Thinking About Biodiversity Assets in Planning

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Outline

- Precursors to Management of Hydrological Issues
- Decision Processes
- Altered Hydrology
- Conceptual Models
- Tolerances and Thresholds
- Threat Analysis & Decisions Processes
  - Some examples of methods being used in the NDRC's
- Data Management Issues
- Why?

Precursor to Management

- Broadly Define Assets
  - Biodiversity
  - Resource and ecosystem services
- A Broadly Defined Threat,
  - Altered hydrology, landuse, climate change, lack of sociopolitical will, pest invasion, etc
  - all of the above!!
- Define Aspirational Goal
  - Resource Condition Targets (RCT's)

Threat Management Flow Diagram

Planning

Overarching Aspirational Goal

Catchment or Asset Specific Aspirational Goal

Define Assets (biodiversity) and/or RCT's

Feasibility

Feasibility Analysis: include evaluation of;

- Biophysical threats, tolerances and thresholds
- Understanding and technical capacity to manage
- Socio-political will/support

Goals revised due to constraints, feasibility, financial, logistic etc

Develop Recovery Plan

Goals Unachievable

Implementation

Implement Management Actions

Monitor and Evaluate

Goal Achieved

Asset Loss/Goal Failure Could Occur Due to Changes in

A - Quantity
Surface water - Hydrology

B - Quantity
Groundwater - Hydrogeology

C - Quality Waterborne
Surface or Groundwater

Increased salinity due to evaporation

Changes in hydroperiod, extent, location, bathymetry, flood extent, duration and existence of lakes & wetlands.

Waterlogging

Increased flows from seepages and shallow subsurface flows

More surface water in the landscape

Increased discharge

Increased GW levels

Increased erosion of soils, drainages lines, streams etc.

Increased soil Moisture

Increased GW recharge

Increased flows

Changes in Water Balance Due to Replacement of Native Perennials With Annual Cereals.

Salinity changes

Nutrient load changes

Increased sedimentation

Spread of weeds

Pesticides and other pollutants

Changes in acidity and alkalinity

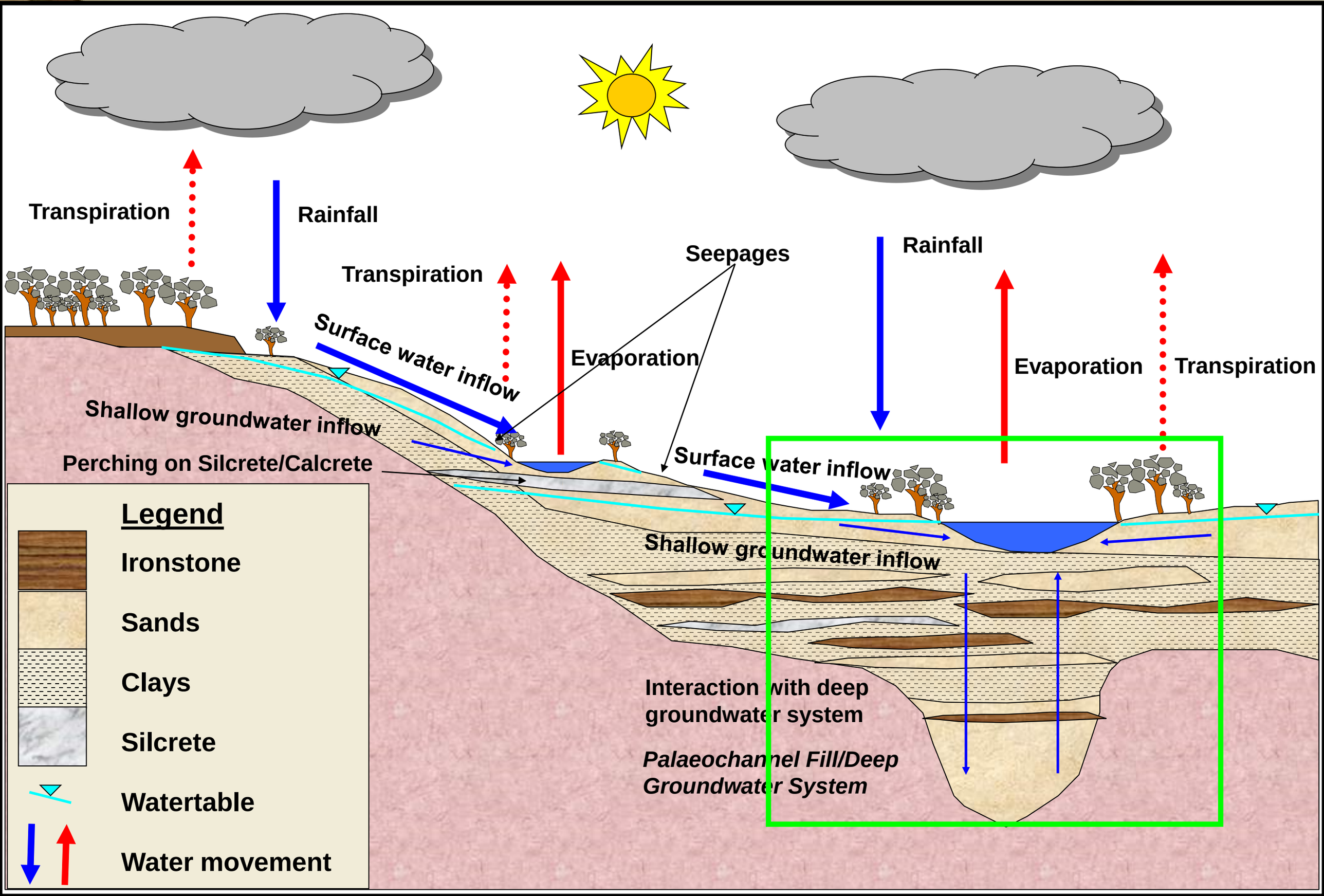
Landuse Change and Drainage Impacts

Legend

- **Focus-Knowledge**
- **Focus-Remediation**
- **Quantity-Quality Linkage**

Altered Hydrology Threat Flow Chart

Catchment Scale Conceptual Model



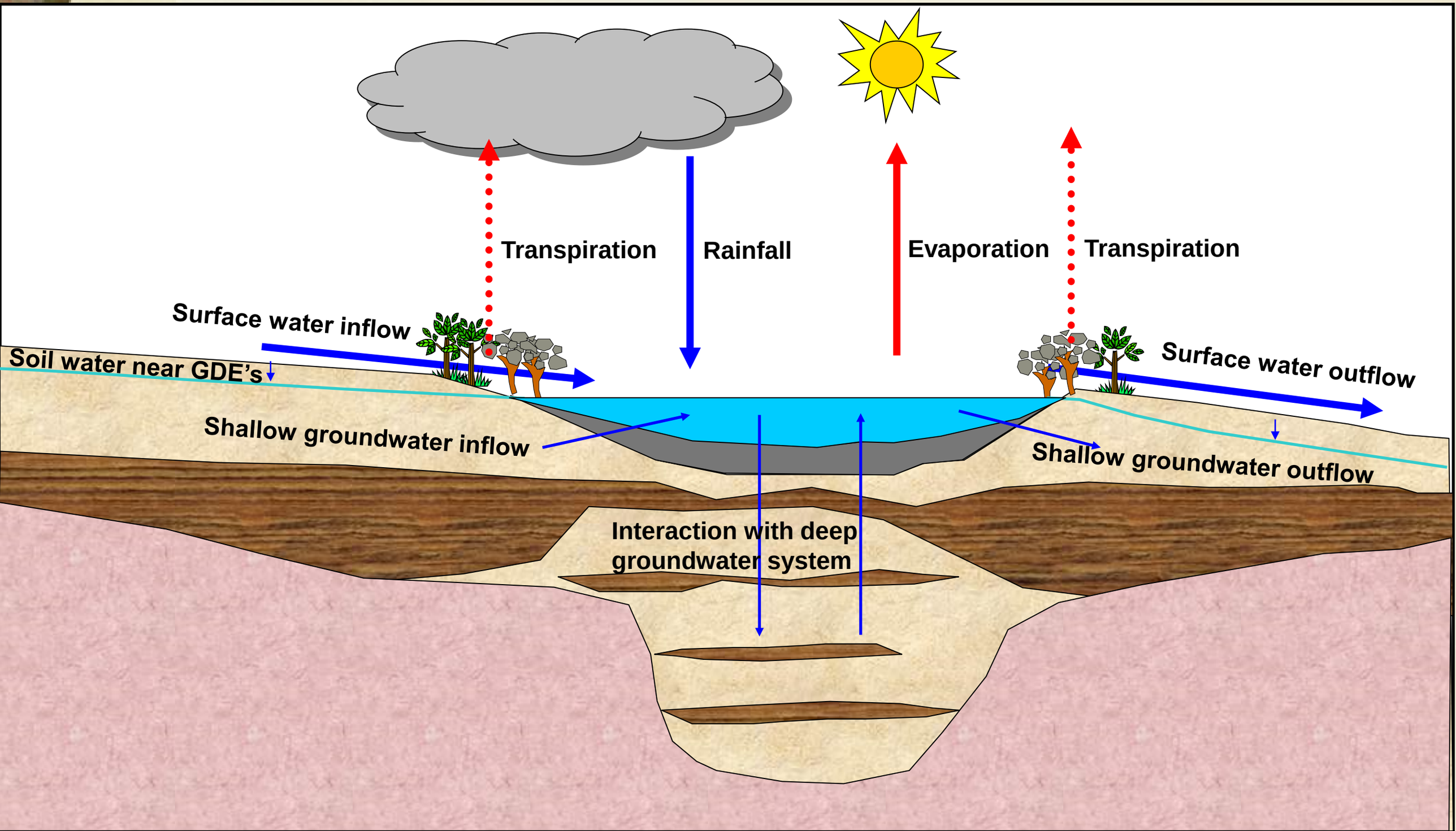
For all of the pathways shown below we need to understand;

A – the movement of water.

B – the movement of salt with that water.

C – the movement and interaction of other water constituents (N, P, SO_4, Cl acidity/alkalinity, “pollutants” etc).

D – tolerances of biota and combine it all to asses the threat



Tolerances and Thresholds, Requirements … Research!

There are gaps in our understanding of how WA biota and ecological regimes have/may shift because of our impacts. Some excellent info is out there but we urgently need a more detailed understanding of;

- Biota tolerances to water level and soil moisture changes
- Biota tolerances to chemicals and compounds: salt, pH, metals, nutrients, metals and metaloids etc
- Variations exist across age categories and within a species
- Thresholds (absolute and rate of change) for of ecological regimes to shift without causing catastrophic consequences (i.e. monocultures etc)
- Feedback mechanisms between altered hydrology and chemistry, acid sulphate soils, eutrophication, erosion, sedimentation etc.
- We also need site specific information about palaeoecology and palaeohydrology
  - How has the environment changes prior to our influence? Rate and absolute levels of change

Limitations - Tolerances and Thresholds for the Biosphere … how much is too much!

- We are starting to gather the sort of information required;
  - Resilience.org, ecological regime shifts
  - ECOtox (USA) tolerances
  - Salt Sensitivity Database (MDB) tolerances
  - CSIRO – Healthy Country Database (MDB) tolerances
  - WA specific data - Biological Survey Data, journal papers are the main source. Some of the most published authors;
    - Stuart Halse
    - Mike Lyons
    - Ray Froend
    - Libby Matiske
    - Andrew Storey
    - Neil Gibson
    - Patrick Smith
    - Jenny Davies
    - Barbara Cook

Tolerances and Thresholds – Biota and Regimes.

HOME > Resources > Thresholds Database > Database

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About *RA*

The RA is a multidisciplinary research group that explores the dynamics of complex adaptive systems. read more

bibliography database

thresholds database

E&S

Database

Thresholds and Alternate States in Ecological and Social-Ecological Systems

A Resilience Alliance / Santa Fe Institute database

Would you like to:

- Add an example to the database.
- View a Glossary of terms; (useful when adding an example to the database).
- Search the database: Search...
- Download entire database (will take several seconds)

1 to 25 of 97 items << < Page 1 of 4 > >>

Threshold Examples

Conservation status

Uses (incl. ethnobotanical)

Summary

Salt Sensitivity Database (MDB)

Microsoft Excel - SaltSensitivityDatabase

File Edit View Insert Format Tools Data Window Help Type a question for help

Geneva 12

F1275 Triglochin procera

	F	G	H	I	J	L
1275	*Triglochin procera*	Water Ribbons	Timing of exposure to NaCl (0 or 40 da		l	
1276	*Vallisneria americana*	Ribbonweed	6660 biomass reduced, 13320 mortality		l	
1277	*Vallisneria americana*	Ribbonweed	12000 had no effect on biomass		l	
1279	*Myoporum acuminatum*		360-700	700	f	Wetland floodplains,
1280	*Eucalyptus camaldulensis*	Rver Red Gum	27200 (groundwater)	27200	f	Murray River, VIC
1281	*Eucalyptus camaldulensis*	Rver Red Gum	360-2200	2200	f	Wetland floodplains,
1282	*Eucalyptus camaldulensis*	Rver Red Gum	12240	12240	f	Kuwait (field trials)
1283	*Eucalyptus cladocalyx*	Sugar Gum	5780	5780	f	Kuwait (field trials)
1284	*Eucalyptus largiflorens*	Black Box	groundwater up to 2,7200	27,200	f	Chowilla floodplain, Mu
1285	*Eucalyptus largiflorens*	Black Box	230-2500	2500	f	Wetland floodplains,
1286	*Eucalyptus largiflorens*	Black Box	5780	5780	f	Kuwait (field trials)
1287	*Eucalyptus sargentii*		12240	12,240	f	Kuwait (field trials)
1288	*Eucalyptus spathulata*	Red Ironbark	12240	12240	f	Kuwait (field trials)
1289	*Eucalyptus tereticornis*	Forest Red Gum	1360	1360	f	Kuwait (field trials)
1290	*Melaleuca ericifolia*	Swamp Paperbark	fresh-(25000-30000)	30000	f	Gippsland Lakes, VIC
1291	*Allocasuarina littoralis*	Black Sheoak	Germination at 2922 = 77% cf controls,		l	
1292	*Allocasuarina littoralis*	Black Sheoak	0-20457 survived 3 weeks		l	
1293	*Allocasuarina verticillata*	Drooping Sheoak	4384 21% shoot growth reduced, 8767		l	
1294	*Allocasuarina verticillata*	Drooping Sheoak	Germination at 1169= 59% cf controls,		l	
1295	*Allocasuarina verticillata*	Drooping Sheoak	0-20457 survived 3 weeks		l	
1296	*Casuarina cunninghamiana*		4384 21% reduction in shoot dry wt, 876		l	
1297	*Casuarina cunninghamiana*		Germination at 1169 = 91% cf controls,		l	

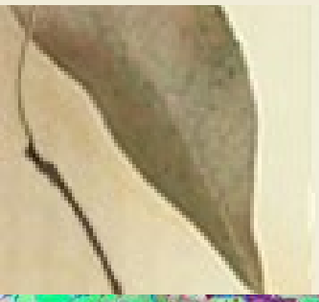
Total Raw Salt DATABASE | Higher Flora | Lower Flora | Sheet5 | Fauna | chart

Filter Mode NUM

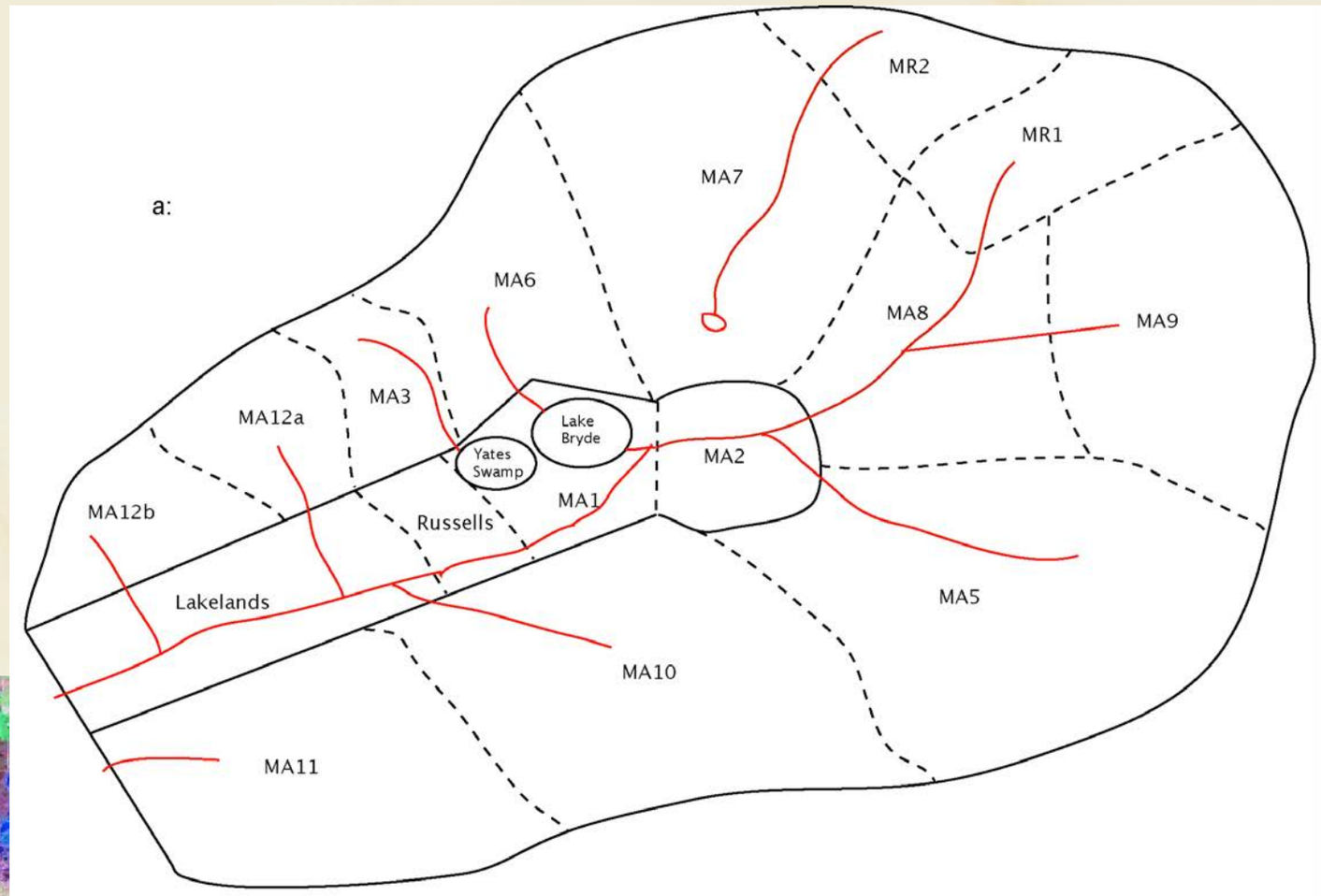
Two Common Methods for Threat Analysis/Risk Assessment.

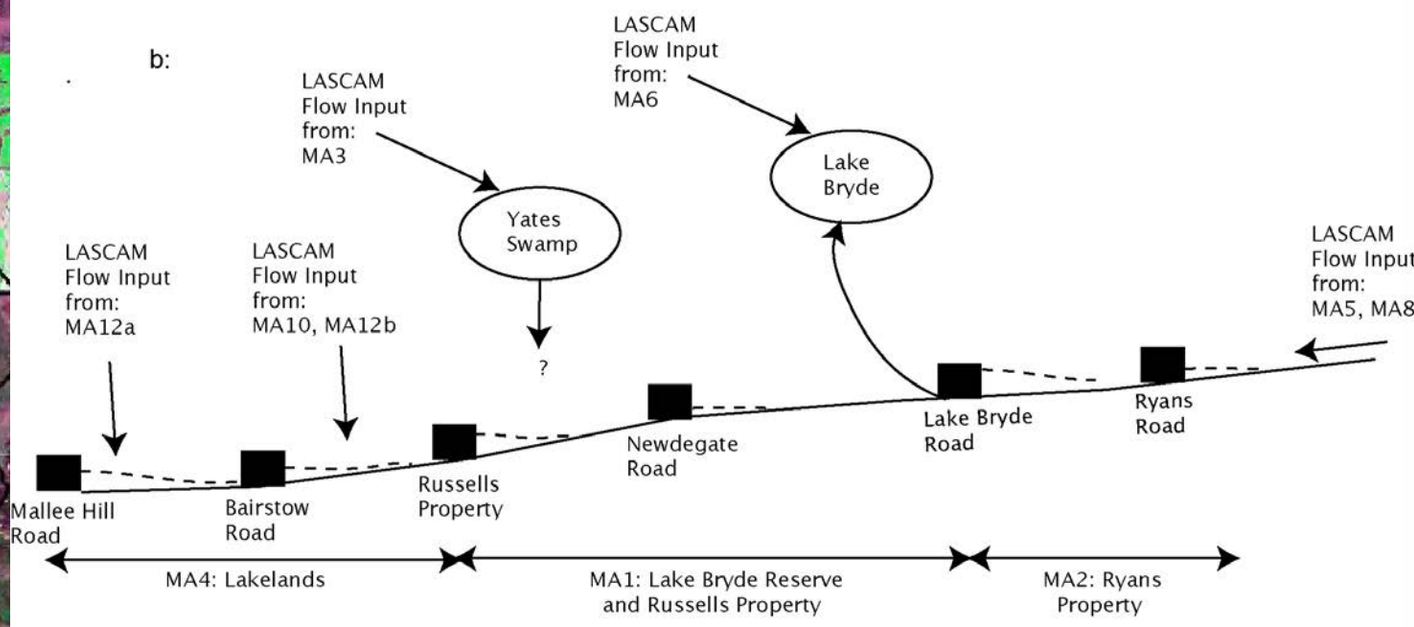
- **Physically based deterministic method.** Measure and model using biota tolerances and thresholds
  - Pros: If successful open and transparent
  - Cons: Very expensive, time consuming and the outcome may be that more information or assessment is required
    - Required for high value projects or ecosystems
- **Probabilistic, semi quantitative method.** Bayesian Belief Networks (BBN) and fault trees utilising expert opinion and intuition
  - Pros: Very cheap and quick
  - Cons: Only as good as experts understanding, can be risky if things go bad
    - Good for feasibility assessment or small projects

Example – Lake Bryde Physically Based, Deterministic. LASCAM-DYRIM

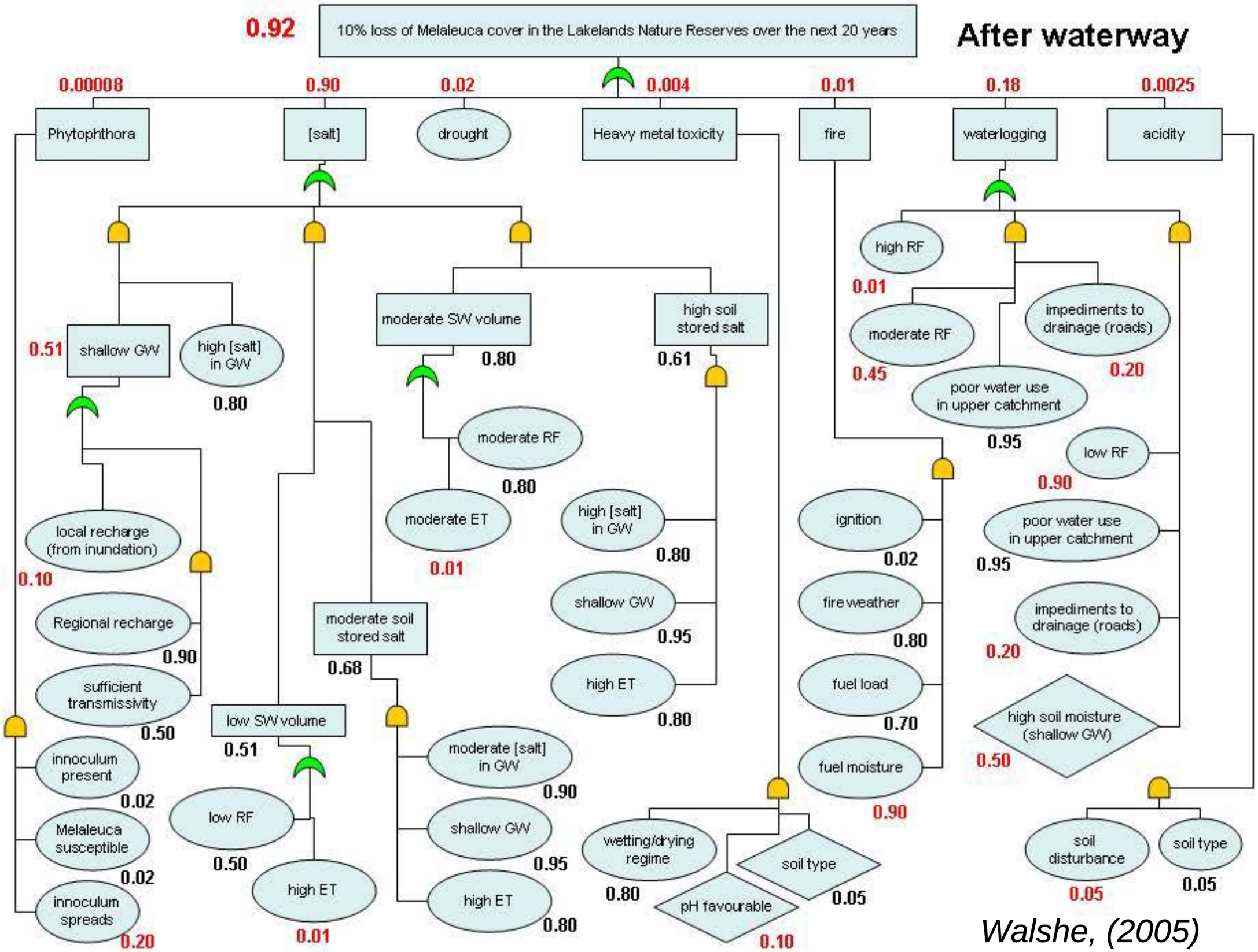


Hipsey, (2006)



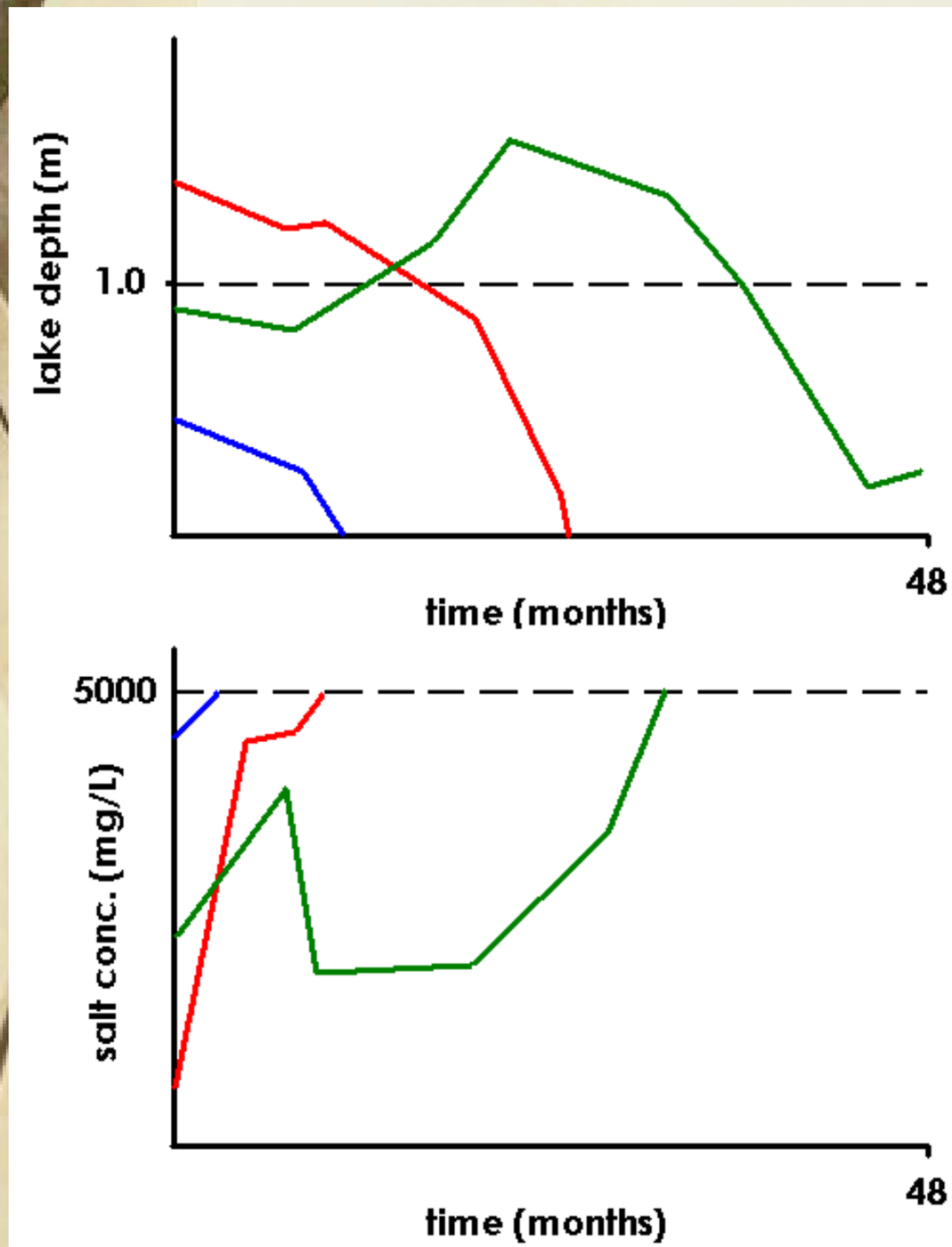


Lake Bryde – Probabilistic BBN



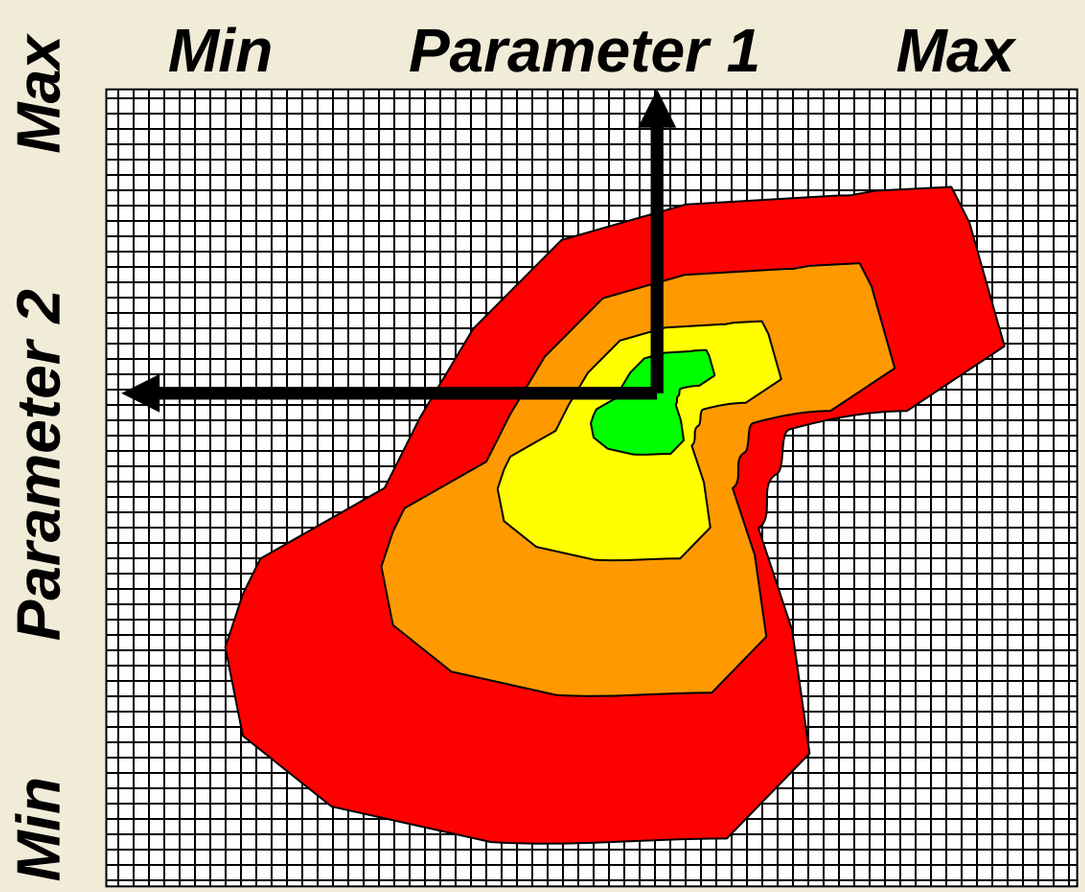
Walshe, (2005)

Complex – Lake Toolibin



- Water balance well understood and modelled
- Resource Condition Targets well defined, excellent infrastructure
- Conflicting goals and model parameter uncertainty
- Define water balance model sensitivity and range of outputs with a Monte Carlo Simulation, typically an automated process
- Results can be used to improve calibration or optimize a management objective

Graph of model "accuracy"



Data Management – Data Types

1. Point Data – *E.g. Bore or surface water gauge reading or analysis results*
2. High Resolution Time Series Data – *E.g. Logger Data*
3. GIS Data – *E.g. Maps, surfaces, geophysics*
4. Models
5. Reports and other documents

✓ What do we do to once collected? do we do with it all? Qa/Qc, security, backups, archiving and auditing

Qa/Qc

- The second most important step in data collection after actually collecting it!
- Essential that you look at the data and see if it makes sense ASAP after you have collected it
- Memories can fade quickly of pertinent field information that could explain a data anomaly, help untie it and make the data useful
- Lindsay Bourke's report is an excellent version of the level of detail expected from this type of Qa/Qc for time series data

Security, Backups, Archiving and Auditing.

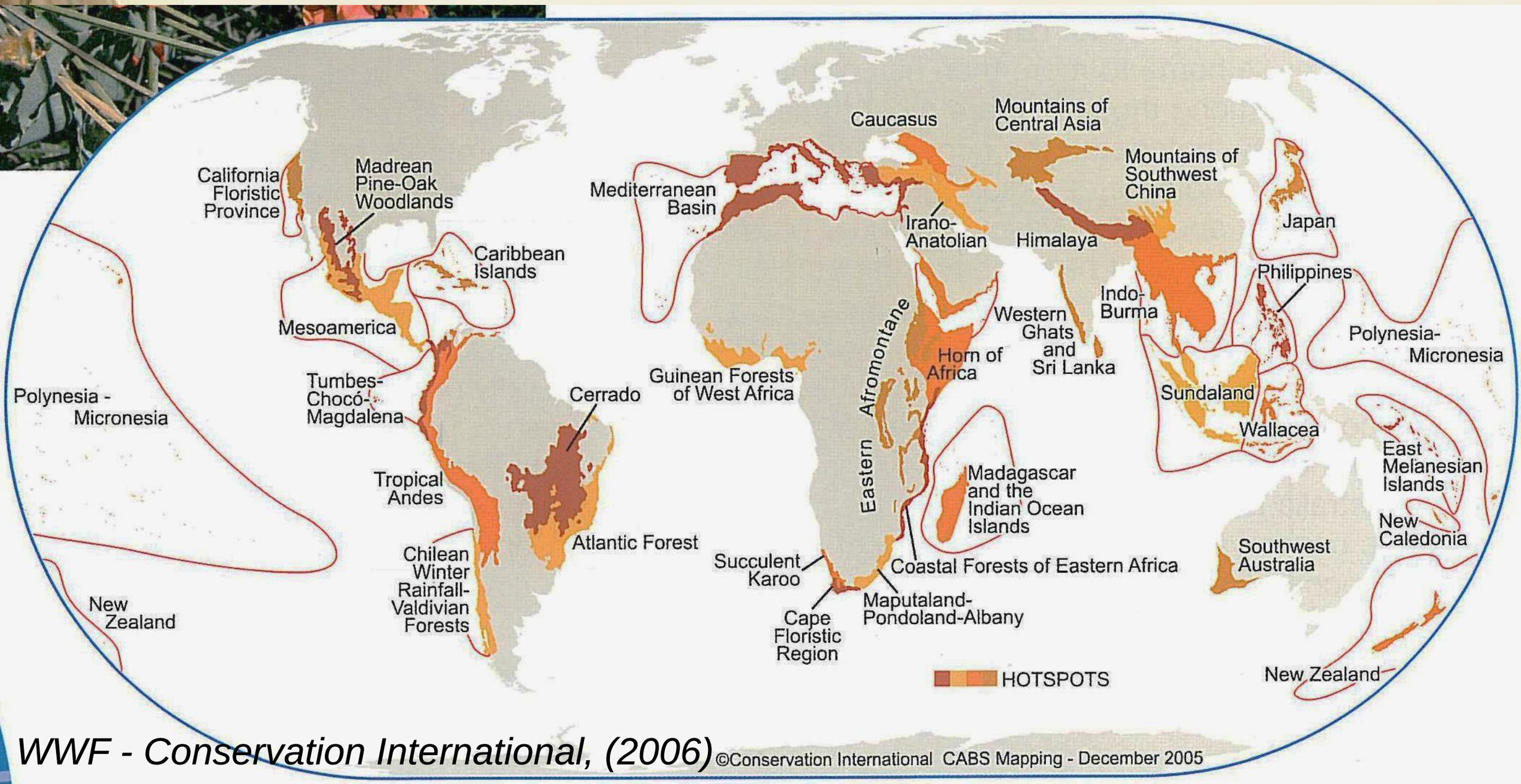
- We need to be careful with the data collected as losing it is hard to overcome.
- Backups/archiving are essential!
- Auditing is something we need to mindful of and all data, reports, models and scenarios that have been used in any way for a decision must be archived for at least 7 and maybe as long as 20 years! Particularly if legally or financially significant decisions have been made based on the results!!

Summary

- Decision process flow diagrams
- Altered hydrology is not just salinity
- Conceptual models
- Tolerances and Thresholds
- Some tools that exist
- Data management
- Why?

Southwest Australia Ecoregion

The Southwest Australia Ecoregion has just been internationally recognised as one of the worlds 34 biodiversity hotspots, the only one in Australia. So in terms of threatened, potentially lucrative genetic resources, South-western Australia is more important than the Great Barrier Reef or Kakadu National Park!



WWF - Conservation International, (2006)

Biodiversity Asset - Unhealthy

Biodiversity Assets - Healthy