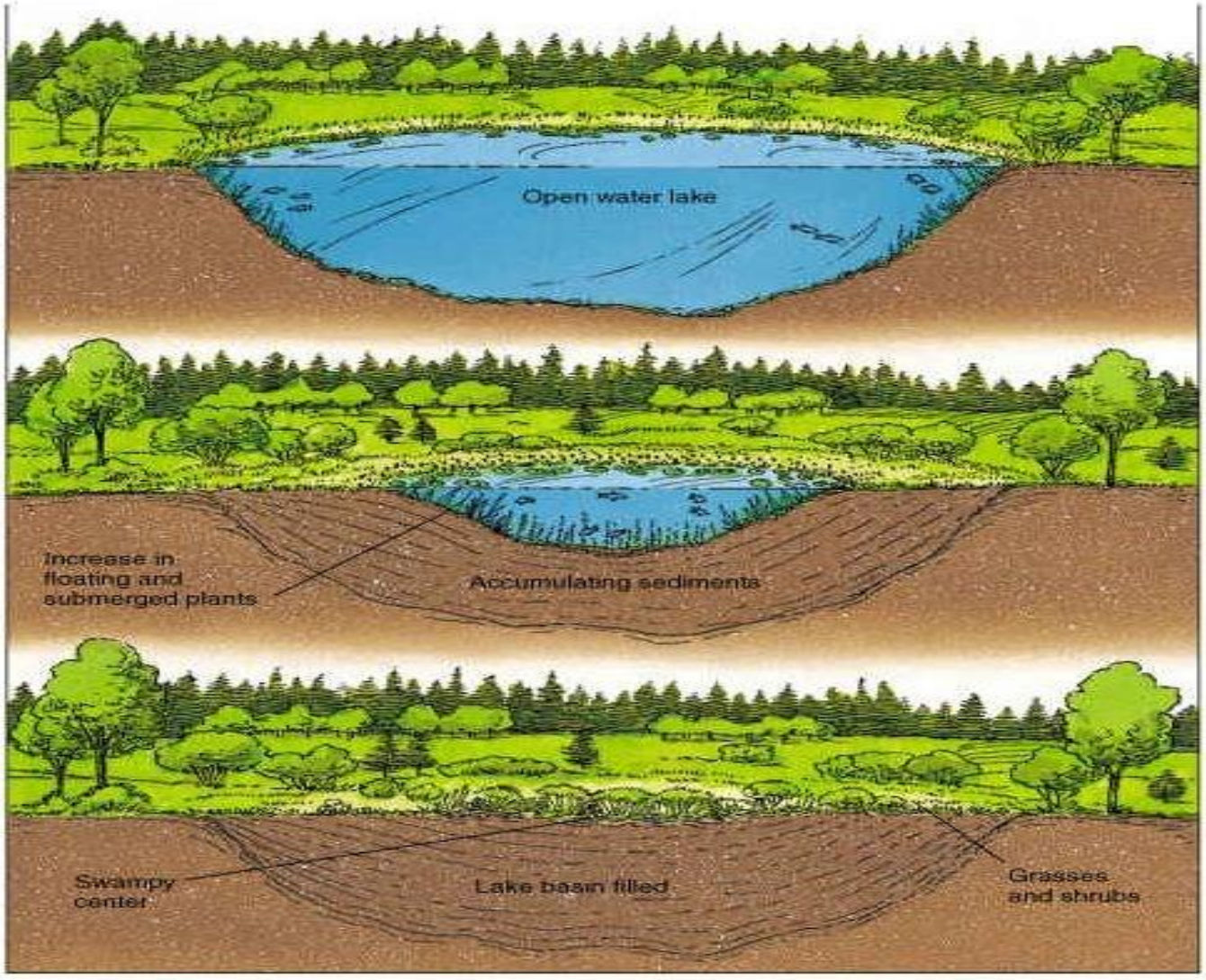
ROOT DIEBACK

OXYGEN STARVATION?

FORMATION OF BOGS



HUMMOCKY SURFACE of BOG

O.M. DECOMPOSITION

The composition of organic matterdepends on the nature and abundance of microorganisms in soil, the C, N, P, K & moisture content of the soil and temperature, pH, aeration, C: N ratio of plant residues and presence/absence of inhibitory substances (e.g. tannins, pesticides).

ORGANISMS

- Bacteria –most abundant organisms & important role in decomposition of O.M.
- Majority of bacteria involved in decomposition of organic matter are heterotrophic (need Oxygen)
- Actinomycetes and fungi also play roles in the decomposition of organic matter.
- Soil algae contribute a small amount of organic matter – not active in decomposition.

AERATION

- Necessary for microorganisms involved in the decomposition of organic matter.
- Under anaerobic conditions fungi and actinomycetes are suppressed and only a few bacteria *(Clostridium)* take part in anaerobic decomposition.
- Anaerobic decomposition results into the production of organic acids and gases -> methane, hydrogen sulfide, & carbon dioxide

OXIDATION–REDUCTION (Eh)

Soil state		Redox potential (mV)
Aerobic		
	Stabilized by oxygen	(800)600<=>400(300)
	stabilized by nitrate	530<=>420
	stabilized by manganese	640<=>410
Anaerobic		
	stabilized by organic matter	200 <=> -40
	stabilized by ferric ions	170 <=>-180
	stabilized by sulphate	-70 <=>-220
	stabilized by carbon dioxide	-120<=>-240

IMPORTANCE OF C:N

C: N controls rate of O.M. decomposition

O.M. in plant-tissues varies widely in C: N ratio (40, 80:1).

C: N ratio 20-25 is ideal (N limiting! = fertilizer),

Low nitrogen content or wide C:N ratio = slow decomposition

Aeration, narrow C: N ratio → optimal decomposition of organic matter (including pesticides).

POOR & GOOD AERATION

Richmond No. 7 Road

DIEBACK (left) HEALTHY (right)

SITE – No. 7 ROAD & RESEARCH SITE

Samples

1. Extensive dieback
2. Healthy, adjacent to dieback
3. Intermediate (or transition zone)
4. Healthy growth (younger plantation than samples 1-3)
5. *Research plot, bare*
6. *Research plot, under production*

RESULTS- Aug. 2014

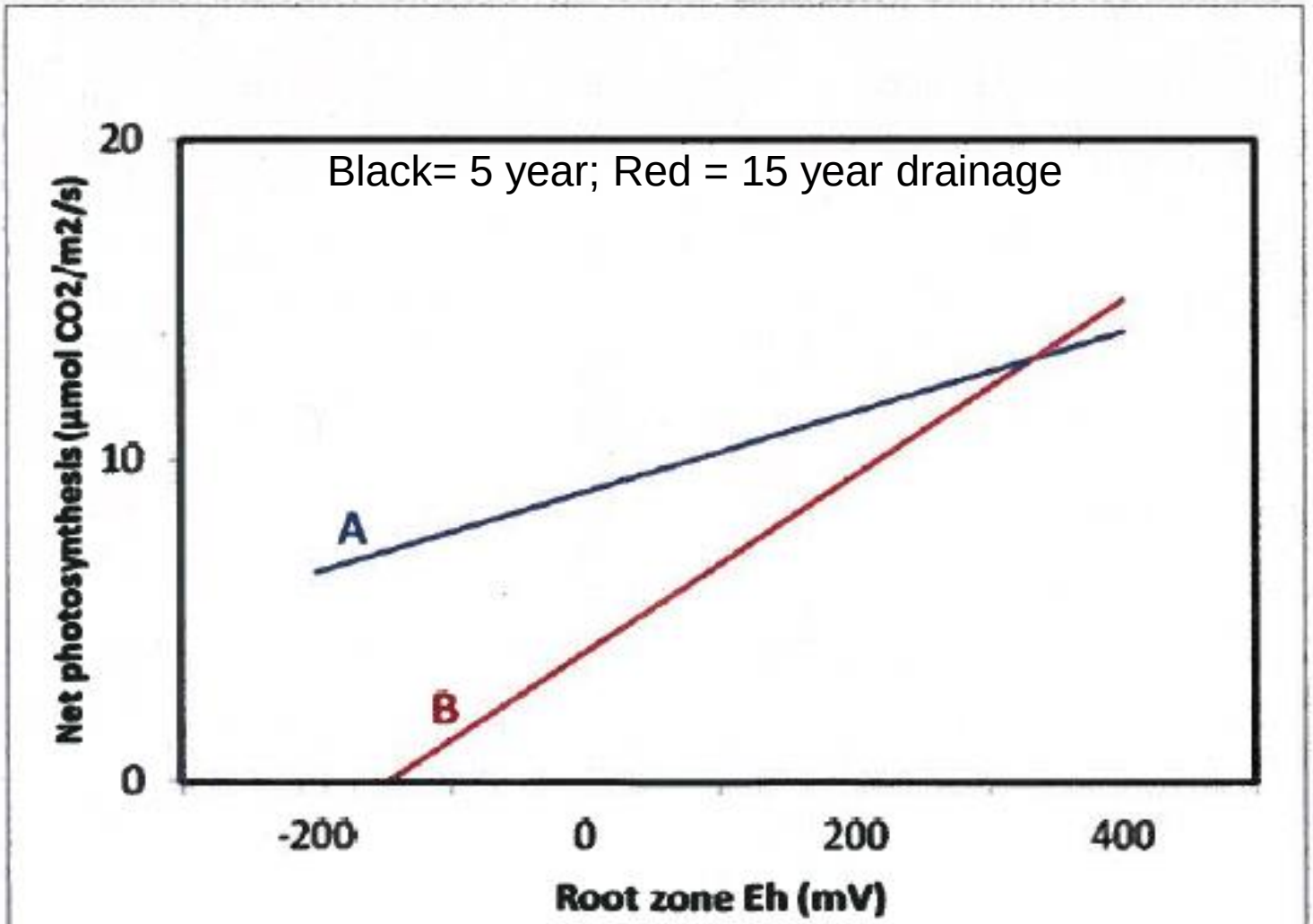
Sample	pH		Eh		H_2O	Bulk Density	Organic Matter	NH_4	NO_x	Porosity
	H_2O	$CaCl_2$	H_2O	$CaCl_2$						
			mv		%	g/cm^3	%	mg/L		%
1.	4.9	3.5	176	270	83	0.75	62	0.96	18	48
2.	5.7	4.7	130	202	58	0.22	77	0.81	0.25	82
3.	5.3	3.9	168	263	65	0.29	72	1.3	1.7	76
4.	3.9	2.4	256	332	49	0.11	92	0.4	0.3	90
5.	4.2	2.7	227	320	26	nd	94	0.7	0.05	-
6.	4.2	2.6	234	321	25	nd	96	0.3	0.2	-

PRELIMINARY ASSESSMENT

- Management regimes lower the water table, oxidation of the original peat soil leads to O.M. decomposition,
- Decrease O.M.--> increase in finer particles → higher water holding capacity & lowers porosity,
- Decreases O_2 and CO_2 diffusion and exchange at the root-soil interface,
- Oxygen availability decreased (lower Eh) → anaerobic soil-root environment,
- Eh values of < 175 ,water/270 ,$CaCl_2$, anaerobic (lack of O_2).
- Plus presence of NH_4, suggest roots in sample 1&2 deprived of oxygen to maintain the oxidizing environment

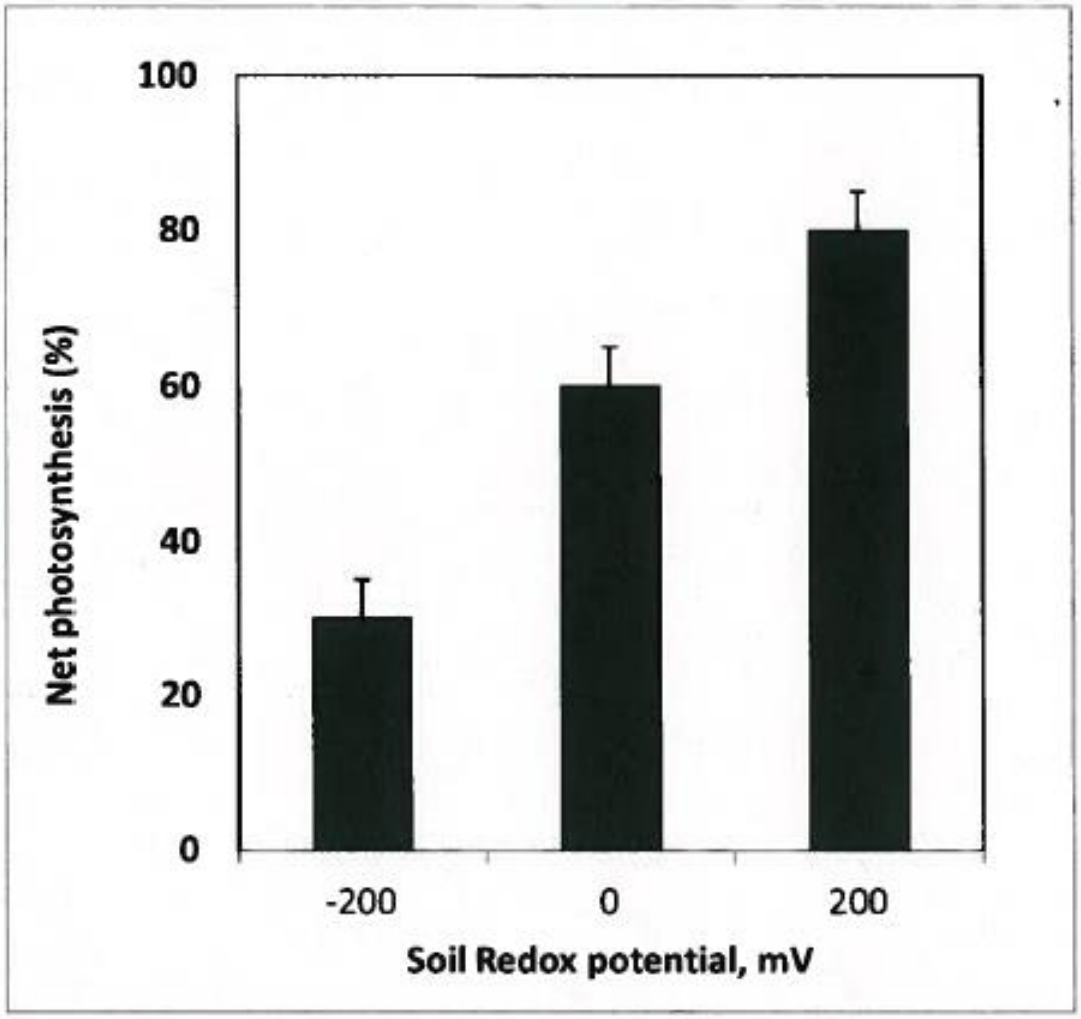
ROOT REDOX (Eh) and GROWTH

(from Pennington and Walters [28]).



REDOX AND PLANT GROWTH

. Values are presented as percent of controls (from Pezeshki *et al.* [157])



Infra Red Photo of site

- ANTONIA Please

NATURAL BOG

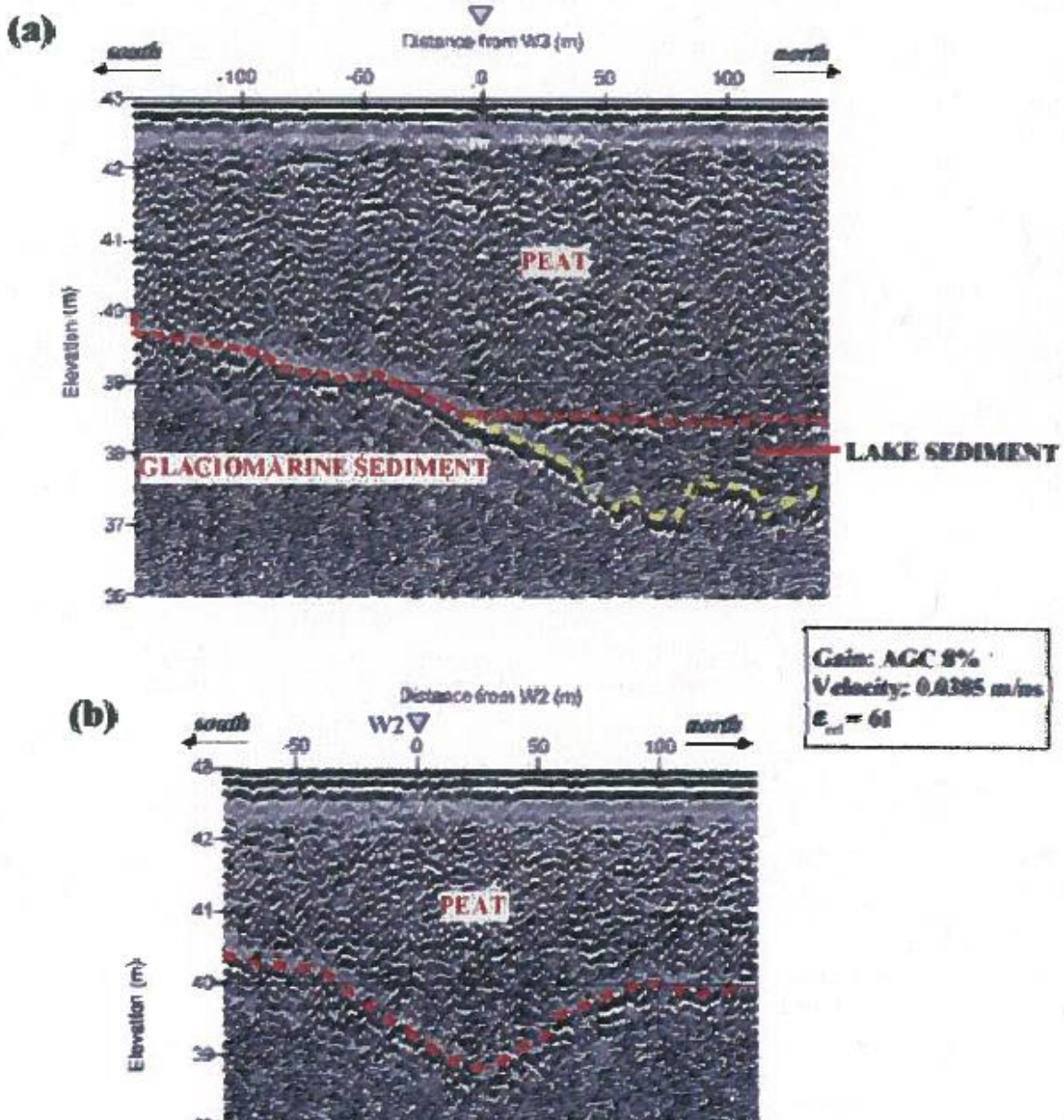
LAYERS IN PEAT BOG

RADAR IMAGERY- SOIL CONDITIONS

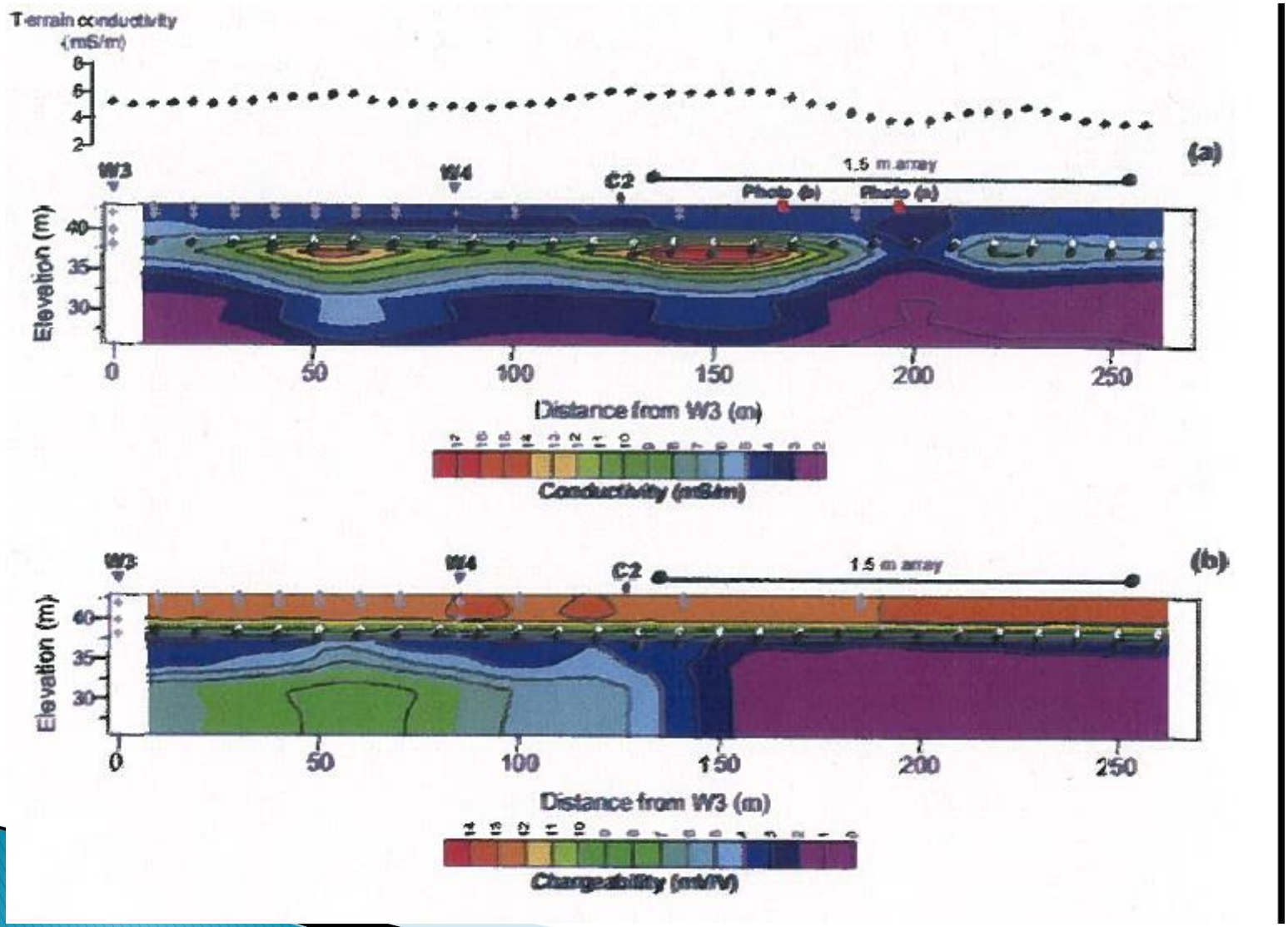
- Ground Penetrating Radar responds to:

- Soil density (bulk density)
- Soil moisture
- Soil layering

X-SECTION -BOG



RADAR IMAGE


Terrain conductivity
(mS/m)
8
6
4
2
(a)
W3
W4
C2
1.5 m array
Photo (b)
Photo (a)
Elevation (m)
40
35
30
0
50
100
150
200
250
Distance from W3 (m)
Conductivity (mS/m)
(b)
W3
W4
C2
1.5 m array
Elevation (m)
40
35
30
0
50
100
150
200
250
Distance from W3 (m)
Chargeability (mV/V)