

# Interpreting Historic Aerial Photographs for Agricultural Patterns

Tutorial

Sally McMurry February 2018;  
PA SHPO updates January 2022

# Purpose and Goals

- Learn how to interpret visual clues to agricultural land uses by examining Penn Pilot aerials (This imagery can be identified and downloaded through the Pennsylvania Spatial Data Access (PASDA) Imagery Navigator located at available [here](#))
- Two main parts:
  - How to make inferences about agricultural production patterns c. 1960 (in lieu of census data for individual farms)
  - How to understand and explain changes over time from 1930s to c. 1960 (supplements Registration Requirements for “change over time”)
- Caveat: take into account that visual analysis at 1:20000 is inexact. There are notable limitations and many “mystery” shapes. However, keeping these limits in mind we can often make informed guesses through careful observation. To establish production patterns more clearly, complement photo analysis with other sources such as oral history interviews.

9-13-58

ARD-4R- 50

# Part I. How to make inferences about farm production patterns

c.  
1960

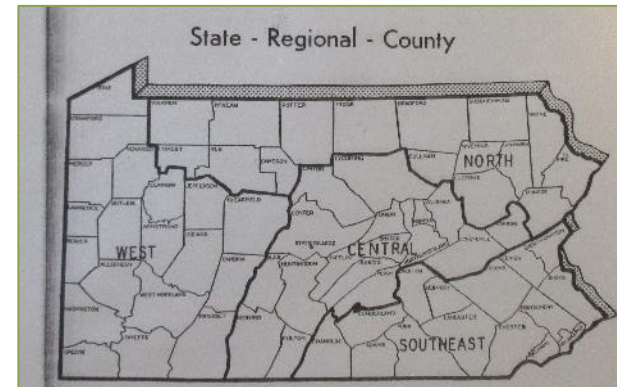
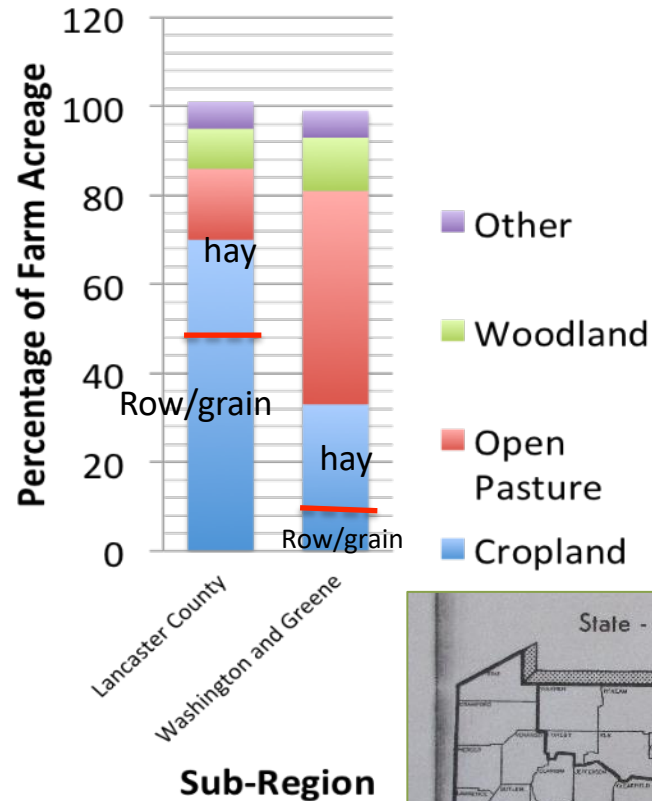
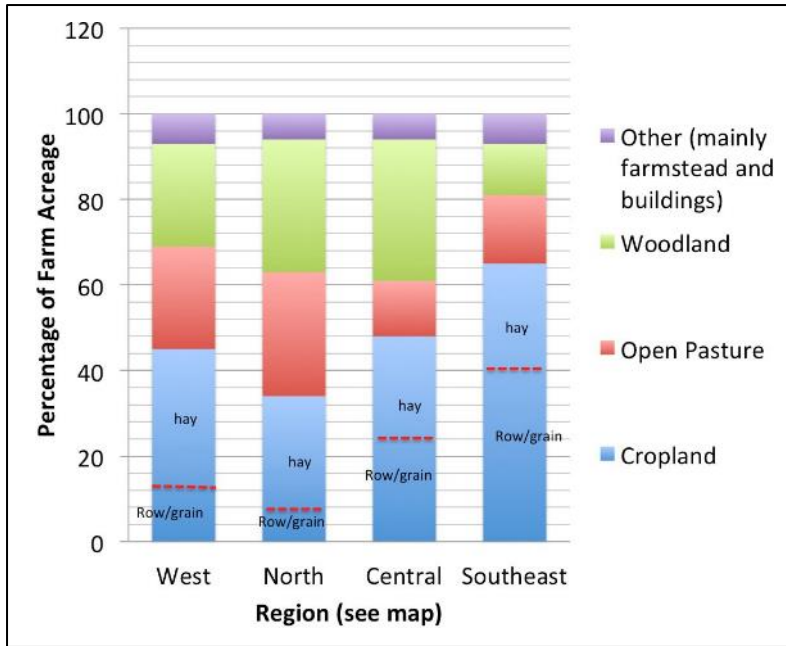
Bucks County



# Definitions and abbreviations

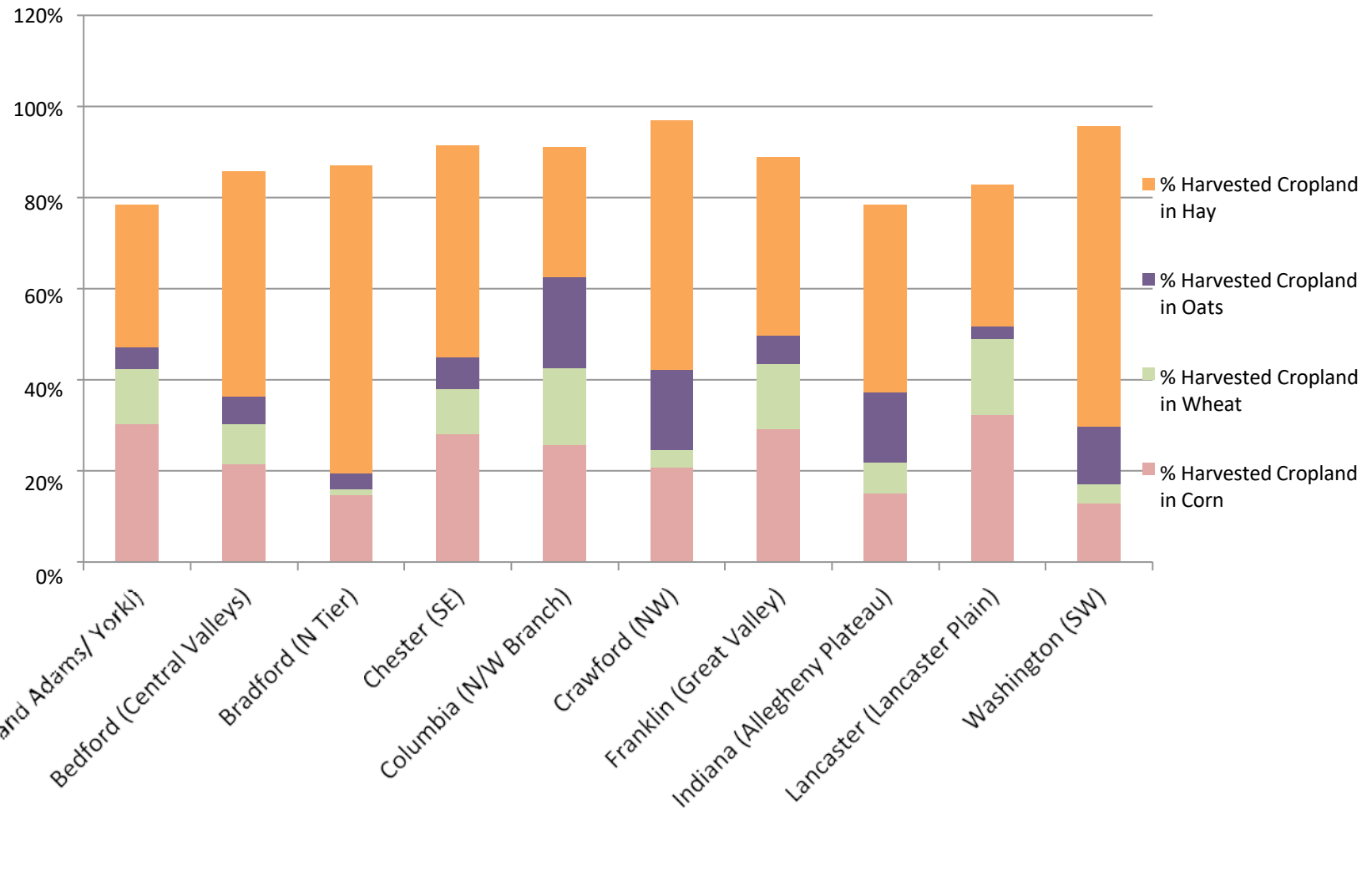
- **Cropland:** land harvested for crops.
  - Row crops: in PA c. 1960, primarily corn, planted each year
  - Small grain crops: in PA c. 1960, primarily wheat and oats, and some barley; planted each year
  - Hay: perennial plants cut for hay, not planted every year. In PA c. 1960, about a third of hay acreage is in alfalfa, the rest in a mix where timothy and clover usually predominate.
  - Abbreviations: C = crop; R/G or H for row/grain and hay respectively. H/h = hay being harvested. Fields may be numbered for clarity
- **Pasture:** land used for grazing cattle or sheep. Can be woodlot, but is usually fenced grass land. Perennial plants. Plowed infrequently if at all.
  - Rotation Pasture: land used alternately for crops (usually hay) and grazing.
  - Abbreviations: P = pasture; PP = permanent pasture; RP = rotation pasture. May be numbered for clarity.
- **Woodlot:** Forested land. On PA farms c. 1960, used for recreation, rarely for grazing. Sometimes harvested for products such as timber or maple syrup.
  - Abbreviation: W. May be numbered for clarity.

# Farm Land Use by Region, 1950.



Source: Pasto, Table R 4, page 29. Pasto's regions do not line up EXACTLY with Pa Agricultural History Project regions. Therefore, specific counties may express regional patterns more or less strongly. Lancaster and Washington/Greene are separated out here because they are the most pronounced cases. However, the general tendencies usually apply, and moreover there were only small overall land-use changes between 1930 and 1960. The hay and row/grain crop figures are for 1960 and derive from the Census of Agriculture, using sample counties as indicated in the next slide. (Land-use data for 1960 is available but not in an easy to use form.)

# Cropland allocation: Details, c. 1960. Just four crops account for much of PA's cropland acreage.



# Basic Visual Characteristics of Agricultural Land on Aerials

- Texture (mottled, smooth, lined, cross-hatched, concentric swaths, shocks, scattered trees)
- Tonal value (nearly white to nearly black)
  - Can vary with time of day, time of year, ground moisture, equipment, light conditions
- Field Shape (regular, irregular, straight edged, wavy edged)

# Row Crops and Small Grain Crop Fields

These features are not usually all present at the same time. They are illustrated in the slides following.

- Show soil mottling
- Medium to lighter tonal values. Corn darkens as the season progresses, other grains lighten. *Not usually possible to tell the difference.*
- Lined or cross hatched texture (caused by plowing and cultivating in parallel or crosswise respectively)
- Harvest pattern
  - linear parallel rows
  - Visible shocks
  - bordering swaths that are not the same width all the way around
  - “hip roof” pattern with long central spine

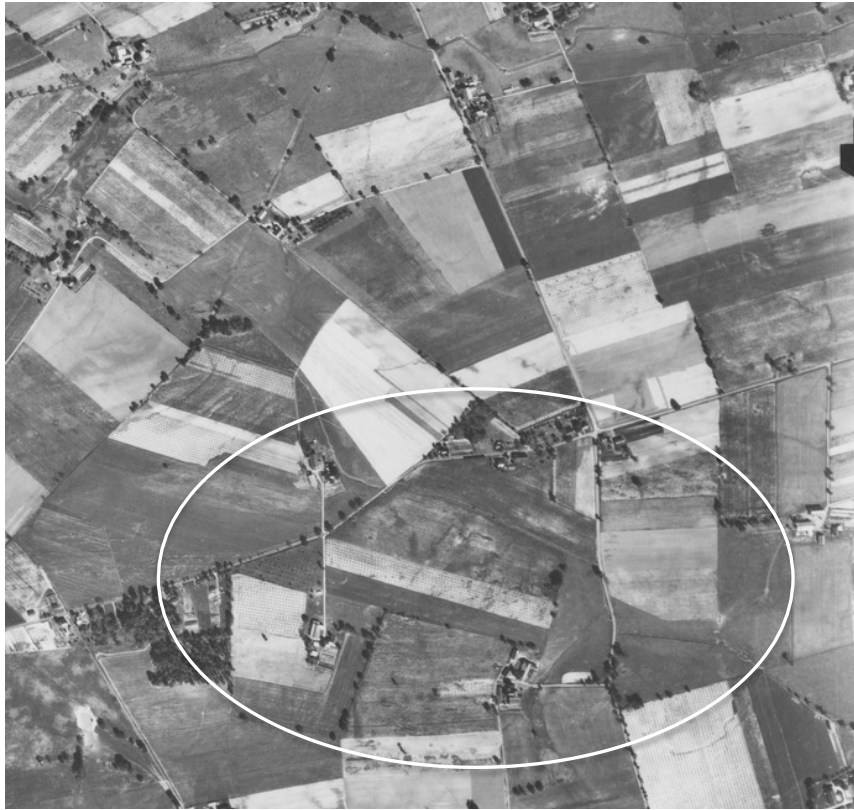


# Mottled texture

- Results from uneven moisture on a field
- Can be seen mainly on row or small grain crop fields, but usually absent or faint on hay or pasture
- This is because field crops are planted annually and so vegetative cover is either absent (on bare ploughed land) or thin, revealing irregularities in the ground's surface. Hay and pasture are perennials and have established a thicker ground cover that is present year round to some extent.
- Heavily mottled fields may also be bare plowed land, especially in early spring or late fall. These lands would ultimately be seeded to a row or grain crop.
- **TAKEAWAY: MOTTLING USUALLY INDICATES ROW OR SMALL GRAIN CROP FIELD, WHETHER PLANTED OR NOT.**

# Texture: Mottled vs. Smooth -- a basic distinction

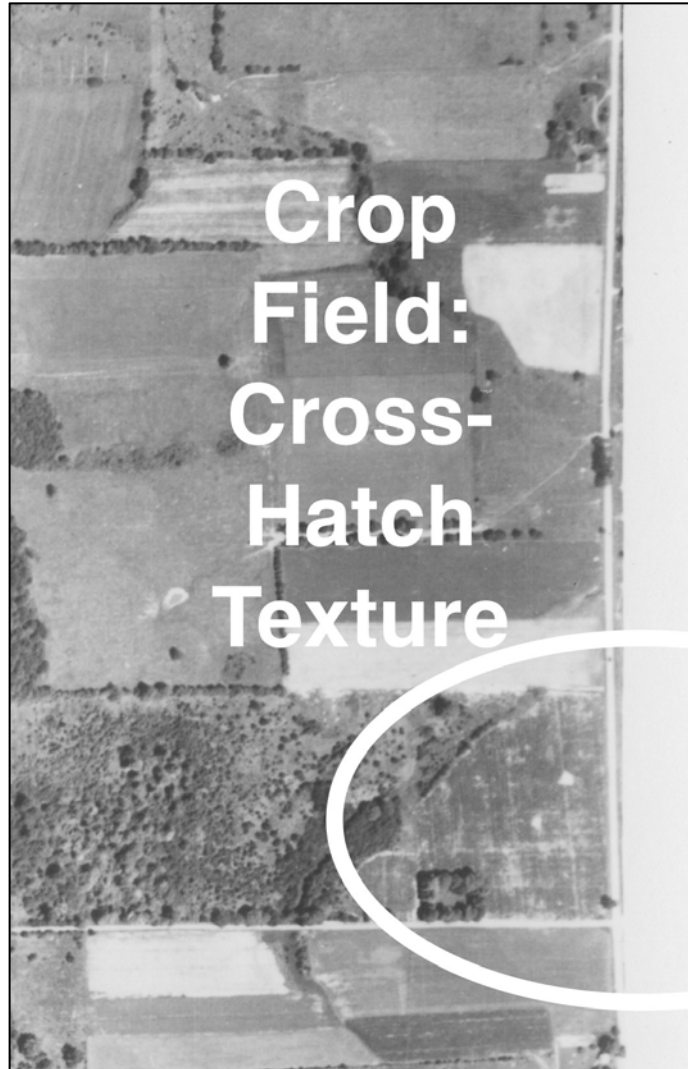
**Mottled**



**Smooth**



# Cross Hatched Texture: Crawford County, 8/2/1959



# Harvest patterns: clue to crop type. Wheat in shocks, 1947.

Lycoming County Extension Archives, Folder 85, Image 4205D, View of D. S. Ulmer Contour 1947



# Corn in shocks, no date.

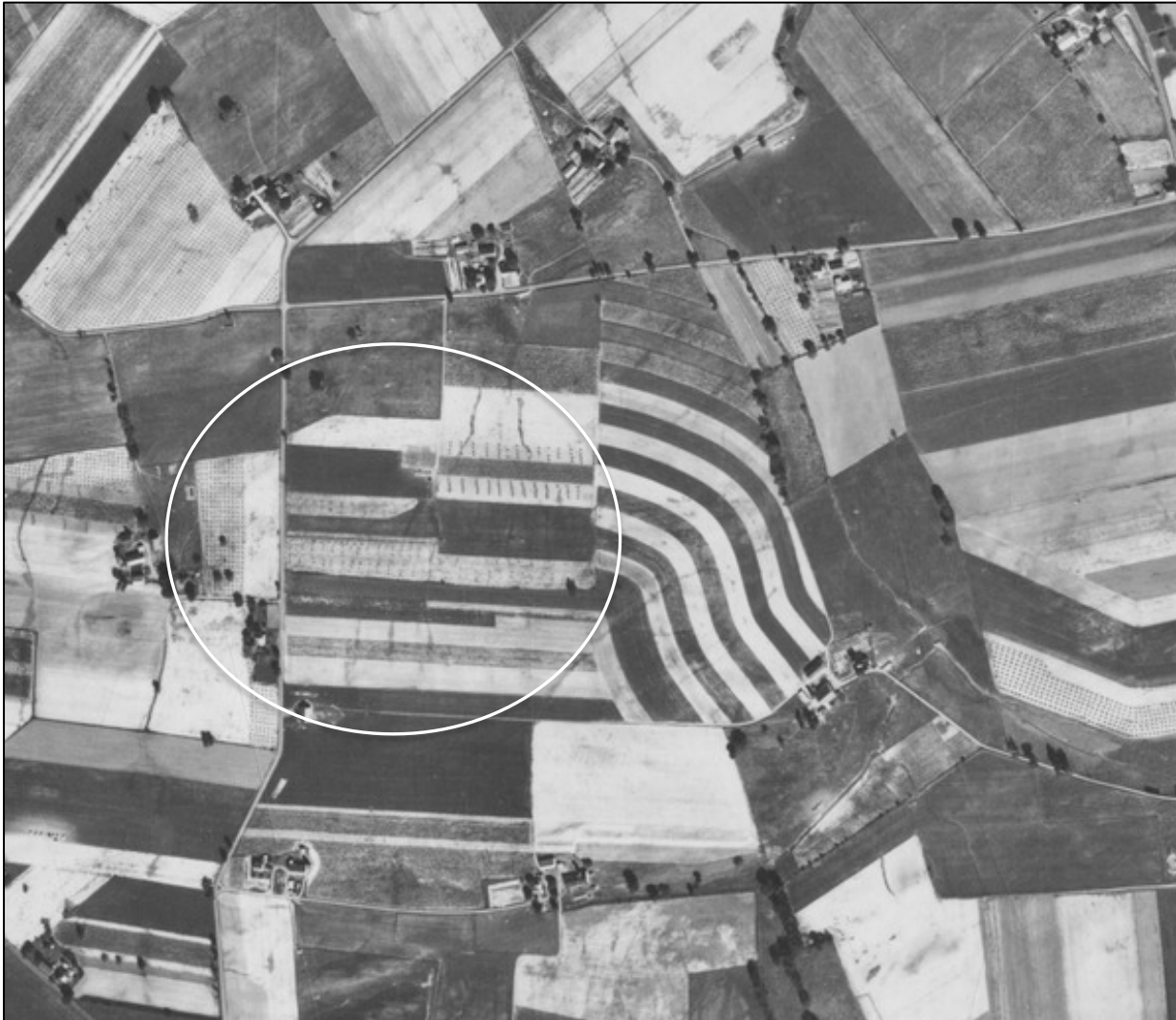
PA State Archives. r031#06-Box1-

CornInField.tif



# Linear Harvest Pattern with visible shocks

(Lancaster County, 9/28/1957)



The crop is being harvested in straight parallel rows, then made into shocks, which appear as tiny, regularly spaced dots. We can be sure this is a row or small grain crop. It is probably grain corn because: 1) the harvest date is late September; 2) there are shocks, so the corn will be dried rather than put into a silo.

**ROW CROP/SMALL GRAIN POST-HARVEST PATTERN: "HIP ROOF" WITH LONG CENTRAL SPINE.** Winter wheat harvest pattern may show this pattern.

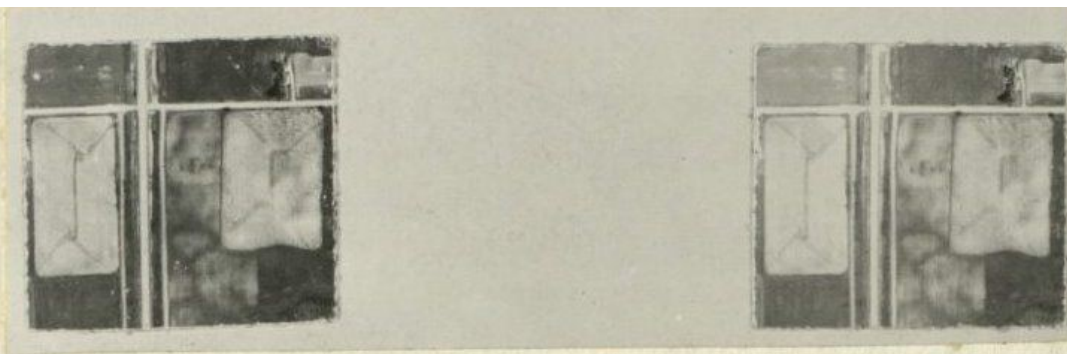


Plate 74.--Stereopair: Two winter wheat fields on July 29 with harvest marks ( $\sphericalangle 0.2 - 0.4 \sphericalangle$  and  $\sphericalangle 0.8 - 0.4 \sphericalangle$ ). Fields have concentric swath marks associated with an "X-like" figure with its arms extended to the four corners of the field.

**C1: Row Crop.** Mottling, light gray tone, faint parallel lines. Possibly corn.

**C2: Small Grain crop, recently harvested.** Harvest markings are visible.

**C3: Small Grain Crop, likely wheat based on time of year.** Mottling, medium to dark gray tone, fine, closely spaced parallel lines AND wider spaced lines. (The different lines occur because different equipment is used at different stages.)





## ROW/SMALL GRAIN CROPS HARVESTED IN SWATHS VS LINEAR ROWS



**HARVEST SWATHS: ROW/SMALL GRAIN CROPS.** Harvest swaths around a corn field are often not the same width on the long and short sides of the field. Swaths also may appear in the middle of a corn field. In this photo it looks as if one field (C1) is being harvested from the inside-out. There are no shocks, possibly because this is silage corn and would be put directly into the silo (not dried in the field). (By contrast, see the hay field at H/h being harvested from the outside in.) At C2, the corn crop is being harvested in parallel lines and gathered into shocks. This indicates corn for grain.

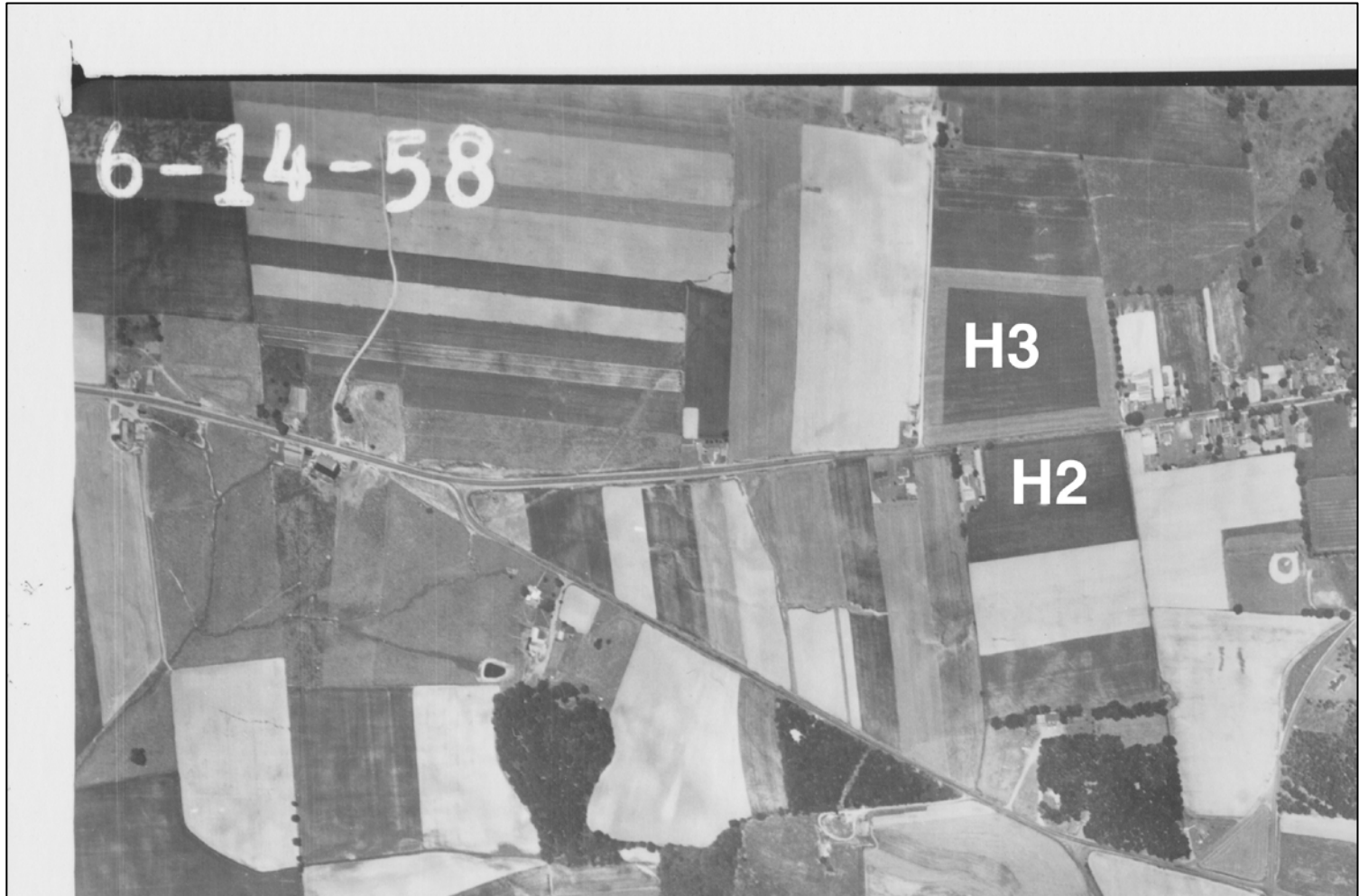
# Hay

- Smooth texture: generally NOT mottled or only faint mottling visible. May have faint, close spaced parallel lines. These occur because hay was usually seeded with a previous year's crop of grain.
- Tonal values: varied, but generally darker grays. May have white "fluff." This is white clover. (Goodman page 44)
- Harvest Markings:
  - Concentric, uniform-width swaths
  - "hip roof" pattern with short central spine, visible after cutting
  - No shocks or stacks (hay is usually baled and taken directly to the barn, not left out)

Chester County, 6/14/1958

**H2: Hay field, not yet cut:** no mottling, dark tone, smooth to faintly lined texture

**H3: New Harvested Hay:** no mottling, dark tone, concentric and uniform width swath marks



**HAY FIELD HARVEST MARKINGS: SWATHS AND “HIP ROOF” PATTERN.** The swath marks are the same width all the way around, not different widths like the ones in Slide 17.



\*concentric swath marks can also mean soybeans but soybean acreage was minimal in PA in 1960. Goodman, 171.

# Harvest Times

- The table in Slide 22 is a rough guide to PA harvest times.
- The photo date of a historic aerial (see upper left hand corner) can help rule out some possibilities when you are looking at harvest marks.
- For example: In Slide 17, the date is September 28. The crop is therefore probably corn because the oats and wheat would have been harvested in mid-summer.



# Pasture

These features are not always all present.

- Texture: smooth-- little to no mottling, usually no regular lines that would be left by harvesting or plowing
- Texture: trees scattered about the field interior (shade for animals)
- Tone: medium to light grays, never light toned
- Site: often near farmstead and within pasture area
- Other signs: faint white lines indicate animal pathways from farmstead
- Other signs: fencing. *Not usually visible in an aerial, but may be indicated by tree lines.*
- Other signs: irregular shape or wavy borders (not cultivated so less need for straight lines for machinery)

# Pasture view, undated.

Pa State Archives

r031#06-Neg#1329a.tif





Bradford County, Luthers Mills vicinity,  
June 2, 1960.



**PASTURE – Northern Tier  
example. (About 1/3 of the land  
in the Northern Tier was in  
pasture c. 1960.)**

- Irregular shape (3 of the 4)
- Pathway from farmstead
- Trees in interior
- Medium gray tone
- Smooth texture (little to no mottling)

Chester County, June 14, 1958

PP

**Pasture: Southeast  
Pennsylvania  
example**

- Smooth texture
- Medium Gray  
Tone
- Scattered trees  
in interior
- Irregular outline
- Faint white lines  
from farmstead  
to pasture



Lippincott vicinity, Greene County,  
August 27, 1958.

### Pasture: Southwestern PA Example.

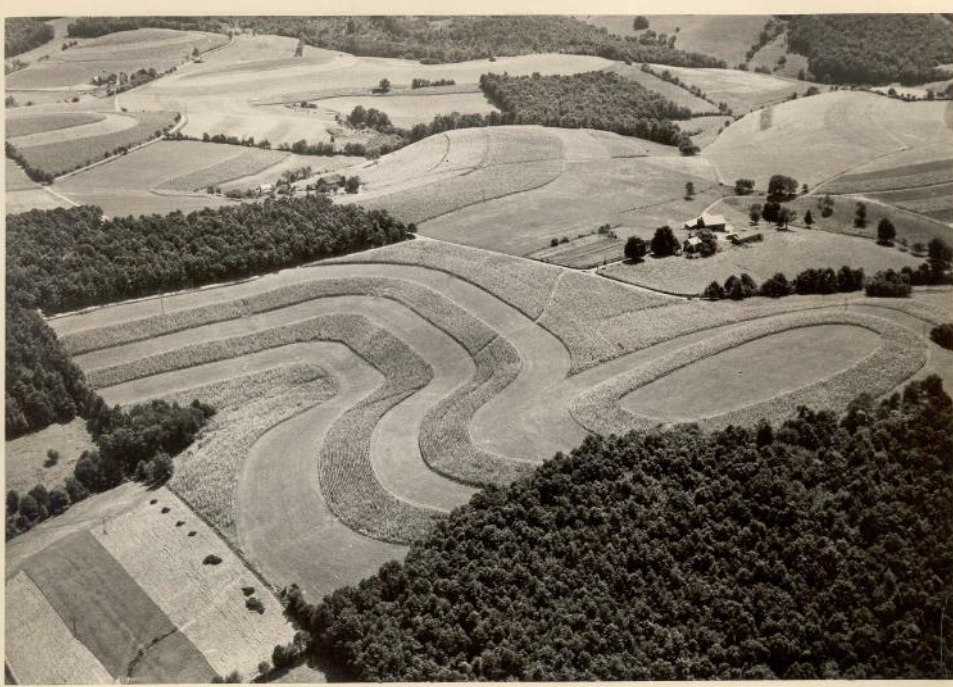
Remember (slide 5) that open pasture is about 50% of farmland here in 1960. Grain/row (G/R) crops would only be about 10% of farm acreage and hay would be about 20% of farm acreage. Because it is so extensive, pasture in Southwest PA is not always obviously connected to a farmstead.

- G/R: (grain or row crop) light tones, square-ish fields
- H: hay field with swath marks
- H2: hay field with "hip roof" marks
- O: orchard
- P: pasture

# Highly Visible Conservation Practices

## c. 1960

- Begun c. 1935 but not widely visible until well after that date
- Purpose: control erosion, conserve water, fulfill New Deal era ideal of “best use” for various land categories
- Main practices in PA (in rough order of popularity):
  - Contour Strips
  - Crop Strips
  - Ponds
- These practices signify new production techniques but not necessarily new products.



**Contour strips:** alternating crops planted along topographic contour lines. Strips catch rainwater and soil particles, prevent soil erosion, make better use of water. By definition, contour strips occur on slopes. They are almost always crops and do not generally function as pasture.

**Crop strips** differ from contour strips in that they are planted on level land and usually parallel. They serve a similar function.



Burt DeWald Farm,  
Lycoming County, c.  
1950. Lycoming  
County Agricultural  
Extension Archives.

# Farm ponds

- Nearly always constructed (not naturally occurring)
- Most date from after 1945
- Uses (in rough order of popularity): recreation, fire insurance, livestock water supply, irrigation, spray mixing, wildlife
- Location: depends on geology, hydrology, and local Soil Conservation District priorities. Common in Adams and Lehigh, but popular throughout the state.
- **Significance:** indicate expanded government role in agriculture; intensified spraying; greater emphasis on recreation.



Pond at James Nicholson Farm, Lycoming County, undated, c. 1950. Lycoming County Agricultural Extension Archives.

# Farm Pond Identification on Aerials

- Clearly bounded
- Dark shaded or reflective
- Variety of shapes, but often oblong, round, or triangular. Sometimes with one flat side where a dam is located.
- Small: most are under 2 acres in area
- Stream that feeds the pond may be visible (but often ponds are spring fed or rain fed)
- Usually sited somewhere near farmstead
- Can often be confirmed with topo maps





Lehigh County, near Lynnport. 1938 (left) and 1958 (right). A pond has appeared, displacing an orchard.

6-14-58

AHK-10R-94



Now put it all together:  
 Chester County,  
 June 14, 1958

**H2: Hay field**, not yet cut: no mottling, dark tone, smooth to faintly lined texture

**H3: New Harvested Hay:** no mottling, dark to medium tone, concentric swath marks

**RP: Rotation Pasture:** no mottling, medium gray tone, faint white lines show cowpaths coming from farmstead

**PP: Permanent Pasture:** No mottling, medium gray tone, smooth texture, trees, white lines show cowpaths coming from farmstead

**C1: Row Crop.** Mottling, light to medium gray tone, faint parallel lines. Probably corn or soybeans.

**C2: Small Grain Crop.** Mottling, medium to dark gray tone, fine, closely spaced parallel lines AND wider spaced lines

Crawford  
County,  
August 2,  
1959

Hay field: little mottling, dark tone, closely spaced parallel lines (Goodman p 137)

Crop  
Field:  
Cross-  
Hatch  
Texture

Permanent Pasture: smooth texture, little  
mottling, medium gray, trees, farm lane  
(Goodman p 137)

hay field: light to medium  
gray, little mottling,  
concentric swath marks  
(Goodman p 137)

Crop Field:  
Medium to light  
gray, mottling

"hip-roof" markings: Recently harvested hay field.  
Goodman p 32.

Put it all  
together in a  
different  
part of the  
state:

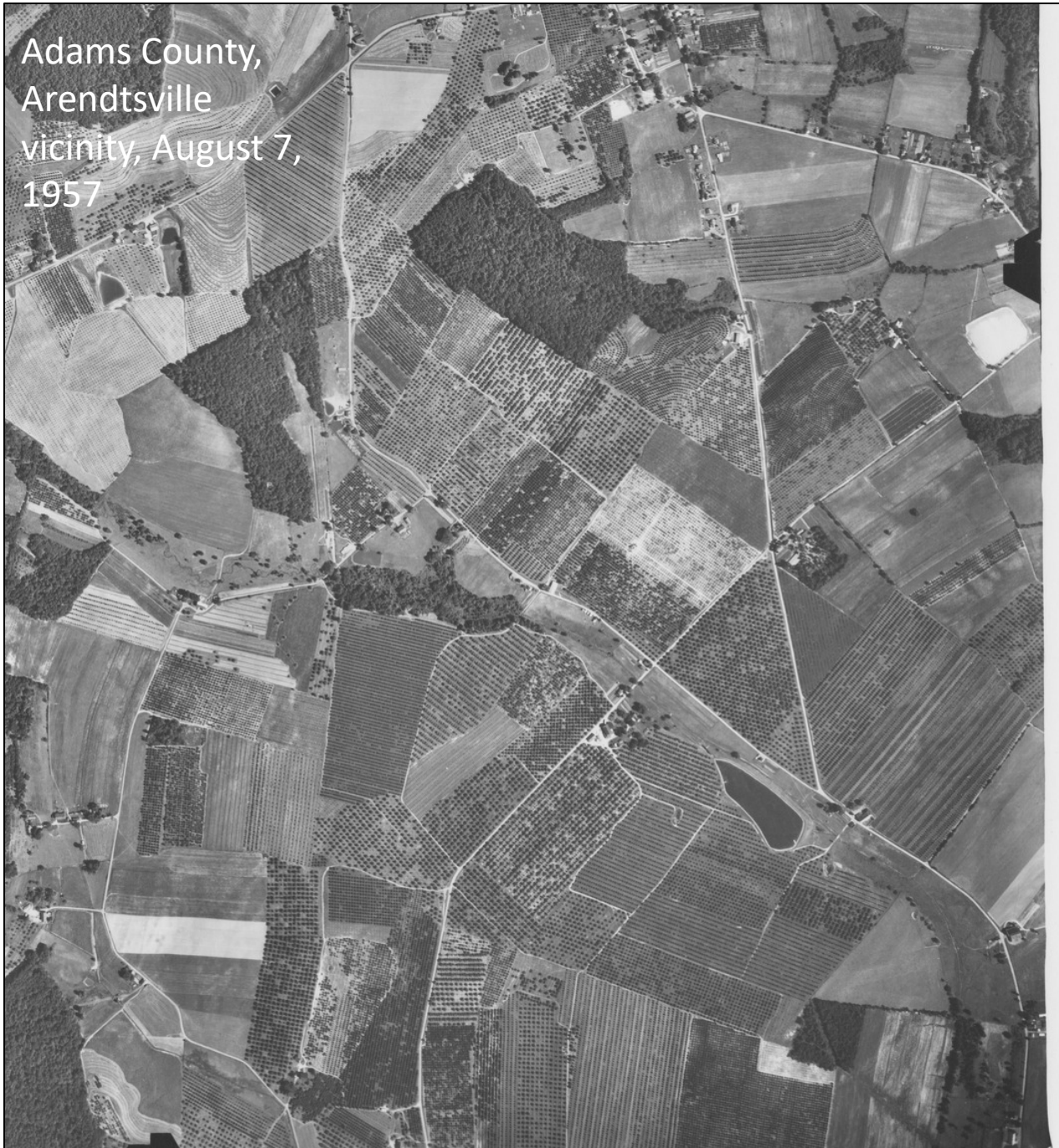
Northwest  
PA, pasture  
and hay  
dominate.  
As Slide 5  
notes, about  
half the  
farmland  
here is either  
in pasture or  
hay, and a  
very small  
proportion  
in  
row/small  
grain crops.

Putting it all together: In the background at right: permanent pasture with possible rotation pasture to its left. Note that the pastures border a woodlot on hilly ground. This is consistent with pasture as a use for lower quality soils on steeper slopes. If you are unsure about whether an area is pasture, the presence of sloping land can give a clue.

Lycoming County Agricultural Extension Archives, Folder 85, Image 4205D, View of D. S. Ulmer Contour 1947



Adams County,  
Arendtsville  
vicinity, August 7,  
1957



**Orchard  
(abbreviation = O)**

Clearly bounded shapes filled with linear rows of dark dots arranged in a rigid grid. The dots are fruit trees. Note several ponds in the picture.

Rural Valley vicinity,  
Washington County,  
June 14, 1958.

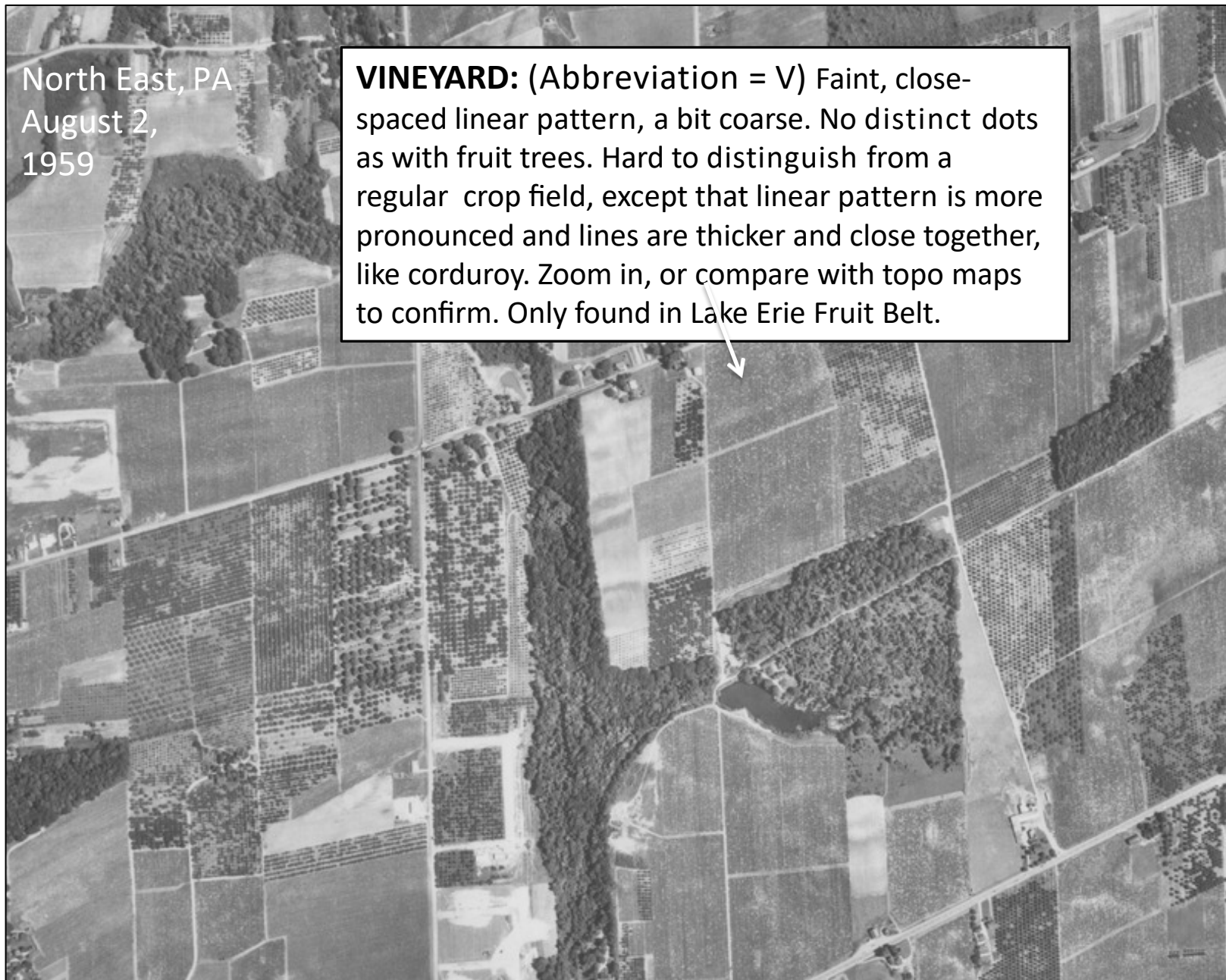


Small orchards on  
farms continued  
to be present c.  
1960.

There are four  
small orchards in  
this photo. The  
contrast with  
Adams's highly  
specialized  
landscape is clear.

North East, PA  
August 2,  
1959

**VINEYARD:** (Abbreviation = V) Faint, close-spaced linear pattern, a bit coarse. No distinct dots as with fruit trees. Hard to distinguish from a regular crop field, except that linear pattern is more pronounced and lines are thicker and close together, like corduroy. Zoom in, or compare with topo maps to confirm. Only found in Lake Erie Fruit Belt.



## TRUCK FARMING/SMALL SCALE PRODUCTION FOR LOCAL MARKETS



- Small Plots for vegetables and small fruits
- Tiny Orchards
- Small Vineyard
- Roadside location
- Ponds, likely for irrigation and spray water

Source: Erie County Horticultural Society Growers Directory, 1975. Penn State Agricultural Extension Archives, Erie County Agent Reports. This farm was present in the 1950s aerial also so it is reasonable to assume a continuity of production to 1975.



Test case: Limestone Township, Montour County (N/W Branch), June 8, 1959.





G/R

G/R

H

H

H

G/R

G/R

G/R

H

G/R

G/R

H

G/R

G/R

H

G/R

W

G/R

G/R

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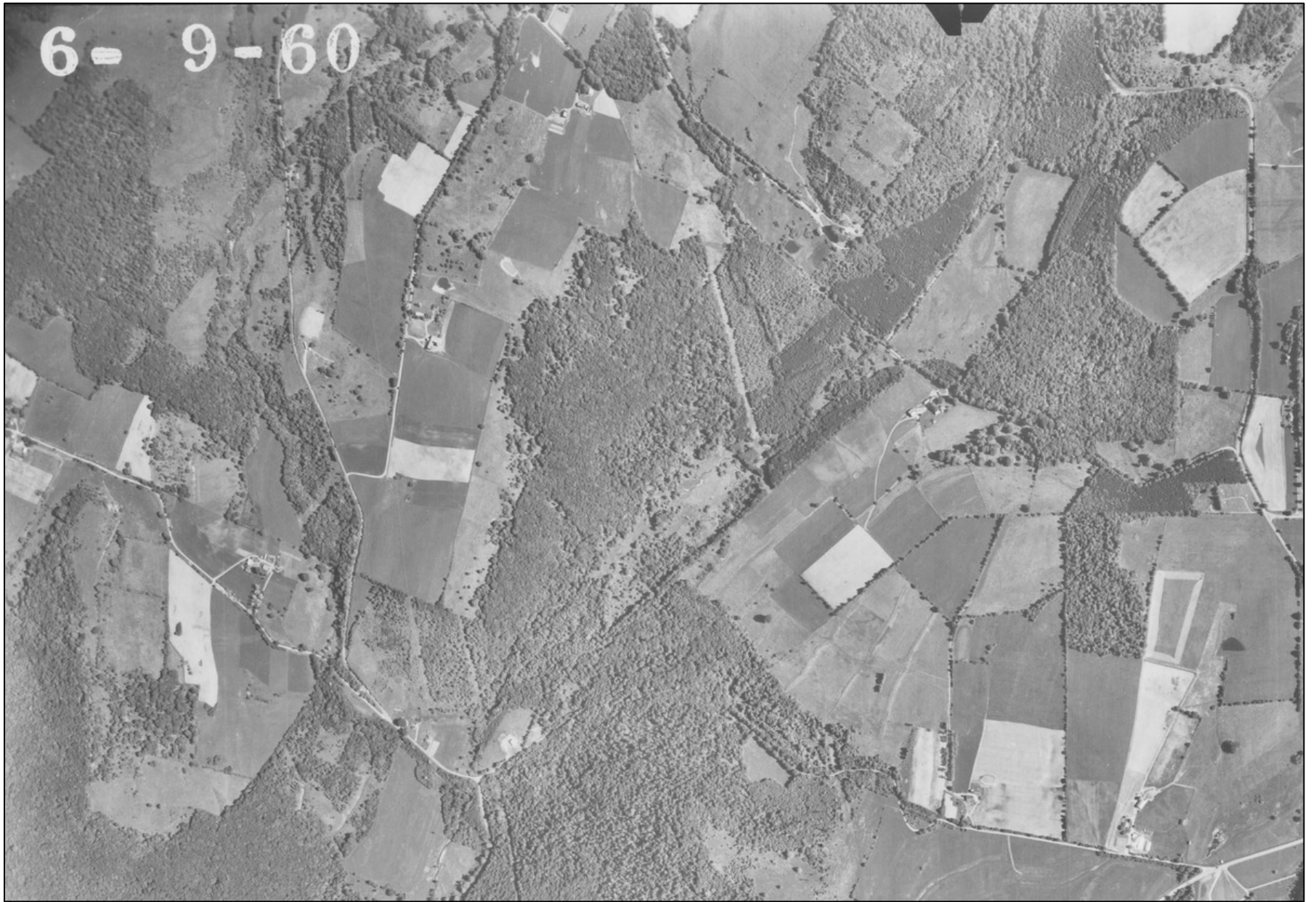
G/R

G/R

# Montour Test Case Comments

- Mottled?
  - Yes = grain or row crop (G/R).
  - Since this photo was taken in early June, it isn't easy to guess the specific crop from the tone. We can see at least two crop tones, so most likely the standard rotation was being followed (corn, oats, wheat, hay)
- Smooth texture, not mottled?
  - Yes = hay or pasture
  - Regular shape, dark tones, no trees, and/or harvest marks?
    - Yes = hay (H); hay being harvested (H/h)\*
  - Irregular shape, medium tones, trees, paths, proximity to farmstead?
    - Yes = pasture (P)
- In this specific image, there is less woodlot (W) than we might expect, but the small area in pasture is consistent with the region.

\*this field could be a row or small grain crop since the swaths are not the same width, but the smooth texture and dark tone suggest hay.



Susquehanna County, Northern Tier



Susquehanna County (Northern Tier).

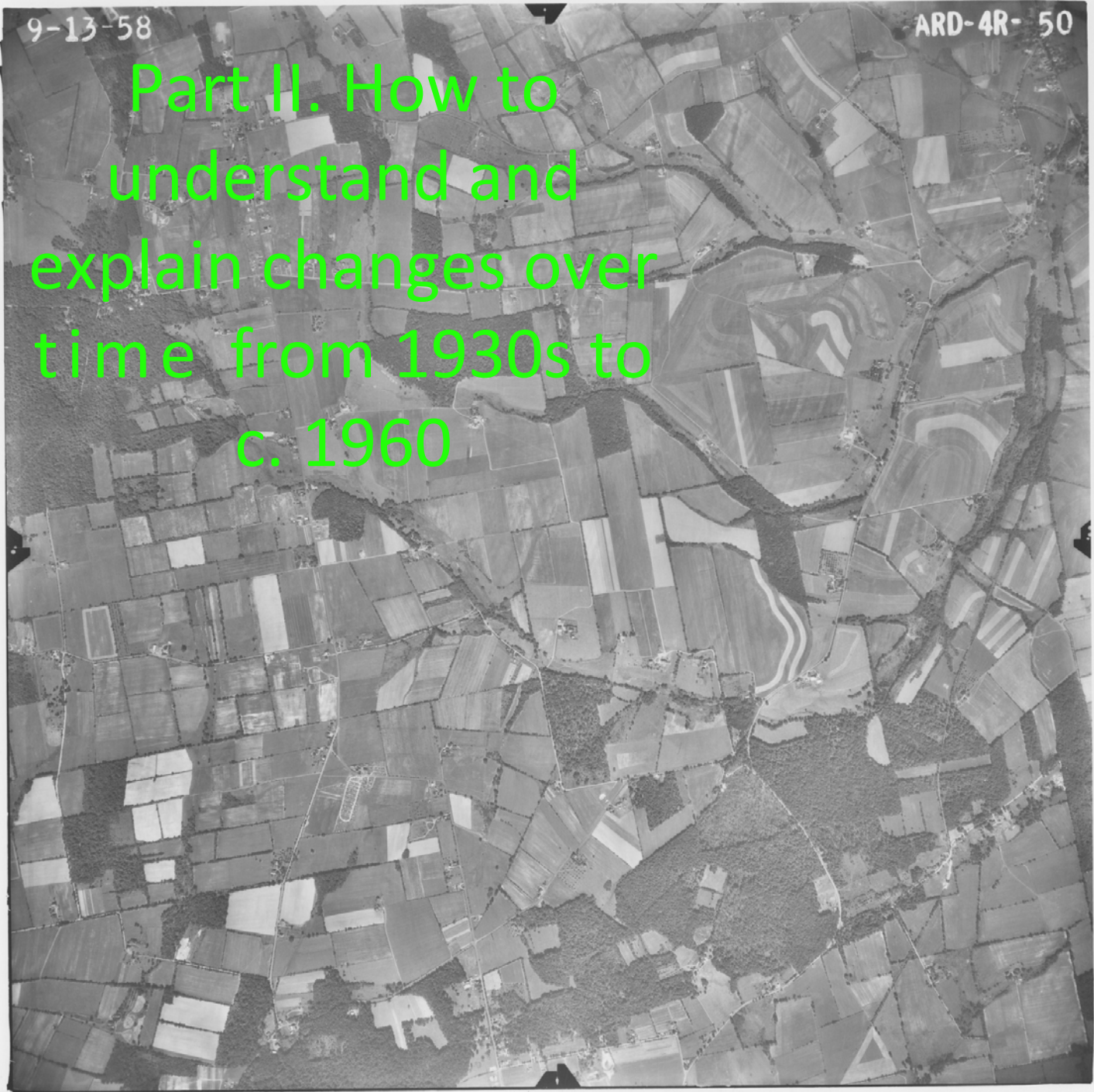
# Susquehanna test case comments

- Mottled and light colored = grain or row crop.
- Pastures are identifiable.
- Smooth dark gray rectangles are hay. Some have a concentric swath indicating harvest in progress.
- What about the medium gray fields that seem mottled? Given that this is the Northern Tier, they are probably hay crops not yet filled in.
- We can't always be sure; sometimes we can just make an informed guess.

9-13-58

ARD-4R- 50

Part II. How to  
understand and  
explain changes over  
time from 1930s to  
c. 1960



Bucks County

# Major changes statewide

## 1930s

1. Specialization (dairy, poultry everywhere, potatoes and fruit localized) is on the increase
2. BUT crop and livestock mix is still diverse (minor grains, wheat, oats, beef cattle, swine, sheep augment dairy and poultry)
3. Strong self-provisioning and local-market sector persists
4. Horse era not yet over
5. Land-grant government, industry are just getting established as forces in agriculture
6. Hay crop is 96% timothy and clover/4% alfalfa
7. IN GENERAL, 1930s landscape has many continuities with the c.1900 landscape.

## c. 1960

1. Specialization pronounced
2. Crop and livestock mix is significantly less diverse (minor grains, wheat, oats, beef cattle, swine, sheep in steep decline)
3. Self-provisioning and local-market sector almost gone
4. Horse era is over: heavily mechanized fossil fuel based farming
5. Land-grant system and allies are fully established
6. Hay crop is 68% timothy and clover/ 32% alfalfa
7. IN GENERAL, c. 1960 landscape represents post WWII departures.



# Landscape Expressions of Change

## Major trends 1930s-1960

1. Greater specialization
2. Disappearance of self-provisioning and local market production
3. Regional specialization in fruit
4. Decline of horses
5. Consolidation of land-grant system, government, industry influence, more power equipment
6. Hay crop composition shifts

## How they appear on aerials

1. Fewer different crops.
2. Fewer clusters of small plots especially near towns and cities
3. Fewer small orchards on farms outside the fruit regions.
4. Two results: elimination of oats (horse feed) from rotations; and consolidation of fields (so that large machines can maneuver.)
5. Contour plowing, strip cropping, terraces, consolidated fields, ponds
6. Hay fields may show more than one tone, whereas earlier they were more monochromatic

# Major continuities

- Agricultural land use patterns (i. e. proportion of crops, woodlot, pasture) are more or less stable over time for the various regions of the state. Refer to the chart in Slide/Page 5.
- Woodlots and boundary markers are often very stable.

# Limitations

1. Each photo represents just a single growing season and may or may not capture broader long-term trends.
2. If aerials were taken at different times in the growing season, their utility is limited because plants grow so rapidly and change their appearance significantly.

IF the photos are from the same period in the growing season, compare for crops (see Slide/page 52), pasture, and other features (field consolidation, contour plantings, ponds, orchard removal, tree line removal, reduction in truck crop areas.)

If they were taken at different points in the growing cycle, compare for other features only: field consolidation, contour plantings, ponds, orchard removal, tree line removal, reduction in truck crop areas.

3. For fruit areas, the season of the photo matters less, because orchards and vineyards are recognizable no matter what the season.

# Crop Changes: what to look for

Since the basic proportion and acreage of crops, pasture, and woodland didn't change markedly, in general the big change between c. 1930 and c. 1960 is *fewer different crops*. Even if you can't identify specific crops, sometimes you can document a decline in crop diversity. **Again, these guidelines only apply if the aerials were taken around the same time in the growing season.** Here are some ways to document a change in crop diversity.

- Note whether any particular tones disappear or occupy an obviously much smaller acreage.
- If the overall number of tones clearly decreases, that is evidence for fewer different crops. However, if the overall number of tones stays the same or increases, that does not tell us much one way or the other. The reason has to do with changes in the composition of the hay crop. Alfalfa, which was more prominent in 1960, tends to show darker tones than the timothy/clover blend. However, the crop is still hay. Alfalfa was very popular in the Great Valley and not widely adopted elsewhere.
- Note when small fields are consolidated into larger ones. This would often be associated with a decline in crop diversity.

## Bradford County, 5/29/1939:

Multi-toned fields: diverse mix of grain and hay crops plus pasture = dairying plus diverse production

Multiple Small irregular fields = low mechanization

Orchards present = diverse production

Small plots = possible truck farming

## Bradford County, 6/2/1960:

Less varied in mix of tones = decline in crop diversity

Some fields consolidated (1) = less diversity, more mechanized farming

Some treelines eliminated (2) = mechanization

At least two new ponds (3) = "ag establishment" influence

Possibly one instance of pasture reverting to wood (4) = decline in pasture practices

Cluster of very small (truck patch?) plots disappears (5) = decline in agricultural diversity

Orchard disappears (6) = decline in agricultural diversity

Woodlots remain fairly constant = long term continuity



NOTE THAT THE TWO PHOTOS WERE TAKEN AT ALMOST EXACTLY THE SAME DATE, 21 YEARS APART

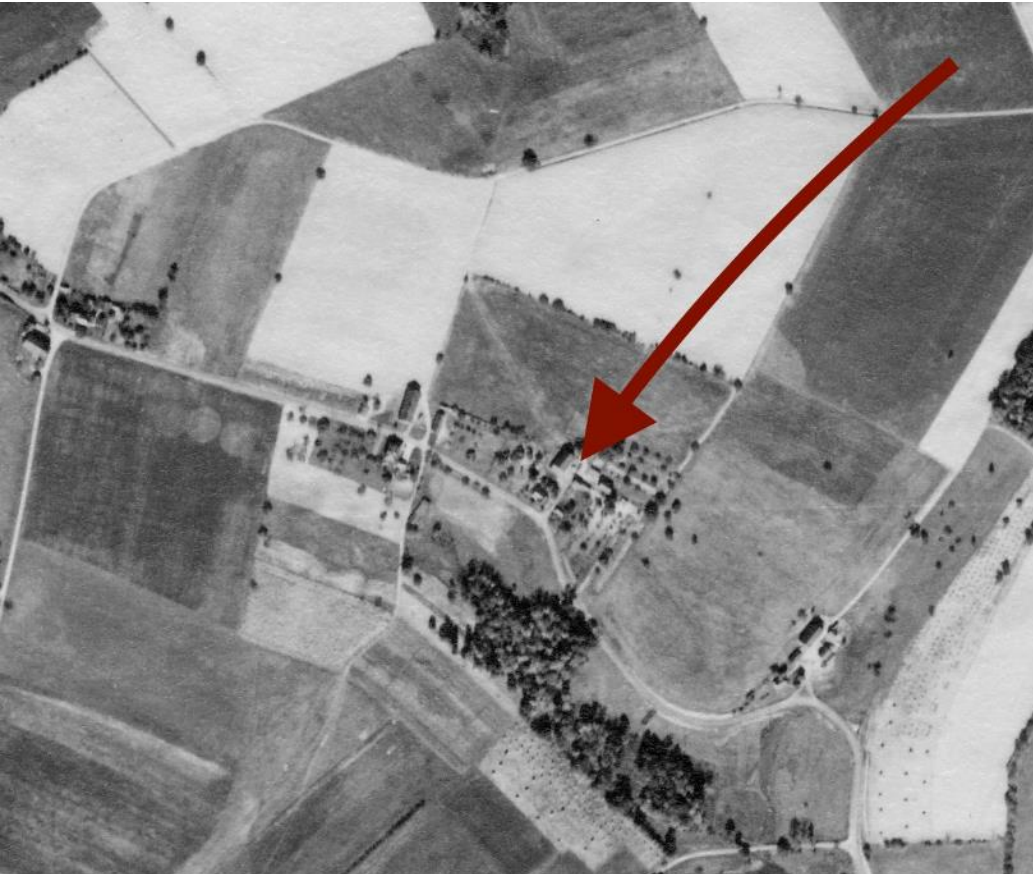
### Major changes:

- Disappearance of lightest tone = possible elimination of oats or wheat from crop mix, decline in crop diversity
- We know from oral history that potatoes were grown on this farm in the 1930s. It is likely that the small field next to the farmstead was planted in potatoes. This gives way to a row/grain crop in 1958. Another decline in crop diversity.
- Orchard is made smaller = less overall agricultural diversity in the region
- Contour strips transform the earlier crop fields = “ag establishment” influence
- A pond appears = “ag establishment” influence and greater mechanization

### Continuities:

- Overall emphasis on crops continues. The woodlot is about the same size and shape in both years.

## Lehigh County, 10/10/38



## Lehigh County, 10/6/58



1937:

Multi-toned field crops plus orchard =  
crop diversity

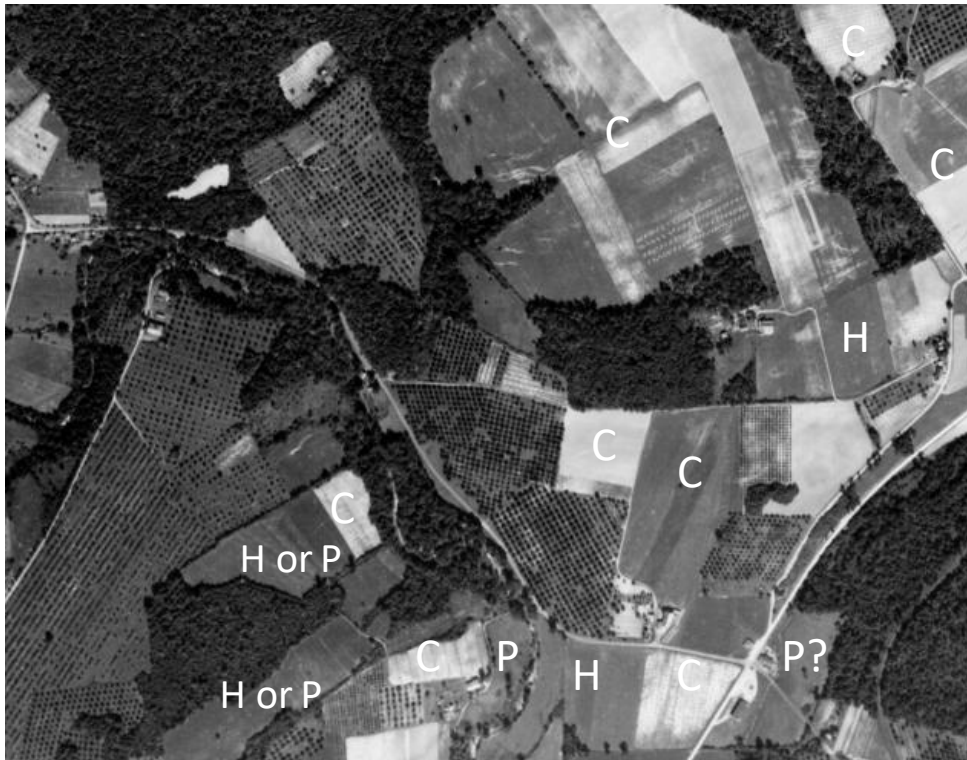
Pasture = some livestock

Represents c. 1930 emphasis on fruit within  
context of general farming

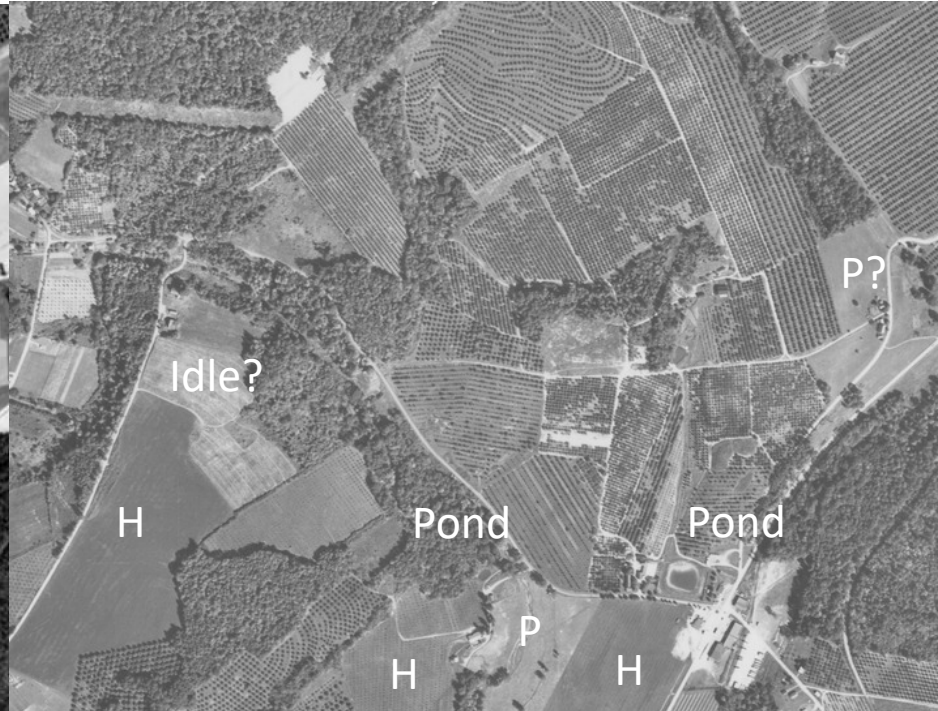
1957:

Greater proportion of orchard, fewer  
crop tones = greater specialization  
Contour planting = “ag establishment”  
influence

Ponds = “ag establishment” influence and  
use of water for sprays and irrigation



Bendersville, Adams County, 9/24/1937



Bendersville, Adams County, 9/25/1957

# Summary

- Aerials can furnish information about land use, crop production, and conservation practices c. 1960. They should be regarded as a supplement to oral history information collected about a farm's post 1930 production history.
- Aerials can furnish information about change over time from c. 1930 to c. 1960.
  - If photos were taken about the same time in the growing season we may be able to detect broad changes in crop patterns.
  - Regardless of when photos were taken, we can find changes such as the implementation of conservation practices; elimination of small orchards, truck plots, hedgerows, and treelines; field consolidation.
  - In the fruit regions, we can see the expansion of orchards and/or vineyards.



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