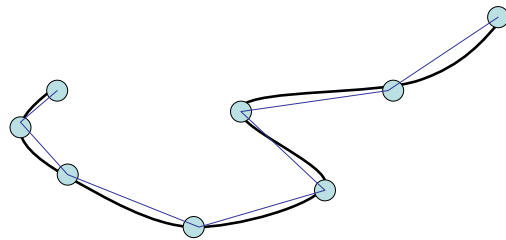Geography 12: Maps and Spatial Reasoning

Lecture 9:
Cartometry: Lines and Areas

Professor Keith Clarke

A generic line

$(X_1, Y_1) \ldots (X_n, Y_n)$

Line and Area features on topo maps

BOUNDARIES

National	
State or territorial	
County or equivalent	
Civil township or equivalent	
Incorporated city or equivalent	
Federally administered park, reservation, or monument (external)	
Federally administered park, reservation, or monument (internal)	
State forest, park, reservation, or monument and large county park	
Forest Service administrative area*	
Forest Service ranger district*	
National Forest System land status, Forest Service lands*	
National Forest System land status, non-Forest Service lands*	
Small park (county or city)	

Roads as lines

Land surveys and roads

A "length" datum

Railroads

Railroads

Power lines

Lines and areas

TRANSMISSION LINES AND PIPELINES

Power transmission line; pole; tower	
Telephone line	Telephone
Aboveground pipeline	
Underground pipeline	Pipeline

VEGETATION

Woodland	
Shrubland	
Orchard	
Vineyard	
Mangrove	Mangrove

Water bodies
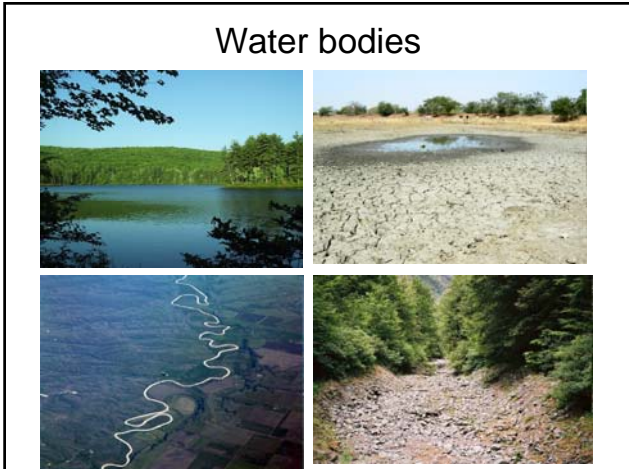
Watery symbols

MARINE SHORELINES		RIVERS, LAKES, AND CANALS	
Shoreline		Perennial stream	
Apparent (edge of vegetation)***		Perennial river	
Indefinite or unsurveyed		Intermittent stream	
COASTAL FEATURES		Intermittent river	
Foreshore flat		Disappearing stream	
Coral or rock reef		Falls, small	
		Falls, large	
Rock, bare or awash; dangerous to navigation		Rapids, small	
Group of rocks, bare or awash		Rapids, large	
Exposed wreck			
Depth curve; sounding		Masonry dam	
Breakwater, pier, jetty, or wharf		Dam with lock	
Seawall			
Oil or gas well; platform		Dam carrying road	

3

Water features

Aquaduct/Canal/Flume/Spring
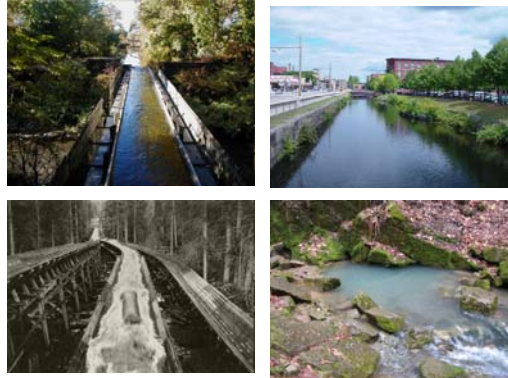
More water

RIVERS, LAKES, AND CANALS – *continued*	
Perennial lake/pond	
Intermittent lake/pond	
Dry lake/pond	
Narrow wash	
Wide wash	
Canal, flume, or aqueduct with lock	
Elevated aqueduct, flume, or conduit	
Aqueduct tunnel	
Water well, geyser, fumarole, or mud pot	
Spring or seep	

Ice and snow

GLACIERS AND PERMANENT SNOWFIELDS	
Contours and limits	
Formlines	
Glacial advance	
Glacial retreat	

Surface features: Strip mine

Swamps

Surface features

SUBMERGED AREAS AND BOGS	
Marsh or swamp	
Submerged marsh or swamp	
Wooded marsh or swamp	
Submerged wooded marsh or swamp	
Land subject to inundation	
SURFACE FEATURES	
Levee	
Sand or mud	Sand
Disturbed surface	
Gravel beach or glacial moraine	Gravel
Tailings pond	Tailings Pond

Topography

Contours: Whole separate lecture

CONTOURS

Topographic

Index	
Approximate or indefinite	
Intermediate	
Approximate or indefinite	
Supplementary	
Depression	
Cut	
Fill	
Continental divide	

Bathymetric

Index***	
Intermediate***	
Index primary***	
Primary***	
Supplementary***	

Distance measurement: from the ground

- Pacing
- Survey
  - Chain/Pole
  - Wheel
  - Stadia
  - EDM
  - GPS
- Tape
- Triangulation
- Ships log

Distance with Stadia

6.42 – 6.06 =
0.36 x 100 =
36 m (or ft.)
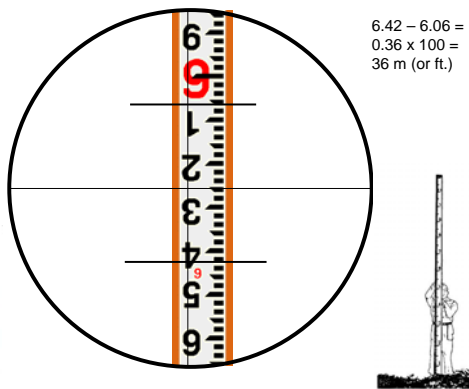
Distance on the ground

- Odometer
- GPS point trace
- Dead reckoning
- Record coordinates and compute

Pacing

- Measure a base line using a superior method
- Devise method for pace counting
- Repeat measurement several times
- Average result and divide for length of pace
- Note how pace varies with terrain
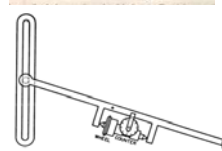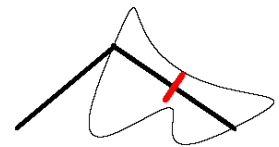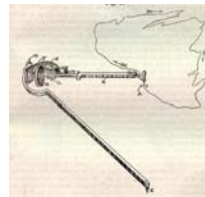
Measuring on the map
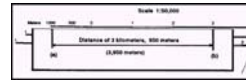
Length from coordinates

$$\text{length} = \sum_{i=1}^{npts} \sqrt{(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2}$$

(x_1, y_1) (x_{npts}, y_{npts})

Area measurement: From the map
Polar planimeter
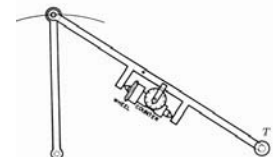
James Clerk Maxwell (1855)
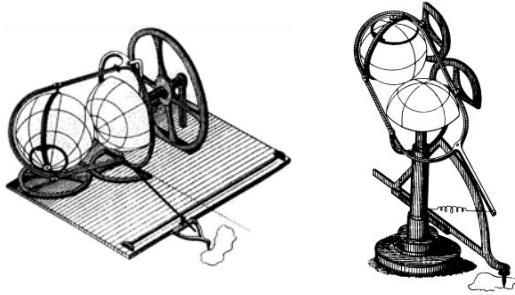
Steinhaus Longimeter

Four methods for area
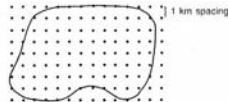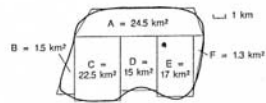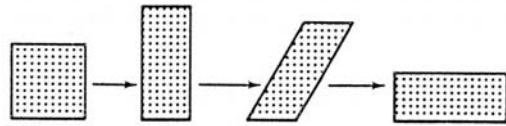

For example, Lake Los Carneros
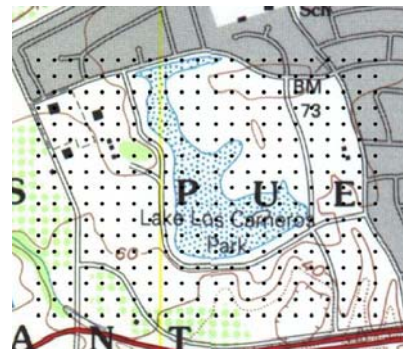
Area from coordinates

$$A = \frac{1}{2}\left| \sum_{i=1}^{npts+1} (x_i y_{i-1}) - (x_{i-1} y_i) \right|$$

Equivalence

FIGURE 198. Equal-area diagram.

Summary

- Topo maps and others show line and area features
- Features have different symbols and colors
- We can measure length and bearing of lines
- We can measure area of areas
- We can do this from the map or the coordinates