

Strategic options for the forest sector in Russia with focus on economic optimization, energy and sustainability

*International Seminar: Economics of Forestry and the Forest Sector: Actual Problems
and Trends, Saint Petersburg, Russia, March 26-27, 2009*

**Saint-Petersburg State Forest Technical Academy, PROCES – EFI Project Centre
in Saint Petersburg, International Centre of Forestry and Forest Industry (ICFFI)**

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Structure of the presentation:

#1. Present forest conditions and industrial production

#2. General observations and suggestions

#3. Rational coordination is necessary

#4. A concrete suggestion

#1. Present forest conditions and industrial production



No country has a larger forest than Russia.

The growing stock is 25.5 times larger in Russia than in Sweden.

The growing stock is 37.3 times larger in Russia than in Finland.

The sustainable long run utilization of the Russian forest could increase very much, maybe ten times!

The harvest levels of the main wood assortments are only 2-3 times higher than in Sweden.



According to FAO (2005):

- The growing stock in Russia (in the land class “forest”) is 80 479 million cubic metres over bark. The growing stock in Russia that is defined as “Commercial growing stock” is 39 630 million cubic metres over bark.
- **Comment by Peter Lohmander: It is however very important to be aware that the size of the stock that is “commercial” depends on the prices in the product markets and production factor markets, the availability of infrastructure such as railroads and roads etc..**

Production of selected forest products (2004) in Finland, Russia, Sweden and the World.

Source: http://www.fao.org/es/ess/yearbook/vol_1_1/pdf/b10.pdf

Production of Forest Products										
1 000 m ³								1 000 tonnes		
COUNTRIES	Industrial roundwood	Pulpwood, round and split	Roundwood	Log:saw & veneer	Sawnwood	Woodfuel	Wood-based panels	Paper & paperboard	Wood charcoal	Wood pulp
Finland	49281	25024	53800	24257	13544	4519	2029	14036		12619
Russian Federation	134000	54171	182000	58758	21500	48000	7159	6789	60	6885
Sweden	61400	25500	67300	35400	16900	5900	681	11589	1	12106
World	1645682	521715	3417660	970481	415553	1771978	224929	354490	43694	174635

Production of selected forest products (2004) in Finland, Russia, Sweden and the World, *in relation to* the production in Sweden.

Source: http://www.fao.org/es/ess/yearbook/vol_1_1/pdf/b10.pdf

Production of Forest Products										
COUNTRY	Industrial roundwood	Pulpwood, round and split	Round wood	Log:saw & veneer	Sawnwood	Woodfuel	Wood-based panels	Paper & paperboard	Wood charcoal	Wood pulp
Finland	0,80	0,98	0,80	0,69	0,80	0,77	2,98	1,21		1,04
Russian Federation	2,18	2,12	2,70	1,66	1,27	8,14	10,51	0,59	60,00	0,57
Sweden	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
World	26,80	20,46	50,78	27,41	24,59	300,34	330,29	30,59	43694,07	14,43

- We find that the production levels of several kinds of forest products are larger in Russia than in Finland and Sweden.
- The production levels of wood pulp, paper and paperboard are however larger in Finland and Sweden than in Russia.

- **A general finding is that the production levels in Russia are very low in relation to the size of the extremely large forest resource.**
- This is true in particular when we investigate the production levels of wood pulp, paper and paperboard.
- However, also the harvest level is very low in relation to the standing volume.

#2. General observations and suggestions

Russia has enormous forest resources, clearly illustrated by the very large growing stock.

The sustainable, long run, utilization of the forest resource could be very much higher.

Maybe the long run sustainable round wood harvest could be ten times higher than today.

Table 9

Distribution of forests by relative stocking and site index, 10³ ha

Subjects of RF, groups of main forest forming species	Total area covered by forest vegetation	Site index														
		II and higher			III			IV			V			Va and lower		
		Distribution of forest area by relative stocking														
		1.0 - 0.8	0.7 - 0.5	0.4 - 0.3	1.0 - 0.8	0.7 - 0.5	0.4 - 0.3	1.0 - 0.8	0.7 - 0.5	0.4 - 0.3	1.0 - 0.8	0.7 - 0.5	0.4 - 0.3	1.0 - 0.8	0.7 - 0.5	0.4 - 0.3
Russian Federation																
Coniferous	504315,8	9194,3	19437,2	2721,7	12405,5	47261,6	12629,7	16327,9	86702,6	31586,3	13148,0	97777,9	51896,8	5193,6	48686,2	49346,5
Hard deciduous	17469,5	434,8	1236,4	127,7	456,0	2177,1	568,2	395,3	2713,4	1067,2	716,1	3467,7	1474,7	294,3	1541,1	799,5
Soft deciduous	123187,1	15071,7	21250,9	2549,0	10477,3	23849,7	4818,0	6086,1	16837,1	3709,9	2524,0	7650,1	1941,1	968,9	3746,3	1707,0
European-Ural part of the Russian Federation																
Coniferous	88090,6	6042,9	10183,0	543,3	3608,9	8719,6	674,5	3256,1	13493,9	1334,1	1625,1	20262,2	3576,5	452,8	9388,7	4929,0
Hard deciduous	5106,5	420,6	1155,7	98,0	348,9	1357,1	110,8	184,6	845,9	90,9	48,5	291,7	38,2	22,3	83,1	10,2
Soft deciduous	47579,8	12041,6	12799,1	561,1	4634,5	7013,1	498,1	1892,0	3363,7	337,1	560,1	1397,5	319,8	212,7	1131,3	818,1
Asian part of the Russian Federation																
Coniferous	416225,2	3151,4	9254,2	2178,4	8796,6	38542,0	11955,2	13071,8	73208,7	30252,2	11522,9	77515,7	48320,3	4740,8	39297,5	44417,5
Hard deciduous	12363,0	14,2	80,7	29,7	107,1	820,0	457,4	210,7	1867,5	976,3	667,6	3176,0	1436,5	272,0	1458,0	789,3
Soft deciduous	75607,3	3030,1	8451,8	1987,9	5842,8	16836,6	4319,9	4194,1	13473,4	3372,8	1963,9	6252,6	1621,3	756,2	2615,0	888,9
Forest regions of the Russian Federation																
Coniferous	73291,0	2448,8	3843,9	226,9	2893,9	6919,2	557,0	3034,4	12648,7	1275,0	1559,2	19828,8	3523,5	428,1	9222,9	4880,7
Hard deciduous	476,5	3,4	14,5	1,0	14,2	107,6	15,1	13,2	216,3	28,5	1,5	45,2	9,2	0,0	4,6	2,2
Soft deciduous	30708,0	7084,0	5322,5	258,4	3784,6	4928,0	346,3	1734,5	2834,7	262,9	528,4	1236,8	280,7	207,5	1088,9	809,8
Non-chernozem zone of the Russian Federation																
Coniferous	84079,0	4864,6	8502,2	445,3	3412,3	8222,5	611,6	3205,8	13338,0	1307,1	1616,1	20222,5	3569,1	452,2	9382,0	4927,7
Hard deciduous	615,2	81,5	311,5	23,6	22,9	146,2	14,3	2,1	11,8	0,7	0,0	0,6	0,0	0,0	0,0	0,0
Soft deciduous	39133,9	10389,0	10408,1	395,0	3897,7	4892,5	290,6	1755,1	2654,6	239,5	542,2	1273,0	282,6	208,2	1094,8	811,0
Baikal lake basin																
Coniferous	11231,0	15,5	54,6	10,5	258,7	1274,8	263,3	686,2	4492,9	1111,0	205,6	1669,3	611,7	43,4	359,3	174,2
Soft deciduous	2083,5	12,9	21,0	2,1	180,0	447,7	66,9	239,3	697,8	111,2	55,0	162,6	35,3	7,9	32,8	11,0
Shoreline around Baikal lake																
Coniferous	1683,6	5,2	13,5	2,7	65,6	218,4	41,0	122,2	483,4	112,3	54,2	248,9	97,0	20,8	128,2	70,2
Soft deciduous	411,9	6,3	8,1	0,7	49,0	80,8	9,3	49,2	86,6	16,2	19,0	40,2	11,5	5,1	20,9	9,0

Source:

http://www.iiasa.ac.at/Research/FOR/forest_cdrom/english/for_fund_en.html

(From Roslesinforg, 2003, VNIILM, 1003)

Table 4

Distribution of areas of forests and growing stock by groups of species and age groups

numerator - area, 10³ hadenominator - growing stock, 10³ m³

Groups of forests and forest available for exploitation	Area covered by forest vegetation	including by group of forest forming trees														
		coniferous					hard deciduous				soft deciduous					
		total	including				total	including			total	including				
	young	middle age	im-mature	mature & over-mature		young	middle age	im-mature	mature & over-mature		young	middle age	im-mature	mature & over-mature		
Russian Federation																
Total forests of I, II and III groups																
area	733150,0	514743,1	93642,2	116662,4	52450,1	251988,4	18184,7	1907,2	4680,7	2016,6	9580,2	125920,7	25722,6	41390,3	13586,2	45221,6
growing stock	76060,11	58461,14	3014,88	13800,95	8111,12	33534,19	2047,27	81,10	570,14	250,49	1145,54	13982,22	538,68	3951,71	2017,82	7474,01
<i>Forests of the I group - Total</i>																
area	146144,3	94609,1	11155,4	27036,7	12849,1	43567,9	8013,5	943,1	3333,3	1021,3	2715,8	28931,8	3245,2	12058,8	3872,8	9755,0
growing stock	18271,09	13291,58	577,69	4321,50	2325,60	6066,79	1060,43	49,61	444,68	152,05	414,09	3570,31	82,68	1366,87	596,53	1524,23
<i>including forests of the I group, acceptable for exploitation</i>																
area	27598,4	15629,9	3300,6	4771,6	1979,6	5578,1	2289,0	369,7	1116,2	303,1	500,0	9668,8	1274,4	4022,6	1481,6	2890,2
growing stock	4138,04	2471,75	199,33	845,06	407,23	1020,13	320,26	22,51	155,98	48,58	93,19	1345,81	36,49	497,56	250,88	560,88
<i>Forests of the II group - Total</i>																
area	55451,8	29813,9	11596,2	7341,5	3505,5	7370,7	1889,1	409,4	523,8	224,1	731,8	22911,2	4187,0	8545,4	3614,2	6564,6
growing stock	7501,00	4147,34	679,10	1272,36	751,88	1444,00	197,18	14,75	57,43	29,16	95,84	3138,39	134,55	1058,36	652,15	1293,33
<i>including forests of the II group, acceptable for exploitation</i>																
area	47111,9	25000,3	10480,8	5862,3	2892,4	5764,8	1591,2	365,0	442,6	186,0	597,6	20519,3	3880,2	7712,9	3232,1	5694,1
growing stock	6306,18	3353,09	617,51	983,88	614,00	1137,70	165,46	13,13	47,87	23,98	80,48	2787,61	123,87	944,87	585,08	1133,79
<i>Forests of the III group - Total</i>																
area	531553,9	390320,1	70890,6	82284,2	36095,5	201049,8	8282,1	554,7	823,6	771,2	6132,6	74077,7	18290,4	20786,1	6099,2	28902,0
growing stock	50288,02	41022,22	1758,09	8207,09	5033,64	26023,40	789,66	16,74	68,03	69,28	635,61	7273,52	321,45	1526,48	769,14	4656,45
<i>including forests of the III group, acceptable for exploitation</i>																
area	255078,6	189956,9	40386,3	39278,5	17427,5	92864,6	3879,8	456,7	582,8	437,0	2403,3	58370,0	14217,7	17373,1	5061,4	21717,8
growing stock	29185,33	22477,26	1199,13	4027,86	2451,65	14798,62	401,66	14,23	50,42	43,47	293,54	6164,43	271,92	1341,43	676,02	3875,06
Forests of I, II and III groups available for exploitation																
area	329788,9	230587,1	54167,7	49912,4	22299,5	104207,5	7760,0	1191,4	2141,6	926,1	3500,9	88558,1	19372,3	29108,6	9775,1	30302,1
growing stock	39629,55	28302,10	2015,97	5856,80	3472,88	16956,45	887,38	49,87	254,27	116,03	467,21	10297,85	432,28	2783,86	1511,98	5569,73

With suitable time consistent contracts, Swedish capital and labour and Russian capital and labour would benefit from participating in these operations in the form of a joint venture.

An increased use of the Russian resources can lead to improved **economic results** for Russia and possible cooperating countries, increased production of **electrical power** and other energy products, increased **employment** and general **regional development** in large areas of Russia and **environmental improvements** with respect to the CO₂ - global warming issue.

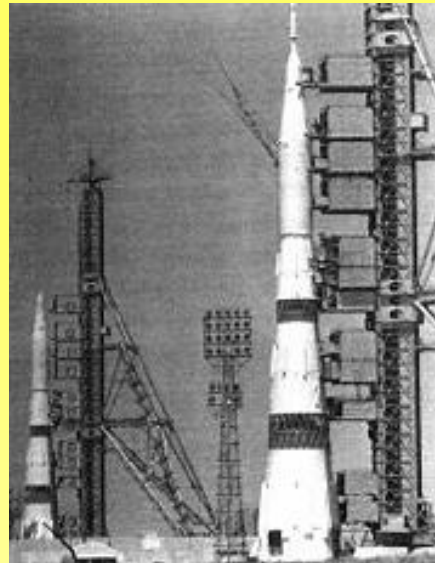
- **Since the relative prices of different production factors, inputs, are not the same in Russia and Sweden, we can be almost sure that the optimal combination of such inputs should be different.**
- **It is very likely that the optimal forest regeneration methods are different, that the optimal numbers of seedlings per hectare are different, that the optimal species mixes are different etc..**
- **The optimal harvest schedules and use of the forest resources should be expected to be quite different in Russia and Sweden.**

***#3. Rational coordination is
necessary***

The forest – forest and energy industry – infrastructure problem is in this respect very similar to a space project:

It is impossible to determine the size of the space craft or the amount of fuel without simultaneously considering all of the missions that should be performed in space.

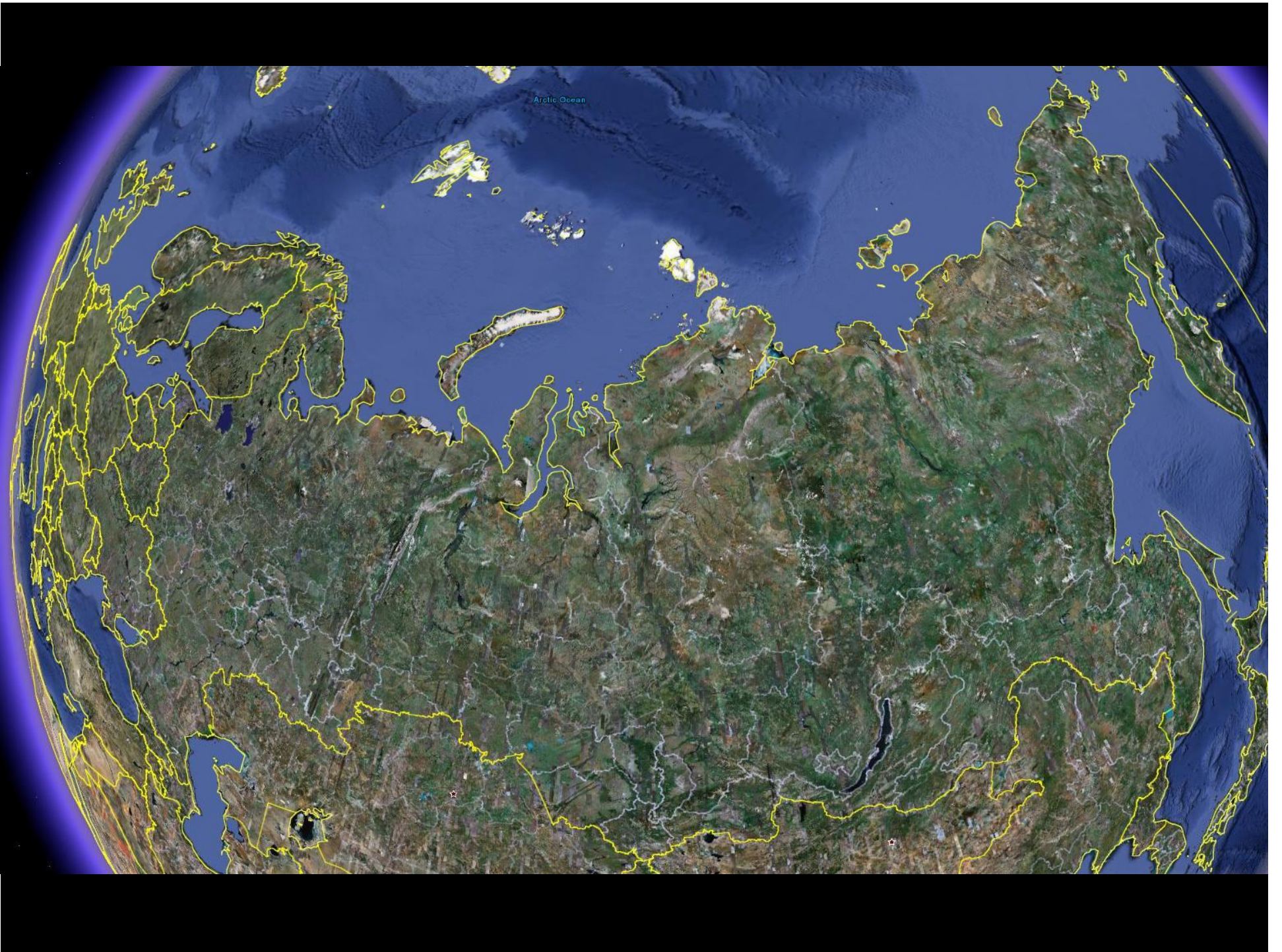
Yuri Gagarin
Юрий Гагарин

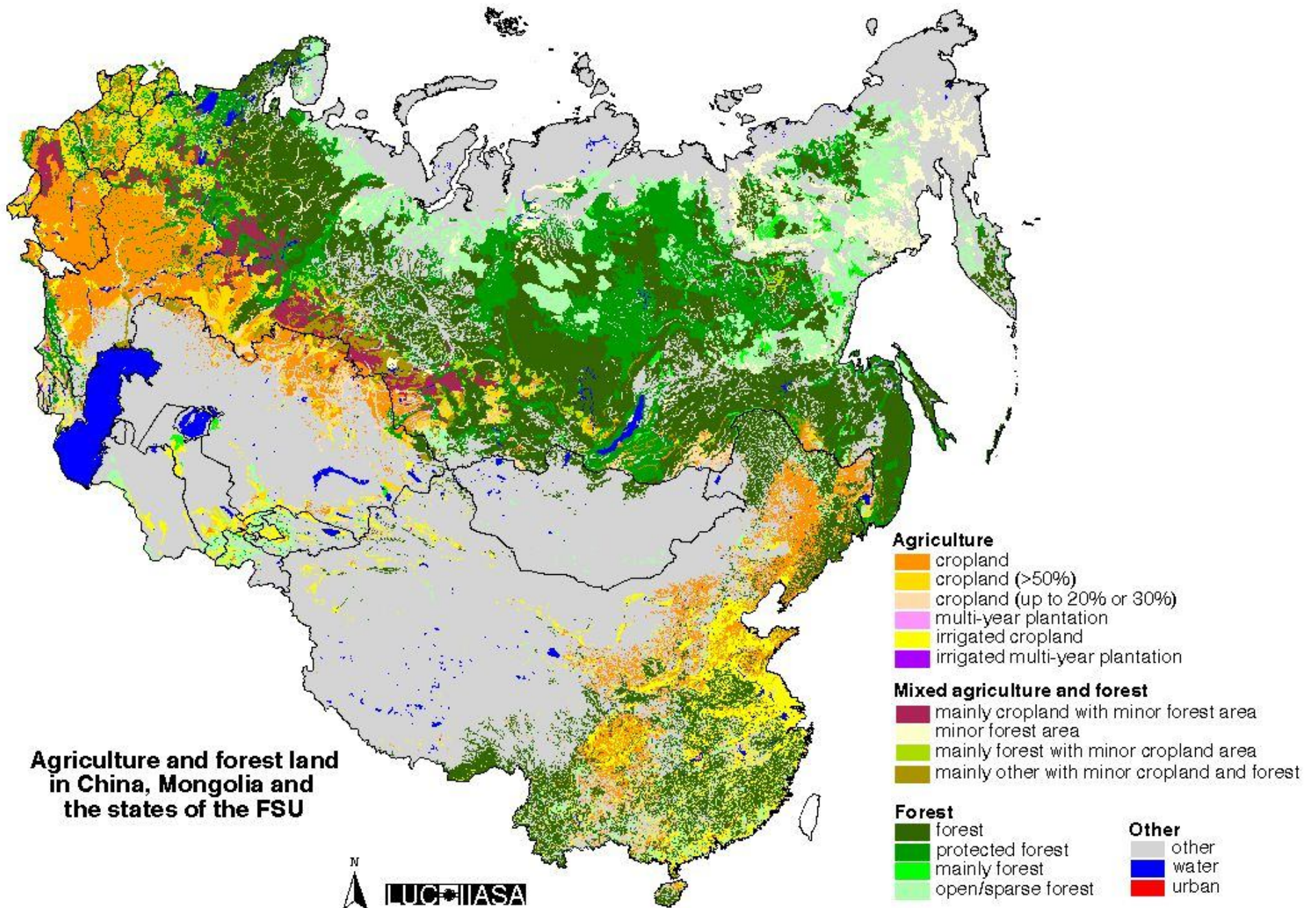


Sergey Korolyov in Red Army uniform (1938) 19

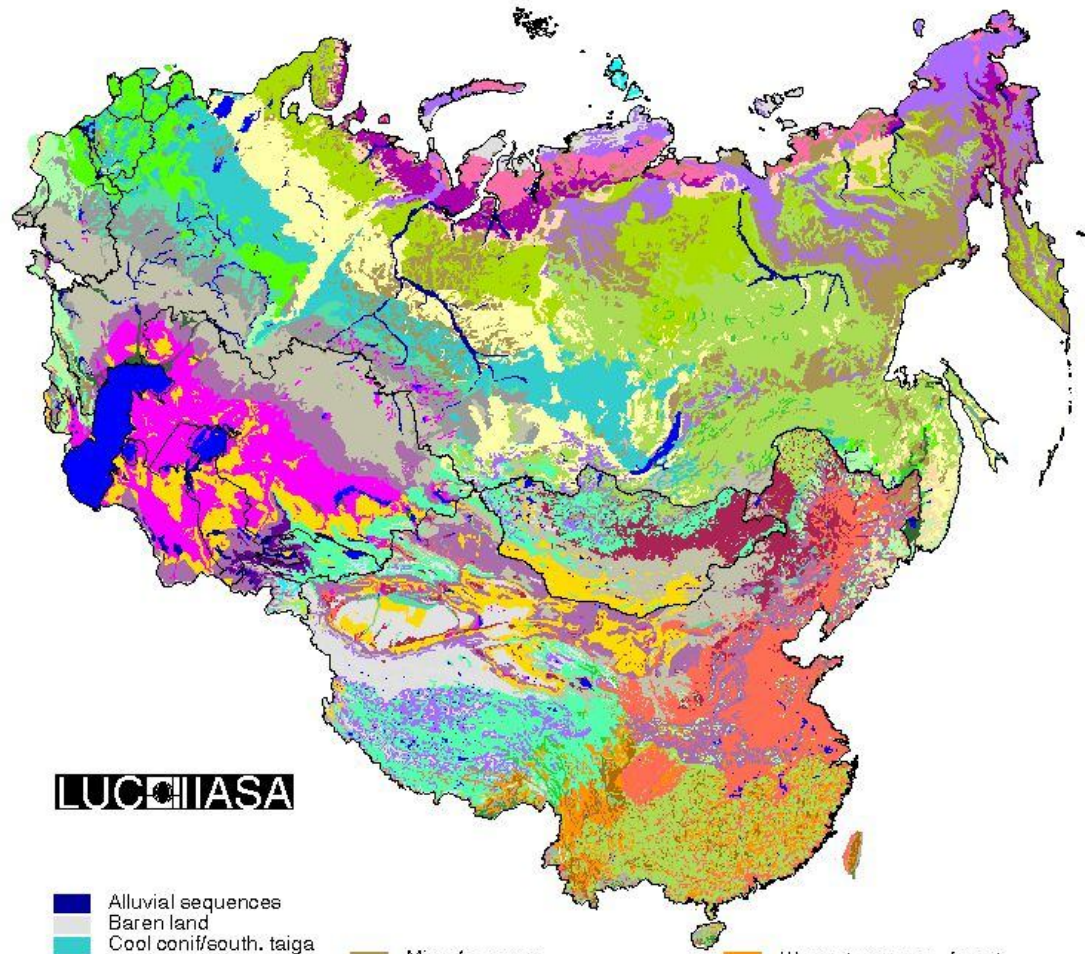
- **It is not possible to calculate the rational use of the forest resources without a dynamic optimization framework in which also the investments in infrastructure, forest industry and energy industry are integrated as endogenous variables.**

4. A concrete suggestion



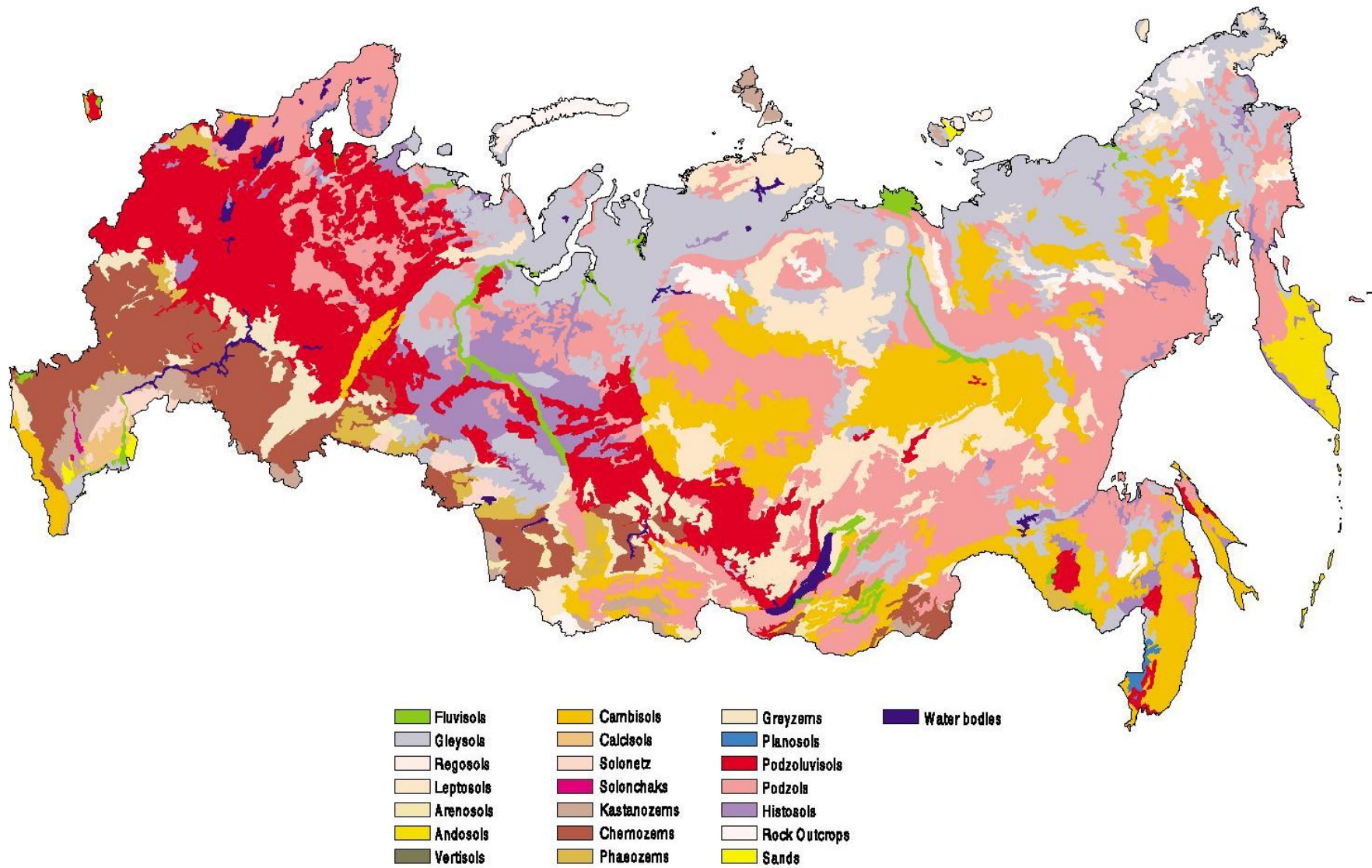


VEGETATION of the Former Soviet Union, Mongolia and China



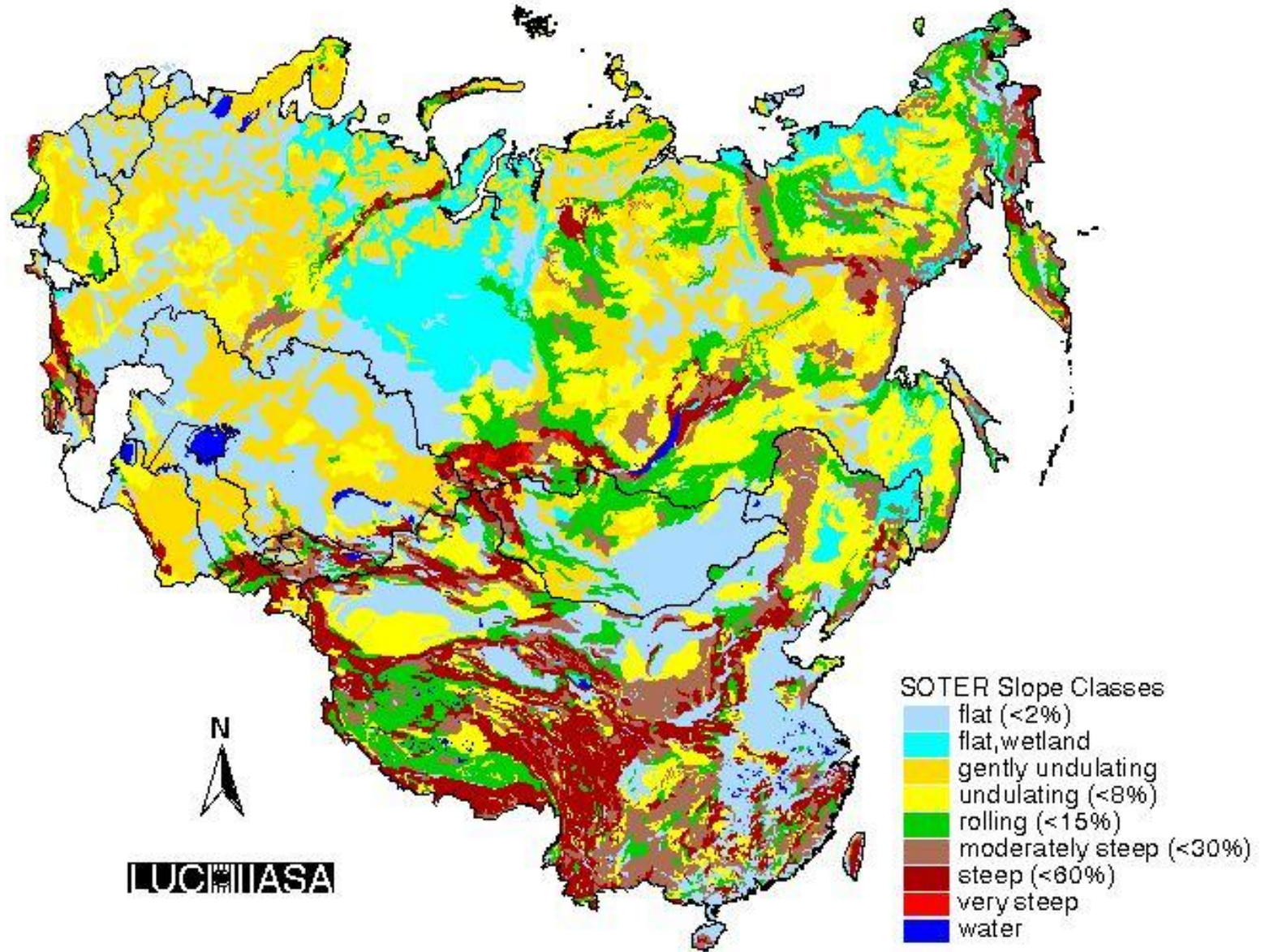
LUCIASA

- | | | |
|---------------------------|---------------------------------------|---------------------------|
| ■ Alluvial sequences | ■ Mires/swamps | ■ Warm. temp. con. forest |
| ■ Baren land | ■ North. contintal taiga | ■ Warm/Temp. dry grass |
| ■ Cool conif/south. taiga | ■ Polar desert | ■ Warm/Temp. moist steppe |
| ■ Cool dec. forest | ■ Reed brakes | ■ Wooded grasslands |
| ■ Cool desert | ■ Salinid desert | ■ Alpine tundra |
| ■ Cool grassland/meadows | ■ Sub-tropical/broadl. evergr. forest | ■ Cool/boreal woodland |
| ■ Cool mixed forest | ■ Temp. deciduous forest | ■ Northern tundra |
| ■ Cool-temp. conf. forest | ■ Temp. mixed forest | ■ Southern tundra |
| ■ Cool/temp. shrubs | ■ Trop. evergr. forest | ■ Temperate woodland |
| ■ Farming land | ■ Trop. raingr.. forest | ■ Wooded tundra |
| ■ Hot sandy desert | ■ Trop. steppe | ■ Xerophitic shrubs |
| ■ Ice | ■ Warm shrubs | ■ Xerophitic woodland |
| ■ Large waterbodies | | |
| ■ Mid continental taiga | | |
| ■ Mid. sub-cont. taiga | | |



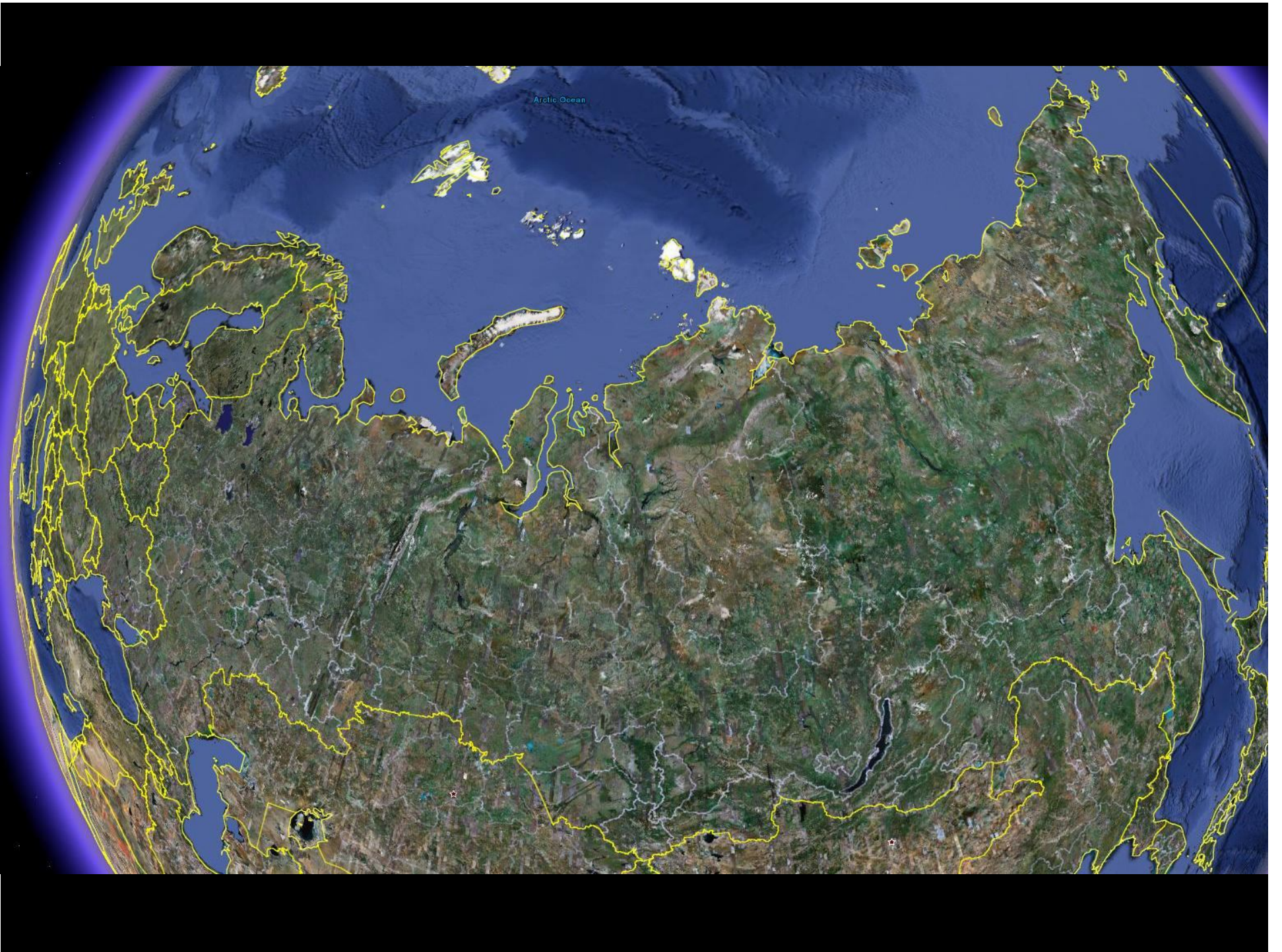
Soils

SLOPE Classes for China, Taiwan, Mongolia, and the countries of the FSU



ТРАНСИБИРСКАЯ МАГИСТРАЛЬ и другие основные транзитные линии России







In this region, the forest has not yet been reached by useful infrastructure

$X(t)$

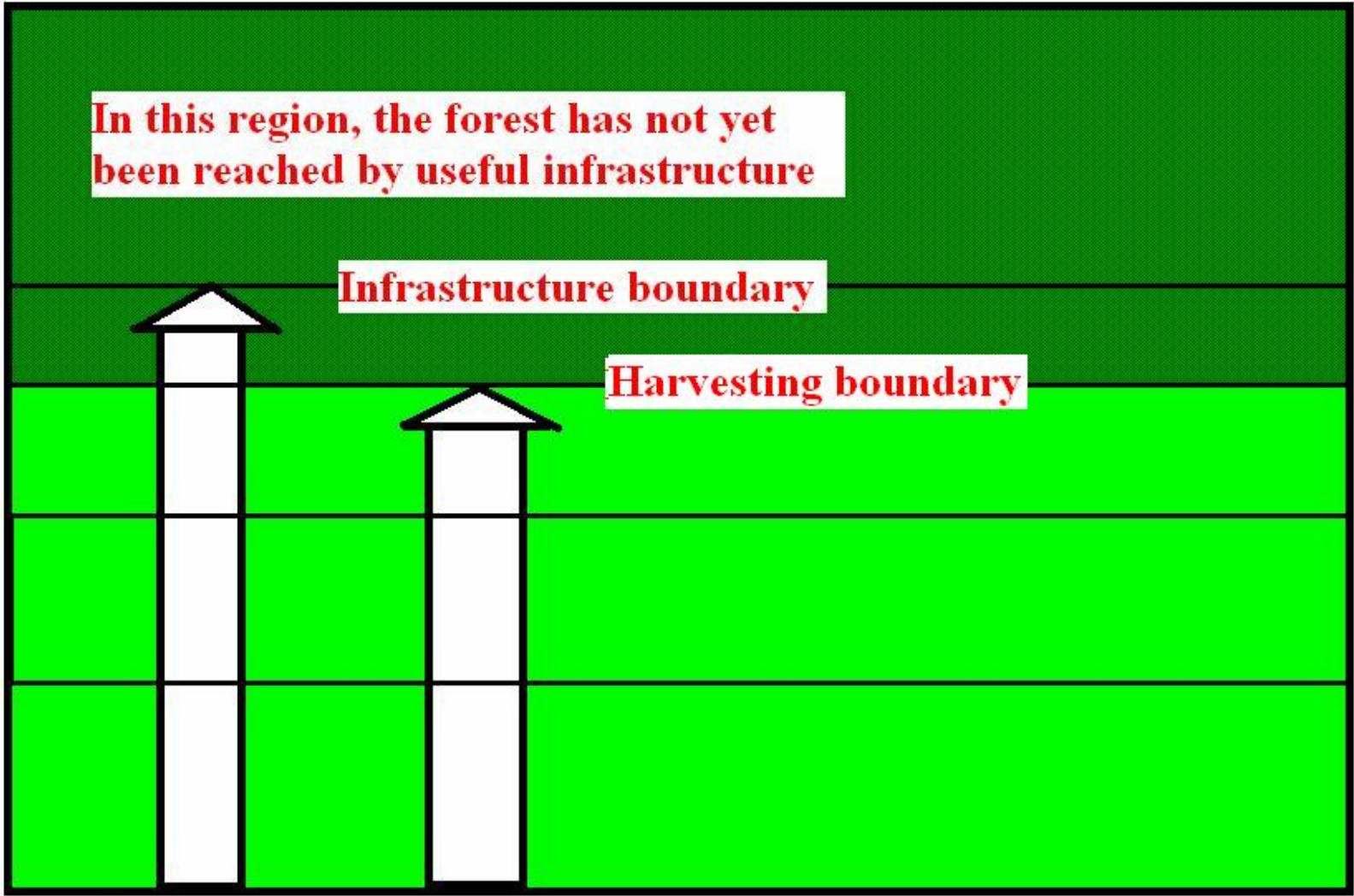
Infrastructure boundary

$Y(t)$

Harvesting boundary

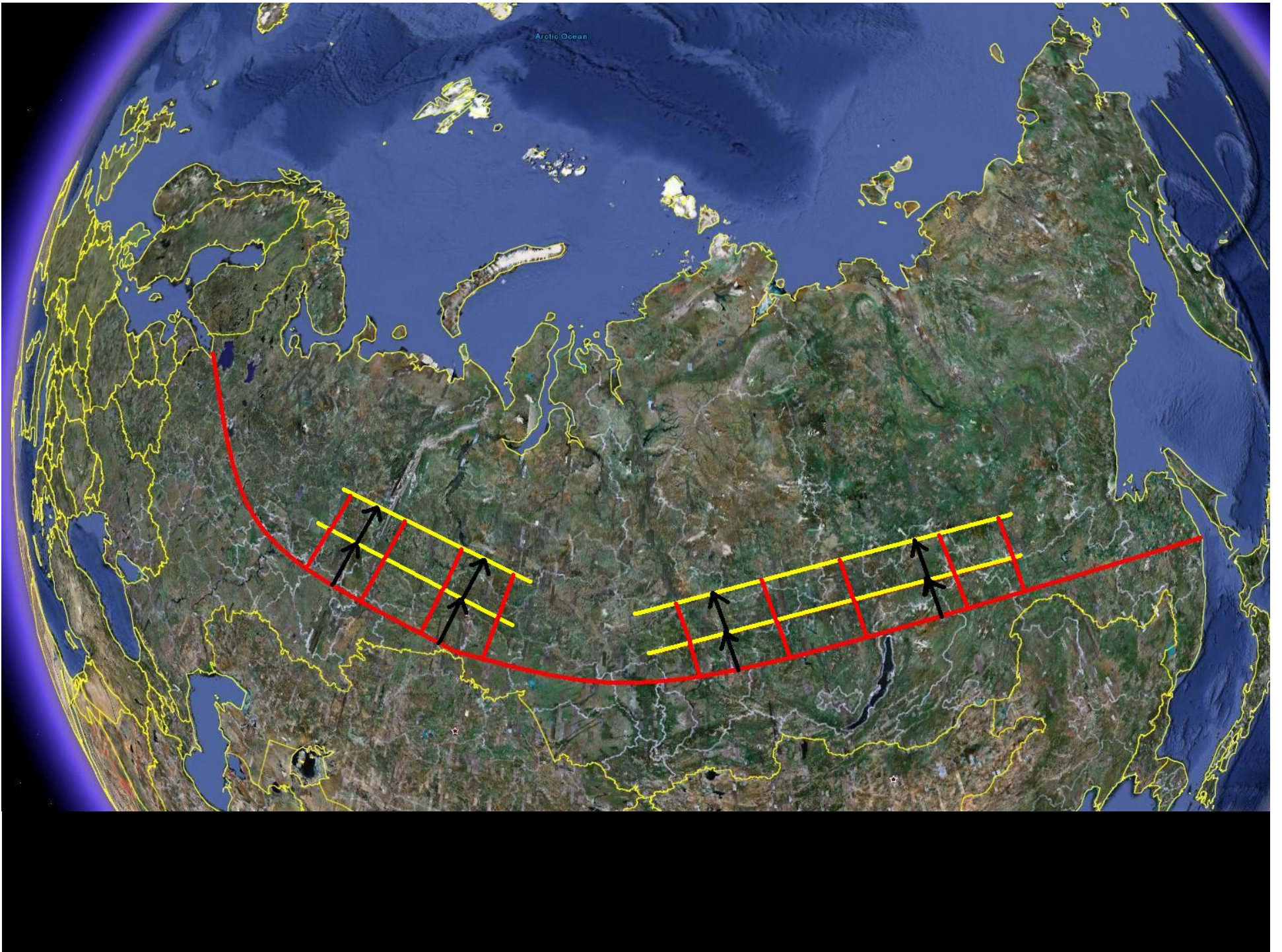
**Infra
structure**

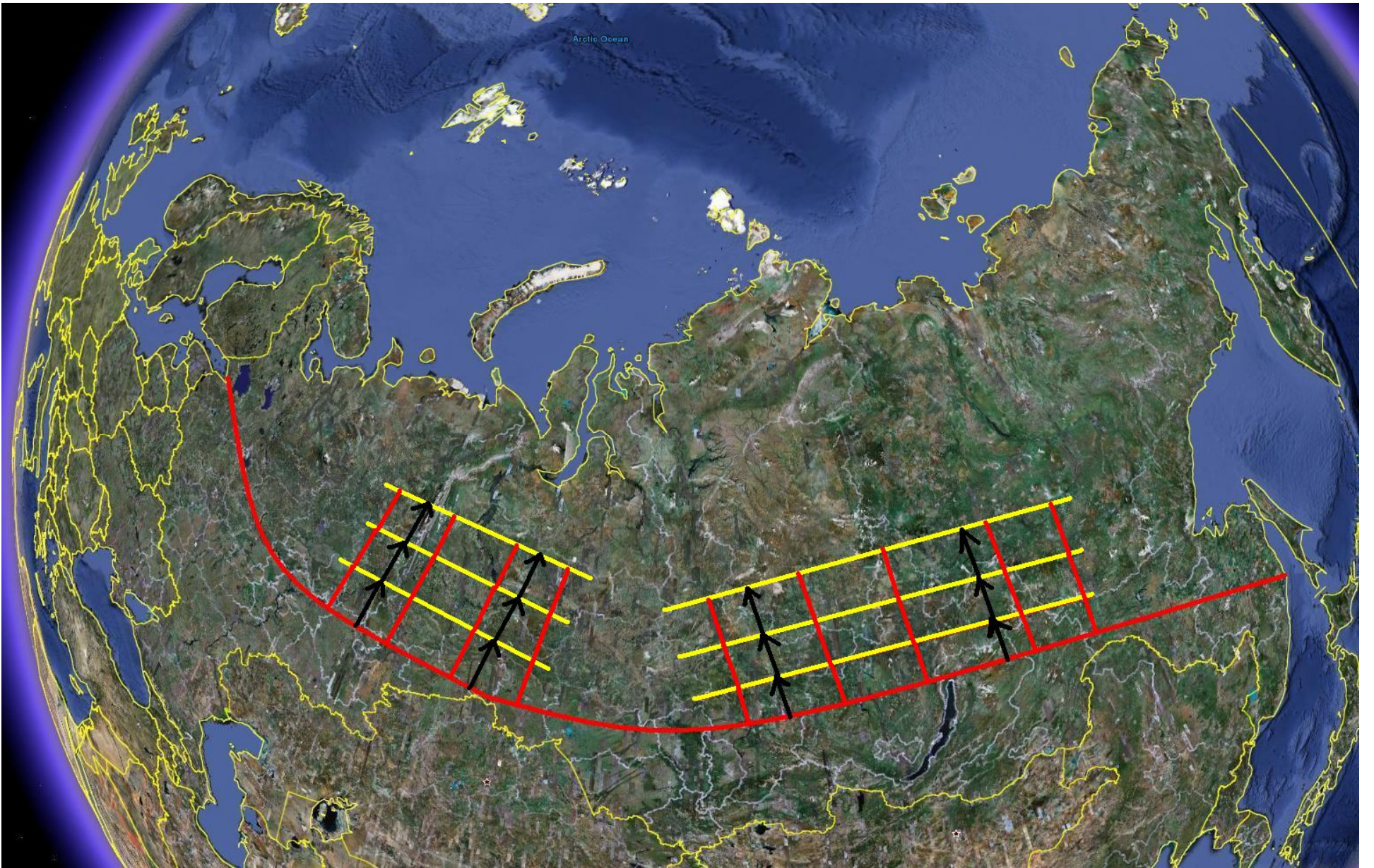
Forestry











Central components of the structure of the dynamic strategy optimization problem are given.

Because of page limitations, the problem description is not rigorous.

Method:

*Multi period
quadratic programming*

Objective function = Total present value

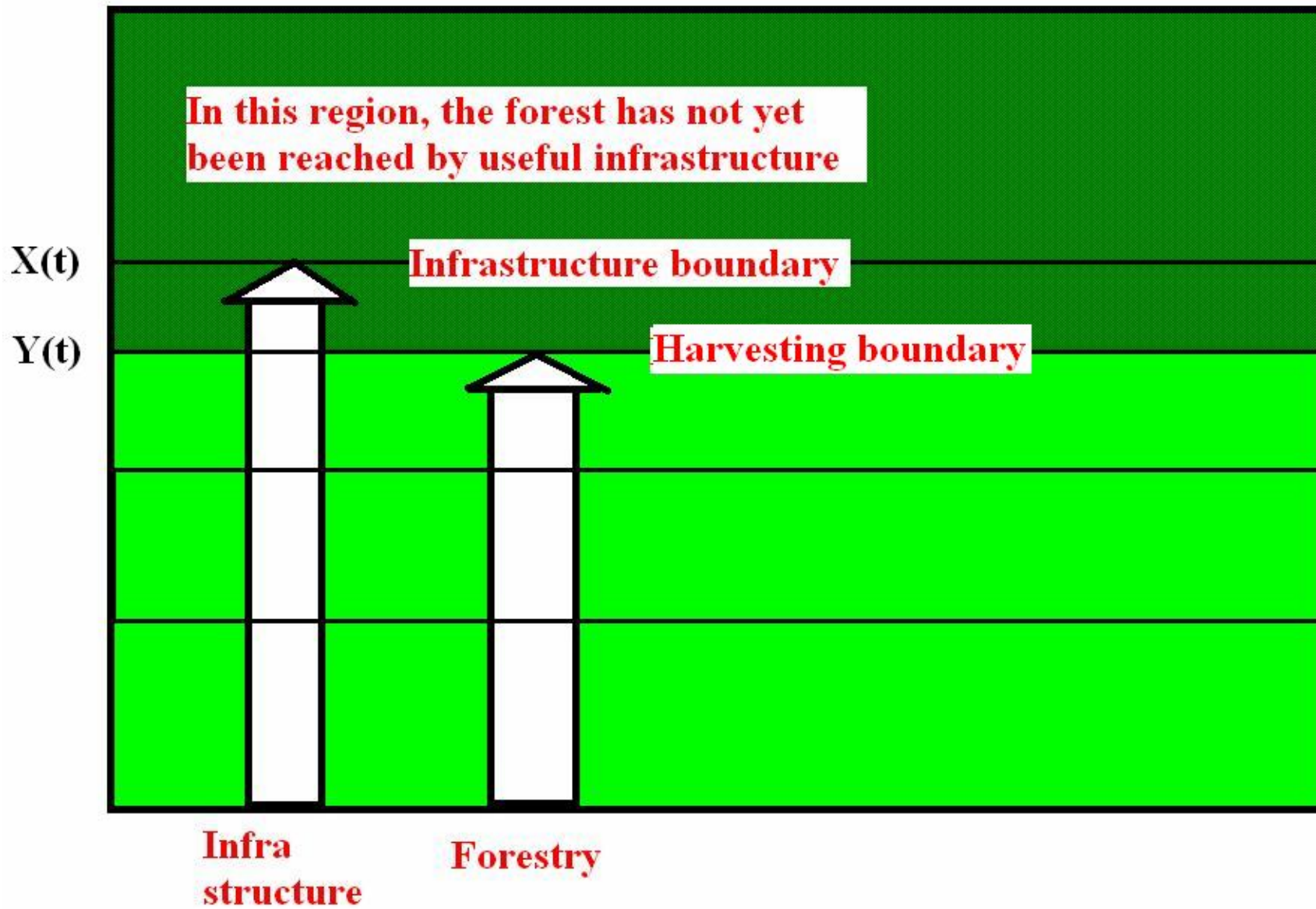
$$\max_{d_1, \dots, d_T} \Pi = \sum_t e^{-rt} \pi(t)$$

The profit in a particular period is a function of the decision in that period and the decision in earlier periods

$$\pi(t) = \pi(t, d_t, d_{t-1}, \dots, d_0; \bullet) \quad , \quad \forall t$$

The decisions include investments and other decisions in infrastructure, forest industry and energy industry (=x) and forestry (=y).

$$d_t = \{x_t, y_t\}, \quad \forall t$$



In each period, the forestry activities are constrained by the infrastructure boundary

$$y_t \leq x_t, \quad \forall t$$

The volume of "first harvest" during a particular period can be described as a function of the change of the "harvesting boundary".

$$h_{0,t} = h_{0,t}(y_t, y_{t-1}; \bullet) \quad , \quad \forall t$$

The volume of "later harvests" during a particular period can be described as a function of the earlier changes of the "harvesting boundaries".

$$h_{n,t} = h_{n,t}(y_{t-s}, y_{t-s-1}, y_{t-2s}, y_{t-2s-1}, \dots, y_{t-ns}, y_{t-ns-1}; \bullet) \quad , \quad \forall t, n$$

**Investments (of different kinds)
during a particular period are
functions of the change of the
infrastructure boundary.**

$$inv_t = inv_t(x_t, x_{t-1}; \bullet) \quad , \quad \forall t$$

In a particular period, the capacities of railroads, roads and different kinds of industries are functions of the infrastructure boundary

$$rail_t = rail_t(x_t; \bullet) \quad , \quad \forall t$$

$$road_t = road_t(x_t; \bullet) \quad , \quad \forall t$$

$$indc_t = indc_t(x_t; \bullet) \quad , \quad \forall t$$

The author of this paper would find it interesting to develop the suggestions found in this paper in cooperation with interested parties in Russia.

Concrete suggestions in this direction are welcome!

There are enormous options in the Russian forest sector if we optimize the dependent activities!



Thank you for listening!

Here you may reach me in the future:

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***My warmest "Thanks" to E.ON
Sweden for economic support to the
project "Economic forest production
with consideration of the forest- and
energy- industries"!***

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