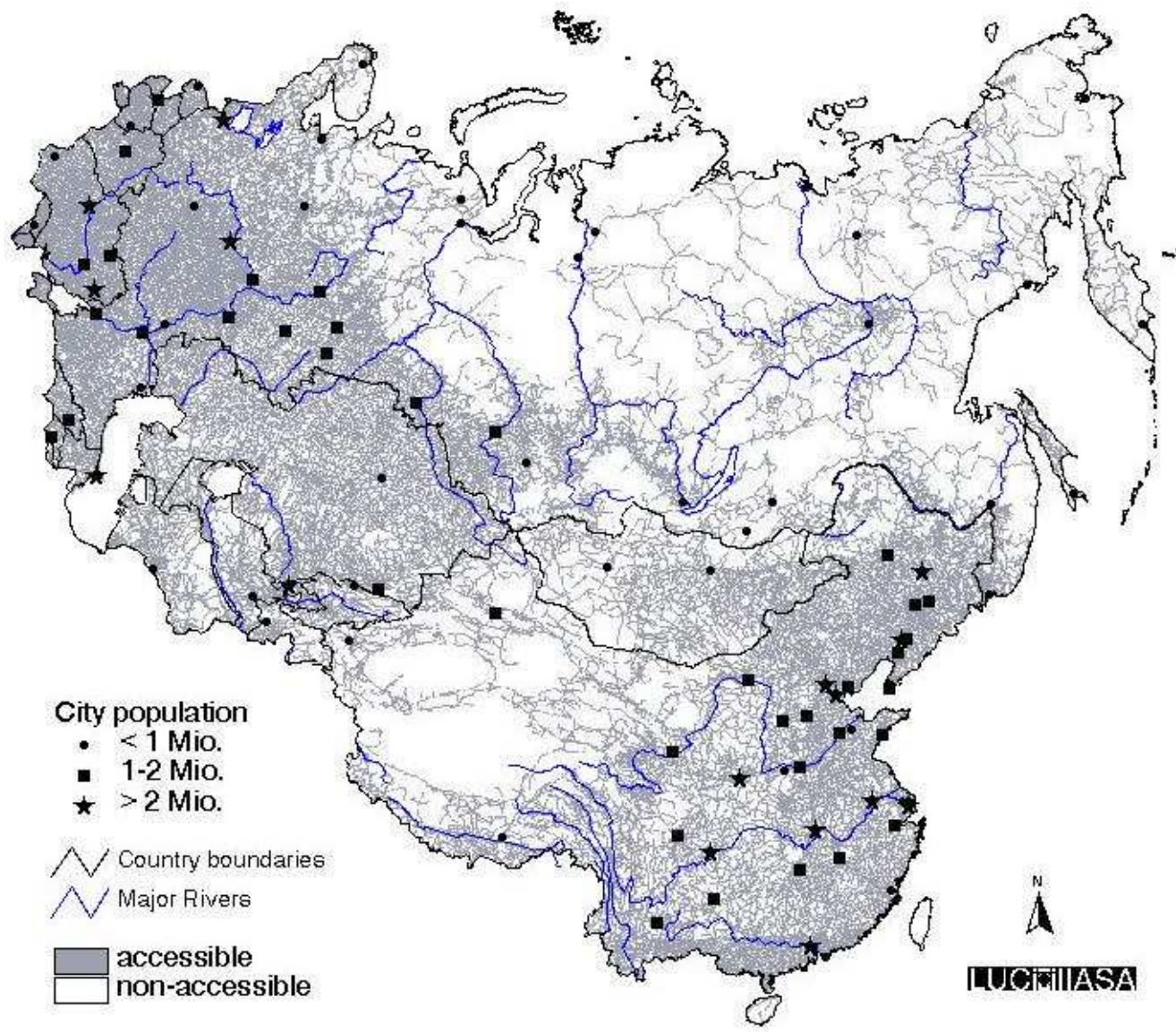


Plate 10

Zones with accessibility to roads and railroads

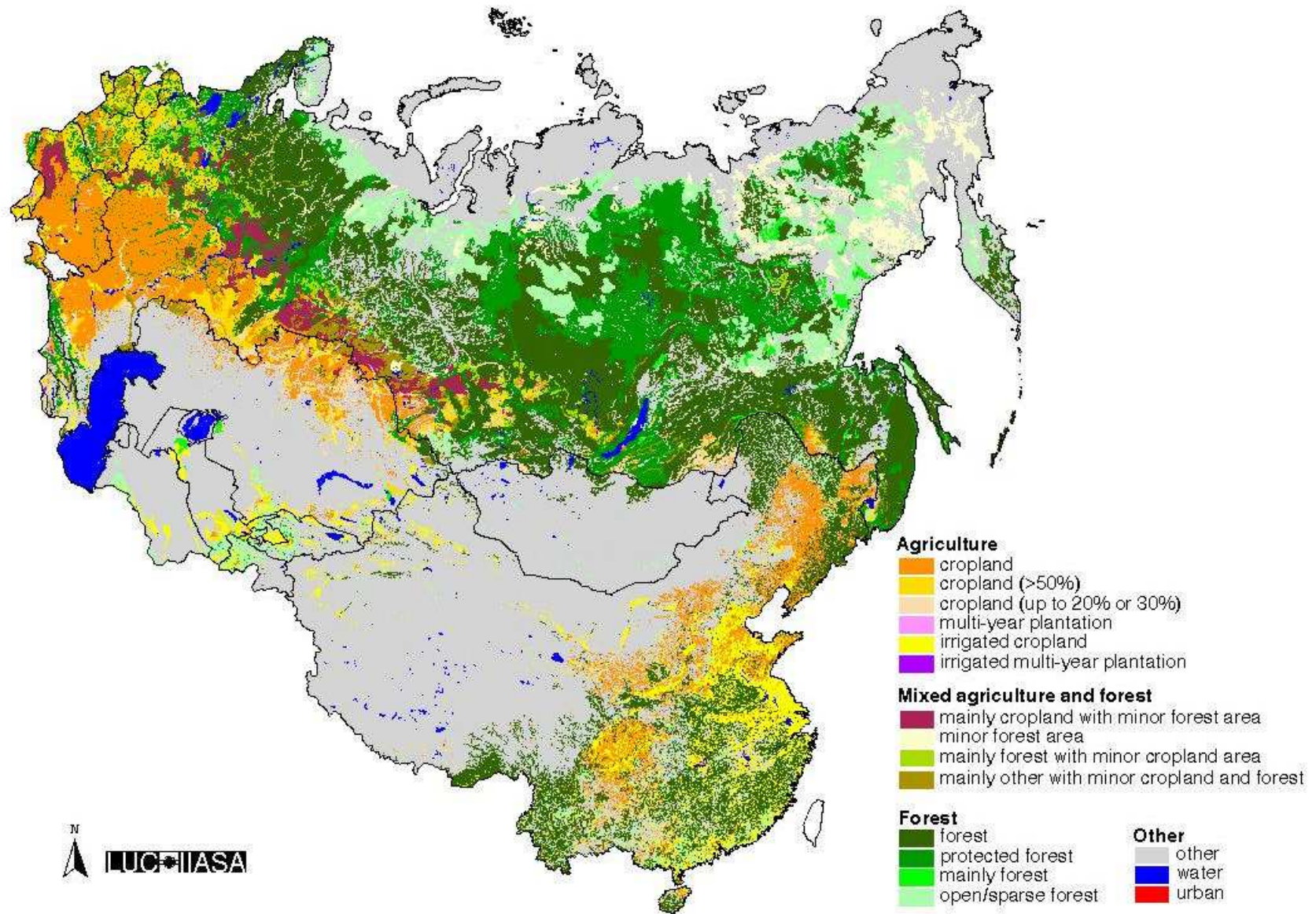


Plate 11 Agriculture and forest land

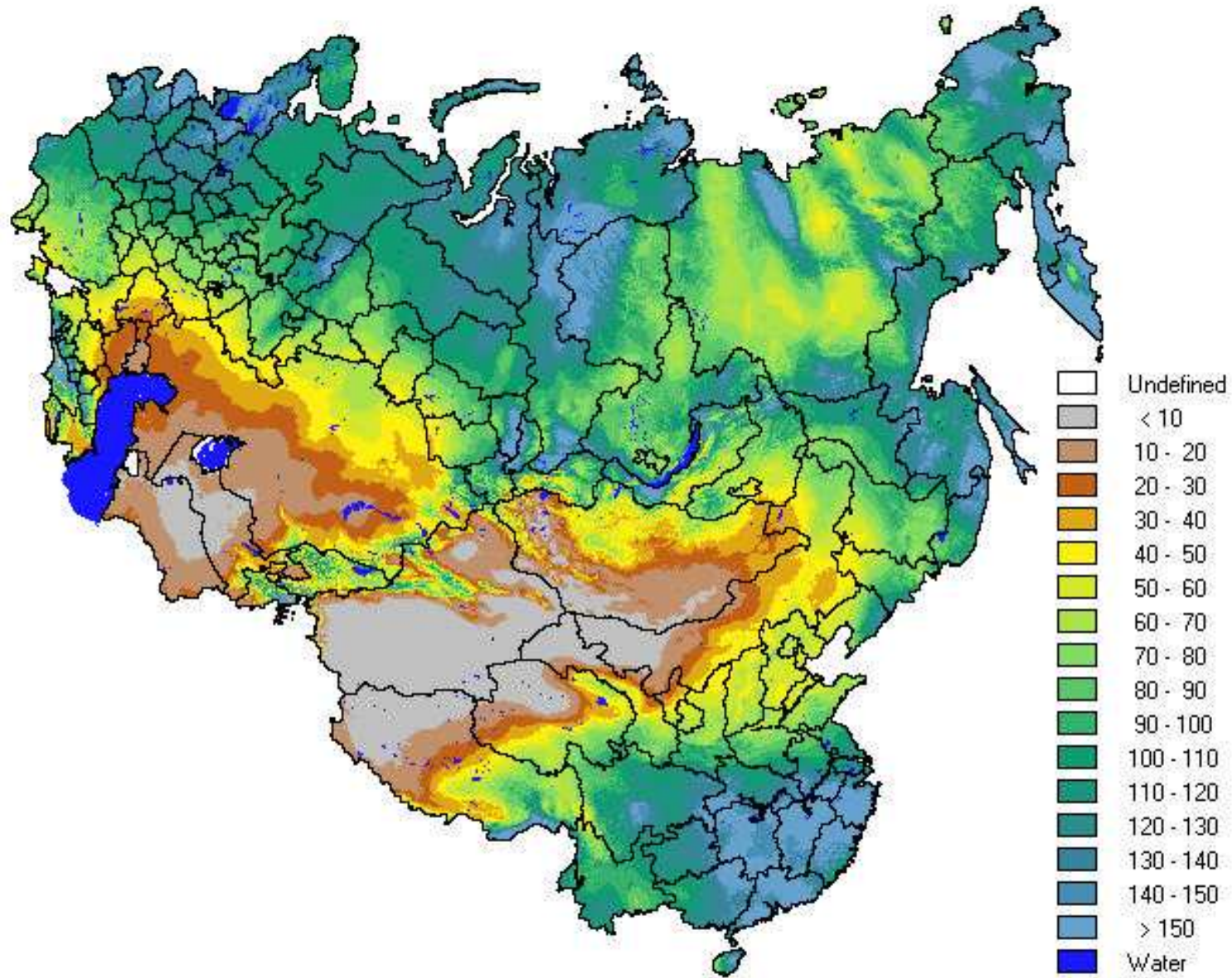


Plate 12 Aridity index



Plate 13 States of the FSU and Oblasts within Russia

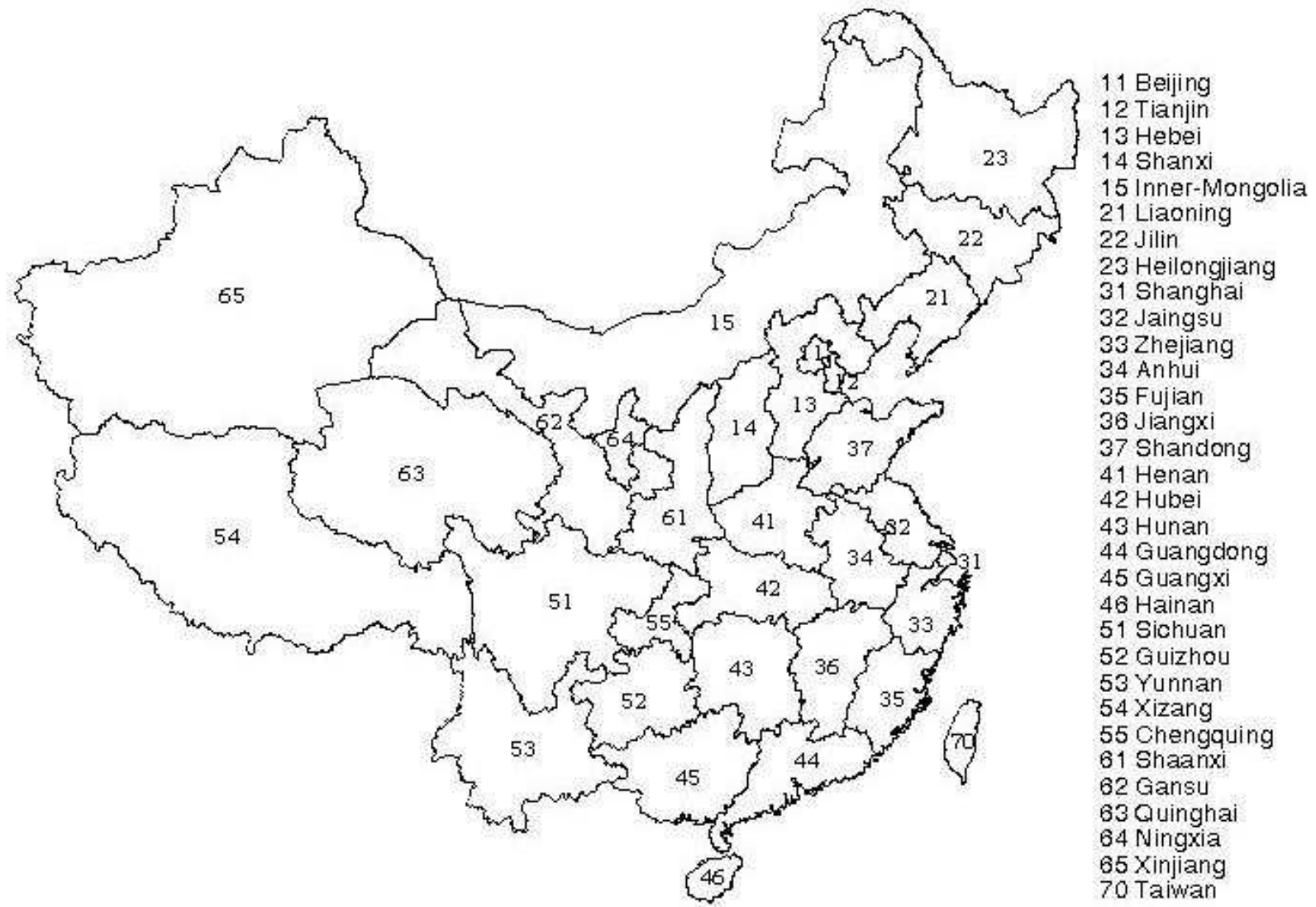


Plate 14 Provinces of China

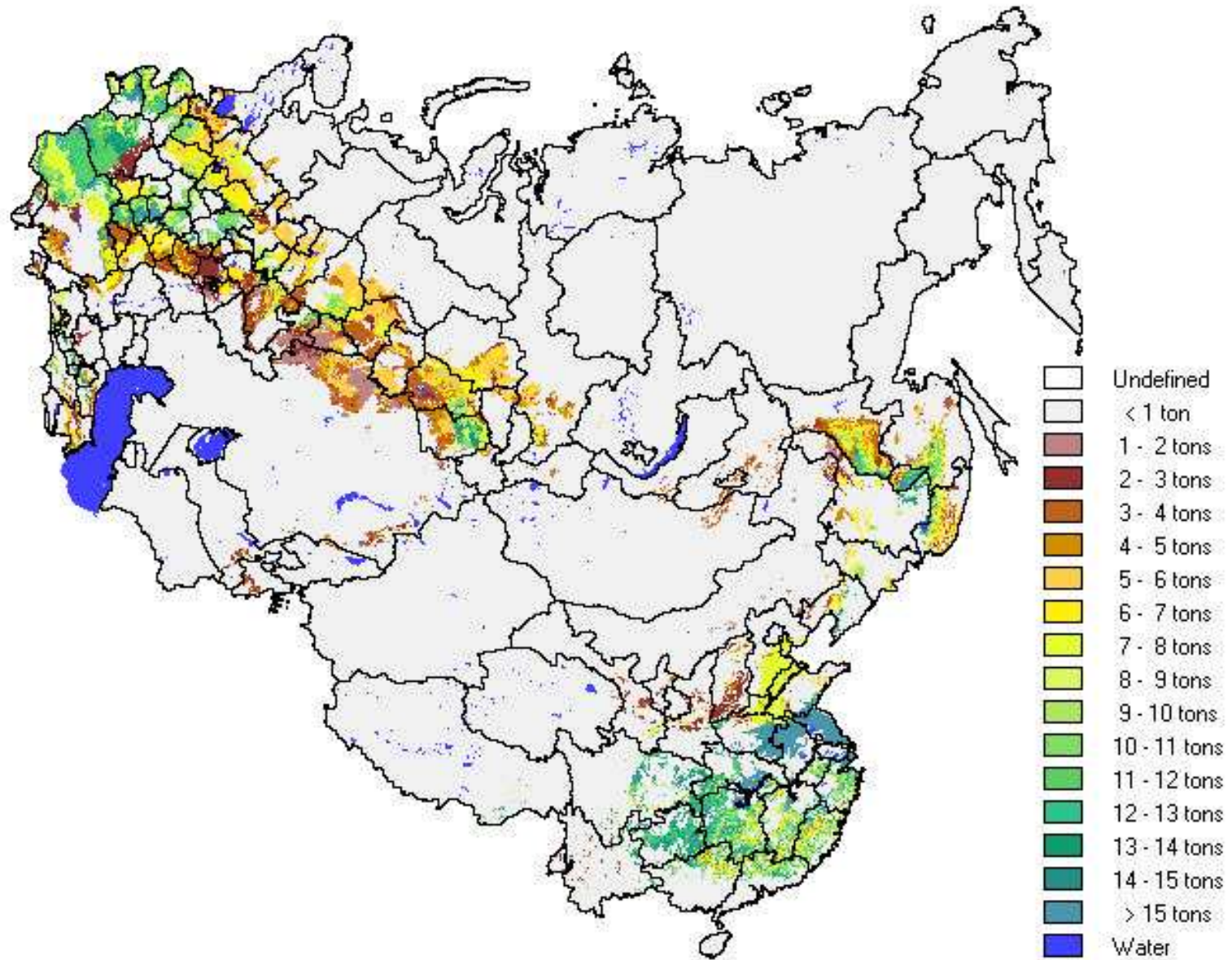


Plate 15 **Productivity of *Salix viminalis* (t/ha biomass yield)**

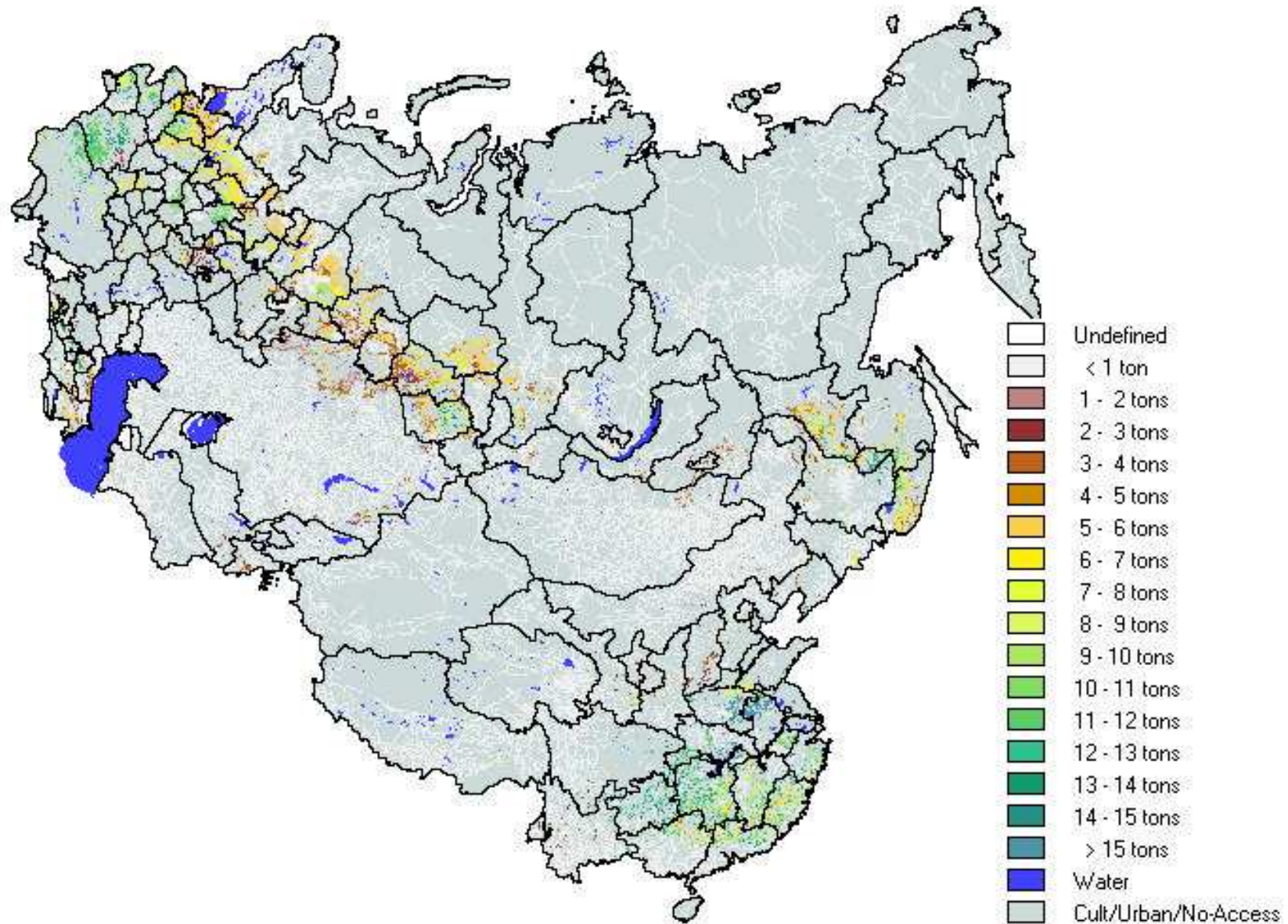


Plate 16 Productivity of *Salix viminalis* in accessible areas, excluding cultivated and urban areas (*t/ha biomass yield*)

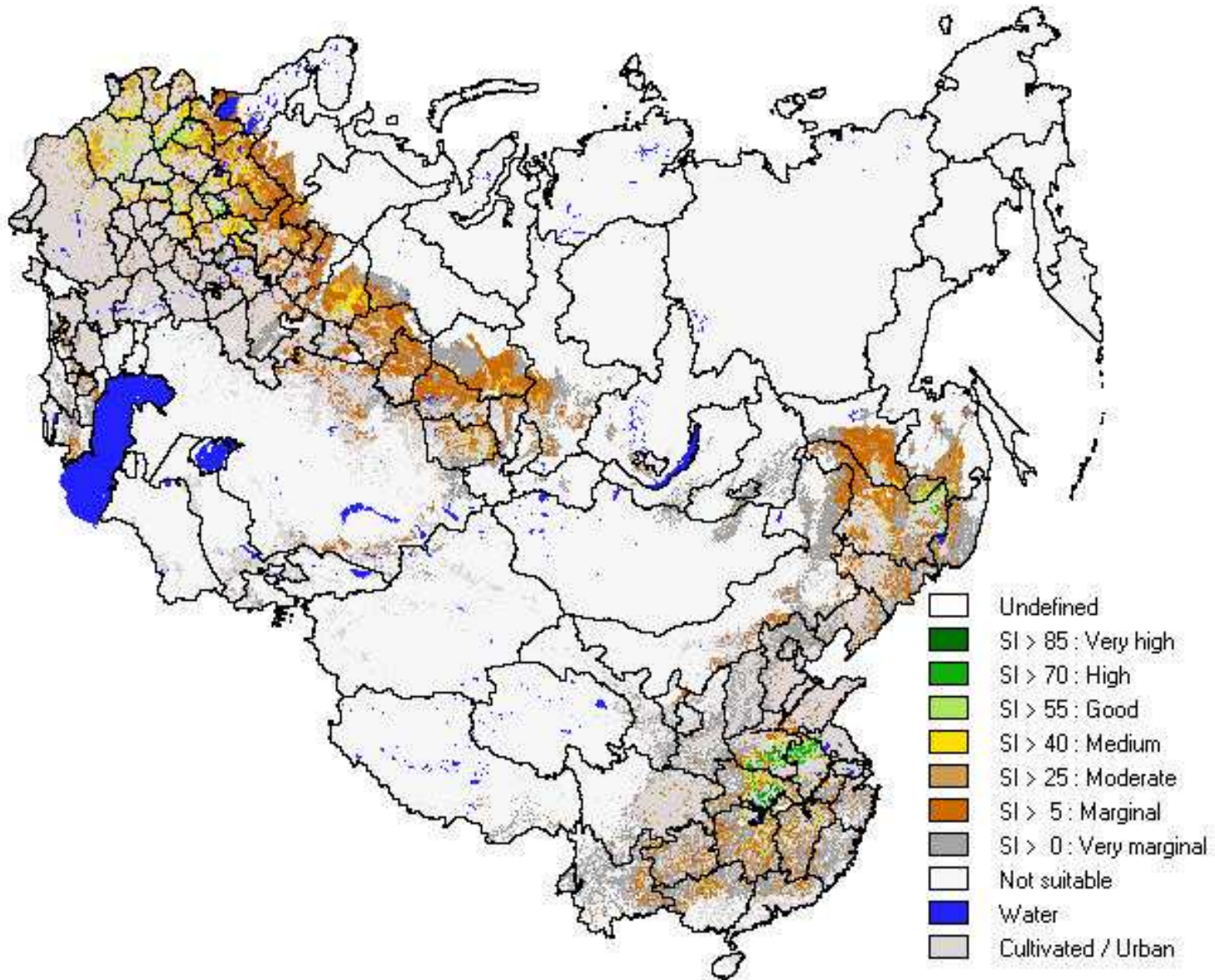


Plate 17 Suitability index for biomass plantation forestry (excluding cultivated and urban areas)

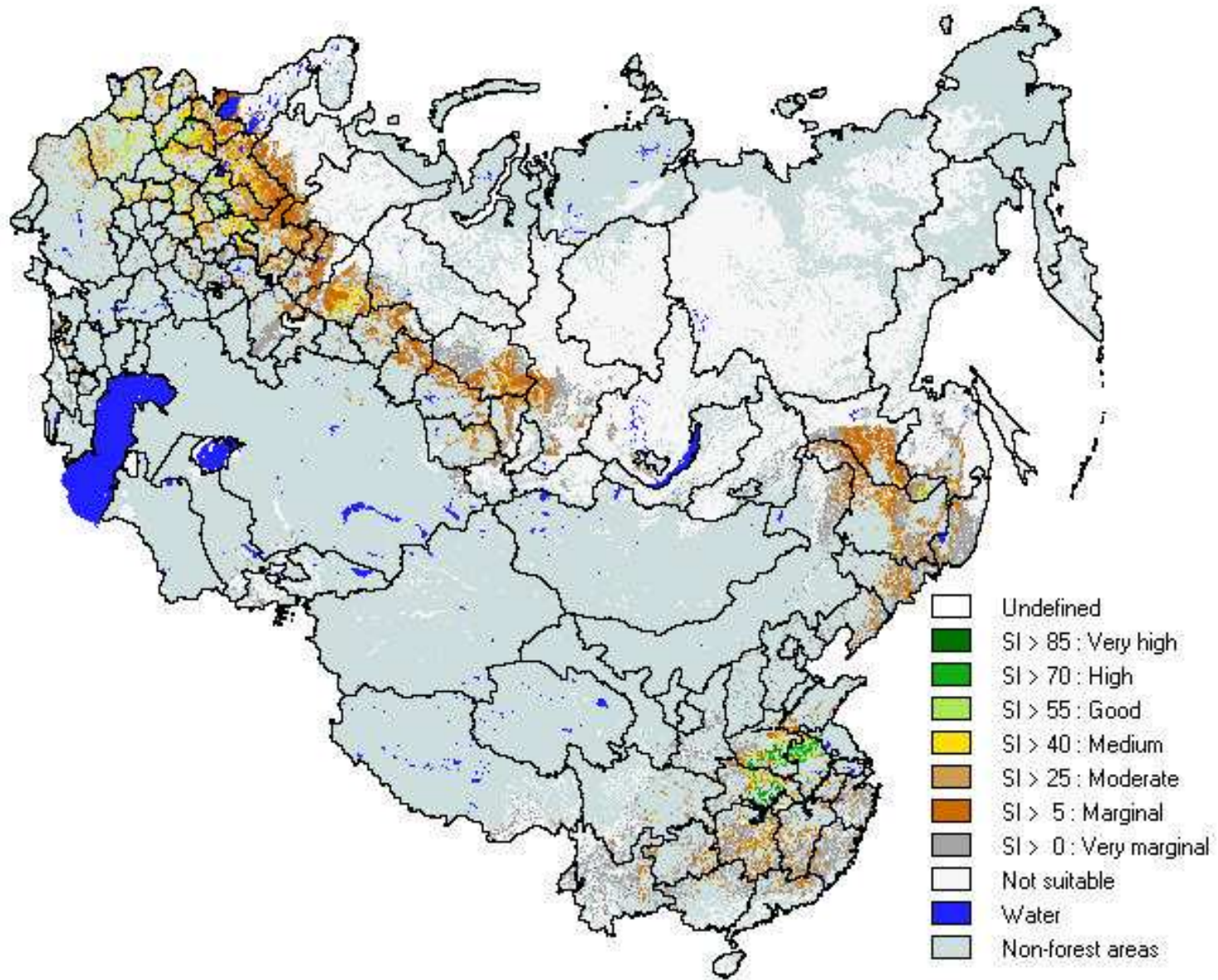


Plate 18 Suitability index for biomass plantation forestry of current forest areas

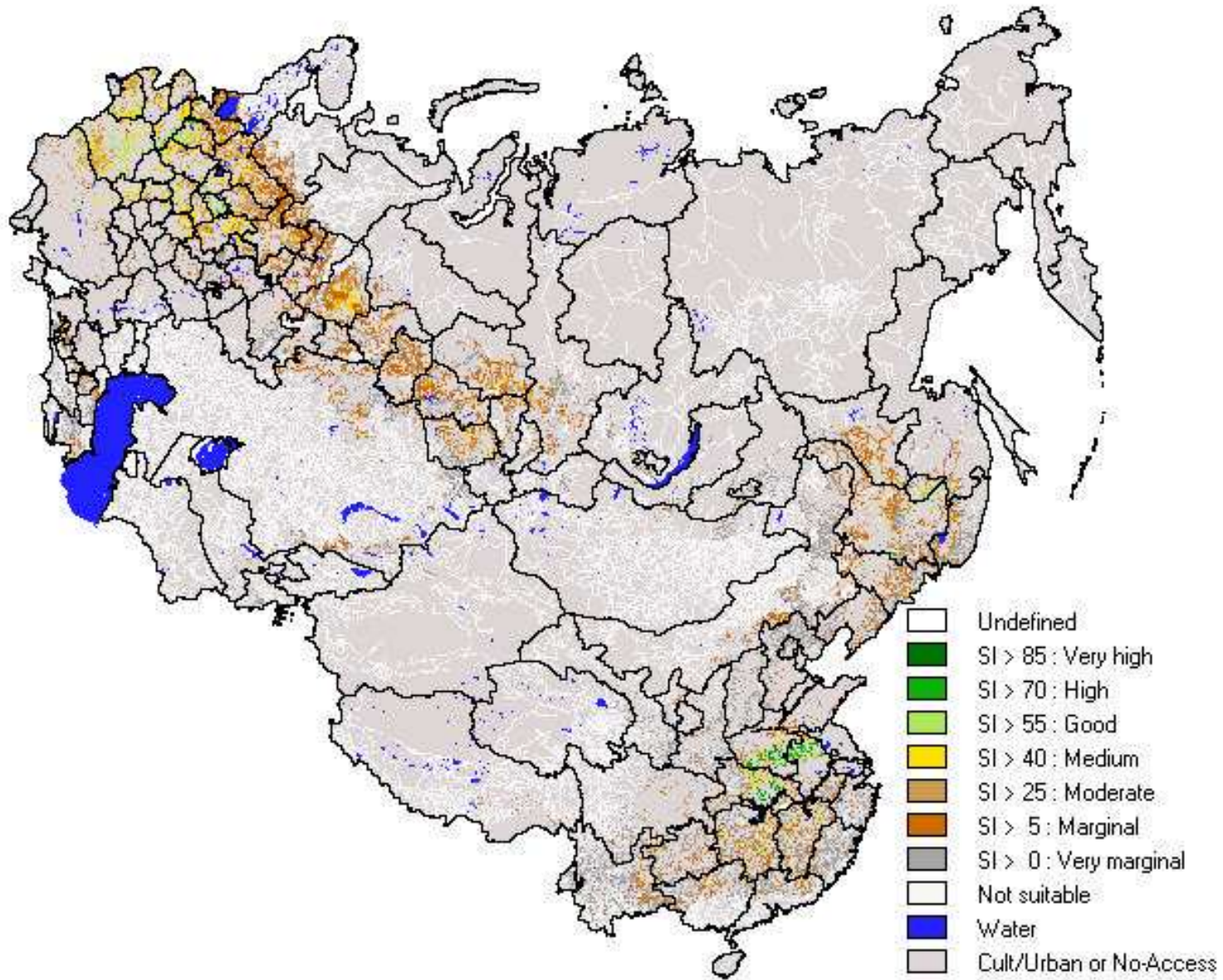


Plate 19 Suitability index for biomass plantation forestry in accessible areas (excluding cultivated and urban areas)

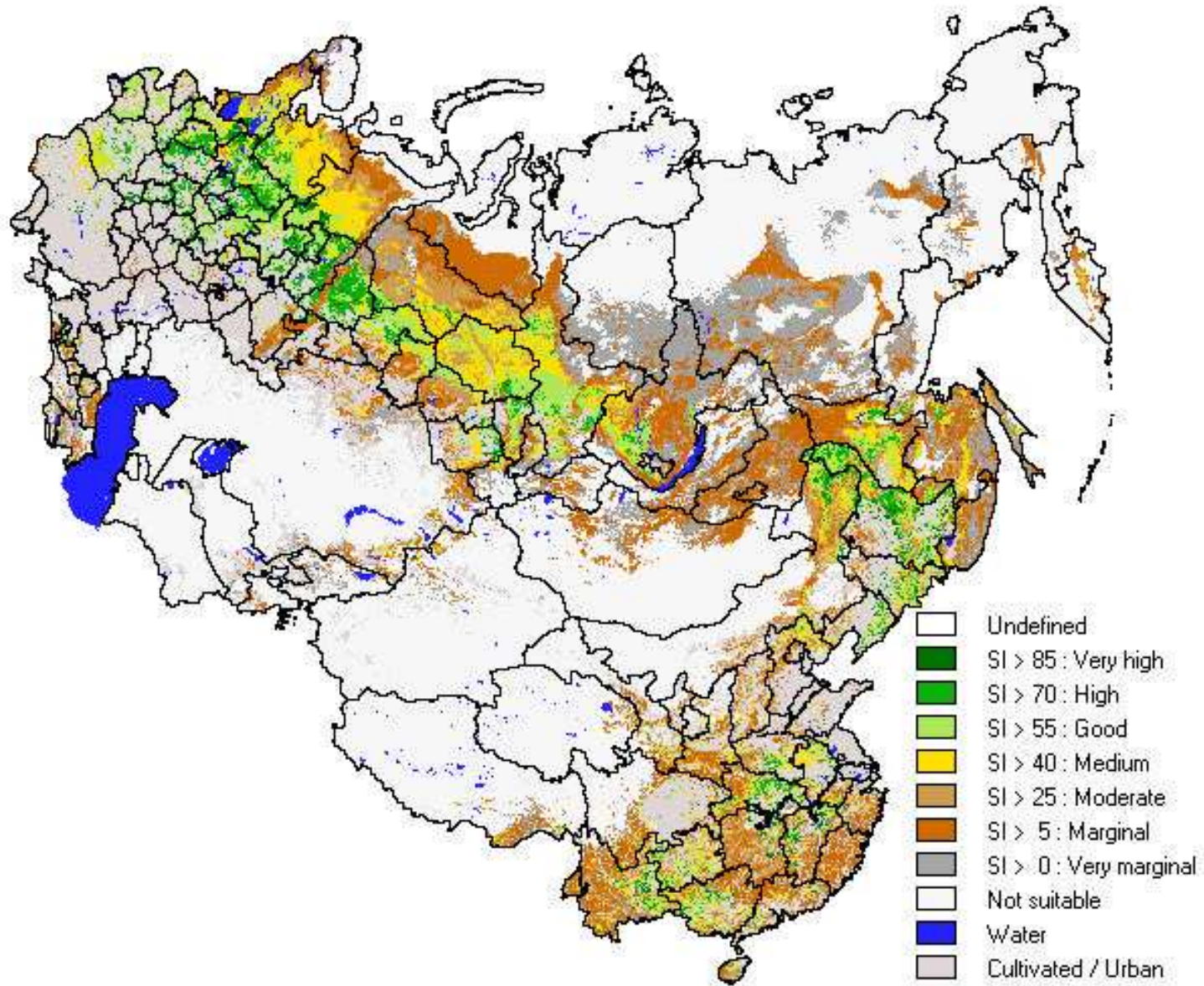


Plate 20

Suitability index for traditional production forestry (excluding cultivated and urban areas)

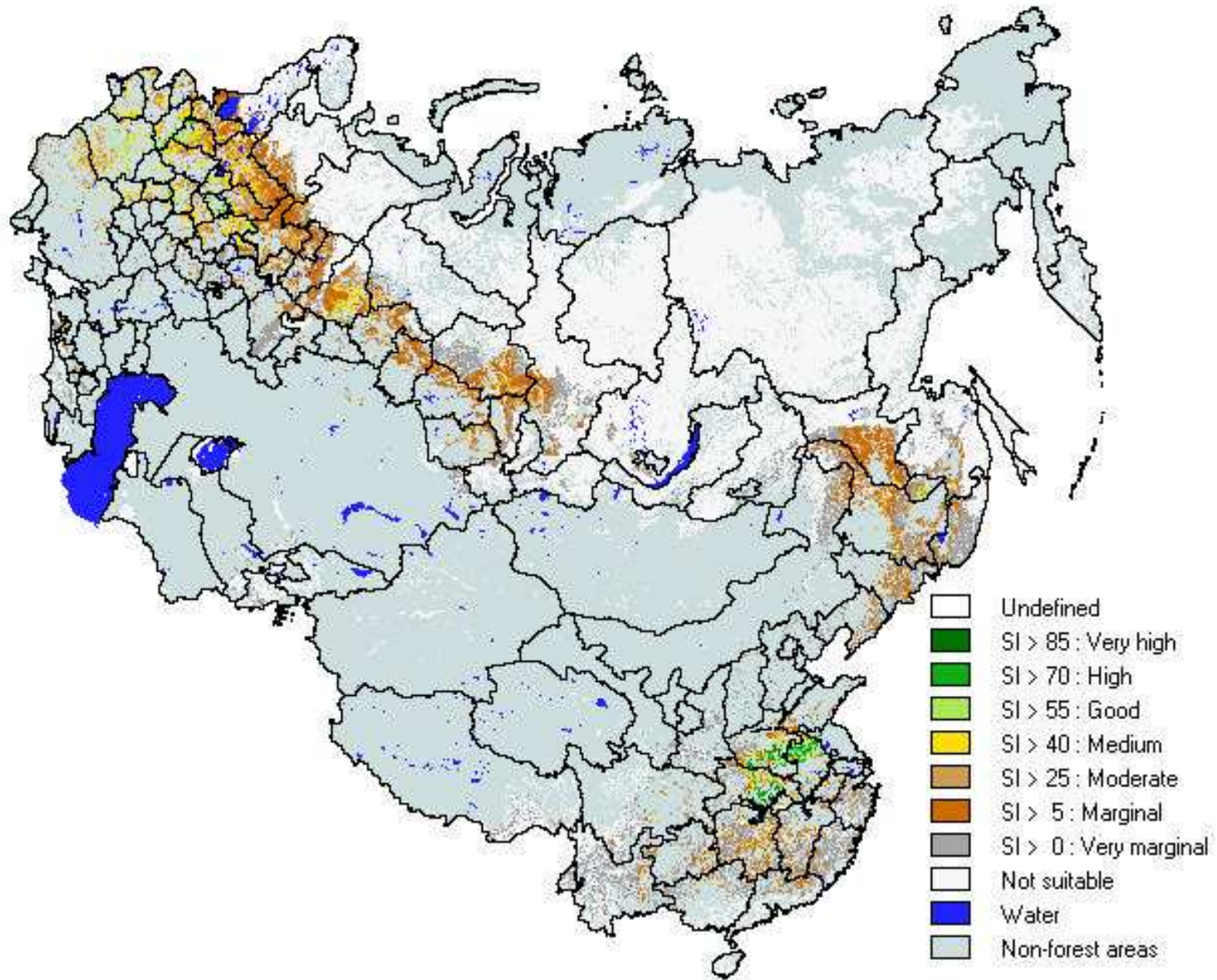


Plate 21

Suitability index for traditional production forestry of current forest areas

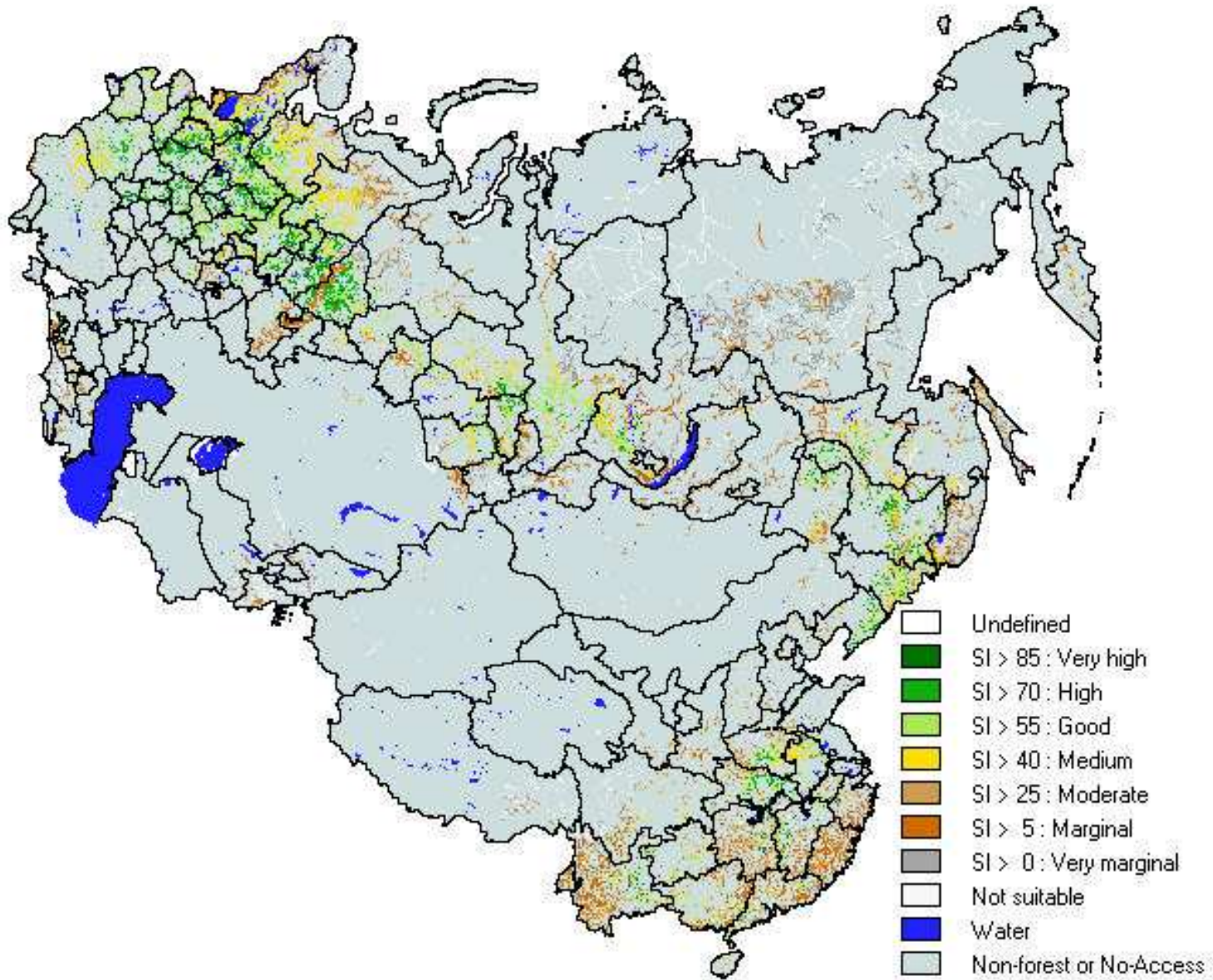


Plate 22

Suitability index for traditional production forestry of accessible current forest areas

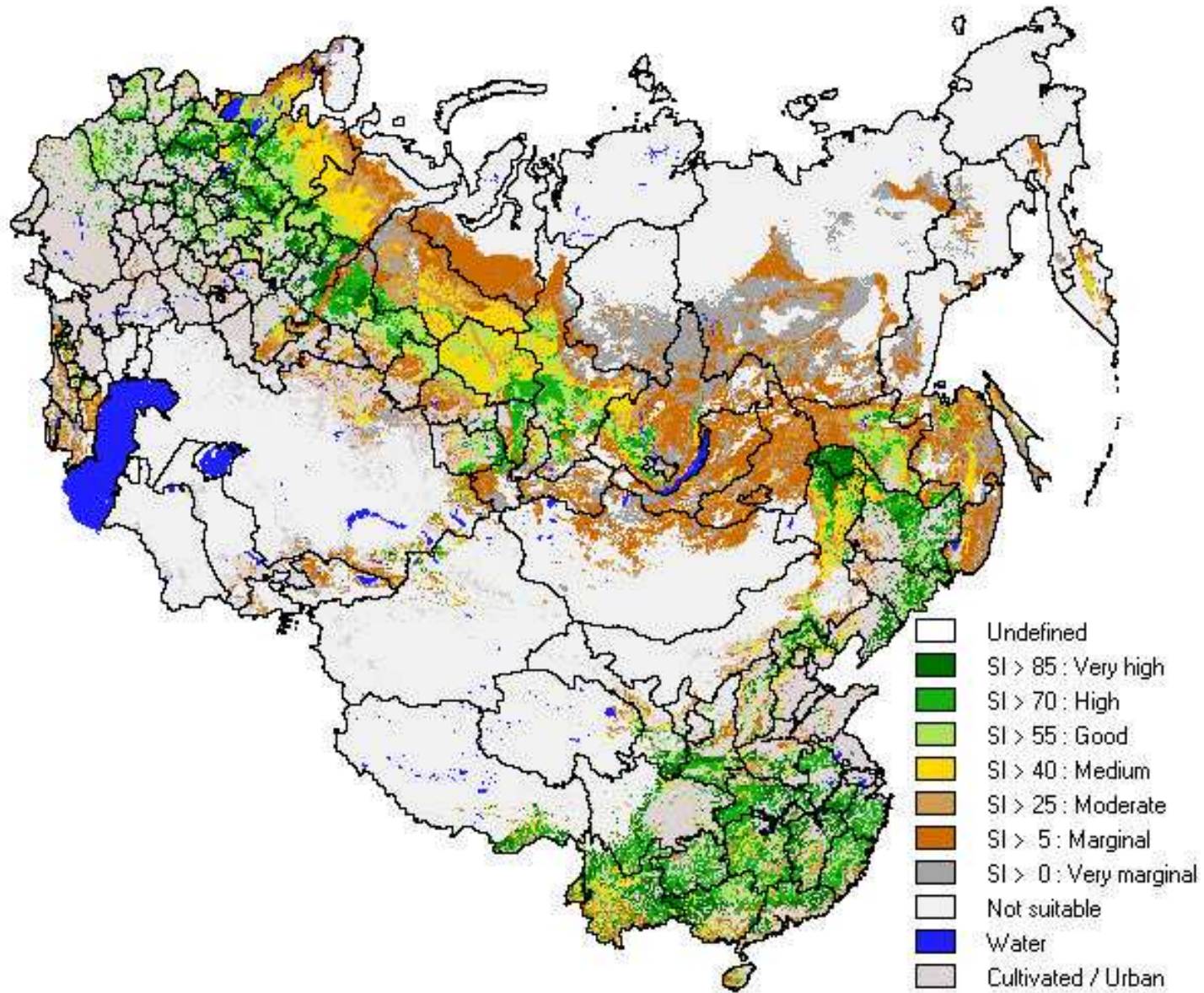


Plate 23

Suitability index for conservation forestry in non-cultivated areas

APPENDIX I

Table A-1 List of States of the FSU and Oblasts of Russia, respectively west and east of the Urals

Code	States of the FSU (excluding Russia)	Extents (000 ha)	Code	Oblasts in Russia (West of the Urals)	Extents (000 ha)
11	Armenia	2690	182	Daghestn Republic	5033
12	Azerbaijan	7868	183	Kabardino-Balkarian Republic	1238
13	Byelorussia	20348	185	Kalmyk-Khalm-Tangch Republic	7510
14	Estonia	3938	186	Karelia Republic	18253
15	Georgia	6523	187	Komi Republic	41370
16	Kazakhstan	268445	188	Mari-El Republic	2365
17	Kirghizstan	19548	189	Mordovian SSR	2590
18	Latvia	6313	190	North-Ossetian SSR	778
19	Lithuania	6420	191	Karachai-Cherkess Republic	1468
20	Moldavia	3000	192	Tatarstan Republic	6663
21	Tajikistan	9013	194	Udmurt Republic	4150
22	Turkmenistan	45390	196	Checheno-Ingush Republic	1930
23	Ukraine	57570	197	Chuvash Republic	1808
	Total	457066		West of URAL Total	389947
Code	Oblasts in Russia (West of the Urals)		Code	Oblasts in Russia (East of the Urals)	
103	Krasnodar Kray	7620	101	Altai Kray	16653
107	Stavropol Kray	6635	102	Gorno-Altai Republic	9385
111	Arkhangelsk oblast	38190	104	Krasnoyarsk Kray	71140
112	Astrakhan oblast	4598	105	Primorski Kray	16338
114	Belgorod oblast	2665	106	Taymyr a.okr.	82285
115	Bryansk oblast	3483	108	Khabarovsk Kray	77545
117	Vladimir oblast	2925	110	Amur oblast	36283
118	Volgograd oblast	11265	116	Evenk a.okr.	75673
119	Vologda oblast	14628	121	Yevrey (Jewish) a.oblast	3700
120	Voronezh oblast	5195	125	Irkutsk oblast	76270
122	Nizhni Novgorod oblast	7515	126	Ust-Orda Buryat a.okr.	2178
123	Nenets a.okr.	16858	130	Kamchatka oblast	17045
124	Ivanovo oblast	2270	131	Koryak a.okr.	28903
127	Kaliningrad oblast	1240	132	Kemerovo oblast	9500
128	Tver oblast	8395	135	Chukchi a.okr.	70770
129	Kaluga oblast	2963	137	Kurgan oblast	7110
133	Kirov oblast	11930	144	Magadan oblast	45830
134	Kostroma oblast	6000	150	Novosibirsk oblast	17673
136	Samara oblast	5118	152	Omsk oblast	13980
138	Kursk oblast	3020	164	Sakhalin oblast	8095
139	Komi-Permyak a.okr.	3280	165	Sverdlovsk oblast	19273
141	Leningrad oblast	7500	167	Aga-Buryat a.okr.	1970
142	Lipetsk oblast	2410	169	Tomsk oblast	31145
146	Moscow oblast	4665	171	Tyumen oblast	15860
147	Murmansk oblast	13960	172	Khanty-Mansi a.okr.	53163
149	Novgorod oblast	5450	174	Yamalo-Nenets a.okr.	66588
153	Orenburg oblast	12418	175	Chelyabinsk oblast	8763
154	Oryel oblast	2458	176	Chita oblast	41493
156	Penza oblast	4320	181	Buryat Republic	33533
157	Perm oblast	12715	193	Tuva Republic	17035
158	Pskov oblast	5568	176	Chita oblast	6120
160	Rostov oblast	10133	181	Buryat Republic	303275
161	Ryazan oblast	3935	193	Tuva Republic	9750
163	Saratov oblast	10375	195	Khakass Republic	3595
166	Smolensk oblast	4943	198	Sakha (Yakutia) Republic	241375
168	Tambov oblast	3435		Russia East of Urals	1284574
170	Tula oblast	2553			
173	Ulyanovsk oblast	3690		Russia	1674521
178	Yaroslavl oblast	3260			
179	Adigei Republic	775		Other States of the FSU	457066
180	Bashkortostan Republic	14435		FSU	2131587

APPENDIX II

Potential Productivity for Forestry - Scenario results.

Salix viminalis:

Table A2	All areas.
Table A3	Accessible areas.
Table A4	Accessible areas, excluding cultivated and urban areas.

Biomass plantation forestry:

Table A5	All areas.
Table A6	Accessible areas.
Table A7	Accessible areas, excluding cultivated and urban areas.
Table A8	Accessible areas currently under forest.
Table A9	All areas, excluding cultivated areas, urban areas and areas currently under forest.

Traditional production forestry:

Table A10	All areas.
Table A11	Accessible areas.
Table A12	Accessible areas, excluding cultivated and urban areas.
Table A13	Accessible areas currently under forest..
Table A14	All areas, excluding cultivated areas, urban areas and areas currently under forest.

Conservation forestry:

Table A15	All areas.
Table A16	All areas, excluding cultivated and urban areas.
Table A17	All areas, excluding cultivated areas, urban areas and areas currently under forest.

APPENDIX II

Table A2 PRODUCTION POTENTIALS FOR BIOMASS PLANTATIONS WITH WILLOW (*Salix viminalis*) - ALL AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)									Average annual biomass increments (000tons)						Average annual biomass yield (kg/ha)									
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS
2 4 Mongolia	12	156198	0	0	0	0	0	0	0	78	156119	0	0	0	0	0	0	1	250	0	0	1000	0	0	0	7026	3208
11 1 Armenia	12	2690	0	0	0	0	0	0	0	0	2690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12 1 Azerbaijan	12	7868	0	0	320	0	0	0	320	706	6274	0	0	2221	0	0	0	2221	1638	0	0	6941	0	0	9602	6945	
13 1 Byelorussia	12	20348	640	2410	3240	0	640	1770	830	393	16715	9391	28141	33345	0	9391	18750	5204	806	14673	11677	10292	0	14673	10595	6271	
14 1 Estonia	12	3938	137	598	938	0	137	461	340	186	2814	1670	5947	7987	0	1670	4277	2040	410	12190	9945	8515	0	12206	9275	5999	
15 1 Georgia	12	6523	6	62	141	1	5	56	79	85	6297	92	696	1233	12	80	604	537	196	15333	11226	8745	18634	15275	10802	6764	
16 1 Kazakhstan	12	268445	1	6	1907	0	1	5	1901	3428	263111	11	53	9723	0	11	42	9670	5881	11000	8833	5099	0	12247	9098	5088	
17 1 Kirghiztan	12	19548	0	0	85	0	0	0	85	103	19359	0	0	450	0	0	0	450	182	0	0	5294	0	0	5265	1773	
18 1 Latvia	12	6313	284	1038	1860	0	284	754	822	273	4180	3669	10957	15621	0	3669	7288	4664	558	12919	10556	8398	0	12939	9665	5676	
19 1 Lithuania	12	6420	582	1288	2070	0	582	706	782	260	4090	7853	14766	19376	0	7853	6913	4610	524	13493	11464	9360	0	13482	9794	5898	
20 1 Moldavia	12	3000	16	54	93	1	15	38	39	42	2865	212	587	836	19	193	375	249	95	13250	10870	8989	16027	13180	9946	6424	
21 1 Tajikistan	12	9013	0	2	23	0	0	2	21	55	8935	0	16	139	0	0	16	123	110	0	8000	6043	0	0	8024	5829	
22 1 Turkmenistan	12	45390	0	0	1	0	0	0	0	1	45388	0	0	7	0	0	0	7	3	0	0	7000	0	0	6446	2131	
23 1 Ukraine	12	57570	634	3059	5095	12	622	2425	2036	541	51930	9292	35231	48529	199	9093	25939	13298	1201	14656	11517	9525	16049	14607	10697	6531	
FSU REPUBLICS		457066	2300	8517	15773	14	2286	6217	7256	6073	434648	32190	96394	139467	230	31960	64204	43073	11604	13996	11318	8842	16429	13981	10327	5936	
103 2 Krasnodar Krai	12	7620	26	42	651	12	14	16	609	298	6665	408	565	5038	212	196	157	4473	730	15692	13452	7739	18305	14278	10047	7345	
107 2 Stavropol Krai	12	6635	1	4	5	0	0	1	3	1	6615	10	41	47	0	10	31	6	34	10000	10250	9400	0	14653	10265	6298	
111 2 Arkhangelsk oblast	12	38190	0	0	152	0	0	0	152	25	37993	0	0	776	0	0	0	776	42	0	0	5105	0	0	5101	1703	
112 2 Astrakhan oblast	12	4598	0	0	0	0	0	0	0	0	4597	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114 2 Belgorod oblast	12	2665	3	9	223	0	3	6	214	369	2073	36	91	1411	0	36	55	1320	756	12000	10111	6327	0	12429	8884	6170	
115 2 Bryansk oblast	12	3483	0	127	367	0	0	127	240	86	3029	0	1293	2775	0	0	1293	1482	181	0	10181	7561	0	0	10151	6181	
117 2 Vladimir oblast	12	2925	0	186	233	0	0	186	47	0	2692	0	1754	2014	0	0	1754	260	0	0	9430	8644	0	0	9442	5500	
118 2 Volgograd oblast	12	11265	0	0	16	0	0	0	16	9	11240	0	0	95	0	0	0	95	17	0	0	5938	0	0	5892	1818	
119 2 Volodga oblast	12	14628	0	220	1768	0	0	220	1548	144	12715	0	1910	10214	0	0	1910	8304	319	0	8682	5777	0	0	8681	5364	
120 2 Voronezh oblast	12	5195	0	0	858	0	0	0	858	301	4036	0	0	5307	0	0	0	5307	617	0	0	6185	0	0	6188	2046	
122 2 Nizhni Novgorod obla	12	7515	50	611	929	0	50	561	318	66	6520	679	6016	7876	0	679	5337	1860	135	13580	9846	8478	0	13653	9513	5844	
123 2 Nenets a.okr.	12	16858	0	0	0	0	0	0	0	0	16837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
124 2 Ivanovo oblast	12	2270	0	38	46	0	0	0	38	8	2225	0	349	392	0	0	349	43	0	0	9184	8522	0	0	9281	5604	
127 2 Kaliningrad oblast	12	1240	29	198	368	0	29	169	170	18	855	417	2169	3221	0	417	1752	1052	37	14379	10955	8753	0	14354	10386	6207	
128 2 Tver oblast	12	8395	16	271	766	0	16	255	495	44	7585	201	2574	5337	0	201	2373	2763	95	12563	9498	6967	0	12440	9298	5585	
129 2 Kaluga oblast	12	2963	0	175	361	0	0	175	186	0	2602	0	1721	2832	0	0	1721	1111	0	0	9834	7845	0	0	9849	5973	
133 2 Kirov oblast	12	11930	0	65	343	0	0	65	278	210	11376	3	688	2215	0	3	685	1527	408	3000	10585	6458	0	13358	10520	5482	
134 2 Kostroma oblast	12	6000	0	73	380	0	0	73	307	67	5554	0	684	2404	0	0	684	1720	125	0	9370	6326	0	0	9419	5611	
136 2 Samara oblast	12	5118	0	0	154	0	0	0	154	322	4641	0	0	904	0	0	0	904	597	0	0	5870	0	0	5861	1853	
138 2 Kursk oblast	12	3020	231	794	1195	0	231	563	400	154	3020	3096	8556	10928	0	3096	5460	2372	444	13403	10776	9145	0	13391	9691	5913	
139 2 Komi-Permyak a.okr.	12	3280	0	0	142	0	0	0	142	31	3107	0	0	746	0	0	0	746	65	0	0	5254	0	0	5253	2078	
141 2 Leningrad oblast	12	7500	0	70	1050	0	0	70	980	643	5806	0	613	5756	0	0	613	5143	1148	0	8757	5482	0	0	8727	5248	
142 2 Lipetsk oblast	12	2410	159	337	837	0	159	178	500	213	1360	2060	3754	6706	0	2060	1694	2952	415	12956	11139	8012	0	12965	9504	5900	
146 2 Moscow oblast	12	4665	0	348	470	0	0	348	122	0	4195	0	3335	4038	0	0	3335	703	0	0	9583	8591	0	0	9585	5779	
147 2 Murmansk oblast	12	13960	0	0	0	0	0	0	0	0	13960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
149 2 Novgorod oblast	12	5450	0	425	751	0	0	425	326	212	4488	0	3960	5784	0	0	3960	1824	404	0	9318	7702	0	0	9326	5594	
153 2 Orenburg oblast	12	12418	0	0	88	0	0	0	88	219	12110	0	0	460	0	0	0	460	382	0	0	5227	0	0	5235	1743	
154 2 Oryel oblast	12	2458	263	793	1090	0	263	530	297	7	1361	3658	8991	10803	0	3658	5333	1812	14	13909	11338	9911	0	13885	10070	6107	
156 2 Penza oblast	12	4320	0	0	618	0	0	0	618	918	2784	0	0	3540	0	0	0	3540	1751	0	0	5728	0	0	5728	1907	
157 2 Perm oblast	12	12715	0	53	467	0	0	53	414	221	12027	0	506	2813	0	0	506	2307	461	0	9547	6024	0	0	9630	5568	
158 2 Pskov oblast	12	5568	16	304	738	0	16	288	434	114	4716	207	2868	5222	0	207	2661	2354	211	12938	9434	7076	0	12873	9256	5428	
160 2 Rostov oblast	12	10133	0	0	196	0	0	0	196	117	9819	0	0	1200	0	0	0	1200	260	0	0	6122	0	0	6107	2228	
161 2 Ryazan oblast	12	3935	166	915	1202	0	166	749	287	17	2716	2124	9442	11109	0	2124	7318	1667	34	12795	10319	9242	0	12772	9766	5816	
163 2 Saratov oblast	12	10375	0	0	88	0	0	0	88	154	10132	0	0	528	0	0	0	528</									

APPENDIX II

Table A2 PRODUCTION POTENTIALS FOR BIOMASS PLANTATIONS WITH WILLOW (*Salix viminalis*) - ALL AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)											
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS			
102	3	Gorno-Altai Republic	12	9385	0	3	44	0	0	3	41	21	9320	6	33	245	0	6	27	212	36	6000	11000	5568	0	12447	8975	5171	1718	
104	3	Krasnoyarsk Krai	12	71140	31	202	1200	0	31	171	998	1022	68918	378	1906	7381	0	378	1428	5575	2222	12194	8941	6151	0	12036	8347	5588	2175	
105	3	Primorskiy Krai	12	16338	111	359	720	0	111	248	361	177	15441	1615	4134	6346	0	1615	2519	2212	376	14550	11515	8814	0	14590	10170	6124	2123	
106	3	Taymyr a.okr.	12	82285	0	0	0	0	0	0	0	0	82285	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	3	Khabarovsk Krai	12	77545	95	693	1305	0	95	598	612	530	75703	1260	7370	11293	0	1260	6110	3923	1268	13263	10635	8654	0	13221	10222	6415	2392	
110	3	Amur oblast	12	36283	202	1168	3459	0	202	966	2291	1708	31116	2766	11846	24359	0	2766	9080	12513	3169	13693	10142	7042	0	13694	9396	5462	1856	
116	3	Evenk a.okr.	12	75673	0	0	0	0	0	0	0	0	75673	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
121	3	Yevrey (Jewish) a.ob	12	3700	334	732	984	0	334	398	252	72	2645	4676	8662	10142	0	4676	3986	1480	139	14000	11833	10307	0	14004	10008	5879	1942	
125	3	Irkutsk oblast	12	76270	0	0	8	0	0	0	8	13	76250	0	0	57	0	0	0	57	33	0	0	7125	0	0	0	0	7570	2601
126	3	Ust-Orda Buryat a.ok	12	2178	0	0	0	0	0	0	0	0	2177	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2980	
130	3	Kamchatka oblast	12	17045	0	0	0	0	0	0	0	0	17022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
131	3	Koryak a.okr.	12	28903	0	0	0	0	0	0	0	0	28902	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	3	Kemerovo oblast	12	9500	0	25	413	0	0	25	388	309	8778	0	205	2150	0	0	205	1945	642	0	8200	5206	0	0	8178	5017	2077	
135	3	Chukchi a.okr.	12	70770	0	0	0	0	0	0	0	0	70745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	3	Kurgan oblast	12	7110	35	273	1228	0	35	238	955	913	4968	440	2807	7838	0	440	2367	5031	1533	12571	10282	6383	0	12435	9941	5270	1679	
144	3	Magadan oblast	12	45830	0	0	0	0	0	0	0	0	45830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	3	Novosibirsk oblast	12	17673	53	1024	3433	0	53	971	2409	1333	12907	653	9392	23239	0	653	8739	13847	2935	12321	9172	6769	0	12216	9004	5748	2202	
152	3	Omsk oblast	12	13980	0	26	2470	0	0	26	2444	751	10759	0	221	12754	0	0	221	12533	2080	0	8500	5164	0	0	8516	5128	2769	
164	3	Sakhalin oblast	12	8095	0	0	3	0	0	0	3	15	7984	0	0	23	0	0	0	0	23	35	0	7667	0	0	0	7059	2315	
165	3	Sverdlovsk oblast	12	19273	16	872	2599	0	16	856	1727	595	16078	204	7935	17281	0	204	7731	9346	1132	12750	9100	6649	0	12535	9031	5411	1903	
167	3	Agaa-Buryat a.okr.	12	1970	0	0	0	0	0	0	0	8	1962	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	3172	
169	3	Tomsk oblast	12	31145	0	143	1910	0	0	143	1767	856	28379	0	1167	10921	0	0	1167	9754	2025	0	8161	5718	0	0	8144	5520	2366	
171	3	Tyumen oblast	12	15860	0	216	2999	0	0	216	2783	1415	11446	0	1922	16391	0	0	1922	14469	3902	0	8898	5465	0	0	8895	5200	2757	
172	3	Khanty-Mansi a.okr.	12	53163	0	0	461	0	0	0	461	272	52429	0	0	2364	0	0	0	2364	696	0	0	5128	0	0	0	5132	2555	
174	3	Yamalo-Nenets a.okr	12	66588	0	0	0	0	0	0	0	0	66580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	3	Chelyabinsk oblast	12	8763	81	336	738	0	81	255	402	1066	6959	1001	3408	5679	0	1001	2407	2271	1796	12358	10143	7695	0	12385	9425	5653	1685	
176	3	Chita oblast	12	41493	0	0	0	0	0	0	0	130	41362	0	0	3	0	0	0	3	413	0	0	3000	0	0	0	7545	3181	
181	3	Buryat Republic	12	33533	0	0	1	0	0	0	0	1	22	33509	0	7	0	0	0	7	70	0	0	7000	0	0	0	7601	3112	
193	3	Tuva Republic	12	17035	0	0	0	0	0	0	0	9	17026	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	3315	
195	3	Khakass Republic	12	6120	5	20	55	0	5	15	35	17	6048	61	189	387	0	61	128	198	38	12200	9450	7036	0	12145	8491	5612	2329	
198	3	Sakha (Yakutia) Repu	12	303275	0	0	0	0	0	0	0	0	303257	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		RUSSIA WEST		389947	1353	7530	22516	36	1317	6177	14986	8755	358600	18346	77949	164532	614	17732	59603	86583	16969	13559	10352	7307	17056	13464	9649	5778	1938	
		RUSSIA EAST		1284574	1661	7624	26979	0	1661	5963	19355	11783	1245632	21954	78049	183406	0	21954	56095	105357	25688	13217	10237	6798	#DIV/0!	13217	9407	5443	2180	
		RUSSIA TOTAL		1674521	3014	15154	49495	36	2978	12140	34341	20538	1604232	40300	155998	347938	614	39686	115698	191940	42657	13371	10294	7030	17056	13326	9530	5589	2077	
211	11	Beijing	12	1640	0	0	48	0	0	0	48	52	1540	0	0	311	0	0	0	311	113	0	0	6479	0	0	0	6492	2164	
212	11	Tianjin	12	1125	0	0	228	0	0	0	228	247	650	0	0	1512	0	0	0	1512	545	0	0	6632	0	0	0	6617	2206	
213	11	Hebei	12	18480	0	1	1681	0	0	1	1680	1768	15031	2	9	11371	0	2	7	11362	3983	2000	9000	6764	0	13300	9764	6762	2254	
214	11	Shanxi	12	15783	1	6	179	0	1	5	173	575	15029	13	57	1147	0	13	44	1090	1283	13000	9500	6408	0	12967	9451	6305	2231	
237	11	Shandong	12	14798	228	468	2099	15	213	240	1631	1693	11006	3610	6322	17484	269	3341	2712	11162	3848	15833	13509	8330	17762	15720	11287	6843	2274	
241	11	Henan	12	16295	1606	2721	4207	535	1071	1115	1486	1153	10934	25467	37185	47122	9731	15736	11718	9937	2590	15857	13666	11201	18190	14686	10511	6688	2246	
221	12	Liaoning	12	13863	105	218	678	10	95	113	460	462	12722	1568	2774	5775	179	1389	1206	3001	1001	14933	12725	8518	17845	14660	10636	6518	2169	
222	12	Jilin	12	19145	8	38	625	0	8	30	587	136	18384	114	385	3721	0	114	271	3336	261	14250	10132	5954	0	13800	9146	5684	1919	
223	12	Heilongjiang	12	44848	173	535	1577	0	173	362	1042	204	43067	2472	6211	11949	0	2472	3739	5738	432	14289	11609	7577	0	14328	10322	5507	2119	
231	13	Shanghai	12	413	228	346	346	114	114	118	0	67	3729	4931	4933	2095	1634	1202	2	0	16355	14251	14257	18409	14317	10226	6103	0		
232	13	Jiangsu	12	9290	3376	5233	5543	1573	1803	1857	310	100	3525	53869	72656	74695	28350	25519	18787	2039	226	15956	13884	13476	18028	14151	10117	6580	2268	
233	13	Zhejiang	12	9250	523	983	1168	171	352	460	185	43	8040	8079	12687	13802	3126	4953	4608	1115	89	15447	12906	11817	18242	14086	10018	6038	2094	
234	13	Anhui	12	13783	2324	3929	4478	976	1348	1605	549	97	9207	37620	54203	57728	18017	19603	16583	3525	218	16188	13796	12891	18458	14543	10331	6416	2248	
236	14	Jiangxi	12	16663	243	801	1291	2	241	558	490	182	15189	3367	8871	11777	34	3333	5504	2906	359	13856	11075	9122	18484	13821	9862	5926	1979	
242	14	Hubei	12	18168	1174	2186	2369	461	713	1012	183	16	15782	18334	28381	29454	8302	10												

APPENDIX II

Table A3 PRODUCTION POTENTIALS FOR BIOMASS PLANTATIONS WITH WILLOW (*Salix viminalis*) - ACCESSIBLE AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)									
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S/VS...MS/VS...mS	VS	S	MS	mS	vmS					
197	2 Chuvash Republic	12	1678	0	5	21	0	0	5	16	92	1565	0	57	156	0	0	57	99	174	0	11400	7429	0	0	12194	6093	1901		
101	3 Altai Kray	12	11538	486	1036	2075	0	486	550	1039	342	9120	6202	11601	17158	0	6202	5399	5557	684	12761	11198	8269	0	12754	9809	5346	2003		
102	3 Gorno-Altai Republic	12	2693	0	3	36	0	0	3	33	16	2640	6	33	203	0	6	27	170	28	6000	11000	5639	0	12447	8975	5198	1727		
104	3 Krasnoyarsk Kray	12	16560	26	157	819	0	26	131	662	687	15055	309	1404	5094	0	309	1095	3690	1502	11885	8943	6220	0	12043	8384	5578	2186		
105	3 Primorskiy Kray	12	7290	68	229	453	0	68	161	224	93	6744	988	2625	3996	0	988	1637	1371	199	14529	11463	8821	0	14439	10165	6134	2143		
106	3 Taymyr a.okr.	12	2848	0	0	0	0	0	0	0	0	2847	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	3 Khabarovsk Kray	12	9013	45	250	429	0	45	205	179	76	8505	601	2600	3671	0	601	1999	1071	169	13356	10400	8557	0	13375	9735	5984	2229		
110	3 Amur oblast	12	9438	142	630	1543	0	142	488	913	653	7241	1951	6659	11796	0	1951	4708	5137	1245	13739	10570	7645	0	13744	9639	5624	1906		
116	3 Evenk a.okr	12	6140	0	0	0	0	0	0	0	0	6140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
121	3 Yevrey (Jewish) a.ol	12	1545	189	408	534	0	189	219	126	29	982	2651	4839	5575	0	2651	2188	736	54	14026	11860	10440	0	14051	9995	5844	1866		
125	3 Irkutsk oblast	12	17280	0	0	7	0	0	0	7	12	17261	0	0	54	0	0	54	32	0	0	7714	0	0	0	0	0	7559	2599	
126	3 Ust-Orda Buryat a.ol	12	1180	0	0	0	0	0	0	0	0	1180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2980	
130	3 Kamchatka oblast	12	3853	0	0	0	0	0	0	0	0	3852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
131	3 Koryak a.okr.	12	5013	0	0	0	0	0	0	0	0	5012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	3 Kemerovo oblast	12	5290	0	15	280	0	0	15	265	210	4800	0	121	1454	0	0	121	1333	446	0	8067	5193	0	0	8152	5028	2118		
135	3 Chukchi a.okr.	12	8158	0	0	0	0	0	0	0	0	8155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	3 Kurgan oblast	12	5195	30	217	940	0	30	187	723	680	3575	368	2226	6026	0	368	1858	3800	1142	12267	10258	6411	0	12434	9941	5252	1680		
144	3 Magadan oblast	12	9245	0	0	0	0	0	0	0	0	9245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	3 Novosibirsk oblast	12	9910	32	678	1691	0	32	646	1013	732	7487	387	6195	12056	0	387	5808	5861	1542	12094	9137	7130	0	12210	8985	5784	2107		
152	3 Omsk oblast	12	8545	0	17	1549	0	0	17	1532	582	6413	0	147	8047	0	0	147	7900	1626	0	8647	5195	0	0	8497	5155	2794		
164	3 Sakhalin oblast	12	4795	0	0	3	0	0	0	3	13	4776	0	0	22	0	0	22	31	0	0	7333	0	0	0	0	0	7051	2303	
165	3 Sverdlovsk oblast	12	12618	16	665	1813	0	16	649	1148	444	10361	204	6060	12344	0	204	5856	6284	844	12750	9113	6809	0	12535	9024	5475	1903		
167	3 Aga-Buryat a.okr.	12	663	0	0	0	0	0	0	0	4	658	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	3162	
169	3 Tomsk oblast	12	7415	0	55	795	0	0	55	740	474	6146	0	447	4638	0	0	447	4191	1096	0	8127	5834	0	0	8144	5665	2312		
171	3 Tyumen oblast	12	7043	0	118	872	0	0	118	754	755	5416	0	1059	5140	0	0	1059	4081	2130	0	8975	5894	0	0	9011	5413	2822		
172	3 Khatny-Mansi a.okr.	12	6830	0	0	34	0	0	0	34	51	6745	0	0	202	0	0	0	202	132	0	0	5941	0	0	0	0	5890	2599	
174	3 Yamalo-Nenets a.okr.	12	2680	0	0	0	0	0	0	0	0	2680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	3 Chelyabinsk oblast	12	6338	62	270	580	0	62	208	310	781	4977	765	2731	4486	0	765	1966	1755	1318	12339	10115	7734	0	12409	9453	5652	1688		
176	3 Chita oblast	12	7850	0	0	0	0	0	0	0	93	7757	0	0	0	0	0	0	0	298	0	0	0	0	0	0	0	7090	3195	
181	3 Buryat Republic	12	6650	0	0	1	0	0	0	1	16	6633	0	0	6	0	0	6	50	0	0	6000	0	0	0	0	0	7646	3114	
193	3 Tuva Republic	12	5043	0	0	0	0	0	0	0	7	5035	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	3300	
195	3 Khakass Republic	12	3093	5	18	50	0	5	13	32	14	3029	61	175	353	0	61	114	178	32	12200	9722	7060	0	12145	8501	5646	2362		
198	3 Sakha (Yakutia) Rep	12	46970	0	0	0	0	0	0	0	0	46970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RUSSIA WEST		244894	1173	6275	18033	34	1139	5102	11758	7032	219786	15895	65196	133683	590	15305	49301	68487	13656	13551	10390	7413	17353	13437	9663	5825	1942		
	RUSSIA EAST		258722	1101	4766	14504	0	1101	3665	9738	6764	237437	14493	48922	102321	0	14493	34429	53399	14637	13163	10265	7055 #DIV/0!	13163	9394	5484	9664	2164		
	RUSSIA TOTAL		503616	2274	11041	32537	34	2240	8767	21496	13796	457223	30388	114118	236004	590	29798	83730	121886	28293	13363	10336	7253	17353	13303	9551	5670	2051		
211	11 Beijing	12	1385	0	0	40	0	0	0	40	43	1302	0	0	257	0	0	0	257	93	0	0	6425	0	0	0	6489	2163		
212	11 Tianjin	12	863	0	0	180	0	0	0	180	194	488	0	0	1191	0	0	0	1191	428	0	0	6617	0	0	0	6614	2205		
213	11 Hebei	12	13455	0	0	1302	0	0	0	1302	1365	10787	1	5	8814	0	1	4	8809	3078	1000	5000	6770	0	13295	9959	6764	2254		
214	11 Shanxi	12	8953	0	1	123	0	0	1	122	442	8386	4	18	787	0	4	14	769	990	4000	18000	6398	0	13114	9611	6292	2237		
237	11 Shandong	12	10518	167	341	1499	12	155	174	1158	1192	7826	2644	4604	12534	212	2432	1960	7930	2712	15832	13501	8362	17757	15649	11260	6847	2275		
241	11 Henan	12	10775	1239	2095	3244	417	822	856	1149	907	6625	19631	28613	36296	7580	12051	8982	7683	2037	15844	13658	11189	18174	14658	10493	6689	2247		
221	12 Liaoning	12	11258	98	203	605	10	88	105	402	401	10251	1465	2587	5211	170	1295	1122	2624	870	14949	12744	8613	17840	14723	10678	6522	2168		
222	12 Jilin	12	14803	8	35	502	0	8	27	467	104	14196	114	363	3034	0	114	249	2671	200	14250	10371	6044	0	13800	9154	5720	1928		
223	12 Heilongjiang	12	26983	90	294	1021	0	90	204	727	139	25822	1286	3396	7369	0	1286	2110	3973	294	14289	11551	7217	0	14247	10363	5461	2117		
231	13 Shanghai	12	370	206	312	312	103	103	106	0	57	3376	4464	4466	1897	1479	1088	2	0	16388	14308	14314	18413	14320	10228	6104	0	0		
232	13 Jiangsu	12	5798	2175	3385	3620	1003	1172	1210	235	80	2094	34731	47006	48567	18092	16639	12275	1561	182	15968	13887	13416	18030	14191	10148	6632	2269		
233	13 Zhejiang	12	5938	380	707	841	123	257	327	134	37	5061	5862	9138	9948	2252	3610	3276	810	77	15426	12925	11829	18256	14074	10026	6055	2105		
234	13 Anhui	12	9145	1710	2883	3311	709	1001	1173	428	76	5758	27656	39797	42557	13075	14581	12141	2760	171	16173	13804	12853	18448	14566	10352	6443	2251		
236	14 Jiangxi	12	10700	141	515	830	1	140	374	315	127	9743	1957	5641	7503	22	1935	3684	1862	251	13879	10953	9040	18415						

APPENDIX II

Table A4 PRODUCTION POTENTIALS FOR BIOMASS PLANTATIONS WITH WILLOW (*Salix viminalis*) - ACCESSIBLE AREAS, EXCLUDING CULTIVATED AND URBAN AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)									
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S/V	VS...MS/V	VS...mS/V	VS	S	MS	mS	vmS			
102	3 Gorno-Altai Republic	12	2668	0	3	36	0	0	3	33	16	2615	6	33	202	0	6	27	169	28	6000	11000	5611	0	12447	8975	5196	1726		
104	3 Krasnoyarsk Kray	12	13728	19	78	433	0	19	59	355	393	12902	224	730	2737	0	224	506	2007	847	11789	9359	6321	0	12015	8552	5656	2157		
105	3 Primorski Kray	12	6520	59	205	412	0	59	146	207	87	6021	847	2323	3588	0	847	1476	1265	188	14356	11332	8709	0	14381	10126	6119	2146		
106	3 Taymyr a.okr.	12	2825	0	0	0	0	0	0	0	0	2825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
108	3 Khabarovsk Kray	12	8873	40	216	386	0	40	176	170	74	8409	536	2258	3277	0	536	1722	1019	165	13400	10454	8490	0	13392	9764	5983	2225		
110	3 Amur oblast	12	8108	78	423	1190	0	78	345	767	591	6327	1069	4332	8574	0	1069	3263	4242	1110	13705	10241	7205	0	13773	9463	5531	1877		
116	3 Evenk a.okr	12	6128	0	0	0	0	0	0	0	0	6127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
121	3 Yevrey (Jewish) a.ot	12	1450	163	354	471	0	163	191	117	29	949	2281	4181	4863	0	2281	1900	682	54	13994	11811	10325	0	13975	9938	5815	1863		
125	3 Irkutsk oblast	12	16035	0	0	7	0	0	0	7	10	16018	0	0	51	0	0	0	51	27	0	0	7286	0	0	0	0	7588	2628	
126	3 Ust-Orda Buryat a.okr	12	693	0	0	0	0	0	0	0	0	692	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
130	3 Kamchatka oblast	12	3853	0	0	0	0	0	0	0	0	3852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
131	3 Koryak a.okr.	12	5010	0	0	0	0	0	0	0	0	5010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	3 Kemerovo oblast	12	3498	0	3	134	0	3	131	107	3256	0	28	674	0	28	646	210	0	9333	5030	0	0	0	0	8136	4946	1961		
135	3 Chukchi a.okr.	12	8158	0	0	0	0	0	0	0	0	8155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	3 Kurgan oblast	12	2403	2	26	321	0	2	24	295	317	1765	26	258	1752	0	26	232	1494	529	13000	9923	5458	0	12600	9806	5066	1669		
144	3 Magadan oblast	12	9245	0	0	0	0	0	0	0	0	9245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	3 Novosibirsk oblast	12	6220	4	180	739	0	4	176	559	473	5008	46	1633	5063	0	46	1587	3430	1037	11500	9072	6851	0	12147	8993	6138	2194		
152	3 Omsk oblast	12	5035	0	16	396	0	0	16	380	412	4228	0	132	2357	0	0	132	2225	1120	0	8250	5952	0	0	8498	5862	2722		
164	3 Sakhalin oblast	12	4760	0	0	3	0	0	0	3	13	4741	0	0	22	0	0	0	22	31	0	0	7333	0	0	0	7051	2303		
165	3 Sverdlovsk oblast	12	10428	1	323	1085	0	1	322	762	293	9049	9	2894	7030	0	9	2885	4136	566	9000	8960	6479	0	11896	8966	5427	1931		
167	3 Aga-Buryat a.okr.	12	630	0	0	0	0	0	0	0	4	626	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	3157	
169	3 Tomsk oblast	12	6968	0	48	717	0	0	48	669	415	5836	0	388	4162	0	388	3774	961	0	8083	5805	0	0	8121	5643	2315			
171	3 Tyumen oblast	12	4585	0	67	651	0	0	67	584	467	3468	0	583	3739	0	0	583	3156	1333	0	8701	5743	0	0	8743	5404	2858		
172	3 Khanty-Mansi a.okr.	12	6780	0	0	31	0	0	0	31	50	6700	0	180	0	0	180	129	0	0	5806	0	0	0	0	0	5866	2597		
174	3 Yamalo-Nenets a.okr	12	2678	0	0	0	0	0	0	0	0	2677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	3 Chelyabinsk oblast	12	2578	10	45	100	0	10	35	55	165	2312	123	499	811	0	123	376	312	276	12300	11089	8110	0	12303	10613	5667	1677		
176	3 Chita oblast	12	7260	0	0	0	0	0	0	0	0	7260	0	0	0	0	0	0	0	256	0	0	0	0	0	0	0	7090	3202	
181	3 Buryat Republic	12	6045	0	0	0	0	0	0	0	0	6035	0	0	1	0	0	0	1	33	0	0	1000	0	0	0	7548	3162		
193	3 Tuva Republic	12	4778	0	0	0	0	0	0	0	6	4772	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	3300	
195	3 Khakass Republic	12	2370	0	3	20	0	0	3	17	7	2344	0	28	109	0	0	28	81	15	0	9333	5450	0	0	9231	4888	2128		
198	3 Sakha (Yakutia) Rep	12	46870	0	0	0	0	0	0	0	0	46870	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	RUSSIA WEST		122175	158	1515	5054	23	135	1357	3539	1666	115414	2190	15065	34548	389	1801	12875	19483	3210	13861	9944	6836	16913	13341	9488	5505	1927		
	RUSSIA EAST		223305	546	2424	8175	0	546	1878	5751	4243	210872	7344	25121	57306	0	7344	17777	32185	9388	13451	10363	7010	#DIV/0!	13451	9466	5596	2213		
	RUSSIA TOTAL		345480	704	3939	13229	23	681	3235	9290	5909	326286	9534	40186	91854	389	9145	30652	51668	12598	13543	10202	6943	16913	13429	9475	5562	2132		
211	11 Beijing	12	705	0	0	0	0	0	0	0	0	705	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
212	11 Tianjin	12	70	0	0	1	0	0	0	1	1	69	0	0	5	0	0	0	5	2	0	0	5000	0	0	0	6742	2247		
213	11 Hebei	12	5220	0	0	39	0	0	0	39	40	5141	1	5	267	0	1	4	262	91	1000	5000	6846	0	13295	9959	6785	2262		
214	11 Shanxi	12	3418	0	1	7	0	0	1	6	40	3370	4	16	54	0	4	12	38	91	4000	16000	7714	0	13287	9583	6358	2259		
237	11 Shandong	12	1513	8	20	181	0	8	12	161	173	1159	114	236	1334	0	114	122	1098	394	14250	11800	7370	0	14878	10581	6826	2277		
241	11 Henan	12	4635	501	856	1246	158	343	355	390	260	3129	7894	11634	14258	2847	5047	3740	2624	586	15756	13591	11443	18056	14718	10545	6724	2254		
221	12 Liaoning	12	3945	3	5	40	0	3	2	35	45	3860	35	56	282	0	35	21	226	97	11667	11200	7050	0	13468	10263	6532	2151		
222	12 Jilin	12	7378	0	7	73	0	0	7	66	13	7292	0	59	415	0	0	59	356	25	0	8429	5685	0	12582	9012	5428	1870		
223	12 Heilongjiang	12	15713	34	108	268	0	34	74	160	47	15398	473	1225	2097	0	473	752	872	117	13912	11343	7825	0	13998	10127	5448	2505		
231	13 Shanghai	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
232	13 Jiangsu	12	583	105	170	200	43	62	65	30	15	367	1669	2342	2543	779	890	673	201	35	15895	13776	12715	17967	14435	10349	6794	2272		
233	13 Zhejiang	12	3165	33	77	108	2	31	44	31	6	3052	466	903	1090	39	427	437	187	13	14121	11727	10093	18456	14000	10046	6073	2096		
234	13 Anhui	12	4535	952	1565	1800	393	559	613	235	59	2676	15381	21771	23331	7214	8167	6390	1560	135	16157	13911	12962	18356	14606	10429	6637	2278		
236	14 Jiangxi	12	7530	54	234	385	1	53	180	151	69	7076	753	2535	3431	16	737	1782	896	137	13944	10833	8912	18424	13822	9884	5944	1991		
242	14 Hubei	12	7245	495	865	937	185	310	370	72	2	6306	7686	11369	11794	3330	4356	3683	425	5	15527	13143	12587	18011	14062	9957	5876	1946		
243	14 Hunan	12	9118	348	998	1362	7	341	650	364	45	7709	4977	11481	13639	127	4850	6504	2158	90	14302	11504	10014	18019	14201	10000	5932	1975		
235	15 Fujian	12	6195	37	103	162	1	36	66	59	18	6014	511	1172	1533	19	492	661	361	39	13811	11379	9463	17046	13607	9982	6075	2201		
244	15 Guangdong	12	7700	96	200	280	0	96	104	80	16	7404	1264	2269	2743	0	1264	1005	474	35	13167	11345	9796	0	13120	9702	5901	2228		
245	15 Guangxi	12	11093	56	236	337	0	56	180	101	39	10716	741	2634	3294	0														

APPENDIX II

Table A5 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ALL AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)									Average annual biomass yield (kg/ha)							
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS
2 4 Mongolia	12	156198	0	0	54	0	0	0	54	191	155953	0	0	11	0	0	0	11	50	0	0	5500	0	0	0	6099	1861
11 1 Armenia	12	2690	0	0	2	0	0	0	2	27	2661	0	0	0	0	0	0	11	50	0	0	5500	0	0	0	6099	1861
12 1 Azerbaijan	12	7868	0	0	520	0	0	0	520	780	6000	0	3	3584	0	3	3581	1812	0	3000	6892	0	12452	9047	6890	2323	
13 1 Byelorussia	12	20348	6048	14103	15879	0	6048	8055	1776	505	3964	87097	171363	182486	0	87097	84266	11123	1035	14401	12151	11492	0	14401	10461	6263	2051
14 1 Estonia	12	3938	567	1362	1974	0	567	795	612	213	1751	7056	14445	17821	0	7056	7389	3376	455	12444	10606	9028	0	12444	9295	5518	2143
15 1 Georgia	12	6523	114	191	291	62	52	77	100	116	6115	1805	2618	3261	1088	717	813	643	254	15833	13707	11206	17540	13841	10492	6456	2185
16 1 Kazakhstan	12	268445	5	35	7645	0	5	30	7610	7285	253515	64	341	39862	0	64	277	39521	12653	12800	9743	5214	0	12661	9322	5193	1737
17 1 Kirghizstan	12	19548	0	4	198	0	0	4	194	167	19182	0	35	1309	0	0	35	1274	350	0	8750	6611	0	0	9246	6561	2093
18 1 Latvia	12	6313	831	2679	4480	0	831	1848	1801	429	1403	10950	28221	38357	0	10950	17271	10136	857	13177	10534	8562	0	13172	9347	5627	1995
19 1 Lithuania	12	6420	1893	3646	4431	0	1893	1753	785	506	1484	25982	43089	47735	0	25982	17107	10466	1015	13725	11818	10773	0	13726	9760	5921	2005
20 1 Moldavia	12	3000	190	276	394	77	113	86	118	257	2350	2706	3545	4332	1240	1466	839	787	588	14242	12844	10995	16200	13033	9760	6688	2290
21 1 Tajikistan	12	9013	0	5	56	0	0	5	51	79	8878	0	37	323	0	0	37	286	154	0	7400	5768	0	0	8098	5613	1955
22 1 Turkmenistan	12	45390	0	0	9	0	0	0	9	7	45374	0	0	56	0	0	0	56	15	0	0	6222	0	0	0	6427	2042
23 1 Ukraine	12	57570	8732	16809	22853	1215	7517	8077	6044	4315	30398	121860	207474	248112	19477	102383	85614	40638	9676	13956	12343	10857	16033	13619	10599	6723	2242
FSU REPUBLICS		457066	18380	39110	58732	1354	17026	20730	19622	14686	383075	257520	471171	587249	21805	235715	213651	116078	28914	14011	12047	9999	16104	13844	10306	5916	1969
103 2 Krasnodar Krai	12	7620	67	101	3623	21	46	34	3522	1154	2836	1038	1371	26531	395	643	333	25160	2760	15493	13574	7323	18445	13947	9928	7145	2391
107 2 Stavropol Krai	12	6635	2	7	1479	0	2	5	1472	877	4279	32	77	9707	3	29	45	9630	1920	16000	11000	6563	15904	13155	9907	6540	2191
111 2 Arkhangelsk oblast	12	38190	0	386	2152	0	0	386	1766	1682	34336	0	3132	11814	0	0	3132	8682	2771	0	8114	5490	0	0	8124	4915	1648
112 2 Astrakhan oblast	12	4598	0	0	0	0	0	0	0	0	4597	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114 2 Belgorod oblast	12	2665	43	114	439	0	43	71	325	349	1878	541	1207	3210	0	541	666	2003	720	12581	10588	7312	0	12523	9383	6168	2064
115 2 Bryansk oblast	12	3483	653	2406	2894	0	653	1753	488	53	535	9472	27680	30723	0	9472	18208	3043	110	14505	11505	10616	0	14496	10384	6237	2078
117 2 Vladimir oblast	12	2925	270	1858	2188	0	270	1588	330	255	483	3485	18690	20567	0	3485	15205	1877	481	12907	10059	9400	0	12909	9578	5690	1889
118 2 Volgograd oblast	12	11265	0	0	266	0	0	266	485	10514	0	0	1303	0	0	0	1303	853	0	0	0	4898	0	0	0	4896	1759
119 2 Volodga oblast	12	14628	0	3057	8810	0	0	3057	5753	1086	4733	0	26600	56463	0	0	26600	29863	1933	0	8701	6409	0	0	8702	5191	1781
120 2 Voronezh oblast	12	5195	6	33	977	0	6	27	944	808	3410	70	350	6179	0	70	280	5829	1657	11667	10606	6324	0	11749	10307	6177	2050
122 2 Nizhni Novgorod obl.	12	7515	878	4394	5204	0	878	3516	810	264	2046	11729	45871	50609	0	11729	34142	4738	505	13359	10439	9725	0	13352	9709	5851	1912
123 2 Nenets a.okr.	12	16858	0	0	0	0	0	0	0	0	16837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124 2 Ivanovo oblast	12	2270	1016	1859	1963	0	1016	843	104	58	249	13170	21063	21651	0	13170	7893	588	109	12963	11330	11030	0	12966	9364	5635	1866
127 2 Kaliningrad oblast	12	1240	541	808	978	0	541	267	170	18	243	7833	10599	11657	0	7833	2766	1058	37	14479	13118	11919	0	14479	10361	6207	2065
128 2 Tver oblast	12	8395	871	4235	6878	0	871	3364	2643	182	1335	10994	41842	56353	0	10994	30848	14511	346	12622	9880	8193	0	12616	9169	5490	1905
129 2 Kaluga oblast	12	2963	752	1885	2158	0	752	1133	273	50	754	10091	21170	22796	0	10091	11079	1626	98	13419	11231	10563	0	13428	9799	5952	1939
133 2 Kirov oblast	12	11930	602	2630	5742	0	602	2028	3112	2022	4167	7769	26015	42964	0	7769	18246	16949	3565	12905	8992	7482	0	12912	8978	5447	1763
134 2 Kostroma oblast	12	6000	113	1694	4215	0	113	1581	2521	514	1271	1446	15999	30129	0	1446	14553	14130	960	12796	9445	7148	0	12787	9208	5604	1868
136 2 Samara oblast	12	5118	0	0	377	0	0	377	720	4021	0	0	2117	0	0	0	2117	1340	0	0	0	5615	0	0	0	5613	1862
138 2 Kursk oblast	12	3020	636	1430	1754	0	636	794	324	79	1187	8802	16645	18566	0	8802	7843	1921	153	13840	11640	10585	0	13847	9873	5937	1943
139 2 Komi-Permyak a.okr	12	3280	0	474	1237	0	0	474	763	526	1517	0	3978	8009	0	0	3978	4031	893	0	8392	6475	0	0	8385	5285	1698
141 2 Leningrad oblast	12	7500	162	1071	3476	0	162	909	2405	1611	2412	1988	9726	22283	0	1988	7738	12557	2967	12272	9081	6411	0	12252	8513	5220	1841
142 2 Lipetsk oblast	12	2410	431	913	1339	0	431	482	426	230	841	5747	10485	13036	0	5747	4738	2551	451	13334	11484	9736	0	13332	9822	5984	1967
146 2 Moscow oblast	12	4665	1290	2832	3560	0	1290	1542	728	60	1045	16895	31419	35466	0	16895	14524	4047	112	13097	11094	9962	0	13096	9420	5557	1875
147 2 Murmansk oblast	12	13960	0	0	0	0	0	0	0	0	13960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149 2 Novgorod oblast	12	5450	909	3053	4431	0	909	2144	1378	234	785	11486	30914	38395	0	11486	19428	7481	444	12636	10126	8665	0	12629	9062	5430	1895
153 2 Orenburg oblast	12	12418	0	0	160	0	0	160	435	11823	0	0	809	0	0	0	809	718	0	0	0	5056	0	0	0	5054	1653
154 2 Oryol oblast	12	2458	572	1375	1541	0	572	803	166	10	907	8228	16452	17463	0	8228	8224	1011	20	14385	11965	11332	0	14396	10242	6091	1917
156 2 Penza oblast	12	4320	15	175	1060	0	15	160	885	1151	2109	172	1862	7021	0	172	1690	5159	2214	11467	10640	6624	0	11707	10533	5831	1924
157 2 Perm oblast	12	12715	184	1587	3583																						

APPENDIX II

Table A5 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ALL AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)					Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)													
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS				
102	3	Gorno-Altai Republic	12	9385	1	19	62	0	1	18	43	16	9306	18	175	403	0	18	157	228	27	18000	9211	6500	0	12446	8624	5266	1710		
104	3	Krasnoyarsk Krai	12	71140	58	883	2818	0	58	825	1935	2189	66132	696	7659	19138	0	696	6963	11479	5195	12000	8674	6791	0	11921	8438	5931	2373		
105	3	Primorskiy Krai	12	16338	182	666	1600	5	177	484	934	361	14376	2614	7602	13411	87	2527	4988	5809	739	14363	11414	8382	16003	14319	10307	6216	2047		
106	3	Taymyr a.okr.	12	82285	0	0	0	0	0	0	0	0	82285	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	3	Khabarovsk Krai	12	77545	316	1696	2624	0	316	1380	928	1060	73855	4218	17375	22935	0	4218	13157	5560	2353	13348	10245	8740	0	13360	9537	5991	2220		
110	3	Amur oblast	12	36283	1041	2460	5533	0	1041	1419	3073	2471	28279	14043	27576	44161	0	14043	13533	16585	4490	13490	11210	7981	0	13493	9535	5398	1817		
116	3	Evenk a.okr.	12	75673	0	0	0	0	0	0	0	0	75672	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
121	3	Yevrey (Jewish) a.o.t	12	3700	491	1248	1544	0	491	757	296	94	2061	6883	14366	16100	0	6883	7483	1734	181	14018	11511	10427	0	14009	9881	5858	1921		
125	3	Irkutsk oblast	12	76270	0	0	117	0	0	0	117	227	75926	0	0	786	0	0	0	786	553	0	0	6718	0	0	0	0	0	0	
126	3	Ust-Orda Buryat a.okr.	12	2178	0	0	1	0	0	0	1	6	2170	0	0	9	0	0	0	9	15	0	0	9000	0	0	0	0	0	0	
130	3	Kamchatka oblast	12	17045	0	0	0	0	0	0	0	0	17022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
131	3	Koryak a.okr.	12	28903	0	0	0	0	0	0	0	0	28902	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	3	Kemerovo oblast	12	9500	0	462	1289	0	0	462	827	405	7806	0	3763	8171	0	0	3763	4408	853	0	8145	6339	0	0	8141	5390	2105		
135	3	Chukchi a.okr.	12	70770	0	0	0	0	0	0	0	0	70745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	3	Kurgan oblast	12	7110	175	579	1602	0	175	404	1023	801	4707	2162	6175	11572	0	2162	4013	5397	1355	12354	10665	7223	0	12334	9938	5275	1691		
144	3	Magadan oblast	12	45830	0	0	0	0	0	0	0	0	45830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	3	Novosibirsk oblast	12	17673	937	2395	5777	0	937	1458	3382	1431	10465	11307	25682	42863	0	11307	14375	17181	2965	12067	10723	7420	0	12068	9857	5081	2073		
152	3	Omsk oblast	12	13980	8	470	5675	0	8	462	5205	1234	7069	98	4584	30108	0	98	4486	25524	2445	12250	9753	5305	0	11631	9702	4903	1981		
164	3	Sakhalin oblast	12	8095	0	5	17	0	0	5	12	30	7956	0	44	108	0	0	44	64	70	0	8800	6353	0	0	9207	5462	2305		
165	3	Sverdlovsk oblast	12	19273	764	3734	8183	0	764	2970	4449	1067	10022	9267	35089	58479	0	9267	25822	23390	1946	12130	9397	7146	0	12132	8695	5257	1823		
167	3	Aga-Buryat a.okr.	12	1970	0	0	6	0	0	0	6	39	1925	0	0	24	0	0	0	24	73	0	0	4000	0	0	0	4288	1874		
169	3	Tomsk oblast	12	31145	4	1355	5405	0	4	1351	4050	2575	23165	42	11777	35349	0	42	11735	23572	5955	10500	8692	6540	0	11665	8685	5820	2313		
171	3	Tyumen oblast	12	15860	112	775	5659	0	112	663	4884	1842	8359	1334	7652	33042	0	1334	6318	25390	4287	11911	9874	5839	0	11905	9530	5198	2327		
172	3	Khanty-Mansi a.okr.	12	53163	0	426	1432	0	0	426	1066	839	50892	0	3466	8976	0	0	3466	5510	2029	0	8136	6268	0	0	8128	5478	2419		
174	3	Yamalo-Nenets a.okr.	12	66588	0	0	0	0	0	0	0	0	66580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
175	3	Chelyabinsk oblast	12	8763	269	640	1247	0	269	371	607	1263	6252	3359	6790	10076	0	3359	3431	3286	2131	12487	10609	8080	0	12471	9257	5410	1686		
176	3	Chita oblast	12	41493	0	0	81	0	0	81	222	41189	0	1	367	0	0	0	1	366	515	0	1000	4531	0	0	8449	4488	2320		
181	3	Buryat Republic	12	33533	0	0	32	0	0	32	120	33381	0	0	197	0	0	0	197	313	0	0	6156	0	0	0	6172	2614			
193	3	Tuva Republic	12	17035	0	0	12	0	0	12	14	17009	0	0	54	0	0	0	54	37	0	0	4500	0	0	0	4471	2670			
195	3	Khakass Republic	12	6120	9	108	299	0	9	99	191	201	5620	111	959	2031	0	111	848	1072	375	12333	8880	6793	0	11976	8554	5617	1868		
198	3	Sakha (Yakutia) Rep.	12	303275	0	0	0	0	0	0	0	0	303257	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
		RUSSIA WEST		389947	17483	57572	103370		82	17401	40089	45798	25282	261223	231651	606564	868806		1443	230208	374913	262242	48200	13250	10536	8405	17598	13230	9352	5726	1906
		RUSSIA EAST		1284574	5627	20501	56371		5	5622	14874	35870	20108	1207911	71997	208856	401098		87	71910	136859	192242	41892	12795	10188	7115	17400	12791	9201	5359	2083
		RUSSIA TOTAL		1674521	23110	78073	159741		87	23023	54963	81668	45390	1469134	303648	815420	1269904		1530	302118	511772	454484	90092	13139	10444	7950	17586	13122	9311	5565	1985
211	11	Beijing	12	1640	0	1	202	0	0	1	201	237	1201	2	7	1318	0	2	5	1311	515	2000	7000	6525	16056	13330	9485	6510	2173		
212	11	Tianjin	12	1125	0	0	270	0	0	0	270	267	588	0	0	1786	0	0	0	1786	590	0	0	6615	0	0	0	6622	2206		
213	11	Hebei	12	18480	2	10	2735	0	2	8	2725	2856	12888	32	110	17989	2	30	78	17879	6263	16000	11000	6577	16089	13197	9468	6561	2193		
214	11	Shanxi	12	15783	19	49	697	3	16	30	648	1083	14002	268	548	4865	51	217	280	4317	2395	14105	11184	6980	16928	13178	9468	6660	2211		
237	11	Shandong	12	14798	878	1547	4100	270	608	669	2553	2459	8239	13382	20440	37969	4721	8661	7058	17529	5655	15241	13213	9261	17459	14255	10555	6867	2300		
241	11	Henan	12	16295	4056	5763	7345	1418	2638	1707	1582	1222	7728	63478	81367	91814	25559	37919	17889	10447	2761	15650	14119	12500	18030	14373	10478	6604	2259		
221	12	Liaoning	12	13863	1473	2012	3211	454	1019	539	1199	1123	9529	21601	27001	34814	7717	13884	5400	7813	2434	14665	13420	10842	17014	13624	10025	6517	2167		
222	12	Jilin	12	19145	1787	3018	5756	430	1357	1231	2738	1093	12296	25223	37487	52640	6922	18301	12264	15153	1940	14115	12421	9145	16091	13483	9967	5534	1776		
223	12	Heilongjiang																													

APPENDIX II

Table A6 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ACCESSIBLE AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)					Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)									
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S...MS/S...mS	VS	S	MS	mS	vmS		
2 4 Mongolia	12	63130	0	0	34	0	0	0	34	97	63000	0	0	147	0	0	147	276	0	0	4324	0	0	4380	2851		
11 1 Armenia	12	2025	0	0	2	0	0	0	2	26	1997	0	0	10	0	0	10	49	0	0	5000	0	0	6081	1857		
12 1 Azerbaijan	12	6095	0	0	382	0	0	0	382	587	4633	0	1	2607	0	0	1	2606	1361	0	1000	6825	0	0	9297	6816	2317
13 1 Byelorussia	12	17955	5375	12434	14001	0	5375	7059	1567	449	3504	77379	151127	160928	0	77379	73748	9801	920	14396	12154	11494	0	14395	10447	6253	2049
14 1 Estonia	12	3365	525	1212	1729	0	525	687	517	176	1460	6534	12900	15745	0	6534	6366	2845	376	12446	10644	9106	0	12450	9266	5503	2136
15 1 Georgia	12	4763	97	163	245	52	45	66	82	93	4425	1536	2218	2742	917	619	682	524	200	15835	13607	11192	17597	13874	10369	6395	2158
16 1 Kazakhstan	12	165068	4	23	5149	0	4	19	5126	4977	154943	46	219	26817	0	46	173	26598	8694	11500	9522	5208	0	12717	9333	5189	1747
17 1 Kirghizstan	12	10428	0	3	172	0	0	3	169	150	10106	0	27	1135	0	0	27	1108	313	0	9000	6599	0	0	9213	6540	2092
18 1 Latvia	12	5573	712	2348	3938	0	712	1636	1590	381	1254	9365	24631	33565	0	9365	15266	8934	757	13153	10490	8523	0	13159	9331	5618	1989
19 1 Lithuania	12	6018	1757	3408	4151	0	1757	1651	743	475	1391	24113	40227	44623	0	24113	16114	4396	950	13724	11804	10750	0	13720	9757	5918	2002
20 1 Moldavia	12	2848	182	264	375	73	109	82	111	242	2230	2608	3408	4149	1185	1423	800	741	554	14330	12909	11064	16204	13033	9768	6688	2288
21 1 Tajikistan	12	4775	0	3	47	0	0	3	44	68	4660	0	28	275	0	28	247	133	0	9333	5851	0	0	8086	5643	1960	
22 1 Turkmenistan	12	22535	0	0	7	0	0	0	7	6	22523	0	0	42	0	0	42	11	0	0	6000	0	0	0	6429	2033	
23 1 Ukraine	12	51955	7973	15142	20602	1141	6832	7169	5460	3947	27407	111172	187047	223784	18294	92878	75875	36737	8858	13944	12353	10862	16037	13595	10584	6728	2244
FSU REPUBLICS		303403	16625	35000	50800	1266	15359	18375	15800	11577	240533	232753	421833	516422	20396	212357	189080	94589	23176	14000	12052	10166	16111	13826	10290	5987	2002
103 2 Krasnodar Kray	12	6715	64	94	3245	21	43	30	3151	1029	2436	991	1291	23810	387	604	300	22519	2461	15484	13734	7337	18476	13984	9959	7147	2392
107 2 Stavropol Kray	12	5428	2	6	1178	0	2	4	1172	747	3503	27	71	7753	2	25	44	7682	1639	13500	11833	6581	16209	13296	9911	6556	2195
111 2 Arkhangelsk oblast	12	14210	0	196	1331	0	0	196	1135	1074	11790	0	1597	7182	0	0	1597	5585	1770	0	8148	5396	0	0	8148	4921	1648
112 2 Astrakhan oblast	12	2923	0	0	0	0	0	0	0	0	2922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114 2 Belgorod oblast	12	2248	39	101	379	0	39	62	278	295	1572	495	1080	2795	0	495	585	1715	609	12692	10693	7375	0	12571	9369	6165	2063
115 2 Bryansk oblast	12	3095	557	2129	2570	0	557	1572	441	47	479	8080	24397	27145	0	8080	16317	2748	97	14506	11459	10562	0	14508	10381	6235	2080
117 2 Vladimir oblast	12	2510	223	1598	1884	0	223	1375	286	217	409	2888	16072	17703	0	2888	13184	1631	410	12951	10058	9396	0	12924	9591	5697	1891
118 2 Volgograd oblast	12	9108	0	0	223	0	0	0	223	411	8473	0	0	1098	0	0	1098	728	0	0	4924	0	0	0	4915	1770	
119 2 Vologda oblast	12	9155	0	2048	5564	0	0	2048	3516	664	2928	0	17772	36017	0	0	17772	18245	1170	0	8678	6473	0	0	8679	5189	1763
120 2 Voronezh oblast	12	4550	5	31	873	0	5	26	842	703	2974	59	332	5545	0	59	273	5213	1444	11800	10710	6352	0	11742	10369	6189	2056
122 2 Nizhni Novgorod obl	12	6403	772	3720	4396	0	772	2948	676	214	1791	10302	38941	42902	0	10302	28639	3961	410	13345	10468	9759	0	13336	9713	5856	1916
123 2 Nenets a.okr.	12	2583	0	0	0	0	0	0	0	0	2582	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124 2 Ivanovo oblast	12	1875	833	1542	1629	0	833	709	87	50	196	10796	17445	17938	0	10796	6649	493	93	12960	11313	11012	0	12963	9375	5639	1868
127 2 Kaliningrad oblast	12	1183	519	771	929	0	519	252	158	17	236	7519	10130	11113	0	7519	2611	983	34	14487	13139	11962	0	14480	10361	6210	2066
128 2 Tver oblast	12	6128	657	3128	5021	0	657	2471	1893	127	980	8284	30939	41332	0	8284	22655	10393	241	12609	9891	8232	0	12615	9168	5491	1905
129 2 Kaluga oblast	12	2445	617	1565	1795	0	617	948	230	38	612	8291	17567	18936	0	8291	9276	1369	74	13438	11225	10549	0	13435	9790	5956	1940
133 2 Kirov oblast	12	8750	462	1934	4144	0	462	1472	2210	1513	3093	5969	19222	31255	0	5969	13253	12033	2665	12920	9939	7542	0	12927	9005	5445	1761
134 2 Kostroma oblast	12	4263	67	1160	2968	0	67	1093	1808	365	930	850	10901	21040	0	850	10051	10139	683	12687	9397	7089	0	12731	9195	5609	1869
136 2 Samara oblast	12	4408	0	0	343	0	0	0	343	644	3420	0	0	1939	0	0	1939	1203	0	0	5653	0	0	0	5652	1867	
138 2 Kursk oblast	12	2623	561	1261	1545	0	561	700	284	64	1013	7771	14678	16365	0	7771	6907	1687	125	13852	11640	10592	0	13839	9870	5933	1933
139 2 Komi-Permyak a.okr	12	2220	0	301	825	0	0	301	524	398	997	0	2546	5334	0	0	2546	2788	678	0	8458	6465	0	0	8462	5325	1704
141 2 Leningrad oblast	12	5678	124	793	2622	0	124	669	1829	1239	1817	1520	7235	16792	0	1520	5715	9557	2287	12258	9124	6404	0	12264	8550	5226	1845
142 2 Lipetsk oblast	12	2140	378	805	1187	0	378	427	382	207	746	5040	9236	11517	0	5040	4196	2281	407	13333	11473	9703	0	13336	9821	5976	1967
146 2 Moscow oblast	12	4130	1163	2543	3148	0	1163	1380	605	51	931	15259	28274	31642	0	15259	13015	3368	95	13120	11118	10051	0	13117	9433	5569	1883
147 2 Murmansk oblast	12	4110	0	0	0	0	0	0	0	0	4110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149 2 Novgorod oblast	12	3935	685	2206	3188	0	685	1521	982	174	572	8650	22416	27740	0	8650	13766	5324	325	12628	10161	8701	0	12620	9048	5419	1871
153 2 Orenburg oblast	12	8305	0	0	117	0	0	0	117	297	7891	0	0	588	0	0	588	489	0	0	5026	0	0	0	5038	1647	
154 2 Oryel oblast	12	2018	477	1138	1272	0	477	661	134	9	736	6864	13633	14448	0	6864	6769	815	18	14390	11980	11358	0	14377	10236	6086	1919
156 2 Penza oblast	12	3893	10	144	934	0	10	134	790	1043	1916	120	1528	6132	0	120	1408	4604	2004	12000	10611	6565	0	11672	10545	5826	1921
157 2 Perm oblast	12	8423	150	1194	2602	0	150	1044	1408	478	5343	1841	11080	18730	0	1841	9239	7650	891								

APPENDIX II

Table A6 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ACCESSIBLE AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)										Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)													
			VS+S		VS...MS		VS...mS		VS	S	MS	mS	vmS	NS	VS+S		VS...MS		VS...mS		VS	S	MS	mS	vmS	VS+S		VS...MS		VS...mS		VS	S	MS	mS	vmS
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	
197	2 Chuvash Republic	12	1678	29	115	200	0	29	86	85	263	1216	370	1181	1693	0	370	811	512	515	12759	10270	8465	0	12903	9470	6019	1962								
101	3 Altai Krai	12	11538	860	1722	3816	0	860	862	2094	1203	6519	10843	18909	29931	0	10843	8066	11022	2255	12608	10981	7844	0	12609	9354	5264	1875								
102	3 Gorno-Altai Republic	12	2693	1	17	49	0	1	16	32	9	2634	18	153	321	0	18	135	168	16	18000	9000	6551	0	12446	8661	5319	1720								
104	3 Krasnoyarsk Krai	12	16560	50	596	1677	0	50	546	1081	945	13938	595	5243	11529	0	595	4648	6286	2190	11900	8797	6875	0	11911	8514	5813	2318								
105	3 Primorsky Krai	12	7290	121	453	1087	5	116	332	634	226	5978	1727	5140	9080	76	1651	3413	3940	468	14273	11347	8353	15996	14245	10294	6216	2072								
106	3 Taymyr a.okr.	12	2848	0	0	0	0	0	0	0	0	2847	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	3 Khabarovsk Krai	12	9013	177	567	859	0	177	390	292	207	7945	2393	6096	7785	0	2393	3703	1689	431	13520	10751	9063	0	13550	9489	5791	2088								
110	3 Amur oblast	12	9438	752	1522	2709	0	752	770	1187	941	5787	10222	17674	24234	0	10222	7452	6560	1745	13593	11612	8946	0	13595	9676	5527	1853								
116	3 Evenk a.okr	12	6140	0	0	0	0	0	0	0	0	6140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
121	3 Yevrey (Jewish) a.ol	12	1545	271	649	795	0	271	378	146	40	711	3810	7558	8409	0	3810	3748	851	74	14059	11646	10577	0	14069	9918	5839	1863								
125	3 Irkutsk oblast	12	17280	0	0	80	0	0	0	80	161	17039	0	0	547	0	0	0	547	396	0	0	6838	0	0	0	0	0	0	6872	2462					
126	3 Ust-Orda Buryat a.ol	12	1180	0	0	1	0	0	0	1	4	1175	0	0	7	0	0	0	7	10	0	0	7000	0	0	0	0	0	5788	2654						
130	3 Kamchatka oblast	12	3853	0	0	0	0	0	0	0	0	3852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
131	3 Koryak a.okr.	12	5013	0	0	0	0	0	0	0	0	5012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	3 Kemerovo oblast	12	5290	0	260	778	0	0	260	518	261	4251	0	2123	4875	0	0	2123	2752	557	0	8165	6266	0	0	8164	5314	2134								
135	3 Chukchi a.okr.	12	8158	0	0	0	0	0	0	0	0	8155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	3 Kurgan oblast	12	5195	138	450	1206	0	138	312	756	596	3392	1698	4797	8786	0	1698	3099	3989	1009	12304	10660	7285	0	12338	9926	5273	1692								
144	3 Magadan oblast	12	9245	0	0	0	0	0	0	0	0	9245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	3 Novosibirsk oblast	12	9910	617	1513	3072	0	617	896	1559	779	6059	7440	16173	24115	0	7440	8733	7942	1542	12058	10689	7850	0	12054	9750	5093	1979								
152	3 Omsk oblast	12	8545	5	315	3600	0	5	310	3285	722	4223	61	3093	19196	0	61	3032	16103	1484	12200	9819	5332	0	11623	9767	4903	2056								
164	3 Sakhalin oblast	12	4795	0	4	14	0	0	4	10	27	4751	0	40	97	0	0	40	57	63	0	10000	6929	0	0	9269	5518	2315								
165	3 Sverdlovsk oblast	12	12618	589	2639	5730	0	589	2050	3091	799	6088	7144	25142	41494	0	7144	17998	16352	1453	12129	9527	7242	0	12137	8778	5290	1819								
167	3 Aga-Buryat a.okr.	12	663	0	0	3	0	0	0	3	18	642	0	0	12	0	0	0	12	34	0	0	4000	0	0	0	0	0	4279	1920						
169	3 Tomsk oblast	12	7415	4	773	2288	0	4	769	1515	928	4199	42	6735	15575	0	42	6693	8840	2127	10500	8713	6807	0	11665	8701	5836	2292								
171	3 Tyumen oblast	12	7043	59	450	2323	0	59	391	1873	810	3909	711	4426	14288	0	711	3715	9862	1834	12051	9836	6151	0	12006	9508	5264	2264								
172	3 Khabant-Mansi a.okr	12	6830	0	123	289	0	0	123	166	164	6377	0	998	1988	0	0	998	990	389	0	8114	6879	0	0	8128	5955	2376								
174	3 Yamalo-Nenets a.okr	12	2680	0	0	0	0	0	0	0	0	2680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
175	3 Chelyabinsk oblast	12	6338	214	509	974	0	214	295	465	920	4443	2671	5412	7938	0	2671	2741	2526	1554	12481	10633	8150	0	12470	9277	5432	1690								
176	3 Chita oblast	12	7850	0	0	61	0	0	61	139	7651	0	0	266	0	0	0	0	266	318	0	0	4361	0	0	0	0	0	4384	2295						
181	3 Buryat Republic	12	6650	0	0	23	0	0	0	23	86	6541	0	0	142	0	0	0	142	224	0	0	6174	0	0	0	0	6118	2607							
193	3 Tuva Republic	12	5043	0	0	11	0	0	0	11	12	5020	0	0	48	0	0	0	48	31	0	0	4364	0	0	0	0	4457	2639							
195	3 Khakass Republic	12	3093	8	98	247	0	8	90	149	160	2685	100	871	1707	0	100	771	836	297	12500	8888	6911	0	11995	8554	5609	1861								
198	3 Sakha (Yakutia) Rep	12	46970	0	0	0	0	0	0	0	0	46970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
RUSSIA WEST			244894	14622	45900	80716	80	14542	31278	34816	19843	144291	194255	488360	689833	1401	192854	294105	201473	38119	13285	10640	8546	17513	13262	9403	5787	1921								
RUSSIA EAST			2258722	3866	12660	31692	5	3861	8794	19032	10157	216858	49475	130583	232370	76	49399	81108	101787	20501	12797	10315	7332	15200	12794	9223	5348	2018								
RUSSIA TOTAL			503616	18488	58560	112408	85	18403	40072	53848	30000	361149	243730	618943	922203	1477	242253	375213	303260	58620	13183	10569	8204	17376	13164	9363	5632	1954								
211	11 Beijing	12	1385	0	0	179	0	0	0	179	214	992	1	4	1173	0	1	3	1169	464	1000	4000	6553	16056	13888	9518	6513	2174								
212	11 Tianjin	12	863	0	0	216	0	0	0	216	211	435	0	0	1430	0	0	0	1430	466	0	0	6620	0	0	0	0	6619	2205							
213	11 Hebei	12	13455	1	6	2164	0	1	5	2158	2266	9023	20	69	14214	1	19	49	14145	4967	20000	11500	6568	16051	13203	9531	6553	2192								
214	11 Shanxi	12	8953	12	28	530	2	10	16	502	822	7600	169	323	3665	34	135	154	3342	1821	14083	11536	6915	16913	13154	9481	6654	2215								
237	11 Shandong	12	10518	684	1169	3055	216	468	485	1886	1797	5665	10397	15515	28474	3772	6625	5118	12959	4138	15200	13272	9320	17455	14152	10554	6873	2302								
241	11 Henan	12	10775	3059	4345	5574	1051	2008	1286	1229	949	4252	47796	61276	69389	18941	28855	13480	8113	2142	15625	14103	12449	18027	14367	10481	6600	2258								
221	12 Liaoning	12	11258	1267	1741	2767	394	873	474	1026	976	7514	18624	23384	30069	6700	11924	4760	6685	2114	14699	13431	10867	16983	13651	10043	6518	2166								
222	12 Jilin	12	14803	1641	2694	4813	405	1236	1053	2119	856	9135	23219	33710	45466	6518	16701	10491	11756	1525	14149	12513	9446	16091	13515	9962	5549	1782								
223	12 Heilongjiang	12	26983	3003	6319	9944	131	2872	3316	3625	1111	15927	42771	76254	96425	2035	40736	33483	20171	1952	14243	12067	9697	15575	14185	10096	5565	1756								
231	13 Shanghai	12	370	238	344	344	134	104	106	0	25	3953	5041	5043	2457	1496	1088	2	0	16609	14654	14660	18384	14319	10229	6123	0									
232	13 Jiangsu	12	5798	3395	4753	4958	1555	1840	13																											

APPENDIX II

Table A7 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ACCESSIBLE AREAS, EXCLUDING CULTIVATED AND URBAN AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)					Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)										
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	
2 4 Mongolia	12	62805	0	0	33	0	0	0	33	97	62675	0	0	147	0	0	0	147	276	0	0	4455	0	0	0	4380	2852	
11 1 Armenia	12	1448	0	0	1	0	0	0	1	12	1434	0	0	9	0	0	0	9	23	0	0	9000	0	0	0	6168	1905	
12 1 Azerbaijan	12	4205	0	0	202	0	0	0	202	273	3363	0	0	1354	0	0	0	1354	620	0	0	6703	0	0	0	8747	6704	2273
13 1 Byelorussia	12	6503	1589	4376	4974	0	1589	2787	598	147	1382	22964	52317	56092	0	22964	29353	3775	304	14452	11955	11277	0	14455	10533	6308	2069	
14 1 Estonia	12	1303	199	475	690	0	199	276	215	89	524	2462	5023	6221	0	2462	2561	1198	186	12372	10575	9016	0	12366	9296	5560	2091	
15 1 Georgia	12	3013	12	31	55	9	3	19	24	29	2928	206	405	560	159	47	199	155	65	17167	13065	10182	17423	13725	10645	6487	2227	
16 1 Kazakhstan	12	134203	3	21	1908	0	3	18	1887	2091	130204	42	208	10020	0	42	166	9812	3677	14000	9905	5252	0	12727	9351	5200	1759	
17 1 Kirghiztan	12	8128	0	2	41	0	0	2	39	30	8056	0	18	271	0	0	18	253	61	0	9000	6610	0	0	9297	6474	2016	
18 1 Latvia	12	1875	192	704	1356	0	192	512	652	118	401	2507	7293	10936	0	2507	4786	3643	232	13057	10359	8065	0	13065	9346	5584	1970	
19 1 Lithuania	12	3013	876	1719	2101	0	876	843	382	275	637	12012	20234	22488	0	12012	8222	2254	547	13712	11771	10703	0	13717	9756	5899	1989	
20 1 Moldavia	12	93	14	15	18	10	4	1	3	9	66	204	219	239	154	50	15	20	20	14571	14600	13278	16161	13481	10511	6841	2288	
21 1 Tajikistan	12	3495	0	2	19	0	0	2	17	20	3455	0	17	110	0	0	17	93	40	0	8500	5789	0	0	8105	5383	1969	
22 1 Turkmenistan	12	20363	0	0	6	0	0	0	6	4	20352	0	0	40	0	0	0	40	9	0	0	6667	0	0	0	6467	2064	
23 1 Ukraine	12	5253	816	2230	2665	76	740	1414	435	117	2470	11870	27156	29978	1219	10651	15286	2822	255	14547	12178	11249	15954	14403	10808	6489	2178	
FSU REPUBLICS		192895	3701	9575	14036	95	3606	5874	4461	3214	175272	52267	112890	138318	1532	50735	60623	25428	6039	14122	11790	9855	16126	14070	10321	5700	1879	
103 2 Krasnodar Krai	12	1820	44	69	254	12	32	25	185	113	1452	674	925	2236	231	443	251	1311	273	15318	13406	8803	18921	13898	9862	7091	2406	
107 2 Stavropol Krai	12	805	1	3	27	0	1	2	24	28	750	20	41	190	2	18	21	149	63	20000	13667	7037	16209	13342	10450	6287	2248	
111 2 Arkhangelsk oblast	12	13708	0	188	1213	0	0	188	1025	1006	11473	0	1534	6578	0	0	1534	5044	1657	0	8160	5423	0	0	8147	4920	1647	
112 2 Astrakhan oblast	12	2853	0	0	0	0	0	0	0	0	2852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114 2 Belgorod oblast	12	73	1	2	10	0	1	1	8	11	52	9	19	69	0	9	10	50	22	9000	9500	6900	0	12837	9348	6152	2050	
115 2 Bryansk oblast	12	638	32	451	558	0	32	419	107	2	78	465	4789	5450	0	465	4324	661	4	14531	10619	9767	0	14519	10328	6199	2053	
117 2 Vladimir oblast	12	1008	75	644	770	0	75	569	126	89	148	979	6438	7156	0	979	5459	718	169	13053	9997	9294	0	13076	9596	5677	1888	
118 2 Volgograd oblast	12	1703	0	0	7	0	0	0	7	5	1691	0	0	34	0	0	34	8	0	0	0	4857	0	0	0	4790	1760	
119 2 Vologda oblast	12	7900	0	1689	4785	0	0	1689	3096	589	2526	0	14614	30655	0	0	14614	16041	1029	0	8652	6406	0	0	8652	5181	1748	
120 2 Voronezh oblast	12	473	0	0	64	0	0	0	64	79	329	0	0	403	0	0	0	403	164	0	0	6297	0	0	0	6249	2071	
122 2 Nizhni Novgorod obl	12	3318	348	2026	2450	0	348	1678	424	165	703	4632	20969	23446	0	4632	16337	2477	313	13310	10350	9570	0	13328	9737	5849	1892	
123 2 Nenets a.okr.	12	2583	0	0	0	0	0	0	0	0	2582	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
124 2 Ivanovo oblast	12	848	373	708	747	0	373	335	39	18	83	4849	8002	8222	0	4849	3153	220	33	13000	11302	11007	0	13009	9408	5645	1863	
127 2 Kaliningrad oblast	12	145	56	96	120	0	56	40	24	2	23	812	1222	1368	0	812	410	146	4	14500	12729	11400	0	14509	10314	6170	2063	
128 2 Tver oblast	12	2598	371	1357	2129	0	371	986	772	44	424	4699	13699	17925	0	4699	9000	4226	82	12666	10095	8419	0	12664	9124	5473	1865	
129 2 Kaluga oblast	12	1038	253	655	759	0	253	402	104	15	264	3367	7290	7910	0	3367	3923	620	29	13308	11130	10422	0	13297	9768	5967	1933	
133 2 Kirov oblast	12	5758	140	968	2481	0	140	828	1513	1258	2020	1796	9088	17213	0	1796	7292	8125	2183	12829	9388	6938	0	12875	8811	5371	1736	
134 2 Kostroma oblast	12	3273	42	857	2333	0	42	815	1476	305	635	531	7987	16261	0	531	7456	8274	568	12643	9320	6970	0	12712	9144	5606	1866	
136 2 Samara oblast	12	370	0	0	26	0	0	0	26	68	275	0	0	153	0	0	153	129	0	0	0	5885	0	0	0	5773	1902	
138 2 Kursk oblast	12	80	17	39	47	0	17	22	8	1	33	236	453	500	0	236	217	47	2	13882	11615	10638	0	14162	10079	5947	2069	
139 2 Komi-Permyak a.okr	12	1838	0	202	588	0	0	202	386	388	861	0	1700	3744	0	0	1700	2044	658	0	8416	6367	0	0	8420	5292	1695	
141 2 Leningrad oblast	12	4743	115	705	2302	0	115	590	1597	1037	1404	1408	6442	14778	0	1408	5034	8336	1911	12243	9138	6420	0	12274	8536	5221	1842	
142 2 Lipetsk oblast	12	80	10	19	26	0	10	9	7	20	34	129	218	260	0	129	89	42	39	12900	11474	10000	0	13470	9927	5774	1967	
146 2 Moscow oblast	12	2008	521	1231	1548	0	521	710	317	33	427	6827	13525	15284	0	6827	6698	1759	62	13104	10987	9873	0	13106	9437	5541	1899	
147 2 Murmansk oblast	12	3965	0	0	0	0	0	0	0	0	3965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
149 2 Novgorod oblast	12	3273	562	1800	2638	0	562	1238	838	149	485	7082	18271	22797	0	7082	11189	4526	275	12601	10151	8642	0	12604	9036	5403	1845	
153 2 Orenburg oblast	12	1840	0	0	1	0	0	0	1	3	1836	0	0	5	0	0	0	5	5	0	0	5000	0	0	0	5195	1717	
154 2 Oryel oblast	12	53	7	27	34	0	7	20	7	0	18	94	300	346	0	94	206	46	0	13429	11111	10176	0	14491	10208	6082	0	
156 2 Penza oblast	12	575	0	12	90	0	0	12	78	143	342	0	131	574	0	0	131	443	273	0	10917	6378	0	0	10807	5702	1911	
157 2 Perm oblast	12	5435	41	485	1236	0	41	444	751	341	3858	500	4379	8462	0	500	3879	4083	634	12195	9029	6846	0	12282	8735	5435	1859	
158 2 Pskov oblast	12	2258	631	1496	1862	0	631	865	366	64	332	8154	16115	18125	0	8154	7961	2010	117	12922	10							

APPENDIX II**Table A7 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ACCESSIBLE AREAS, EXCLUDING CULTIVATED AND URBAN AREAS**

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)					Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)										
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	
197	2	643	5	29	66	0	5	24	37	135	441	65	298	508	0	65	233	210	270	13000	10276	7697	0	13090	9640	5602	2003	
101	3	6125	339	761	1787	0	339	422	1026	712	3626	4278	8243	13705	0	4278	3965	5462	1366	12619	10832	7669	0	12634	9394	5323	1917	
102	3	2668	1	16	48	0	1	15	32	9	2610	18	152	320	0	18	134	168	16	18000	9500	6667	0	12446	8660	5319	1720	
104	3	13728	35	378	1016	0	35	343	638	657	12055	415	3336	7135	0	415	2921	3799	1537	11857	8825	7023	0	11901	8518	5956	2341	
105	3	6520	105	373	831	5	100	268	458	168	5521	1489	4228	7049	76	1413	2739	2821	346	14181	11335	8483	15996	14153	10227	6161	2057	
106	3	2825	0	0	0	0	0	0	0	0	2825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	3	8873	165	505	783	0	165	340	278	202	7885	2235	5460	7071	0	2235	3225	1611	421	13545	10812	9031	0	13562	9488	5788	2089	
110	3	8108	323	813	1823	0	323	490	1010	850	5435	4382	9088	14589	0	4382	4706	5501	1553	13567	11178	8003	0	13556	9612	5447	1828	
116	3	6128	0	0	0	0	0	0	0	0	6127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121	3	1450	233	575	712	0	233	342	137	40	698	3266	6646	7439	0	3266	3380	793	74	14017	11558	10448	0	13993	9869	5812	1861	
125	3	16035	0	0	64	0	0	0	64	134	15837	0	0	450	0	0	0	450	330	0	0	7031	0	0	0	0	6994	2466
126	3	693	0	0	1	0	0	0	1	0	691	0	0	4	0	0	0	4	1	0	0	4000	0	0	0	0	5640	2128
130	3	3853	0	0	0	0	0	0	0	0	3852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	3	5010	0	0	0	0	0	0	0	0	5010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	3	3498	0	204	545	0	0	204	341	177	2776	0	1663	3453	0	0	1663	1790	362	0	8152	6336	0	0	8157	5252	2047	
135	3	8158	0	0	0	0	0	0	0	0	8155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	3	2403	20	76	442	0	20	56	366	296	1664	249	795	2653	0	249	546	1858	497	12450	10461	6002	0	12196	9701	5082	1680	
144	3	9245	0	0	0	0	0	0	0	0	9245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	3	6220	156	692	1613	0	156	536	921	532	4075	1864	7328	12037	0	1864	5464	4709	1097	11949	10590	7462	0	11968	10195	5113	2062	
152	3	5035	5	286	1647	0	5	281	1361	501	2887	61	2810	9507	0	61	2749	6697	1072	12200	9825	5772	0	11623	9801	4920	2140	
164	3	4760	0	4	14	0	0	4	10	27	4716	0	40	97	0	0	40	57	63	0	10000	6929	0	0	9269	5518	2315	
165	3	10428	284	1929	4442	0	284	1645	2513	672	5313	3419	17731	30939	0	3419	14312	13208	1217	12039	9192	6965	0	12034	8699	5257	1811	
167	3	630	0	0	2	0	0	0	2	15	612	0	0	11	0	0	0	11	30	0	0	5500	0	0	0	0	4278	1990
169	3	6968	2	696	2138	0	2	694	1442	838	3992	21	5978	14431	0	21	5957	8453	1910	10500	8589	6750	0	11680	8580	5861	2281	
171	3	4585	32	304	1675	0	32	272	1371	506	2403	388	2962	10132	0	388	2574	7170	1150	12125	9743	6049	0	11941	9449	5229	2273	
172	3	6780	0	116	275	0	0	116	159	161	6344	0	947	1898	0	0	947	951	383	0	8164	6902	0	0	8135	5973	2381	
174	3	2678	0	0	0	0	0	0	0	0	2677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	3	2578	43	89	194	0	43	46	105	269	2115	534	951	1510	0	534	417	559	454	12419	10685	7784	0	12501	9065	5318	1690	
176	3	7260	0	0	56	0	0	56	116	7088	0	0	246	0	0	0	246	263	0	0	4393	0	0	0	0	4391	2267	
181	3	6045	0	0	11	0	0	0	11	62	5971	0	0	62	0	0	0	62	166	0	0	5636	0	0	0	0	5512	2659
193	3	4778	0	0	9	0	0	0	9	10	4759	0	0	41	0	0	0	41	25	0	0	4556	0	0	0	0	4453	2577
195	3	2370	1	34	119	0	1	33	85	91	2159	12	298	782	0	12	286	484	170	12000	8765	6571	0	11743	8616	5671	1862	
198	3	46870	0	0	0	0	0	0	0	0	46870	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUSSIA WEST		122175	4515	19040	34229	45	4470	14525	15189	8024	79883	58769	192348	274628	778	57991	133579	82280	14508	13016	10102	8023	17289	12973	9196	5417	1808	
RUSSIA EAST		223305	1744	7851	20247	5	1739	6107	12396	7045	195993	22631	78656	145561	76	22555	56025	66905	14503	12976	10019	7189	15200	12970	9174	5397	2059	
RUSSIA TOTAL		345480	6259	26891	54476	50	6209	20632	27585	15069	275876	81400	271004	420189	854	80546	189604	149185	29011	13005	10078	7713	17080	12972	9190	5408	1925	
211	11	705	0	0	14	0	0	0	14	30	661	1	4	95	0	1	3	91	66	1000	4000	6786	16056	13888	9610	6578	2193	
212	11	70	0	0	2	0	0	0	2	2	66	0	0	10	0	0	0	10	5	0	0	5000	0	0	0	0	6674	2224
213	11	5220	1	5	217	0	1	4	212	333	4670	18	61	1377	1	17	43	1316	697	18000	12200	6346	16051	13171	9511	6206	2096	
214	11	3418	6	14	60	1	5	8	46	115	3242	87	165	466	20	67	78	301	255	14500	11786	7767	16856	13047	9395	6535	2216	
237	11	1513	65	123	288	20	45	58	165	209	1015	972	1602	2728	352	620	630	1126	482	14954	13024	9472	17342	13748	10889	6834	2307	
241	11	4635	1596	2211	2585	517	1079	615	374	214	1836	24739	31189	33653	9273	15466	6450	2464	489	15501	14106	13019	17935	14335	10480	6594	2281	
221	12	3945	226	273	380	57	169	47	107	191	3374	3212	3668	4372	978	2234	456	704	413	14212	13436	11505	17051	13219	9718	6557	2164	
222	12	7378	434	855	1531	94	340	421	676	281	5566	6053	10208	13830	1509	4544	4155	3622	468	13947	11939	9033	16073	13366	9880	5359	1664	
223	12	15713	1108	2669	4317	51	1057	1561	1648	464	10932	15605	31068	40042	787	14818	15463	8974	785	14084	11640	9275	15579	14020	9905	5446	1691	
231	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
232	13	583	225	321	346	84	141	96	25	8	228	3525	4520	4688	1507	2018	995	168	19	15667	14081	13549	17933	14343	10339	6629	2304	
233	13	3165	77	138	180	16	61	61	42	6	2978	1149	1768	2022	284	865	619	254	13	14922	12812	11233	17717	14067	10078	6075	2092	
234	13	4535	1549	2348	2587	539	1010	799	239	32	1917	24405	32727	34284	9907	14498	8322	1557	76	15755	13938	13252	18369	14359	10420	6527	2389	
236	14	7530	796	1141	1328	353	443	345	187	87	6114	12722	16209	17335	6448	6274	3487	1126	169	15982	14206	13053	18251	14160	10109	6029	1928	
242	14	7245	2066	2769	2844	845	1221	703	75	2	4399	32477	39556	39988	15262	17215	7079	442	5	15720	14285	14064	18060	14103	10068	5893	1946	
243	14	9118	989	1629	1976	263	726	640	347	51	7090	15019	21511	23584	4740	10279												

APPENDIX II

Table A8 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - ACCESSIBLE AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)					Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)											
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS		
197	2 Chuvash Republic	12	643	5	29	66	0	5	24	37	135	441	65	298	508	0	65	233	210	270	13000	10276	7697	0	13090	9640	5602	2003	
101	3 Altai Kray	12	2920	175	386	728	0	175	211	342	401	1791	2193	4198	6076	0	2193	2005	1878	790	12531	10876	8346	0	12544	9508	5500	1968	
102	3 Gorno-Altai Republic	12	1693	0	11	40	0	0	11	29	9	1645	0	91	243	0	0	91	152	15	0	8273	6075	0	12474	8581	5307	1718	
104	3 Krasnoyarsk Kray	12	12555	17	259	729	0	17	242	470	544	11282	197	2225	5034	0	197	2028	2809	1270	11588	8591	6905	0	11923	8366	5978	2334	
105	3 Primorski Kray	12	5300	48	191	434	5	43	143	243	116	4750	682	2152	3648	73	609	1470	1496	239	14208	11267	8406	16004	14177	10286	6151	2055	
106	3 Taymyr a.okr.	12	988	0	0	0	0	0	0	0	0	987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	3 Khabarovsk Kray	12	6658	109	290	456	0	109	181	166	132	6067	1473	3181	4131	0	1473	1708	950	267	13514	10969	9059	0	13531	9459	5711	2022	
110	3 Amur oblast	12	6083	72	338	1041	0	72	266	703	628	4413	962	3471	7235	0	962	2509	3764	1126	13361	10269	6950	0	13320	9416	5352	1792	
116	3 Evenk a.okr	12	5605	0	0	0	0	0	0	0	0	5605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
121	3 Yevrey (Jewish) a.ol	12	750	99	213	266	0	99	114	53	25	459	1396	2531	2839	0	1396	1135	308	46	14101	11883	10673	0	14068	9974	5778	1844	
125	3 Irkutsk oblast	12	14285	0	0	56	0	0	0	56	120	14109	0	0	394	0	0	394	299	0	0	7036	0	0	0	0	7045	2482	0
126	3 Ust-Orda Buryat a.ol	12	413	0	0	0	0	0	0	0	0	412	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2698	
130	3 Kamchatka oblast	12	2035	0	0	0	0	0	0	0	0	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
131	3 Koryak a.okr.	12	873	0	0	0	0	0	0	0	0	872	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
132	3 Kemerovo oblast	12	2875	0	192	523	0	0	192	331	172	2181	0	1562	3300	0	0	1562	1738	353	0	8135	6310	0	0	8130	5257	2058	
135	3 Chukchi a.okr.	12	2220	0	0	0	0	0	0	0	0	2220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
137	3 Kurgan oblast	12	483	16	40	93	0	16	24	53	43	347	193	426	710	0	193	233	284	74	12063	10650	7634	0	12166	9694	5403	1734	
144	3 Magadan oblast	12	2635	0	0	0	0	0	0	0	0	2635	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	3 Novosibirsk oblast	12	1660	59	252	572	0	59	193	320	202	886	712	2600	4287	0	712	1888	1687	434	12068	10317	7495	0	12092	9786	5272	2148	
152	3 Omsk oblast	12	1958	2	140	642	0	2	138	502	265	1051	24	1436	3935	0	24	1412	2499	545	12000	10257	6129	0	11603	10213	4980	2057	
164	3 Sakhalin oblast	12	4178	0	4	14	0	0	4	10	27	4134	0	40	96	0	40	56	62	0	10000	6857	0	0	9269	5512	2313	0	
165	3 Sverdlovsk oblast	12	9003	271	1620	3695	0	271	1349	2075	565	4743	3260	14931	25834	0	3260	11671	10903	1008	12030	9217	6992	0	12037	8651	5255	1785	
167	3 Aga-Buryat a.okr.	12	155	0	0	0	0	0	0	0	1	154	0	0	1	0	0	0	1	3	0	0	1000	0	0	0	4296	2521	0
169	3 Tomsk oblast	12	4765	1	467	1450	0	1	466	983	578	2737	14	3914	9692	0	14	3900	5778	1321	14000	8381	6684	0	11692	8364	5876	2286	
171	3 Tyumen oblast	12	1593	20	83	529	0	20	63	446	214	850	237	848	3242	0	237	611	2394	480	11850	10217	6129	0	12054	9633	5371	2246	
172	3 Khanty-Mansi a.okr	12	4878	0	99	201	0	0	99	102	68	4608	0	805	1397	0	0	805	592	152	0	8131	6950	0	0	8130	5804	2215	0
174	3 Yamalo-Nenets a.okr	12	1173	0	0	0	0	0	0	0	0	1172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	3 Chelyabinsk oblast	12	1520	8	37	115	0	8	29	78	53	1352	96	356	762	0	96	260	406	90	12000	9622	6626	0	12411	8941	5229	1698	
176	3 Chita oblast	12	3128	0	0	4	0	0	0	4	18	3106	0	0	20	0	0	0	20	45	0	0	5000	0	0	0	5005	2537	0
181	3 Buryat Republic	12	3718	0	0	4	0	0	0	4	20	3693	0	0	27	0	0	0	27	49	0	0	6750	0	0	0	6038	2486	0
193	3 Tuva Republic	12	2858	0	0	8	0	0	0	8	8	2842	0	0	36	0	0	0	36	19	0	0	4500	0	0	0	4449	2508	0
195	3 Khakass Republic	12	1603	0	5	16	0	0	5	11	12	1575	0	41	114	0	41	73	24	0	8200	7125	0	0	8315	6351	2110	0	
198	3 Sakha (Yakutia) Rep	12	33823	0	0	0	0	0	0	0	0	33822	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUSSIA WEST			90232	4190	17625	31354	19	4171	13435	13729	7006	51856	54431	177948	252045	332	54099	123517	74097	12634	12991	10096	8039	14774	12970	9194	5397	1803	
RUSSIA EAST			144384	897	4627	11616	5	892	3730	6989	4221	128535	11439	44808	83053	73	11366	33369	38245	8711	12753	9684	7150	14600	12970	8946	5472	2064	
RUSSIA TOTAL			234616	5087	22252	42970	24	5063	17165	20718	11227	180391	65870	222756	335098	405	65465	156886	112342	21345	12949	10011	7798	16875	12930	9140	5422	1901	
211	11 Beijing	12	158	0	0	5	0	0	0	5	10	142	0	1	35	0	0	1	34	23	0	1000	7000	16056	13452	9347	6513	2175	
212	11 Tianjin	12	18	0	0	0	0	0	0	0	1	16	0	0	3	0	0	0	3	2	0	0	3000	0	0	0	6639	2215	0
213	11 Hebei	12	938	0	1	40	0	0	1	39	55	843	3	10	271	0	3	7	261	123	3000	10000	6775	0	13069	9677	6729	2236	
214	11 Shanxi	12	695	0	2	11	0	0	2	9	23	660	7	25	85	1	6	18	60	51	7000	12500	7727	17484	13241	9406	6390	2175	
237	11 Shandong	12	1170	43	93	232	12	31	50	139	179	760	619	1163	2112	202	417	544	949	412	14395	12505	9103	17286	13555	10931	6830	2311	
241	11 Henan	12	4095	1566	2160	2492	512	1054	594	332	153	1450	24306	30542	32733	9190	15116	6236	2191	352	15521	14140	13135	17935	14347	10504	6590	2302	
221	12 Liaoning	12	2870	199	240	293	51	148	41	53	98	2479	2837	3232	3580	872	1965	395	348	215	14256	13467	12218	17099	13258	9685	6595	2195	
222	12 Jilin	12	5498	363	729	936	87	276	366	207	24	4537	5100	8711	9953	1404	3696	3611	1242	43	14050	11949	10634	16076	13379	9877	5986	1769	
223	12 Heilongjiang	12	10550	473	1444	2114	43	430	971	670	109	8326	6645	16225	20112	676	5969	9580	3887	199	14049	11236	9514	15569	13874	9869	5803	1825	
231	13 Shanghai	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
232	13 Jiangsu	12	395	160	233	255	50	110	73	22	8	132	2475	3234	3381	899	1576	759	147	19	15469	13880	13259	17906	14386	10392	6620	2306	
233	13 Zhejiang	12	2828	70	125	160	15	55	55	35	6	2662	1033	1583	1799	263	770	550	216	12	14757	12664	11244	17677	14040	10087	6096	2106	
234	13 Anhui	12	3683	1502	2261	2480	532	970	759	219	31	1172	23687	31603	33044	9763	13924	7916	1441	75	15770	13977	13324	18366	14362	10432	6573	2396	
236	14 Jiangxi	12	4348	298	479	589	109	189	181	110	49	3710	4644	6471	7138	1974	2670	1827	667	96	15584	13509	12119	18181	14123	10140	6038	1963	
242	1																												

APPENDIX II

Table A9 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - EXCLUDING CULTIVATED AREAS, URBAN AREAS AND AREAS CURRENTLY UNDER FOREST

ADM	REG	NAME	LC	Suitable Areas (000ha)								Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)											
				Total Extent	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS		
2	4	Mongolia	12	147800	0	0	53	0	0	0	53	190	147557	0	0	10	0	0	10	24	0	0	5000	0	0	0	6180	1913			
11	1	Armenia	12	1788	0	0	2	0	0	0	2	12	1774	0	0	10	0	0	0	24	0	0	5000	0	0	0	6180	1913			
12	1	Azerbaijan	12	4578	0	0	285	0	0	0	285	390	3595	0	0	1957	0	0	0	895	0	0	6867	0	0	0	8791	6857	2297		
13	1	Byelorussia	12	1680	209	1068	1244	0	209	859	176	24	412	3124	12327	13458	0	3124	9203	1131	52	14947	11542	10818	0	14920	10716	6428	2144		
14	1	Estonia	12	370	58	165	207	0	58	107	42	26	137	701	1701	1959	0	701	1000	258	60	12086	10309	9464	0	12092	9324	6186	2303		
15	1	Georgia	12	1515	12	34	58	10	2	22	24	30	1427	207	449	611	179	28	242	162	69	17250	13206	10534	17143	13212	11173	6769	2296		
16	1	Kazakhstan	12	214330	5	30	2659	0	5	25	2629	2798	208873	60	298	13966	0	60	238	13668	4897	12000	9933	5252	0	12659	9368	5199	1750		
17	1	Kirghizstan	12	12170	0	2	40	0	0	2	38	28	12102	0	18	266	0	0	18	248	57	0	9000	6650	0	0	9297	6536	2028		
18	1	Latvia	12	210	60	115	152	0	60	55	37	17	41	805	1325	1540	0	805	520	215	34	13417	11522	10132	0	13386	9495	5824	2061		
19	1	Lithuania	12	1463	336	807	1027	0	336	471	220	124	311	4580	9169	10467	0	4580	4589	1298	248	13631	11362	10192	0	13620	9736	5912	2001		
20	1	Moldavia	12	10	2	3	5	1	1	1	2	2	4	22	29	44	12	10	7	15	4	11000	9667	8800	16649	16650	11117	6916	2290		
21	1	Tajikistan	12	2655	0	0	2	0	0	2	5	2648	0	0	14	0	0	0	14	9	0	0	7000	0	0	0	5590	1866	0		
22	1	Turkmenistan	12	40375	0	0	8	0	0	0	8	2	40366	0	0	49	0	0	0	49	4	0	0	6125	0	0	0	6500	2161	0	
23	1	Ukraine	12	640	109	294	375	11	98	185	81	26	238	1521	3477	4019	181	1340	1956	542	60	13954	11827	10717	15892	13619	10582	6730	2285	0	
FSU REPUBLICS				281784	791	2518	6064	22	769	1727	3546	3484	271928	11020	28793	48360	372	10648	17773	19567	6413	13932	11435	7975	16909	13847	10291	5518	1841		
103	2	Krasnodar Kray	12	625	24	33	174	5	19	9	141	78	373	347	429	1433	86	261	82	1004	187	14458	13000	8236	17750	13564	9561	7128	2389		
107	2	Stavropol Kray	12	965	2	4	25	0	2	21	33	907	0	25	46	178	3	22	21	132	75	12500	11500	7120	15904	13148	10424	6324	2255		
111	2	Arkhangelsk oblast	12	11818	0	33	89	0	0	0	33	56	308	11407	0	271	550	0	0	271	279	506	0	8212	6180	0	0	8188	4942	1642	
112	2	Astrakhan oblast	12	4380	0	0	0	0	0	0	0	0	4380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114	2	Belgorod oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115	2	Bryansk oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
117	2	Vladimir oblast	12	13	2	11	13	0	2	9	2	1	0	20	103	113	0	20	83	10	1	10000	9364	8692	0	13421	9586	5752	1917		
118	2	Volgograd oblast	12	1890	0	0	0	0	0	0	0	0	1890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
119	2	Vologda oblast	12	1253	0	157	842	0	0	157	685	129	282	0	1351	4915	0	0	1351	3564	226	0	8605	5837	0	0	8618	5205	1752		
120	2	Voronezh oblast	12	258	0	0	32	0	0	0	32	35	191	0	0	193	0	0	0	193	71	0	0	6031	0	0	0	6083	2045		
122	2	Nizhni Novgorod obl.	12	298	3	179	217	0	3	176	38	29	51	48	1759	1980	0	48	1711	221	54	16000	9827	9124	0	13948	9705	5827	1876		
123	2	Nenets a.okr.	12	15018	0	0	0	0	0	0	0	0	14997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
124	2	Ivanovo oblast	12	25	2	21	24	0	2	19	3	1	1	24	203	219	0	24	179	16	1	12000	9667	9125	0	13284	9521	5689	1901		
127	2	Kaliningrad oblast	12	30	8	21	28	0	8	13	7	0	1	110	245	290	0	110	135	45	1	13750	11667	10357	0	14311	10171	6102	2035		
128	2	Tver oblast	12	118	19	61	97	0	19	42	36	4	17	244	628	828	0	244	384	200	8	12842	10295	8536	0	12716	9235	5545	1959		
129	2	Kaluga oblast	12	65	14	32	33	0	14	18	1	30	194	372	380	0	194	178	8	1	13857	11625	11515	0	13421	9601	5811	1936			
133	2	Kirov oblast	12	235	0	11	65	0	0	11	54	78	92	0	88	357	0	0	88	269	131	0	8000	5492	0	0	8426	5001	1677		
134	2	Kostroma oblast	12	253	6	60	182	0	6	54	122	25	46	76	569	1259	0	76	493	690	47	12667	9483	6918	0	12615	9152	5667	1883		
136	2	Samara oblast	12	5	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1532		
138	2	Kursk oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
139	2	Komi-Permyak a.okr	12	170	0	15	63	0	0	15	48	56	52	0	124	377	0	0	124	253	97	0	8267	5984	0	0	8446	5278	1741		
141	2	Leningrad oblast	12	800	8	99	466	0	8	91	367	194	141	92	863	2769	0	92	771	1906	349	11500	8717	5942	0	12162	8502	5197	1801		
142	2	Lipetsk oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
146	2	Moscow oblast	12	193	55	122	144	0	55	67	22	4	45	737	1387	1506	0	737	650	119	8	13400	11369	10458	0	13493	9669	5445	2053		
147	2	Murmansk oblast	12	6555	0	0	0	0	0	0	0	0	6555	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
149	2	Novgorod oblast	12	233	47	186	216	0	47	139	30	11	4	602	1872	2037	0	602	1270	165	20	12809	10065	9431	0	12726	9125	5437	1826		
153	2	Orenburg oblast	12	2480	0	0	0	0	0	0	0	4	2476	0	0	1	0	0	0	1	5	0	0	1000	0	0	0	4024	1330		
154	2	Oryel oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
156	2	Penza oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
157	2	Perm oblast	12	325	0	23	87	0	0	23	64	63	175	0	188	542	0	0	188	354	113	0	8174	6230	0	0	8118	5517	1796		
158	2	Pskov oblast	12	265	58	195	234	0	58	137	39	10	20	747	1																

APPENDIX II

Table A9 PRODUCTION POTENTIALS FOR BIOMASS PLANTATION FORESTRY SPECIES - EXCLUDING CULTIVATED AREAS, URBAN AREAS AND AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)											
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS			
102	3	Gorno-Altai Republic	12	4118	1	6	9	0	1	5	3	1	4107	18	61	78	0	18	43	17	2	18000	10167	8667	0	12446	8831	5367	1807	
104	3	Krasnoyarsk Krai	12	5383	20	158	456	0	20	138	298	183	4744	240	1458	3220	0	240	1218	1762	429	12000	9228	7061	0	11896	8834	5910	2349	
105	3	Primorski Krai	12	1490	76	222	487	0	76	146	265	63	940	1080	2565	4203	3	1077	1485	1638	130	14175	11544	8627	15826	14091	10163	6187	2060	
106	3	Taymyr a.okr.	12	71523	0	0	0	0	0	0	0	0	71522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108	3	Khabarovsk Krai	12	18580	147	1073	1543	0	147	926	470	582	16456	1951	10791	13685	0	1951	8840	2894	1358	13272	10057	8869	0	13308	9551	6157	2333	
110	3	Amur oblast	12	6033	322	680	1416	0	322	358	736	508	4109	4350	7829	11841	0	4350	3479	4012	940	13509	11513	8362	0	13530	9727	5455	1849	
116	3	Evenk a.okr	12	9323	0	0	0	0	0	0	0	0	9322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
121	3	Yevrey (Jewish) a.oot	12	1318	218	652	808	0	218	434	156	30	479	3039	7308	8229	0	3039	4269	921	62	13940	11209	10184	0	13941	9832	5903	2043	
125	3	Irkutsk oblast	12	8388	0	0	21	0	0	0	21	24	8343	0	0	127	0	0	127	53	0	0	6048	0	0	0	0	0	6100	2233
126	3	Ust-Orda Buryat a.okr	12	350	0	0	1	0	0	0	1	0	349	0	0	4	0	0	0	4	1	0	0	4000	0	0	0	0	5726	1932
130	3	Kamchatka oblast	12	9120	0	0	0	0	0	0	0	0	9097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	3	Koryak a.okr.	12	25808	0	0	0	0	0	0	0	0	25807	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	3	Kemerovo oblast	12	925	0	15	33	0	0	15	18	8	885	0	127	216	0	0	127	89	14	0	8467	6545	0	0	8583	5081	1683	
135	3	Chukchi a.okr.	12	60873	0	0	0	0	0	0	0	0	60847	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	3	Kurgan oblast	12	2543	9	46	444	0	9	37	398	319	1781	108	461	2456	0	108	353	1995	531	12000	10022	5532	0	12346	9657	5017	1668	
144	3	Magadan oblast	12	31205	0	0	0	0	0	0	0	0	31205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	3	Novosibirsk oblast	12	8383	171	749	2300	0	171	578	1551	648	5434	2031	8084	15889	0	2031	6053	7805	1364	11877	10793	6908	0	11869	10469	5032	2106	
152	3	Omsk oblast	12	5148	6	215	1722	0	6	209	1507	372	3054	71	2047	9410	0	71	1976	7363	801	11833	9521	5465	0	11643	9473	4884	2154	
164	3	Sakhalin oblast	12	973	0	0	0	0	0	0	0	0	964	0	0	0	0	0	0	0	1	0	0	0	0	0	0	10655	7072	2488
165	3	Sverdlovsk oblast	12	2898	25	616	1503	0	25	591	887	183	1212	297	5407	10008	0	297	5110	4601	349	11880	8778	6659	0	12078	8641	5187	1908	
167	3	Agaa-Buryat a.okr.	12	1038	0	0	4	0	0	0	4	30	1004	0	0	18	0	0	0	18	56	0	0	4500	0	0	0	0	4275	1864
169	3	Tomsk oblast	12	10153	1	356	1717	0	1	355	1361	619	7816	7	3255	10956	0	7	3248	7701	1420	7000	9143	6381	0	11656	9138	5659	2293	
171	3	Tyumen oblast	12	7145	36	421	3027	0	36	385	2606	720	3398	423	4052	17419	0	423	3629	13367	1698	11750	9625	5755	0	11743	9415	5130	2359	
172	3	Khanty-Mansi a.okr.	12	20210	0	101	656	0	0	101	555	520	19034	0	819	3789	0	0	819	2970	1289	0	8109	5776	0	0	8103	5347	2480	
174	3	Yamalo-Nenets a.okr	12	41490	0	0	0	0	0	0	0	0	41482	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	3	Chelyabinsk oblast	12	1518	42	62	99	0	42	20	37	287	1132	524	707	912	0	524	183	205	484	12476	11403	9212	0	12537	9231	5503	1687	
176	3	Chita oblast	12	11328	0	0	63	0	0	0	63	137	11127	0	0	274	0	0	0	274	307	0	0	4349	0	0	0	0	4353	2237
181	3	Buryat Republic	12	10333	0	0	10	0	0	0	10	58	10264	0	0	53	0	0	0	53	160	0	0	5300	0	0	0	0	5390	2739
193	3	Tuva Republic	12	5498	0	0	1	0	0	0	1	2	5494	0	0	5	0	0	0	5	6	0	0	5000	0	0	0	0	4480	2814
195	3	Khakass Republic	12	1360	1	32	128	0	1	31	96	100	1131	12	286	815	0	12	274	529	183	12000	8938	6367	0	11743	8694	5497	1819	
198	3	Sakha (Yakutia) Rep	12	107800	0	0	0	0	0	0	0	0	107782	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUSSIA WEST				75204	389	1854	3996	27	362	1465	2142	1420	69725	5211	18730	30537	463	4748	13519	11807	2575	13396	10102	7642	17148	13116	9228	5512	1813	
RUSSIA EAST				496758	1313	5978	17894	0	1313	4665	1916	5789	472982	17161	61381	124299	3	17158	44220	62918	12367	13068	10267	6946	15826	13068	9479	5280	2136	
RUSSIA TOTAL				571962	1702	7832	21890	27	1675	6130	14058	7209	542704	22372	80111	154836	466	21906	57739	74725	14942	13143	10228	7073	17139	13078	9419	5315	2073	
211	11	Beijing	12	673	0	0	9	0	0	0	9	21	642	1	5	64	0	1	4	59	46	1000	5000	7111	0	13636	9652	6611	2202	
212	11	Tianjin	12	78	0	0	3	0	0	0	3	72	0	0	20	0	0	0	20	6	0	0	6667	0	0	0	0	6681	2231	
213	11	Hebei	12	6618	2	8	241	0	2	6	233	369	6008	23	81	1500	1	22	58	1419	764	11500	10125	6224	15890	13178	9446	6095	2072	
214	11	Shanxi	12	6105	11	25	86	2	9	14	61	165	5855	145	272	669	31	114	127	397	366	13182	10880	7779	16865	13092	9406	6514	2215	
237	11	Shandong	12	515	28	38	69	10	18	10	31	36	410	425	528	740	175	250	103	212	82	15179	13895	10725	17425	14062	10473	6841	2281	
241	11	Henan	12	1193	64	106	157	13	51	42	51	74	960	957	1373	1711	241	716	416	338	166	14953	12953	10898	18015	13004	9868	6588	2232	
221	12	Liaoning	12	1468	34	44	125	8	26	10	81	116	1226	457	559	1094	127	330	102	535	249	13441	12705	8752	16640	12919	9806	6563	2146	
222	12	Jilin	12	2573	84	150	816	7	77	66	666	344	1412	1140	1797	5194	115	1025	657	3397	568	13571	11980	6365	16022	13247	9900	5102	1654	
223	12	Heilongjiang	12	9320	1190	2322	3871	8	1182	1132	1549	547	4902	16929	28129	36328	126	16803	11200	8199	913	14226	12114	9385	15638	14220	9898	5292	1669	
231	13	Shanghai	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
232	13	Jiangsu	12	275	103	139	142	56	47	36	3	0	132	1669	2037	2060	1009	660	368	23	1	16204	14655	14507	17987	14134	10114	6626	2204	
233	13	Zhejiang	12	500	10	19	26	2	8	9	7	1	473	144	230	274	31	113	86	44	2	14400	12105	10538	18282	14278	10024	5973	2004	
234	13	Anhui	12	1465	79	141	168	15	64	62	27	1	1297	1191	1821	1983	273	918	630	162	1	15076	12915	11804	18504	14297	10181	6016	1958	
236	14	Jiangxi	12	4710	684	910	1018	336	348	226	108	51	3641	11085	13372	14024	6149	4936	2287	652	96	16206	14695	13776	18285	14195	10120	6024	1884	
242	14	Hubei	12	5280	357	558	573	95	262	201	15	2	4705	5458	7503	7956	1733	3725	2045	92	3	15289	13446	13255</						

APPENDIX II

Table A10 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - ALL AREAS

ADM	REG	NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)								
					VS+S	VS...	VS...MS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...MS	VS	S	MS	mS	vmS	VS+S/VS...	VS.../VS...MS	VS	S	MS	mS	vmS	
2	4	Mongolia	12	156198	96	650	5229	8	88	554	4579	5638	145330	1027	4619	23866	132	895	3592	19247	8173	10698	7106	4564	16073	10168	6483	4203	1450
11	1	Armenia	12	2690	53	191	360	0	53	138	169	117	2213	542	1455	2093	0	542	913	638	165	10226	7618	5814	0	10158	6595	3783	1414
12	1	Azerbaijan	12	7868	63	187	771	0	63	124	584	1244	5285	713	1615	5413	6	707	902	3798	2744	11317	8636	7021	13864	11213	7292	6503	2207
13	1	Belorussia	12	20348	10413	18076	18656	1799	8614	7663	580	0	1692	147391	232047	235731	25579	121812	84656	3684	0	14155	12837	12636	14216	14142	11048	6346	1836
14	1	Estonia	12	3938	1735	2274	2343	21	1714	539	69	6	1588	21485	26260	26553	291	21194	4775	293	7	12383	11548	11333	13899	12363	8862	4247	1132
15	1	Georgia	12	6523	404	692	984	187	217	288	292	325	5213	6869	9720	11526	3844	3025	2851	1806	722	17002	14046	11713	20564	13918	9901	6189	2221
16	1	Kazakhstan	12	268445	814	5280	19957	92	722	4466	14677	4837	243652	8305	44572	117061	1206	7099	36267	72489	7856	10203	8442	5866	13157	9832	8120	4939	1624
17	1	Kirghiztan	12	19548	53	320	1036	3	50	267	716	565	17947	561	2480	6087	52	509	1919	3607	952	10585	7750	5875	18465	10145	7187	5041	1685
18	1	Latvia	12	6313	2226	5111	5488	243	1983	2885	377	5	821	28869	55548	57707	3440	25429	26679	2159	7	12969	10868	10515	14178	12826	9249	5726	1567
19	1	Lithuania	12	6420	2900	5226	5490	214	2686	2326	264	0	929	41296	64719	66467	3118	38178	23423	1748	1	14240	12384	12107	14549	14213	10070	6626	1792
20	1	Moldavia	12	3000	805	1982	2476	112	693	1177	494	199	325	10947	21993	25154	1816	9131	11046	3161	429	13599	11096	10159	16189	13178	9386	6400	2153
21	1	Tajikistan	12	9013	0	32	343	0	0	32	311	403	8267	0	256	1895	0	256	1639	789	0	8000	5525	0	0	8137	5274	1956	
22	1	Turkmenistan	12	45390	0	0	22	0	0	0	22	61	45307	0	0	139	0	0	139	124	0	0	6318	0	0	0	6192	2046	
23	1	Ukraine	12	57570	20665	37624	44361	4756	15909	16959	6737	6155	7052	300582	473885	516445	82535	218047	173303	42560	13553	14545	12595	11642	17353	13706	10219	6317	2202
		FSU REPUBLICS		457066	40131	76995	102287	7427	32704	36864	25292	13917	340291	567560	934550	1072271	121887	445673	366990	137721	27349	14143	12138	10483	16411	13627	9955	5445	1965
103	2	Krasnodar Kray	12	7620	934	1885	4324	98	836	951	2439	1550	1739	12945	21930	38777	1847	11098	8985	16847	3615	13860	11634	8968	18938	13281	9446	6907	2333
107	2	Stavropol Kray	12	6635	202	745	3186	117	191	543	2441	709	2740	2283	7210	22067	169	2114	4927	14857	1436	11302	9678	6926	14743	11064	9072	6086	2026
111	2	Arkhangelsk oblast	12	38190	7175	19021	24637	1263	5912	11846	5616	1890	11643	98316	199001	224450	21817	76499	100685	25449	2352	13703	10462	9110	12726	12939	8499	4531	1245
112	2	Astrakhan oblast	12	4598	0	0	0	0	0	0	0	0	0	4597	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	2	Belgorod oblast	12	2665	385	1488	1644	80	305	1103	156	387	634	4175	14854	15675	1034	3141	10679	821	798	10844	9983	9535	12961	10307	9684	5256	2060
115	2	Bryansk oblast	12	3483	2836	3399	3429	1064	1772	563	30	0	54	34211	40258	40449	13995	20216	6047	191	0	12063	11844	11796	13151	11409	10748	6437	732
117	2	Vladimir oblast	12	2925	1352	2812	2871	139	1213	1460	59	0	54	17192	30069	30391	1992	15200	12877	322	0	12716	10693	10586	14362	12528	8821	5416	0
118	2	Volgograd oblast	12	11265	0	0	568	0	0	568	900	9797	0	0	0	2767	0	0	2767	1608	0	0	4871	0	0	0	0	4872	1787
119	2	Vologda oblast	12	14628	9568	11910	12538	1942	7626	2342	628	40	2049	132326	154034	156907	30871	101455	21708	2873	42	13830	12933	12515	15893	13303	9269	4578	1065
120	2	Voronezh oblast	12	5195	333	1221	2091	61	272	888	870	2473	629	3495	12161	16946	773	2722	8666	4785	5056	10495	9960	8104	12572	9992	9754	5498	2044
122	2	Nizhni Novgorod obl.	12	7515	3760	7238	7387	436	3324	3478	149	0	128	46264	77813	78726	5450	40814	31549	913	0	12304	10751	10657	12509	12278	9071	6110	2035
123	2	Nenets a.okr.	12	16858	0	10	309	0	0	10	299	173	16355	0	61	1148	0	61	1087	193	0	6100	3715	0	0	5979	3640	1113	
124	2	Ivanovo oblast	12	2270	1839	2248	2261	78	1761	409	13	0	10	26266	29936	30001	1111	25155	3670	65	0	14283	13317	13269	14261	14288	8981	5133	0
127	2	Kaliningrad oblast	12	1240	744	914	989	48	696	170	75	0	250	11404	13330	13824	616	10788	1926	494	0	15328	14584	13978	12793	15489	9161	6595	0
128	2	Tver oblast	12	8395	6947	7794	7912	841	6106	847	118	0	483	98389	106416	107307	11740	86649	8027	621	0	14163	13654	13528	13955	14190	9302	6260	1738
129	2	Kaluga oblast	12	2963	2235	2896	2934	129	2106	661	38	0	29	31306	37880	38104	1705	29601	6574	224	0	14007	13080	12987	13258	14053	9942	5967	0
133	2	Kirov oblast	12	11930	6322	11114	11569	1268	5054	4792	455	37	325	85168	126860	129141	20451	64717	41692	2281	49	13472	11414	11163	16132	12806	8700	5012	1338
134	2	Kostroma oblast	12	6000	4093	5719	5849	494	3599	1626	130	0	150	57413	73006	73629	8702	48711	15593	623	0	14027	12766	12588	17598	13535	9589	4790	1071
136	2	Samara oblast	12	5118	466	746	2033	0	466	280	1287	705	2379	4516	6317	12539	0	4516	1801	6222	1229	9691	8468	6168	0	9697	6421	4835	1743
138	2	Kursk oblast	12	3020	1724	2684	2714	298	1426	960	30	32	275	21668	32183	32368	3846	17822	10515	185	57	12568	11991	11926	12912	14257	10948	6249	1790
139	2	Komi-Permyak a.okr	12	3280	2045	3040	3128	995	1050	995	88	0	151	30284	39245	39700	16667	13617	8961	455	0	14809	12910	12692	16749	12964	9002	5191	1734
141	2	Leningrad oblast	12	7500	2520	6015	6306	915	1605	3495	291	75	1119	35762	67225	69055	15457	20305	31963	1330	79	14191	11259	10951	16894	12648	9146	4571	1049
142	2	Lipetsk oblast	12	2410	1601	2230	2351	376	1225	629	121	54	4	20823	27074	27733	4698	16125	6251	659	105	13006	12141	11796	12483	13162	9930	5442	1953
146	2	Moscow oblast	12	4665	3615	4394	4537	297	3318	779	143	0	128	51370	58346	59068	4244	47126	6976	714	0	14210	13279	13017	14286	14202	8958	5003	0
147	2	Murmansk oblast	12	13960	11	85	484	0	11	74	399	805	12671	118	565	2087	0	118	447	1522	1057	10727	6647	4312	0	10599	6069	3813	1314
149	2	Novgorod oblast	12	5450	3614	4758	4812	412																					

APPENDIX II

Table A10 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - ALL AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)										
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S/VS...MS/VS...mS	VS	S	MS	mS	vmS				
102	3	Gorno-Altai Republic	12	9385	424	698	987	85	339	274	289	178	8221	4647	6662	7923	1152	3495	2015	1261	251	10960	9544	8027	13600	10324	7356	4368	1411
104	3	Krasnoyarsk Krai	12	71140	14263	26294	33801	1820	12443	12031	7507	5666	31673	166263	259863	297361	24729	141534	93600	37498	8804	11657	9883	8797	13588	11374	7780	4995	1554
105	3	Primorski Krai	12	16338	812	2489	4109	182	630	1677	1620	1411	10817	9974	21550	29062	2609	7365	11576	7512	2510	12283	8658	7073	14322	11689	6903	4637	1779
106	3	Taymyr a.okr.	12	82285	0	0	0	0	0	0	0	0	82285	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	3	Khabarovsk Krai	12	77545	3368	7526	13225	209	3159	4158	5699	5535	58777	37803	69378	94819	3045	34758	31575	25441	8093	11224	9218	7170	14574	11002	7594	4464	1462
110	3	Amur oblast	12	36283	7656	11900	17451	1310	6346	4244	5551	3640	15192	83439	117977	143550	16471	66968	34538	25573	5382	10899	9914	8226	12578	10553	8137	4607	1479
116	3	Evenk a.okr.	12	75673	5	285	776	0	5	280	491	3116	71780	55	2115	3889	0	55	2060	1774	4041	11000	7421	5012	0	10912	7363	3611	1297
121	3	Yevrey (Jewish) a.o.t	12	3700	1025	1512	1944	189	836	487	432	179	1576	13043	16533	18760	2506	10537	3490	2227	316	12725	10935	9650	13227	12606	7165	5154	1762
125	3	Irkutsk oblast	12	76270	5183	11610	19239	52	5131	6427	7629	9058	47973	60383	108574	141938	590	59793	48191	33364	13721	11650	9352	7378	11289	11654	7498	4373	1515
126	3	Ust-Orda Buryat a.okr.	12	2178	163	478	817	4	159	315	339	89	1272	1618	3978	5328	45	1573	2360	1350	122	9926	8322	6521	10956	9924	7481	3988	1373
130	3	Kamchatka oblast	12	17045	14	655	2238	0	14	641	1583	688	14097	127	5615	13344	0	127	5488	7729	10666	9071	8573	5962	0	9293	8564	4882	1550
131	3	Koryak a.okr.	12	28903	0	106	375	0	0	106	269	1027	27501	0	733	1714	0	0	733	981	1144	0	6915	4571	0	0	6915	3652	1114
132	3	Kemerovo oblast	12	9500	3251	4780	5728	609	2642	1529	948	763	3009	37436	48782	52798	7897	29539	11346	4016	1231	11515	10205	9218	12971	11182	7420	4237	1614
135	3	Chukchi a.okr.	12	70770	0	0	0	0	0	0	0	0	70745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	3	Kurgan oblast	12	7110	1141	2746	3777	0	1141	1605	1031	548	2786	12266	24786	29844	0	12266	12520	5058	881	10750	9026	7902	0	10748	7802	4908	1610
144	3	Magadan oblast	12	45830	0	14	788	0	0	14	774	971	44071	0	103	3560	0	0	103	3457	1301	0	7357	4518	0	0	7148	4468	1340
150	3	Novosibirsk oblast	12	17673	4823	8223	10056	441	4382	3400	1833	759	6858	55212	82953	91906	5968	49244	27741	8953	1255	11448	10088	9139	13548	11238	8158	4885	1654
152	3	Omsk oblast	12	13980	2544	4996	8959	50	2494	2452	3963	716	4306	29662	50432	69202	667	28995	20770	18770	1213	11660	10094	7724	13333	11627	8472	4736	1693
164	3	Sakhalin oblast	12	8095	401	1379	2553	0	401	978	1174	371	5079	4975	12631	18865	0	4975	7656	6234	630	12406	9160	7389	0	12404	7828	5312	1698
165	3	Sverdlovsk oblast	12	19273	11247	13541	14567	2294	8953	2294	1026	164	4542	143652	162081	166728	35838	107814	18429	4647	243	12772	11970	11446	15625	12043	8032	4531	1477
167	3	Aga-Buryat a.okr.	12	1970	1	47	551	0	1	46	504	364	1055	8	272	2200	0	8	264	1928	508	8000	5787	3993	0	10828	5806	3822	1396
169	3	Tomsk oblast	12	31145	12538	20290	23730	996	11542	7752	3440	255	7160	146757	210286	228180	13701	133056	63529	17894	374	11705	10364	9616	13759	11528	8195	5202	1468
171	3	Tyumen oblast	12	15860	6649	10125	11624	271	6378	3476	1499	547	3690	71305	98059	105269	3687	67618	26754	7210	866	10724	9685	9056	13625	10602	7697	4810	1584
172	3	Khanty-Mansi a.okr.	12	53163	7884	18557	28595	508	7376	10673	10038	2810	21758	95007	182422	233572	7657	87350	87415	51150	5064	12051	9830	8168	15076	11843	8190	5096	1802
174	3	Yamal-Nenets a.okr.	12	66588	3	994	5413	0	3	991	4419	9713	51455	26	7228	30648	0	26	7202	23420	17735	8667	7272	5662	0	10441	7269	5300	1826
175	3	Chelyabinsk oblast	12	8763	1546	2866	4086	185	1361	1320	1220	1318	3359	17861	27843	32640	2760	15101	9982	4797	1996	11553	9715	7988	14956	11096	7564	3930	1514
176	3	Chita oblast	12	41493	150	1338	6939	0	150	1188	5601	7183	27371	1613	9826	33423	3	1610	8213	23597	10505	10753	7344	4817	10197	10738	6916	4213	1463
181	3	Buryat Republic	12	33533	192	1302	3348	7	185	1110	2046	4879	25305	2104	10430	19325	99	2005	8326	8895	7382	10958	8011	5772	14585	10809	7501	4347	1513
193	3	Tuva Republic	12	17035	29	294	1275	0	29	265	981	1161	14599	310	2205	6304	0	310	1895	4099	1634	10690	7500	4944	0	10707	7152	4178	1408
195	3	Khakass Republic	12	6120	812	1646	2489	97	715	834	843	281	3350	8596	14756	18386	1239	7357	6160	3630	384	10586	8965	7387	12719	10285	7386	4308	1367
198	3	Sakha (Yakutia) Rep	12	303275	335	2595	9193	0	335	2260	6598	13944	280120	3610	20620	49341	0	3610	17010	28721	19567	10776	7946	5367	0	10791	7266	4353	1403
		RUSSIA WEST		389947	113377	190495	233949	18734	94643	77118	43454	24368	131553	1527738	2205842	2428478	291647	1236091	678104	222636	41944	13475	11580	10380	15568	13061	8793	5123	1721
		RUSSIA EAST		1284574	90871	167270	249514	10360	80511	76399	82244	77836	957053	1061041	1661165	2046528	145665	915376	600124	385363	119031	11676	9931	8202	14060	11370	7855	4686	1529
		RUSSIA TOTAL		1674521	204248	357765	483463	29094	175154	153517	125698	102204	1088606	2588779	3867007	4475006	437312	2151467	1278228	607999	160975	12675	10809	9256	15031	12283	8322	4837	1575
211	11	Beijing	12	1640	124	559	899	2	122	435	340	25	717	1819	6502	8498	27	1792	4683	1996	42	14669	11631	9453	15020	14715	10722	5876	1654
212	11	Tianjin	12	1125	1	189	344	0	1	188	155	163	618	10	2230	3287	0	10	2220	1057	345	10000	11799	9555	0	15571	11812	6827	2108
213	11	Hebei	12	18480	1722	5257	9629	221	1501	3535	4372	1425	7426	19011	52507	78874	2262	16749	33496	26367	3145	11040	9988	8191	10219	11161	9477	6030	2207
214	11	Shanxi	12	15783	1175	3347	6426	166	1009	2172	3079	2666	6689	14291	35644	54265	2264	12027	21353	18621	5849	12163	10650	8445	13601	11918	9831	6047	2194
237	11	Shandong	12	14798	2761	5569	7154	60	2701	2808	1585	434	7209	43853	78520	89181	1081	42772	34667	10661	918	15883	14099	12466	17892	15835	12347	6727	2114
241	11	Henan	12	16295	5242	8039	9601	921	4321	2797	1562	459	6236	82960	115959	125507	16796	66164	32999	9548	1024	15826	14425	13072	18242	15313	11798	6113	2234
221	12	Liaoning	12	13863	5539	8396	10318	1961	3578	2857	1922	1093	2451	82253	113151	123739	31610	50643	30898	10588	2288	14850	13477	11993	16115	14153	10816	5509	2093
222	12	Jilin	12	19145	7179	10848	13664	2401	4778	3669	2816	746	4734	97235	134484	148854	34280	62955	37249	14370	1202	13544	12397	10894	14275	13175	10154	5104	1611
223	12	Heilongjiang	12	44848	23333	31468	36390	7318	16015	8135	4922	1729	6729	290819	364795	391420	99875	190944	73976	26625	2927	12464	11593	10756	13649	11923	9093	5410	1693
231	13	Shanghai	12	413	133	200	267	47	86	67	67	0	145	2100	2780	3191	866	1234	680	411	0	15789	13900	11951	18324	14271	10172	6156	0
232	13	Jiangsu	12	9290	3088	5622	5991	1081	2007	2534	369	10	3167	50970	76644	79077													

APPENDIX II

Table A11 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - ACCESSIBLE AREAS

ADM	REG	NAME	LC	Total Extent	Suitable Areas (000ha)				Average annual biomass increments (000tons)											Average annual biomass yield (kg/ha)									
					VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS
2	4	Mongolia	12	63130	9	180	1864	1	8	171	1684	2063	59202	107	1173	8360	19	88	1066	7187	3128	11889	6517	4485	16456	10387	6245	4267	1516
11	1	Armenia	12	2025	47	169	317	0	47	122	148	100	1609	475	1280	1829	0	475	805	549	141	10106	7574	5770	0	10166	6614	3718	1411
12	1	Azerbaijan	12	6095	49	147	583	0	49	98	436	970	4049	553	1268	4072	5	548	715	2804	2142	11286	8626	6985	13868	11064	7319	6431	2209
13	1	Byelorussia	12	17955	9261	16011	16521	1539	7722	6750	510	0	1434	131196	205862	209099	21880	109316	74666	3237	0	14167	12858	12657	14221	14156	11062	6348	1852
14	1	Estonia	12	3365	1543	2015	2071	17	1526	472	56	4	1289	19312	23507	23745	236	19076	4195	238	5	12516	11666	11465	13935	12498	8883	4280	1080
15	1	Georgia	12	4763	351	600	832	161	190	249	232	249	3682	5968	8441	9879	3320	2648	2473	1438	549	17003	14068	11874	20598	13918	9942	6209	2208
16	1	Kazakhstan	12	165068	495	3439	13369	50	445	2944	9930	3235	148464	4993	29070	78215	636	4357	24077	49145	5315	10087	8453	5850	12730	9800	8180	4949	1643
17	1	Kirghiztan	12	10428	43	243	813	1	42	200	570	453	9160	457	1900	4840	27	430	1443	2940	776	10628	7819	5953	18657	10117	7228	5153	1712
18	1	Latvia	12	5573	1951	4495	4830	210	1741	2544	335	5	738	25315	48821	50728	2982	22333	23506	1907	7	12975	10861	10503	14172	12826	9240	5698	1567
19	1	Lithuania	12	6018	2719	4901	5151	205	2514	2182	250	0	867	38698	60645	62304	2980	35718	21947	1659	1	14232	12374	12096	14566	14206	10059	6646	1779
20	1	Moldavia	12	2848	778	1902	2358	109	669	1124	456	187	303	10585	21155	24078	1758	8827	10570	2923	402	13605	11123	10211	16190	13202	9400	6407	2154
21	1	Tajikistan	12	4775	0	23	252	0	0	23	229	303	4220	0	188	1406	0	0	188	1218	595	0	8174	5579	0	0	8135	5323	1961
22	1	Turkmenistan	12	22535	0	0	17	0	0	0	17	42	22476	0	0	103	0	0	103	86	0	0	6059	0	0	0	0	6174	2040
23	1	Ukraine	12	51955	18794	34066	40172	4337	14457	15272	6106	5619	6163	273206	429067	467786	75165	198041	155861	38719	12384	14537	12595	11645	17329	13698	10206	6341	2204
FSU REPUBLICS				303403	36031	68011	87286	6629	29402	31980	19275	11167	204454	510758	831204	938084	108989	401769	320446	106880	22403	14176	12222	10747	16441	13665	10020	5545	2006
103	2	Krasnodar Kray	12	6715	873	1723	3898	89	784	850	2175	1387	1425	12113	20082	35099	1701	10412	7969	15017	3233	13875	11655	9004	19114	13281	9379	6903	2331
107	2	Stavropol Kray	12	5428	181	662	2645	9	172	481	1983	608	2175	2036	6440	18481	128	1908	4404	12041	1230	11249	9728	6987	14848	11115	9161	6071	2022
111	2	Arkhangelsk oblast	12	14210	3950	10047	12066	587	3363	6097	2019	589	1540	54082	106385	115643	10172	43910	52303	9258	729	13692	10589	9584	17317	13056	8579	4585	1238
112	2	Astrakhan oblast	12	2923	0	0	0	0	0	0	0	0	2922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	2	Belgorod oblast	12	2248	332	1259	1387	71	261	927	128	328	532	3616	12608	13282	926	2690	8992	674	677	10892	10014	9576	12970	10314	9703	5254	2061
115	2	Bryansk oblast	12	3095	2514	3024	3051	937	1577	510	27	0	44	30279	35769	35941	12299	17980	5490	172	0	12044	11828	11780	13123	11401	10756	6439	732
117	2	Vladimir oblast	12	2510	1149	2409	2462	123	1026	1260	53	0	49	14549	25632	25916	1766	12783	11083	284	0	12662	10640	10526	14367	12463	8799	5397	0
118	2	Volograd oblast	12	9108	0	0	478	0	0	478	771	7859	0	0	2338	0	0	0	2338	1383	0	0	4891	0	0	0	0	4889	1795
119	2	Vologda oblast	12	9155	6169	7648	8044	1275	4894	1479	396	31	1080	85733	99495	101340	20293	65440	13762	1845	33	13897	13009	12598	15913	13372	9303	4658	1073
120	2	Voronezh oblast	12	4550	305	1074	1832	59	246	769	758	2173	546	3202	10648	14831	742	2460	7446	4183	4441	10498	9914	8096	12567	9988	9688	5520	2044
122	2	Nizhni Novgorod obl	12	6403	3229	6185	6307	379	2850	2956	122	0	94	39791	66602	67362	4739	35052	26811	760	0	12323	10768	10681	12488	12300	9069	6211	2035
123	2	Nenets a.okr.	12	2583	0	2	33	0	0	2	31	12	2537	0	11	121	0	0	11	110	12	0	5500	3667	0	0	5941	3551	1005
124	2	Ivanovo oblast	12	1875	1501	1858	1869	65	1436	357	11	0	6	21371	24559	24615	927	20444	3188	56	0	14238	13218	13170	14262	14238	8918	5181	0
127	2	Kaliningrad oblast	12	1183	711	880	946	46	665	169	66	0	238	10900	12803	13239	583	10317	1903	436	0	15331	14549	13995	12795	15521	11289	6597	0
128	2	Tver oblast	12	6128	5096	5704	5789	596	4500	608	85	0	338	72260	78015	78463	8314	63946	5755	448	0	14180	13677	13554	13955	14209	9462	5279	1644
129	2	Kaluga oblast	12	2445	1845	2389	2419	113	1732	544	30	0	25	25748	31138	31317	1500	24248	5390	179	0	13956	13034	12946	13250	14401	9901	5944	0
133	2	Kirov oblast	12	8750	4594	8139	8489	919	3675	3545	350	27	234	61874	92755	94514	14770	47104	30881	1759	37	13468	11396	11134	16079	12816	8711	5032	1351
134	2	Kostroma oblast	12	4263	2918	4072	4153	356	2562	1154	81	0	110	41020	52096	52480	6353	34667	11076	384	0	14058	12794	12637	17846	13533	9600	4729	1459
136	2	Samara oblast	12	4408	428	647	1785	0	428	219	1138	620	2003	4157	5594	11184	0	4157	1437	5590	1093	9713	8646	6266	0	9705	6577	4913	1762
138	2	Kursk oblast	12	2623	1509	2339	2862	267	1242	830	23	25	235	18964	27994	28139	3453	15511	9030	145	44	12567	11968	11913	12922	12487	10879	6232	1752
139	2	Komi-Permyak a.okr	12	2220	1339	2055	2117	614	725	716	62	0	102	19752	26244	26574	10296	9456	6492	330	0	14751	12771	12553	16767	13034	9068	5322	1850
141	2	Leningrad oblast	12	5678	1808	4526	4771	592	1216	2718	245	68	838	25466	50460	51592	9966	15500	24994	1132	72	14085	11149	10814	16823	12749	9195	4621	1057
142	2	Lipetsk oblast	12	2140	1419	1982	2091	323	1096	563	109	47	2	18403	23985	24581	4021	14382	5582	596	92	12969	12101	11756	12464	13128	9913	5460	1951
146	2	Moscow oblast	12	4130	3233	3897	4020	282	2951	664	123	0	110	45852	51813	52421	4031	41821	5961	608	0	14182	13296	13040	14295	14172	8981	4921	0
147	2	Murmansk oblast	12	4110	1	7	141	0	1	6	134	379	3590	12	52	564	0	12	40	512	492	12000	7429	4000	0	10588	6544	3810	1298
149	2	Novgorod oblast	12	3935	2630	3467	3506	293	2337	837	39	0	428	36529	44476	44669	4												

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ADM	REG	NAME	LC	Total	Suitable Areas (000ha)					Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)									
					Extent	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS
197	2	Chuvash Republic	12	1678	355	915	1223	13	342	560	308	357	96	4074	8498	9700	163	3911	4424	1202	592	11476	9287	7931	12237	11423	7896	3903	1657
101	3	Altai Krai	12	11538	2831	5421	7500	570	2261	2590	2079	357	3680	34068	55250	65483	8126	25942	21182	10233	583	12034	10192	8731	14245	11474	8180	4922	1632
102	3	Gorno-Altai Republic	12	2693	236	375	540	54	182	139	165	96	2056	2643	3674	4403	747	1896	1031	729	136	11199	9797	8154	13800	10424	7425	4416	1410
104	3	Krasnoyarsk Krai	12	16560	5408	9155	10887	1015	4393	3747	1732	882	4790	60780	89313	97874	13365	47415	28533	8561	1399	11239	9756	8990	13174	10793	7615	4941	1586
105	3	Primorsky Krai	12	7290	614	1776	2493	144	470	1162	717	684	4112	7535	15690	19077	2060	5475	8155	3387	1287	12272	8834	7652	14292	11640	7016	4722	1881
106	3	Taymyr a.okr.	12	2848	0	0	0	0	0	0	0	0	2847	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	3	Khabarovsk Krai	12	9013	677	1633	2497	31	646	956	864	701	5812	7830	15131	19062	386	7444	7301	3931	1019	11566	9266	7634	12611	11515	7639	4549	1454
110	3	Amur oblast	12	9438	2722	4256	6030	698	2024	1534	1774	564	2844	31122	43841	52429	8771	22351	12719	8588	883	11434	10301	8695	12571	11045	8290	4840	1567
116	3	Evenk a.okr.	12	6140	1	9	34	0	1	8	25	197	5909	7	65	173	0	7	58	108	256	7000	7222	5088	0	10908	6966	4282	1298
121	3	Yevrey (Jewish) a.o	12	1545	532	738	922	110	422	206	184	41	582	6712	8176	9142	1419	5293	1464	966	72	12617	11079	9915	12944	12550	7096	5251	1748
125	3	Irkutsk oblast	12	17280	2742	5472	7404	42	2700	2730	1932	1480	8394	31465	51898	60525	482	30983	20433	8627	2267	11475	9484	8175	11387	11474	7483	4465	1532
126	3	Ust-Orda Buryat a.o	12	1180	89	303	520	2	87	214	217	64	597	857	2455	3305	26	831	1598	850	90	9629	8102	6356	11122	9602	7477	3914	1418
130	3	Kamchatka oblast	12	3853	6	329	1056	0	6	323	727	260	2537	52	2844	6391	0	52	2792	3547	402	8667	8644	6052	0	9412	8652	4876	1545
131	3	Koryak a.okr.	12	5013	0	36	129	0	0	36	93	279	4604	0	249	617	0	0	249	368	318	0	6917	4783	0	0	6904	3936	1142
132	3	Kemerovo oblast	12	5290	1822	2608	3206	374	1448	786	598	571	1514	21065	26892	29423	4852	16213	5827	2531	933	11561	10311	9177	12985	11199	7415	4232	1634
135	3	Chukchi a.okr.	12	8158	0	0	0	0	0	0	0	0	8155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	3	Kurgan oblast	12	5195	913	2087	2816	0	913	1174	729	390	1988	9828	18978	22540	0	9828	9150	3562	628	10765	9093	8004	0	10764	7793	4883	1607
144	3	Magadan oblast	12	9245	0	6	179	0	0	6	173	322	8744	0	42	935	0	0	42	893	429	0	7000	5223	0	0	7186	5151	1329
150	3	Novosibirsk oblast	12	9910	2322	4333	5490	298	2024	2011	1157	529	3892	26954	43470	49122	4073	22881	16516	5652	875	11608	10032	8948	13681	11303	8214	4886	1655
152	3	Omsk oblast	12	8545	995	2399	5242	30	965	1404	2843	531	2772	11691	23485	37016	408	11283	11794	13531	909	11750	9789	7061	13578	11697	8401	4759	1711
164	3	Sakhalin oblast	12	4795	329	979	1712	0	329	650	733	246	2834	4080	9144	12984	0	4080	5064	3840	424	12401	9340	7584	0	12406	7786	5238	1722
165	3	Sverdlovsk oblast	12	12618	7921	9631	10296	1723	6198	1710	665	42	2279	102482	116218	119262	27102	75380	13736	3044	67	12938	12067	11583	15733	12161	8031	4577	1581
167	3	Aga-Buryat a.okr.	12	663	0	14	160	0	0	14	146	120	382	0	81	633	0	0	81	552	167	0	5786	3956	0	0	5885	3770	1387
169	3	Tomsk oblast	12	7415	3301	4949	5733	367	2934	1648	784	119	1563	38493	52054	56809	4943	33550	13561	4035	207	11661	10518	9784	13483	11436	8228	5144	1737
171	3	Tyumen oblast	12	7043	1981	3911	4682	88	1893	1930	771	381	1979	20355	35373	23121	1243	19112	15018	3748	608	10275	9044	8356	14119	10097	7779	4863	1596
172	3	Khanty-Mansi a.okr.	12	6830	1188	2357	3360	62	1126	1169	1003	258	3212	14546	24261	29417	915	13631	9715	5156	459	12244	10293	8755	14786	12104	8311	5141	1782
174	3	Yamalo-Nenets a.okr.	12	2680	0	38	166	0	0	38	128	335	2179	0	274	946	0	0	274	672	594	0	7211	5699	0	0	7288	5245	1774
175	3	Chelyabinsk oblast	12	6338	1184	2132	2994	141	1043	948	862	953	2390	13641	20824	24222	2086	11555	7183	3398	1446	11521	9767	8090	14762	11078	7577	3942	1517
176	3	Chita oblast	12	7850	52	590	1618	0	52	538	1028	1045	5187	526	4155	8540	2	524	3629	4385	1476	10115	7042	5278	9946	10105	6742	4266	1412
181	3	Buryat Republic	12	6650	93	574	1346	1	92	481	772	1048	4256	1015	4585	7951	14	1001	3570	3366	1589	10914	7988	5907	15405	10901	7425	4358	1515
193	3	Tuva Republic	12	5043	10	152	717	0	10	142	565	552	3774	104	1123	3508	0	104	1021	2383	792	10400	7401	4893	0	10396	7194	4221	1436
195	3	Khakass Republic	12	3093	591	1185	1691	81	510	594	506	151	1251	6242	10630	12829	1030	5212	4388	2199	208	10562	8970	7587	12712	10221	7393	4344	1383
198	3	Sakha (Yakuta) Rep.	12	46970	69	737	2524	0	69	668	1787	2560	41886	727	5637	13103	0	727	4910	7466	3439	10536	7649	5191	0	10548	7353	4177	1343
		RUSSIA WEST		244894	84497	136903	164514	12820	71677	52406	27611	15281	65047	1133389	1598982	1746203	196230	937159	465593	147221	27960	13413	11680	10614	15307	13075	7884	5332	1830
		RUSSIA EAST		258722	38629	68185	93944	5831	32798	29556	25759	15758	149001	454820	685814	806122	82050	372770	230994	120308	23962	11774	10058	8581	14071	11366	7815	4671	1521
		RUSSIA TOTAL		503616	123126	205088	258458	18651	104475	81962	53370	31039	214048	1588209	2284796	2552325	278280	1309929	696587	267529	51922	12899	11141	9875	14920	12538	8499	5013	1673
211	11	Beijing	12	1385	99	478	785	1	98	379	307	24	576	1445	5508	7313	20	1425	4063	1805	39	14596	11523	9316	15139	14609	10716	5885	1650
212	11	Tianjin	12	863	1	149	270	0	1	148	121	122	470	10	1764	2597	0	10	1754	833	266	10000	11839	9619	0	15571	11842	6855	2182
213	11	Hebei	12	13455	1087	3641	7075	125	962	2554	3434	1082	5298	11781	35651	56228	1244	10537	23870	20577	2384	10838	9792	7947	9986	10957	9346	5992	2203
214	11	Shanxi	12	8953	510	1635	3609	73	437	1125	1974	1819	3525	6251	17327	29071	1017	5234	11076	11744	4015	12257	10598	8055	13842	11986	9849	5950	2207
237	11	Shandong	12	10518	2049	4099	5227	39	2010	2050	1128	280	5011	32490	57817	65346	697	31793	25327	7529	592	15857	14105	12502	17860	15821	12354	6676	2112
241	11	Henan	12	10775	3461	5456	6656	616	2845	1995	1200	323	3795	54631	78384	85686	11230	43401	23753	7302	724	15785	14367	12873	18219	15254	11904	6085	2241
221	12	Liaoning	12	11258	4462	6773	8391	1547	2915	2311	1618	931	1935	66413	91667	100575	24994	41419	25254	8908	1949	14884	13534	11986	16152	14211	10927	5505	2093
222	12	Jilin	12	14803	5980	8835	10920	1993	3987	2855	2085	525	3357	81215	110323	120916	28542	52673	29108	10593	855	13581	12487	11073	14323	13320	10196	5080	1627
223	12	Heilongjiang	12	26983	13741	18609	21713																						

APPENDIX II

Table A12 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - ACCESSIBLE AREAS, EXCLUDING CULTIVATED AND URBAN AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)	Average annual biomass increments (000tons)																Average annual biomass yield (kg/ha)								
				VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS
2 4 Mongolia	12	62805	9	180	1857	1	8	171	1677	2042	58906	107	1173	8329	19	88	1066	7156	3102	11889	6517	4485	16456	10387	6245	4267	1519	
11 1 Armenia	12	1448	39	113	202	0	39	74	89	60	1185	402	901	1243	0	402	499	342	84	10308	7973	6153	0	10225	6714	3849	1389	
12 1 Azerbaijan	12	4205	45	115	358	0	45	70	243	532	2948	506	989	2489	3	503	483	1500	1151	11244	8600	6953	13888	11123	6945	6176	2164	
13 1 Byelorussia	12	6503	3017	5716	5878	537	2480	2699	162	0	624	41984	71280	72260	7503	34481	29296	980	0	13916	12470	12293	13960	13904	10853	6059	2026	
14 1 Estonia	12	1303	574	772	805	7	567	198	33	4	493	6992	8717	8854	95	6897	1725	137	4	12181	11291	10999	13609	12154	8705	4124	1081	
15 1 Georgia	12	3013	91	197	321	19	72	106	124	132	2560	1281	2288	3043	348	933	1007	755	295	14077	11614	9480	18585	12881	9498	6113	2234	
16 1 Kazakhstan	12	134203	385	1917	6245	41	344	1532	4328	1765	126193	3910	16332	37567	529	3381	12422	21235	2811	10156	8520	6016	12752	9832	8110	4906	1593	
17 1 Kirghiztan	12	8128	28	125	343	1	27	97	218	229	7555	302	971	1935	27	275	669	964	350	10786	7768	5641	18657	10036	6918	4417	1527	
18 1 Latvia	12	1875	609	1558	1700	59	550	949	142	2	172	7619	16358	17151	840	6779	8739	793	3	12511	10499	10089	14135	12321	9207	5577	1392	
19 1 Lithuania	12	3013	1479	2573	2698	121	1358	1094	125	0	314	21255	32242	33082	1766	19489	10987	840	0	14371	12531	12262	14621	14348	10042	6714	1885	
20 1 Moldavia	12	93	26	55	75	3	23	29	20	9	8	364	630	761	53	311	266	131	19	14000	11455	10147	16076	13744	9238	6417	2107	
21 1 Tajikistan	12	3495	0	18	154	0	0	18	136	154	3188	0	144	853	0	0	144	709	302	0	8000	5539	0	0	8149	5225	1963	
22 1 Turkmenistan	12	20363	0	0	14	0	0	0	14	37	20312	0	0	87	0	0	0	87	76	0	0	6214	0	0	0	6251	2051	
23 1 Ukraine	12	5253	1827	3454	3943	434	1393	1627	489	62	1248	27236	45309	47875	7357	19879	18073	2566	133	14907	13118	12142	16951	14273	11108	5249	2135	
FSU REPUBLICS		192895	8120	16613	22736	1222	6898	8493	6123	2986	166800	111851	196161	227200	18521	93330	84310	31039	5228	13775	11808	9993	15156	13530	9927	5069	1751	
103 2 Krasnodar Krai	12	1820	354	567	738	63	291	213	171	58	1024	5663	7945	9140	1296	4367	2282	1195	131	15997	14012	12385	20605	15031	10694	6989	2245	
107 2 Stavropol Krai	12	805	51	164	224	7	44	113	60	13	568	660	1738	2100	106	554	1078	362	24	12941	10598	9375	15368	12455	9551	6027	1883	
111 2 Arkhangelsk oblast	12	13708	3706	9635	11603	571	3135	5929	1968	585	1505	50772	101574	110598	9878	40894	50802	9024	725	13700	10542	9532	17305	13046	8569	4586	1238	
112 2 Astrakhan oblast	12	2853	0	0	0	0	0	0	0	0	2852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114 2 Belgorod oblast	12	73	7	40	46	1	6	33	6	7	19	79	416	450	16	63	337	34	15	11286	10400	9783	13074	10785	10339	5296	2051	
115 2 Bryansk oblast	12	638	573	632	635	223	350	59	3	0	3	6561	7136	7153	2849	3712	575	17	0	11450	11291	11265	12761	10610	9803	6539	0	
117 2 Vladimir oblast	12	1008	428	953	980	44	384	525	27	0	28	5318	9965	10111	634	4684	4647	146	0	12425	10456	10317	14441	12189	8543	5467	0	
118 2 Volgograd oblast	12	1703	0	0	10	0	0	0	10	9	1684	0	0	46	0	0	0	46	16	0	0	4600	0	0	0	4790	1731	
119 2 Vologda oblast	12	7900	5368	6699	7061	1124	4244	1331	362	29	810	74799	87177	88871	17980	56819	12378	1694	31	13934	13013	12586	16004	13387	9301	4672	1076	
120 2 Voronezh oblast	12	473	3	50	147	0	3	47	97	255	70	29	525	1066	0	29	496	541	515	9667	10500	7252	0	9473	10452	5550	2022	
122 2 Nizhni Novgorod obl	12	3318	1525	3175	3243	86	1439	1650	68	0	74	19088	33794	34189	1094	17994	14706	395	0	12517	10644	10542	12648	12506	8910	5827	0	
123 2 Nenets a.okr.	12	2583	0	2	33	0	0	2	31	12	2537	0	11	121	0	0	11	110	12	0	5500	3667	0	0	5941	3551	1005	
124 2 Ivanovo oblast	12	848	683	840	847	26	657	157	7	0	1	9737	11148	11183	372	9365	1411	35	0	14256	13271	13203	14288	14263	8962	5244	0	
127 2 Kaliningrad oblast	12	145	75	93	106	4	71	18	13	0	38	1139	1348	1436	57	1082	209	88	0	15187	14495	13547	12727	15231	11496	6580	0	
128 2 Tver oblast	12	2598	2184	2423	2451	304	1880	239	28	0	146	30942	33226	33372	4240	26702	2284	146	0	14168	13713	13616	13964	14201	9555	5197	2446	
129 2 Kaluga oblast	12	1038	807	1019	1031	45	762	212	12	0	6	11246	13341	13415	575	10671	2095	74	0	13936	13092	13012	12663	13999	9852	5982	0	
133 2 Kirov oblast	12	5758	2811	5375	5578	693	2118	2564	203	11	167	38912	61237	62348	11554	27358	22325	1111	14	13843	11393	11177	16663	12914	8707	5469	1245	
134 2 Kostroma oblast	12	3273	2202	3174	3234	326	1876	972	60	0	39	31032	40338	40611	5914	25118	9306	273	0	14093	12709	12558	18152	13391	9750	4571	1252	
136 2 Samara oblast	12	370	81	105	174	0	81	24	69	65	130	795	954	1254	0	795	159	300	112	9815	9086	7207	0	9790	6588	4329	1716	
138 2 Kursk oblast	12	80	48	70	71	5	43	22	1	1	7	619	846	856	73	546	227	10	2	12896	12086	12056	14068	12624	10105	7116	1906	
139 2 Komi-Permyak a.okr	12	1838	1003	1703	1764	461	542	700	61	0	75	14702	21043	21364	7716	6986	6341	321	0	14658	12356	12111	16744	12900	9065	5298	1850	
141 2 Leningrad oblast	12	4743	1587	3914	4103	540	1047	2327	189	37	602	22479	43980	44864	9112	13367	21501	884	39	14164	11237	10934	16863	12768	9242	4673	1042	
142 2 Lipetsk oblast	12	80	33	58	79	8	25	25	21	1	0	430	648	767	93	337	218	119	1	13030	11172	9709	12358	13213	8582	5685	2073	
146 2 Moscow oblast	12	2008	1553	1891	1955	145	1408	338	64	0	53	22118	25131	25464	2072	20046	3013	333	0	14242	13290	13025	14260	14241	8909	5228	0	
147 2 Murmansk oblast	12	3965	1	7	134	0	1	6	127	366	3465	12	52	536	0	12	40	484	476	12000	7429	4000	0	10591	6544	3820	1298	
149 2 Novgorod oblast	12	3273	2236	2910	2941	252	1984	674	31	0	331	31018	37372	37526	3634	27384	6354	154	0	13872	12843	12760	14449	13803	9426	4909	1057	
153 2 Orenburg oblast	12	1840	2	6	18	0	2	4	12	6	1817	16	43	97	0	16	27	54	8	8000	7167	5389	0	9663	7315	4673	1295	
154 2 Oryol oblast	12	53	41	51	52	7	34	10	1	0	0	497	590	595	98	399	93	5	0	12122	11569	11442	13029	11726	9359	6865	0	
156 2 Penza oblast	12	575	243	384	521	6	237	141	137	35	19	2651	3653	4354	73	2578	1											

APPENDIX II

Table A13 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - ACCESSIBLE AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)										Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)							
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	
2 4 Mongolia	12	1163	0	9	50	0	0	9	41	99	1013	0	61	241	0	0	61	180	132	0	6778	4820	0	0	6871	4370	1337	
11 1 Armenia	12	135	7	13	20	0	7	6	7	8	108	69	103	132	0	69	34	29	12	9857	7923	6600	0	10689	6243	3910	1585	
12 1 Azerbaijan	12	698	19	41	78	0	19	22	37	58	462	228	366	571	3	225	138	205	124	12000	8927	7321	13925	12082	6243	5603	2141	
13 1 Belorussia	12	5098	2527	4565	4664	432	2095	2038	99	0	433	35440	57723	58344	6038	29402	22283	621	0	14025	12645	12509	13971	14033	10935	6272	2026	
14 1 Estonia	12	975	417	592	621	7	410	175	29	4	350	5304	6820	6945	94	5210	1516	125	4	12719	11520	11184	13610	12706	8660	4274	1082	
15 1 Georgia	12	1995	42	82	151	11	31	40	69	56	1789	621	1068	1519	193	428	447	451	124	14786	13024	10060	18070	13971	11126	6575	2200	
16 1 Kazakhstan	12	4208	56	306	594	3	53	250	288	183	3431	492	2406	3714	28	464	1914	1308	295	8786	7863	6253	8726	8804	7657	4548	1612	
17 1 Kirghiztan	12	2290	0	15	60	0	0	15	45	82	2148	3	111	290	0	3	108	179	127	3000	7400	4833	0	8795	7021	4011	1550	
18 1 Latvia	12	1748	553	1450	1585	49	504	897	135	2	161	6850	15078	15829	684	6166	8228	751	3	12387	10399	9987	14084	12245	9172	5556	1392	
19 1 Lithuania	12	1605	820	1369	1438	30	790	549	69	0	167	12095	17793	18241	431	11664	5698	448	0	14750	12997	12685	14552	14762	10375	6525	1401	
20 1 Moldavia	12	85	25	51	71	3	22	26	20	6	8	342	585	712	41	301	243	127	13	13680	11471	10028	15923	13665	9236	6400	2047	
21 1 Tajikistan	12	2640	0	18	151	0	0	18	133	151	2338	0	144	839	0	144	695	297	0	8000	5556	0	0	8149	5218	1965		
22 1 Turkmenistan	12	1198	0	0	8	0	0	0	0	8	1153	0	0	48	0	0	0	48	76	0	0	6000	0	0	0	6066	2051	
23 1 Ukraine	12	4743	1605	3085	3530	382	1223	1480	445	51	1161	24070	40563	42850	6528	17542	16493	2287	106	14997	13148	12139	17100	14341	11142	5134	2096	
FSU REPUBLICS		27418	6071	11587	12971	917	5154	5516	1384	638	13709	85514	142760	150034	14040	71474	57246	7274	1181	14086	12321	11567	15311	13868	10378	5256	1851	
103 2 Krasnodar Kray	12	1335	242	392	452	31	211	150	60	24	858	3689	5272	5686	624	3065	1583	414	51	15244	13449	12580	20138	14493	10559	6912	2104	
107 2 Stavropol Kray	12	20	0	2	11	0	0	2	9	0	9	0	19	71	0	0	19	52	1	0	9500	6455	0	0	7849	6147	2080	
111 2 Arkhangelsk oblast	12	11643	3413	8289	9915	533	2880	4876	1626	477	1244	46953	88831	96296	9229	37724	41878	7465	599	13757	10717	9712	17320	13099	8588	4591	1257	
112 2 Astrakhan oblast	12	48	0	0	0	0	0	0	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114 2 Belgorod oblast	12	73	7	40	46	1	6	33	6	7	19	79	416	450	16	63	337	34	15	11286	10400	9783	13074	10785	10039	5296	2051	
115 2 Bryansk oblast	12	638	573	632	635	223	350	59	3	0	3	6561	7136	7153	2849	3712	575	17	0	11450	11291	11265	12761	10610	9830	6539	0	
117 2 Vladimir oblast	12	995	425	942	969	43	382	517	27	0	26	5283	9857	10003	618	4665	4574	146	0	12431	10464	10323	14437	12196	8850	5467	0	
118 2 Volgograd oblast	12	203	0	0	10	0	0	0	10	9	184	0	0	46	0	0	0	46	16	0	0	4600	0	0	0	4790	1731	
119 2 Vologda oblast	12	7190	4952	6130	6480	1043	3909	1178	350	29	681	69578	80488	82128	16742	52836	10910	1640	31	14050	13130	12674	16046	13517	9261	4684	1076	
120 2 Voronezh oblast	12	245	0	37	102	0	0	37	65	127	16	0	409	768	0	0	409	359	260	0	11054	7529	0	0	10938	5550	2044	
122 2 Nizhni Novgorod obl.	12	3093	1446	2967	3025	84	1362	1521	58	0	67	18154	31736	32078	1066	17088	13582	342	0	12555	10696	10604	12653	12542	8930	5876	0	
123 2 Nenets a.okr.	12	255	0	2	25	0	0	2	23	11	220	0	10	91	0	10	81	11	0	0	5000	3640	0	0	5945	3565	1024	
124 2 Ivanovo oblast	12	823	670	815	822	25	645	145	7	0	1	9582	10891	10926	355	9227	1309	35	0	14301	13363	13292	14296	14308	9002	5244	0	
127 2 Kaliningrad oblast	12	115	67	77	86	4	63	10	9	0	28	1036	1145	1206	57	979	109	61	0	15463	14870	14023	12727	15409	11196	6663	0	
128 2 Tver oblast	12	2510	2116	2344	2371	291	1825	228	27	0	138	29986	32159	32301	4065	25921	2173	142	0	14171	13720	13623	13945	14094	9926	5202	2448	
129 2 Kaluga oblast	12	980	759	963	974	45	714	204	11	0	6	10527	12538	12603	575	9952	2011	65	0	13870	13020	12939	12663	13931	9870	6005	0	
133 2 Kirov oblast	12	5580	2718	5214	5404	662	2056	2496	190	11	164	37622	59336	60377	11063	26559	21714	1041	14	13842	11380	11173	16711	12915	8699	5482	1245	
134 2 Kostroma oblast	12	3073	2072	2980	3035	265	1807	908	55	0	37	29037	37687	37937	4765	24272	8650	250	0	14014	12647	12500	17963	13431	9531	4535	1327	
136 2 Samara oblast	12	365	81	105	173	0	81	24	68	64	128	795	954	1251	0	795	159	297	110	9815	9086	7231	0	9790	6588	4342	1724	
138 2 Kursk oblast	12	80	48	70	71	5	43	22	1	1	7	619	846	856	73	546	227	10	2	12896	12086	12056	14068	12624	10105	7116	1906	
139 2 Komi-Permyak a.okr	12	1720	950	1595	1651	444	506	645	56	0	70	14016	19856	20149	7457	6559	5840	293	0	14754	12449	12204	16796	12975	9051	5266	1851	
141 2 Leningrad oblast	12	4215	1421	3471	3635	494	927	2050	164	36	545	20223	39238	40001	8338	11885	19015	763	37	14232	11305	11004	16884	12825	9277	4659	1044	
142 2 Lipetsk oblast	12	80	33	58	79	8	25	25	21	1	0	430	648	767	93	337	218	119	1	13030	11172	9709	12358	13213	8882	5685	2073	
146 2 Moscow oblast	12	1835	1426	1727	1782	114	1312	301	55	0	51	20449	23126	23411	1639	18810	2677	285	0	14340	13391	13137	14333	14332	8886	5134	0	
147 2 Murmansk oblast	12	2660	1	7	108	0	1	6	101	320	2231	11	51	441	0	11	40	390	420	11000	7286	4083	0	10592	6544	3860	1310	
149 2 Novgorod oblast	12	3133	2157	2805	2836	243	1914	648	31	0	296	30041	36164	36317	3503	26538	6123	153	0	13927	12893	12806	14421	13864	9450	4908	1057	
153 2 Orenburg oblast	12	53	2	6	18	0	2	4	12	6	30	16	43	97	0	16	27	54	8	8000	7167	5389	0	9663	7315	4673	1298	
154 2 Oryel oblast	12	53	41	51	52	7	34	10	1	0	0	497	590	595	98	399	93	5	0	12122	11569	11442	13029	11726	9359	8865	0	
156 2 Penza oblast	12	575	243	384	521	6	237	141	137	35	19	2651	3653	4354	73	2578	1002	701	46	10909	9513	8357	12523	10885	7125	5107	1319	
157 2 Perm oblast	12	5190	3226	4123	4364	1007	2219																					

APPENDIX II

Table A13 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - ACCESSIBLE AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)										Average annual biomass increments (000tons)										Average annual biomass yield (kg/ha)									
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS					
102	3	Gorno-Altai Republic	12	1693	202	322	455	43	159	120	133	53	1185	2237	3135	3738	590	1647	898	603	76	11074	9736	8215	13641	10384	7459	4545	1446			
104	3	Krasnoyarsk Krai	12	12555	3368	6188	7646	324	3044	2820	1458	852	4057	38238	59651	66783	4445	33793	21413	7132	1352	11353	9640	8734	13706	11101	7592	4893	1587			
105	3	Primorski Krai	12	5300	378	930	1360	113	265	552	430	604	3337	4703	8973	11128	1627	3076	4270	2155	1133	12442	9648	8182	14449	11622	7739	5008	1877			
106	3	Taymyr a.okr.	12	988	0	0	0	0	0	0	0	0	987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
108	3	Khabarovsk Krai	12	6658	471	1069	1777	17	454	598	708	529	4348	5302	9880	13121	207	5095	4578	3241	745	11257	9242	7384	11976	11234	7650	4576	1407			
110	3	Amur oblast	12	6083	1370	2420	3629	183	1187	1050	1209	470	1983	14604	23233	28897	2231	12373	8629	5664	727	10660	9600	7963	12183	10427	8218	4684	1546			
116	3	Evenk a.okr	12	5605	1	9	34	0	1	8	25	195	5376	7	65	173	0	7	58	108	252	7000	7222	5088	0	10908	6958	4282	1299			
121	3	Yevrey (Jewish) a.ot	12	750	211	293	378	42	169	82	85	34	339	2655	3260	3691	551	2104	605	431	59	12583	11126	9765	13006	12465	7395	5093	1738			
125	3	Irkutsk oblast	12	14285	2361	4557	6235	35	2326	2196	1678	1335	6716	27351	43739	51287	405	26946	16388	7548	2043	11584	9598	8226	11523	11586	7463	4498	1530			
126	3	Ust-Orda Buryat a.okr	12	413	38	96	168	1	37	58	72	12	232	386	832	1131	16	370	446	299	15	10158	8667	6732	11026	9915	7722	4150	1277			
130	3	Kamchatka oblast	12	2035	6	219	731	0	6	213	512	198	1106	52	1868	4394	0	52	1816	2526	297	8667	8530	6011	0	9405	8512	4933	1502			
131	3	Koryak a.okr.	12	873	0	1	24	0	0	1	23	26	823	0	8	101	0	0	8	93	30	0	8000	4208	0	0	6754	4078	1185			
132	3	Kemerovo oblast	12	2875	1342	1972	2241	242	1100	630	269	94	540	15747	20409	21577	3138	12609	4662	1168	148	11734	10349	9628	12973	11460	7401	4344	1573			
135	3	Chukchi a.okr.	12	2220	0	0	0	0	0	0	0	0	2220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
137	3	Kurgan oblast	12	483	65	300	366	0	65	235	66	9	107	713	2442	2785	0	713	1729	343	15	10969	8140	7609	0	11040	7348	5174	1618			
144	3	Magadan oblast	12	2635	0	2	66	0	0	2	64	151	2418	0	16	354	0	0	16	338	195	0	8000	5364	0	0	7216	5276	1297			
150	3	Novosibirsk oblast	12	1660	548	1118	1252	56	492	570	134	17	390	6219	10727	11387	755	5464	4508	660	30	11349	9595	9095	13414	11115	7904	4929	1688			
152	3	Omsk oblast	12	1958	455	1056	1372	4	451	601	316	5	581	5330	10572	11974	49	5281	5242	1402	8	11714	10011	8727	12120	11703	8722	4439	1724			
164	3	Sakhalin oblast	12	4178	273	824	1502	0	273	551	678	240	2433	3425	7720	11266	0	3425	4295	3546	414	12546	9369	7501	0	12528	7800	5229	1725			
165	3	Sverdlovsk oblast	12	9003	5272	6409	6956	1146	4126	1137	547	41	2006	69231	78230	80695	18011	51220	8999	2465	65	13132	12206	11601	15718	12414	7917	4506	1584			
167	3	Aga-Buryat a.okr.	12	155	0	5	22	0	0	5	17	32	102	0	30	85	0	0	30	55	44	0	6000	3864	0	0	6010	3300	1378			
169	3	Tomsk oblast	12	4765	2145	3287	3726	212	1933	1142	439	76	963	24979	34378	36604	2814	22165	9399	2226	132	11645	10459	9824	13258	11469	8231	5074	1737			
171	3	Tyumen oblast	12	1593	500	1081	1240	42	458	581	159	48	304	5505	10025	10831	623	4882	4520	806	71	11010	9274	8735	14911	10652	7775	5083	1461			
172	3	Khanty-Mansi a.okr.	12	4878	727	1614	2284	40	687	887	670	148	2445	8921	16312	19796	585	8336	7391	3484	253	12271	10107	8667	14804	12141	8329	5197	1704			
174	3	Yamalo-Nenets a.okr	12	1173	0	33	133	0	0	33	100	266	774	0	237	765	0	0	237	528	469	0	7182	5752	0	0	7304	5288	1762			
175	3	Chelyabinsk oblast	12	1520	233	463	731	52	181	230	268	101	687	2875	4394	5498	839	2036	1519	1104	163	12339	9490	7521	16047	11253	6605	4120	1612			
176	3	Chita oblast	12	3128	24	169	601	0	24	145	432	474	2052	273	1316	3194	2	271	1043	1878	687	11375	7787	5314	9946	11065	7184	4348	1451			
181	3	Buryat Republic	12	3718	39	312	730	1	38	273	418	580	2407	426	2472	4296	14	412	2046	1824	867	10923	7923	5885	15405	10844	7482	4360	1494			
193	3	Tuva Republic	12	2858	5	89	446	0	5	84	357	347	2064	53	658	2179	0	53	605	1521	504	10600	7393	4886	0	10615	7183	4262	1450			
195	3	Khakass Republic	12	1603	115	243	568	19	96	128	325	112	922	1230	2135	3486	241	989	905	1351	148	10696	8786	6137	12546	10278	7085	4152	1323			
198	3	Sakha (Yakutia) Rep	12	33823	50	629	2075	0	50	579	1446	2007	29741	530	4743	10847	0	530	4213	6104	2711	10600	7541	5227	0	10594	7282	4221	1351			
		RUSSIA WEST		90232	37144	64690	73677	6903	30241	27546	8987	3631	12902	512814	754840	797710	111501	401313	242026	42870	5659	13806	11669	10827	16153	13270	8786	4770	1559			
		RUSSIA EAST		144384	21010	37387	50740	2718	18292	16377	13353	9195	84435	250371	377732	439824	39211	211160	127361	62092	13878	11917	10103	8668	14426	11544	7777	4650	1509			
		RUSSIA TOTAL		234616	58154	102077	124417	9621	48533	43923	22340	12826	97337	763185	1132572	1237534	150712	612473	369387	104962	19537	13124	11095	9947	15665	12620	8410	4698	1523			
211	11	Beijing	12	158	18	60	90	1	17	42	30	4	63	273	716	901	15	258	443	185	6	15167	11933	10011	15430	14873	10449	6112	1704			
212	11	Tianjin	12	18	1	5	8	0	1	4	3	1	9	9	46	61	0	9	37	15	2	9000	9200	7625	0	15586	9386	5616	1766			
213	11	Hebei	12	938	169	396	536	29	140	227	140	37	365	1832	3828	4674	306	1526	1996	846	78	10840	9667	8720	10511	10887	8907	6038	2130			
214	11	Shanxi	12	695	75	212	306	10	65	137	94	101	288	979	2306	2848	142	837	1327	542	225	13053	10877	9307	13921	12880	9697	5776	2228			
237	11	Shandong	12	1170	161	384	531	1	160	223	147	10	628	2532	5683	6478	27	2505	3151	795	24	15727	14799	12200	18377	15611	14115	5392	2502			
241	11	Henan	12	4095	1788	2268	2589	214	1574	480	321	68	1438	27870	33301	35396	3880	23990	5431	2095	144	15587	14683	13672	18137	15244	11309	6526	2128			
221	12	Liaoning	12	2870	1476	1984	2223	620	856	508	239	116	531	21655	26808	28098	9881	11774	5153	1290	225	14671	13512	12640	15925	13763	10137	5408	1946			
222	12	Jilin	12	5498	2393	3775	4302	1027	1366	1382	527	21	1174	31962	46279	49437	14347	17615	14317	3158	38	13356	12259	11492	13969	12897	10361	5987	1804			
223	12	Heilongjiang	12	10550	5322	7741	8715	1896	3426	2419	974	98	1738	65988	89019	94657	25667	40321	23031	5638	169	12399	11500	10861	13541	11768	9523	5790	1731			
231	13	Shanghai	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
232	13	Jiangsu	12	395	161	238	270	8	153	77	32	0	124	2496	3311	3521	139	2357	815	210	1	15503	13912	13041	18056	15373	10605	6501	2386			
233	13	Zhejiang	12	2828	485	914	1009	68	417	429	95	15	1803	6747	10992	11538	1052	5695	4245	546	29	13911	12026</									

APPENDIX II

Table A14 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - EXCLUDING CULTIVATED AREAS, URBAN AREAS AND AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)									Average annual biomass increments (000tons)									Average annual biomass yield (kg/ha)								
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS		
2 4 Mongolia	12	147800	81	569	4858	5	76	488	4289	4901	138043	829	3936	21943	77	752	3107	18007	7189	10235	6917	4517	16415	9925	6372	4199	1467		
11 1 Armenia	12	1788	37	117	212	0	37	80	95	64	1512	375	913	1283	0	375	538	370	88	10135	7803	6052	0	10094	6742	3903	1374		
12 1 Azerbaijan	12	4578	32	89	387	0	32	57	298	638	3244	335	735	2666	1	334	400	1931	1389	10469	8258	6889	13782	10439	7068	6471	2175		
13 1 Byelorussia	12	1680	584	1356	1435	131	453	772	79	0	244	7712	15883	16342	1801	5911	8171	459	0	13205	11713	11388	13732	13047	10579	5782	0		
14 1 Estonia	12	370	177	204	209	0	177	27	5	0	160	1894	2139	2156	2	1892	245	17	0	10701	10485	10316	13463	10702	8957	3295	1587		
15 1 Georgia	12	1515	59	139	209	8	51	80	70	104	1201	777	1453	1841	160	617	676	388	236	13169	10453	8809	19101	12117	8460	5504	2270		
16 1 Kazakhstan	12	214330	558	2478	8337	72	486	1920	5859	2385	203608	5880	21477	50198	982	4898	15597	28721	3760	10538	8667	6021	13568	10071	8122	4902	1577		
17 1 Kirghiztan	12	12170	31	143	377	3	28	112	234	199	11594	340	1109	2124	52	288	769	1015	295	10968	7755	5634	18465	10138	6872	4339	1482		
18 1 Latvia	12	210	90	180	191	17	73	90	11	0	19	1206	2101	2164	239	967	895	63	0	13400	11672	11330	14365	13163	9971	5946	0		
19 1 Lithuania	12	1463	690	1254	1312	93	597	564	58	0	151	9600	15083	15488	1357	8243	5853	405	0	13913	12028	11805	14640	13815	9723	6925	2143		
20 1 Moldavia	12	10	2	4	6	1	1	2	2	2	2	22	45	59	12	10	23	14	6	11000	11250	9833	16649	16650	9254	7059	2263		
21 1 Tajikistan	12	2655	0	0	7	0	0	0	7	7	2641	0	0	38	0	0	38	14	0	0	0	5429	0	0	0	5589	1859		
22 1 Turkmenistan	12	40375	0	0	8	0	0	0	8	0	40367	0	0	53	0	0	53	0	0	0	0	6625	0	0	0	6484	0		
23 1 Ukraine	12	640	267	445	510	66	201	178	65	14	115	3867	5793	6220	1065	2802	1926	427	33	14483	13018	12196	16055	13935	10815	6543	2325		
FSU REPUBLICS		281784	2527	6409	13200	391	2136	3882	6791	3413	264858	32008	66731	100632	5671	26337	34723	33901	5821	12666	10412	7624	14504	12330	8945	4992	1706		
103 2 Krasnodar Kray	12	625	126	203	336	36	90	77	133	37	252	2226	3082	4016	746	1480	856	934	88	17667	15182	11952	20913	16466	11089	7023	2348		
107 2 Stavropol Kray	12	965	62	197	264	9	53	135	67	15	686	787	2053	2453	137	650	1266	400	27	12694	10421	9292	15287	12250	9349	5978	1852		
111 2 Arkhangelsk oblast	12	11818	545	2210	3052	71	474	1665	842	272	8481	7094	21147	24865	1205	5889	14053	3718	315	13017	9569	8147	17050	12418	8442	4416	1156		
112 2 Astrakhan oblast	12	4380	0	0	0	0	0	0	0	4380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
114 2 Belgorod oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115 2 Bryansk oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
117 2 Vladimir oblast	12	13	3	11	11	1	2	8	0	0	2	34	107	107	15	19	73	0	0	11333	9727	9727	14635	10635	9102	0	0		
118 2 Volgograd oblast	12	1890	0	0	0	0	0	0	0	1890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
119 2 Vologda oblast	12	1253	700	974	1000	117	583	274	26	0	252	8762	11358	11465	1815	6947	2596	107	0	12517	11661	11465	15467	11918	9463	4173	941		
120 2 Voronezh oblast	12	258	4	15	58	0	4	11	43	139	60	38	131	368	0	38	93	237	277	9500	8733	6345	0	9470	8479	5442	1992		
122 2 Nizhni Novgorod obl.	12	298	109	277	289	5	104	168	12	0	9	1286	2757	2823	58	1228	1471	66	0	11798	9953	9768	12575	11836	8732	5505	0		
123 2 Nenets a.okr.	12	15018	0	2	95	0	0	2	93	38	14865	0	14	346	0	0	14	332	41	0	7000	3642	0	0	6006	3584	1087		
124 2 Ivanovo oblast	12	25	13	25	25	1	12	12	0	25	0	156	258	258	18	138	102	0	0	12000	10320	10320	14130	11781	8479	0	0		
127 2 Kaliningrad oblast	12	30	8	16	20	0	8	8	4	0	10	103	203	229	0	103	100	26	0	12875	12688	11450	0	13078	11843	6398	0		
128 2 Tver oblast	12	118	87	101	103	17	70	14	2	0	14	1220	1363	1374	240	980	143	11	0	14023	13495	13340	13988	14097	10030	5016	2433		
129 2 Kaluga oblast	12	65	54	63	65	0	54	9	2	0	0	812	907	917	0	812	95	10	0	15037	14397	14108	0	15019	10404	5809	0		
133 2 Kirov oblast	12	235	116	214	231	38	78	98	17	0	4	1583	2465	2556	595	988	882	91	0	13647	11519	11065	15670	12681	8983	5263	0		
134 2 Kostroma oblast	12	253	155	240	247	67	88	85	7	0	6	2368	3217	3251	1271	1097	849	34	0	15277	13404	13162	18912	12460	10005	4888	1337		
136 2 Samara oblast	12	5	0	0	1	0	0	0	1	3	0	0	0	3	0	0	3	2	0	0	0	3000	0	0	0	3373	1353		
138 2 Kursk oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
139 2 Komi-Permyak a.okr	12	170	82	153	160	24	58	71	7	0	10	1046	1701	1742	362	684	655	41	0	12756	11118	10888	15360	11713	9229	5548	1833		
141 2 Leningrad oblast	12	800	294	671	701	73	221	377	30	2	97	3926	7279	7421	1229	2697	3353	142	2	13354	10848	10586	16731	12216	8905	4680	981		
142 2 Lipetsk oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
146 2 Moscow oblast	12	193	135	180	190	33	102	45	10	0	2	1779	2187	2247	461	1318	408	60	0	13178	12150	11826	13996	12949	9037	5830	0		
147 2 Murmansk oblast	12	6555	0	38	166	0	0	38	128	140	6249	0	224	685	0	224	461	169	0	5895	4127	0	10485	5905	3595	1207			
149 2 Novgorod oblast	12	233	128	176	176	12	116	48	0	0	55	1646	2080	2082	186	1460	434	2	0	12859	11818	11830	15179	12551	9010	4961	0		
153 2 Orenburg oblast	12	2480	0	0	2	0	0	0	2	7	2471	0	0	7	0	0	7	9	0	0	0	3500	0	0	0	3041	1262		
154 2 Oryel oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
156 2 Penza oblast	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
157 2 Perm oblast	12	325	137	276	295	68	69	139	19	2	29	1947	3209	3321	1129	818	1262	112	2	14212	11627	11258	16634	11920	9093	6015	963		
158 2 Pskov oblast	12	265	139	231	237	13	126	92	6	0	28	1848	2637	2667	188	1660	789	30	0	13295	11416	11253	14262	13190	8564	5148	0		
160 2 Rostov oblast	12	453	0	0	6																								

APPENDIX II

Table A14 PRODUCTION POTENTIALS FOR TRADITIONAL PRODUCTION FORESTRY SPECIES - EXCLUDING CULTIVATED AREAS, URBAN AREAS AND AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)								Average annual biomass increments (000tons)								Average annual biomass yield (kg/ha)										
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS		
102	3	Gorno-Altai Republic	12	4118	43	67	107	12	31	24	40	52	3958	497	671	824	173	324	174	153	69	11558	10015	7701	14257	10488	7170	3850	1322
104	3	Krasnoyarsk Krai	12	5383	1015	1889	2213	192	823	874	324	108	3061	11700	18715	20426	2607	9093	7015	1711	159	11527	9907	9230	13558	11052	8026	5286	1470
105	3	Primorski Krai	12	1490	138	535	737	10	128	397	202	78	674	1765	4354	5254	149	1616	2589	900	148	12790	8138	7129	14731	12642	6520	4449	1891
106	3	Taymyr a.okr.	12	71523	0	0	0	0	0	0	0	0	71522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	3	Khabarovsk Krai	12	18580	1370	3011	4270	78	1292	1641	1259	797	13513	15421	27738	33171	1133	14288	12317	5433	1196	11256	9212	7768	14558	11057	7505	4315	1500
110	3	Amur oblast	12	6033	1923	2635	3401	344	1579	712	766	427	2204	21207	27162	30901	4405	16802	5955	3739	631	11028	10308	9086	12796	10641	8360	4879	1478
116	3	Evenk a.okr.	12	9323	0	13	21	0	13	8	78	9223	3	103	135	0	3	100	32	98	3000	7923	6429	0	10843	7614	3734	1258	
121	3	Yevrey (Jewish) a.ot	12	1318	398	656	822	70	328	258	166	16	481	5059	6834	7714	902	4157	1775	880	29	12711	10418	9384	12911	12673	6878	5316	1836
125	3	Irkutsk oblast	12	8388	196	402	700	2	194	206	298	439	7249	2411	4016	5212	20	2391	1605	1196	618	12301	9990	7446	10768	12318	7782	4018	1409
126	3	Ust-Orda Buryat a.okr.	12	350	3	22	101	0	3	19	79	35	214	29	175	457	0	29	146	282	49	9667	7955	4525	0	10655	7680	3560	1406
130	3	Kamchatka oblast	12	9120	1	202	570	0	1	201	368	146	8381	10	1813	3551	0	10	1803	1738	224	10000	8975	6230	0	9315	8958	4729	1528
131	3	Koryak a.okr.	12	25808	0	103	309	0	0	103	206	935	24564	0	712	1455	0	0	712	743	1039	0	6913	4709	0	0	6937	3612	1111
132	3	Kemerovo oblast	12	925	109	153	307	21	88	44	154	150	468	1173	1486	2161	276	897	313	675	237	10761	9712	7039	13251	10168	7122	4379	1581
135	3	Chukchi a.okr.	12	60873	0	0	0	0	0	0	0	0	60847	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	3	Kurgan oblast	12	2543	171	650	1096	0	171	479	446	285	1162	1779	5597	7754	0	1779	3818	2157	453	10404	8611	7075	0	10393	7968	4838	1591
144	3	Magadan oblast	12	31205	0	8	507	0	0	8	499	426	30272	0	57	2208	0	0	57	2151	591	0	7125	4355	0	0	7061	4309	1389
150	3	Novosibirsk oblast	12	8383	1697	3292	4116	193	1504	1595	824	216	4051	18985	32228	36232	2546	16439	13243	4004	350	11187	9790	8803	13209	10933	8302	4861	1621
152	3	Omsk oblast	12	5148	1099	2010	2860	37	1062	911	850	250	2038	12845	20282	24337	510	12335	7437	4055	425	11688	10091	8509	13620	11615	8166	4771	1701
164	3	Sakhalin oblast	12	973	60	211	282	0	60	151	71	21	661	713	1899	2285	0	713	1186	386	26	11883	9000	8103	0	11812	7839	5427	1204
165	3	Sverdlovsk oblast	12	2898	2048	2311	2383	354	1694	263	72	3	512	24987	27116	27498	5695	19292	2129	382	3	12201	11733	11539	16104	11388	8096	5269	1263
167	3	Aga-Buryat a.okr.	12	1038	0	20	300	0	0	20	280	184	554	0	114	1168	0	0	114	1054	255	0	5700	3893	0	0	5731	3764	1387
169	3	Tomsk oblast	12	10153	3887	6214	7499	249	3638	2327	1285	47	2607	45259	64153	70776	3410	41849	18894	6627	64	11644	10324	9438	13709	11502	8121	5153	1373
171	3	Tyumen oblast	12	7145	3328	4547	5145	118	3210	1219	598	272	1728	34691	44087	46836	1516	33175	9396	2749	439	10424	9696	9103	12884	10335	7708	4601	1610
172	3	Khanty-Mansi a.okr.	12	20210	3552	7511	11604	125	3427	3959	4093	1268	7338	42116	74285	94421	1877	40239	32169	20136	2345	11857	9890	8137	14973	11742	8124	4920	1850
174	3	Yamalo-Nenets a.okr.	12	41490	0	324	2155	0	0	324	1831	2722	36605	2	2282	12157	0	2	2280	9875	4904	2000	7043	5641	0	10502	7032	5393	1802
175	3	Chelyabinsk oblast	12	1518	96	230	405	1	95	134	175	406	706	1123	2190	2781	12	1111	1067	591	610	11698	9522	6867	14062	11729	7941	3367	1502
176	3	Chita oblast	12	11328	37	526	1690	0	37	489	1164	1397	8241	358	3596	8450	0	358	3238	4854	1972	9676	6837	5000	0	9765	7621	4169	1412
181	3	Buryat Republic	12	10333	46	361	798	0	46	315	437	951	8584	508	2902	4806	0	508	2394	1904	1452	11043	8039	6023	0	11022	7607	4356	1528
193	3	Tuva Republic	12	5498	9	77	288	0	9	68	211	241	4968	97	586	1437	0	97	489	851	329	10778	7610	4990	0	10625	7191	4031	1362
195	3	Khakass Republic	12	1360	323	650	802	16	307	327	152	37	521	3468	5932	6625	205	3263	2464	693	56	10737	9126	8261	12745	10611	7546	4561	1515
198	3	Sakha (Yakutia) Rep	12	107800	57	297	1222	0	57	240	925	2483	104078	615	2426	6430	0	615	1811	4004	3275	10789	8168	5262	0	11775	7560	4329	1319
		RUSSIA WEST		75204	4501	11629	15352	986	3515	7128	3723	1752	58039	59965	121941	140711	16036	43929	61976	18770	2745	13323	10486	9166	16264	12498	8695	5042	1567
		RUSSIA EAST		496758	22649	40953	59609	2134	20515	18304	18656	14626	422432	259708	404393	492654	30032	229676	144685	88261	22303	11467	9875	8265	14073	11196	7905	4731	1525
		RUSSIA TOTAL		571962	27150	52582	74961	3120	24030	25432	22379	16378	480471	319673	526334	633365	46068	273605	206661	107031	25048	11774	10010	8449	14765	11386	8126	4783	1529
211	11	Beijing	12	673	76	228	315	0	76	152	87	14	343	1130	2612	3088	5	1125	1482	476	23	14868	11456	9803	14313	14787	9742	5487	1663
212	11	Tianjin	12	78	0	6	8	0	0	6	2	67	0	0	60	73	0	0	60	13	5	0	10000	9125	0	14859	9866	6197	2229
213	11	Hebei	12	6618	1154	2858	4219	141	1013	1704	1361	219	2178	12949	28039	36034	1441	11508	15090	7995	450	11221	9811	8541	10203	11360	8854	5872	2053
214	11	Shanxi	12	6105	620	1530	2412	91	529	910	882	806	2888	7519	16591	22095	12480	6279	9072	5504	1757	12127	10844	9160	13579	11881	9974	6243	2181
237	11	Shandong	12	515	94	144	161	8	86	50	17	24	330	1477	2058	2192	146	1331	581	134	54	15713	14292	13615	17753	15500	11588	7653	2300
241	11	Henan	12	1193	336	527	615	39	297	191	88	35	543	5231	7439	8029	713	4518	2208	590	76	15568	14116	13055	18190	15218	11551	6739	2182
221	12	Liaoning	12	1468	393	710	995	133	260	317	285	172	300	5709	8892	10466	2105	3604	3183	1574	340	14527	12524	10519	15807	13868	10041	5514	1978
222	12	Jilin	12	2573	309	482	1244	71	238	173	762	262	1067	4024	5743	9287	969	3055	1719	3544	417	13023	11915	7465	13594	12841	9954	4650	1590
223	12	Heilongjiang	12	9320	4243	5510	7186	1113	3130	1267	1676	630	1504	53039	63983	72506	15201	37838	10944	8523	1036	12500	11612	10090	13652	12088	8639	5086	1645
231	13	Shanghai	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
232	13	Jiangsu	12	275	85	129	132	24	61	44	3	0	143	1349	1795	1819	430	919	446	24	0	15871	13915	13780	18142	15034	10132	7231	2391
233	13	Zhejiang	12	500	71	135	159	8	63	64	24	3	338	999	1633	1769	129	870	634	136	6	14070	12096	11126	15711	13754	9888	5679	1915
234	13	Anhui	12	1465	478	766	772	36	442	288	6	0	693	6905	9796	9830	530	6375	2891	34	0	14446	12789	12733	14675	14408	10046	5975	2106

APPENDIX II

Table A15 SUITABLE AREAS FOR CONSERVATION FORESTRY - ALL AREAS

ADM REG NAME		LC	Total Extent	Suitable Areas (000ha)								
				VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS
2	4 Mongolia	12	156198	200	2622	8843	18	182	2422	6221	6549	140806
11	1 Armenia	12	2690	169	472	688	0	169	303	216	155	1847
12	1 Azerbaijan	12	7868	217	704	1495	14	203	487	791	1646	4159
13	1 Byelorussia	12	20348	15798	18694	19061	5742	10056	2896	367	13	1273
14	1 Estonia	12	3938	1929	2393	2742	440	1489	464	349	120	1075
15	1 Georgia	12	6523	738	1485	2067	374	364	747	582	593	3863
16	1 Kazakhstan	12	268445	3853	9596	22058	559	3294	5743	12462	4951	241435
17	1 Kirghiztan	12	19548	171	1010	2191	30	141	839	1181	710	16645
18	1 Latvia	12	6313	2826	5508	5708	773	2053	2682	200	85	519
19	1 Lithuania	12	6420	3505	5653	5853	1572	1933	2148	200	31	536
20	1 Moldavia	12	3000	1566	2398	2596	414	1152	832	198	224	180
21	1 Tajikistan	12	9013	0	86	762	0	0	86	676	512	7738
22	1 Turkmenistan	12	45390	0	0	31	0	0	0	31	127	45231
23	1 Ukraine	12	57570	29877	41613	45761	11343	18534	11736	4148	6864	4942
FSU REPUBLICS			457066	60649	89612	111013	21261	39388	28963	21401	16031	329443
103	2 Krasnodar Kray	12	7620	1362	2408	4667	379	983	1046	2259	1770	1176
107	2 Stavropol Kray	12	6635	480	1475	3330	105	375	995	1855	647	2658
111	2 Arkhangelsk oblast	12	38190	7692	19696	24917	1909	5783	12004	5221	1742	11511
112	2 Astrakhan oblast	12	4598	0	0	0	0	0	0	0	0	4597
114	2 Belgorod oblast	12	2665	977	1565	1715	269	708	588	150	481	470
115	2 Bryansk oblast	12	3483	3315	3429	3431	1336	1979	114	2	0	51
117	2 Vladimir oblast	12	2925	1555	2866	2908	288	1267	1311	42	0	17
118	2 Volgograd oblast	12	11265	0	0	583	0	0	0	583	945	9737
119	2 Vologda oblast	12	14628	9938	12127	12928	3618	6320	2189	801	248	1452
120	2 Voronezh oblast	12	5195	676	1341	2157	264	412	665	816	2751	288
122	2 Nizhni Novgorod obl	12	7515	4852	7356	7430	1596	3256	2504	74	6	79
123	2 Nenets a.okr.	12	16858	0	15	309	0	0	15	294	177	16352
124	2 Ivanovo oblast	12	2270	1862	2251	2260	779	1083	389	9	0	10
127	2 Kaliningrad oblast	12	1240	765	954	1036	366	399	189	82	0	204
128	2 Tver oblast	12	8395	7253	7933	8173	3247	4006	680	240	53	170
129	2 Kaluga oblast	12	2963	2525	2935	2940	832	1693	410	5	0	22
133	2 Kirov oblast	12	11930	7552	11211	11601	3172	4380	3659	390	66	262
134	2 Kostroma oblast	12	6000	4324	5759	5851	1621	2703	1435	92	13	137
136	2 Samara oblast	12	5118	539	860	2164	0	539	321	1304	736	2216
138	2 Kursk oblast	12	3020	2683	2691	2740	1331	1352	8	49	12	267
139	2 Komi-Permyak a.okr	12	3280	2061	3046	3157	1310	751	985	111	0	123
141	2 Leningrad oblast	12	7500	3043	6125	6598	1321	1722	3082	473	373	528
142	2 Lipetsk oblast	12	2410	1989	2257	2354	1562	427	268	97	52	4
146	2 Moscow oblast	12	4665	4005	4445	4571	1703	2302	440	126	1	94
147	2 Murmansk oblast	12	13960	13	89	486	0	13	76	397	942	12532
149	2 Novgorod oblast	12	5450	4098	5076	5228	1491	2607	978	152	115	107
153	2 Orenburg oblast	12	12418	310	655	1323	21	289	345	668	332	10763
154	2 Oryel oblast	12	2458	2418	2454	2454	1435	983	36	0	0	3
156	2 Penza oblast	12	4320	2749	3725	4024	1591	1158	976	299	230	66
157	2 Perm oblast	12	12715	8602	10284	10613	5326	3276	1682	329	85	2016
158	2 Pskov oblast	12	5568	3419	4791	4886	1338	2081	1372	95	43	638
160	2 Rostov oblast	12	10133	361	847	4499	81	280	486	3652	1719	3915
161	2 Ryazan oblast	12	3935	3261	3886	3936	1704	1557	625	50	0	0
163	2 Saratov oblast	12	10375	177	529	1720	0	177	352	1191	1679	6977
166	2 Smolensk oblast	12	4943	4368	4734	4769	2129	2239	366	35	0	174
168	2 Tambov oblast	12	3435	2084	2788	2963	1304	780	704	175	438	34
170	2 Tula oblast	12	2553	2534	2552	2552	1748	786	18	0	0	0
173	2 Ulyanovsk oblast	12	3690	495	1593	2445	104	391	1098	852	542	704
178	2 Yaroslavl oblast	12	3260	2990	3090	3198	1440	1550	100	108	21	40
179	2 Adigei Republic	12	775	386	482	530	154	232	96	48	13	232
180	2 Bashkortostan Repu	12	14435	6688	9372	10807	2926	3762	2684	1435	1087	2540
182	2 Dagestn Republic	12	5033	196	411	1112	73	123	215	701	558	3356
183	2 Kabardino-Balkarian	12	1238	424	628	676	162	262	204	48	41	519
185	2 Kalmyk-Khalm-Tang	12	7510	0	0	172	0	0	0	172	61	7277
186	2 Karelia Republic	12	18253	2147	9008	11853	613	1534	6861	2845	1816	4575
187	2 Komi Republic	12	41370	4784	16384	25093	2135	2649	11600	8709	5070	11207
188	2 Mari-El Republic	12	2365	1136	1909	2191	260	876	773	282	36	138
189	2 Mordovian SSR	12	2590	1891	2469	2528	1373	518	578	59	42	20
190	2 North-Ossetian SSR	12	778	317	383	464	241	76	66	81	31	283
191	2 Karachai-Cherkess I	12	1468	388	524	588	159	229	136	64	72	807
192	2 Tatarstan Republic	12	6663	2707	4226	5195	1287	1420	1519	969	553	915
194	2 Udmurt Republic	12	4150	3375	3890	3897	1392	1983	515	7	13	240
196	2 Checheno-Ingush R	12	1930	441	671	1164	185	256	230	493	120	647
197	2 Chuvash Republic	12	1808	644	1079	1349	183	461	435	270	415	44
101	3 Altai Kray	12	16653	6373	9812	11393	3428	2945	3439	1581	492	4768

APPENDIX II

Table A15 SUITABLE AREAS FOR CONSERVATION FORESTRY - ALL AREAS

ADM	REG	NAME	LC	Total Extent	Suitable Areas (000ha)							NS	
					VS+S	VS...MS	VS...mS	VS	S	MS	mS		vmS
102	3	Gorno-Altai Republic	12	9385	805	2050	2229	108	697	1245	179	236	6920
104	3	Krasnoyarsk Krai	12	71140	17169	29443	35569	4760	12409	12274	6126	6085	29485
105	3	Primorski Krai	12	16338	1118	3038	5214	334	784	1920	2176	2277	8847
106	3	Taymyr a.okr.	12	82285	0	0	0	0	0	0	0	0	82285
108	3	Khabarovsk Krai	12	77545	4712	8733	16880	898	3814	4021	8147	7809	52849
110	3	Amur oblast	12	36283	9068	13302	20282	2440	6628	4234	6980	4631	11370
116	3	Evenk a.okr.	12	75673	5	372	888	0	5	367	516	3533	71251
121	3	Yevrey (Jewish) a.ot	12	3700	1189	1842	2211	607	582	653	369	436	1052
125	3	Irkutsk oblast	12	76270	7218	14469	22248	1324	5894	7251	7779	12324	41698
126	3	Ust-Orda Buryat a.ol	12	2178	234	660	867	40	194	426	207	55	1254
130	3	Kamchatka oblast	12	17045	100	112	2880	0	100	1022	1758	676	13467
131	3	Koryak a.okr.	12	28903	0	112	399	0	0	112	287	1105	27399
132	3	Kemerovo oblast	12	9500	4386	5429	6377	1043	3343	1043	948	639	2483
135	3	Chukchi a.okr.	12	70770	0	0	0	0	0	0	0	0	70745
137	3	Kurgan oblast	12	7110	1600	2907	3780	521	1079	1307	873	564	2767
144	3	Magadan oblast	12	45830	0	24	934	0	0	24	910	1154	43742
150	3	Novosibirsk oblast	12	17673	5423	8632	10062	2708	2715	3209	1430	880	6730
152	3	Omsk oblast	12	13980	3302	5265	8964	518	2784	1963	3699	721	4295
164	3	Sakhalin oblast	12	8095	743	1680	2758	5	738	937	1078	327	4918
165	3	Sverdlovsk oblast	12	19273	11885	13969	14649	5498	6387	2084	680	212	4412
167	3	Aga-Buryat a.okr.	12	1970	2	85	754	0	2	83	669	308	907
169	3	Tomsk oblast	12	31145	14606	21195	23760	3644	10962	6589	2565	228	7157
171	3	Tyumen oblast	12	15860	7486	10408	11635	1972	5514	2922	1227	578	3647
172	3	Khanty-Mansi a.okr.	12	53163	10264	18913	28719	1271	8993	8649	9806	2870	21573
174	3	Yamalo-Nenets a.okr.	12	66588	20	1389	5425	0	20	1369	4036	9761	51393
175	3	Chelyabinsk oblast	12	8763	2130	3321	4408	741	1389	1191	1087	1226	3129
176	3	Chita oblast	12	41493	316	2685	12052	1	315	2369	9367	9019	20420
181	3	Buryat Republic	12	33533	393	3753	6916	17	376	3360	3163	7630	18987
193	3	Tuva Republic	12	17035	107	1519	2836	0	107	1412	1317	1547	12652
195	3	Khakass Republic	12	6120	1427	2358	3143	223	1204	931	785	194	2782
198	3	Sakha (Yakutia) Rep	12	303275	519	3407	10022	0	519	2888	6615	17029	276207
RUSSIA WEST				389947	132851	201274	240535	57863	74988	68423	39261	26147	123194
RUSSIA EAST				1284574	112600	191894	278254	32101	80499	79294	86360	94546	911591
RUSSIA TOTAL				1674521	245451	393168	518789	89964	155487	147717	125621	120693	1034785
211	11	Beijing	12	1640	567	1007	1250	132	435	440	243	1	389
212	11	Tianjin	12	1125	32	236	349	0	32	204	113	241	534
213	11	Hebei	12	18480	5492	9646	12346	1505	3987	4154	2700	2009	4125
214	11	Shanxi	12	15783	4060	6841	9082	1284	2776	2781	2241	3488	3212
237	11	Shandong	12	14798	4302	6028	7478	1367	2935	1726	1450	1055	6266
241	11	Henan	12	16295	8121	10241	11638	2841	5280	2120	1397	508	4150
221	12	Liaoning	12	13863	7924	10430	11834	4073	3851	2506	1404	1070	958
222	12	Jilin	12	19145	10224	13564	15507	4915	5309	3340	1943	729	2909
223	12	Heilongjiang	12	44848	29796	36616	39425	15520	14276	6820	2809	1485	3938
231	13	Shanghai	12	413	268	386	386	134	134	118	0	0	27
232	13	Jiangsu	12	9290	5967	7879	8100	2763	3204	1912	221	8	1059
233	13	Zhejiang	12	9250	8052	9024	9130	1412	6640	972	106	34	85
234	13	Anhui	12	13783	10363	12888	13168	3236	7127	2525	280	16	600
236	14	Jiangxi	12	16663	12081	13834	14250	5343	6738	1753	416	185	2227
242	14	Hubei	12	18168	14944	16366	16377	4587	10357	1422	11	0	1792
243	14	Hunan	12	21050	16592	18304	18457	3249	13343	1712	153	162	2430
235	15	Fujian	12	11995	8176	9844	10204	319	7857	1668	360	133	1658
244	15	Guangdong	12	16385	8946	10638	11148	2116	6830	1692	510	191	5047
245	15	Guangxi	12	23425	14365	18651	19531	4051	10314	4286	880	393	3502
246	15	Hainan	12	2840	406	1104	1621	57	349	698	517	272	947
251	16	Sichuan	12	56143	22192	29588	31081	5293	16899	7396	1493	656	24405
252	16	Guizhou	12	17725	15884	16567	16568	2298	13586	683	1	0	1157
253	16	Yunnan	12	37325	21569	24627	27781	8730	12839	3058	3154	3940	5603
215	17	Nei Mongol	12	115468	12288	21631	33223	4364	7924	9343	11592	4104	78141
261	17	Shaanxi	12	20900	8512	11152	11750	1872	6640	2640	598	942	8208
262	17	Gansu	12	40580	5170	7637	9258	2006	3164	2467	1621	487	30835
264	17	Ningxia	12	5038	151	558	1388	45	106	407	830	33	3615
265	17	Xinjiang	12	163355	688	1616	3018	216	472	928	1402	900	159437
254	18	Xizang	12	119045	4931	5841	6944	1647	3284	910	1103	545	111557
263	18	Qinghai	12	72183	428	963	2290	41	387	535	1327	416	69476
272	19	Hongkong	12	40	0	1	2	0	0	1	1	0	37
CHINA TOTAL				937041	262491	333708	374584	85416	177075	71217	40876	24003	538326

APPENDIX II

Table A16 SUITABLE AREAS FOR CONSERVATION FORESTRY - EXCLUDING CULTIVATED AND URBAN AREAS

ADM REG NAME		LC	Total Extent	Suitable Areas (000ha)							NS	
				VS+S	VS...MS	VS...mS	VS	S	MS	mS		vmS
2	4 Mongolia	12	154858	200	2610	8774	18	182	2410	6164	6481	139602
11	1 Armenia	12	1965	138	353	499	0	138	215	146	110	1356
12	1 Azerbaijan	12	5588	199	608	1110	13	186	409	502	998	3062
13	1 Byelorussia	12	7628	5734	6878	7014	1862	3872	1144	136	11	603
14	1 Estonia	12	1508	699	936	1069	146	553	237	133	68	370
15	1 Georgia	12	4480	249	815	1191	66	183	566	376	387	2902
16	1 Kazakhstan	12	220903	2468	5543	10982	500	1968	3075	5439	2837	207083
17	1 Kirghiztan	12	16238	84	747	1330	20	64	663	583	538	14370
18	1 Latvia	12	2220	981	1966	2056	225	756	985	90	29	135
19	1 Lithuania	12	3205	1788	2915	2986	768	1020	1127	71	12	208
20	1 Moldavia	12	105	51	80	89	13	38	29	9	12	3
21	1 Tajikistan	12	7423	0	62	511	0	0	62	449	355	6556
22	1 Turkmenistan	12	42520	0	0	26	0	0	0	26	118	42376
23	1 Ukraine	12	6305	3667	4590	4907	1343	2324	923	317	112	1285
FSU REPUBLICS			320088	16058	25493	33770	4956	11102	9435	8277	5587	280309
103	2 Krasnodar Kray	12	2158	595	854	1055	216	379	259	201	241	861
107	2 Stavropol Kray	12	988	147	255	293	59	88	108	38	14	681
111	2 Arkhangelsk oblast	12	37453	7292	19055	24231	1858	5434	11763	5176	1741	11460
112	2 Astrakhan oblast	12	4453	0	0	0	0	0	0	0	0	4452
114	2 Belgorod oblast	12	80	31	47	54	13	18	16	7	10	16
115	2 Bryansk oblast	12	718	680	713	713	271	409	33	0	0	4
117	2 Vladimir oblast	12	1175	602	1141	1166	101	501	539	25	0	10
118	2 Volgograd oblast	12	2173	0	0	23	0	0	0	23	20	2130
119	2 Vologda oblast	12	12483	8748	10714	11416	3150	5598	1966	702	228	838
120	2 Voronezh oblast	12	548	31	70	187	6	25	39	117	314	47
122	2 Nizhni Novgorod obl	12	4018	2130	3886	3946	489	1641	1756	60	5	67
123	2 Nenets a.okr.	12	16818	0	15	308	0	0	15	293	176	16314
124	2 Ivanovo oblast	12	1063	864	1054	1060	359	505	190	6	0	3
127	2 Kaliningrad oblast	12	160	91	116	135	40	51	25	19	0	25
128	2 Tver oblast	12	3450	3008	3271	3369	1311	1697	263	98	13	69
129	2 Kaluga oblast	12	1240	1051	1235	1236	375	676	184	1	0	5
133	2 Kirov oblast	12	7908	4440	7469	7673	1883	2557	3029	204	39	197
134	2 Kostroma oblast	12	4593	3269	4452	4531	1224	2045	1183	79	5	56
136	2 Samara oblast	12	445	102	137	209	0	102	35	72	81	155
138	2 Kursk oblast	12	90	80	80	82	35	45	0	2	0	7
139	2 Komi-Permyak a.okr	12	2813	1648	2617	2718	1047	601	969	101	0	95
141	2 Leningrad oblast	12	6358	2695	5372	5687	1221	1474	2677	315	288	383
142	2 Lipetsk oblast	12	98	45	72	96	33	12	27	24	1	0
146	2 Moscow oblast	12	2270	1917	2164	2232	835	1082	247	68	0	38
147	2 Murmansk oblast	12	13535	8	84	452	0	8	76	368	887	12196
149	2 Novgorod oblast	12	4568	3515	4288	4406	1290	2225	773	118	84	78
153	2 Orenburg oblast	12	2623	7	30	64	0	7	23	34	20	2538
154	2 Oryel oblast	12	63	61	62	62	20	41	1	0	0	0
156	2 Penza oblast	12	625	310	504	577	139	171	194	73	33	16
157	2 Perm oblast	12	8853	5586	6803	7057	3610	1976	1217	254	64	1731
158	2 Pskov oblast	12	2750	1735	2557	2616	659	1076	822	59	21	113
160	2 Rostov oblast	12	475	0	6	81	0	0	6	75	15	379
161	2 Ryazan oblast	12	1253	844	1219	1252	263	581	375	33	0	0
163	2 Saratov oblast	12	1033	12	26	55	0	12	14	29	79	899
166	2 Smolensk oblast	12	748	679	721	726	332	347	42	5	0	21
168	2 Tambov oblast	12	328	190	299	317	100	90	109	18	10	1
170	2 Tula oblast	12	238	234	238	238	105	129	4	0	0	0
173	2 Ulyanovsk oblast	12	848	114	404	631	32	82	290	227	107	109
178	2 Yaroslavl oblast	12	1320	1244	1262	1308	615	629	18	46	3	10
179	2 Adigei Republic	12	380	133	162	191	49	84	29	29	12	176
180	2 Bashkortostan Repu	12	5880	1450	2600	3637	416	1034	1150	1037	719	1524
182	2 Daghhestn Republic	12	4543	187	374	987	70	117	187	613	490	3057
183	2 Kabardino-Balkarian	12	873	248	286	316	101	147	38	30	40	517
185	2 Kalmyk-Khalm-Tang	12	6185	0	0	0	0	0	0	0	0	6185
186	2 Karelia Republic	12	14833	1994	8553	11325	571	1423	6559	2772	1784	1716
187	2 Komi Republic	12	41370	4784	16384	25093	2135	2649	11600	8709	5070	11207
188	2 Mari-El Republic	12	1410	695	1210	1308	122	573	515	98	23	79
189	2 Mordovian SSR	12	673	434	646	659	255	179	212	13	10	4
190	2 North-Ossetian SSR	12	570	167	214	264	111	56	47	50	28	277
191	2 Karachai-Cherkess I	12	1255	243	323	385	112	131	80	62	72	797
192	2 Tatarstan Republic	12	678	271	455	562	108	163	184	107	54	62
194	2 Udmurt Republic	12	1678	1270	1576	1580	547	723	306	4	8	90
196	2 Checheno-Ingush Ri	12	1383	360	526	715	175	185	166	189	92	575
197	2 Chuvash Republic	12	688	261	494	565	33	228	233	71	110	12
101	3 Altai Kray	12	9045	3500	5553	6364	1593	1907	2053	811	345	2337

APPENDIX II

Table A16 SUITABLE AREAS FOR CONSERVATION FORESTRY - EXCLUDING CULTIVATED AND URBAN AREAS

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)										
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS		
102	3	Gorno-Altai Republic	12	9330	802	2041	2213	107	695	1239	172	226	6891
104	3	Krasnoyarsk Krai	12	67158	14756	26286	32302	3717	11039	11530	6016	6067	28788
105	3	Primorski Krai	12	15145	893	2358	4386	292	601	1465	2028	2260	8499
106	3	Taymyr a.okr.	12	81188	0	0	0	0	0	0	0	0	81187
108	3	Khabarovsk Krai	12	77168	4596	8521	16623	892	3704	3925	8102	7795	52742
110	3	Amur oblast	12	34328	8205	12103	18838	2046	6159	3898	6735	4578	10911
116	3	Evenk a.okr	12	75635	5	372	888	0	5	367	516	3533	71214
121	3	Yevrey (Jewish) a.ot	12	3590	1107	1748	2109	556	551	641	361	436	1045
125	3	Irkutsk oblast	12	71560	6661	13381	21073	1224	5437	6720	7692	12248	38239
126	3	Ust-Orda Buryat a.ol	12	1445	121	308	445	21	100	187	137	38	961
130	3	Kamchatka oblast	12	17018	100	1122	2877	0	100	1022	1755	676	13442
131	3	Koryak a.okr.	12	28898	0	112	398	0	0	112	286	1105	27394
132	3	Kemerovo oblast	12	7103	3736	4605	5237	814	2922	869	632	210	1654
135	3	Chukchi a.okr.	12	70690	0	0	0	0	0	0	0	0	70665
137	3	Kurgan oblast	12	3223	450	1161	1606	96	354	711	445	306	1311
144	3	Magadan oblast	12	45825	0	24	934	0	0	24	910	1154	43737
150	3	Novosibirsk oblast	12	12435	3674	6208	7089	1432	2242	2534	881	324	5022
152	3	Omsk oblast	12	9258	3046	4731	5945	501	2545	1685	1214	256	3058
164	3	Sakhalin oblast	12	8045	735	1661	2734	5	730	926	1073	327	4892
165	3	Sverdlovsk oblast	12	16690	9819	11492	12164	4456	5363	1673	672	189	4337
167	3	Aga-Buryat a.okr.	12	1873	2	83	715	0	2	81	632	294	865
169	3	Tomsk oblast	12	30583	14311	20800	23341	3538	10773	6489	2541	201	7040
171	3	Tyumen oblast	12	12890	6737	8955	9856	1833	4904	2218	901	370	2664
172	3	Khanty-Mansi a.okr.	12	53040	10224	18862	28659	1267	8957	8638	9797	2867	21515
174	3	Yamalo-Nenets a.ok	12	66395	20	1389	5424	0	20	1369	4035	9759	51204
175	3	Chelyabinsk oblast	12	3685	698	1267	1769	248	450	569	502	447	1469
176	3	Chita oblast	12	40300	293	2417	11612	1	292	2124	9195	8906	19782
181	3	Buryat Republic	12	32600	343	3589	6527	17	326	3246	2938	7503	18571
193	3	Tuva Republic	12	16665	106	1466	2663	0	106	1360	1197	1489	12513
195	3	Khakass Republic	12	5180	871	1652	2376	102	769	781	724	189	2616
198	3	Sakha (Yakutia) Rep	12	302708	519	3406	9997	0	519	2887	6591	17004	275689
RUSSIA WEST				235212	66502	117095	139849	26496	40006	50593	22754	13011	82282
RUSSIA EAST				1230696	96330	167673	247164	24758	71572	71343	79491	91102	892254
RUSSIA TOTAL				1465908	162832	284768	387013	51254	111578	121936	102245	104113	974536
211	11	Beijing	12	878	411	660	755	127	284	249	95	0	122
212	11	Tianjin	12	95	1	14	19	0	1	13	5	2	74
213	11	Hebei	12	8108	4515	6520	7269	1348	3167	2005	749	98	741
214	11	Shanxi	12	7653	2768	4091	4718	921	1847	1323	627	1404	1530
237	11	Shandong	12	2360	692	815	1033	214	478	123	218	52	1274
241	11	Henan	12	7650	4257	5062	5519	1598	2659	805	457	161	1970
221	12	Liaoning	12	5388	3833	4538	4886	2057	1776	705	348	312	189
222	12	Jilin	12	10343	5407	7770	8637	2963	2444	2363	867	273	1434
223	12	Heilongjiang	12	29720	20083	25229	26946	10472	9611	5146	1717	615	2159
231	12	Shanghai	12	0	0	0	0	0	0	0	0	0	0
232	13	Jiangsu	12	830	508	616	653	208	300	108	37	1	176
233	13	Zhejiang	12	5480	5180	5442	5457	693	4487	262	15	7	15
234	13	Anhui	12	6878	5453	6457	6637	1542	3911	1004	180	16	224
236	14	Jiangxi	12	12195	9169	10322	10462	3732	5437	1153	140	112	1622
242	14	Hubei	12	13748	11470	12426	12434	3268	8202	956	8	0	1314
243	14	Hunan	12	16935	13397	14599	14696	2074	11323	1202	97	116	2123
235	15	Fujian	12	9233	6697	7845	8054	253	6444	1148	209	74	1105
244	15	Guangdong	12	10590	6893	7800	8068	1576	5317	907	268	109	2412
245	15	Guangxi	12	18013	11826	14679	15332	3401	8425	2853	653	254	2427
246	15	Hainan	12	2165	332	843	1268	52	280	511	425	230	666
251	16	Sichuan	12	37043	11199	12848	13543	3424	7775	1649	695	339	23159
252	16	Guizhou	12	11843	10698	11156	11157	1575	9123	458	1	0	686
253	16	Yunnan	12	32713	18462	21174	24021	7470	10992	2712	2847	3545	5146
215	17	Nei Mongol	12	104640	11638	19723	29102	4289	7349	8085	9379	3118	72420
261	17	Shaanxi	12	14298	6594	8167	8479	1450	5144	1573	312	212	5607
262	17	Gansu	12	33838	3759	5423	6515	1574	2185	1664	1092	347	26976
264	17	Ningxia	12	3550	79	267	937	40	39	188	670	23	2590
265	17	Xinjiang	12	156700	651	1563	2939	184	467	912	1376	891	152870
254	18	Xizang	12	116778	4794	5626	6681	1606	3188	832	1055	526	109571
263	18	Qinghai	12	70143	304	692	1800	29	275	388	1108	338	68004
272	19	Hongkong	12	33	0	1	2	0	0	1	1	0	31
CHINA TOTAL				749841	181070	222368	248019	58140	122930	41298	25651	13175	488637

APPENDIX II

Table A 17 SUITABLE AREAS FOR CONSERVATION FORESTRY - EXCLUDING CULTIVATED AREAS, URBAN AREAS AND AREAS CURRENTLY UNDER FOREST

ADM REG NAME		LC	Total Extent	Suitable Areas (000ha)								
				VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS
2	4 Mongolia	12	147800	158	2239	8074	11	147	2081	5835	5259	134466
11	1 Armenia	12	1788	101	303	429	0	101	202	126	91	1268
12	1 Azerbaijan	12	4578	95	379	783	0	95	284	404	844	2643
13	1 Byelorussia	12	1680	1149	1427	1490	301	848	278	63	9	180
14	1 Estonia	12	370	178	220	261	22	156	42	41	25	84
15	1 Georgia	12	1515	126	393	511	29	97	267	118	180	824
16	1 Kazakhstan	12	214330	1891	4565	9616	414	1477	2674	5051	2536	202178
17	1 Kirghiztan	12	12170	82	566	1009	19	63	484	443	287	10874
18	1 Latvia	12	210	127	195	198	40	87	68	3	2	10
19	1 Lithuania	12	1463	786	1348	1365	336	450	562	17	7	89
20	1 Moldavia	12	10	2	5	6	1	1	3	1	3	1
21	1 Tajikistan	12	2655	0	0	8	0	0	0	8	7	2640
22	1 Turkmenistan	12	40375	0	0	8	0	0	0	8	1	40366
23	1 Ukraine	12	640	378	494	530	146	232	116	36	16	94
FSU REPUBLICS			281784	4915	9895	16214	1308	3607	4980	6319	4008	261251
103	2 Krasnodar Kray	12	625	195	224	354	92	103	29	130	97	174
107	2 Stavropol Kray	12	965	147	251	278	59	88	104	27	14	672
111	2 Arkhangelsk oblast	12	11818	636	2261	3064	177	459	1625	803	268	8473
112	2 Astrakhan oblast	12	4380	0	0	0	0	0	0	0	0	4380
114	2 Belgorod oblast	12	0	0	0	0	0	0	0	0	0	0
115	2 Bryansk oblast	12	0	0	0	0	0	0	0	0	0	0
117	2 Vladimir oblast	12	13	9	12	13	1	8	3	1	0	0
118	2 Volgograd oblast	12	1890	0	0	0	0	0	0	0	0	1890
119	2 Vologda oblast	12	1253	772	981	1088	242	530	209	107	72	92
120	2 Voronezh oblast	12	258	5	18	58	0	5	13	40	156	42
122	2 Nizhni Novgorod obl	12	298	115	285	293	8	107	170	8	0	5
123	2 Nenets a.okr.	12	15018	0	3	95	0	0	3	92	39	14864
124	2 Ivanovo oblast	12	25	13	25	25	1	12	12	0	0	0
127	2 Kaliningrad oblast	12	30	13	21	28	4	9	8	7	0	1
128	2 Tver oblast	12	118	90	105	109	37	53	15	4	2	7
129	2 Kaluga oblast	12	65	61	65	65	26	35	4	0	0	0
133	2 Kirov oblast	12	235	123	215	232	57	66	92	17	0	4
134	2 Kostroma oblast	12	253	166	240	247	82	84	74	7	1	4
136	2 Samara oblast	12	5	0	0	1	0	0	0	1	2	2
138	2 Kursk oblast	12	0	0	0	0	0	0	0	0	0	0
139	2 Komi-Permyak a.okr	12	170	82	153	165	37	45	71	12	0	5
141	2 Leningrad oblast	12	800	393	682	730	152	241	289	48	57	14
142	2 Lipetsk oblast	12	0	0	0	0	0	0	0	0	0	0
146	2 Moscow oblast	12	193	162	183	192	62	100	21	9	0	1
147	2 Murmansk oblast	12	6555	0	38	166	0	0	38	128	146	6243
149	2 Novgorod oblast	12	233	161	222	225	36	125	61	3	7	1
153	2 Orenburg oblast	12	2480	0	0	2	0	0	0	2	7	2471
154	2 Oryel oblast	12	0	0	0	0	0	0	0	0	0	0
156	2 Penza oblast	12	0	0	0	0	0	0	0	0	0	0
157	2 Perm oblast	12	325	153	285	306	91	62	132	21	2	17
158	2 Pskov oblast	12	265	154	246	255	47	107	92	9	2	8
160	2 Rostov oblast	12	453	0	0	66	0	0	0	66	14	372
161	2 Ryazan oblast	12	405	276	398	405	78	198	122	7	0	0
163	2 Saratov oblast	12	615	0	0	10	0	0	0	10	3	601
166	2 Smolensk oblast	12	0	0	0	0	0	0	0	0	0	0
168	2 Tambov oblast	12	0	0	0	0	0	0	0	0	0	0
170	2 Tula oblast	12	13	13	13	13	6	7	0	0	0	0
173	2 Ulyanovsk oblast	12	18	0	0	5	0	0	0	5	6	6
178	2 Yaroslavl oblast	12	83	69	71	72	34	35	2	1	0	10
179	2 Adigei Republic	12	103	55	56	60	25	30	1	4	0	43
180	2 Bashkortostan Repu	12	808	88	162	219	21	67	74	57	136	452
182	2 Daghestn Republic	12	4188	160	325	890	62	98	165	565	414	2876
183	2 Kabardino-Balkarian	12	663	109	137	162	43	66	28	25	37	465
185	2 Kalmyk-Khalm-Tang	12	6183	0	0	0	0	0	0	0	0	6182
186	2 Karelia Republic	12	3005	354	1949	2510	21	333	1595	561	178	310
187	2 Komi Republic	12	8200	485	2116	2915	202	283	1631	799	590	4695
188	2 Mari-El Republic	12	100	45	85	91	5	40	40	6	0	8
189	2 Mordovian SSR	12	125	87	124	124	52	35	37	0	0	0
190	2 North-Ossetian SSR	12	378	74	99	123	61	13	25	24	25	229
191	2 Karachai-Cherkess I	12	623	116	164	192	55	61	48	28	20	411
192	2 Tatarstan Republic	12	8	6	6	6	4	2	0	0	0	2
194	2 Udmurt Republic	12	3	3	3	3	2	1	0	0	0	0
196	2 Checheno-Ingush Ri	12	960	194	290	432	111	83	96	142	74	454
197	2 Chuvash Republic	12	0	0	0	0	0	0	0	0	0	0
101	3 Altai Kray	12	4503	1706	2590	3081	848	858	884	491	143	1279

APPENDIX II

Table A 17 SUITABLE AREAS FOR CONSERVATION FORESTRY - EXCLUDING CULTIVATED AREAS, URBAN AREAS AND AREAS CURRENTLY UNDER FOREST

ADM REG NAME	LC	Total Extent	Suitable Areas (000ha)										
			VS+S	VS...MS	VS...mS	VS	S	MS	mS	vmS	NS		
102	3	Gorno-Altai Republic	12	4118	73	505	531	14	59	432	26	77	3510
104	3	Krasnoyarsk Krai	12	5383	1143	2033	2252	393	750	890	219	123	3008
105	3	Primorski Krai	12	1490	172	637	836	39	133	465	199	156	498
106	3	Taymyr a.okr.	12	71523	0	0	0	0	0	0	0	0	71522
108	3	Khabarovsk Krai	12	18580	1718	3326	4563	342	1376	1608	1237	1238	12780
110	3	Amur oblast	12	6033	2153	2831	3777	722	1431	678	946	606	1650
116	3	Evenk a.okr.	12	9323	0	16	26	0	0	16	10	78	9219
121	3	Yevrey (Jewish) a.ot	12	1318	422	800	941	203	219	378	141	34	342
125	3	Irkutsk oblast	12	8388	240	718	1026	47	193	478	308	847	6514
126	3	Ust-Orda Buryat a.ol	12	350	7	57	115	0	7	50	58	29	207
130	3	Kamchatka oblast	12	9120	23	303	725	0	23	280	422	185	8188
131	3	Koryak a.okr.	12	25808	0	108	320	0	0	108	212	1018	24469
132	3	Kemerovo oblast	12	925	161	178	365	23	138	17	187	135	425
135	3	Chukchi a.okr.	12	60873	0	0	0	0	0	0	0	0	60847
137	3	Kurgan oblast	12	2543	306	743	1098	53	253	437	355	289	1156
144	3	Magadan oblast	12	31205	0	12	580	0	0	12	568	522	30104
150	3	Novosibirsk oblast	12	8383	2004	3435	4116	890	1114	1431	681	269	3997
152	3	Omsk oblast	12	5148	1392	2144	2863	303	1089	752	719	250	2034
164	3	Sakhalin oblast	12	973	103	247	291	0	103	144	44	23	651
165	3	Sverdlovsk oblast	12	2898	2113	2330	2383	950	1163	217	53	3	511
167	3	Aga-Buryat a.okr.	12	1038	0	35	377	0	0	35	342	178	482
169	3	Tomsk oblast	12	10153	4322	6465	7502	870	3452	2143	1037	44	2606
171	3	Tyumen oblast	12	7145	3643	4625	5151	959	2684	982	526	287	1707
172	3	Khanty-Mansi a.okr.	12	20210	4702	7701	11633	445	4257	2999	3932	1308	7269
174	3	Yamalo-Nenets a.ok	12	41490	3	470	2159	0	3	467	1689	2728	36596
175	3	Chelyabinsk oblast	12	1518	131	247	412	71	60	116	165	409	696
176	3	Chita oblast	12	11328	95	1275	2832	0	95	1180	1557	1718	6778
181	3	Buryat Republic	12	10333	95	1557	2162	1	94	1462	605	1298	6873
193	3	Tuva Republic	12	5498	30	655	929	0	30	625	274	306	4263
195	3	Khakass Republic	12	1360	590	781	892	71	519	191	111	19	449
198	3	Sakha (Yakutia) Rep	12	107800	68	490	1386	0	68	422	896	3205	103191
RUSSIA WEST				75204	5584	12513	16289	1993	3591	6929	3776	2369	56486
RUSSIA EAST				496758	27415	47314	65324	7244	20171	19899	18010	17525	413821
RUSSIA TOTAL				571962	32999	59827	81613	9237	23762	26828	21786	19894	470307
211	11	Beijing	12	673	306	492	559	91	215	186	67	0	112
212	11	Tianjin	12	78	0	7	9	0	0	7	2	2	66
213	11	Hebei	12	6618	3653	5338	5960	1044	2609	1685	622	74	583
214	11	Shanxi	12	6105	2109	3169	3662	689	1420	1060	493	1140	1304
237	11	Shandong	12	515	134	172	187	64	70	38	15	31	298
241	11	Henan	12	1193	605	734	770	231	374	129	36	43	381
221	12	Liaoning	12	1468	660	992	1196	310	350	332	204	162	109
222	12	Jilin	12	2573	409	523	1262	183	226	114	739	266	1044
223	12	Heilongjiang	12	9320	5090	6140	7502	2793	2297	1050	1362	592	1226
231	12	Shanghai	12	0	0	0	0	0	0	0	0	0	0
232	13	Jiangsu	12	275	130	161	164	62	68	31	3	0	110
233	13	Zhejiang	12	500	452	494	499	40	412	42	5	0	0
234	13	Anhui	12	1465	1376	1433	1433	290	1086	57	0	0	32
236	14	Jiangxi	12	4710	3742	4086	4144	1864	1878	344	58	51	515
242	14	Hubei	12	5280	4486	4792	4792	1037	3449	306	0	0	488
243	14	Hunan	12	4623	3732	3962	3977	548	3184	230	15	37	609
235	15	Fujian	12	540	318	364	393	10	308	46	29	12	134
244	15	Guangdong	12	2330	1551	1798	1848	288	1263	247	50	17	465
245	15	Guangxi	12	7725	5589	6737	6941	1862	3727	1148	204	56	727
246	15	Hainan	12	848	112	299	460	17	95	187	161	100	287
251	16	Sichuan	12	24765	4528	5088	5387	1413	3115	560	299	145	19233
252	16	Guizhou	12	6493	5934	6160	6160	861	5073	226	0	0	332
253	16	Yunnan	12	11850	7041	7855	8793	2692	4349	814	938	1228	1830
215	17	Nei Mongol	12	90058	4421	9652	16697	1223	3198	5231	7045	2284	71076
261	17	Shaanxi	12	9673	3452	4524	4828	708	2744	1072	304	129	4717
262	17	Gansu	12	31640	2690	4038	5062	1096	1594	1348	1024	318	26259
264	17	Ningxia	12	3505	66	246	896	30	36	180	650	23	2585
265	17	Xinjiang	12	153305	578	1385	2632	152	426	807	1247	791	149882
254	18	Xizang	12	106460	679	1001	1458	295	384	322	457	252	104751
263	18	Qinghai	12	69645	298	664	1741	29	269	366	1077	334	67570
272	19	Hongkong	12	10	0	0	0	0	0	0	0	0	9
CHINA TOTAL				564243	64141	82306	99412	19922	44219	18165	17106	8087	456734

APPENDIX III

Soil Suitability Ratings

Table A18	Soil unit suitability ratings for tree species
Table A19	Soil phase suitability ratings for tree species

