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Mr. Charles A. Mann, Director

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Population and Land Use Inventory
of MR II by Aerial Survey

H. Thung's
Copy -
7 February 1974

We hereby submit Dr. Heng L. Thung's final report: "Population and Land Use Inventory of MR II by Aerial Photo Survey". This project was started late October 1973.

The following is a brief summary of the report followed by comments on Dr. Thung's findings.

SUMMARY

1. Population - The following three independent sources were used to determine the estimated population of MR II:

Cao Muong Records (official RLG Muong census).

Relocation Survey (conducted under the auspices of the RLG Ministry of Plan).

Aerial Survey (conducted by Dr. Thung, USAID/ORRA).

All three sources show the population of MR II (excluding the distant enclaves around and including LS-32 in the north and LS-46, 61, and 63 in the east, which account for approximately 15,500 persons) to be less than 140,000 persons. The population total based on the RLG relocation survey and the aerial photo survey is estimated to be somewhere between 135,500 and 137,500 persons. Adding the enclave areas, the estimated current population of the entire Vientiane government-controlled area of MR II ranges between 151,000 to 153,000 persons.

• Rice Surplus - Total rice production based on the aerial photo survey is estimated to be 85,827 metric tons of paddy equal to approximately 36,000 metric tons of milled rice. This compares closely with results of the Agriculture Division Crop Production Branch survey of rice yields in MR II which estimated total production of 87,185 metric tons paddy equal to 41,848 metric tons milled rice.

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Differences in rate of return of milled rice are explained by the fact that the Agriculture Division used a loss factor of 20% in handling and storage while this report used a more conservative loss factor of 30% before milling. Both surveys used a loss factor of 40% during milling.

Total consumption for the population of the area is calculated to be 24,689 metric tons of milled rice.

Additional requirements for seed and animal feed are estimated to be another 20%, or 4,938 metric tons of the gross consumption rate.

Thus, the net indicated surplus appears to be approximately 6,676 metric tons of milled rice. If this estimate is correct, the indicated surplus would amount to a 3-month additional supply in excess of annual requirements. However, as stated in the report, and similar to other geographic distribution peculiarities in other parts of Laos, there are some areas within MR II which are deficient in rice production while other areas have a rice surplus and no practical or economic means for solving this distribution problem.

3. Relocation - Although there is an apparent rice surplus for the area generally, it must be stressed that approximately 24% of the population (or roughly 30,000 people) remain below subsistence level in rice due to the high population density of up to 250 persons per square kilometer in the Ban Non (LS-272) and Pak Mouai (LS-273) region, the ridge north of the Na Luang valley, the Ban Pa Khe (LS-353) region and the Muong Cha (LS 113) valley. In relocation planning these people should move first if the net population requiring food support is to be reduced.

COMMENTS

1. Population - The FY-74-75 FBS reported the estimated population of the Vientiane government-controlled area of MR II as of 1 July 1973, to be approximately 235,000 people of which some 215,000 must depend upon farming (or food from outside the area in the case of refugees and troops) to exist. At that time it was estimated that there were roughly 78,000 people in MR II who were not refugees, soldiers, merchants, or officials and their families, but who were existing on a subsistence level without outside assistance. These estimates were made based on the best information available at that time (primarily information provided by local Nai Khongs

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and village leaders) and without the benefit of more modern surveying techniques. It has only been since the cease-fire of one year ago that the population has remained relatively stable for a period of time long enough to permit the in-depth surveys which have just been completed, indicating the great likelihood of double-counting in earlier days.

Based on the new surveys it now appears that the statement in the FY-74-75 FBS that there were 78,000 persons in MR II existing without outside assistance is no longer valid. It is most likely that at some time in the past these 78,000 people did live in MR II, but because of the war they were unable to pursue their normal means of livelihood and gradually moved out of the area. Information previously supplied by the Nai Khongs and other local officials apparently did not take into consideration the movement of these people out of the area as they were never registered on the support rolls.

2. Refugee Support - The maximum refugee population on support in all of MR II was 155,941 persons as recorded in October 1973. The newly estimated population of MR II is approximately 153,000 persons (as indicated by the recent RLG and USAID surveys). There is a difference of only 2% between the total population of the area and the total number of people having received food support. This implies that the entire current population has at one time or another received support. Given the war situation which has existed until recently and the density of the population, it is not unreasonable to assume that the entire population may have required some assistance during at least part of each year.

Enclosure, a/s

cc: DD, All ADs, PRO, PHD, PWD, AGR, EAD, EMB/Pol(RH), EMB/Pol(DA),
AC/XK, AC/Vte, C&R(3)

ORRA:JLV ^Williams:mhb

POPULATION AND LAND USE INVENTORY OF MR II BY AERIAL PHOTO SURVEY

PURPOSE

To provide Mission Project Managers with a data base which could be used for policy determination and for planning purposes.

OBJECTIVES

The objectives of this evaluation was to determine:

- (1) The size and distribution of population within Military Region II.
- (2) The amount of land under rice cultivation.
- (3) The reliability of aerial survey methods (techniques) for determining population data and resources inventory.

AREA

The area surveyed comprises of the greater part of Xieng Khouang Province and covers approximately 4,100 square kilometers (fig. 1). The terrain is mountainous with very limited level flood plains where wet rice paddy cultivation is practiced.

METHODOLOGY

This methodology is based on full utilization of aerial photo analysis to obtain population size and distribution, land use type and area of MR II.

POPULATION DATA

The population data has been obtained by a count of dwellings on the aerial photographs, which show permanent habitation. This excludes structures which are obviously schools, dispensaries, warehouses and military compounds.

A population census in the field was conducted for the purposes of evaluating the desires of the population towards relocation. This Relocation Survey was conducted by Colonel Vang Geu with assistance of Dr. Yang Dao of the Ministry of Plan.

This field data was used for correlation purposes, and for quantification of the aerial photographic data.

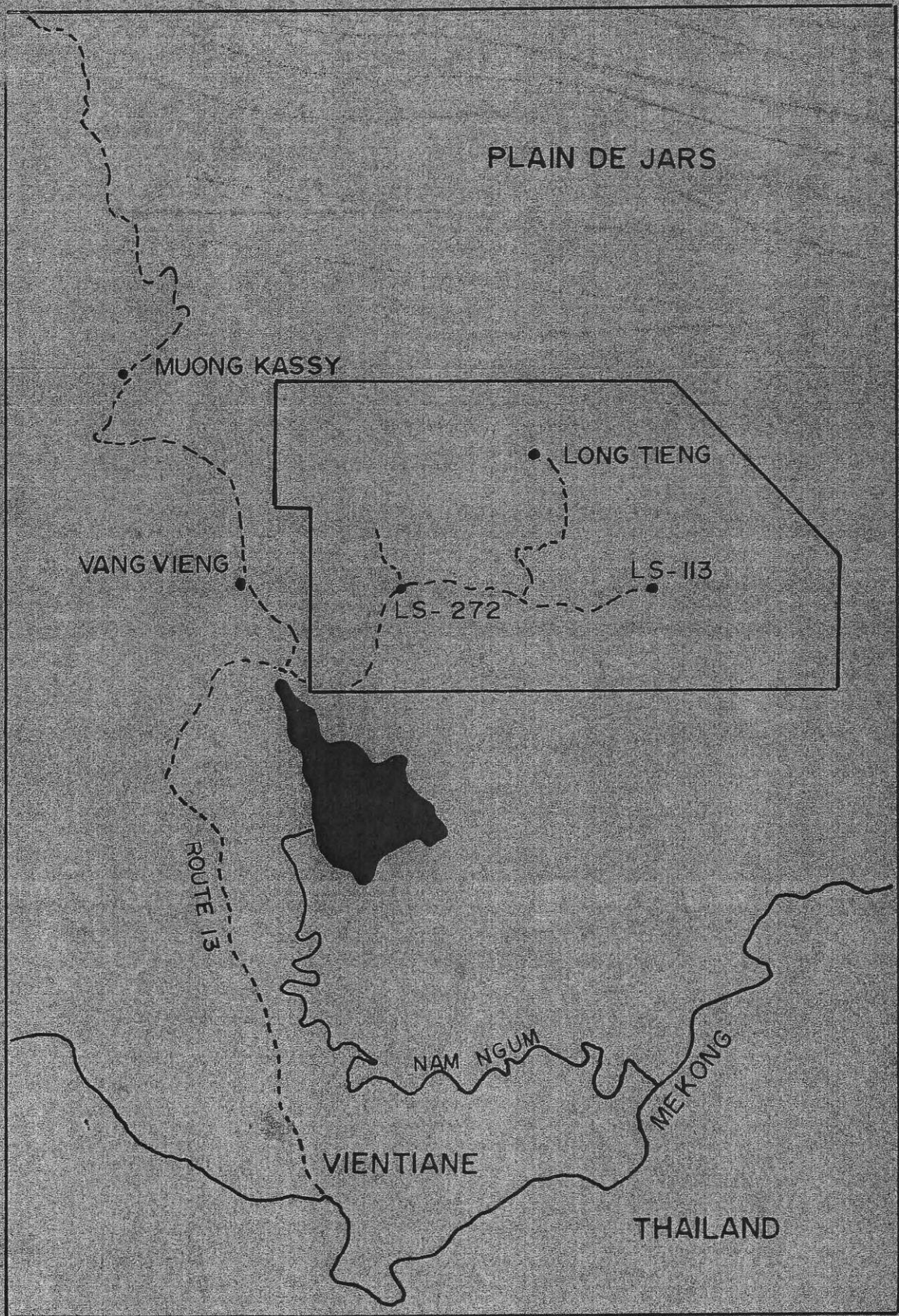


FIG 1 LOCATION MAP SURVEY AREA

The field survey was unique in the sense that a total census was conducted in a very short time over rugged territory. A repeat of this effort will be hard to duplicate, because of the manpower (80 persons) and the extensive logistical support required. The data collected had one serious flaw, and that is the incomplete identification of the exact location of over half of the settlements. This coupled with the loss of a greater part of the survey team maps - rendered the data only partially useful - and site by site analysis is not practical at this time.

The total number of households and population in the area was obtained - thus making it possible to arrive at an average household size for quantification purposes.

LAND USE MEASUREMENT

The major land uses of the area are upland rice, wet paddy rice and poppy cultivation. Each of these land uses have a distinct characteristic which is easily identified on the aerial photographs.

The fields were identified and outlined. Proper procedure would be the data transfer from the photographs onto the base map, and thus automatically correcting for scale (altitude) and parallax. The data transfer projection equipment has not arrived. Thus a cumbersome and less accurate method had to be devised in order to come up with the total hectareage of each crop in MR II. The lack of equipment also rendered it impractical to conduct a site by site evaluation due to resulting lack of trained manpower and time constraints.

Instead, the fields were measured on the photographs using a simple dot planimeter. An attempt was made to use the center of each photograph to minimize radial distortion. The average altitude was established for the fields, and a correction was made for scale variation due to elevation.

A five by five kilometer grid was used to plot the amount of hectareage according to the location of the photo center points. This is not a very satisfactory system, but the only practical one at this time.

The amount of surplus or deficiency of rice production is identified by area or group of settlements within that five kilometer square. Certain discrepancies are caused by the fact that the area on the photographs often extend into another grid square. However, in general, it will show the relative condition of the various areas.

AERIAL PHOTOGRAPHY

The aerial photography used for this analysis was flown recently, and is part of the aerial photo coverage of Central and North Laos for land inventory purposes.

The average scale is 1:30,000 and adequate for the purpose, although 1:20,000 would have been optimum for the dwelling count. However, this would result in a 50% increase in flying time and 100% increase in the number of photographs.

The overall quality of the photographs for the survey is marginally acceptable. The flight-lines are only roughly parallel, resulting in variable side overlap. The forward overlap is irregular. Gaps and cloud cover was minimal. The tilt of the photographs were often excessive and rendering some of the material useless for cartographic needs in the future.

The photographic prints were poor, too dark, and often causing loss of information in the shadow area or the edge of the photographs. Better printing would enhance the quality of the interpretation.

POPULATION DATA

The data collected in the field and by aerial photo interpretation are reasonably close. This encourages the use of aerial photography for broad data collection purposes for other parts of Laos where the extensive area and poor accessibility would make total field data collection an almost impossible task.

The population of MR II is unique in so far that a village can consist of more than one administrative unit. This subdivision of each village is caused by the fact that after relocation the inhabitants remained within their original administrative entity.

The villages usually consist of clusters of settlements which may indicate diversity within the village.

RELOCATION SURVEY

The number of households canvassed in the field is 19,277 units. The total population as listed is 135,688 persons. This data is a straight tabulation, and no effort has been made to evaluate or correlate this material, because the Ministry of Plan has not made any effort to tabulate the data or performed any analysis.

The average household size is 7.04 persons per household as obtained from the field survey. The extreme range of household sizes for the individual settlements is between a low of 2.45 and a high of 14.30 persons per household.

AERIAL PHOTO SURVEY

The exact location and number of dwellings of the various settlements were plotted on a 1:50,000 base map (Maps 1, 2, 3, and 4). The settlements were broken down into various clusters, which showed a definite physical unity. These could be related to the administrative subdivision as mentioned before.

There were approximately 1,000 dwelling clusters (fig. 2) larger than three houses. Individual and up to two dwellings (137 clusters) were added to the count whenever the size and complexity of the compound indicated permanent habitation (Table 1). This phenomena of isolated dwellings has also been observed by the field teams.

Table 1: Size and occurrence of settlement clusters in MR II.

1 - 2	houses	137	dwelling	clusters
3 - 5	"	309	"	"
6 - 10	"	267	"	"
11 - 25	"	294	"	"
26 - 50	"	95	"	"
51 - 100	"	51	"	"
101 - 200	"	12	"	"
201 - and more houses		4	"	"
				<u>1,169 dwelling clusters</u>

An attempt has been made to identify each group of dwelling clusters with a Drop Zone or Landing Strip (See Appendix I). A surplus population exists which does not appear to belong to any of the various DZs and LSs.

The total dwelling count is 20,093 for the entire area, which includes the edge of the Vang Vieng and Vientiane Plain. The count for MR II area only is 19,483. The area conforms as closely as possible with the area covered by the field survey teams. For additional correlation, Chao Muong population records covering the surveyed area were examined (Table 2). The total population using aerial photography is 137,160 persons using 7.04 persons per household. The average population density is 33 persons per square kilometer.

Table 2: Comparison of population data.

<u>Source</u>	<u>Households</u>	<u>People</u>
Chao Muong Records	19,380	132,049
Relocation Survey	19,277	135,688
Aerial Survey	19,483	137,160
<i>Official Population List</i>	—	124,852

The highest density of population is in the known urban-like centers of Ban Xon (LS-272), Pak Mouei (LS-273), Ban Phak Ke (LS-353), and Muong Cha (LS-113). The ridge north of the Na Luang valley (Map 3) which includes Song Lao (LS-318), Phou San Nyai (LS-362) and Phu Sang Noi (LS-244) is unique in the sense that the density of settlement clusters is very high. The population density of this ridge is 2,155 households or 15,171 persons on an area of 60 square kilometers or 253 persons per square kilometer.

SURVEY VARIATIONS

The discrepancy between the field and aerial survey is approximately one percent. However, it does not mean that such correlation exists on a site-by-site basis. Some larger discrepancies have been observed in a sample check of the large, almost urban conglomeration. This does not necessarily mean that the ground sample is more accurate, rather a greater possibility of error, and greater sophistications of the respondents is likely. A much closer correlation was observed when testing clusters smaller than 50 dwellings and isolated surroundings.

The exact error could not be calculated because of the still vague identification of field data. Past experience has shown that the aerial survey varies no more than five percent on a specific field correlation. Comparison of an average field survey against an aerial survey has shown better correlation, because the field survey often misses a large percentage of villages because of the inaccessibility and lack of synoptic view of the area.

LAND USE

The major land uses in MR II are for upland rice, wet paddy rice, and poppy cultivation. The wet rice paddies are located in the few flood plains scattered through the region. The poppy cultivation concentrated on the high east-west running ridges north of the Muong Cha (LS-113) valley. Small fields, generally for local consumption, are scattered throughout the region on the higher elevations. The upland rice grows on the slopes between the paddy and the poppy.

1. Upland Rice

The total hectarage of upland rice was measured at 29,999 hectares for the total survey area. The hectarage for MR II itself measured 27,968 hectares. Approximately 2,000 hectares fall within the Vang Vieng and Vientiane Plain and an area in Borikhane Province in the southeast corner.

The highest concentration of rice is in the following areas (fig. 3):

1. Adjacent to the road from Hin Heup to Ban Xon.
2. The area north of Ban Xon (LS-211 and LS-367).
3. The ridge south of Na Luang Valley.
4. The ridge north of Na Luang Valley.
5. The area surrounding LS-255.
6. The area surrounding LS-223.

The new rice fields are concentrated in the areas #1, #2, #5 and #6. The high concentration in area #2 is related to the dense population of this ridge, and the fields have been worked for many years and very little original forest covers this ridge.

The major area of expansion of upland rice cultivation is southwards into primary forest. This trend has been started since early 1973.

The total hectarage of upland rice covers only 7.5% of the survey area, but the density varies up to almost 60% of some localities.

2. Wet Rice

The total area in wet rice paddy is 1,652 hectares (fig. 4). The flood plain serviced by Route 13 from Vang Vieng covers 445 hectares. Thus the net area under wet rice cultivation is 1,207 hectares. The total hectarage of rice on these flood plains is minimal compared to upland rice cultivation.

Expansion of wet rice is possible in many areas. However, the total area will never amount to much, because of environmental limitations.

3. Poppy Cultivation

The total poppy production is very extensive in the limestone area north of the Muong Cha (LS-113) valley, while scattered fields are evenly distributed on the higher elevations (fig. 5). The total area under cultivation in the survey area is 2,678 hectares. This includes 167 hectares in Borikhane Province. Thus the total area for MR II is 2,511 hectares.

The actual area with harvest production is still unknown, because it is expected that the extreme cold weather in January may have caused damage.

RICE YIELD

The rice yield data is very important, because it is the quantifier for obtaining the production figure - when multiplied against the area in cultivation.

The Crop Production Branch of the RLG has concluded a survey of the upland rice yields in Laos during the 1973 harvest season. This included 36 samples for Xieng Khouang Province with an average of 2,945 kilograms (weighted average) per hectare and a range between a low of 1,794 kilograms and a high of 4,096 kilograms. A loss of 30% was used to reduce the total production due to obstructions in the field, harvest, transportation and storage waste. 1255.8 kg

The average wet rice yield is estimated at 2,950 kilograms per hectare. The total loss is estimated at 20% as it is assumed that harvest practices are much more efficient on these level fields.

Since 1973 was an exceptionally good year caution should be used in using this data.

RICE PRODUCTION

The total upland rice production for MR II is 82,366 metric tons of paddy. Taking into account transportation and storage waste of 30% reduces the net production to 57,656 metric tons. After an estimated additional milling loss of 40% the net production is 34,594 metric tons of milled rice. Added to this total is the wet rice production of 1,709 metric tons of milled rice. The grand total of all types of rice production is 36,303 metric tons (Table 3).

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Table 3 hectarage and production data of the major resources in MR II.

	Area in Ha.	Paddy yield per ha. in metric tons	Production paddy in metric tons	Production milled rice in metric tons
Upland Rice	27,968	2,945	82,266	34,594
Wet Rice	1,207	2,950	3,561	1,709
Poppy	2,511	Unknown	---	---
Totals	31,686	N/A	85,827	36,303

RICE CONSUMPTION

The average person uses 180 kilograms of milled rice annually or 1,267 kilograms per average household (7.04 persons/household) in MR II. The total consumption for the area is therefore 24,689 metric tons.

RICE SURPLUS AND DEFICIENCY

Assuming that the above production (36,303 metric tons) and consumption (24,689 metric tons) is correct, the gross surplus is 11,614 metric tons of milled rice. It is assumed that other additional uses for seed, animal feed and foodstuff will require another 20% (4,938 metric tons) of the gross consumption rate. Thus the net surplus may be closer to 6,676 metric tons or 26.20% of the gross consumption rate or a 3-month additional supply.

This surplus is not equitably distributed and approximately 7,000 households live in the various 25 square kilometer blocks showing deficiency. It is estimated that in these areas the rice production can support 2,323 households. Thus a net deficiency of rice exists for 4,677 households or 24% of the total population of MR II. Of course, this deficiency is based on rice production and consumption only, and does not take into account other resources that may be available.

The distribution of surplus and deficiency is directly related to population density. A clear pattern has developed even though a simple spatial grid pattern (fig. 6 & 7) was used to relate the rice production with the population.

The major deficiency areas are: The Ban Xon (LS-272) and Pak Mouei (LS-273) region, the densely populated ridge north of the Na Luang valley, Ban Pa Khe (LS-353) region and the Muong Cha (LS-113) valley.

Deficiency is also shown in the poppy growing region in the limestone area north of the Muong Cha valley. This is critical in the sense that if the cash crop fails the population will not have adequate cash for purchase of the rice.

The apparent deficiency in the area around LS-224, south Na Luang valley, has been caused by the irregular flightlines. The photo centers are located outside these blocks, thus the rice hectarage has been plotted in the adjacent blocks. A correction has been made for the net per-capita rice surplus or deficiency as shown in figure 7, and shows no deficiency in the area.

CONCLUSION

I. The population in MR II from both the ground survey and the aerial survey appears to be less than 140,000 persons. This does not include the southern rim of PDJ nor the distant enclave area.

The total rice production due to the extremely favorable weather condition has shown a bumper crop of approximately 84,000 metric tons of paddy or 36,000 metric tons of milled rice. Thus, it is estimated that a gross surplus of 11,614 metric tons exists, or a net surplus of 6,676 metric tons.

However, approximately 24% of the population remains below subsistence in rice because the high population density of over 250 persons per square kilometer in the areas in which they live limits their ability to grow a sufficient rice crop.

In relocation planning it will be imperative to consider the resettlement of these people first from the densely populated areas so that they have an opportunity to become self-sufficient next year and reducing the net population which will require support in the future.

Indiscriminate relocation of people without regard of needs for developing self-sufficiency will simply extend the need for continued support.

II. Aerial photo interpretation for population data and land use inventory has shown its value. The extensive efforts of the field teams have indicated that data acquired is of limited value when exact locations of the settlements cannot be made.

The area measurements have indicated that land use hectarage is more accurate on the aerial photographs. The reported field estimates are less than half of the actual measurements on the photographs and would have provided erroneous information and thus wrong conclusions. The estimates would have shown that MR II is a rice deficient area.

Distribution of support has been based on the information gathered in the field. The final census - both on the ground and by aerial photo interpretation - has shown that the actual population of MR II is lower than we have been led to believe. This indicates the difficulty of our field personnel to acquire the actual population of each individual settlement because of obvious material advantage to increase the population count. Field personnel have been reporting difficulty in conducting a head count.

Using aerial photographic interpretation we have been able to determine the number of houses in a cluster. We have also been able to determine the general areas of sufficiency or deficiency. Thus a gross determination can be made of the total requirement.

With the hopeful arrival of the equipment ordered the output of this office can be even further improved so that more detailed analysis can be executed in the future.

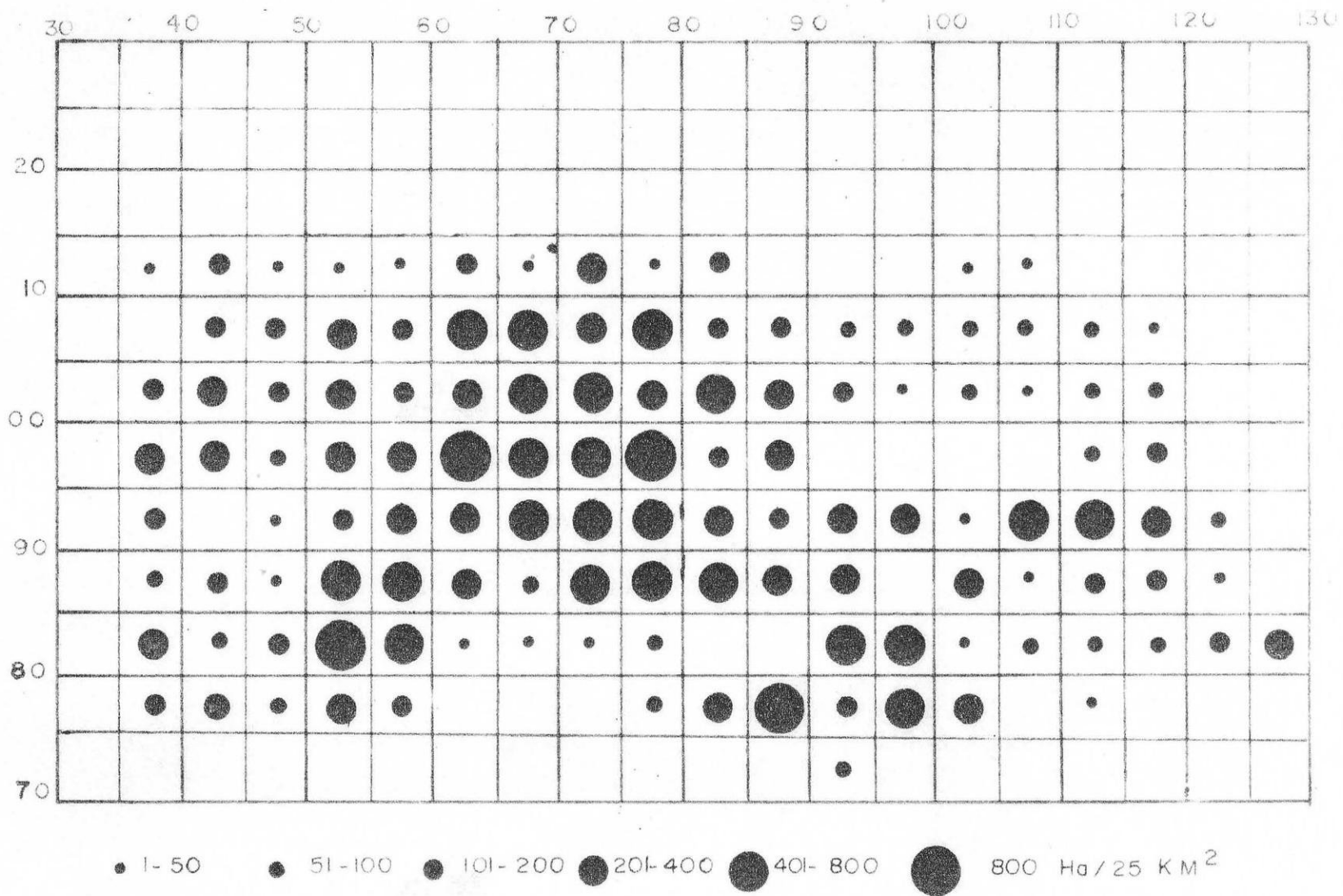


FIGURE 3. DISTRIBUTION OF UPLAND RICE HECTARAGE IN MR II.

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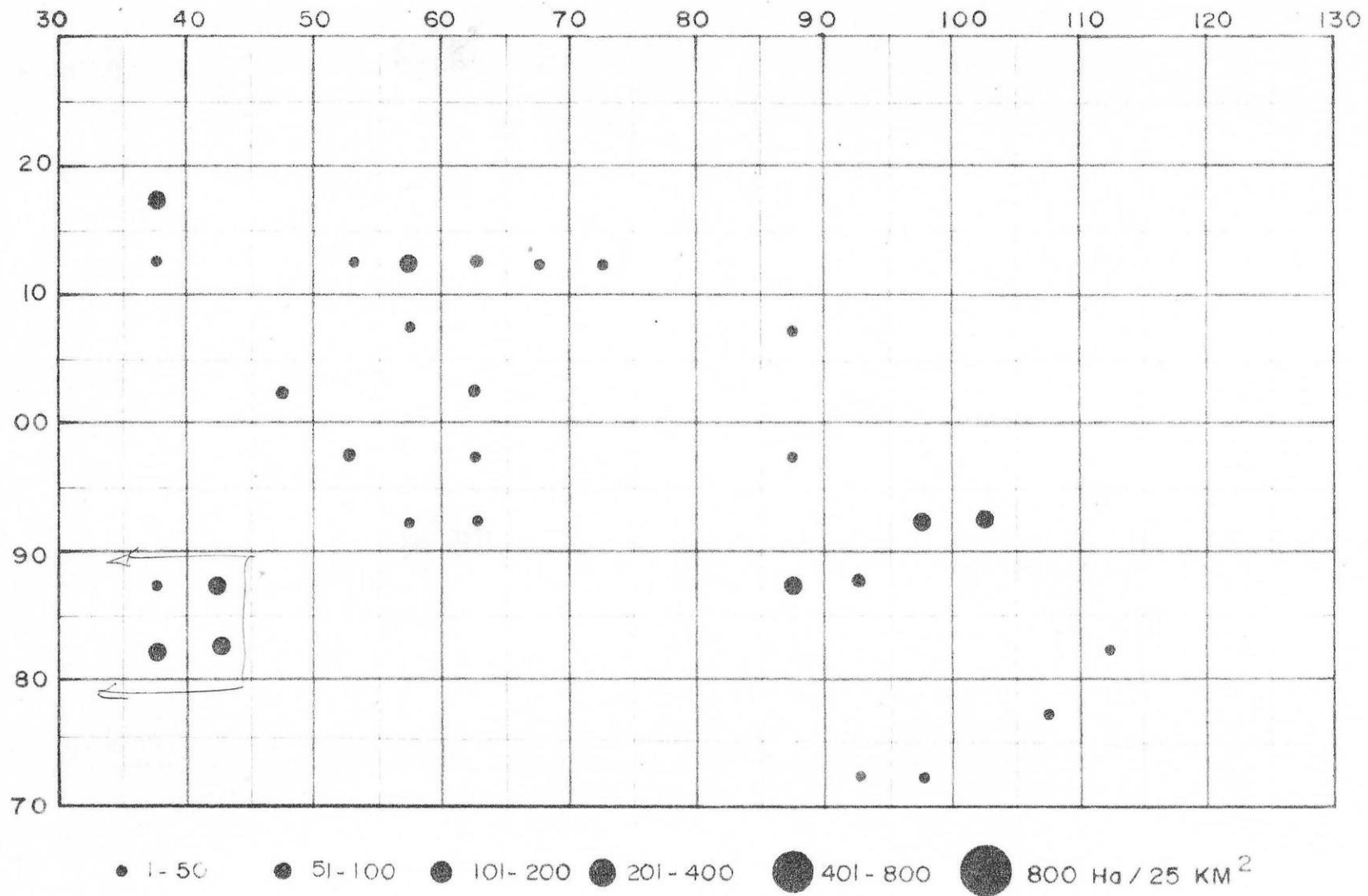


FIGURE 4. DISTRIBUTION OF WET RICE PADDY HECTARAGE IN MR. II

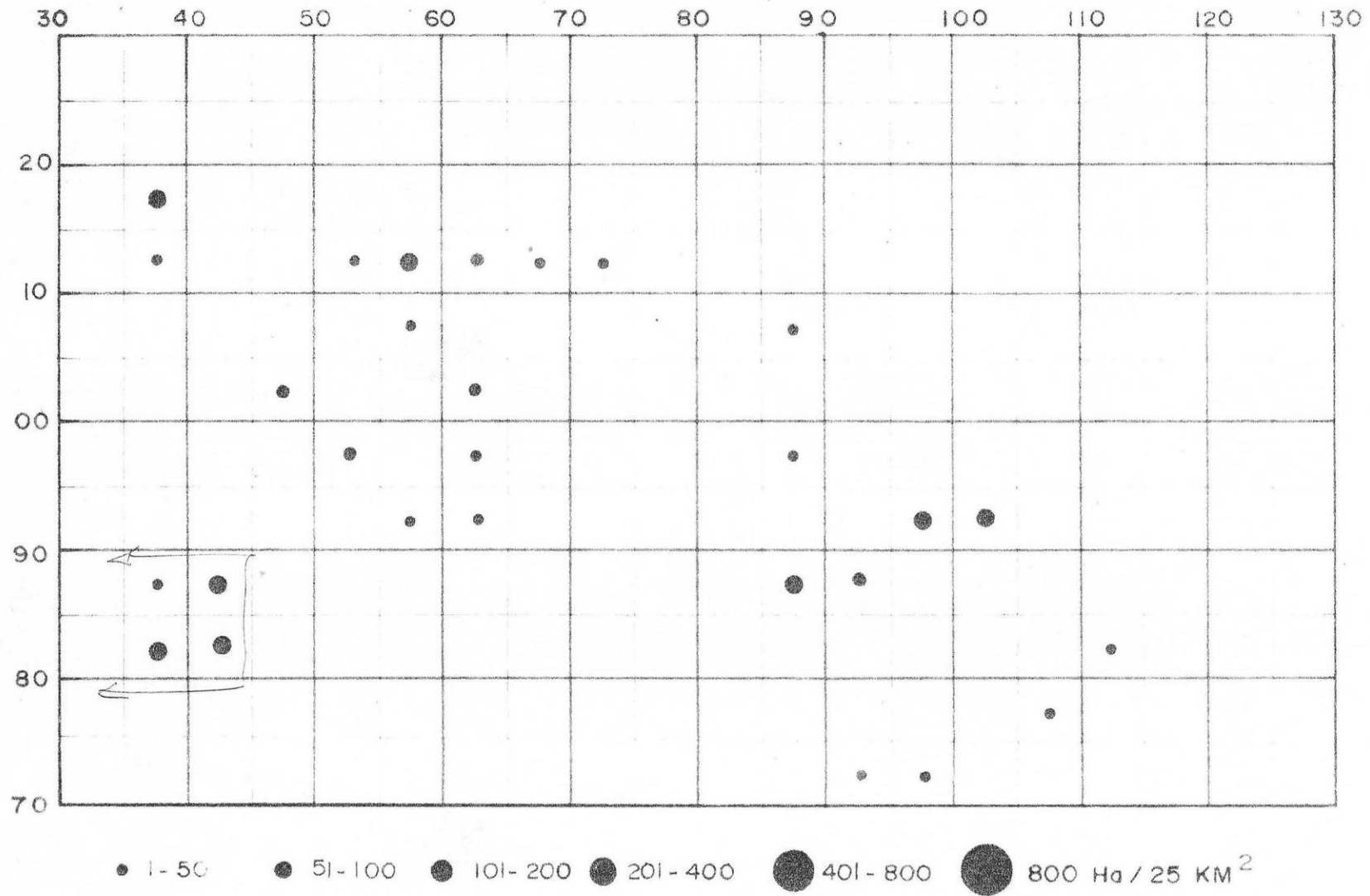


FIGURE 4. DISTRIBUTION OF WET RICE PADDY HECTARAGE IN MR. 11

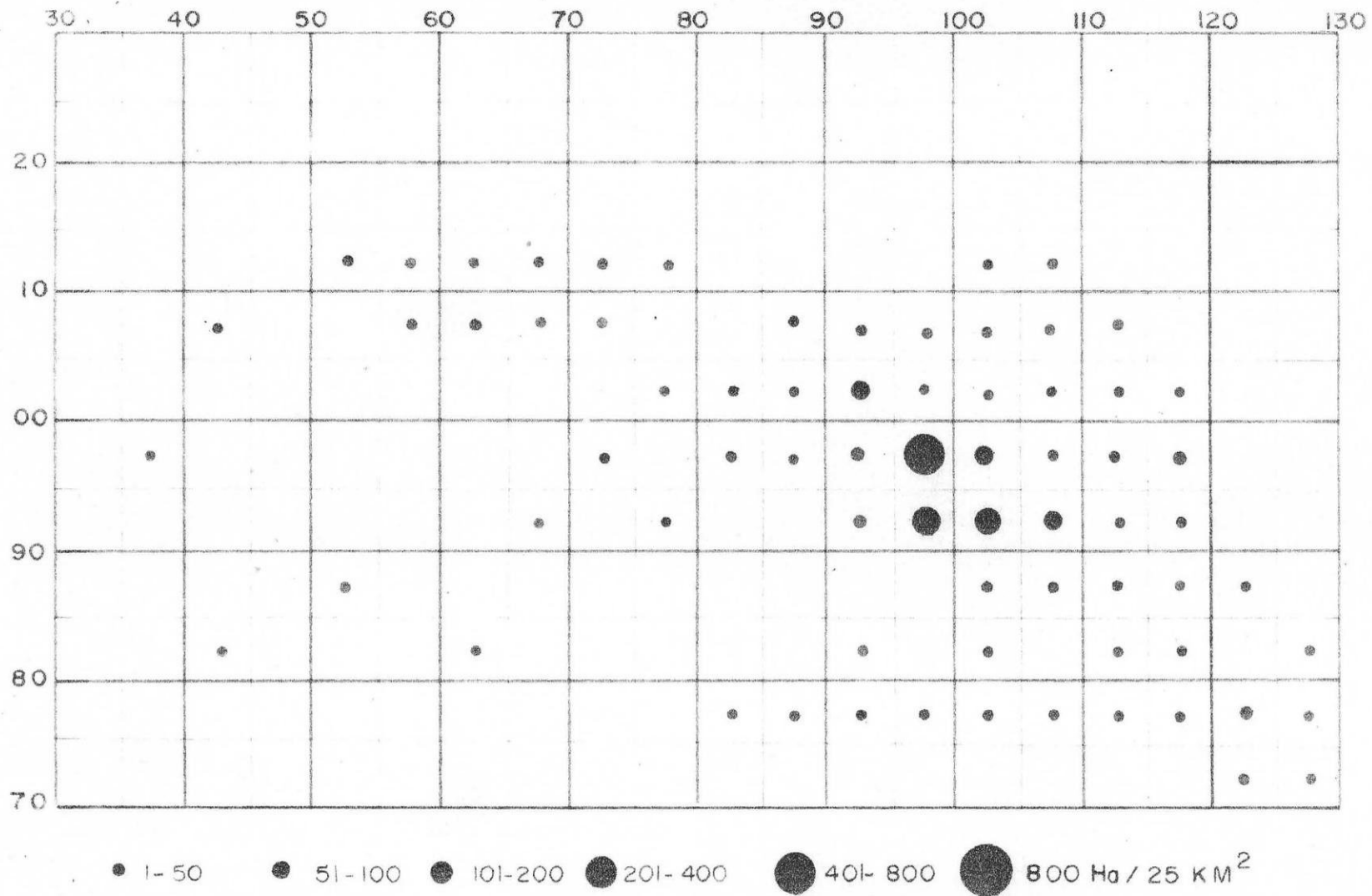
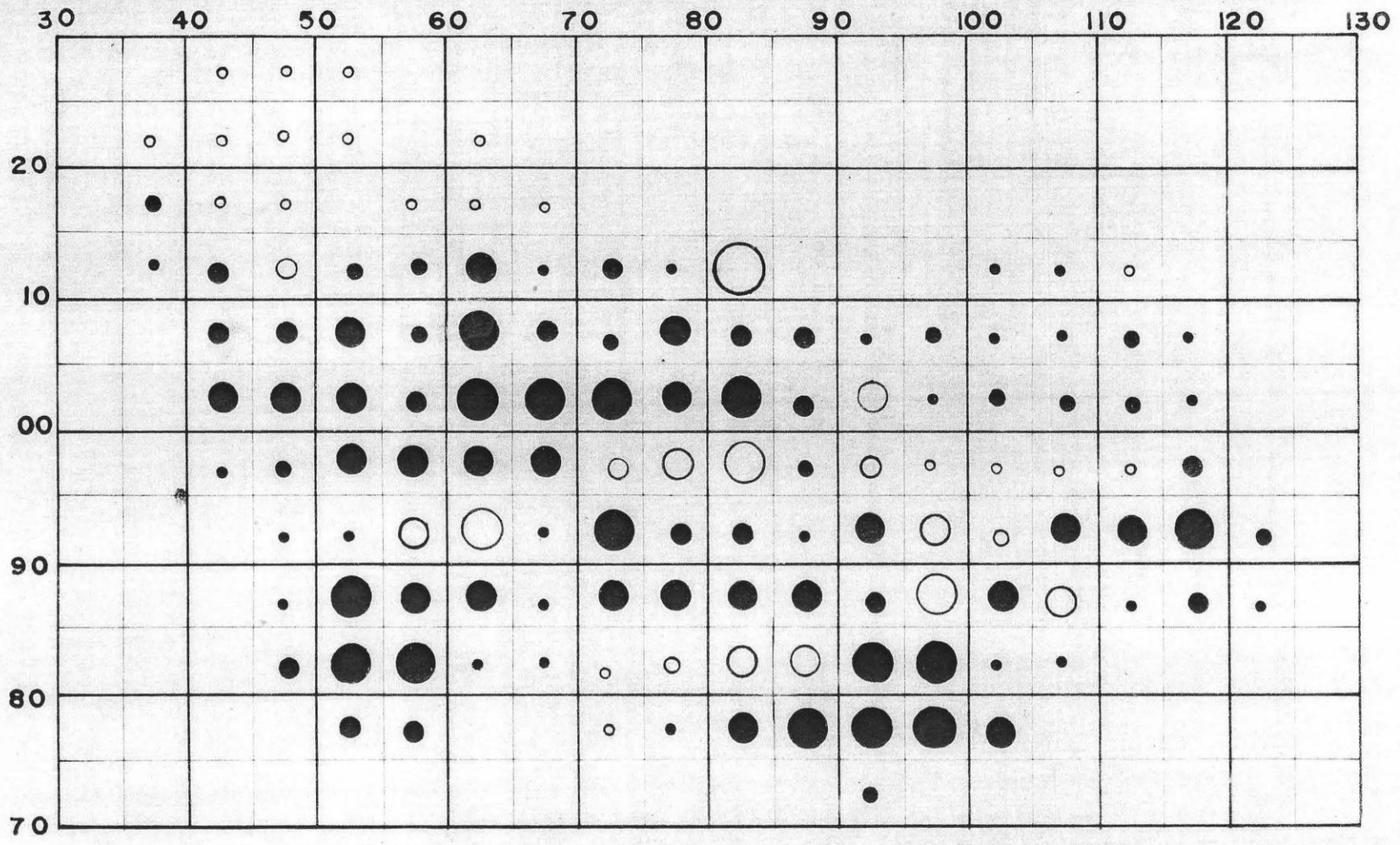


FIGURE 5. DISTRIBUTION OF POPPY HECTARAGE IN MR II.



● 1 - 50 ● 51 - 100 ● 101 - 200 ● 201 - 400 ● 400 - 800 TONS / 25 K M²
 ○ OR DEFICIENCY ○ FOR EACH 25 SQUARE KILOMETER BLOCK.

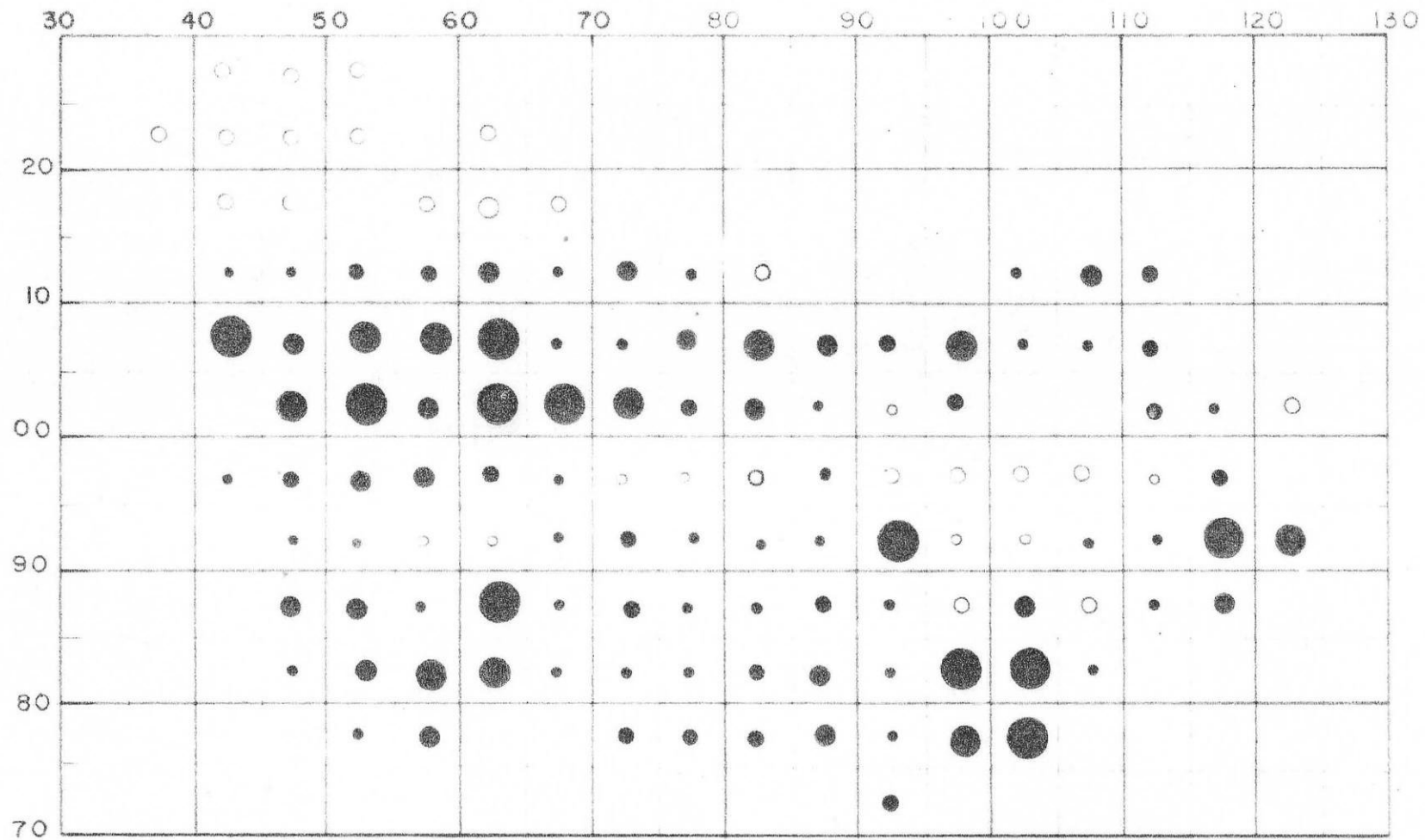


FIGURE 7. PER HOUSEHOLD RICE SURPLUS ● OR DEFICIENCY ○ FOR EACH 25 SQUARE KILOMETER BLOCK.

APPENDIX I

Comparative listing of the population of MR II from a list compiled 29 May 1973, by USAID, and the aerial photo dwelling count.

The aerial photo population numbers include those settlement clusters which are within reasonable distance from the LS or DZ. The dwelling count has been multiplied by 7.04 to arrive at the population size of each site.

<u>LS or DZ</u>	<u>Coord.</u>	<u>Signal</u>	<u>Name</u>	<u>Aerial Photo Count</u>	<u>May 1973 USAID Population List</u>
LS-05	UG-0212	I	Pa Dong	183	700
LS-14	TG-9205	T	Pha Khao	1288	1,016
LS-32	UG-2686	U	Bouam Long	--	---
LS-37	TG-6114	II	Muong Phun	605	840
LS-51	TG-6337	PK	Pha Khe	105	205
LS-66	TF-6692	L	Na Luang	1182	1,369
LS-90	TG-5020	T	Tin Bong	204	---
LS-97	TG-5620	-	Ban Pha En	98	---
LS-113	UF-0091	F	Muong Cha	3372	4,681
LS-191	TF-9387	E	Thong Kheun	1612	1,320
LS-207	TF-8287	L	Nam Mon	3076	4,107
LS-211	TF-6299	-	Phone Sai	781	---
LS-218	TF-8096	O	Nam Pha Noi	872	2,882
LS-223	UF-1491	L	Nam Feng	2403	2,907
LS-224	TF-8282	-	Houei Nam Om	711	---
LS-227	UF-0781	WK	M. Ao Neua	647	775
LS-229	TG-7304	-	Pong Ta	126	---
LS-244	TF-7195	E	Phu Sang Noi	1435	3,483
LS-251	TF-7782	4	Phu Khan Hua	415	270
LS-252	TF-7191	T	Na Tou	204	986
LS-255	TF-9377	T	Phu He	3745	7,055
LS-266	TF-8987	P	Thong Miang	1717	3,200
LS-270	UF-0990	O	Phu Sang Ngop	1147	1,044
LS-272	TF-5994	-	Ban Xon	7518	20,000
LS-273	TF-6493	MT	Sop Mouei	1119	7,155
LS-281	TG-4901	-	Ban Na Kouang	309	---
LS-284	TF-5594	-	Houei Sai	1182	---
LS-288	TF-7795	K	Nam Yon	1224	3,411
LS-307	TF-7896	NH	Nam Yon Neua	1365	1,645
LS-313	TG-6506	E	Nam Luang	1893	5,094
LS-316	UF-1194	N	Tham Lo	1886	2,235
LS-317	TF-9590	T	Thong Khen	1591	4,417
LS-318	TF-7398	8	Song Lai	696	1,135
LS-319	TG-4505	-	Muong Sao	140	---
LS-321	TG-9402	VN	Nyot Mon	1041	1,201
LS-330	TF-9483	AL	Thong Noi	549	933
LS-331	TF-7694	L	Keo Sakai Neua	901	800
LS-33	UF-0893	EI	Nam Fen Neua	1091	2,125
LS-334	TF-9990	WI	Tung Cha	809	485
LS-335	TF-7295	UI	Nam Vep	2255	3,539
LS-337	TG-7309	EE	Phu Khao Neua	1837	3,190
LS-340	UF-0689	LA	Pa Dong Noi	584	798
LS-341	TG-7303	-	Pha Deng	260	---

<u>LS or DZ</u>	<u>Coord.</u>	<u>Signal</u>	<u>Name</u>	<u>Aerial Photo Count</u>	<u>Population List</u>
LS-344	TF-9887	K	Nam Poun	2689	2,758
LS-349	UF-0686	TH	San Kak	1576	2,293
LS-353	TF-8498	E	Pha Khe	8602	20,727
LS-362	TF-7598	PH	Hua Phu Sang	2520	3,418
LS-363	TG-4413	F	Nam Song	344	1,967
LS-367	TG-6604	X	San Bouam Moh	464	457
LS-368	UF-1496	-	Ban Ta Lou	35	---
DZ-016	TG-8605	VF	Phu Vang Fung	274	282
DZ-031	TF-7991	III	Phu Houei Kham	323	1,749
DZ-047	TF-8093	V	Muong Yon	950	1,494
DZ-0119	TG-6211	LO	Don Nya	190	208
DZ-0125	TF-7190	A	Nyot Tou	429	2,808
DZ-0128	TG-6501	FH	Bouam Moh	640	1,208
DZ-0145	TG-8009	KI	Nam Choi	140	219
DZ-0146	TF-7691	NI	Nam Ian	528	328
DZ-0156	TF-8198	TL	Phu San Kang	1661	1,071
DZ-0166	TF-7693	P	Keo Sakai Kang	577	700
DZ-0175	TF-6595	P	Hat Khouang	492	485
DZ-0176	TG-6005	HP	Keo Mak Feuang	591	1,263
DZ-0184	TG-9203	KK	Phu Fai Mai	1330	5,316
DZ-0190	TF 8482	AT	Houei Kham Lang	788	648
DZ-0192	TF-9690	H	Na Li	646	5,849
DZ-0193	TF-7292	IP	Nam Thong	598	1,005
DZ-0194	TF-8779	LI	Phu Kheung	570	1,329
DZ-0196	TF-6896	ZI	Houei Lao	1422	3,243
DZ-0201	TF-9778	III	Sop Ao	633	439
DZ-0202	UG-0707	HO	Phu Bia	872	1,025
DZ-0204	TG-7900	A	Pha Houei	725	874
DZ-0205	TF-8795	LL	Pung Moh	647	1,210
DZ-0206	TF-7791	TI	Keo Sakai Tai	260	1,780
DZ-0208	TG-9108	L	Nyot Moh	253	623
DZ-0209	TG-8805	FF	Long Muong	492	606
DZ-0210	TF-8999	I	Pha Nok Kok	337	1,584
DZ-0212	TF 8091	HH	Keo Pha Kheun	246	500
DZ-0216	TG-8200	UI	Pha Chong	894	1,600
DZ-0224	TF-7899	TT	Keo Pha	556	1,073
DZ-0230	TF-7895	VL	Phu Muong Yon	760	107
DZ-0232	TG-6411	T	Nam Khouak	380	583
DZ-0236	TF-7797	WX	Phu Sang Nyai	1140	3,324
DZ-0237	TF-7989	T	Pouei Kham Tai	661	599
DZ-0239	TG-7103	FL	Houei Nam Phai	168	187

<u>LS or DZ</u>	<u>Coord.</u>	<u>Signal</u>	<u>Name</u>	<u>Aerial Photo Count</u>	<u>Population List</u>
DZ-0240	TF-7197	H	Kang Mai	696	823
DZ-0243	TG-8005	H	Phu Vieng	471	787
DZ-0244	TG-4303	VV	Phu Ban	401	712
DZ-0247	UF-9164	II	Phu Ma Tau	--	---
DZ-0250	TF-7992	IO	Ban Phon	457	720
DZ-0251	TG-4410	NW	Nam Kheuang	654	558
DZ-0252	TF-5899	AL	Phu Kang Nyai	373	352
DZ-0253	TG-7111	K	Phu Mi	147	260
DZ-0256	TG-4417	PU	Nong Kho	168	375
DZ-0261	TF-7998	XT	Nong Pa	485	1, 100
DZ-0263	TF-8394	PI	Nam Sak	577	192
DZ-0264	TF-6995	HK	Houei Chuang	696	762
DZ-0268	TF-9198	PP	Nam Sai	337	1, 071
DZ-0270	UF-0593	VO	Pha Ka Tai	344	550
DZ-0273	TG-6715	IL	Keo Tom	239	335
DZ-0276	TG-6601	IV	Houei San	633	764
DZ-0278	TF-9386	OO	Phu Vieng	246	306
DZ-0279	TF-9892	44	Muong Decha	345	411
DZ-0283	TF-7497	YI	Nam Kok	520	653
DZ-0284	TG-7108	TV	Phu Mi Tai	795	562
DZ-0285	TF-6885	PV	Sop Moh	408	551
DZ-0286	UF-8881	LK	Phu Long Noi	--	---
DZ-0287	TF-7890	XX	Tin Phu	464	450
DZ-0288	TG-8402	EF	Houei Hom	450	256
DZ-0289	TF-5386	NT	Sam Phu	401	625
DZ-0291	TG-4404	HI	Nam Sa Lai	274	297
DZ-0292	TF-4399	Y	Nam Sing	1084	664
DZ-0293	TF-5986	SS	Phu Xe Noi	964	1, 625
DZ-0295	TF-8603	X	Pouei Tat	619	833
DZ-0296	TF-5576	O	Pha Ka Dong	98	219
DZ-0297	TF-6393	S	Sop Xang	408	531
DZ-0298	TF-5778	HL	Nong Kop	218	209
DZ-0299	TG-3924	AO	Nam Khoung	218	324
DZ-0300	TF-5084	TI	Phu Dok	647	1, 502
DZ-0301	UF-9373	HI	Nam Ngu	--	516
DZ-0302	TF-8994	T	Pha Nok En	105	199
DZ-0303	TF-7885	O	Nam Nok	168	232
DZ-0304	TG-5513	AL	Nam Deng	401	415
DZ-0305	TG-4221	HA	Nam Noi	126	161
DZ-0306	TF-5288	FA	Houei Sa Ngai	401	518
DZ-0308	TF-9199	HF	Houei Khi Nin	570	275
DZ-0310	TF-8686	I	Thong Hak	408	298

<u>LS or DZ</u>	<u>Coord.</u>	<u>Signal</u>	<u>Name</u>	<u>Aerial Photo Count</u>	<u>Population List</u>
TG-6003		FS	Keo Mak Feuang Tai	133	158
UF-1899		IF	Pha Hia	344	154
TG-7806		Z	Nam Van Wai	126	207
TF-7291		E	Nam Tou	176	220
TF-7879		HI	Houei Nam Oun	323	71
TF-6083		EN	Nam Khuang	77	66
TG-7013		N	Houei Ha	302	45
LSs & DZs				Total =	108,757
Population distant from LSs & DZs				28,403	N/A
Total =				137,160	194,856

D Km 37 105/740
 33 12/84
 31 62/436
 25 64/450
 22 48/338

TO : Mr. Charles A. Mann, Director

March 30, 1973

FROM : Dr. Heng Thung



SUBJECT : Aerial Survey of Poppy Cultivation in Northern Laos

Summary

The objective of the project is to estimate the opium production in regions of North Laos that are relatively secure. These include potential poppy growing areas in Ban Houei Sai, Sayaboury, Luang Prabang and Xieng Khouang Provinces covering a total of approximately 20,000 sq km (7,720 sq mi). Only 11,000 sq km (4,250 sq mi) was recovered because of camera failure. However, correlations and field observations were used to estimate the poppy cultivation in the areas not photographed. Additional field data was obtained for an area in Xieng Khouang Province. The final total area analyzed is approximately 19,000 sq km (7,335 sq mi).

The area in poppy cultivation within the 11,000 sq km area photographed was measured at 2,211 hectares (5,461 acres). Additional areas amounting to 1,160 hectares (2,866 acres) were included in the calculations by correlation of field data within the remaining 8,000 sq km. The total land in poppy cultivation is 3,371 hectares (8,326 acres) for the whole 19,000 sq km.

The analysis of the yield data of opium showed a wide range from 0.2 to 25.0 kg per hectare of poppy field. The average low figure is 2.4 kg, the average median is 6.0 kg and the average high is 16.0 kg of opium per hectare. The Xieng Khouang sample indicates that 2.18 is the average yield. However, this may be a low figure and the acceptable average for a normal year, it is believed, is closer to 6.0 kg per hectare.

Quantification of the 3,371 hectares of poppy cultivation with the yield figures above gives a range of poppy production from a low of 8.09 metric tons (yield 2.4 kg/ha) to a high of 53.94 metric tons (yield 16.0 kg/ha). The average production figure for that same area is 20.23 metric tons using the yield of 6.0 kg per hectare.

Note that these figures are valid for the project area only. There are other uses of aerial photography which can be used for planning and execution of the various aspects of the overall Narcotics Control Project. The analysis of the survey so far has been mostly restricted to improving the estimates of opium production as stated in the beginning of the summary as to the objective of this initial limited aerial survey.

SURVEY OF POPPY CULTIVATION IN NORTHERN LAOS

Objective

The objective of the project is to obtain a measure of the opium production in Northwest Laos using aerial photographic methods. The area under poppy cultivation as measured on the photographs is further quantified using opium yield data from the field.

Area

The area selected totals 19,000 sq km (7,450 sq mi) in the Ban Houei Sai, Sayaboury, Luang Prabang, Vang Vieng and Pak Lay regions (Fig. 1). The selection was based on the security situation in these regions. Other potential regions were not covered because of lack of security. High-altitude photography was planned over these regions to provide a sample. This plan was abandoned because of various operational restrictions. Camera failure further limited the aerial photo coverage. The final area flown is 11,000 sq km (4,250 sq mi) or 55 percent of the originally scheduled area. Camera repair and present smog conditions are preventing further recovery of the areas not flown this season.

The following is a breakdown of the areas:

	<u>Scheduled</u>	<u>Usable Coverage</u>
Ban Houei Sai	2,800 KM ²	2,600 KM ²
Sayaboury	5,400 KM ²	5,400 KM ²
Luang Prabang/Vang Vieng	7,800 KM ²	3,000 KM ²
Ridge with LS 258	1,000 KM ²	.
Pak Lay	2,300 KM ²	-
Total	19,300 KM ²	11,000 KM ²

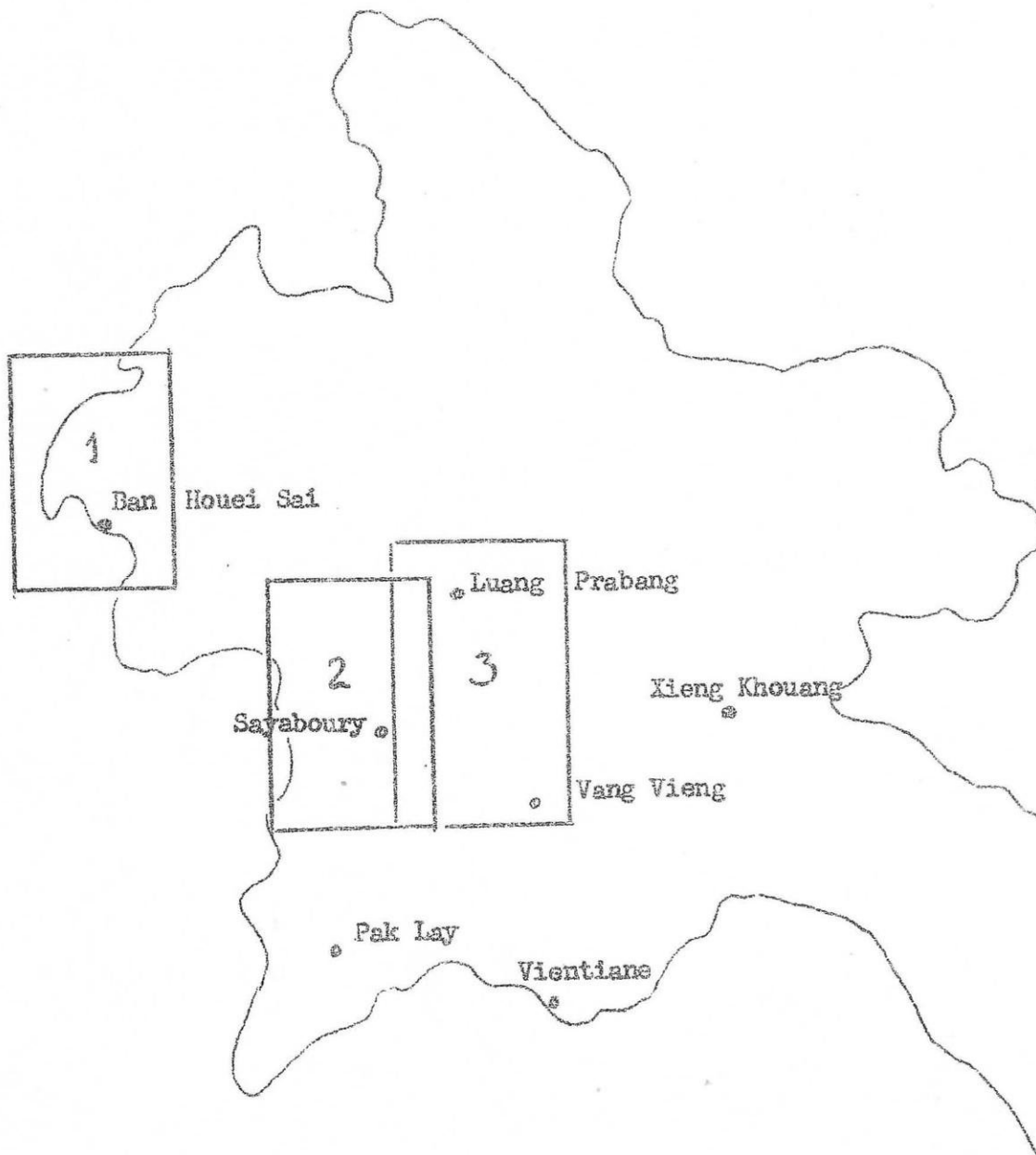


Fig. 1. The Locations of Detailed Poppy Distribution Maps

Photography

The photographic coverage is continuous for large blocks of area. This wider coverage allows multiple use of the material at a later date, and it also facilitates regional analysis of relationships between poppy cultivation and the environmental and socio-economical aspects of the regions.

The aerial photographic missions were conducted using a twin engine aircraft (Volpar) flying at an altitude between 10,000 and 14,000 feet above mean terrain elevation at an average speed of 130 knots. The camera used was a Wild RC-8 percussion mapping camera with a six-inch lens and a 9-by-9-inch format.

A total of approximately 2,200 frames were exposed, requiring approximately twelve 250 foot rolls of Kodak Double X Aerographic film.

The operation, support, and processing was coordinated by Detachment 3, 6003rd Support Squadron. Their cooperation was excellent; they were responsible for the fast execution of the mission and should be given credit for success of the project despite the difficulty of repeated camera failure.

The photographs have the following characteristics:

1. Vertical photographs of 9" by 9" format.
2. Scale at average base elevation is 1:20,000 and 1:25,000. The actual scale depended on the topographic elevation and varied between 1:12,000 and 1:27,000.
3. Flightlines are acceptable. The forward overlap for stereo viewing is approximately 50-60% and the side overlap is 0-75%.
4. Image quality is good to excellent, allowing easy identification of poppy fields.
5. Cloud cover is minimal; most of the cloud cover occurs around high peaks and ridges thus obscuring some potential poppy growing areas.

Analysis Procedure

The photographs have been indexed and plotted on 1:50,000 scale topographic maps (L7015 Series). This step is necessary for locating the photographs and plotting the fields on the maps.

Identification

The fields were identified by using various characteristics of the cultivation pattern of this crop.

1. Size - The poppy fields are usually small compared to such crops as rice. Even the rare large fields consist of a conglomerate of smaller fields.
2. Texture - The poppy fields have a very smooth texture (silky). This characteristic is the result of careful weeding of the fields and a rather uniform thin crop.
3. Tone - The tonal characteristics are light to medium grey depending on the sun angle. Tonal variation within one field is usually very gradual and indicates a variation of moisture content of the soil or uneven distribution of the crop. Low altitude photography may show some row patterns which are caused by the walking pattern during weeding and tapping and not caused by planting.
4. Location - The fields are located at an altitude above 600 meters (1,800 feet). A few fields were observed lower, but these are exceptions to the rule. Most fields are at an average altitude of 1,000 meters.
5. Slope position - The fields are usually located on the slope of a hill or ridge, and rarely on the ridgeline itself. The ridgeline is usually subject to drought during the period that the poppy is cultivated.
6. Rock/soil conditions - The poppy fields have been observed on various soils, although extensive fields have been related to limestone formations. The good commercial size fields have been located on the hill slopes below the limestone outcrops, because of deeper soils and more fertile conditions. Sinkholes in the limestone have often been favored for the same reasons, but generally they are small. Fields have been found on the limestone itself, but the rock outcrops reduce the usable areas by more than 50%.
7. Season - Poppy cultivation is related to the cold season. The planting starts in October with the harvest through March. In general, this is the major crop at this time of the year after the rice harvest. So the activities of the poppy fields

deviate from the normal agricultural season because they fall mainly in the dry period. This season also coincides with the weather window for aerial photography.

Measurements

The area measurements were kept simple because of the limited effort and time frame of the project. The fields were directly measured on the photos using simple dot planimeters; untrained technicians performed the more routine operations. The acceptable maximum error is approximately 20%, while the average is more likely in the 10% range.

1. The identified fields were measured using dot planimeters with a density of 25 dots per square centimeter. This method is fast and consistent when only untrained technicians are available.
2. Only the center section of the photographs were used whenever possible to minimize the radial distortion caused by the high topographic relief. Stereo-plotting was not used for this initial effort because it would require additional time to properly train the technicians.
3. The altitude of each conglomerate of fields was noted after plotting the field location on the topographic map.
4. A conversion table was made to correct for scale variations caused by the topographic relief and low flying altitude.
5. The measured areas were tabulated and the conglomerate of fields with a total of more than one hectare was plotted on a distribution map to show the various concentrations of poppy fields (Maps 1, 2, and 3).

Area measured

The distribution of poppy fields is shown on the attached Maps 1 through 3 of Ban Houei Sai, Sayaboury, and Luang Prabang/Vang Vieng regions.

The total area measured in the various regions are the following:

1. Ban Houei Sai	931 hectares
2. Sayaboury	
Along the Thai border	445 hectares
Along the Mekong	475 hectares
3. Luang Prabang	291 hectares
4. Vang Vieng	<u>69 hectares</u>
Total measured	2,211 hectares

Ban Houei Sai area (Map 1)

The highest concentration of fields is located in the central highlands of the region where the elevation reaches 1,800 meters (5,400 feet). Smaller concentrations are found along the eastern edge of the photographed area. The extent of these fields is more limited compared to the concentration in the central highlands. However, it does suggest that more fields can be located beyond the aerial photo coverage.

The distribution of the poppy fields is directly related to altitude. Access to transportation is short for any point and never more than 30 km from the Mekong River and the international borders.

The security conditions have been altered and movement of the population out of the area will undoubtedly have affected the total production of opium, which will be lower than in other years.

Sayaboury - Thai border (Map 2)

Extensive fields are found in the highlands bordering Thailand. The elevations reach a maximum of 2,300 meters (7,000 feet). The fields are hard to reach by surface transportation from the Sayaboury valley, although access to Thailand is easy through the insecure border area. There are, however, three landing sites in the area. One of these, LS-42, shows significant relationship with the opium production in the area; very extensive fields are within immediate reach of the landing site. Trails between the fields and the landing site indicate that transportation of the opium may be accomplished by air.

Sayaboury - Mekong (Map 2)

The distribution of fields again related to the highlands. Most of the fields are evenly distributed along the ridges. However, a very high concentration is located on a ridge overlooking the Thadeua ferry crossing only 5 km away. Another high concentration is located farther north on a ridge also overlooking the Mekong.

The aerial photographic coverage does not extend farther eastward. However, some rather extensive fields have been noted along the extreme edge of the photo coverage indicating that more fields exist towards Luang Prabang. Field observations concur, although the extent is limited as the highland area decreases in that direction.

Luang Prabang (Map 3)

The photographic coverage extends north-south over a 20 km strip east of the Royal Capital. The extensive fields are located on the slopes of the limestone outcrops east and southeast of the city. Some cultivation was noted on the limestone itself, but the rock outcrops were visible and reduce the usable soil surface by at least 50%. Several smaller concentrations of fields are located on the various hills farther south.

Vang Vieng (Map 3)

There are several concentrations of fields east and south of Muong Kassy. Only one area is significant, which is located on a limestone ridge 20 km north of Vang Vieng. Several scattered concentrations are located adjacent or near Route 13 in the area.

Whole areas between Luang Prabang and Vang Vieng have been denuded of forest, and may be a reason for the lack of poppy cultivation in spite of the high elevation.

Areas Estimated

The poppy cultivation in the areas not photographed was estimated by correlating the characteristics of poppy fields obtained from the aerial photographs, field observations and other pertinent data which was obtained from individuals who live and have worked in these areas.

The significant characteristics are: altitude, rock formation, soil conditions, transportation and population. Unfortunately the population movement has been significant since the compilation of the topographic maps. However, correlation of dwellings plotted on those maps at an altitude of 1,000 meters and above are still valuable as a substitute for some of the aerial photo information.

An attempt has been made to use ERTS imagery as a substitution. The cloud cover and relatively poor resolution prevented the use of this material.

The estimated area under poppy cultivation in the missing strip south of Luang Prabang, east of the Mekong (Map 3), is the following:

Limestone ridges between Luang Prabang and Phou Chia (LS-25)	392 hectares
Phou Chia (LS-25) and surrounding area	106 hectares
Highlands south of Phou Chia	207 hectares
Ridge (LS-258) north of Ban Sanakham	<u>57 hectares</u>
Total	762 hectares

Areas from Field Data

Opium cultivation data is available from an area in the southwest corner of Xieng Khouang Province. This data has been collected to estimate the compensation of poppy fields damaged by alleged spraying.

The data covers information of fifteen villages inhabited by 252 households claiming compensation. The total area in poppy cultivation claimed is listed as 398.2 hectares. The area measurements are given in the length and width of the fields. The exact system of measurement is unknown, and the values may be rough estimates. The actual area may be smaller if the maximum length and width of irregular sized fields were measured.

Field observers have also spotted some concentrations of fields along the banks of the Mekong north of Hong Sa, and in some of the highland areas in Pak Lay province. The reports do not indicate extensive fields.

Total Area

The total area under poppy cultivation for the 1972/73 season in the original project area is estimated at 2,973 hectares. This figure includes 2,211 hectares measured and 762 hectares estimated. The additional field data for Xieng Khouang Province accounts for at least an additional 398 hectares, making the total area 3,371 hectares.

Opium Yields

The opium yield figures are important for quantifying the area information in order to derive the total production of the region. The present available data is highly variable. No other specific information accompanies the yield data which may indicate the causes or circumstances for the variance.

The following is a list of yield figures and their sources:

1. Agricultural Division (opium trader)		2.4 Kg/ha
2. PSD advisor BHS		6.7 Kg/ha
3. Field Report BHS		12.0 Kg/ha
4. Agricultural advisor BHS	Large	4.8- 5.2 Kg/ha
	Maximum	20.0 Kg/ha
	Average	12.0 Kg/ha
5. Lao administrator		25.0 Kg/ha
6. Tribal Research Centre Thailand		6.0-20.0 Kg/ha
7. Burma report		6.1-16.2 Kg/ha
8. Xieng Khouang 252 samples	Large	0.2-17.1 Kg/ha
	Median	2.4 Kg/ha

The above figures show an average range of yield data from 0.2 to 25.0 Kg per hectare.

The 252 samples of poppy yields from Xieng Khouang province ranged from 0.2 to 17.11 kg per hectare. The total area in poppy cultivation of this area is 398.2 hectares.

The yield figures are divided in three groups: (a) from 0.2 to 5.5 kg, (b) from 5.5 to 6.5 kg, (c) 6.5 kg and above. The percentages of area covered by each group is the following: (a) 97.47 percent, (b) 1.05 percent, and (c) 1.48 percent. Therefore the average of 2.4 kg per hectare is a more valid figure for this area.

A correlation of the field size and yield indicates that the increase of field size leads to a decrease of productivity. The high yield figures between 6.5 and 17.11 Kg represents a group of fields with an average size of 0.54 hectares. The lowest yields of less than one hectare are related to very large fields with sizes up to 12 hectares.

This indicates that higher productivity of the small fields can be attributed to a better selection of site and better cultivation practices.

No analysis has been made of the bias of the field data. It was expected that the figures would be higher, because of the fact that the figures were collected for compensation purposes.

The yield figure of 2.4 kg per hectare from a well established opium trader (source no. 1) falls within the first and largest group of samples of the Xieng Khouang data. The average figure of 6.0 kg was given as a low yield figure by other sources and falls within the second group of the Xieng Khouang data. The high values are not impossible as reported in the same large sample, although the total area represented is rather minimal.

The wide range of yield figures available from the different sources can be attributed to a variety of reasons, of which we can list a few:

1. No actual measurements have been made of a large sample. Most of the yield and the area estimates are given by the tribesman and these estimates incorporate every possible bias. Often the yield data is based on the performance of a family whose size is usually not specified.
2. No actual relationship of soils is recorded. The poppy is grown on almost any soil provided that the altitude, and moisture requirements are satisfactory.
3. The number of seasons that a field has been in use is not recorded. This is important, because the fields derive their fertility from the ashes of the burned vegetation. The production of the fields decreases rapidly with each successional use.
4. The relationship between yield and ethnic group has not been established, although it has been commonly accepted that the Yaos are the best producers of opium. This assumption is based on the high sophistication and aggressiveness exhibited by the Yaos.

Estimated Opium Production

The total area in poppy cultivation accounted for in this project is 3,371 hectares. The production is 8.09 tons if 2.4 Kg is used as the quantifying value. The production is 20.23 tons if 6.0 Kg is used. A maximum of 53.94 tons if 16.0 Kg is used.

Thus the range of production estimate for the project area is between a low of 8.09 tons and high 53.94 tons. The available yield figures suggest that the real production is more in the range of 20 tons, excluding the areas unaccounted.

It should be noted that the production figures are only valid for the area evaluated. Although it is assumed that most of the potential poppy growing areas were covered, and that poppy cultivation in the contested area is negligible. However, no verification of the last fact was available.

The fact is also important that the range of yield figures is large. Thus refinement of area measurements is less meaningful until a more accurate yield data is available for quantification.

Correlations

There are two environmental characteristics that are related to poppy cultivation. First is the obviously known requirement of a high elevation. The average elevation is approximately 1000 meters (3000 feet), while the lower limit is 600 meters (1800 feet). Second is the type of soils. Although the poppy fields have been found on all type of soils, but extensive fields are very common in areas where limestone rock outcrops are dominant.

The cultural relationships are rather interesting. The presence of government control appears to be no deterrent to poppy cultivation. The contrary appears to be more often the case. The presence of transportation, thus accessibility is a significant encouragement for growing poppies. For instance, landing strips such as LS-42 have a direct bearing to the extensive cultivation of poppy fields at their doorsteps. The same is true for Phou Chia (LS-25) and LS-258. Several extensive fields are located adjacent to the major routes, such as Route 13 from Luang Prabang. Other extensive concentrations are located within sight of the Mekong, such as the large fields near the ferry crossing at Thadeua in Sayaboury.

This situation should be considered as a specific condition in Laos, and is a function of the political and administrative conditions prevailing.

Conclusion

The objective of this project has been limited to a better determination of opium production. Other pertinent relationships between the poppy cultivation and the environmental, and socio-economical conditions were only cursory to the process of reaching the major objective of the project. Therefore only general statements can be made to indicate the areas where some deeper probes should be conducted.

The information regarding opium production is only of real value when it can be used in support of the various aspects of the overall Narcotics Control Project, such as enforcement, resettlement, and agriculture redirection programs. This requires a more regional approach to the solution. The spatial distribution and magnitude of poppy cultivation must be better understood in relation to other factors.

For instance some decision has to be made concerning the high concentration of poppy cultivation determined by this project. The question is whether this would require enforcement by law, or substitution

effort on site which may require additional transportation, or it would be more effective in the long run to move the population to another site with better agricultural potential. Such decisions require the information concerning the number of people involved, the resources in the area and potential resources of the new site.

The priorities must be set in time and space. Often programs are related to specific incidents, and the overall distribution is not properly evaluated. For instance, resettled villages may have a large opium production and equally high consumption. However, it may well be true that other villages may require more immediate attention, because their per capita opium production may be much larger resulting in a large surplus.

The relationship between poppy field concentration and transportation indicates the type of effort to be established. For instance, the surveillance should be directed against the illegal use of air support, if the relationship between the landing sites and the poppy fields can be clarified, such as the absence of surface transportation. The existence of large concentration of fields along major roads would indicate that enforcement is more an administrative-political rather than a police matter.

The prime use of aerial photographic methods is to obtain the spatial data of the pertinent resources in a relative short time. This information quantified with field data collection would form a base of information which has a time and spatial relationship. This is a prime requirement of proper decision making.




It should be noted, however, that aerial data should be used in conjunction with field observations for verification and quantification of the data.

DISTRIBUTION OF POPPY FIELDS
IN CENTRAL AND NORTHERN LAOS

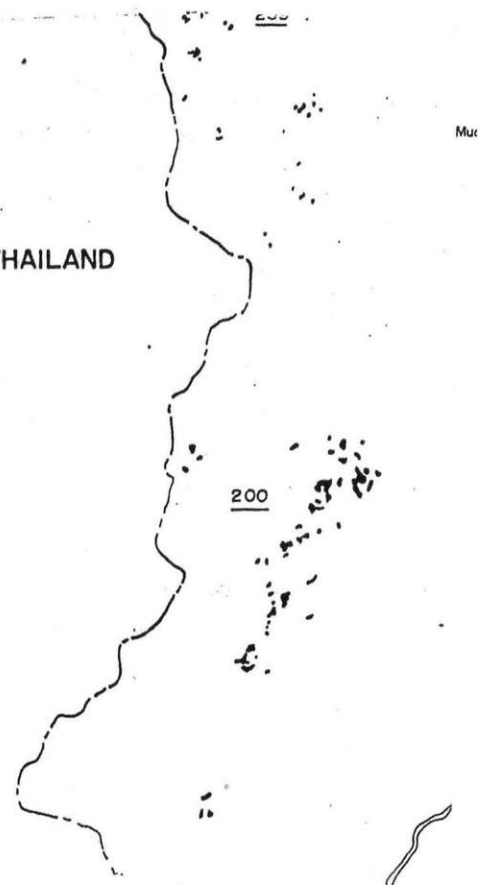
BY
HENG L. THUNG

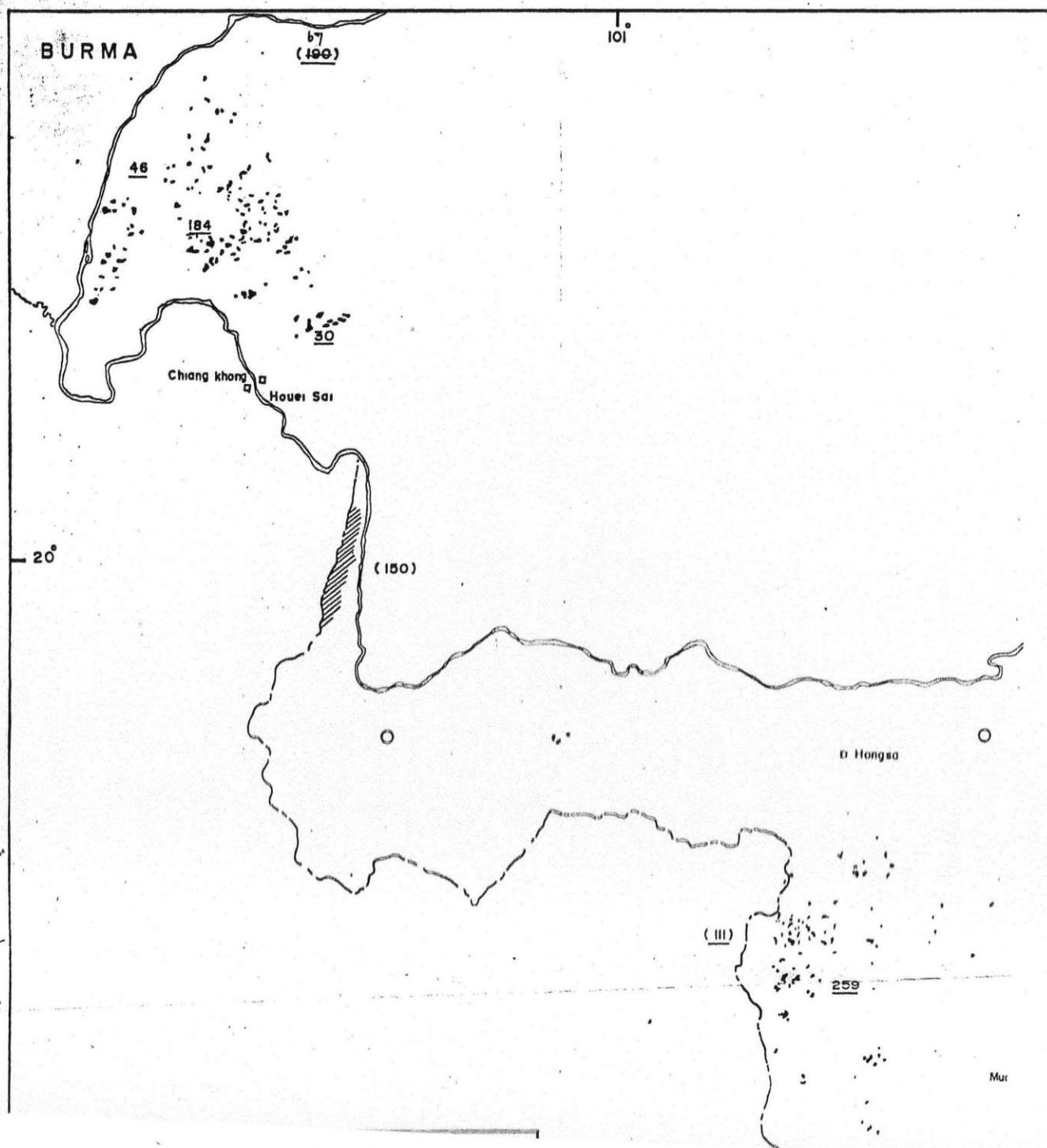
SCALE 1: 500,000

LEGEND

-  CLUSTER OF FIELDS MEASURED 1974
-  CLUSTER OF FIELDS MEASURED 1973
-  CLUSTER OF FIELDS ESTIMATED 1974

THAILAND

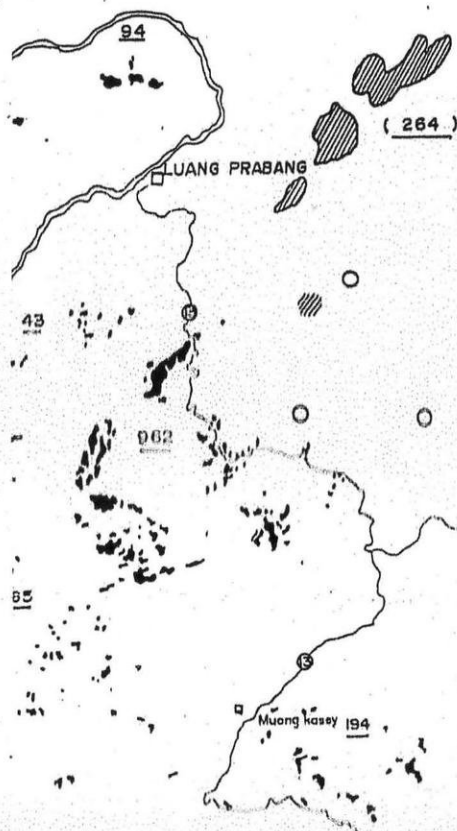




102

103

N. VIETNAM



LS 339

L. G 32

Xieng Khouang

PLAINE DE JARS

Muong Kasey 194

53

Long Tieng


2



Heng Thung

OFFICE MEMORANDUM

TO : See Distribution

FROM : Charles A. Mann, Director 

SUBJECT : Aerial Survey of Poppy Cultivation in Northern Laos

Attached is Dr. Heng Thung's report on the limited aerial survey for which aerial photography photoanalysis, and correlation of poppy yield data were accomplished over the past 3 1/2 months.

The estimated yield for those areas in Northern Laos under RLG control, on the basis of this survey, amounts to 20.23 metric tons of raw opium. Although there are many calculations included in Dr. Thung's survey that are based on rough data, I believe we can feel more confident in stating that annual production estimates for Laos (RLG areas) run between 20-25 MT. If we consider that the greater portion (possibly all) of this opium production is consumed by opium smokers in Laos, we would then conclude that very little, if any, opium produced in Laos enters into international trafficking.

Dr. Thung has done a professional and commendable job in his report with rather rough and limited data. His procedures, however, are reasoned and logical, and I believe you will find the report informative in many respects.

DIST: AMB, DCM, POL I, POL II, NA, DD, AD/P, CAD, PSD,
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THE 1974 SURVEY OF POPPY GROWING REGIONS
OF NORTH AND CENTRAL LAOS

BY

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SUMMARY

The objective of this second survey is to estimate the 1974 opium production and determine whether there are any changes in poppy cultivation in the Vientiane Government Controlled territory of Laos. The 45,000 sq. km photographed included parts of Vientiane, Xieng Khouang, Luang Prabang, Sayaboury and Houa Khong Provinces.

On the 1974 photographs 5,569 hectares were measured. Additional photographs covering 696 hectares were used from last year's survey and 200 hectares were visually estimated, giving a total area in poppy that was measured of 6,465 hectares.

The hectarage in poppy this year is almost twice the estimated hectarage of last year. The large increase is primarily the result of more extensive aerial coverage this season, which was increased fourfold from 11,000 sq. km to 45,000 sq. km.

The best available base data give a yield range from 3.5 kg/ha to 9.2 kg/ha. (Based on 1966 Thai data) The average yield used for Laos 74 Survey quantification is 6.0 kg/ha. Therefore, the range of production estimates for Laos varies from a low of 22.628 tons to a high of 59.478 tons using the average yield (6.0 kg/ha) the total estimated production from 6,465 ha is 38.790 metric tons.

The general trend, based on an area by area comparison with the 1973 survey, is downward. This trend, however, reflects primarily the war related migration of hilltribe groups away from their traditional opium growing areas since the 1973 survey. Because of this migration, it isn't possible to realistically relate the trend toward a decrease in poppy cultivation to the anti-narcotics program. ✓

The conclusion is that regions of high altitudes, preferably underlain by limestone rocks and enjoying stable security conditions have a potential for continued poppy cultivation until alternative crops can be substituted systematically and on a large scale.

OBJECTIVE

The objective of the second survey is to estimate the 1974 opium production and to determine whether there are any significant changes in the measured areas under poppy cultivation in most of the Vientiane Government controlled territory of Laos.

AREA SURVEYED

The area photographed this year is approximately 45,000 sq.km covering the Vientiane side areas of Central and Northern Laos, which consists of greater parts of Vientiane, Xieng Khouang, Luang Prabang, Sayaboury and Houa Khong Provinces (See Map). This area is approximately four times the size covered last year. However, certain regions in Luang Prabang, Sayaboury and Houa Khong Provinces were not covered because of various restrictions.

The photography this year was flown for multi-purpose use. One major use is for the land use inventory and land capability studies for regional planning and development.

PHOTOGRAPHY

The limited resources and time determined the use of the smaller scale of 1:30,000, which is slightly less than optimum. This change in scale made it possible to photograph a greater area in a much shorter period.

ANALYSIS PROCEDURE

The photographs have been plotted on the 1:50,000 scale topographic maps (AMS-L7015 series). This indexing was necessary because of the large number of photographs involved and, variation in direction and spacing of the flightlines.

This task has reduced the time requirement for data transfer and measurements significantly. It will also facilitate the analysis and retrieval of data in the future.

IDENTIFICATION

The identification of the poppy fields has been simple in spite of the much smaller scale of photography. The same characteristics are valid as described last year.

MEASUREMENTS

The measurement technique for this survey has been improved because of added equipment and additional time to perform the analysis. The percentage of error (+10%), however, remains about the same because of the smaller scale of the photography.

The outlines of the poppy fields were transferred to the topographic maps using a Zeiss sketchmaster.

The original scale of 1:50,000 of the topographic maps was found too small for accurate measurements. Therefore, the actual measurements with the dot planimeter were performed on 1:25,000 scale enlargements of the poppy fields in order to reduce the reading error.

It is estimated that the compounded error of reading, plotting and slope configuration is approximately +10%.

AREA UNDER POPPER CULTIVATION

The total gross area measured on the 1974 photographs is 5,569 hectares. There were 696 hectares measured in an area on last year's photographs which was not included in the photo coverage of this year. Approximately 150 hectares have been observed on the ridge south of Ban Houei Sai. Occurrences of an additional 50 hectares are scattered throughout the various areas that were not photographed last year nor this year, this figure includes such areas in the proximity of Shin Sha (LS-339) and Boum Long (LS-32). The total gross hectarage estimated this year is 6,465 hectares (see map).

A breakdown by provinces is listed in the following table.

Table 1. Area under poppy cultivation by province

<u>Province</u>	<u>1974 Photography Hectares</u>	<u>1973 Photography Hectares</u>	<u>Visual Estimates</u>	<u>Total Hectares</u>
Houa Khong	268	67	150	485
Sayaloury	789	365	---	1,154
Luzig Prabang	1,465	264	---	1,729
Vientiane	443	---	---	443
Xieng Khouang	2,437	---	---	2,437
Borikhane	167	---	---	167
Other	----	---	50	50
TOTAL	5,569	696	200	6,465

There are certain variations of the surface of the fields which would affect the net tillable area. The poppy fields are outlined and the area measured on the aerial photographs. This procedure measures the gross hectarage and does not take into account the reduction of surface due to obstructions such as boulders or rock outcrops. This is the case with the fields on limestone parent material. However, we consider this variation a matter of quality of the field rather the change of surface and will be discussed in detail under yield variation.

Variations with the 1973 Survey

There is a significant difference between the results of the two surveys in 1973 and 1974. The increase of poppy hectarage is mainly due to the more extensive area photographed this year. This four times increase has enabled us to make measurements in the important poppy growing regions rather than using rough estimates. Xieng Khouang Province accounts for approximately 2,600 hectares, and another additional 340 hectares was observed in southern Sayaboury Province.

An attempt has been made to compare identical geographic locations photographed during the two years to measure the actual changes that have taken place (table 2). These changes do not include those caused by possible population movements. Specific sampling has shown that there is a general net decrease of poppy cultivation except for the area around Muong Kassy and Vang Vieng, where the recent hectarage has almost doubled last year's figure (Table 2).

Table 2. Changes in poppy cultivation in identical areas of the 1973 and 1974 growing season

	<u>Hectares in 1973</u>	<u>Hectares in 1974</u>	<u>Decrease or increase in hectares</u>	<u>Decrease or increase in hectares</u>
Houa Khong	741	259	-432	-65%
Sayaboury Thai B.	334	259	- 75	-17%
Sayaboury Mek.	175	162	- 13	- 3.1%
Luang Prabang	27	28	+ 1	+ 3.7%
Vang Vieng/M.Kassy	69	133	+ 64	+93%
All Area	1506	977	-529	-35%
All Areas Except BHS	765	718	- 47	- 6%

Houa Khong

This area showed the largest decrease in poppy cultivation which was caused by the unsettled political-military situation present. The field officers reported that they considered the situation temporary and increase of cultivation will take place once the situation stabilizes.

Specific sampling of the areas on the aerial photographs has indicated that the field density this year has thinned significantly and that they are more scattered than last year. However, very large commercial fields have been observed on the ridge south of Ban Houei Sai, straddling the Thai-Lao border. It is estimated that a similar percentage (-65%) decrease is prevalent in the areas not photographed in 1974. On this assumption the 190 hectares would be reduced to 67 hectares.

Sayaboury

There is minimal change in this province. Comparative analysis shows a slight decrease in cultivated hectarage. However, it is possible that there has been a slight westward population movement towards the area near the Thaiborder which was not photographed this year.

The southwards extension of the aerial photographic coverage allowed detection and measurement of additional fields on the

high north-south running ridges (200 hectares), and some 81 hectares were found close to the Thai border in the extreme south corner of the province.

Luang Prabang

The most active area south of Luang Prabang was not photographed last year due to camera failure. Extensive fields were measured on the limestone ridges which include the Phou Chia (LS-25) region. The estimates last year were very conservative.

Additional hectarage was found across the Mekong and northwest from Luang Prabang, where several extensive fields were measured.

The region northeast from the Royal Capital was not photographed this year. It appears that no changes have taken place in this area which was verified by visual observation. Therefore, the 1973 hectarage figure was used to cover this missing photography. Some scattered fields were found on some high mountain slopes immediately east of these ridges, but the area further east was devoid of poppy fields except in the immediate surroundings of Boum Long (LS-32) and Shing Sha (LS-339) near Phu Cum. Rice cultivation, however, was extensive and new settlements were visible throughout this area.

Vientiane

The region of Vientiane province consists of low ridges except for the area between Muong Kassy and Vang Vieng with its high limestone outcrops, and the granite ridge east of the Mekong, where the concentration of poppy fields were located. A few scattered areas were found north and south of Ban Xon in Military Region II.

Xieng Khouang

Most of the poppy fields were located in the high limestone mountainous area around the Muong Cha (LS-113) valley. This area has the largest concentration of poppy fields of the area mapped.

Borikhane

Some scattered fields were found in the border area with Xieng Khouang north of the Nam Ngum reservoir.

OPIUM YIELD

As stressed in last year's report the opium yield is the most important quantifier. The fact that opium is an illicit drug makes it very difficult to obtain hard information in the field. As a result, field officers have not been able to make field measurements, except for Houa Khong Province where the agri-

cultural officer took four controlled samples.

Therefore, we have to re-evaluate the data and statistics available to us to arrive at a reasonable value for the opium yield, which can be used to determine the total production.

It is obvious that the range of yields is as (Table 3) wide as last year. However, several other statistics have been found which verify our use of last year figure (Table 4).

Table 3

Poppy Yields for 1974

1.	Agricultural Advisor Ban Houei Sai	
	measured (excellent yield) estimated	10.74 - 19.55 kg/ha
	average range no frost damage reported	5.00 - 7.00 kg/ha
2.	Luang Prabang	
	estimated average	19.250 kg/ha
	50 - 80% frost damage reported	
3.	Thailand Survey	
	estimated range	1.65 - 38.43 kg/ha
	no frost damage reported	
4.	Xieng Khouang	
	estimated average	7.8 kg/ha

All sources reported a poor year, because of late rains, less ground fog and frost damage.

Table 4

Poppy yields from various sources

1.	From former Custom and tax inspector for French Indo China ¹ .	5 kg/ha
2.	Former Agricultural Director (Xieng Khouang) ¹	5-10 kg/ha
3.	Former Administrator (Sam Neua) ¹ exceptional year	10-18 kg/ha
4.	LeMoine 1965 Survey (Sayaboury) ¹ exceptional year	5.70 kg/ha 7-11.4 kg/ha
5.	Binney 1966 (Meo North Thailand) ² range average	2.53-6.74 kg/ha 4.72 kg/ha
6.	Dr. Krui Punyasingh 1966 ³ (190 samples of N. Thailand) average	4.5-11.80 kg/ha 8.125

The most systematic opium yield was taken in 1966 by Dr. Krui Punyasingh of the Royal Thai Ministry of Agriculture in conjunction of the UN opium survey at that time (Table 4). He had taken 190 samples from controlled 4 by 8 meter plots throughout

1) Life Among the Hmoung, Yang Dao, Paris 1972

2) The Social and Economic Organization of Two White Meo Communities in Northern Thailand, George A. Binney, Washington, 1970

3) Report of the United Nations Survey Team on Economic and Social Needs of the Opium Producing Areas in Thailand, Bangkok, 1967

North Thailand and reported an average yield of 8.125 kg/ha with a standard deviation of 3.681 kg/ha.

He also differentiated ethnic identity of the growers and the type of parent material. The Meos produced an opium yield about average at 8.137 kg/ha while to Yao average was 10.094 kg; limestone areas yielded almost twice the weight of opium compared to granite.

It is stated that the 8.125 kg/ha average is for a poor year, which would be similar to both 1973 and 1974.

Two other researchers have listed some figure which can be considered better than average, because they have lived extended periods in the Meo villages they have studied. It can be assumed that their figures may be more reliable than those gathered by others during short visit to villages, because these resident researchers would have better opportunity and greater trust of the population to make field observations.

One is Mr. Binney who studied the White Meos in North Thailand and the other Mr. LeMoine in Sayaboury, Laos. Mr. Binney had a sample of 48 households, who cultivated a total of 334 Rais (53.4 Ha) and harvested 167.5 "Joy" (270.8 kg). This gave an average yield of 4.72 kg/ha. Mr. LeMoine reported an average

of 5.70 kg/ha for the village of Pha Hok in Sayaboury Province.

Environmental Variation of the Poppy Yield.

Approximately 4,000 hectares of the poppy fields are on limestone material. These fields have a much higher yield than those of the granitic ridges, but due to the surface obstructions the net tillable area is reduced. Thus, in order to quantify the aerial photo measurements with the field sample yields an adjustment has to be made to account for the decrease of tillable area.

The Thai field team in 1966 is the only research team to date which has made an effort to establish the relationship of opium yields and the parent material.

The average opium yield from fields on granitic parent material was 5.66 kg/ha. On limestone this yield figure averages 9.68 kg/ha.

Sample areas used for the Thai field survey are four by eight meter plots. It is reasonable to accept that they have selected areas covered with soil and have avoided rock outcrops. Thus the figures indicate net yields.

It is estimated that on limestone the rock outcrops cover an area which range between zero to 80%. Approximately 30% in

rock outcrops is the estimated average for all the limestone areas. Thus the gross yield figure for limestone, which is comparable with the type of fields measured on the photographs, is 6.78 kg/ha, or almost similar to the yield figure for areas on granite parent material.

Therefore it is reasonable to use one yield figure as the quantifying figure until better field samples can be obtained in the future.

Estimated Opium Yield Quantifier.

The previously listed tables show that the extreme range of yields in 1974 was reported from Thailand which is from a low of 1.65 kg/ha to a high of 38.43 kg/ha with an average of 2.54 kg/ha. The estimates for Laos range from 5.00 kg/ha to 19.55 kg/ha.

Field officers reported that 6.00 kg/ha represent a reasonable yield figure, because of frost damage and other adverse weather conditions. However, the information on frost damage is very erratic and non-conclusive. No field officers have personally witnessed frost damaged fields.

The 1966 Thai-UN report indicated that the weather conditions in Thailand that year was unfavorable for poppy cultivation. Thus the condition maybe reasonably similar to those in 1973

and 1974. In lieu of better data it may be safe to assume that the range between 4.5 kg/ha and 11.80 kg/ha is reasonable to use in this survey, because the estimates of 5.0-7.0 kg/ha from Ban Houei Sai and 7.8 kg/ha from Xieng Khouang fall within this range. However, it should be adjusted for the variation caused by the limestone outcrop areas. The adjusted range is from 3.5 kg/ha to 9.2 kg/ha. The calculated and adjusted averages of 5.66 kg/ha and 6.78 kg/ha are respectively for yields on granitic and calcareous parent material. These maybe too specific to be used in this report. For this reason a more general figure of 6.00 kg/ha should be used as the quantifying factor.

ESTIMATED OPIUM PRODUCTION

The total area in poppy cultivation is 6,465 hectares. It should be noted that this hectarage is valid only for the 45,000 sq. km surveyed, plus the missing areas using 1973 figures and the occurrences visually estimated.

The survey area is approximately four times the size of last year. It can be assumed that most of the potential poppy growing areas in Vientiane side held areas have been covered in 1974. There is no hard information available for areas outside those mentioned above, although available information indicates that it may be negligible.

The range of opium yield used is 3.5 kg/ha to 9.2 kg/ha. These estimates give production range from a low of 22.628 tons and a high of 59.478 tons for 1974. The average of 6.0 kg/ha gives a production of 38.790 tons for this year.

CONCLUSION

The 6,465 hectares in poppy cultivation measured this year are approximately twice the estimate of last year's hectarage and produced an estimated 38.790 tons of opium. This year's aerial photo coverage of Vientiane side is four times the photo coverage of 1973 which accounts for the large increase in cultivation. The largest additional hectarage was measured in Xieng Khouang Province, which was not photographed last year. This region had the largest concentration of poppy fields in the Kingdom.

The present distribution pattern of poppy cultivation indicates that it is likely that the hectarage last year was approximately the same as 1974. The correlations conducted for identical geographical areas on 1973 and 1974 photographs showed a general decrease of poppy hectarage. Some areas, however, showed significant changes which were related to the altered socio-economic conditions.

Regions with serious population disruptions such as Houa Khong Province have shown sharp decreases, because the population could not be assured access to the fields during the critical two week harvest period.

On the other hand areas with increase stabilization and added population, such as the region between Muong Kassy and Vang Vieng, have shown a sharp increase of poppy cultivation.

These impacts were so large that it was not possible to measure any direct effect caused by the Lao Narcotic Control program.

The conclusion is that regions of high altitude, preferably underlain by limestone rocks and enjoying stable security condition have a potential for continued poppy cultivation until alternative crops can be substituted systematically and on a large scale.