About this Unit

Reading maps and aerial photographs can be a matter of life and death. If other crew members are injured, it may be up to you to find the way out of the area, or to call in a rescue plane or helicopter.

Maps are flat models of the land. They are used to find horizontal distances between locations. Maps are made from aerial photographs.

Aerial photographs let you see depth. By viewing an overlapping pair of aerial photographs through a stereoscope, you can see a three-dimensional model of the ground. You can recognize objects more easily than when you see them on a flat, single photograph. Viewing aerial photographs in depth allows you to recognize the sample location and the details of the land around it.

Aerial photographs are used to find your way. They cannot be used to measure distances.

The topics covered in this unit are:

- Reading forest-cover codes on a field map.
- Reading contour lines on a topographic map.
- Using a scale rule and a protractor to find distance and bearing on a map.
- How and why maps are made from aerial photographs.

- Using a map to roughly estimate the average scale of an aerial photograph.
- Using a stereoscope to identify basic land features from a stereo pair of aerial photographs.

Acknowledgments

Some of the material in this unit has been taken, in modified form, from the following reference texts:

BCIT BRIDGE Program 1983, Module 3-2, *How to Select and Obtain Maps and Airphotos*; Module 3-5, *Measurement of Area, Direction, and Location of Points*; Module 3-6, *Stereoscopes and the Stereoscopic View*

Bark Beetle Probing Course, 1995, Ministry of Forests Cariboo Forest Region

BCIT Developmental Approvals Program, 1994, TDSA 1105 *Maps and Topographic Drawings*

Performance Objectives

When you have successfully completed this unit, you will be able to:

- Identify the parts of the code in a forest-cover label.
- Using a reference guide, describe the trees in a forested polygon from reading the forest-cover label on the field map.
- Calculate the elevation between selected contour lines on a topographic field map.
- State the six laws of contour lines.
- Use a scale rule to find the ground distance between two locations marked on a field map.
- Use a protractor to find the azimuth between locations marked on a field map.
- Explain why aerial photographs are used by field sampling crews.
- Explain why aerial photographs are *not* used for finding distances.
- Describe how to use a map to roughly estimate the average scale of an aerial photograph.
- Operate and maintain a stereoscope.
- Use a stereoscope to identify basic land features from a stereo pair of aerial photographs.

Before You Begin

The skills you need before starting Unit 3 are:

- Successful completion of Unit 2, Describe Basic Inventory Practices
- Successful completion of Level 1 Resource Inventory Skills Training Program

Before you begin this unit, check that you have all the Level 1 skills needed for safe and successful completion of it. A detailed list of Level 1 skills is given in Unit 1 Course Introduction. This unit builds on the map reading skills in Level 1 and you will have difficulty if you do not know how to use a compass, read a map legend or use UTM co-ordinates. So take time now to review the Level 1 skills you should have.

Also ask your facilitator to help you assess your skills by having you complete the Unit 3 Skill Assessment Exercise that follows. It will give both of you a better idea of your skill level. If you find that you do not have all the Level 1 skills you need to begin this unit, work out a plan with your facilitator for developing these skills. This way, you will have a better chance of successfully completing it.

Skill Assessment Exercise

1. Given a tape measure or ruler, measure something to the nearest millimeter.
2. Given two numbers, calculate the ratio of one to the other.
3. Given a compass, find the azimuth from your position to an object pointed out by the Facilitator.
4. On a map, find the scale of the map and explain what it means.
5. Your Facilitator will point out features on a map. State what they are by reading the map's legend.
6. State the approximate UTM coordinates of the features pointed out on the map.

Reading Field Maps

Field maps are the British Columbia Geographic System (BCGS) maps used by resource inventory sampling crews. Field maps are usually on a scale of 1:20,000. There are two types of field maps. The main field map is used to identify and accurately locate the sample location. See the sample field map on the next page *(Figure FR3-1*).

This map is a base map that includes three different levels of information:

- the planimetric base map (water, roads, power lines, UTM grid)
- the property net
- the vegetation polygons

All base maps contain markings for matching the map to the stereoscopic pair of aerial photographs. The next section covers how to use these markings to read aerial photographs.

A second type of BCGS map your crew should have in the field is a topographic map with contour lines, for reading the shape of the land. Topographic maps are often needed to plan the easiest access to the sample location, especially in the mountains. You'll see an example of a topographic map later in this section.

Topics covered in this section are:

- Reading forest cover labels.
- Reading contour lines.
- Using a scale rule to find distance.
- Using a protractor to find bearing.

Figure FR3-1 Field Map

Reading Forest Cover Labels

Vegetation polygons are mapped over the entire land surface of BC. They are each labeled with a single number. For forested polygons, a code is added to the label of each polygon, underneath the polygon number. Turn back to Figure FR3-1 to see a sample field map with forest cover codes in some of the vegetation polygons.

These codes are the forest cover codes used by timber cruisers. The code tells you that the polygon area is forested. It also describes the type of tree stands in the forested polygon. Knowing what kind of tree stands to expect is very helpful for navigating and for comparing the map to the aerial photograph. It also helps you to interpret the aerial photograph.

Turn to Figure FR3-2 on the next page. This figure is a guide to identifying the parts of the forest cover label and understanding what they are telling you.

Tree species

There are at least two lines in the forest cover label. The top line tells you the main tree species. Is uses a letter code. For example, Douglas Fir is shown by an "F," Lodgepole pine is shown as "Pl." Become familiar with these codes.

The list of species shown in Figure 2 is not a complete list. The complete list of tree codes is in the field tally book. Each inventory sampling crew member carries a copy of this book. Your Facilitator will show you a copy of a sampling crew person's field tally book. Find the list of tree species codes. It's called the *Vegetation Inventory Tree Species List*, or *Tree Species Guide*. Use this guide in the field until you know the codes for the trees in your region.

Turn back to Figure FR3-2 again. Look at the second line in the code. Only the first two numbers are important to you. Ignore the rest. The first number tells you the age class of the trees. The second number is the height class of the trees.

Species Codes

F	Douglas Fir
C	Western red-cedar
H	Hemlock
B	Balsam (True fir)
S	Spruce
Sb	Black spruce
Pw	Western pine
Pa	Whitebark pine
Pl	Lodgepole pine
Py	Yellow pine
L	Larch
Ac	Cottonwood
B	Birch
Al	Aspen

Tree species — **FSPl**
630MS

Average age of trees

Average tree height

This forest cover label tells you:

- the Douglas fir, Spruce, and Lodgepole pine trees are
- 101 - 120 years old, and
- stand 19.5 - 28.4m high

Age Class

Code	Limits (years)
1	1 - 20
2	21 - 40
3	41 - 60
4	61 - 80
5	81 - 100
6	101 - 120
7	121 - 140
8	141 - 250
9	251+ -

Height Class

Code	Limits (meters)
1	0.1 - 10.4
2	10.5 - 19.4
3	19.5 - 28.4
4	28.5 - 37.4
5	37.5 - 46.4
6	46.5 - 55.4
7	55.5 - 64.4
8	64.5+ -

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L67

History

Class Symbol	Code	History
Disturbance	B L	Wildfire Logging
Regeneration		Artificial Regeneration with year(s) of planting
Stand Tending	J	Juvenile Tending
Site Preparation	B M	Broadcast burn Mechanical

This forest cover label is more detailed, and it tells you:

- the Spruce, Balsam, and Lodgepole pine trees are
- 1 - 20 years old,
- stand .1 - 10.4m high, and
- the site has been logged

Figure FR3-2 Reading Forest Cover Labels

Age class

The age class tells you about the average age for the trees. The age class code is a number from 1 to 9. The number tells you a range of ages. The average age of the trees is within that range.

Height class

The height class tells you about the average height for the trees. The height class code is a number from 1 to 8. The number tells you a range of heights. The average height of the trees is within that range.

History symbols

Some forest cover labels may have a third line. This line tells you about the history of the site. It has a circular symbol with a line in it. It may also have a letter. These codes tell you about disturbances that have occurred by fire or by logging. Study Figure FR3-2 for a full description.

Legend symbols

History Class codes are found in the map legend

Polygons that contain swamps will have their own symbol

Reading Contour Lines

Your crew's topographic field map is a powerful aid to understanding the lay of the land around your sampling location. The contour lines on the topographic map show you the elevation of the ground at every location. Elevation is the vertical distance above sea level. Because contour lines show elevation, they also show you the steepness and form of the land.

The easiest way to see how to read contour lines is to look at Figure FR3-3. In this figure a hill is shown from the side. You can easily see which side of the hill is steepest. A series of numbered horizontal lines show you the elevations at each level. You can easily read the numbers on the horizontal elevation lines to find out how high the hill is at different points. The elevation lines are like slices through the hill. The top view shows the same thing, but now the "slices" look like curved, closed lines. By comparing the top view to the side view, you can see that the closely spaced contour lines show a steep slope. The widely spaced contour lines show a flatter slope.

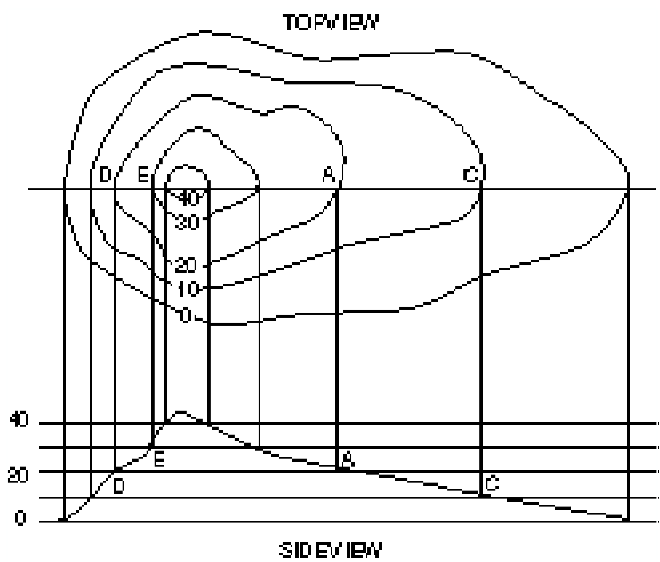

Figure Fr3-3 - Showing The Form Of A Hill

That's the way it always is for contour lines. Numerous contour lines that are close to one another show hilly or mountainous land. When far apart, they indicate a gentler slope.

What exactly *are* contour lines? Here's a definition: *Contour lines connect a series of points of equal elevation and are used to illustrate the physical form of the earth's surface*.

The two figures below give examples of land forms shown by contour lines.

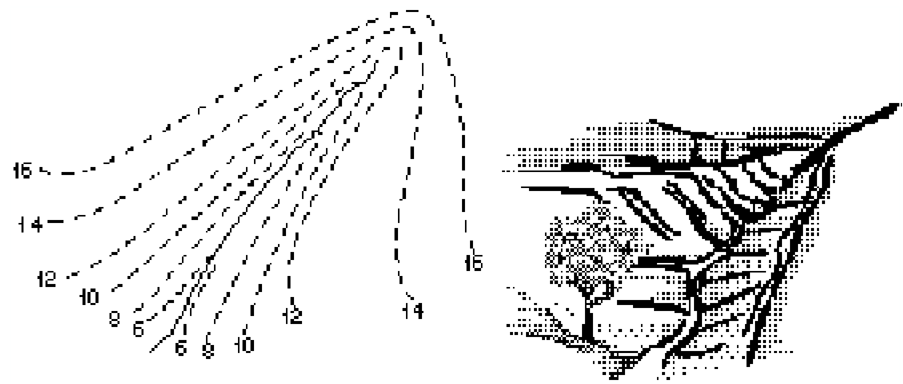

Figure Fr3-4 Ravine

A ravine is a deep valley bounded by steep slopes with little flat land at the base, usually only a creek bed.

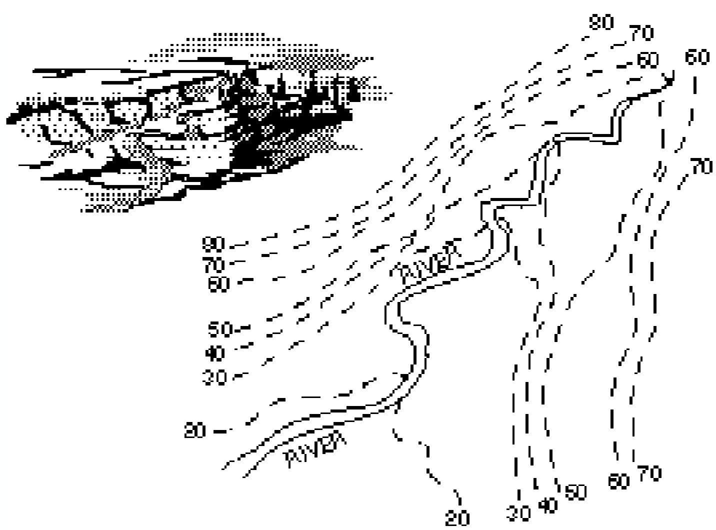

Figure Fr3-5 Flood Plain

A flood plain is a broad, flat to gently-rolling land area bounded by distant ridge lines.

Now look at the topographic map shown in Figure FR3- 6. Try to imagine what the landscape would look like if you were standing on the ground. As you can see, the planimetric base and property net are also included on the topographic map. So are some vegetation symbols, such as the swamp symbol.

Figure FR3-6 Topographic Map - Bowen Island

The six laws of contours:

1. **All contours close on themselves.**
   All contours will close somewhere on the face of the earth, even though they may not appear to on the field map itself.

Contours always occur in pairs.
Contours that indicate a ridge or a depression will always close. That means that if you continue to walk in the same direction and you cross a 50 m contour on your map as you hike uphill, then you will cross another 50 m contour before you find yourself heading downhill. Study the example below.

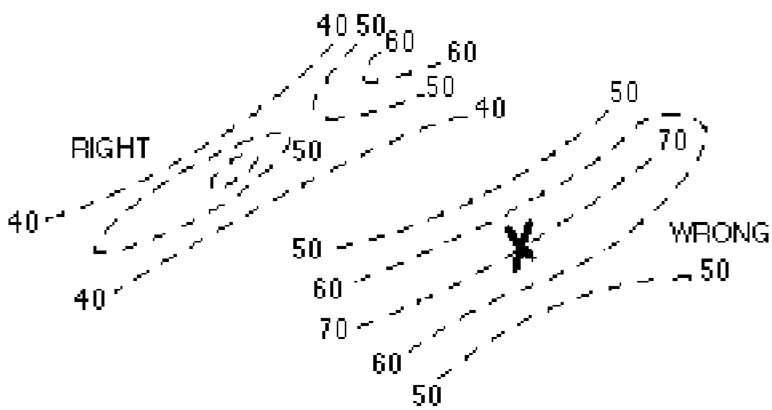

Figure Fr3-7 Contours In Pairs

1. **Contours never cross**.

2. **Contours have equal vertical separation**.

3. **Contours do not merge**.

4. **Water always flows at right angles to the contours**.
   Water always flows down the line of steepest slopes, which is always at right angles to the contour lines, as shown below.

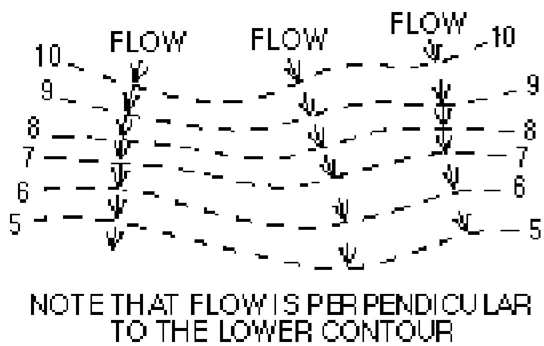

Figure Fr3-8 Water-Flow

Contour interval

The first thing to do when you read a topographic map is to check the contour interval. The contour interval is the vertical distance in metres between neighbouring contour lines. (Remember, "all contour lines have equal vertical separation.") The contour interval will be written somewhere in the legend, or near the scale notation.

To find the difference in elevation between one location and another:

1. Find the two locations on your topographic field map.

2. Count the number of contours between the two locations.

3. Multiply that number by the contour interval.

Using A Scale Rule To Find Distances

The link between map distance and ground distance is the scale. A scale of 1:20,000 means that one unit on the map equals 20,000 units on the ground. One centimeter (cm) on the map equals 20,000 centimeters on the ground. Of course we don't measure ground distances in centimeters, so we would say that one centimeter on the map equals 200 metres (m) on the ground.

If you had a 1;20,000 scale map, what would the real ground distance be for a map distance of 4.5 cm? It would be 4.5 times 200 m, which comes to 900 m.

To simplify this work, a special ruler is used. This ruler, or “rule,” has marks on it that look like centimeters and millimeters, but they aren’t.

Inventory field crews use a clear plastic scale rule, shown below.

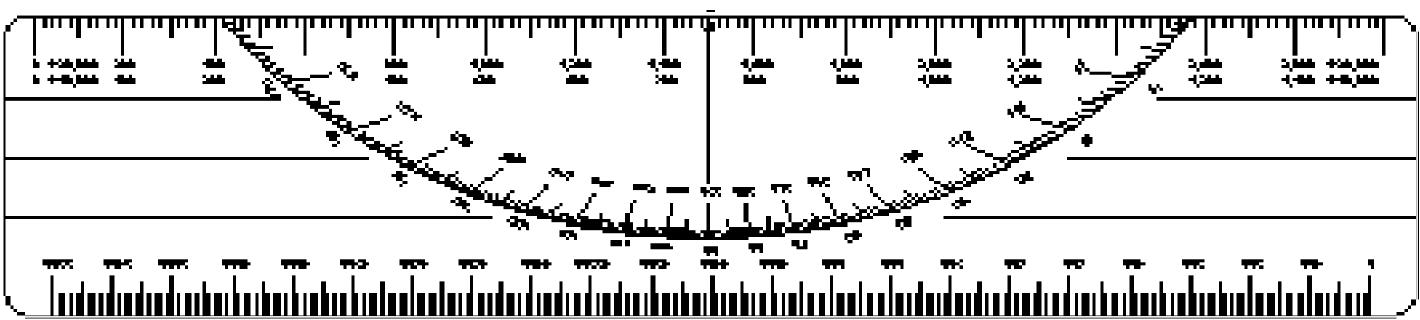

Figure Fr3-9 Scale Rule

This scale rule has three different scales marked on it. Each scale is for a different scale ratio. The ratios are 1:10,000, 1:15,000, and 1:20,000. The ratio is written on each scale. Use the one that fits with the scale on your map to measure ground distance directly from the map.

Look at Figure FR3-10 below. Which ratio on your scale rule would you use to find the ground distance between points A and B? The 1:20,000 ratio.

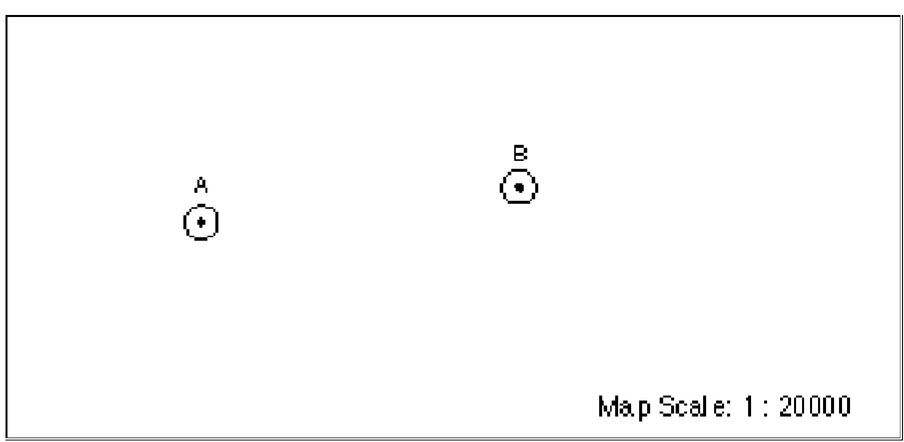

Figure Fr3-10

Now measure the distance with your scale rule. What is the distance from A to B that you measure using the 1:20,000 ratio? It should be about 800 m.

In summary, there are three simple steps to follow to use a scale rule to read the ground distance directly from the map:

1. Check the scale ratio of the map.

2. Choose the same ratio on the scale rule.

3. Read off the distance measured directly by the scale rule in metres.

Caring for your scale rule

A scale rule will be accurate only as long at it is properly maintained. Treat it gently. Avoid hitting sharp, hard objects with it, such as the edges of desks. Nicked edges of a scale rule make it hard to read accurately.

Avoid drawing lines with a scale rule. Drawing lines with it darkens the edge of the scale rule and smears lead or ink on it, making it hard to read. If you do get ink or dirt on your scale rule, clean it off right away to keep it easy to read. Cleaning it right away also stops dirt from being transferred onto a good map you might be using.

Using A Protractor To Find Bearings

Let’s say you have arrived with your sampling crew at the tie point. It’s now time to navigate to the sample location. You have the tie point and the sample point marked on your field map. The tie point is your starting point, the sample point is your destination. You must know exactly which direction to walk. So how do you find the azimuth to set on your compass?

Finding the azimuth between two points on a map is easy to do with a protractor. A protractor is a piece of clear plastic with angles marked on it in degrees. The kind of protractor used by the sampling crew is a square-shaped one called a Douglas protractor.

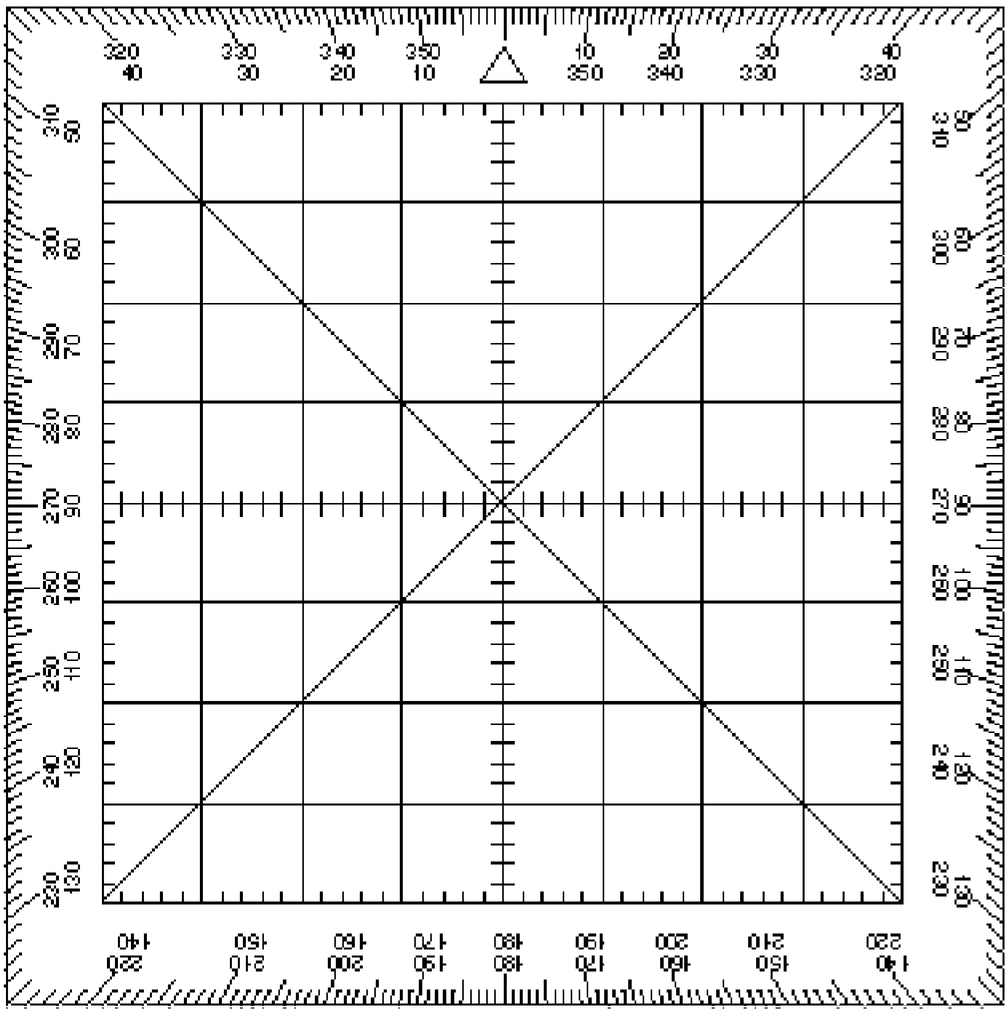

Figure Fr3-11 - Douglas Protractor

As shown in Figure FR3-11, the Douglas protractor contains:

- degree markings
- a north arrow

- a north-south grid

Here are the steps to use a Douglas protractor:

1. On the map draw a north-south line through your starting point. To make sure the line is exactly north-south in direction, you might have to measure from the nearest UTM grid marks.

2. Use a ruler or the edge of the protractor to line up the starting point and the destination point. Draw a line from the starting point to the destination point. This is your travel line. The travel line does not have to go all the way to the destination point. It only needs to be about 10 cm long for finding the azimuth.

3. Before using the protractor, make an eyeballed “guesstimate” of what you think the azimuth should be for the travel line. You should do this for safety, as you’ll see below.

4. Place the protractor on the map so that the north arrow lines up with the north-south line that you drew. Place it so that the center point of the protractor lies exactly on the starting point.

5. Along the edge of the protractor, read the angle of the travel line from the protractor’s graduation marks. If the line is not long enough to reach the edge of the protractor, just draw the line longer. Make sure you keep the north arrow pointing to the top of the map, and the grid lines parallel with the UTM grid markings of the map.

6. Compare this azimuth reading with your earlier “guestimate.” If they are very different, check your work again for a mistake. In the field it’s easier than you might suspect to read off an azimuth that is exactly *opposite* to the correct one -- and then hike off directly *away* from your destination!

   Most protractor mistakes give readings that are exactly 90 degrees, 180 degrees, or 270 degrees off from the correct one. If your reading and “guestimate” disagree by about 180 degrees, then you’ve probably got a back-azimuth. If they disagree by about 90 degrees or 270 degrees, then the protractor is probably not aligned properly.

7. Now that you've found the bearing of your travel line, you can set your compass to that azimuth and begin to travel in the right direction to reach the sample location, your destination.

\+ *When you feel you are ready, complete the practical exercises*

Practical Exercises

These self-paced exercises will help you get the practical hands-on experience you will need to become competent in this skill. Do not attempt these exercises until you have read the text for this section.

1. Look at the figure below. What is the highest contour elevation? What is the lowest contour elevation? What is the contour interval? Is the ground steepest in the north, south, east, or west portion of the map? Check your answers with your Facilitator.

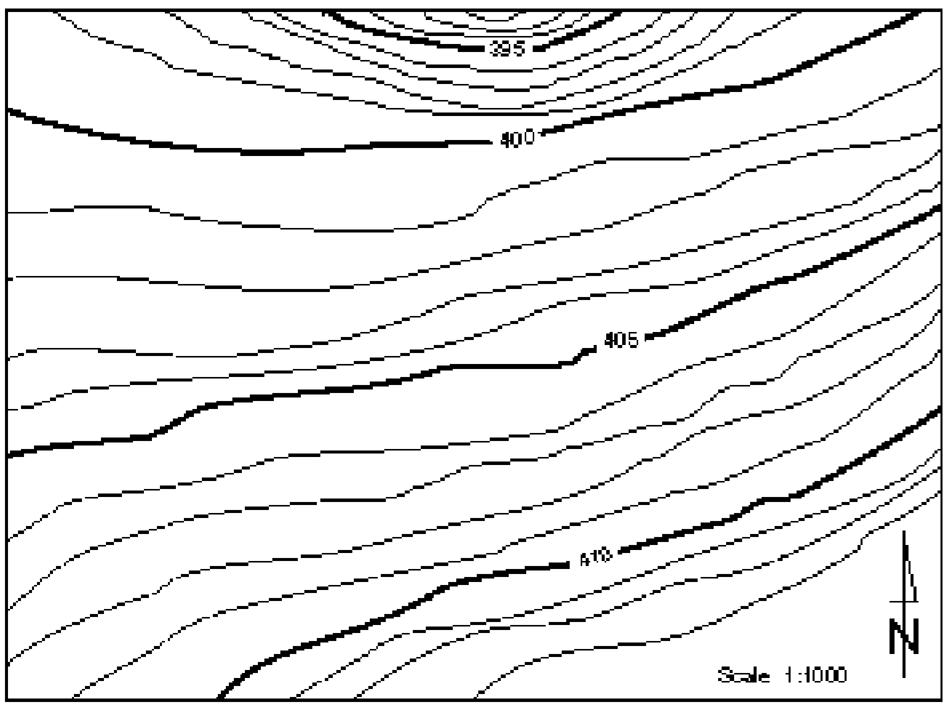

Figure Fr3-12, Contour Test

2. Arrange with your Facilitator to obtain the following:
   - -- a field map
   - -- a matching topographic map

Arrange time to work with these maps and photos for the following exercises.

3. Look at the codes in all of the polygons with forest-cover labels and do your best to recall what they mean—without referring to your reference material. Now you can open your reference material and double check them.

4. Get your Facilitator to point to a forested polygon on the field map. Describe to your facilitator the trees in that polygon. The Facilitator will correct you if you make an error. Repeat this with at least two more polygons. Make sure you are clear about the answers.

5. For each polygon you discuss with your Facilitator, identify the highest elevation in the polygon. State the UTM coordinates of that point.

6. Identify and give UTM coordinates for as many of the following that you can find:
   -- steep slopes
   -- ridges
   -- depressions
   -- valleys/draws

7. Find the size of a marked feature on the map.

8. Find the bearing and ground distance between two points on the map.

9. Now your Facilitator will mark on the field map a starting location and a destination. You must determine the best route to get to the destination.

10. **Field exercise:** Now tell your Facilitator that you are ready for a practical exercise in the field. The Facilitator will arrange for you to travel to the inventory location that is covered by your map. Using the same map, determine the following things about an area selected by your Facilitator on the map:

RESOURCES INVENTORY COMMITTEE

-- bearing to the center of the selected area,
-- distance to the center of the selected area
-- size of the selected area
-- tree type in the selected area,
-- elevation of the selected area.

Then, travel to the selected area and confirm your answers.

+ *After you have completed the practical exercises, or have arranged for them to occur, continue on to the next section of this unit*

Reading Aerial Photographs

An aerial photo is similar to other types of photographs, but it's taken from an aircraft. Usually the camera is attached to the aircraft and aimed directly downward at the earth's surface.

Aerial photographs are used in the field. In the field, pairs of overlapping aerial photographs are viewed with a stereoscope to see depth. This helps identify land features.

Turn to the back of this manual. There you will see a pair of aerial photographs for you to use in your practical exercises. These photos are the ones used to make your field map. One of the photographs has the vegetation polygons drawn on it These are the original polygon borders that were transferred to your field map. Study these photographs as you read this section.

Ground sampling crews use aerial photographs to:

1. Navigate to and from the sample location

2. Verify that the crew is sampling in the correct polygon

Topics covered in this section are:

- Differences between maps and aerial photographs
- Estimating average scale on an aerial photograph
- Operating and maintaining a stereoscope
- Identifying land features from a stereo pair
- Finding your field location on an aerial photograph.

Differences Between Maps and Aerial Photos

There are three very important differences between an aerial photograph and a map:

1. The direction of north on an aerial photograph is not standard.

2. The scale of an aerial photograph varies from one place to another.

3. Aerial photographs can give you a three-dimensional view

To understand these three important differences between an aerial photo and a map, you must understand how aerial photos are taken from the aircraft, and how the photos are used.

How aerial photos are taken

When taking aerial photographs, the aircraft is flown on a predetermined flight path. Photos are taken automatically, about every 15 seconds. When the whole roll of film has been exposed (about 250 pictures), the roll is taken to an air photo laboratory for developing and printing. The resulting photographs are then indexed, distributed, and stored or used as needed.

The scale of an aerial photograph is not a simple subject, as you'll see. For the moment, we can say that aerial photographs in BC are available at roughly the scales of 1:20,000 and 1:40,000.

When aerial photos are being taken, the aircraft travels along a straight path called a "flight line", until reaching the edge of the area to be covered. Most areas are too large to be covered by the photos taken along a single flight line. So the aircraft must fly several parallel flight lines back and forth over the area.

Flight lines must be close enough together to ensure that no part of the area is left unphotographed. This is done by making sure that the photos along neighbouring lines overlap each other by about 20 percent. This kind of overlap is known as "sidelap."

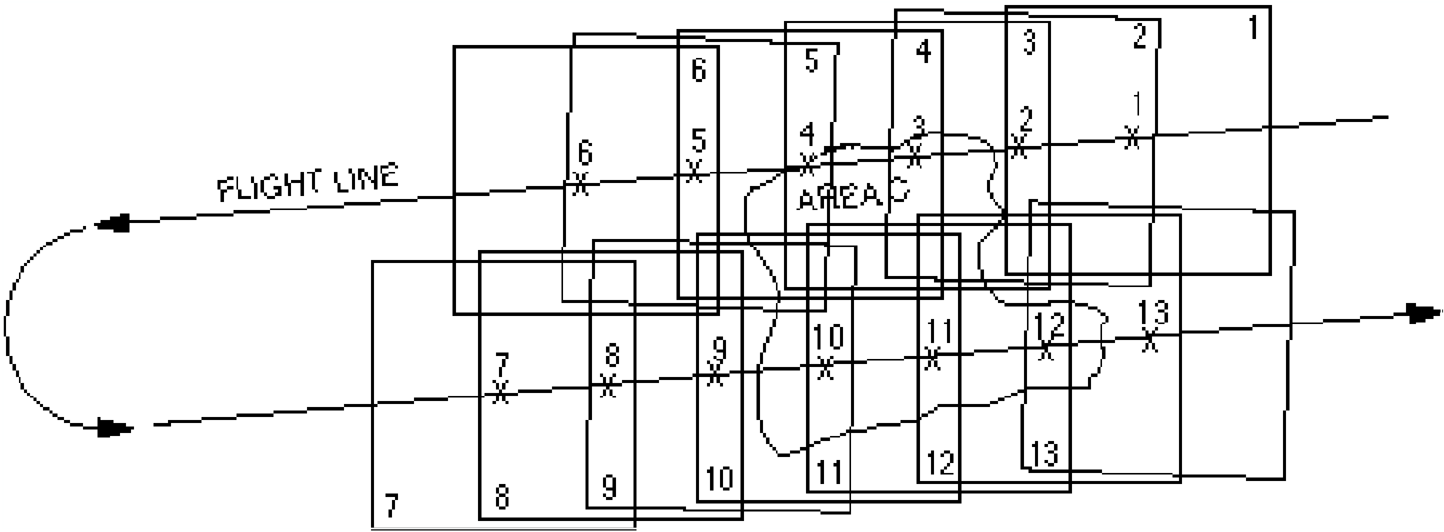

Figure FR3-13 - flight line Side-Lap

Flight lines are usually run parallel to the general shape of the landscape. For example, if the Fraser Valley between Vancouver and Hope was being photographed, the flight lines would be laid out in an east-west direction, along the valley below. Photography of the Okanogan would run along the valley in a north-south direction.

In some cases the shape of the area being photographed is not important enough to control flight line direction. Where this happens, the flight lines are laid out in either north-south or east-west directions.

Why the photos are used in pairs

You only get the full benefit of aerial photography when two overlapping photos are viewed “stereoscopically,” through a stereoscope instrument. Stereoscopic vision is the way we normally see the world. Your brain uses the slight difference between what your two eyes see to create the sense of depth, or three-dimensional vision. The stereoscope instrument is a visual aid that helps you to do the same thing with two separate, flat photos. Stereoscopic vision gives the photo a three-dimensional effect, as if you were actually looking down on a real landscape, instead of a pair of photos. Mountains and treetops appear to stand up higher than valleys or the forest floor.

To allow stereoscopic viewing of the photographed area, each point on the ground must appear on at least two photographs. This can only be achieved by maintaining enough overlap between photos.

How air photos are spaced along a flight line

The figure below shows the spacing of photos along the flight line.

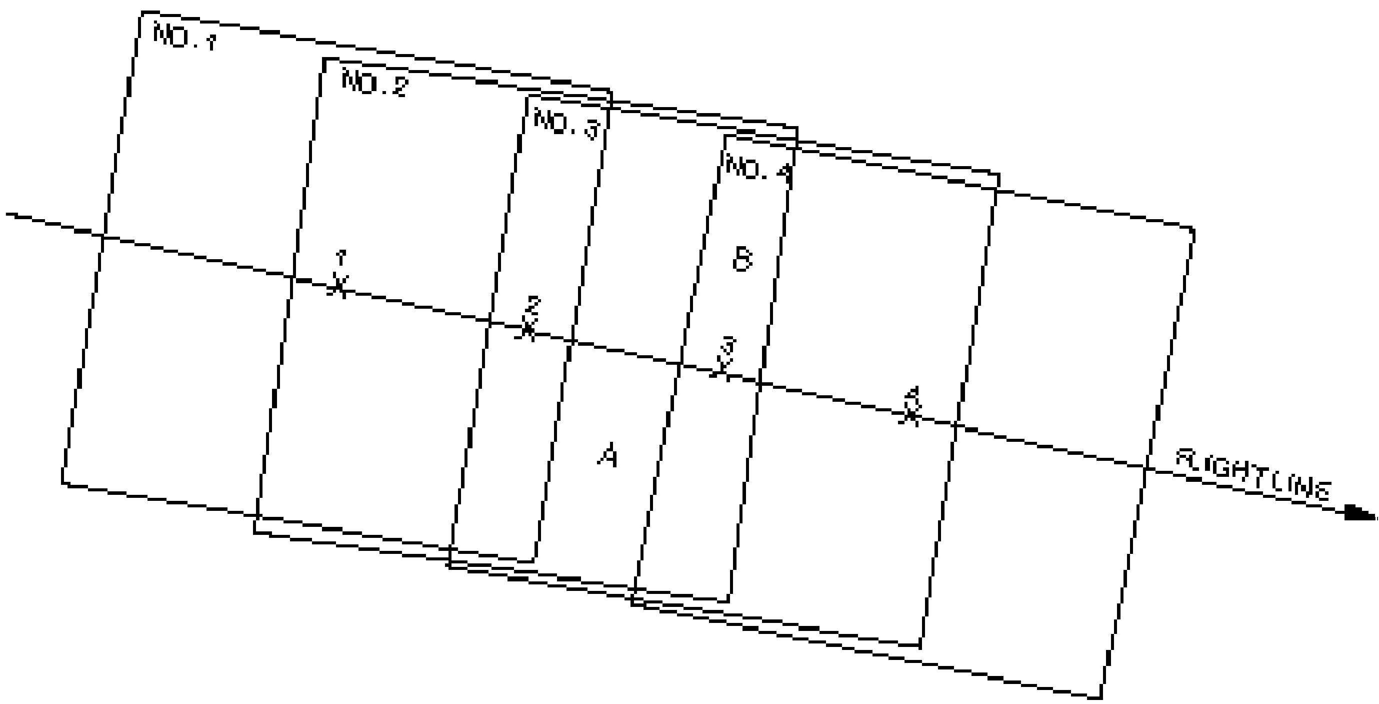

Figure Fr3-14 - Flight Line Endlap

As this figure shows, each photo covers an area a little past the center of its neighbouring photos along the flight line. Each photograph must overlap its neighbors along a flight line by about 60 percent. Overlap along the flight line is called “endlap.” Another way to imagine endlap is to remember that the aircraft travels only 40 percent of the photo width between exposures.

Study this diagram until you are familiar with it.

Notice that the two points marked “A” and “B” each appear on two neighbouring photos.

Notice the photo centers. These are marked by “x” marks and numbered for the number of the photo they belong to. The photo centers will be marked on your crew’s aerial photograph. Each photo will be marked with the photo centers of all neighbouring photos, not just the one for that photo. You must use the photo center marks to line up the photos to view them stereoscopically with the stereoscope.

Finding north on an aerial photograph

Because of differences in flight line direction, it’s harder to find north on air photos than it is on a map. On a BGCS map, north is always at the top of the sheet. On a photo, finding north is the first task in reading the photo.

North can be found by comparing the photo to the field map. Your crew leader will work out the direction of north on the photo and mark it on the photo before going out to the field.

Scale on aerial photographs

The idea of scale on maps and aerial photos is the same, except for one important difference. The scale of a map is the same all over the map sheet, but on an aerial photo the scale can vary from one portion of the photo to another. What causes the scale of an aerial photo to vary from one place to another?

The two main causes of variation in scale on an aerial photo are:

- Changes in the elevation of the ground
- The angle of view

Differences in the elevation of the ground make the biggest variations in scale, as shown in the diagram on the next page.

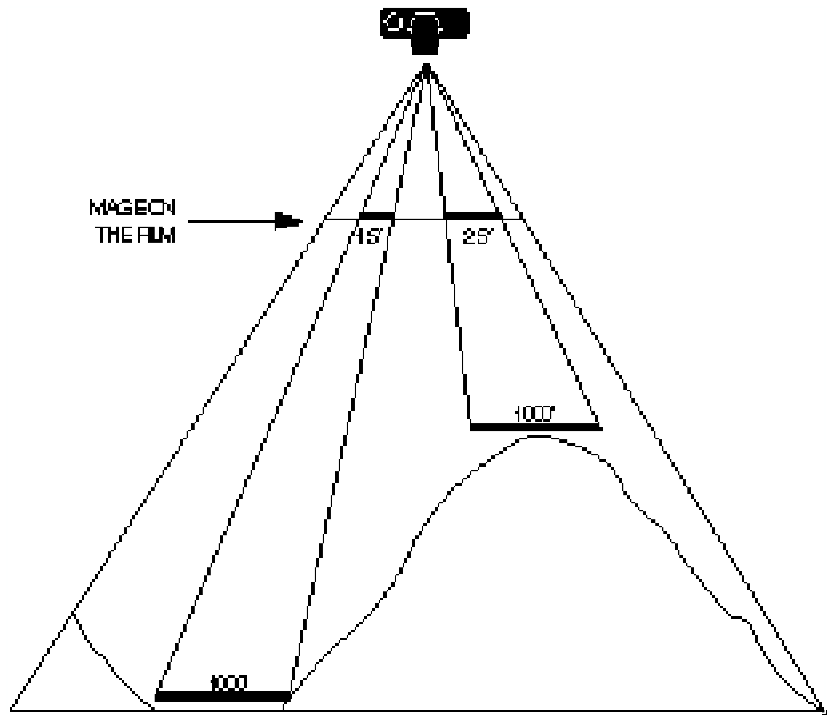

Figure Fr3-15 Image On Film

The two areas on the ground are both a thousand metres wide. But the sizes of those areas that appear on the film are not the same.

You might call this a sort of “illusion.” The same sort of illusion occurs even for ground that is all at the same elevation. It happens because the camera points straight down. That means that only the spot on the ground that’s directly below is being viewed exactly straight on. Ground areas a little further away from that spot, on all sides, are viewed at a bit of an angle. Areas way out at the edges of the photograph are viewed at much more of an angle.

Here’s how to think about what happens. Close one eye and look at this page straight on. Now turn the page at an angle to your view. The writing and drawings now look thinner, squashed. It’s the same thing with taking a photograph with any camera—the areas seen at more of an angle get squashed. The scale varies.

This problem is magnified when the land itself has a slope to it.

Making maps from aerial photographs.

Maps are made from aerial photographs, but not directly. Map makers use a very special stereoscope and plotting device. With this devise and the 3D vision of the stereo pair, they are able to trace out features they see onto a flat surface with true horizontal scale.

So you can see that maps, and only maps, have accurate horizontal distances that can be measured with a scale rule. That's why you don't measure distances on aerial photos.

Estimating Average Scale On An Aerial Photo

As you've seen, we can only talk about average scale on an aerial photograph. The average scale of a photo is an approximate figure. It's the scale at the average elevation of the ground shown in the photo. This figure is okay if the ground is fairly flat, or if you only need rough, approximate measurements of distance from the photo.

To roughly estimate the average scale of an aerial photo, you have to compare it to something you know on the corresponding field map. Follow these steps.

1. Find two points that appear on both the map and the photo.

2. Measure the actual distance between the points on the map.

3. Measure the actual photo distance between the points on the photo

4. Divide the measured map distance by the measured photo distance. That gives you a ratio that expresses the difference in scale between the photo and the map.

5. Multiply the ratio you calculated by the map scale. Now you have the answer.

Operating A Stereoscope

A stereoscope is a simple visual aid. I helps you to look at two photos at the same time, one with each eye. It also makes the image seem much farther away.

The type of stereoscope used by field crews is a lens stereoscope. It has a pair of lenses of low magnification, mounted in an adjustable frame so that the lenses can be made to fit the distance between your eyes.

The compact size and durability of the lens stereoscope makes it easy to carry and use in the field. For this reason it's sometimes called a pocket stereoscope. Your Facilitator will lend you a stereoscope to use in the practical exercises. You should have it on hand now before you go on.

Care and maintenance of the stereoscope

Take care not to bend the mounting or the legs. If the mounting is bent the eye adjustment will not work. If the legs are bent the stereo image will be out of focus.

Avoid scratching the lens by keeping the stereoscope in its carrying case, and by using cleaning solution and a lens tissue to remove dust and grease.

Operating the stereoscope

In order to get the best stereoscopic view from the two aerial photos, the photos must be positioned properly. To position the two photos, you must first find the flight line

On a single photo, the flight line passes through the photo center. Since the photos have and endlap of about 60 percent, the photo centers of the neighbouring photos will also appear on the single photo.

Before the crew starts out, the crew leader uses a stereoscope to accurately transfer the neighbouring photo centers from one photo to the other. The points are marked with ink or a pin prick. In addition, a circle one quarter of an inch wide is drawn around each point.

Follow these steps to align the photos for stereoscopic viewing. You will need a ruler or some other straight edge to work with.

1. Make sure the photos are positioned in the same order they occurred when taken.

2. Choose which photograph to put on the bottom of the overlap.

3. Make sure the shadows point toward you. If they don't, pick up both photos and turn them 180 degrees.

4. On one photograph, line up the photo centers with the ruler.

5. Hold the ruler in place and carefully slide the second photograph into place.

6. Place the stereoscope over the lined-up photos. The flight line must be parallel to the lenses.

7. View the image and adjust the separation of the photos by sliding the second photo in and out a little along the flight line as needed.

Vertical exaggeration

The differences in elevation that you see are exaggerated. Everything looks taller than it really is. The exaggeration of differences in height of features can be helpful in recognizing objects.

Reverse image

If you have accidentally reversed the stereo pair of photos, you will see a strange sight, where up and down are reversed. For example, the normal view of a creek running through a gully will appear to run along the top of a ridge, and trees will appear as holes in the ground.

+ *When you feel you are ready, complete the practical exercises*

Practical Exercises

These self-paced exercises will help you get the practical hands-on experience you will need to become competent in this skill. Do not attempt these exercises until you have read the text for this section.

1. You should already have a stereoscope on hand. Your Facilitator will provide you with a grease pencil for drawing on photographs.

2. Turn to the photo pair at the back of this book. Outline at least four major land features you can recognize under the stereoscope. Write on the photo what you think each feature is. When you have finished, ask your Facilitator to see the "answer photos." This pair of photos has some of the major land features outlined and named.

3. Arrange with your Facilitator to obtain the following:
   -- a field map with photo centers marked
   -- the corresponding pair of stereoscopic aerial photographs
   This map and these photos include the location to which you will be travelling to perform the field exercises.

4. Using both the map and matching stereoscopic photos, identify all the ground features you can. One area on the photo will be marked as a sampling location. Your Facilitator will point out a prominent land feature on the photograph that is seen somewhere near the sampling location. That feature, however, will *not* appear on the map. Using the map as a reference, estimate the actual size of the feature, such as it's longest dimension. Describe what you think the feature looks like from a position on the ground. You will soon be travelling to this location.

5. Your Facilitator will now take you on a field trip to the sampling location marked on the photo you just studied. On the ground, confirm for yourself how the photographed land feature appears in reality

+ *After you have completed the practical exercises, or have arranged for them to occur, continue on to the Skill Test for this unit.*

Skills Test

Instructions

Now that you have studied and practiced reading maps and aerial photographs, it is time to be tested on your performance.

The Skills test is based on the following activities:

- Coloring a segment of a field map.
- Working with a topographic map.
- Marking an aerial photograph, while using a stereoscope.
- Answering questions asked by the Facilitator.

Your Facilitator will evaluate your performance according to a skills evaluation checklist. Comments may also be included on the checklist form so that you can better understand your own performance.

When you feel you are ready, notify the Facilitator and a time will be arranged for your Skills Test.

Procedures

1. You will be given a photocopied section of a field map, some colored pencils, and a color code to use. Color in the areas of the map to show:
   a) older and taller trees (old growth)
   b) younger and shorter trees (second growth)
   c) wet areas and water

2. On the same map, pick a forest cover code and state the meaning of the parts of that code.

3. Given a topographic map, protractor, and scale rule:
   a) state the elevation of selected peaks
   b) state the contour interval
   c) find the azimuth and distance between two selected points
   d) locate a ravine

4. State the six laws of contours.

5. Given pair of aerial photographs, a stereoscope, and a grease pencil, outline, on one photograph, broad areas such as urban, rural, and wild lands, as specified by your Facilitator.

6. Explain why aerial photographs are used by field sampling crews.

7. Explain by aerial photographs are not used for finding distances.

8. Describe how to use a map to roughly estimate the average scale of an aerial photograph.

Facilitator's Checklist

UNIT 3 - READ MAPS AND AERIAL PHOTOS

SKILLS EVALUATION FORM

	YES / NO
Identified the 3 different areas on the field map to 75% accuracy.	
Correctly described the parts of the selected forest-cover code	
Correctly read elevations	
Correctly identified the contour interval	
Used appropriate scale on scale rule	
Measured azimuth to 1% accuracy	
Measured distance to 1% accuracy	
Identified a ravine	
Correctly stated at least 5 of the 6 laws of contours	
Outlined all of the correct areas on the photograph	
Gave two reasons why aerial photos are used in the field	
Explained scale distortion on photos adequately	

Adequately described how to use a map to estimate photo average scale