

HG-02-108/July 28, 2002



Some Economic Aspects of Monitoring of Siberian Moth in Krasnoyarskiy Krai and Irkutsk Oblast of the Russian Federation

*Submitted by
Raphael Vartanov, Ph.D.*



*The Heron Group, LLC
PO Box 741
Georgetown, DE 19947
302-856-3324 (voice)
302-856-6985 (fax)
www.herongroupllc.com*



This report was made possible through support provided by the Office of Business Development and Investment, Bureau for Europe and Eurasia, U.S. Agency for International Development, under the terms and conditions of Award No. 118-A-00-00-00119-00. The opinions expressed herein are those of the author(s) and do not necessarily reflect the views of the U.S. Agency for International Development.

For additional information:

The Heron Group, LLC
P.O. Box 741
Georgetown, DE 19947 USA

302-856-3324 (Voice)
302-856-6985 (Fax)
jkparker@dca.net (email)
mcfadden@dca.net (email)

www.herongroupllc.com

© 2002 The Heron Group, LLC

Executive Summary

In this report, the consultant examines various costs associated with two different methodologies for monitoring populations of Siberian moth in Krasnoyarskiy Krai and Irkutsk Oblast. The two methodologies are:

- sampling of larvae on permanent plots, using the “okolot method” and
- use of pheromone traps to capture adult male moths.

In sampling larvae using the “okolot” method, the consultant found that activities involve: a) setting up the permanent plots, b) actual sampling which involves travel to the plots, c) “hammering of sample trees to knock larvae out of the canopy, d) then, picking them up from a ground cloth and e) counting them.

In using pheromone traps, the consultant found that activities involve: a) placing traps in the field which includes assembly of “milk carton” traps and addition of a pheromone strip dispenser and a fumigant to kill the insects after they enter the trap, and b) retrieving traps from the field , and c) identifying and counting them.

Main findings:

- a. For the “okolot” method, costs primarily relate to:
 - labor and fuel for one trip to the field, but
 - these costs are also influenced by the experience of the labor used.
- b. For the “pheromone trap” method, costs primarily relate to:
 - fuel and labor associated with two trips to the field,
 - these trips include one to place the trap and the other to collect the trap and return it to a location where the moths will be identified and counted.
- c. In Krasnoyarskiy Krai, where the work force is experienced in sampling larvae using the “okolot” method, the cost was approximately 8,000 rubles/plot,
- d. The same technique applied in Irkutsk Oblast, where there were no experienced workers, was about 20,000 Rubles/plot.
- e. Costs for sampling with pheromone traps was approximately 8,500 Rubles in Krasnoyarskiy Krai and 10,300 Rubles in Irkutsk Oblast.

General Conclusions

1. Each method has advantages and disadvantages. Many experts believe that the best monitoring approach would be a combination of the two.
2. The consultant suggests that, over time, economic efficiencies in use of pheromone traps (lower cost of traps, lower cost of pheromone dispensers, etc.) will lead to more widespread use of this technique across the vast expanses of Siberia and the Russian Far East. This, in turn, will lead to prediction of incipient outbreaks of Siberian moth and the possibility of early treatment.
3. In a brief discussion of treatment of an outbreak of Siberian moth in Krasnoyarskiy Krai, the consultant shows the high cost of trying to control large outbreaks with aircraft and application of pesticides. In terms of cost effectiveness, it will be more economical to continuously monitor populations of Siberian moth; to predict potential outbreaks early in the outbreak cycle; and to treat them before they expand to hundreds of thousands of hectares with associated tree defoliation and mortality.
4. In addition, the consultant emphasizes that because of the reduced cost of early treatment in the outbreak cycle in the pheromone trapping scenario, multiple benefits such as millions of cubic meters of timber saved, non-timber products saved, fire reduction, increased sales of timber products and exports, protection of soil and biodiversity maintained in the forest will be provided.

Table of Contents

Executive Summary	i
Table of Contents	1
Objectives	2
Schedule of Work/Sources of Information	2
Presentation of Data Collected	3
Findings and Results	18
Conclusions and Recommendations	19
Bibliography and Acknowledgements	19

1. Objectives

This feasibility study had the following objectives:

- 1) Examine data available in Russia (mainly from Krasnoyarskiy Krai) on monitoring of Siberian Moth
- 2) Accumulate and evaluate this data, taking into consideration some relatively new experience gained in Siberia in using pheromone traps for monitoring Siberian moth
- 3) Use these data to undertake a benefit/cost analysis
- 4) Identify gaps in data
- 5) Give recommendations (if the information available would allow) on strengthening the economic efficiency of monitoring
- 6) Contribute to efforts of The Heron Group, LLC in making Component 2 of the USAID/Winrock FOREST project an efficient vehicle in building capacity in Siberia and the Russian Far East to predict incipient outbreaks of the Siberian Moth through increased efficiency of the monitoring system.

2. Schedule of Work/Sources of Information

The Consultant spent the first 3 days studying the general issues related to Siberian Moth, specific problems related to the Russian Far East and Siberia, the current Russian system of monitoring, and monitoring management. The Consultant visited Krasnoyarskiy Krai for a Component 2 Workshop and a Working Group Meeting to meet and discuss issues with experts and to discuss data availability. The Consultant then spent additional time communicating with Russian experts and institutions, identifying data needed and for report preparation.

The main source of information, actual data on monitoring, was the Krasnoyarskiy Center of Forest Protection located in Krasnoyarskiy. At the same time, the consultant reviewed a number of existing documents and publications and requested additional data from other regional Centers of Forest Protection to determine if data from Krasnoyarskiy was typical for general conclusions and recommendations.

3. Presentation of Data Collected

The Consultant used data obtained in Krasnoyarskiy Krai to review the two methods of monitoring Siberian Moth

- sampling of larvae (called in Russian “okolot” from the name of the huge wooden “hammer” used in that method),



and

- use of pheromone traps.



The consultant compiled information on costs associated with each method, on specific types and elements of work and actions, as well as on costs within each method. The following tables show the results of monitoring to determine population density of Siberian moth in Kranoyarksiy Krai.

Table 1: Work Performed to Monitor Siberian Moth Using Pheromone Traps and Collecting Larvae

№	Steps of the work during monitoring (First year)	
	Russian method of sampling larvae	Pheromone traps
1	Study/analysis of the situation in the forest, and pest's dissemination	Study/analysis of the situation in the forest, and pest's dissemination
2	Preparation of sampling sites	
3	Carrying out "okolot" (hitting sample trees with "hammer", then collecting larvae)	Installation of traps in field
4		Bringing traps back from field
5	Analysis of data collected	Analysis of data collected

Because preparation of sampling sites for larvae seems one of the most time consuming parts of this monitoring technique- specific information on that process was also collected from the Krasnoyarskiy Center of Forest Protection.

Table 2: Preparation of Testing Sites

Work performed	Time (days)	Cost (in rubles)
-Bouding of the test site by "vizir" (1 meter wide lines) along definite directions, removing cut branches from the site, marking trees on the edges of the "vizirs".	0.11	0.11 x 1,516.52 = 166.81
- Preparation of posts – 1.4 m long with a diameter 8-10 cm. (cutting trees, removing smaller parts, de-barking, preparation of the post's surface, etc.)	0.21	0.21 x 1,516.52 = 318.46
- Installation of posts (digging, installing, marking)	0.16	0.16 x 1,516.52 = 242.64
- Assessment of trees on the test site: description of the condition of the vegetation, counting trees (according to different groups, kinds, conditions, etc.)	0.20	0.20 x 1,516.52 = 303.30
TOTALS	0.68	1,031.21

Cost of 1 day, in the above table, equals the daily salary rate for different employees:
 Forest Pathologist (430.42 rub.), Forester (430.42 rub.), workers (225.26 rub.)
 $430.42 \times 3 + 225.26 = 1516.52 \text{ rub.}$

Table 3: Collecting Larvae from Sample Trees

Work performed	Labor (days)	Cost (in Rubles)
- Selection of the sample tree, determining it's condition and category, cleaning of the ground around the tree, placing a ground cloth to collect falling larvae), making the "kolot" (wooden "hammer") – 2.5-3 m. long. Hitting trees (6-8 hits for each sample tree), total of 10 trees; - Counting larvae on ground cloth according to their age and species.	0.7	$0.7 \times 1,516.52 = 1,061.56$

Table 4: Placing Pheromone Traps

Work performed	Labor (days)	Cost, In rubles
-Driving on route following itinerary and directions. -Marking the beginning and end of the route with posts. -Placing traps	0.3	$0.3 \times 1,516.52 = 454.95$

Information on labor and costs are based on actual information from the Krasnoyarskiy Center of Foret Protection.

Summary of Costs

To illustrate and analyze the cost of fuel needed for monitoring, a site was selected which could be considered as average in terms of distance from the place where the trips were initiated.

Region Researched: Tassevskiy

Distance from Krasnoyarkiy 375 km (750 km. round trip)

Fuel cost (Normally 19.4 l. per 100 km): $19.4 \times 750/100 = 145.50 \text{ rub.}$

Average cost of gasoline A-80 (on 01.01.2002)

$145.50 \times 8.00 \text{ rub.} = 1164.00 \text{ rub.}$

With an average speed of 60 kmph, time spent on the road equals, using either way 12.5 hours (1.6 days)

Table 5: Labor Time Spent for Monitoring

№	Stages of the work			
	Sampling of larvae		Pheromone traps	
2	Preparation of permanent sampling sites	0.68		
3	Sampling larvae	0.7	Placing traps every 500 m. (6 traps)	0.3
4			Collecting traps	0.3
5	Time on the road	1.6	Time on the road	3.2
5	Actual time	2.98 days	Actual time	3.8 days
	Paid	3 days	Paid	4 days

Calculation of trip expenses (according to norms established on 01.01.2002)

Per Diem: 100 Rub/day

Lodging: 12 Rub/night

Representatives of local leskhozoes are not eligible for per diem and other trip related expenses.

**Table 6: Calculation of Daily Salary Rates
According to the Norms Established on 01.12.2001**

№	Components of the payment	%	6 level	10 level	13 level
1	Daily rate		36.04	52.66	68.85
2	Addition	30	10.81	(40%) 21.06	20.66
3	Bonus for experience	30	10.81	15.80	20.66
4	Bonus	75	43.25	67.14	82.63
5	Addition for qualification	50		26.33	
	TOTALS		100.91	182.99	192.80
6	District coefficient	30	30.27	54.90	57.84
7	Bonus for Northern territories	30	30.27	54.90	57.84
	TOTALS		161.45	292.79	308.48
8	Payments for social needs	35,8	57.80	104.82	110.44
9	Financial Aid	20КЛ/12	6.01	8.78	11.50
	TOTALS		225.26	406.39	430.42

**Table 7: Employees Participating
in Monitoring Activities for one site
in Krasnoyarskiy Krai
(Year One)**

Larvae sampling	Pheromone traps
Forest Pathologist (13 level) –2 persons Forester (13 level) – 1 (from leskhoz) Worker (6 level) - 1 (from leskhoz) Driver (10 level) - 1	Forest Pathologist (13 level) –1 Forester (13 level) - 1 (from leskhoz) Driver (10 level) - 1
Total: 5 people	Total: 3 people
Labor cost for 1 day: $430.42 \times 3 + 225.26 + 406.39 = 1922.91$ RUB	Labor cost for 1 day: $430.42 \times 2 + 406.39 = 1267.23$ RUB

Table 8: The Cost of Monitoring (1st year)

Table 8a: Sampling Larvae

№	Cost	Calculation	Amount, RUB
1	Labor	$1,922.91 \times 3$ days	5,768.73
2	Fuel	145.50×8.00 RUB	1,164.00
3	Trip expenses	100×3 persons. $\times 3$ days + 12×2 nights $\times 3$ persons	972.00
4	Materials	Ground cloth (data on December 1, 2000)	93.00
	Total		7,997.73

Table 8b: Pheromone Traps

№	Cost	Calculation	Amount, RUB
1	Labor	$1,267.23 \times 4$ days	5,068.92
2	Fuel	$145.50 \times 8.00 \times 2$ trips	2,328.00
3	Trip expenses	100×2 persons. $\times 4$ days + $12 \times 3 \times 2$ persons	872.00
4	Materials	Traps 6×40 RUB	240.00
	Total		8,508.92

NOTE: The cost for the trap was 40 RUB. If more traps are purchased the cost would be reduced to 25 RUB and lower. The cost of the pheromone is not included

Table 9: Second Year Work

№	Steps of the work in monitoring (second year)			
	Sampling larvae		Pheromone traps	
2	Preparation of permanent sampling sites	----		
3	Sampling larvae	0.7	Placing traps every 500 m. (6 traps)	0.3
4			Collecting traps	0.3
5	Time on road	1.6	Time on road	3.2
5	Actual time	2.3 days	Actual time	3.8 days
	To be paid	3 days	To be paid	4 days

Table 10: Employees Participating in Monitoring for One Site in Krasnoyarskiy Krai (Year Two)

Sampling larvae	Pheromone traps
Forest Pathologist (13 level) –1 Forester (13 level) - 1 (from leskhoz) Driver (10 level) - 1	Forest Pathologist (13 level) –1 Forester (13 level) - 1 (from leskhoz) Driver (10 level) - 1
Total: 3 people	Total: 3 people
Cost of labor for 1 day: $430.42 \times 2 + 40639 = 1,267.23$ RUB	Cost of labor for 1 day: $430.42 \times 2 + 40639 = 1,267.23$ RUB

Table 11: Expenses for Monitoring (Second year)

Table 11a: Sampling Larvae (Traditional “Okolot” Method)

№	Expenses	Calculations	Total (in Rub)
1	Salary	1267.23 x 3 days.	3,801.69
2	Fuel	145.50 x 8.00 rub.	1,164.00
3	Per Diem	100 x 2 people x 3 days + 12 x 2 nights x 2 people	648.00
4	Materials	Material to cover ground under tree to collect larvae (purchased year before)	----
	TOTALS		5,613.69

Table 11b: Pheromone Traps

№	Expenses	Calculations	Total (in Rub.)
1	Salary	1267.23 x 4 days	5,068.92
2	Fuel/Oil	145.50 x 8.00 x 2 trips	2,328.00
3	Per diem	100 x 2 people X 4 days + 12 x 3 x 2 people	872.00
4	Materials	6 traps pieces x 40 rub.	240.00
	TOTALS		8,508.92

The Consultant learned (from the Center of Forest Protection of Krasnoyarskiy Krai and from some Workshop participants) that the specialists and workers who sample larvae are usually very experienced people in that field. They do the same work for many years, know the sites well and are very skilled in preparation of sample sites. One concern expressed was that if sampling for larvae was not continued – accumulated experience including well-trained personnel could be lost.

Looking through the data collected from Krasnoyarskiy Krai, the Consultant got the impression that the work performed to prepare the sample plots for sampling of larvae is much more difficult than for using pheromone traps. This work would be even more time consuming (50-70 % more time spent) if the workers did not have the special skills developed from years of experience. Taking into consideration the history of the Siberian moth outbreaks, The Krasnoyarskiy Center of Forest Protection is perhaps one of the most experienced in sampling larvae in all of Russia.

On the other hand, monitoring with pheromone traps is relatively new in terms of accumulated practical experience (although the consultant found that studies on the use of pheromone traps, including printed guidance materials, were produced in Russia many years earlier) and efforts needed for this method would probably eventually decrease.

Taking into consideration the above circumstances and also because of the importance in comparing costs between different places/regions, the Consultant requested information from other regions (provided by Irkutsk Oblast) on their actual cost for monitoring Siberian Moth. Information was provided on monitoring in the territory of Angarskiy

Leskhoz using both methods. As can be seen from the tables below, labor required for sampling larvae is twice higher than for monitoring with pheromone traps. Use of more persons/day for monitoring of larvae affected the increased transportation cost, which as we learned (taking into consideration low salary, long distance, and high cost and huge amount of fuel needed) is the most expensive part of this form of monitoring.

**Table 12: The Cost of Monitoring Siberian Moth
in Angarskiy Leskhoz in 2001 Using
Pheromone Traps**

№ п/п		Measure	Time, person/day	Cost, RUB	Total, RUB.
1	Labor				
	a) Forest Pathologist	Person/day	6	238.01	1,428.06
	b) Worker	Person/day	6	146.24	877.44
2	Additions to the labor cost	RUB			855.34
3	Trip expenses	days	12	107.00	1284.00
4	Leasing: A truck GAZ – 66 Tractor	Car/shift Tractor/shift	2	2,808.00	5,616.00
5	Other expenses	RUB			230.55
	Total, RUB				10,291.39

**Table 13: The Cost of Monitoring Siberian Moth
in Angarskiy Leskhoz in 2001
by Sampling Larvae.**

№ п/п		Measure	Time, person/day	Cost, RUB	Total, RUB.
1	Labor				
	a) Forest Pathologist	Person/day	8	238.01	1,904.08
	b) Worker	Person/day	16	146.24	2,339.84
2	Additions to the labor cost, 37.1% (retirement fund, social insurance, etc)	RUB			1,574.49
3	Trip expenses	days	12	107.00	2,568.00
4	Leasing: A truck GAZ – 66 Tractor	Car/shift Tractor/shift	4	2,808.00	11,232.00
5	Other expenses	RUB			414.40
	Total, RUB				20,032.81

Two other regions (Khabarovskiy Krai and Primorskiy Krai) apparently did not have enough information to allow identification of monitoring costs using pheromone traps or could not provide their records. Nevertheless, both of these regions provided us with related information.

Total expenses of the Center of Forest Protection in Primorskiy Krai in 2001 on work related to forest protection, including forest health monitoring on 12 million hectares, was 1.015.000.00 (about 1 million RUB or about 33.4 thousand USD). This amount includes the cost of monitoring gypsy moth (280 thousand RUB) in the 25km forested area around the port of Vladivostok carried out under an Agreement between the U.S. Forest Service, U.S. Department of Interior and the Government of the Russian Federation. According to the budget for 2002, the Center will spend 202.78 thousand RUB to monitor gypsy moth. According to information provided by the Center, expenses associated with the purchase, installation, and servicing of 1 pheromone trap in the forest in Primorie will be 13.50 USD.

The table on the cost of the forest health monitoring in Innoketevskiy Leskhoz (Khabarovskiy Krai) during the period June 12 –15, 2001 (provided by the Center of Forest Protection, Khabarovskiy Krai) and the table on the Budget of the Center of Forest Protection, Primorskiy Krai for monitoring of Siberian moth in 2002 (provided by the Center on Forest Protection, Primorskiy Krai) are provided as Attachments to the Report.

The Consultant does not consider himself qualified to judge the overall efficiency of the monitoring or the quality of data received from sampling of larvae and/or use of pheromone traps. The Consultant considered only the issues associated with the cost of monitoring Siberian Moth, where both methods are currently used.

According to local experts, however, each method has both advantages and disadvantages associated with its use. For example, monitoring by sampling larvae is usually conducted on trees, which have 16-20 cm diameters (maximum 22); on the other hand, larvae usually start feeding on larger trees, 36-40 cm and more in diameter. For sampling larvae, foresters prepare sample plots, which they then use for many years. When striking the tree with the big “hammer” they often damage the sample trees and often, the sample trees do not survive this damage. Also, according to some specialists in Krasnoyarskiy, there should be two trips to the forest to monitor larvae (one at the end of May/beginning of June; the other at the end of August/beginning of September). Many Russian experts consider monitoring with pheromone traps as a less accurate method of providing information. Nevertheless, despite all these arguments, the Consultant found that many experts consider that each method of monitoring is important and can provide valuable information needed for protection of the forest.

Also, practically all experts with whom the consultant communicated agreed that the scope of monitoring for Siberian Moth should be much more extensive (at least 4-5 times, maybe more). Experts think that if significant growth of Siberian Moth populations could be identified at an early stage, and if specific outbreak spots/areas (so called in Russian “pervichnie ochagi”, initial outbreak spots) could be detected with adequate monitoring. These spots then could be treated and populations of the moth, along with the entire “problem” could eventually decrease. Often, because of the current limited scope of monitoring, the outbreak is identified at a stage when it is no longer clear whether it would be better to start treatment with its associated expenses, wide range of pesticide use which impacts the environment and human populations, and still suffer significant losses in forest industrial activities, etc. or just choose the so called Russian strategy of “antibor’bi” (anti-treatment) when the treatment would not be effective and should not be carried out at all.

The cost of the monitoring is many times lower than the cost of treatment. This is especially true in Russia, where the lease cost and fuel for two helicopters needed for treatment could be much higher than the annual cost of the monitoring. Also, as it is well known, the consequences after each treatment is significant environmental damage and a huge area of dead forest. A brief description of the cost of treatment in the Krasnoyarskiy Krai during an outbreak of the Siberian Moth in the mid 90’s is given below. This information is submitted to illustrate the actual cost of different aspects of treatment, as well as to show that if we use the resources equal to those spent on treatment (or at least part of that) for increasing the capacity and intensifying the monitoring, the benefit could be measured in hundreds of thousands of hectares of protected forests, cleaner environment, and healthier local economies (oriented on wood harvesting and exporting). Benefits could include: millions of cubic meters of timber

saved, non-timber products saved, fire reduction, increased sales of timber products and exports, protection of the soil and wildlife in the forest.

Treatment of Siberian Moth in Krasnoyarskiy Krai in 1995-1996

In 1995–1996, 564.9 thousand hectares were treated in Krasnoyarskiy Krai to control the Siberian moth. The tables below provide information on the expenses associated with that treatment and on the scope of utilization of air transportation, different equipment, pesticides, manpower, etc. to enable the treatment.

Treatment was provided in 1995 on 224.8 thousand hectares and in 1996 on 340.1 thousand hectares. Each year treatment was carried out in two stages – in the spring and in the fall. In 1995 – 103.3/121.5 thousand hectares were treated and in 1996 - 223.5/116.6 thousand hectares. The territories of the following forestry facilities (Leskhozoes) were treated with the pesticides:

- Abanskiy
- Irbeiskiy
- Kazachinskiy
- Pirovskiy
- Motiginskiy
- Eniseiskiy
- Chunsky
- Manzenskiy

The costs of the treatment were associated with: labor (salary), purchase of pesticides, leasing of air transportation, purchase of fuel and other materials, and other operating expenses. Total cost of the treatment in 1995-1996 in Krasnoyarskiy Krai was 6,072.7 thousand USD and 47.4% of that cost was associated with the leasing of air transportation and purchase and supply of fuel. Expenses related to the purchase of pesticides were a bit higher than 32% of the total cost and were 1,947.3 thousand USD.

Table 14: Treatment Costs Against Siberian Moth in Krasnoyarskiy Krai in 1995

№	Expenses	Amount, In Miln. RUB	% to the total	Amount, In Thsd. USD
1	Labor/Salary	267.0	3.0	57.5
2	Social needs	98.6	1.1	21.3
3	Chemicals	1,520.5	17.2	327.7
4	Lease of planes and helicopters	3,950.0	44.8	851.3
5	Fuel for air transport	507.2	5.7	109.3
6	Fuel for auto transport	181.8	2.1	39.2
7	Services related to transportation, unloading, and storing fuel	417.0	4.7	89.9
8	Meals	138.7	1.6	29.9
9	Equipment, materials	412.4	4.7	88.9
10	Communication	169.1	1.9	36.4
11	Services of other organizations	1,121.0	12.7	241.6
12	Trip expenses	24.3	0.3	5.2
13	Other direct expenses	14.6	0.2	3.1
	Total	8,822.2	100	1,901.3

For calculations of the expenses in USD, the consultant used data of the Central Bank of the Russian Federation for 1995 and 1996, including the exchange rate as it was on the last day of the year – 1995, 1996. Taking into consideration conditions (inflation) existing at that time in Russia (within each year) the actual expenses in USD could be slightly higher. The Central Bank exchange rate was:

1995 1 USD = 4,640.00 RUB

1996 1 USD = 5,560.00 RUB

Table 15: Treatment Costs for Siberian Moth in Krasnoyarskiy Krai in 1996

№	Expenses	Amount In Miln. RUB	% of Total	Amount In Thsd. USD
1	Labor/Salary	398.9	1.7	71.7
2	Social needs	146.9	0.6	26.4
3	Chemicals	9,005.2	38.8	1,619.6
4	Lease of planes and helicopters	7,852.8	33.9	1,412.4
5	Fuel for air transport	836.4	3.6	150.4
6	Fuel for auto transport	216.3	0.9	38.9
7	Services related to transportation, unloading, and storing fuel	1,466.9	6.3	263.9
8	Meals	232.8	1.0	41.9
9	Forest topological research	235.0	1.0	42.3
10	Equipment and materials	525.2	2.3	94.5
11	Services of other organizations	2,203.5	9.5	396.3
12	Trip expenses	60.2	0.3	10.8
13	Other direct expenses	12.9	0.1	2.3
	Total	23,193.0	100	4,171.4

**Table 16: Summary of Treatment Expenses
during the Outbreak of Siberian Moth in
Krasnoyarskiy Krai in 1995-1996**

№	Expenses	Amount, In USD	% of total
1	Labor/Salary	129.2	2.1
2	Social needs	47.7	0.8
3	Chemicals	1,947.3	32.1
4	Lease of planes and helicopters	2,263.7	37.3
5	Fuel for air transport	259.7	4.3
6	Fuel for auto transport	78.1	1.3
7	Services related to transportation, unloading, and storing fuel	353.8	5.7
8	Meals	71.8	1.2
9	Forest pathological research	42.3	0.7
10	Equipment and materials	219.8	3.6
11	Services of other organizations	637.9	10.5
12	Trip expenses	16.0	0.3
13	Other direct expenses	5.4	0.1
	Total	6,072.7	100

Aerial application of chemicals was conducted on 564.9 thousand hectares (about 1,412.25 thousand acres)

Average cost of air treatment of 1 hectare was – 10.75 \$.

Table 17: Cost of a One-Hour Lease of AN-2¹ Airplane

№	Air Team	Cost of 1 hour lease in thousand RUB
1	Achinsk	2,160.0
2	Norilsk	2,300.0
3	Tuva	1,900.0
4	Chita	2,000.0
5	Krasnoyarskiy	2,080.0
	Average	2,088.0

Fuel used for the AN-2 plane --- B-91/115 (6-92) – 19,975 RUB for 1 ton

The cost of the product DECIS used for treatment («ДЭЦИС») - 41.0 thousand RUB for 1 ton

The cost of the product DIPEL (imported) used for treatment («ДИПЕЛ») - \$6.83 for 1 liter.

Services of other organizations includes:

1. Payments to Customs for duties and for preparation of documents.
2. Payments for the lease of train wagons for fuel transportation
3. Financing of research provided by the Sukachev Institute of Forest
4. Payment to the Sanitary-Epidemic Service for preparation of documents on the safety of the treatment materials used.

¹ According to Air forest protection Agency (part of the Ministry on Natural Resource's Avialesookhrana) the cost of 1-hour lease of the airplane AN-2 on December 1, 2001 for different places in Krasnoyarsk Krai was from 8 to 12 thousand RUB (about 275.00 - 400.00 USD). 1 hour of the helicopter Mi 8 was – 18-22 thousand RUB (about 610.00 - 750.00 USD). Additional cost required for the fuel. Thanks to a special arrangement made on a federal level Natural Resources Committees do not pay VAT (20%) for plane/helicopter rentals.

4. Findings and Results

1. The level of and need for more extensive monitoring of Siberian moth are high and not being met by existing capacity;
2. The vast territory covered by forest in the Russian Far East and Siberia make the issue of economic efficiency in monitoring Siberian moth extremely important;
3. Some areas in Siberia gained valuable experience in sampling larvae of Siberian Moth, (for example, the amount of labor used to prepare one sample site was quite low and demonstrates the high level of experience of workers doing the sampling). On the other hand, a further increase in the economic efficiency of sampling larvae is very limited (or even unlikely), as it will require a considerable amount of labor;
4. The cost of labor in Russia, in general, and especially in sectors related to environmental protection, municipal services, forest industry, etc. is very low. On the other hand, it is increasing (in dollar value salaries have increased every year since August 1998). And, there is evidence that as long as the economy in Russia continues to improve, the cost of labor will also increase. This will make the use of pheromone traps for monitoring more attractive than sampling larvae;
5. At present, there is not a wide range of experience in the use of pheromone traps for monitoring Siberian Moth. Economic efficiency in the use of pheromone traps for monitoring is still low (though in many places the cost of monitoring -- when it is possible to compare -- is better than for sampling larvae), and has potential to increase. Economic efficiency touches upon activities in many aspects: industrial (production of pheromone, traps, etc.), personnel (training), management (the most cost-efficient way to organize using less people and facilities, etc.);
6. The challenge to increase the scope of monitoring (including a significant increase in the geographic area covered) could be met by increasing the industrial (pheromone lures, traps) and human resource capacity needed to conduct the monitoring with pheromone traps in a more efficient manner. Sampling of larvae, on the other hand, is much more limited in scope.
7. Monitoring with pheromone traps could be less expensive over time as more experience is gained; more pheromone and traps produced could significantly diminish the cost of each unit (traps could become 2-3 times less expensive when purchased in bulk).
8. Taking into consideration the fact that many experts think that sampling of larvae is more accurate (when it is possible to compare), and also that experience and

capacity play an important role, it seems important to develop a monitoring strategy where both methods could be used to complement one another.

5. Conclusions and Recommendations

The challenge to increasing the scope of monitoring (including a significant increase in the geographic area covered) could be met by increasing the industrial (pheromone lures, traps) and human resource capacity needed to make monitoring with pheromone traps more efficient. Monitoring with pheromone traps could be less expensive over time as more experience is gained. In addition, greater production of pheromone and traps could significantly diminish the cost of each unit. Actions to increase economic efficiency and greater use of pheromone traps for monitoring look promising and have good potential for success. Taking into consideration the experience gained in sampling larvae, it seems important to develop a **monitoring strategy** that would enable both methods to complement one another.

In the meantime, allocation of more economic and financial resources is needed to strengthen monitoring of Siberian Moth, complimented by action to increase the efficiency of the monitoring system being developed.

6. Bibliography and Acknowledgements

1. «Нормы выработки для инженерно-технических работников на полевые работы», Брянск. 1992г.
2. «Нормативы трудозатрат на работы по лесопатологическому обследованию лесов и типовые нормы выработки и времени на работы по очажно-комплексному методу защиты леса», Москва.1986 г.
3. «Методические указания по экспедиционному лесопатологическому обследованию лесов СССР», 1986 г.
4. Report prepared under World Bank Loan 3806-RU (Team Leader Alexander S. Isaev), 1997
5. Data from the Centers of Forestry Protection of Krasnoyarskiy Krai, Irkutsk Oblast, Khabarovskiy Krai and Primorskiy Krai

The Consultant wishes to express special appreciation to Tatyana N. Tregubova for her work in collecting a significant amount of data during the consultant's trip to Krasnoyarskiy (November 24-30, 2001), and for her input to the work.

For his work on the preparation of this Report, the Consultant found extremely useful, his participation in the November Workshop, and the Working Group Meeting of Component 2 of the FOREST project held in Krasnoyarskiy – November 28-29, 2001, and the opportunity to meet and discuss the issue with experts in the field of pest management.

At the meetings and after that, during the period of January-February, the Consultant used the opportunity to communicate with heads and representatives of several Regional Centers of Forest Protection: Vladimir V. Soldatov, Dmitry Grodnitsky, Tatyana N. Tregubova, Svetlana I. Adarich (Kasnoyarskiy Krai), Valeriy A. Mironov, Galina A. Chekhova (Irkutsk Oblast), Vera V. Poselenova (Khabarovskiy Krai), Alexey T. Popov (Primorskiy Krai). All these people provided assistance and support by sharing information and their knowledge.

The Consultant also wishes to express special appreciation to the Component 2 Team Leader – Max McFadden, and two his main associates Alexei Sharov and Yuri Baranchikov for sharing their knowledge and giving the consultant important background introduction to the problems related to Siberian moth and pest management in general.

NOTE: The editors of this document were Max W. McFadden and J. Kathy Parker of The Heron Group, LLC.