

AN EVALUATION OF AERIAL PHOTOGRAPHY
AS A QUALITY CONTROL MEASURE
OF THE JUNE ENUMERATIVE SURVEY

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SUMMARY

Color aerial photography can function successfully as a quality control technique for the June Enumerative Survey (JES).

The following table shows the percent of segments correctly identified by the Aerial Photo Survey (APS) for presence or absence of certain characteristics. Also shown are the estimated rank-correlation coefficients between JES and APS data for each characteristic.

Characteristic to be identified	Segments correctly: identified by APS (Percent)	r_s
Occupied dwellings.....	96	0.978**
Grain storage capabilities.....	96	0.662**
Livestock:		
Cattle.....	96*	0.835**
Hogs.....	88*	0.786**
Sheep.....	88*	0.822**
Chickens.....	68*	0.580**
Cattle crossing tract boundaries.....	96	0.823**
Land usage:		
Buildings.....	100	0.996**
Small grain and hay.....	100	0.875**
Pasture w/evid. of livestock.....	100	0.947**
Row crops.....	96	0.950**
Woods.....	100	0.913**
Pasture w/o evid. of livestock.....	96	0.639**

* Evidence of livestock was considered synonymous with livestock present.

** Denotes with a probability greater than 0.99 that the population correlation coefficient is greater than zero.

A multivariate test for differences in reported tract and crop acreage between JES and APS indicated no significant difference between means of the two surveys. Listed below are the tract and crop acreage means and the difference (d) between the two surveys.

	JES	APS	d
Tract total.....	238.55	239.44	0.89
Row crops.....	61.31	63.14	1.83
Corn.....	22.97	23.85	0.88
Soybeans.....	37.68	38.07	0.39
Small grain, hay.....	39.11	39.44	0.33
Wheat.....	8.71	9.03	0.32
Oats.....	3.42	3.52	0.10

(All figures are in acres)

Using the power function of the test on mean vectors, it was determined a sample size of 53 segments would be required to detect differences as small as the above listed sample differences with a probability of significant results greater than 0.90.

The total cost of the APS was approximately \$2500, or \$100 per segment. This was almost twice the cost of the re-enumeration survey used in previous years as the quality control technique for the JES. The use of black and white film would reduce the cost of the APS to about \$80 per segment, still substantially more than the cost for re-enumeration. It is believed that this cost difference would not decrease substantially even if this survey were expanded to an operational basis under the present survey cost structure.

Due to the different nature of aerial photography as a quality control check, it may provide a practical means of obtaining data for respondents not at home or refusals in full scale surveys, or as an independent source for certain types of information.

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INTRODUCTION

In the past, the quality control technique utilized for the annual June Enumerative Survey (JES) has been a re-enumeration of a subsample of tracts enumerated in the JES. This technique has not been fully satisfactory, since it is subject to some of the same communication, response, data recording and processing errors as the original enumerative survey. Very little consideration has been given to the results of the re-enumeration survey (RES) when preparing the estimates for the JES because of the limitations of the RES. The main benefits of the RES were its psychological effect on enumerators and alerting supervisory enumerators to errors in the current survey. Knowing some of their interviews will be checked, the enumerators are believed to take greater care in obtaining accurate data on the initial interview.

Previous aerial photo surveys have indicated that aerial photography might be used as a quality control technique.^{1/} It would provide the same psychological effect as the RES, as well as providing a permanent document of the conditions at the time of photography for future reference. An aerial survey would also have the following advantages: 1) photos could be obtained at or near the time of the interview, 2) respondent burden would be relieved, and 3) it is a more objective (though not necessarily more accurate) quality control since it is not subject to the same communication and response errors as the JES and RES.

In view of these advantages and the results of previous research, it was decided a small scale pilot survey would be made. The broad objective of the survey was to evaluate aerial photography and its interpretation as a quality control check for the 1970 June Enumerative Survey for Ohio. Ohio was selected for the study because of the interest of Dan Tucker, Ohio's Statistician in Charge.

The following is a list of comparisons or measurements made between the JES and the aerial photo survey (APS): 1) number of occupied dwellings, 2) identification of grain storage capabilities, 3) identification of livestock species actually present and evidence of the presence of livestock, 4) determination of areas where livestock have access to pastures or lots adjacent to the tract, 5) classification of land use into six categories; woods, sites with buildings, row crops, pasture with evidence of livestock, small grain and hay, and pasture without evidence of livestock, and 6) reported crop acreages and planimetered acreages from aerial photographs.

^{1/} See "An Evaluation of Remote Sensing Data for Estimating Livestock Inventories," by W. W. Wilson, D. H. Von Steen, and P. V. Hurt, Standards and Research Division, Statistical Reporting Service, January 1972.

METHODS AND PROCEDURES

Sample Selection

A desirable sample would have been one containing at least two JES segments in each enumerator's district or assignment area. Since Ohio had approximately 22 enumerators, this would have meant a sample size of 44 segments. This was about twice as large as available funds would allow. Monetary restrictions limited the study to 25 segments. Twenty-three segments were randomly selected from the previous years enumerator assignments. In addition, two NOC (non-open country) segments were selected at random from all NOC's. See figure 1, page 3 for the geographic distribution of the sample. The idea was to have one segment per enumerator plus the NOC segments. However, enumerator assignments changed in 1970, resulting in a final sample with more than one segment for some enumerators and no segments for other enumerators. The previous year's assignments were used for allocation because materials (photos and aeronautical charts) had to be prepared before the final enumerator assignments were made.

Data Collection

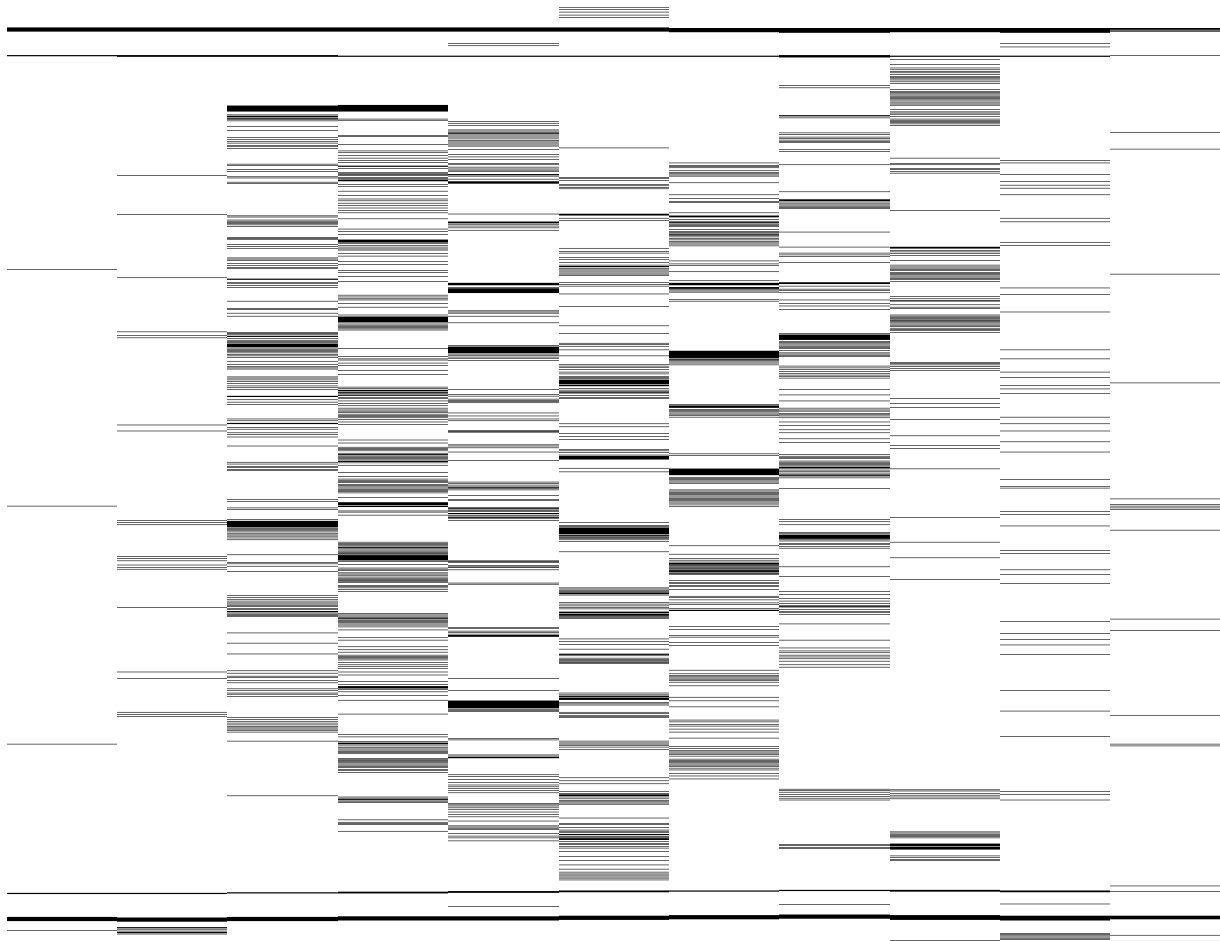
The June Enumerative Survey was conducted during the period May 25-June 5. The aerial photos were to be obtained between May 25 and June 13. All segments were photographed on May 26-28. However, due to incomplete photo coverage of some segments, a second flight was necessary. This was made on June 7.

The standard Ohio JES questionnaire was used--no special questionnaires were used for the segments in the APS.

The aerial photos were taken from a Cessna 180 at an altitude of approximately 2500 feet with 35mm cameras mounted on the struts of the aircraft. Color Extachrome film was used and color enlargements were made to provide a scale of about 1:4000.

The photography was processed and sent to the Ohio SSO for interpretation. Photo interpretation was performed according to the instructions for handling aerial photographs. See Appendix I, Exhibit C, page 30. Livestock were identified according to the procedures used in the 1969 Idaho Livestock Survey.^{2/} The land use identification key is shown on page 6. The key is an abbreviated decision chart designed to aid in determining land use categories by color discrimination in conjunction with characteristic land use patterns. In reading the key, begin at the top, and after each decision box follow the arrow to the appropriate alternative until this process terminates in the choice of a particular land use category. Photographs illustrating each land use category are included on pages 7 and 8.

^{2/} W. W. Wilson, D. H. Von Steen, and P. V. Hurt. Op Cit.



While the photographs were being interpreted, copies were made of the edited JES questionnaires. Immediately following interpretation of the aerial photographs the results of the two surveys were compared. Where gross differences were detected, a supervisory enumerator was sent to the segment to verify the correct report for the purpose of understanding why the differences might have occurred. However, the original data was not changed for the analysis.

The following criteria were used to determine which segments were to be verified for gross differences detected: 1) if the photography showed fields missed during the enumeration, 2) if the identification of occupied dwellings differed from the JES reported, 3) if the identification of livestock species differed from the JES reported, 4) if the identification of land use differed from the JES reported. When a segment was to be revisited for verification purposes, all tracts and fields were to be verified if possible. These visits were generally limited to one hour.

Appendix I, page 24, contains instructions for coding and editing June Enumerative questionnaires, handling aerial photographs, and the recording form used for the summarization of the survey.

Key Operation

An attempt will now be made to talk through the land use identification key by referring to the photographs on pages 7 and 8.

Buildings

Since buildings do not resemble any other land use, they are not included in the key. An example of buildings is shown on the first photograph.

Row Crops

Beginning at the top of the key, we note the areas labeled row crops are not green. In early June, when the photographs were taken, the fields had been plowed and planted but there was not sufficient ground cover to make the row crop fields appear green on the aerial photos. Hence, row crops appeared to be bare soil and the coloration of the fields was gray or brown, this decision leads us to the decision box for fine lines or checks. Having decided there are fine lines within the fields, this leads us to the determination that the fields are in fact row crops. Fallow soil was also coded row crops.

Woods

Referring to the area labeled woods on the first photograph, the following decisions can be made. The area is green, there is not smooth even cover and the area appears very rough. Hence, we determine the area is woods.

Small Grain or Hay

Looking at the examples on the second photograph, we see the area is green and has smooth, even cover. This leads us to the decision that the area is small

grain or hay. The shade of green may vary from light to fairly dark green. Fields set aside for government programs were also included in the small grain and hay category even though the land use characteristics are somewhat dissimilar.

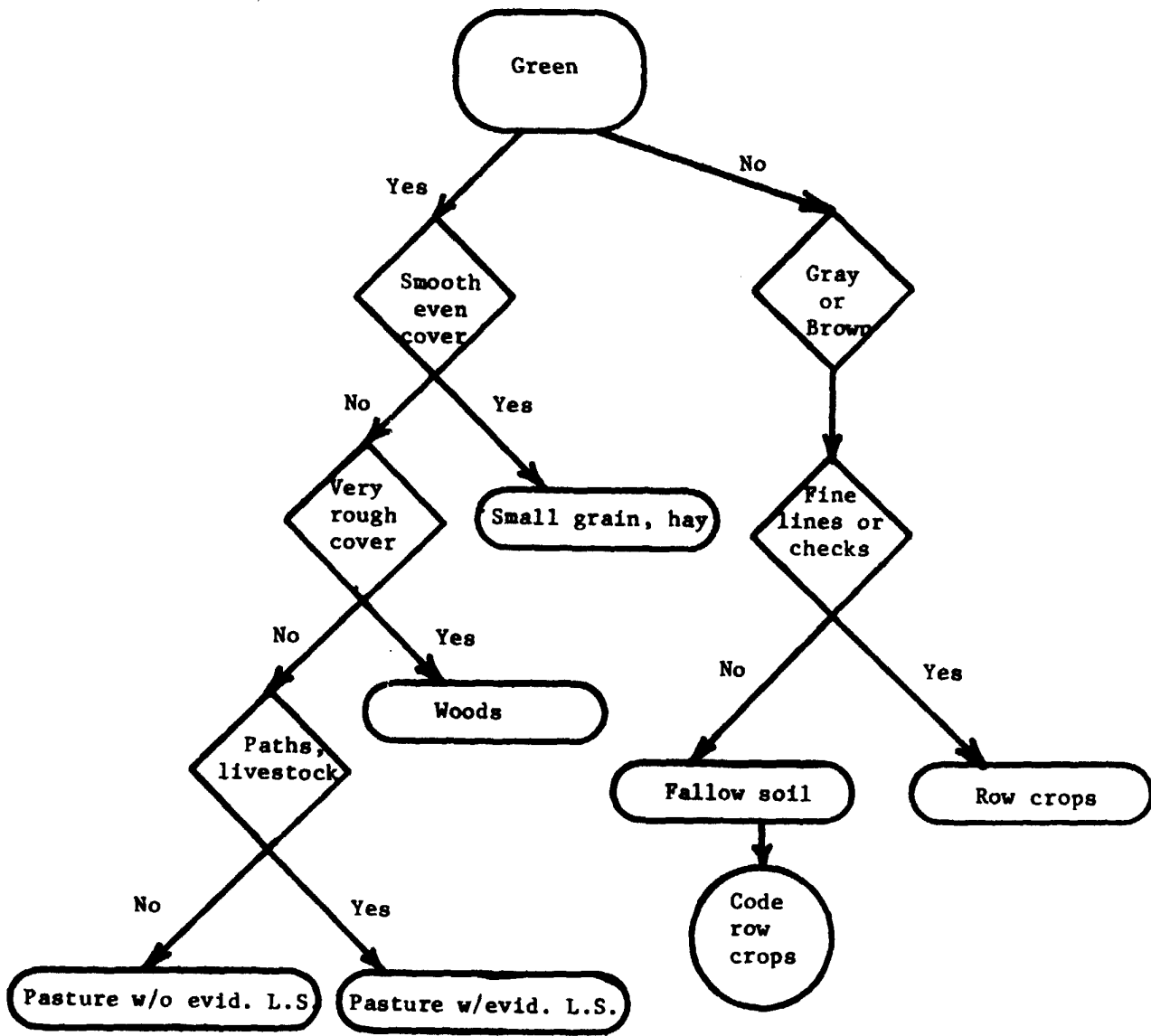
Pasture With Evidence of Livestock

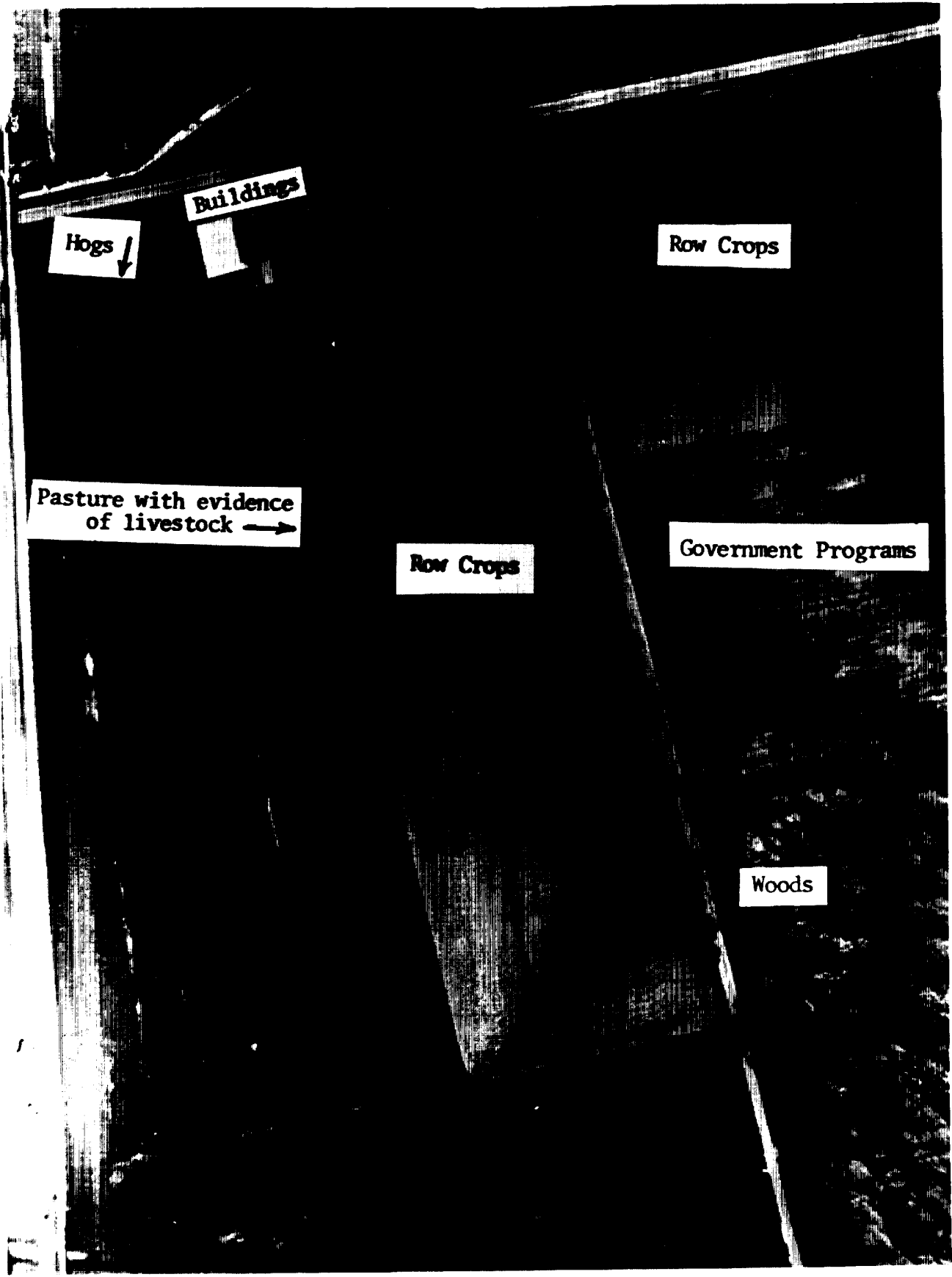
In the example shown on the first photograph, both hogs and cattle can be discerned within the pasture. Also, note the paths running from the barn to the general area of the cattle. In most cases, evidence of livestock within a pasture will be determined by paths such as these. Trees may be found within pastures. Observing the pasture, note that it appears green, the ground cover is neither extremely smooth nor extremely rough, and there are paths and livestock within the field.

Pasture Without Evidence of Livestock

Pasture will appear the same as previously explained except there will be no livestock or paths within the field. No examples are shown on the photographs of pasture without evidence of livestock. However, it should not be too difficult to visually imagine no cattle, hogs or paths within the area labeled pasture with evidence of livestock, thus providing you with an example of pasture without evidence of livestock.

Ohio
Land Use
Identification Key





Hogs ↓

Buildings

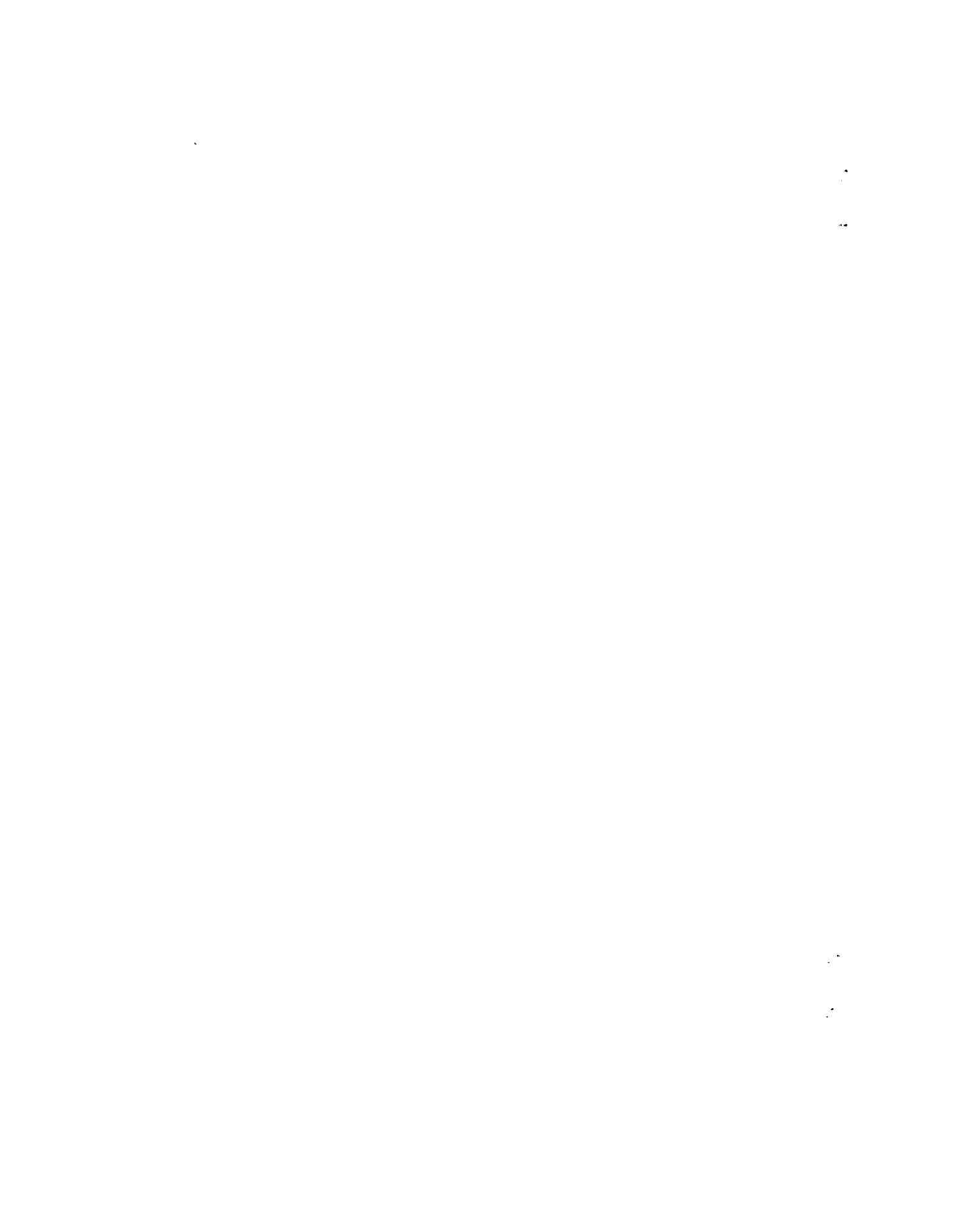
Row Crops

Pasture with evidence of livestock →

Row Crops

Government Programs

Woods

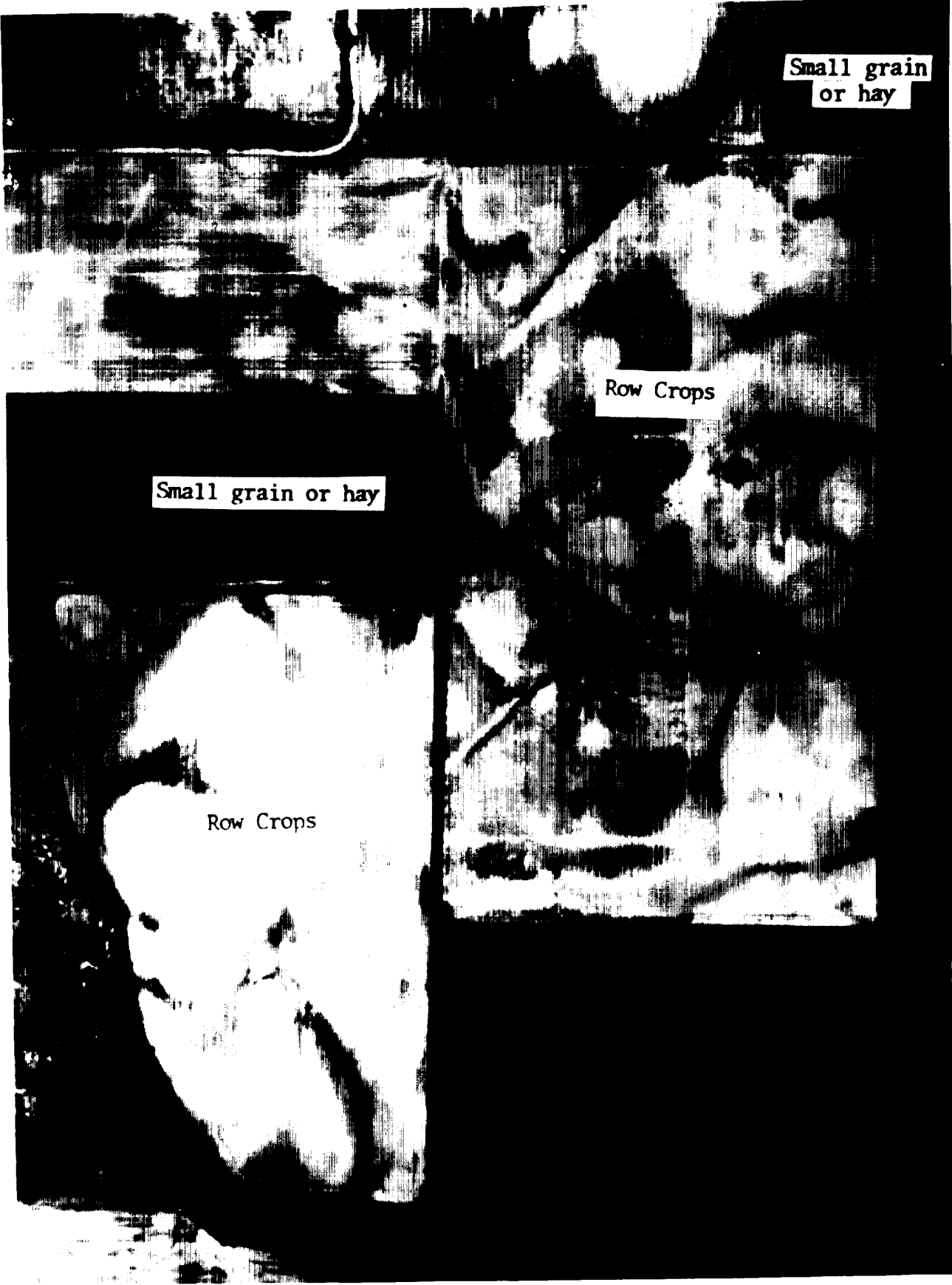


Small grain
or hay

Row Crops

Small grain or hay

Row Crops



COMPUTATIONS

Estimated Correlation Coefficients

Since the objective of this study was to evaluate aerial photography as a quality control technique, a matter of primary importance is the relationship between JES and APS data. The correlation coefficient can be used as an indicator of the strength of linear relationship between two variables, i.e., JES and APS data.

The data used for this analysis was the number of tracts within each segment containing the specified characteristic. Since these counts were not normally distributed, it was necessary to turn to a non-parametric statistic where no assumptions are made concerning the underlying distribution. Spearman's rank-correlation coefficients were used to test the hypothesis that the JES and APS data were independent under the null hypothesis $H_0: \rho = 0$, where ρ denotes the true correlation.

Rank-correlation coefficients were estimated for occupied dwellings, grain storage, livestock (by species), cattle crossing tract boundaries, and land use (by usage classification).

Table Comparisons

Two-way classification tables were constructed and comparisons made for the previously listed classifications.

The values used in these tables are the number of segments with the specified characteristic present or absent. As such, it is a qualitative analysis, agreement between the two surveys for presence or absence of a characteristic does not imply quantitative agreement. For example, the JES may report a segment having occupied dwellings in five tracts, but the APS may only report dwellings in two tracts. For this segment the two surveys would be considered to be in agreement since they both reported occupied dwellings present. The two-way classification tables and comparisons are shown in the results section, tables 2-9, pp. 11-17.

Multivariate Analysis of Variance Test For Differences Between JES and APS

A paired-observations multivariate test was used to determine if there were significant differences between group mean vectors for JES and APS reported tract and crop acreage. The hypothesis to be tested was $H_0: \delta = 0$ against the alternative $H_1: \delta \neq 0$ where $\delta = \mu_1 - \mu_2$, and μ_1 and μ_2 are the mean vectors for JES and APS, respectively. Hotelling's T^2 - statistic was used to test the hypothesis.

RESULTS

Estimated Correlation Coefficients

Spearman's rank-correlation coefficient r_s was estimated as follows:

$$r_s = 1 - \frac{6(\sum d_i^2)}{N(N^2-1)}$$

where: $d_i = (X_i) - (Y_i)$

$(X_i) =$ Rank of X_i

$(Y_i) =$ Rank of Y_i

$X_i =$ Number of tracts in the i^{th} segment containing the specified characteristic as reported by the APS.

$Y_i =$ Number of tracts in the i^{th} segment containing the specified characteristic as reported by the JES.

$N = 25$ segments.

The observed X values were arranged in order of size and a rank was assigned for each value. For tied-ranks (two or more segments with equivalent values for X), an average was taken of the ranks they would have been assigned if the values were distinguishable. For example, if a rank of 7 were assigned to an X value of 5 and three segments had X values of 4, the three segments would be ranked 8, 9 and 10 if they were distinguishable. However, since they aren't distinguishable, the rank of each would be taken as $(8+9+10) \div 3 = 9$. The same procedures were followed for ranking the Y values. Next, each (Y_i) was subtracted from its paired (X_i) to obtain the difference d_i .

Spearman's rank-correlation was used because the X_i 's and Y_i 's were not normally distributed, thus it was necessary to use a non-parametric statistic.

The following table lists the values computed for r for each classification. When the estimated rank-correlation coefficient exceeds 0.505, there is a probability of .99 that the population correlation coefficient, ρ , is greater than zero. This is known as the 1 percent level of significance. The 5 percent level of significance is attained when r is greater than 0.396.

The rank-correlation coefficients are highly significant for all classification. The hypothesis of independence between JES and APS data was rejected and it was concluded there was a significant correlation between JES and APS.

Table Comparisons

Table comparisons were made for occupied dwellings, grain storage, livestock (by species), cattle crossing tract boundaries, and land use (by usage classification).

Table 1.--Estimated rank-correlation coefficients between JES and APS

Sample Classification	r_s
Occupied dwellings	0.978**
Grain storage	0.662**
Livestock (by species)	
Cattle	0.835**
Hogs	0.786**
Sheep	0.822**
Chickens	0.580**
Cattle crossing tract boundaries	0.823**
Land use:	
Woods	0.913**
Buildings	0.996**
Row crops	0.950**
Pasture with evidence of livestock	0.947**
Small grain, hay	0.875**
Pasture without evidence of livestock	0.639**

**Denotes with a probability of 0.99 that the population correlation coefficient is greater than zero. (n=25)

The first comparison was for presence or absence of occupied dwellings within each segment. Occupied dwellings are important because they may house farm operators. For 23 of the 25 segments, both surveys reported occupied dwellings present. For one segment APS and JES both reported no occupied dwellings present. The two surveys did not agree in only one segment. The APS reported occupied dwellings present, the JES reported no occupied dwellings. The re-enumeration concurred with the JES.

Table 2.--Comparison of presence or absence of occupied dwellings by JES and APS

APS \ JES	No. of segments with occupied dwellings	No. of segments without occupied dwellings	APS total
No. of segments with occupied dwellings.....	23	1	24
No. of segments without occupied dwellings.....	0	1	1
JES total.....	23	2	25

These results indicate the APS was successful in determining presence or absence of occupied dwellings in 96 percent of the segments.

The classification of grain storage capabilities by the two surveys was also fairly close overall. The JES and APS agreed there were grain storage facilities in 21 segments, and were none in three segments. Again they only disagreed on one segment. JES reported there were grain storage capabilities, but according to the photo interpreter there were none. For storage capabilities, no attempt was made to re-enumerate where there were conflicting reports since the JES question did not specify the location of the storage capabilities with regard to segment boundaries. They could have been located outside the segment and still been reported. See Appendix II, Exhibit B, page 38.

The comparison of the presence, absence and evidence of cattle is shown in Table 4.

The two surveys were in accord as to the presence or absence of cattle in 19 segments. In addition, if evidence of cattle is considered synonymous with cattle present as it was in computing correlation coefficients, there would be 21 segments for which the two surveys agreed. For the two segments in which APS reported evidence and JES reported no cattle, the re-enumeration determined cattle were present in one and absent in the other. The JES reported two segments with cattle present whereas APS reported no cattle present. The re-enumeration concurred with the photo interpretation for both segments. When cattle present and evidence of cattle are considered synonymous, the APS correctly identified the presence or absence of cattle in 96 percent of the segments.

The comparison of the presence, absence and evidence of hogs is presented in Table 5.

There were 18 segments for which the two surveys were in agreement. The 4 segments where APS reported evidence of hogs and JES reported hogs present, the re-enumeration indicated hogs present for all four. However, for the 2 segments the photo interpreter determined evidence of hogs present and JES reported no hogs present, the re-enumeration found no hogs. The re-enumeration corresponded with the JES report in the one segment identified by the JES as having hogs present and by the APS as having no hogs present. When hogs present and evidence of hogs are considered the same, the APS correctly identified 88 percent of the segments for presence or absence of hogs.

Sheep were practically nonexistent in the survey area. Table 6 shows the comparison of sheep present, absent or in evidence. In only one segment did the two surveys agree for presence or evidence of sheep. The JES reported sheep present, the photo interpreter indicated evidence of sheep. One tract was re-enumerated for sheep, but only because it was being re-enumerated for other reasons. In that instance both JES and APS reported no sheep, but the re-enumeration reported sheep present.

Table 3.--Comparison of presence or absence of grain storage capabilities by JES and APS

APS \ JES	No. of segments with grain storage	No. of segments with- out grain storage	APS total
Number of segments with grain storage.....	21	0	21
Number of segments with- out grain storage.....	1	3	4
JES total.....	22	3	25

Table 4.--Comparison of presence, absence or evidence of cattle by JES and APS

APS \ JES	No. of segments with cattle	No. of segments without cattle	APS total
Number of segments with cattle.....	9	0	9
Number of segments with cattle evidence.....	2	2	4
Number of segments with- out cattle.....	2	10	12
JES total.....	13	12	25

Table 5.--Comparison of presence, absence and evidence of hogs by JES and APS

APS \ JES	No. of segments with hogs present	No. of segments with- out hogs present	APS total
Number of segments with hogs present.....	5	0	5
Number of segments with evidence of hogs.....	4	2	6
Number of segments with- out hogs present.....	1	13	14
JES total.....	10	15	25

Table 6.--Comparison of presence, absence and evidence of sheep by the JES and APS

APS \ JES	No. of segments with sheep present	No. of segments without sheep present	APS total
Number of segments with sheep present.....	0	1	1
Number of segments with evidence of sheep.....	1	0	1
Number of segments without sheep present.....	2	21	23
JES total.....	3	22	25

Although chickens are not visible in aerial photographs at a scale of 1:4,000, it is possible to identify their presence in some instances by looking for chicken coops, poultry barns, etc. The photo interpreter correctly identified 4 of 12 segments with evidence of chickens or chickens present as reported by the JES. None of the segments were re-enumerated for chickens. Using the JES data as the basis for correct classification, the photo interpreter correctly identified 68 percent of the segments.

Table 7.--Comparison of presence, absence and evidence of chickens by JES and APS

APS \ JES	No. of segments with chickens present	No. of segments without chickens present	APS total
Number of segments with chicken present.....	3	0	3
Number of segments with evidence of chickens.....	1	0	1
Number of segments without chickens present.....	8	13	21
JES total.....	12	13	25

Both surveys corresponded almost completely in identifying segments where cattle could cross tract boundaries to areas outside the segment. There was only one segment in which the two surveys disagreed. No attempt was made to re-enumerate for reported "cattle crossings." The APS concurred with the JES classification for 96 percent of the segments.

Table 8.--Comparison of cattle crossing tract boundaries by JES and APS

APS	JES	No. of segments with cattle crossing tract boundaries	No. of segments with out cattle crossing tract boundaries	APS total
Number of segments with cattle crossing tract boundaries.....		3	0	3
Number of segments with out cattle crossing tract boundaries.....		1	21	22
JES total.....		4	21	25

Comparisons between APS and JES for land use (by usage classification) are shown in Table 9 a-f. For the following classifications the two surveys were in total accord: buildings, small grain and hay, and pasture with evidence of livestock. There were two segments in which JES reported pasture with evidence of livestock but the APS did not report any. Plus, there were five segments where just the opposite was reported. The re-enumeration concurred with the photo interpreter for six of these seven segments. The two surveys disagreed on one segment in each of the remaining classifications. The re-enumeration verified the APS for the segment in the woods classification. For row crops though, the re-enumeration supported the JES report. Thus, in four of the six land use classifications, the APS correctly identified land usage for all segments. In the remaining two classifications it correctly identified land use for 96 percent of the segments.

Manova Test for Differences Between JES and APS

As stated before, the purpose of this analysis was to determine if there were significant differences between group mean vectors for JES and APS reported tract and crop acreage. The test hypothesis is $H_0: \delta = 0$ where $\delta = \mu_1 - \mu_2$ and μ_1 and μ_2 are the mean vectors associated with JES and APS, respectively.

Table 9.--Comparison of land use (by usage classification) between JES and APS

a. Woods

APS \ JES	Segments with woods	Segments without woods	APS total
Segments with woods.....	23	1	24
Segments without woods.....	0	1	1
JES total.....	23	2	25

b. Buildings

APS \ JES	Segments with buildings	Segments without buildings	APS total
Segments with buildings.....	24	0	24
Segments without buildings..	0	1	1
JES total.....	24	1	25

c. Row crops

APS \ JES	Segments with row crops	Segments without row crops	APS total
Segments with row crops.....	21	1	22
Segments without row crops.....	0	3	3
JES total.....	21	4	25

d. Pasture with evidence of livestock

APS	JES	Segments with pasture with evidence livestock	Segments without pasture with evidence livestock	APS total
Segments with pasture with evidence livestock.....	17	0	17	
Segments without pasture with evidence livestock..	0	8	8	
JES total.....	17	8	25	

e. Small grain and hay

APS	JES	Segments with small grain and hay	Segments without small grain and hay	APS total
Segments with small grain and hay.....	23	0	23	
Segments without small grain and hay.....	0	2	2	
JES total.....	23	2	25	

f. Pasture without evidence of livestock

APS	JES	Segments with pasture without evidence livestock	Segments without pasture without evidence livestock	APS total
Segments with pasture without evidence livestock...	4	5	9	
Segments without pasture without evidence livestock.....	2	14	16	
JES total.....	6	19	25	

There are three basic assumptions or conditions required to test $H_0: \delta = 0$. First, it is necessary to have $V_E \geq p$ where V_E is the error degrees of freedom and p is the number of dependent variables. For this case, $V_E = 24$ and $p = 7$, so this condition is satisfied. The second assumption is that the observation vectors are normally distributed, and the third concerns equality of covariance matrices, and this assumption will be based on statistical evidence.

To test for equality of covariance matrices, the hypothesis $H_{10}: \Sigma_1 = \Sigma_2$ is tested against the alternative $H_{11}: \Sigma_1 \neq \Sigma_2$, where Σ_i denotes the covariance matrix of the i th treatment. The test statistic is given as $V = 2.3026$ ~~m~~M which follows a chi-square distribution with $p(p+1)/2$ degrees of freedom, where

$$m = 1 - \left[\frac{1}{(n_1-1)} + \frac{1}{(n_2-1)} - \frac{1}{(n_1+n_2-2)} \right] \left[\frac{2p^2+3p-1}{6(p+1)} \right],$$

and

$$M = (n_1+n_2-2) \log_{10} |S| - (n_1-1) \log_{10} |S_1| - (n_2-1) \log_{10} |S_2|.$$

S_1 and S_2 are the sample covariance matrices (unbiased estimates of Σ_1 and Σ_2) for JES and APS, respectively,

$$\text{and } S = [(n_1-1) S_1 + (n_2-1) S_2] / (n_1 + n_2 - 2).$$

S_1 , S_2 , and S are shown on the following page.

$$\text{Then } |S_1| = 9.54578 \times 10^{27}$$

$$|S_2| = 9.77088 \times 10^{27}$$

$$|S| = 9.67176 \times 10^{27}$$

$$n_1 = n_2 = 25$$

A five place log table (base 10) allows approximations:

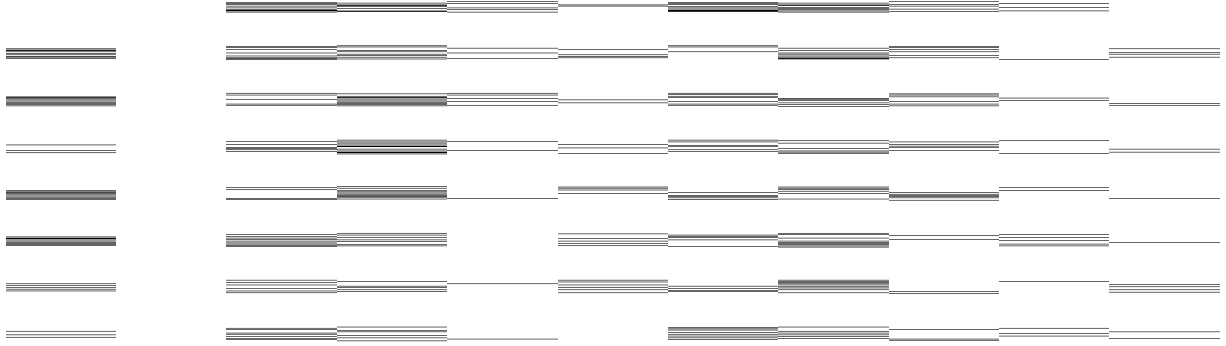
$$\log_{10} |S_1| = 27.97981$$

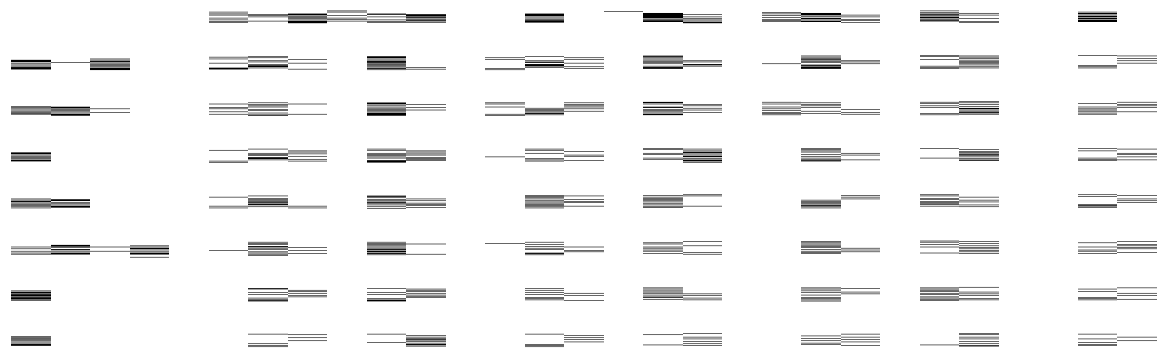
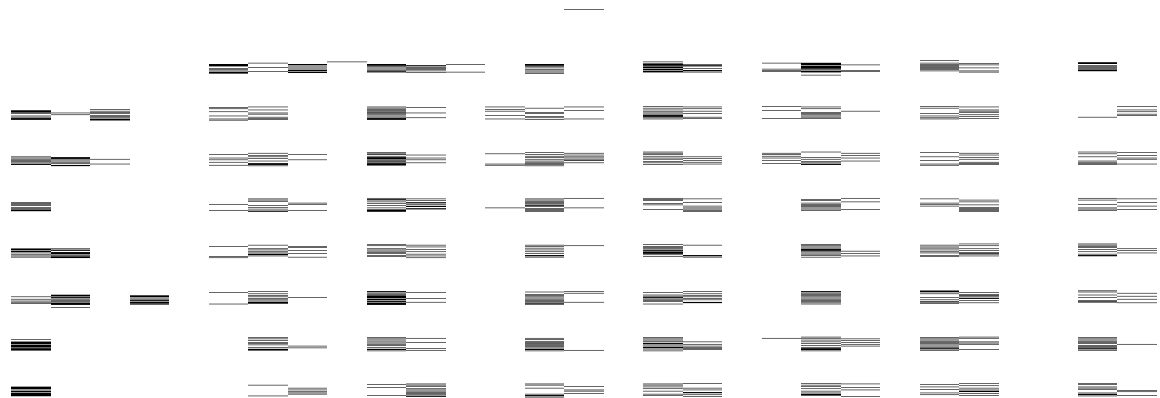
$$\log_{10} |S_2| = 27.98993$$

$$\log_{10} |S| = 27.98551$$

By substitution, $M = 0.03072$

$$m = 1 - [1/24 + 1/24 - 1/48] \frac{[98 + 21 - 1]}{48} = 0.84635$$





and

$$d.f. = p(p+1)/2 = 28$$

therefore,

$$\chi^2(28) = 2.3026(0.84635)(0.03072) = 0.05987$$

The tabular value for $\chi^2_{0.05}(28) = 41.34$. Thus, $H_{10}: \Sigma_1 = \Sigma_2$ is accepted and the basic assumptions are concluded to be viable.

Now, Hotelling's T^2 - statistic is used to test $H_0: \delta = 0$. The test statistic is $T^2(7,24) = nD^2$ and D^2 is computed as follows:

$$d_{kj} = Y_{1kj} - Y_{2kj} \quad k = 1, \dots, 7; j = 1, \dots, 25$$

$$\bar{d}_k = \sum_{j=1}^{25} d_{kj} / 25 \quad k = 1, \dots, 7$$

$$SS_k = \sum_{j=1}^{25} d_{kj}^2 - \left(\sum_{j=1}^{25} d_{kj} \right)^2 / 25 \quad k = 1, \dots, 7$$

$$SP_{km} = \sum_{j=1}^{25} d_{kj} d_{mj} - \left(\sum_{j=1}^{25} d_{kj} \right) \left(\sum_{j=1}^{25} d_{mj} \right) / 25 \quad k \neq m = 1, \dots, 7$$

$$S_{kk} = SS_k / 24 \quad k = 1, \dots, 7$$

$$S_{km} = SP_{km} / 24 \quad k \neq m = 1, \dots, 7$$

In terms of the quantities \bar{d}_k , S_{kk} , and S_{km} , D^2 is defined as

$$D^2 = (\bar{d}_1 \ \bar{d}_2 \ \dots \ \bar{d}_7) \begin{bmatrix} S_{11} & S_{12} & \dots & S_{17} \\ S_{12} & S_{22} & \dots & S_{27} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ S_{17} & S_{27} & \dots & S_{77} \end{bmatrix}^{-1} \begin{bmatrix} \bar{d}_1 \\ \bar{d}_2 \\ \cdot \\ \cdot \\ \bar{d}_7 \end{bmatrix}$$

Calculations yielded $D^2 = 0.3985$ and $T^2 = 25 D^2 = 9.963$ which is less than the tabular value of $T^2_{0.05(7,24)} = 24.049$, thus the null hypothesis is not rejected and it is concluded there is no significant difference between JES and APS mean vectors.

Power of Test on Mean Vectors

In a properly designed experiment the probability of the type II error should also be controlled. However, since there was no prior experience on which to base an estimate of the population covariance matrix, Σ , it was not possible to determine the sample size needed to acquire significant results prior to this survey. Also, as stated before, monetary restrictions limited the size of the experiment to 25 segments.

The probability of a type II error, β , can be obtained from the distribution of T^2 . For testing the hypothesis $H_0: \delta = 0$ against the alternative $H_1: \delta \neq 0$, the statistic:

$$F = \frac{n - p}{np - p} T^2$$

follows the non-central F-distribution with parameter

$$\delta^2 = n(\mu_1 - \mu_2)' \Sigma^{-1} (\mu_1 - \mu_2)$$

and degrees of freedom p and $n - p$ with n , p , and T^2 as previously defined. The power function of the test is $1 - \beta(\delta^2) = P(F' < F_\alpha; p, n - p)^{3/}$

The following are the differences between sample means for this survey (in acres):

<u>Tract total</u>	<u>Row crops</u>	<u>Corn</u>	<u>Soybeans</u>	<u>Small grain</u>	<u>Wheat</u>	<u>Oats</u>
(0.89	1.83	0.88	0.39	0.33	0.32	0.10)

A sample size of 53 would be required to detect differences as small as were observed in this survey with a probability of significant results greater than 0.90.

3/ Donald F. Morrison, Multivariate Statistical Methods, page 149.

COST DATA

An in-depth cost analysis has not been carried out for this survey. The following is a brief discussion of total costs and cost per segment for obtaining APS data in comparison to RES data.

Total cost for the color aerial photography was approximately \$2200. Interpretation required 56 hours. The interpretation was actually done by a GS-12, at the rate of \$6.50 per hour for a total of \$365. However, it could have been done by a GS-3 or 4 photo interpreter at a rate of \$3.00 per hour for a total of \$168. In addition, 66 man-hours were required for verification and travel between segments. The cost for verification was about \$180. Since editing and processing costs would be approximately the same for the two surveys, this data has been omitted. Therefore, total cost for the aerial photo survey was about \$2550, or \$102 per segment.

For the three years prior to this survey, the average expenditure for the re-enumeration survey was \$1300, or \$52 per segment.

Use of black and white instead of color photography would reduce the expenditure for the APS by approximately \$500, reducing the cost to \$80 per segment. However, additional studies would be necessary to determine if the data acquired from black and white photography would be sufficient for use as a quality control. University of California studies 4/ conclude there is no appreciable advantage in color photography over black and white photography for identification of livestock or orchard crops. Experience has also shown that crop acreage can be measured to within one percent of the correct area on conventional aerial photography. Here again, there's no appreciable difference between color and black and white photography.

4/ The Inventory of Livestock and Crops, R. N. Colwell, E. H. Roberts, D. T. Lauer, University of California, 1966.

APPENDIX I EXHIBIT A

OHIO RESEARCH PROJECT
 JUNE 1970
 AERIAL PHOTOGRAPHY JUNE SEGMENTS
 INSTRUCTIONS FOR COPYING
 JUNE SURVEY DATA

Heading Information: SEGMENT NO. :1-4 :
: - - - - :
:5-6 :
 TRACT _____ (enter code) : - - :
:7-10 :
 DATE _____ (enter code) : - - - - :
:11 :
 TYPE /CODE: Enumeration 1, Photography 2, Re-enumeration 3/ (enter code) : - :

Enter segment number, tract letter and code, date and Julian date code and code 1 under type.

1. OCCUPIED DWELLING /CODE: Yes 1, No 0/.....(enter code) :12 :
: - - :
 If tract is listed on top half of Part I.D. Code 1
 If tract is listed on bottom half of Part I.D. Code 0

2. GRAIN STORAGE /CODE: Yes 1, No 0/.....(enter code) :13 :
: - - :

- Case 1. TRACT listed in column 12, Part I.D.
Code as column 13, part I.D, go to 5.
- Case 2. Green questionnaire as completed. Code 0, go to 5.
- Case 3. Brown questionnaire -- code as questionnaire is coded on page 7, section C, question 2. Item code 539, go to 3.
- Case 4. Blue questionnaire -- code as questionnaire is coded on page 5, section C, question 2. Item code 539, go to 3.

3. LIVESTOCK: CHECK ONE

	No	Yes	Evidence		
CATTLE:	<input type="checkbox"/> /0	<input type="checkbox"/> /1	<input type="checkbox"/> /2	Fields _____	(enter code) :14 :
					: - - :
HOGS:	<input type="checkbox"/> /0	<input type="checkbox"/> /1	<input type="checkbox"/> /2	Fields _____	(enter code) :15 :
					: - - :
SHEEP:	<input type="checkbox"/> /0	<input type="checkbox"/> /1	<input type="checkbox"/> /2	Fields _____	(enter code) :16 :
					: - - :
CHICKENS:	<input type="checkbox"/> /0	<input type="checkbox"/> /1	<input type="checkbox"/> /2	Fields _____	(enter code) :17 :
					: - - :

Cattle:

If section E (page 7 Blue) (page 4 Brown) question 2 is checked yes, check yes for cattle and enter code 1. Enter fields from line 6 blocks A + B; go to Hogs section F, check no, enter 0, go to Hogs section F.

Hogs:

Case 1 Blue questionnaire, page 8, section F, question 6, item code 210 is positive. Check yes, add code 1, 0 code 0 go to sheep. Case 2, Brown questionnaire--page 5, section F. If question 1 is checked yes, check yes, add code 1, if no code 0, go to chickens.

Sheep:

There are no tract questions on sheep. Skip this section if on Brown questionnaire. If Blue and section G, question 1, page 9, item code 340 is positive circle evidence but DO NOT CODE. Go to chickens.

Chickens:

If section G (chickens), question 1 (page 10 Blue) (page 6 Brown) is checked yes, check yes and code 1; if checked no, code 0, go to 4.

4. CATTLE CROSSING tract boundaries /CODE: Yes 1, No 0/..(enter code) : 18 :
 : - :

IF CATTLE: question is checked No (coded 0) code 0 and skip to LAND USE.

IF CATTLE: question is checked Yes and there are entries in block B (page 4 Brown) (page 7 Blue) line 6 enter code 1.

5. LAND USE: (one digit code for each field)

:CODES: Woods-1	Past. W/Evid. LS-4	:	Fields 1-5	: <u>19-23</u>	:
:	Building-2	Small grain, Hay-5	:	: <u>24-28</u>	:
:	Row Crops-3	Past. W/O Evid. LS-6:	Fields 6-10	: <u>29-33</u>	:
			Fields 11-15	: <u>34-38</u>	:
			Fields 16-20	: <u> </u>	:

Case 1. Questionnaire ends on Part ID or Green code from the land use description in column 14, Part ID or if Green code 2, go to 6.

Code 1 - woods, waste, ditches, highway, timber, commercial timber, railroad, idle, gravel pit, etc.

Code 2 - subdivision W/ construction start, house and lot, F.S., elevator, cemetary, school, church, store, commercial, factory, railroad yards, vacant house, vacant buildings, or any other use which implies building.

Code 6 - pasture, idle pasture. Do not use code 3, 4, or 5.
Use code 6 very sparingly. Go to 6.

Case 2. Brown or Blue questionnaire photo copy pages 2 and 3 and all supplements. Attach to recording form and go to next tract.

6. ACREAGE: Tract total..... acres : 19-43 :

(You should be on part ID or Green). Enter acres from Column 12 part ID or question 6 green enter acres from Item code 846 to 1/10 of an acre, to next tract.

Photocopy segment enlargements as they come into field office.

EXHIBIT B

OHIO RESEARCH PROJECT
JUNE 1970
AERIAL PHOTOGRAPHY JUNE SEGMENTS

Instructions for Editing Copied
JES Questionnaires

Heading information, enter all codes and make sure it is completely filled out.

1. OCCUPIED DWELLING -- enter code if not coded.
2. GRAIN STORAGE -- enter code if not coded.
3. LIVESTOCK -- if tract ends on ID or Green, there should be no entries. Code all livestock items 0.

If tract is on a brown or blue edit for reasonableness. There should be fields reported if cattle are coded 1. Sheep should be coded 0.

4. CATTLE CROSSING

Should be coded 0 if cattle code is 0.
Should be coded 0 or 1 if cattle code is 1.

5. LAND USE

If tract ends on part ID, the left hand blank in block :19-23 should be coded 1, 2, or 6. All others should be blank. :2 - - - -:
If tract ends on brown or blue, code each field in order: :19-23 starting with left hand blank in block :1 2 4 3 3: and continuing from left to right until all fields are coded. If more than 20 fields, use a second sheet and mark.

If principal land use is:

- Code 1 Woods, waste, ditches, highway, railroad, gravel pit, etc.
- Code 2 Farmstead, FS, tenant house, house and lot, barns, corn crib, elevator or any other description that indicates buildings.
- Code 3 Corn, soybeans, drybeans, popcorn, sorghum, vegetables or any other row crop.
- Code 4 Pasture on tracts with livestock (cattle, hogs, or sheep). One or more coded 1.

OATS..... acres : 69-93 :
:-----:

Sum oats planted acreage as reported on pages 2 and 3, item code
533, JUNE SURVEY PART A.

Enumerator _____

Make sure that the original enumerator is recorded.

EXHIBIT C

OHIO RESEARCH PROJECT
OHIO 1970
AERIAL PHOTOGRAPHY JUNE SEGMENTS
INSTRUCTIONS FOR HANDLING AERIAL PHOTOGRAPHS

When photos become available, identify each photograph, indicate north, segment number, number of photographs for segment, date of flight, direction of flight and altitude. If more than one camera setup is used, indicate what setup was used for this photograph. The above information should be available from contractor on flight logs, etc.

After all photos are identified, draw segment boundaries in permanent red ink; with blue grease pencil draw tract boundaries and label and with red grease pencil number fields. Field boundaries should be visible on photograph but if not--due to unplanted or crops not up, etc.--draw field boundary with dashed red grease pencil. The above information can be taken directly from the photo enlargement used by the enumerator or a photo copy.

At this time obtain a recording form for each tract (same as used for copying June data) and fill out headings. Use date of flight for date and code 2 under TYPE.

1. OCCUPIED DWELLINGS /CODE: Yes 1, No 0/.....(enter code) : 11 :
: - :

Examine tract for buildings. If none enter code (0) and explain on back e.g. (1. no buildings). Examine each set of buildings for occupied dwelling and code 1 for occupied dwelling and 0 for none. Explain on back reasons for doing so:

- i.e.,
1. Driveway with car partly in garage (code 1)
 2. Hog lot next to only building (code 0)

We have no specific guidelines but the notes should help us determine what might be helpful. Some things that indicate occupancy are visible toys, a washing on a clothes line, cars in driveway, well kept lawns, paths to barn, etc. Some things that indicate unoccupancy are unkept lawns, roof shape more typical of a barn, weeds, tombstones, large parking lot such as for school or church.

The interpreter should weigh the pluses and minuses, make a decision and record reasons on back of form.

: DON'T look at observer's notes or the :
: June Survey Questionnaire or copied :
: data to help him decide. :

2. GRAIN STORAGE /CODE: Yes 1, No 0/.....(enter code) : 12 :
 : - :

If no buildings enter 0 and go to cattle. If buildings examine each set to determine if it could be grain storage. Does it look like a round steel bin? Does it have hatches or dormers for elevator equipment? Does its shadow cast a characteristics grain storage building shadow? Code and state reason for code on back.

3. LIVESTOCK: CHECK ONE:

	<u>No</u>	<u>Yes</u>	<u>Evidence</u>	
CATTLE:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields....(enter code)	: <u>14</u> : : - :
HOGS:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields....(enter code)	: <u>15</u> : : - :
SHEEP:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields....(enter code)	: <u>16</u> : : - :
CHICKENS:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields....(enter code)	: <u>17</u> : : - :

Examine each field for livestock. If livestock are actually identified, check yes for specie and enter field number. If livestock are not actually identified but current or recent use of a field is indicated, check evidence and enter field number. Explain in notes on back.

If one or more fields are identified as having a specie, enter 1 in code box. If no fields are identified as having the specie, but evidence is found in one or more fields, enter a 2 in code box.

If no fields contain any evidence for a specie enter an 0 in code box.

4. CATTLE CROSSING tract boundaries /CODE: Yes 1, No 0/(enter code): 18 :
 : - :

If cattle is coded 0 or if all fields containing cattle, or evidence of cattle do not have a point or boundary in common with a segment boundary, code 0.

If cattle is coded 1 and one or more fields containing cattle, or evidence of cattle has a common point or common boundary with the segment, examine such boundary or point to determine if such cattle have access to land adjoining the segment. If so, code 1 and explain on back; otherwise, code 0.

5. LAND USE: (one digit code for each field)	Fields 1-5	:19-23 : :-----:
	Fields 6-10	:24-28 : :-----:
<u>:CODES: Woods-1 Past. W/Evid. LS-4 :</u>		:29-33 : :-----:
<u>: Buildings-2 Small grain, Hay-5 :</u>	Fields 11-15	:34-38 : :-----:
<u>: Row Crops-3 Past. W/O Evid. LS-6 :</u>	Fields 16-20	:-----:

Examine each field for cropping pattern, pastures for trees and brush that would indicate permanent pasture, etc. If bare soil and a row crop pattern can be ascertained, code 3. Explain bare soil and row crop codes if row crop cannot actually be seen. Make sure pasture codes 4 and 6 are consistent with LIVESTOCK. (NOTE LIVESTOCK MAY BE FOUND IN WOODS ON AG. TRACTS AND BE CONSISTANT). Most Government program land will have appearance of small grain and hay. All GP land will be coded 5.

If there appears to be a field that does not appear on the copied June data, on the photograph use a green grease pencil and mark this field and number it using the next higher field number. Code this field the same as above. A list of uses will be found in the copying instructions.

Planimetered Acres

This section will be done after all other data has been collected.

6. ACREAGE: Tract total	
ALL ROW CROPS.....(acres)	:_____:
CORN.....(acres)	:_____:
SOYBEANS.....(acres)	:_____:
ALL SMALL GRAIN AND HAY.....(acres)	:_____:
WHEAT.....(acres)	:_____:
OATS.....(acres)	:_____:

Prior to survey period a photo enlargement (8" to 1 mile scale) will be prepared by tracing segment boundaries.

Field boundaries will be located as accurately as possible from the photography (1970). For type 2 forms, only TRACT TOTAL, ALL ROW CROPS, ALL SMALL GRAIN AND HAY will be entered. Under all small grain and hay all agricultural land will be entered on the type 2 form. Land use will be determined from 5, LAND USE. The entire tract will be planimetered as a unit. The all row crops and all small grains and hay will be planimetered field by field, then totaled. A separate form will be used to record this planimetering.

EXHIBIT D

OHIO RESEARCH PROJECT
JUNE 1970
AERIAL PHOTOGRAPHY JUNE SEGMENTS
SUMMARIZATION FORM

				SEGMENT NO.	:1-4
					: - - - -
					:5-6
		TRACT _____	(enter code)		: - - -
					:7-10
DATE _____			(enter code)		: - - - -
					:11
		TYPE/CODE: Enumeration 1, Photography 2, Re-numeration 3/ (enter code)			: - - - -
1. OCCUPIED DWELLING /CODE: Yes 1, No 0/.....			(enter code)		:12
2. GRAIN STORAGE /CODE: Yes 1, No 0/.....			(enter code)		:13
3. LIVESTOCK: CHECK ONE:					: - - - -
	<u>No</u>	<u>Yes</u>	<u>Evidence</u>		:14
CATTLE:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields.....	(enter code)	: - - - -
HOGS:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields.....	(enter code)	:15
SHEEP:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields.....	(enter code)	:16
CHICKENS:	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2 Fields.....	(enter code)	:17
4. CATTLE CROSSING tract Boundaries /CODE: Yes 1, No 0/.....			(enter code)		:18
5. LAND USE: (One digit code for each field)			Fields 1-5		:19-23
			Fields 6-10		:24-28
:CODES: Woods-1		Past. W/Evid. LS-4			: - - - -
: Buildings-2		Small grain, Hay-5			:29-33
: Row Crops-3		Past. W/O Evid. LS-6			: - - - -
			Fields 11-15		:34-38
			Fields 16-20		: - - - -
6. ACREAGE: Tract Total					:39-43
ALL ROW CROPS.....(acres)					:44-48
CORN.....(acres)					:49-53
SOYBEANS.....(acres)					:54-58
ALL SMALL GRAIN & HAY.....(acres)					:59-63
WHEAT.....(acres)					:64-68
OATS.....(acres)					:69-73
Enumerator _____					: - - - -

6

State	District	Segment No.
-------	----------	-------------

UNITED STATES DEPARTMENT OF AGRICULTURE
 Statistical Reporting Service
 Budget Bureau No. - 40-R2766
 Approval Expires - 4/30/71
 Item Count - 19

COUNTY _____

PART I.D. - 3 N.C. States

APPENDIX II
 EXHIBIT A

JUNE 1970 ACREAGE, LIVESTOCK & LABOR ENUMERATIVE SURVEY

PART I.D. _____ OF _____

ENUMERATOR CHECK LIST: Complete this check list when enumeration of segment is completed.

1. Total tract codes listed in Column 1, Page 2... _____
 2. Number of tract codes listed on photo or map... _____
- Item 1 and 2 must agree.*
3. Number of BLUE questionnaires completed..... _____
 4. Number of BROWN questionnaires completed..... _____
 5. Number of GREEN questionnaires completed..... _____
 6. Number of tracts listed in Column 12, Page 4... _____
 7. Total of items 3 + 4 + 5 + 6 equals..... _____

Item 7 must agree with items 1 and 2.

Comment on any enumerating problems caused by segment boundaries, split fields, aerial photo coverage, etc.

(ENUMERATOR'S SIGNATURE)

VISITS TO SEGMENT

Month	Day

OFFICE USE	Date	Initials
Received		
1st EDIT		
2nd EDIT		
3rd EDIT		
Mailed from SSO		

Do you _____ (Col. 4 person) operate a farm or ranch at any location? <i>Go to Blue Question 9</i>	Will any crops be grown in 1970 by you (Col. 4 person)?	Do you (Col. 4 person) have any cattle hogs, sheep or poultry, or expect to have any this year?	During the last 12 months did you sell any agricultural products or receive govern- ment farm payments?	Do you own or are you buying your house?	Do you pay Cash rent for your house?
5	6	7	8	9	10
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green
<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Blue <input type="checkbox"/> NO →	<input type="checkbox"/> YES-Page 4 <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Page 4 <input type="checkbox"/> NO - Green

<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →
<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →
<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →
<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →
<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →
<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →
<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →	<input type="checkbox"/> YES - Brown <input type="checkbox"/> NO →

OFFICE USE	How many acres are in this tract?	Are there any facilities on this tract which could be used for storing grain or soybeans? NO () Continue YES () Enter Code 1	LAND USE <i>Describe</i>	Are there any other persons living in this household who operate a farm or ranch?	OFFICE USE	
					Tract Count	Hash Total
11	12	13	14	15	16	17
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999
--	846	849 NO () → YES () → .0	House &	YES () - <i>New Line</i> NO () - <i>Stop</i>	920 1.0	999

			OFFICE USE	
			Tract Count	Hash Total
--	846	849 NO () → YES () → .0	920 1.0	999
--	846	849 NO () → YES () → .0	920 1.0	999
--	846	849 NO () → YES () → .0	920 1.0	999
--	846	849 NO () → YES () → .0	920 1.0	999
--	846	849 NO () → YES () → .0	920 1.0	999
--	846	849 NO () → YES () → .0	920 1.0	999
--	846	849 NO () → YES () → .0	920 1.0	999

- A - 01
- B - 02
- C - 03
- D - 04
- E - 05
- F - 06
- G - 07
- H - 08
- I - 09
- J - 10
- K - 11
- L - 12
- M - 13
- N - 14
- O - 15
- P - 16
- Q - 17
- R - 18
- S - 19
- T - 20
- U - 21
- V - 22
- W - 23
- X - 24
- Y - 25
- Z - 26
- AA - 27
- BB - 28
- CC - 29
- DD - 30
- EE - 31
- etc.

OFFICE USE
R.A.
P.A.
R.A./P.A.

SECTION A - ACREAGES OF

A-2

FIELD NUMBER.....		1	2	3	4
1.	TOTAL ACRES IN FIELD	.	.	.	.
2.	CROP or LAND USE - Name				
3.	TWO CROPS HARVESTED FROM THIS FIELD?	YES () NO ()	YES () NO ()	YES () NO ()	YES () NO ()
4.	ACRES IRRIGATED AND TO BE IRRIGATED?	.	.	.	.
5.	FARMSTEAD, DITCHES, WOODS, ROADS, WASTE	.	.	.	.
6.	PASTURE Permanent-Not in Crop Rotation	842	842	842	842
7.	Cropland-Used only for Pasture	845	845	845	845
10.	WINTER WHEAT Planted	540	540	540	540
11.	Intended for grain	541	541	541	541
12.	DURUM WHEAT Planted	551	551	551	551
13.	OTHER SPRING WHEAT Planted	550	550	550	550
16.	SOYBEANS ALONE Planted and to be planted	600	600	600	600
19.	FLAXSEED Planted and to be planted	693	693	693	693
23.	SORGHUM Planted and to be planted	603	603	603	603
24.	Intended for grain	604	604	604	604
25.	ALFALFA AND ALFALFA MIXTURES	853	853	853	853
26.	CLOVER-TIMOTHY OR CLOVER-GRASSES	855	855	855	855
27.	GRAIN	857	857	857	857
28.	LESPEDEZA	852	852	852	852
29.	OTHER	854	854	854	854
30.	WILD	851	851	851	851
31.	CORN Planted and to be planted	530	530	530	530
32.	Intended for grain	531	531	531	531
33.	RYE Planted	547	547	547	547
34.	Intended for grain	548	548	548	548
35.	OATS Planted	533	533	533	533
36.	Intended for grain	534	534	534	534
37.	BARLEY Planted	535	535	535	535
38.	Intended for grain	536	536	536	536
39.	OTHER CROPS Name of crop				
	Acres planted or in use	.	.	.	.
40.	OTHER UTILIZATION AND ABANDONMENT Name, use or crop				
	Acres	.	.	.	.
41.	SUMMER FALLOW Acres	847	847	847	847
42.	SOIL IMPROVEMENT CROPS ONLY No other use in 1970	856	856	856	856
43.	IDLE CROPLAND Acres idle in 1970	857	857	857	857

FIELDS AND CROPS IN TRACT

	5	6	7	8	9	OFFICE USE
Total Acres	.	.	.	.	.	840
Land Use	.	.	.	.	.	820 1.0
Two Crops	YES () NO ()	YES () NO ()	YES () NO ()	YES () NO ()	YES () NO ()	
Irrigated 1970	.	.	.	.	.	843
Other Land	.	.	.	.	.	841
Permanent Pasture	842	842	842	842	842	
Cropland Pasture	845	845	845	845	845	
Winter Wheat Planted	540	540	540	540	540	
Winter Wheat Harvested	541	541	541	541	541	
Durum Wheat	551	551	551	551	551	
Other Spring Wheat	550	550	550	550	550	
Soybeans	800	800	800	800	800	801
Flaxseed	883	883	883	883	883	
Sorghum Planted	803	803	803	803	803	
Sorghum Harvested	804	804	804	804	804	
Alfalfa Hay	853	853	853	853	853	
Clo-Tim Hay	855	855	855	855	855	
Brain Hay	857	857	857	857	857	
Lespedeza Hay	852	852	852	852	852	
Other Hay	854	854	854	854	854	
Wild Hay	851	851	851	851	851	
Corn Planted	530	530	530	530	530	
Corn Harvested	531	531	531	531	531	
Rye Planted	547	547	547	547	547	
Rye Harvested	548	548	548	548	548	
Oats Planted	533	533	533	533	533	
Oats Harvested	534	534	534	534	534	
Barley Planted	535	535	535	535	535	
Barley Harvested	538	538	538	538	538	
Other Crops						
Acres	.	.	.	.	.
Other Utilization						
Acres	.	.	.	.	.
Summer Fallow	847	847	847	847	847	
Soil Improvement	858	858	858	858	858	
Idle Cropland	857	857	857	857	857	

SECTION A. (cont'd)

ACRES IRRIGATED FOR THE FIRST TIME

Ask item 45 only if any fields in the tract will be irrigated in 1970

45. How many acres in this tract will be irrigated in 1970 which were not irrigated in 1969 or earlier years?.....Acres 844

WINTER WHEAT INTENTIONS

46. Do you intend to seed any WINTER WHEAT in this tract this fall?.....
 YES () - 1 }
 Don't Know () - 1 }Enter Code 543
 NO ()

SECTION B. ACRES OWNED AND OPERATED

Now I would like to talk about all the acres of land that you own or operate, including cropland, woodland, pastureland, wasteland and non-agricultural land. Include land you rent in or manage as well as land you own. Let's sketch each parcel or piece of land you own or operate and its relative location from this segment, tract _____. Include land you own or operate in other counties.

1. Sketch



Tract _____
Parcel No. 1

Parcel Number	Location or name of parcel	Acreage			
		Owned	Rented from Others	Operated as hired manager	Rented to Others
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1	Tract _____	.	.	.	.
2		.	.	.	.
3		.	.	.	.
4		.	.	.	.
5		.	.	.	.
TOTAL		901	902	904	905
<i>Sum each column</i>		.	.	.	.

2. Add totals of cols. c+d+e and subtract col. f: Then the TOTAL land you now OPERATE in your entire farm is?.... 900

SECTION C. GRAIN CROPS AND GRAIN STORAGE

If any small grain, corn, sorghum, flax or soybeans were reported in Section A, check YES for item 1 and SKIP to item 2.

1. Will you produce any small grains, corn, sorghum, soybeans or flax on land you now operate?
- | | | | |
|---------------|--------------------|-----|----|
| YES () - 1 | } Enter Code | 538 | .0 |
| Don't () - 1 | | | |
| Know () - 1 | | | |
| NO () | | | |
2. Will any small grains, corn, sorghum, soybeans or flax be stored by you or anyone else in 1970 on any land you now operate?
- | | | | |
|---------------|--------------------|-----|----|
| YES () - 1 | } Enter Code | 539 | .0 |
| Don't () - 1 | | | |
| Know () - 1 | | | |
| NO () | | | |

SECTION D. CATTLE ON TOTAL ACRES OPERATED

1. Are there any CATTLE and CALVES on these _____ acres you now operate?
(page 4, item 2)

() YES NO () → 2. Will there be any cattle and calves on these acres from now through the end of the year?

YES () - 1 } Enter code and then 193 .0
Don't Know () - 1 } go to item 6...
NO () - Go to item 6

3. HOW MANY ARE:

a. BEEF COWS? Include heifers that have calved one or more times. 356 .0

b. MILK COWS, dry and in milk? Include heifers that have calved one or more times? 357 .0

c. OTHER CATTLE and CALVES including 1970 calves now on hand? 358 .0

4. Add items 3a + 3b + 3c: Then the TOTAL CATTLE and CALVES on these _____ acres now is? 351 .0
Is that correct?

CALF CROP

5. Of the cows and heifers on these _____ acres now, how many will have CALVES from now through December 31, 1970? 367 .0

6. How many CALVES were born on these _____ acres from January 1, 1970 to now? Include those still on the farm, sold or died. 366 .0

CATTLE GRAZING ON OTHER LAND

7. Some cattlemen have cattle on other land, such as public grazing land, land operated by grazing associations, feed yards or on rent free land. Do you have any other cattle and calves elsewhere?

YES () Continue NO () Go to page 7

8. In addition to the (item 3a + 3b) _____ COWS, how many cows do you have ON OTHER LAND? Include heifers that have calved one or more times. 363 .0

9. Of the COWS and HEIFERS on this OTHER LAND, how many will have calves from now through December 31, 1970? 369 .0

10. In addition to the (item 6) _____ calves born that you already reported, how many CALVES WERE BORN on other land from January 1, 1970 to now? 368 .0

If zero in items 8 thru 10, go to page 7

11. Who owns or operates THE OTHER LAND on which the (item 8) _____ cows are located?

Check here

(a) Federal, State or Local Government, School?...

(b) Company or Corporation?.....

(c) Privately operated Farm, Ranch or Feed Yard?
Specify:

(d) Other (specify)

SECTION E. COWS AND HEIFERS ON TRACT

If zero in items 3a and 3b on page 6, go to Hogs on page 8.

1. Do you operate any **ADJOINING** land **OUTSIDE** the tract? Review sketch of parcels.

() YES NO ()



2. Are there any **COWS** and **HEIFERS** now **INSIDE** the tract?

YES () Go to Block A below.
NO () Go to Hogs, page 8.

3. Are there any **COWS** and **HEIFERS** on any of the land **INSIDE** this tract or on **ADJOINING** land outside the tract?

() YES NO () Go to Hogs, page 8.



4. Because of **open gates**, **lack of fences**, or for other reasons, can any of these **COWS** and **HEIFERS** **NOW MOVE FREELY ACROSS** the tract boundary to land both **INSIDE** and **OUTSIDE** this tract?

() YES - Go to Block A and Block B. NO ()

5. Are any of these **COWS** and **HEIFERS** **INSIDE** the tract?

() YES - Go to Block A NO () - Go to Hogs, page 8

LINE	ITEM	Block A			Block B		
		COWS now INSIDE tract and CANNOT move to land OUTSIDE.			COWS CAN cross tract boundary to adjoining land.		
6	June Field Number →						OFFICE USE
7	BEEF COWS? Include heifers that have calved one or more times.	256 .0	256 .0	256 .0			256
8	MILK COWS, dry and in milk? Include heifers that have calved one or more times.	257 .0	257 .0	257 .0			257
9	→ Acres in field INSIDE tract.....						
10	→ Acres OUTSIDE tract cattle can now graze.						
	Add 9 + 10:						
11	→ TOTAL acres in area cattle can now graze.						

12. We have recorded the cows in fields —, —, — (Blocks A and B). The photo shows fields —, —, — remaining on the photo. In these remaining fields are there now any cows or can any cows from adjoining land outside the tract freely move into these fields?

NO () Continue YES () Complete a column above for each additional field

SECTION F. HOGS AND PIGS

HOGS AND PIGS INVENTORY

1. Are there any **SOWS, BOARS, HOGS** or **PIGS** on these _____ acres you now operate?

() YES () NO



2. Have there been any **HOGS** or **PIGS** on these acres since December 1, 1969?

YES () Go to item 8
NO ()

3. Will there be any **HOGS** or **PIGS** on these _____ acres from now through the end of this year?

YES () - 1 } Enter code and then
Don't Know () - 1 } go to Sheep, page 9
NO () - Go to Sheep, page 9

192	.0
-----	----

Let's start with the **HOGS** and **PIGS** you keep for breeding.

4. How many are:...		On Total	
		Acres Operated	On the Tract
a. SOWS, GILTS and YOUNG GILTS for breeding? Include those bred and to be bred..... b. BOARS and YOUNG MALES for breeding?.... c. SOWS and BOARS no longer used for breeding?.....		305	217
		.0	.0
		306	218
		.0	.0
		307	219
		.0	.0

Now I would like some information about your hogs and pigs for market and home use. Exclude breeding hogs you already told me about.

5. How many are:	a. Under 60 lbs. including pigs not yet weaned?.....	311	221
		.0	.0
	b. 60-119 lbs?.....	312	223
		.0	.0
	c. 120-179 lbs?.....	313	226
	.0	.0	
	d. 180-219 lbs?.....	314	227
		.0	.0
	e. 220 lbs. and over?..... Exclude hogs no longer used for breeding	315	228
		.0	.0
6. Add item 4+5: Then the TOTAL SOWS, BOARS, HOGS and PIGS is?		300	210
		.0	.0

EXPECTED FARROWINGS ON THE ENTIRE FARM

7. How many sows and gilts on these _____ acres are expected to farrow:
(page 4, item 2)
- | | On Total
Acres Operated |
|---|----------------------------|
| a. From now through June, July and August?..... | 317 .0 |
| b. During September, October and November?..... | 318 .0 |

PREVIOUS SIX MONTHS FARROWINGS

8. How many SOWS and GILTS farrowed on these _____ acres
December 1969 and January and February of this year?.....
- | | |
|--|--------|
| | 321 .0 |
|--|--------|
9. How many PIGS from these _____ litters are:.....
(item 8)
- | | |
|--------------------------------------|--------|
| a. Now on hand?..... | 322 .0 |
| b. Already sold or slaughtered?..... | 323 .0 |
10. How many SOWS and GILTS farrowed
during March, April, May until Now?.....
- | | |
|--|--------|
| | 325 .0 |
|--|--------|
11. How many PIGS from these _____ litters are:.....
(item 10)
- | | |
|-----------------------|--------|
| a. Now on hand?..... | 326 .0 |
| b. Already sold?..... | 327 .0 |

HOG AND PIG DEATHS

12. How many hogs and pigs of weaning age and older
have died on these acres since December 1, 1969?.....
- | | |
|--|--------|
| | 308 .0 |
|--|--------|

SECTION G. SHEEP AND CHICKENS

SHEEP AND LAMBS

1. How many SHEEP and LAMBS of all ages are on these _____ acres now?..
(page 4, item 2)
- | | |
|--|--------|
| | 340 .0 |
|--|--------|

CHICKENS

1. Are there any CHICKENS (excluding commercial broilers) on this tract now?

() YES () NO

2. Will there be any CHICKENS on this tract between now and the end of this year?

YES () - 1 } Enter code, then go to item 9.....
Don't Know () - 1 }
NO () Go to item 9

On The Tract
195 .0

3. How many CHICKENS (excluding commercial broilers) are on this tract now?.....

280 .0

4. Of these (item 3) CHICKENS, how many are HENS AND PULLETS of laying age?.....

281 .0

If less than 400 chickens in item 3, go to item 10
If 400 or more chickens, ask item 5

5. Are any of these (item 3) chickens owned by another person or firm?

YES () Continue NO () Go to item 10

6. How many of the chickens are OWNED by someone else?.....

282 .0

7. Of the (item 6) chickens owned by someone else, how many are HENS and PULLETS of laying age?.....

283 .0

8. Who owns these (item 6) CHICKENS?

NAME ADDRESS

Go to item 10

9. Are there any CHICKENS on any other land you operate?.. YES () NO () -1. Enter Code

On Total Acres Operated
917 .0

- 10. RESPONDENT CODE: Operator... 1
Wife... 2
Other relative... 3
Hired worker... 4
Neighbor... 5
Other (specify)... 6
Observed Data Only-Refusal... 7
Observed Data Only-No Respondent.. 8

Code

Enter Code

88 1.0

HT

999

Enter Name of respondent if not person in charge:

NAME

MINK

1. Do you raise mink or know anyone who does raise mink?

YES () List each name on Supplement C

NO () Conclude interview

SECTION H. AGRICULTURAL LABOR

1. During the week of May 17-23, did anyone do agricultural work for pay on the _____ acres you operate?

() YES NO () Go to item 5

2. How many were:

a. Paid family members?..... _____

24-27

b. Other workers hired and paid by you?.....

28-31

c. Workers hired and paid by a contractor or custom operator?.....

31-35

3. Add b+c: Then the total non-family workers is?..... Is that correct?

If item 3 is zero, go to item 5

4. How many of the (item 3) _____ workers:

a. Will work 150 days or more on the land you operate?.....

36-39

b. Were migratory workers?.....

40-43

c. Were paid on a piece-rate basis?.....

44-47

5. During 1969 did you hire any agricultural workers to work on the land you operated?

YES () - 1 - Enter code and then go to item 7..... NO () Ask item 6

48

6. Do you expect to employ workers to do agricultural work during the next 12 months? YES () Ask item 7 NO () Go to item 8

7. During the year, on which crop or kind of livestock do your hired workers spend most of their time?

(Example: cotton, tobacco, fruit, vegetables, dairy, etc.)

ANSWER: _____

OFFICE USE

49

8. Considering -- All your 1969 crops sold and to be sold, -- All livestock, poultry, (including commercial broilers) and products sold in 1969, -- All sales of any miscellaneous agricultural products in 1969, -- All government payments received in 1969,

What was the total value of sales?

Less than \$50----- 0 () \$ 50 - \$ 250----- 1 ()

9. What two crops or principal agricultural uses will have the largest planted acreage this year on the land you operate?

Table with 2 columns: Crop or Land Use, Acres

\$ 250 - \$ 2,499---- 2 () \$ 2,500 - \$ 4,999---- 3 () \$ 5,000 - \$ 9,999---- 4 () \$ 10,000 - \$19,999---- 5 () \$ 20,000 - \$39,999---- 6 () \$ 40,000 - \$59,999---- 7 () \$ 60,000 - \$79,999---- 8 () \$ 80,000 - \$99,999---- 9 () \$100,000 & Over ----- 10 ()

.....Enter Code

50-51

10. In terms of total value of sales, what were the three most important agricultural products sold from the land you operated in 1969?

Specify Products	Percent of total
1st: _____	_____%
2nd: _____	_____%
3rd: _____	_____%
4th: <u>ALL OTHER</u> _____	_____%

OFFICE USE

Now I would like to refer back to 1968.

11. During 1968 did you hire 5 or more agricultural workers?

YES () - 1. Enter Code
 NO () Go to Farm Population, Section I

12. Did at least 5 of these workers each work more than 20 days or did each earn more than \$150 on the land you operate?

YES () - 1. Enter Code
 NO ()

13. Did you file an Employer's Social Security Return for these employees?

YES () - 1. Enter Code
 NO () Go to Farm Population, Section I

14. Has there been any change since 1968 in the Employer's name you use in filing these returns?

YES () - 1. Enter Code
 NO () Go to Farm Population, Section I

SECTION I. FARM POPULATION

1. RACE - observe - Is this family: ^{Check}
 White - 1 ()
 Negro - 2 ()
 Other - 3 () - specify _____

Enter Code

2. How many people are now living in your house?..... No.

3. Since June 1, 1969, how many babies were born to residents of this house?..... No.

4. Since June 1, 1969, how many persons died who were residents of this house?..... No.

5. Are there any other persons living in this household who operate a farm or ranch?

YES () Enter Name _____
 List this person on page 2, Part ID and interview him
 NO () Conclude interview

OFFICE USE
 Tenure
 Rptd. Sales
 Edtd. Sales

SECTION A - ACREAGES OF

A-2

FIELD NUMBER.....		1	2	3	4
1.	TOTAL ACRES IN FIELD	.	.	.	.
2.	CROP or LAND USE - Name				
3.	TWO CROPS HARVESTED FROM THIS FIELD?	YES () NO ()	YES () NO ()	YES () NO ()	YES () NO ()
4.	ACRES IRRIGATED AND TO BE IRRIGATED?	.	.	.	.
5.	FARMSTEAD, DITCHES, WOODS, ROADS, WASTE	.	.	.	.
6.	PASTURE Permanent-Not in Crop Rotation	842	842	842	842
7.	Cropland-Used only for Pasture	845	845	845	845
10.	WINTER WHEAT Planted	540	540	540	540
11.	Intended for grain	541	541	541	541
12.	DURUM WHEAT Planted	551	551	551	551
13.	OTHER SPRING WHEAT Planted	550	550	550	550
16.	SOYBEANS ALONE Planted and to be planted	600	600	600	600
19.	FLAXSEED Planted and to be planted	693	693	693	693
23.	SORGHUM Planted and to be planted	603	603	603	603
24.	Intended for grain	604	604	604	604
25.	ALFALFA AND ALFALFA MIXTURES	653	653	653	653
26.	CLOVER-TIMOTHY OR CLOVER-GRASSES	655	655	655	655
27.	GRAIN	657	657	657	657
28.	HAY LESPEDEZA	652	652	652	652
29.	OTHER	654	654	654	654
30.	WILD	651	651	651	651
31.	CORN Planted and to be planted	530	530	530	530
32.	Intended for grain	531	531	531	531
33.	RYE Planted	547	547	547	547
34.	Intended for grain	548	548	548	548
35.	OATS Planted	533	533	533	533
36.	Intended for grain	534	534	534	534
37.	BARLEY Planted	535	535	535	535
38.	Intended for grain	536	536	536	536
39.	OTHER CROPS	Name of crop			
		Acres planted or in use	.	.	.
40.	OTHER UTILIZATION AND ABANDONMENT	Name, use or crop			
		Acres	.	.	.
41.	SUMMER FALLOW	Acres	847	847	847
42.	SOIL IMPROVEMENT CROPS ONLY	No other use in 1970	856	856	856
43.	IDLE CROPLAND	Acres idle in 1970	857	857	857

FIELDS AND CROPS IN TRACT

	5	6	7	8	9	OFFICE USE
Total Acres	.	.	.	.	.	840
Land Use						920 1.0
Two Crops	YES () NO ()	YES () NO ()	YES () NO ()	YES () NO ()	YES () NO ()	
Irrigated 1970	.	.	.	.	.	843
Other Land	.	.	.	.	.	841
Permanent Pasture	842	842	842	842	842	
Cropland Pasture	845	845	845	845	845	
Winter Wheat Planted	540	540	540	540	540	
Winter Wheat Harvested	541	541	541	541	541	
Durum Wheat	551	551	551	551	551	
Other Spring Wheat	550	550	550	550	550	
Soybeans	600	600	600	600	600	601
Flaxseed	693	693	693	693	693	
Sorghum Planted	603	603	603	603	603	
Sorghum Harvested	604	604	604	604	604	
Alfalfa Hay	653	653	653	653	353	
Clo-Tim Hay	655	655	655	655	355	
Grain Hay	657	657	657	657	657	
Lespedeza Hay	652	652	652	652	652	
Other Hay	654	654	654	654	654	
Wild Hay	651	651	651	651	651	
Corn Planted	530	530	530	530	530	
Corn Harvested	531	531	531	531	531	
Rye Planted	547	547	547	547	547	
Rye Harvested	548	548	548	548	548	
Oats Planted	533	533	533	533	533	
Oats Harvested	534	534	534	534	534	
Barley Planted	535	535	535	535	535	
Barley Harvested	536	536	536	536	536	
Other Crops-Name						
Acres	.	.	.	.	.
Other Utilization						
Acres	.	.	.	.	.
Summer Fallow	847	847	847	847	847	
Soil Improvement	856	856	856	856	856	
Idle Cropland	857	857	857	857	857	

SECTION A. (cont'd)

ACRES IRRIGATED FOR THE FIRST TIME

Ask item 45 only if any fields in the tract will be irrigated in 1970

45. How many acres in this tract will be irrigated in 1970 which were not irrigated in 1969 or earlier years?.....Acres 844

WINTER WHEAT INTENTIONS

46. Do you intend to seed any WINTER WHEAT in this tract this fall?.....Enter Code 543
 YES () - 1 }
 Don't Know () - 1 }
 NO ()

SECTION E. COWS AND HEIFERS ON TRACT

1. Do you operate any ADJOINING land OUTSIDE the tract?

() YES NO ()

2. Are there any COWS and HEIFERS now INSIDE the tract?

YES () Go to Block A below
 NO () Go to item 13 below

3. Are there any COWS and HEIFERS on any of the land INSIDE this tract or on ADJOINING land outside the tract?

() YES NO () Go to item 13 below

4. Because of open gates, lack of fences, or for other reasons, can any of these COWS and HEIFERS NOW MOVE FREELY ACROSS the tract boundary to land both INSIDE and OUTSIDE this tract?

() YES - Go to Block A and Block B NO ()

5. Are any of these COWS and HEIFERS INSIDE the tract?

() YES - Go to Block A
 () NO - Go to item 13 below

LINE	ITEM	Block A			Block B	
		COWS now INSIDE tract and CANNOT move to land OUTSIDE.			COWS CAN cross tract boundary to adjoining land.	
6	June Field Number →					OFFICE USE
7	BEEF COWS? Include heifers that have calved one or more times.	258 .0	256 .0	258 .0		258
8	MILK COWS, dry and in milk? Include heifers that have calved one or more times.	257 .0	257 .0	257 .0		257
9	→ Acres in field INSIDE tract.....					
10	→ Acres OUTSIDE tract cattle can now graze...					
11	→ Add 9 + 10: TOTAL acres in area cattle can now graze...					

13. Will there be any cattle and calves on this tract between now and the end of the year?

YES () - 1 }
 Don't Know () - 1 }
 NO () }.....Enter Code 193.0

SECTION F. HOGS

HOGS AND PIGS INVENTORY

1. Are there any **SOWS, BOARS, HOGS** or **PIGS** on this tract now?

() YES NO ()



3. Will there be any **HOGS** or **PIGS** on this tract from now through the end of this year?

YES () - 1 } Enter code and then
Don't () - 1 } go to Chickens on page 6.....
Know () - 1 }
NO () - Go to Chickens on page 6

182	.0
-----	----

Let's start with the **HOGS** and **PIGS** you keep for breeding.

4. How many are:
- a. **SOWS, GILTS and YOUNG GILTS** for breeding? 217 .0
Include those bred and to be bred.....
 - b. **BOARS and YOUNG MALES** used and to be used for breeding? 218 .0
 - c. **SOWS and BOARS** no longer used for breeding? 219 .0

Now I would like some information about your hogs and pigs for market and home use. Exclude breeding hogs you already told me about.

5. How many are:
- a. Under 60 lbs. including pigs not yet weaned, 221 .0
 - b. 60-119 lbs? 223 .0
 - c. 120-179 lbs? 226 .0
 - d. 180-219 lbs? 227 .0
 - e. 220 lbs. and over? 228 .0
Exclude hogs no longer used for breeding

6. Add item 4 + 5: Then the **TOTAL SOWS, BOARS, HOGS** and **PIGS** is? 210 .0

SECTION G. CHICKENS

CHICKENS

1. Are there any CHICKENS (excluding commercial broilers) on this tract now?

() YES () NO



2. Will there be any CHICKENS on this tract between now and the end of this year?

YES () - 1 } Enter code then go to item 10.....
Don't Know () - 1 }
NO ()

195 .0

3. How many CHICKENS (excluding commercial broilers) are on this tract now?.....

280 .0

4. Of these (item 3) _____ CHICKENS, how many are hens and pullets of laying age?.....

281 .0

If less than 400 chickens in item 3, go to item 10
If 400 or more chickens, ask item 5

5. Are any of these (item 3) _____ chickens owned by another person or firm?

YES () Continue NO () Go to item 10

6. How many of the chickens are OWNED by another person?.....

282 .0

7. Of the (item 6) _____ chickens owned by another person, how many are MENS and PULLETS of laying age?.....

283 .0

8. Who is the person or firm that owns the CHICKENS?

NAME _____ ADDRESS _____

- 10. RESPONDENT CODE: Operator..... 1
- Wife..... 2
- Other relative..... 3
- Hired worker..... 4
- Neighbor..... 5
- Other (specify)..... 6
- Observed Data Only-Refusal..... 7
- Observed Data Only-No Respondent.. 8

} Enter Code 88 1.0

HT 989

Enter Name of respondent if not person in charge:

Name _____

SECTION B. LAND OPERATED

Now I would like to talk about all the acres of land that you own or operate, including cropland, woodland, pastureland, wasteland and non-agricultural land. Include land you rent in or manage as well as land you own. Let's sketch each parcel or piece of land you own or operate and its relative location from this segment, tract _____. Include land you own or operate in other counties.

1. Sketch



Parcel Number	Location or name of parcel	Acreage			
		Owned	Rented from Others	Operated as hired manager	Rented to Others
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
1	Tract _____	.	.	.	.
2		.	.	.	.
3		.	.	.	.
4		.	.	.	.
5		.	.	.	.
Sum each column TOTAL		.	.	.	.

2. Add totals of cols. $c + d + e$ and subtract col. f : Then the TOTAL land you now OPERATE in your entire farm is?... 906

SECTION C. GRAIN CROPS AND GRAIN STORAGE

Now I would like to ask about grain crops and grain storage on all the (item 2) _____ acres you now operate.

If any small grain, corn, sorghum, flax or soybeans were reported in Section A, check YES for item 1 and SKIP to item 2.

1. Will you produce any small grains, corn, sorghum, soybeans or flax on land you now operate?

YES () - 1 }
 Don't Know () - 1 } Enter Code 538 0
 NO ()

2. Will any small grains, corn, sorghum, soybeans or flax be stored by you or anyone else in 1970 on any land you now operate?

YES () - 1 }
 Don't Know () - 1 } Enter Code 539 0
 NO ()

HT 999

SECTION J. TENURE OF TRACT

1. Is there an occupied dwelling on any of the land you own, rent or manage **INSIDE THIS SEGMENT?**

NO ()

YES ()



MINK

4. Considering -- All your 1969 crops sold and to be sold,
 -- All livestock, poultry, (including commercial broilers) and products sold in 1969,
 -- All sales of any miscellaneous agricultural products in 1969,
 -- All government payments received in 1969.

What was the total value of sales?

Less than \$50----- 0 ()
 \$ 50 - \$ 250----- 1 ()

5. What two crops or principal agricultural uses will have the largest acreage this year on the land you operate?

Crop or Use	Acres

\$ 250 - \$ 2,499----- 2 ()
 \$ 2,500 - \$ 4,999----- 3 ()
 \$ 5,000 - \$ 9,999----- 4 ()
 \$ 10,000 - \$19,999----- 5 ()
 \$ 20,000 - \$39,999----- 6 ()
 \$ 40,000 - \$59,999----- 7 ()
 \$ 60,000 - \$79,999----- 8 ()
 \$ 80,000 - \$99,999----- 9 ()
 \$100,000 & Over ----- 10 ()

1. Do you raise mink or know anyone who does raise mink?

YES () List each name on Supplement C

NO () Conclude interview