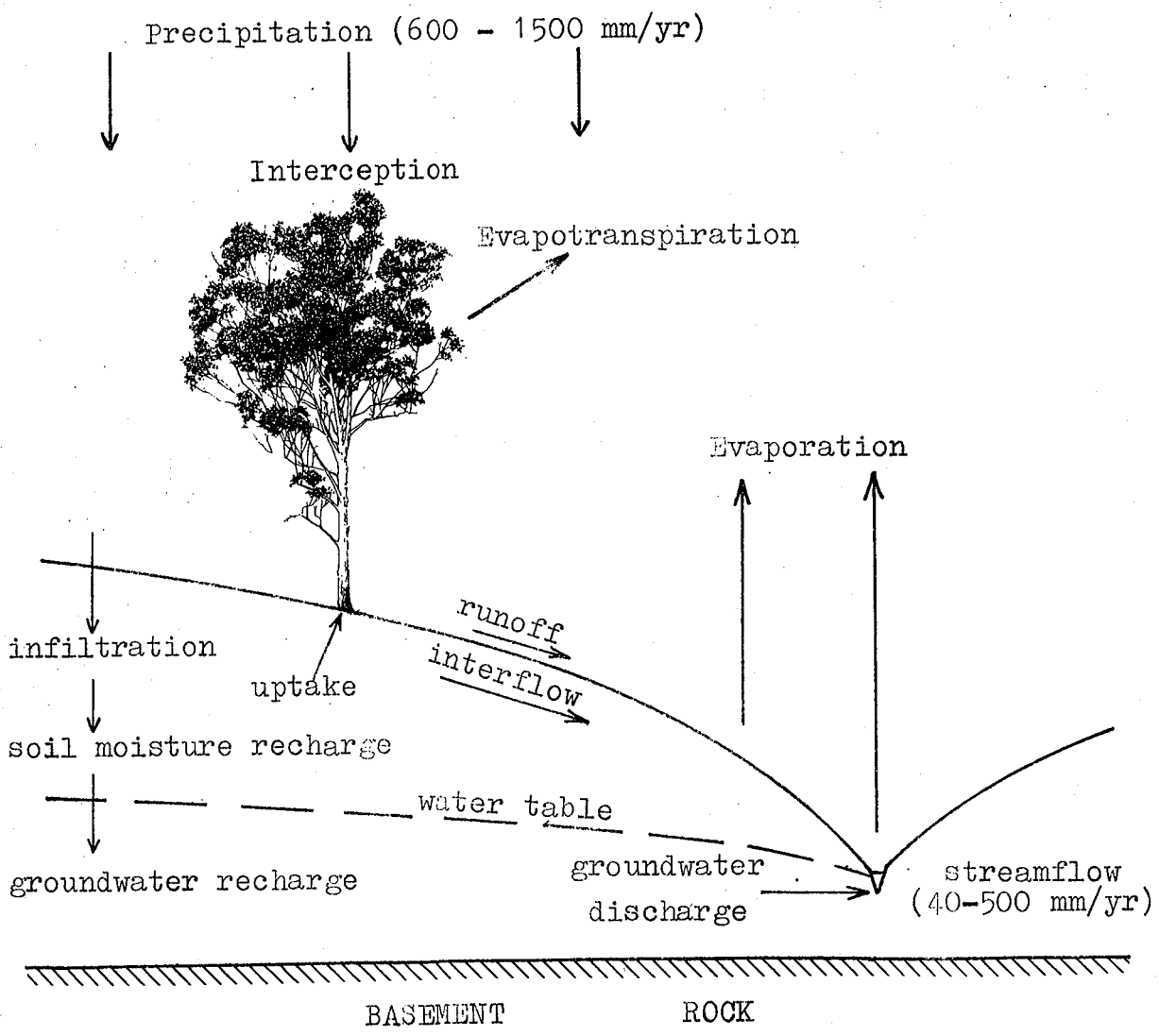
SALINITY - A NEW LOOK AT AN OLD PROBLEM

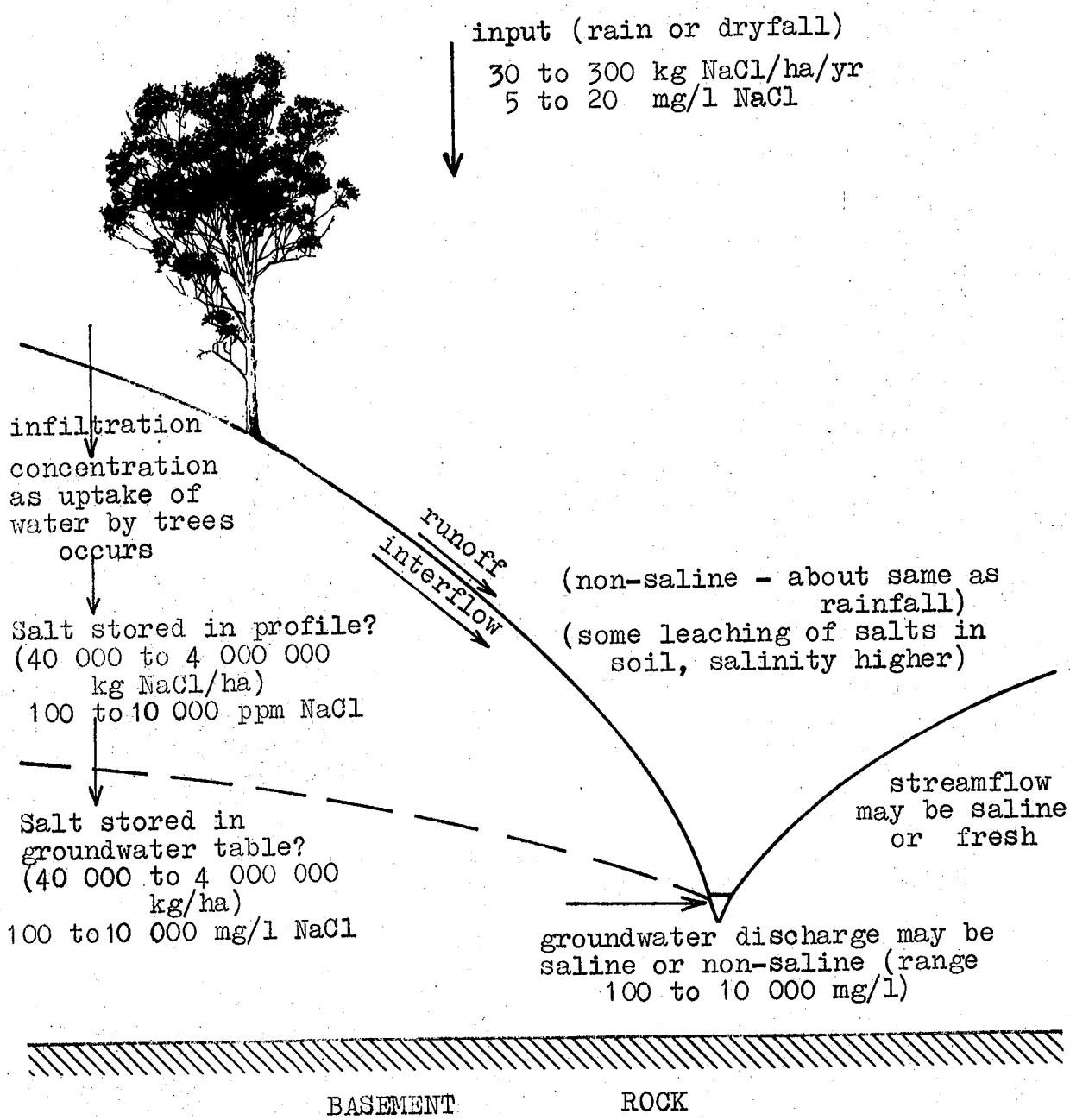
The Research Branch

During August 1974, many officers attended a lecture on the cause and effects of the salinity problem in Western Australia. These brief notes may be a useful resume of the talks.

Hydrological cycle



Salt cycle


input (rain or dryfall)
30 to 300 kg NaCl/ha/yr
5 to 20 mg/l NaCl
infiltration
concentration as uptake of water by trees occurs
Salt stored in profile?
(40 000 to 4 000 000 kg NaCl/ha)
100 to 10 000 ppm NaCl
runoff
interflow
(non-saline - about same as rainfall)
(some leaching of salts in soil, salinity higher)
streamflow may be saline or fresh
Salt stored in groundwater table?
(40 000 to 4 000 000 kg/ha)
100 to 10 000 mg/l NaCl
groundwater discharge may be saline or non-saline (range 100 to 10 000 mg/l)
BASEMENT ROCK

When an area is cleared or its existing vegetation reduced (by agriculture, mining, dieback, establishment of pine plantations or sawmilling operations etc.), then:

a. the evapotranspiration is reduced, at least for a time;

b. the runoff may increase;

c. the interflow may increase;

d. the groundwater recharge may increase and the water table may rise;

e. the groundwater discharge may increase;

f. seeps may appear.

If the groundwater is not saline and little salt is stored in the profile, then the additional yield of potable water may be beneficial. If however the groundwater table is highly saline and additional salt is stored in the profile, then the increased discharge of groundwater into the stream may have a detrimental effect.

Studies by CSIRO show that, in forested catchments, the output of salt nearly balances the inputs (ie. output/input is in the range 1.1 to 1.6). In catchments where 30% or more of the area has been cleared for agriculture, the output greatly exceeds input (output/input is in the range 3.1 to 21). In the latter case the salt store is slowly being reduced. The time to leach out these salts and achieve a balance has been estimated to range between 30 and 400 years.

Many of the major streams in the South-west are already brackish (Murray, Frankland and Blackwood); others (Collie, Warren) are in the marginal range.

Measurement

Salinity can be measured by titration, evaporation or electrical conductivity. It is expressed in milligrams/litre (mg/l) or parts per million (ppm). Total Dissolved Solids (TDS) and/or Sodium Chloride may be used as the standard. Arbitrarily selected ranges which are used to define potability are as follows:

< 500 mg/l	TDS	(fresh)
500-1000 mg/l	TDS	(marginal)
1000-3000 mg/l	TDS	(brackish)
> 3000 mg/l	TDS	(saline)

Research

Several agencies are involved in the study of salinity. Some of the projects being carried out are listed below.

Forests Department

1. Sampling of streams to estimate base flow and groundwater salinity (Dwellingup, Mundaring, Busselton and Manjimup).

2. Study of the effects of catchment management on water yield and quality (Yarragil).

3. Paired catchment study (effects of pine establishment on salinity, Mundaring).

4. Mathematical analysis of input/output for the Helena catchment. Relating dam salinity to changes in vegetation and rainfall.

5. Root studies of various species on different sites.

6. Detailed studies of soil, groundwater and stream salinity at Del Park and Jarrahdale. (Increases in elevation of groundwater table after mining have exceeded 7m to date).

7. Modelling approach using Peck's model.

8. Revegetation of mined sites.

C.S.I.R.O.

1. Paired catchment studies at Yallanbie and Collie.

2. Catchment study in an area to be mined (Del Park).

3. Use of deep bores to assess groundwater salinity and salts stored in the profile.

4. Transpiration studies using various species.

P.W.D.

1. Salinity sampling - Murray catchment.

2. Stream gauging and stream salinity records.

3. Detailed study of Collie catchment.

Department of Agriculture

1. Salinity sampling (Collie and Manjimup).

2. Detailed study of Collie catchment.

3. Analysis of production losses due to salinity in irrigation districts.

4. Salinity "Role Play" game.

Solution

There are several ways of dealing with the salinity problem and we leave it to the reader to decide the likely political, economic or technical limitations of the various alternatives, which include -

1. A ban on further alienation in salt-prone catchments.

2. A ban on further clearing of private land on salt-prone catchments.

3. Repurchase of uncleared, private-owned land.

4. Repurchase of cleared farmland and replanting of same with a tree cover.

5. Encouragement of changes to agricultural practices:

   a. mixed grazing - forestry;

   b. tree paddocks in strips to transpire excess groundwater;

   c. wide buffers of salt-tolerant trees along streams;

   d. changes in agricultural practices to increase water use (different species, varieties, cultural and fertiliser practices).

6. Building more dams to trap only non-saline streams.

7. "Shandying" brackish supplies with fresh supplies.

8. Building pipehead dams in the eastern parts of catchments and directing saline flows around the main dam.

9. Desalination.

10. Stricter control on operations such as sawmilling, bauxite mining, roads and S.E.C. lines.

11. Replanting of dieback-affected areas with tolerant species.

12. Forest hygiene and quarantine.