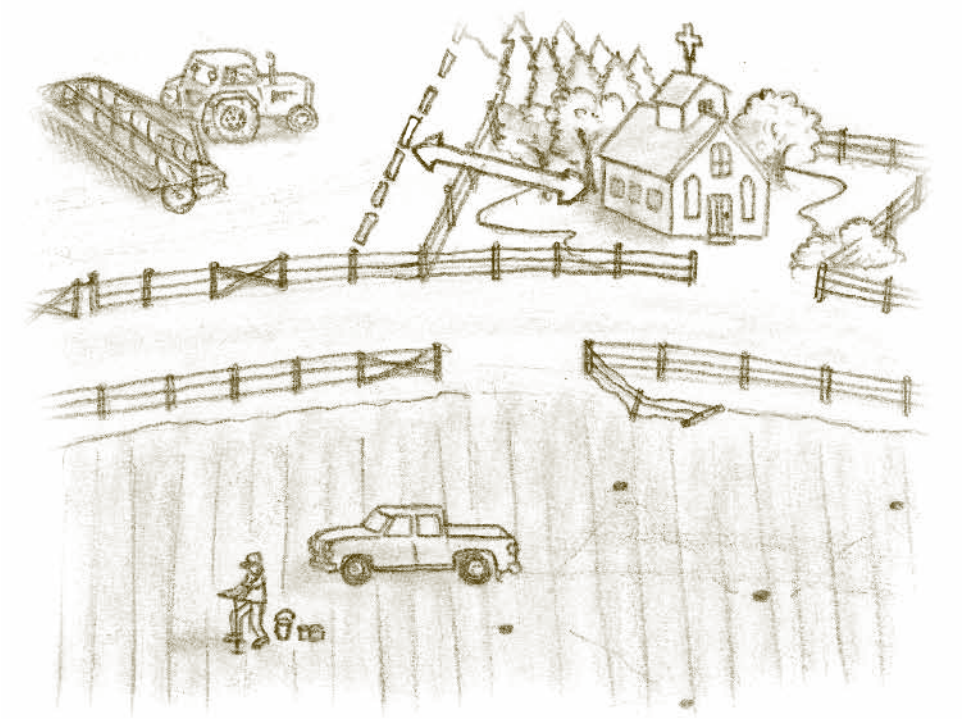
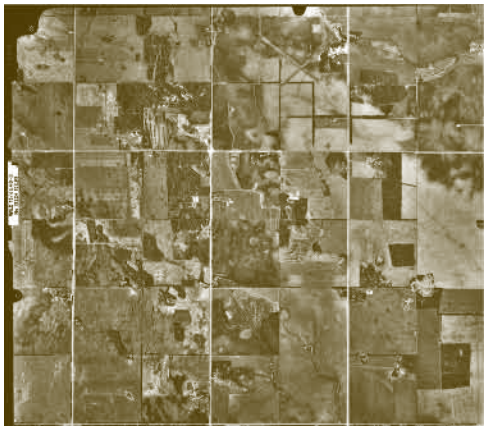
Chapter 3.2
Using Aerial Photos for Nutrient Management Planning



learning objectives

- Use aerial photos to identify major permanent features in a field.
- Estimate distances and land areas on aerial photos of known scale.
- Order air photo products from the Provincial Government's Air Photo Distribution Office.



Important Terms

Table 3.2.1 Key Terms and Definitions

Term	Definition
Spatial	Relating to, occupying, or having the character of space. Relating to the three dimensional positioning of an object in space.

An aerial photo shows spatial relationships between features in a field. Aerial photos can be used to estimate total available area for nutrient application, while considering application setbacks from sensitive areas. Interpreting aerial photos involves identifying features, assessing their significance, and determining their spatial relationship to other features in the field. An aerial photo provides a different perspective of the landscape than ground-based observation. An aerial perspective reveals the horizontal orientation of a feature in a landscape, but the trade-off is the inability to judge the height or elevation of a feature.

There are two important points to remember when using aerial images:

- Aerial photos complement, but should not replace, a ground-based site assessment. They provide a complete perspective of the relative location and orientation of features within a field.
- The usefulness of aerial photos depends on the user's ability to interpret qualitative and quantitative information in the image.

Interpreting aerial photos involves considering the following aspects:

- **Scale** is the ratio of the distance between two points on an aerial photo to the actual distance between those two points on Earth's surface (Table 3.2.2). For example, an aerial photo with a scale of 1:15,000, one unit of measurement (centimeters or inches) on the photo is equal to 15,000 of these same units on the ground.
- The relative **size** of known features can be used to estimate their relative "footprint" on the landscape as well as the approximate size of surrounding features.
- The **shape** of an object from an aerial view can help distinguish human-made features (e.g., buildings) from natural features (e.g., water bodies).
- The **shadows** cast by objects in a photo will depend on the time of day and year the photo was taken. This may affect the interpretation of the objects casting the shadow.
- **Tone** refers to the colour or shade of grey of objects in a photo, and the pattern in which these colours are reflected (uniform, mottled or banded). Tone is influenced by several factors including soil moisture, vegetation type and density, time of day and year the photo was taken (Table 3.2.3).
- **Texture** is the impression of "smoothness" or "roughness" of an image. Texture offers the ability to distinguish boundaries between individual objects in a photo. Objects that are too small to be distinguished from each other tend to appear "smooth" (e.g., grass, cement, water), while objects with more distinguishable boundaries appear "rough" (e.g., forest canopy).
- **Pattern** refers to the spatial arrangement of objects in an aerial photo. Patterns can be natural (e.g., forested area) or the result of human activities (e.g., cultivated woodlot).
- **Unknown objects** can be identified in an aerial photo by considering their location and association to known objects.

Table 3.2.2 Map Scales and Conversions

Map Scale	Map cm ⇩ Actual m	Actual km ⇩ Map cm	Map inches ⇩ Actual feet/miles	Actual miles ⇩ Map inches
1:10,000	× 100	× 10	× 833.33 (ft)	× 6.34
1:12,000	× 120	× 8.33	× 1,000 (ft)	× 5.28
1:15,000	× 150	× 6.67	× 1,250 (ft)	× 4.22
1:50,000	× 500	× 2	× 0.789 (mi)	× 1.27
1:100,000	× 1,000	× 1	× 1.58 (mi)	× 0.63

Adapted from McNeil et al., 1998b

tip

Remember that distances and dimensions distort as you move from the centre of the image to the edge of the photo.

Estimating Areas and Distances Using an Aerial Photo

Aerial photos can be used to estimate distances and areas with simple equipment and calculations. To aid in the calculation of distances and areas, nine of the commonly used or available air photo scales are listed in Table 3.2.4 and Table 3.2.5. For each of the common scales, table 3.2.4 reports the distance on the ground for each one cm measurement on the photo, the cm measurement for each km, the number of hectares per square cm and the number of hectares represented by each dot on an acreage grid map (64 dots per square inch). For each scale table 3.2.5 reports the distance on the ground for each one inch measurement on the photo, the measurement for each mile, the number of acres per square inch and the number of acres represented by each dot on an acreage grid map (64 dots per square inch).

An example of a partial acreage grid map is illustrated in Figure 3.2.1. A grid map will be made up of multiple rows and columns segmented into one inch by one inch squares. Each square contains 64 evenly spaced dots. The size of the grid map can vary depending on its application. The larger the photo, the larger the grid map may be. Appendix 3 contains a grid map that is seven columns wide by seven rows deep. This may be photocopied onto a transparency and used to determine areas on a photograph.

Table 3.2.3 Appearance of Selected Features on an Aerial Photograph (black and white, true colour, and false colour infrared aerial photographs)

Feature	Type of Aerial Photography		
	Black and White Panchromatic	True Colour	False Colour Infrared
Soils			
Dry	Light grey	Light grey	Light green-black
Wet	Dark grey-black	Dark grey-black	Dark green-black
Eroded	Similar in appearance to dry soils		
Sandy	Light grey-white	Light grey-white	Light grey-white
Vegetation			
Cereals	Mottled grey-black	Mottled green	Mottled pinkish-red
Cereals (harvested)	Mottled light grey/black	Mottled goldish	Mottled goldish pink-white
Forages/Hay	Uniform grey-black	Uniform green	Uniform red
Forages/Hay (harvested)	Uniform light grey-black	Uniform gold-pink	Uniform pinkish-white
Canola (bloom)	Uniform light grey	Uniform yellow	Uniform pink
Canola (harvested)	Similar in appearance to harvested cereals		
Grasses	Uniform grey	Green brown	Brown
Conifers	Conical shaped grey-black	Conical shaped green	Conical shaped purplish-brown
Deciduous	Fluffy grey	Fluffy green	Fluffy red
Deciduous (autumn)	Grey	Yellow	White
Natural features			
Hilly Topography (bare soil)	Mottled grey-black	Mottled grey-black	Mottled green-black depending on soil moisture
Eroded Knolls	Lighter versions of hilly topography		
Sloughs	Will appear dark if they are clear. If sediment is present near the surface, they will appear lighter as the sunlight is reflected back.		
Rivers/Streams	Winding shaped features that will reflect similar to water bodies.		
Organics	Uniform grey	Uniform green	Uniform pink-red
Salinity	Whitish	Whitish	Whitish
Cultural features			
Fields	Will appear as square or rectangular and reflect according to what has been planted (i.e., cereals, forages, etc.)		
Pasture	Mottled grey-black	Mottled green-black	Mottled pink-green
Gravel Road	Grey	Grey	Grey
Paved Road	Black	Black	White-grey

Source: AF

Table 3.2.4 Common Map Scales Plus Approximate Metric Measurements and Estimates of Area

Relative Scale	Scale in Centimetres and Meters	cm per km	ha per Grid Map Square (2.5 x 2.5 cm)	Representative ha for Each Dot in the Square
1:5,000	1 cm = 50 m	20.0 cm	1.613	0.0252
1:10,000	1 = 100	10.0	6.452	0.101
1:15,000	1 = 150	6.667	14.517	0.227
1:20,000	1 = 200	5.0	25.807	0.403
1:30,000	1 = 300	3.333	58.066	0.907
1:31,680	1 = 316.8	3.157	64.752	1.012
1:40,000	1 = 400	2.5	103.229	1.613
1:60,000	1 = 600	1.667	232.265	3.629
1:63,360	1 = 633.6	1.578	259.008	4.047

Table 3.2.5 Common map scales plus approximate imperial measurements and estimates of area

Relative Scale	Scale in Inches and Feet	Inches per Mile	ac per Grid Map Square (2.5 x 2.5 cm)	Representative ac for Each Dot in the Square
1:5,000	1 inch = 417 ft	12.672	3.986	0.0623
1:10,000	1 = 833	6.336	15.942	0.249
1:15,000	1 = 1,250	4.224	35.870	0.560
1:20,000	1 = 1,667	3.168	63.769	0.996
1:30,000	1 = 2,500	2.112	143.48	2.242
1:31,680	1 = 2,640	2.000	160.00	2.5
1:40,000	1 = 3,333	1.584	255.076	3.986
1:60,000	1 = 5,000	1.056	573.92	8.970
1:63,360	1 = 5,280	1.000	640.00	10.0

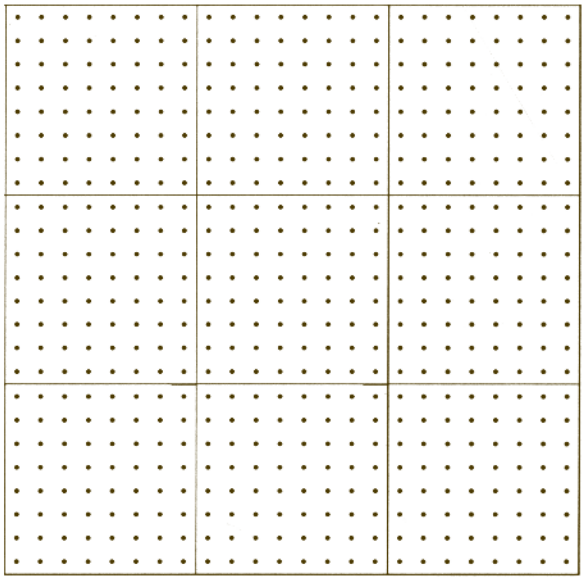


Figure 3.2.1 A partial acreage grid map

Calculating Distances

The scale of an aerial photo is the ratio of the distance between two objects on a photo to the actual distance on the surface of Earth, in the same units. For example, an aerial photo with a scale of 1:5,000, a 1 cm measurement on the photo is equal to 5,000 cm or 50 m on the actual ground. Distance can be calculated from the scale of a photo using the following equation:

Distance on the Ground (units) = Measurement on Photo (units) x Scale of Photo (e.g., 5,000)

Calculating Distances from an Aerial Photo

AOPA does not allow surface application and incorporation of manure within 30 m of a common body of water.

A producer has a field that is bordered by a creek. Using an aerial photo, the producer wants to determine the width of the grassed strip between the edge of the field and the creek. He wants to determine if he can apply manure right to the edge of this field or if he needs to stay back from the grassed edge to meet the 30 m setback. On a 1:5,000 scale aerial photo, the distance between the edge of the field and the creek is 1.4 cm.

Distance on the Ground (units) = Measurement on Photo (units) x Scale of Photo (e.g., 5,000)

= 1.4 cm x 5,000

= 7,000 cm

= 70 m is the distance on the ground

The edge of the field is 70 m from the creek. Therefore, the producer can apply manure to the field boundary, provided it is incorporated within 48 hours of application.

Estimating Areas

To estimate areas on aerial photos of known scale the following materials are needed:

- standardized grid that is printed or copied onto a transparency
- fine tipped, non-permanent pen (for use on transparencies)
- standard school geometry set
- calculator

By overlaying a transparent acreage grid map on an aerial photo you can estimate area, knowing the aerial photo's scale. The following is a list of steps to estimate areas from aerial photos:

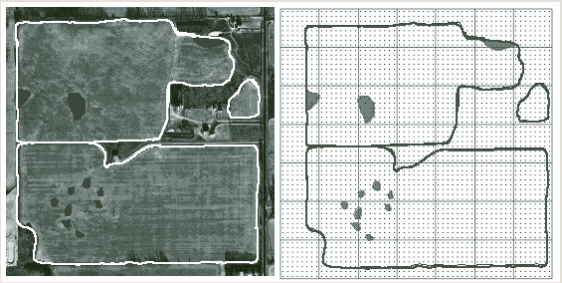
1. Trace the outline of areas to be estimated on a photocopy of the aerial photo, a printed copy of a digital image or an unmarked transparency. This will make area boundaries easier to identify and will preserve the original photo.
2. Superimpose the standardized grid on the tracing of the aerial photo and trace directly on the grid the boundaries of all areas to be estimated.
3. Put the grid on a white background for easier viewing. Count and record the grid dots contained in each outlined area. For dots that lie on the boundary line, count every other one.
4. Using the grid dots recorded in step 3 and table 3.2.4 or table 3.2.5 to estimate areas identified in the aerial photo.

tip

To estimate the area eligible for manure application, trace the outline of fields manure is to be applied, and then outline and fill in any areas ineligible to receive manure (e.g., application setbacks, sensitive areas).

Calculating Area from an Aerial Photo

Based on the aerial photo of this field (1:5,000 scale), determine the number of hectares eligible to receive manure (taking into account required and voluntary setbacks from sensitive areas, obstructions, non-productive areas, etc.).



Total number of grid dots in areas with field boundary = **1,440**

Total number of dots in shaded areas (i.e., setbacks, physical obstacles) = **38**

Referring to table 3.2.4, at the 1:5,000 scale, each grid dot is equal to 0.0252 ha.

Total field area (ha) = number of grid dots x ha per grid dot
= 1,440 x 0.0252
= 36.3 ha is the total field area which included 1,440 grid dots

Total shaded areas (e.g., setback, obstacles) (ha) = number of grid dots x ha per grid dot
= 38 x 0.0252
= 1.0 ha is the total field area which included 38 grid dots

Approximate area available for manure (ha) = Total field area (ha) - Total shaded area (ha)
= 36.3 x 1.0
= 35.3 ha of this field is available for manure application

tip

Search for aerial photos online using the external Aerial Photo Record System (APRS) website maintained by the Air Photo Distribution Office. APRS is the database program used to search for photographic projects covering a specific section or block of sections (block searches are not as accurate as specific searches). To complete a search, simply enter the legal land description starting with the section number. Only use the numerical values of a legal description (e.g., the Section, Township, Range, and Meridian numbers). Each set of numbers must be separated by dots, dashes, or spaces (e.g., 34-50-23-4).

APRS Website: https://securexnet.env.gov.ab.ca/aprs/index.html

Username: guest
Password: guest

Air photo(s) can be selected and viewed from the library knowing the year, type of film and scale of photography taken for any given legal land description.

Air Photo Products

The Alberta Government's Air Photo Distribution Office (www.srd.gov.ab.ca/land/g_airphotos.html) houses a collection of over 1.4 million aerial photos of the entire province dating back to 1949. Copies of these photos may be purchased in several formats.

All air photos are produced on demand basis. One copy of each aerial photo is available for viewing in the Distribution Office reference library.

The photographs were taken at many different scales. Common scales available include:

1:20,000 1:30,000 1:40,000 1:60,000

The entire province has been photographed in black and white. Larger scale photography (greater than 1:30000) and colour photography may be obtained for selected areas within the province. Contact the Distribution Office for more information on special photographs.

How to Obtain Aerial Photos

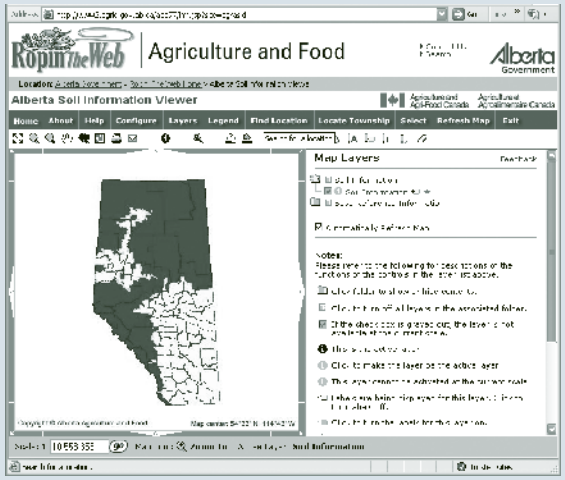
To minimize ordering mistakes, visit the Air Photo Distribution Office in Edmonton. The staff can provide assistance in selecting the right photo and format. Orders can also be placed by calling toll free at 310-0000 then (780) 427-3520, e-mailing air.photo@gov.ab.ca, faxing to (780) 422-9683, or writing to:

Air Photo Distribution
9920 – 108 Street Main Floor
Edmonton, Alberta T5K 2M4

To order an air photo, the following information is required: legal land description, type of product, intended use, mailing address and phone, fax or e-mail address.

The Alberta Soil Information Viewer (ASIV)

The ASIV can be used to view and query soil data for the agricultural area of Alberta. AGRASID Version 3.0 is a digital database of seamless GIS coverage and data files, which describe the soil landscapes for the agricultural regions of the province.



You can view soil related information and colour aerial photos (maximum scale varies by region). Tools are available that allow users to label, mark up and calculate areas on the aerial photos. Finished photos can be printed in PDF format. Tutorials are available to assist new users with features and capabilities of the viewer. For example, instructions on how to manipulate aerial images for nutrient management planning can be found at www.agric.gov.ab.ca/flash/ASIV/manure_presentation.html

The ASIV can be accessed online by entering "soil information viewer" in the search window on Ropin' the Web.

summary

- Aerial photos provide a big picture of landscape features. Structures and sensitive areas that should be included on a site assessment are often visible on aerial photos. Water bodies, types of vegetation, and problem soil conditions can be identified by subtleties in colour and shading on black and white or colour aerial photos.
- Actual land based distances and areas can be estimated from aerial photos of known scale using simple tools and procedures. The ASIV also has tools that allow areas and distances to be measured easily.
- Aerial photos are available by ordering from the Alberta Government's Air Photo Distribution Office or using the ASIV.