Science behind environmental flows for the River Murray System

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COOPERATIVE RESEARCH CENTRE FOR
FRESHWATER ECOLOGY

Talk Overview

- Summary of Scientific process
- Threats to health of River Murray
- Snapshot of River Condition
- Key findings from Stage 1 study
- Stage 2 study - ecological benefits assessment process
- Murray Flow Assessment Tool

Key steps in Murray scientific process

February 2000 – First integrated scientific assessment of threats to River Murray health (Thoms et al 2001)

2001 – *Rivers as ecological systems:Murray-Darling Basin,* book by CSIRO

March 2001 – Ministerial Council decision to undertake preliminary e-flows assessment

April 2002 – Scientific Panel Mk.1 report informs decision on stage 2 analyses. Three reference points – 350, 750, 1500 GL - agreed for further analysis

November 2002 – Scientific Panel Mk. 2 working with regional scientific groups commences detailed ecological benefits analysis

August 2003 – Final ecological assessment report to be submitted to MDBC and Ministerial Council

Comparison of Stages 1 & 2

Stage 1 – 2002 Ministerial Council asked

"Flow required to deliver a healthy working River Murray according to community-based objectives"

Stage 2 – 2003 Ministerial Council asked

"Ecological benefits that could be provided by 350, 750, 1500 GL plus structural & operational improvements, compared with current (do nothing more) and 93/94 conditions"

Ministerial Council for Stage 2

Special focus on icon wetlands

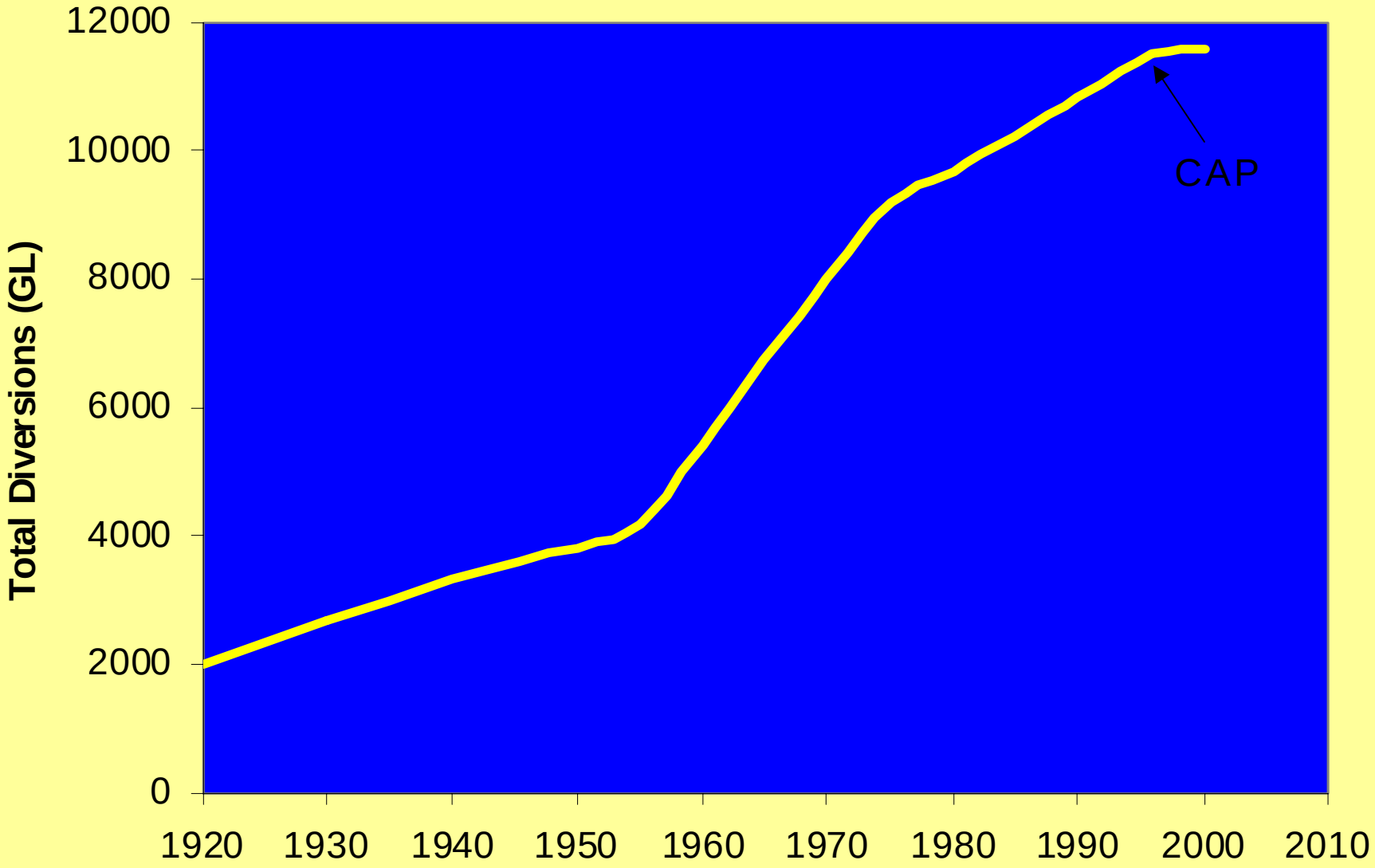
Barmah-Millewa, Gunbower, Koondrook-Pericoota, Hattah Lakes, Chowilla, Coorong

…and icon species

Murray Cod, River Red Gums

Impacts of flow regime changes on River Murray ecological condition

History of Water Use in MDB



Unseasonal flooding

Constant elevated flows

Severe bank erosion caused by constant high flows

Barmah Choke

Stable water levels

Encourages exotic species

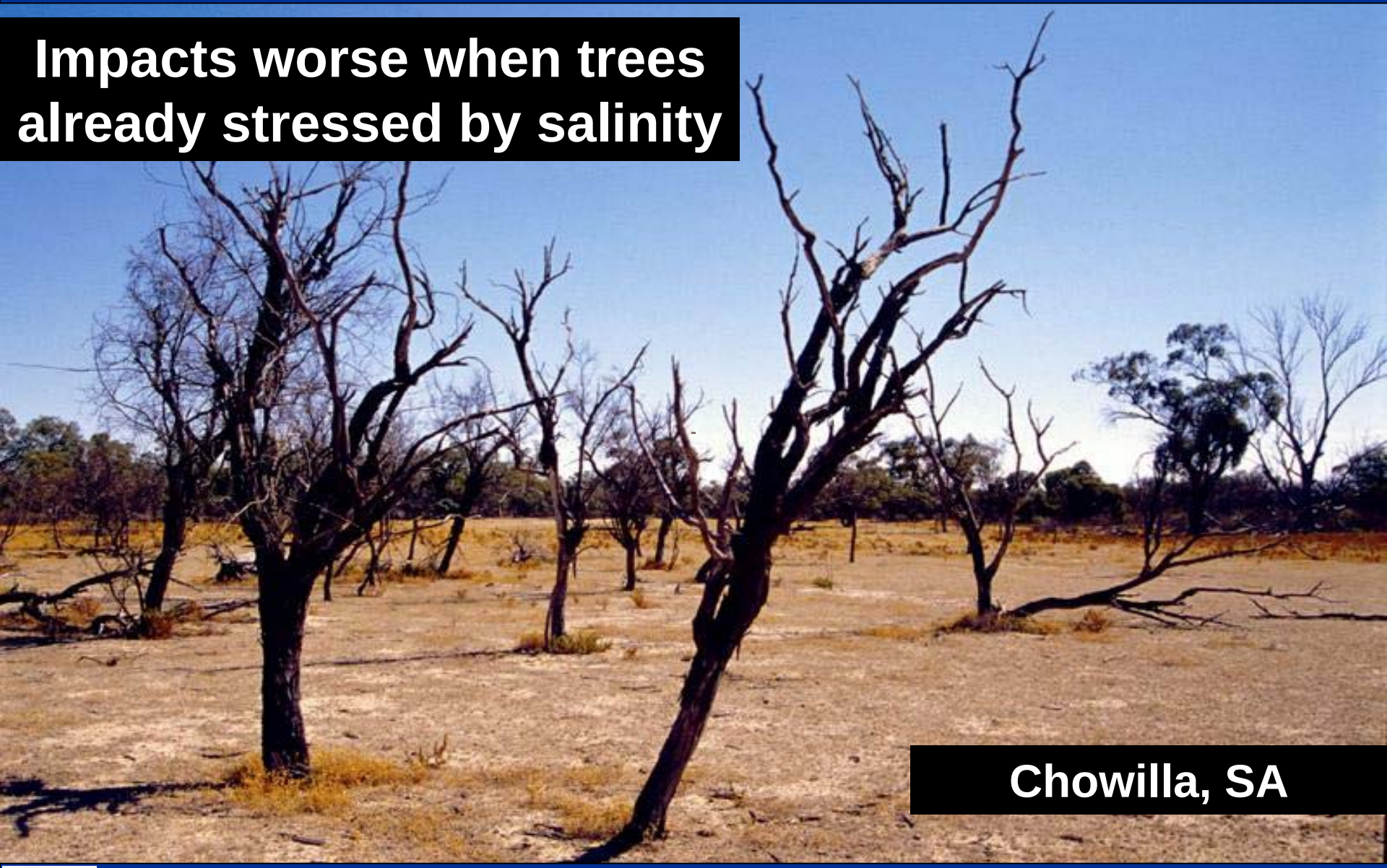
Rigid operation of barrages & weirs

Barriers to fish passage

Lack of floodplain inundation

Poor health and death of Red Gum and Black Box forests

Lack of floodplain inundation ….



Reduced flow volume

Reduced flow volume …

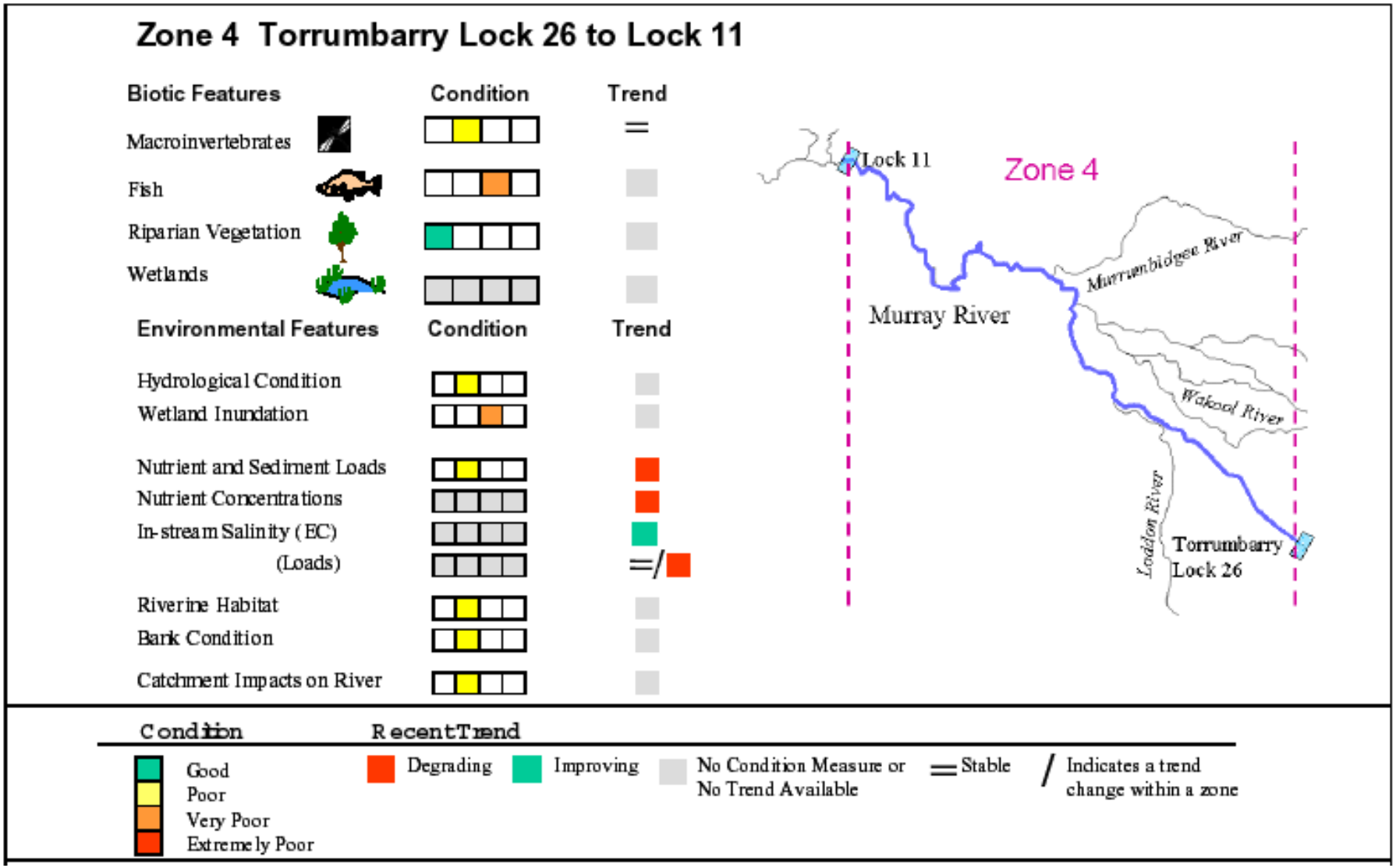
Impacts of non-flow changes on River Murray ecological condition

Land management practices

Salinity – threat for wetlands

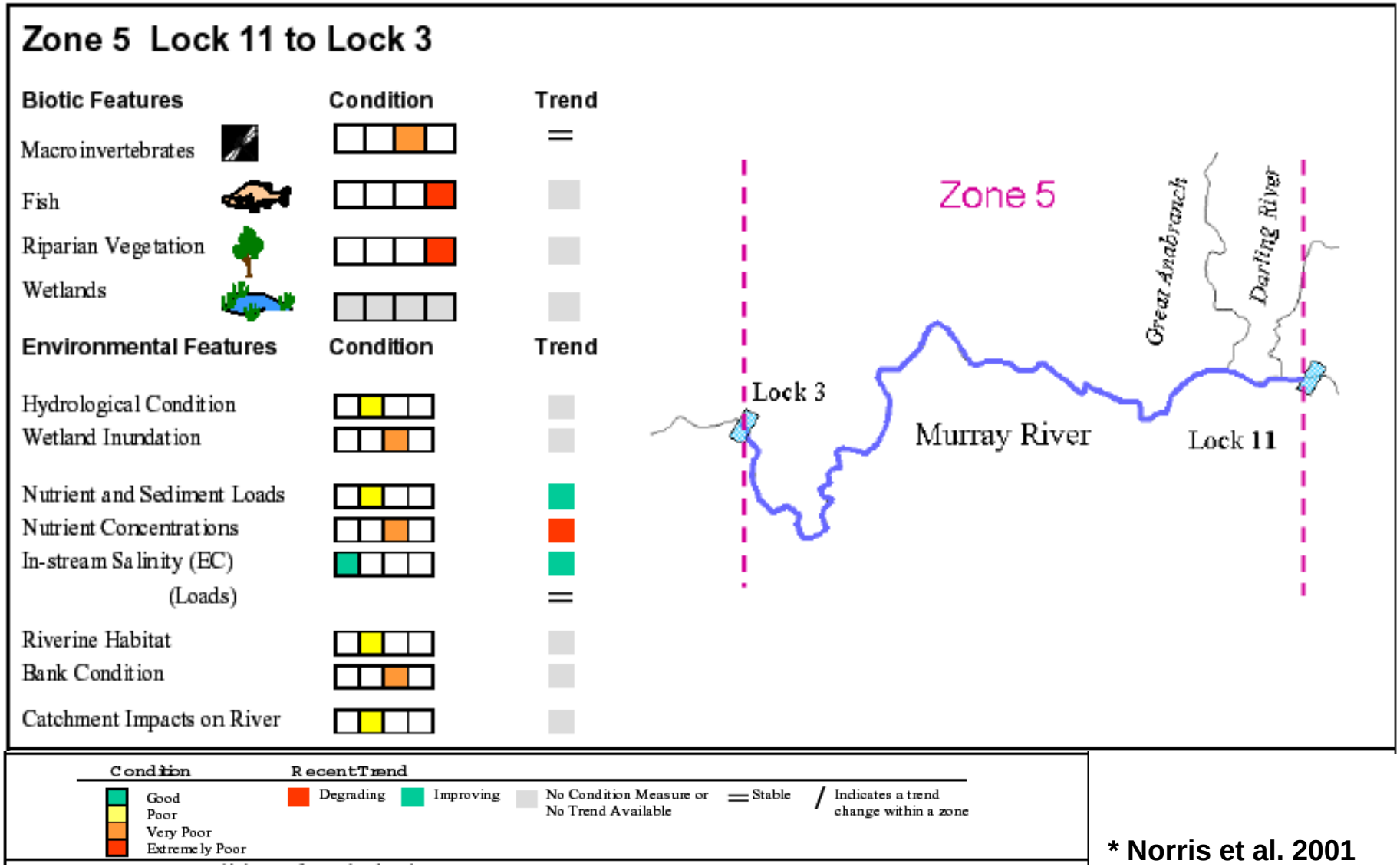
Pest species such as Carp

Snapshot of River Murray Condition*



* Norris et al. 2001

Snapshot of River Murray Condition*



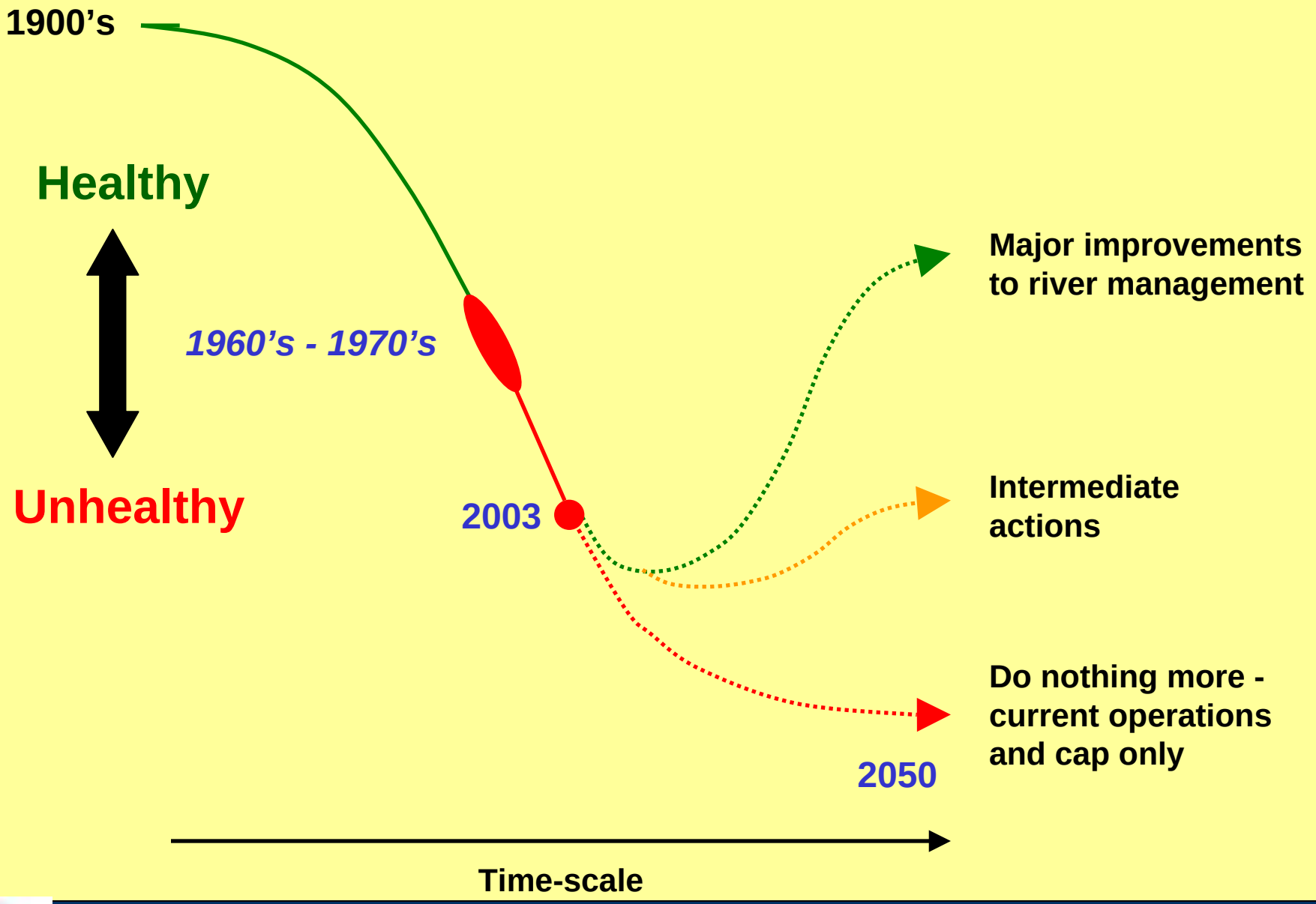
* Norris et al. 2001

CSIRO Stakeholder Survey*

- 93% of survey group (n=320) believe River Murray has serious health problems
- 95% support e-flow allocation
- support drops to <70% if some people's livelihoods badly affected
- and further to <40% if local people not involved in decision making

* Syme et al. 2001

History of River Murray Health



How much e-flow is needed to ensure a healthy working River Murray?

Stage 1 Scientific Panel – April 2002

Aim: Healthy Working River Murray system:

> Two-thirds natural flow	High likelihood
> Half natural flow	Moderate likelihood
< Half natural flow	Low likelihood

Stage 1: Range-finding process

- Based on non-optimised flow operations and modelling
- Whole of River focus, and on overall ecological condition
- Indications of likelihood or risk
- Qualitative approach based largely on expert opinion
- Non-flow benefits not directly considered, though noted as constraints

* All these issues addressed in Stage 2

Stage 2 - Scientific Panel 2003

- Regional and 'whole of system' benefits
- Specific biota & groups: Fish, Birds, Floodplain & Wetland Vegetation, Toxic Algae
- Includes Murrumbidgee & Goulburn (to be confirmed)
- Smarter flow operations & modelling
- Quantitative indices of ecological condition

Stage 2: Ecological benefits analysis

Assessing benefits from operational & structural improvements & volumes:

- **Operational improvements to flow regime**
- **New structures to improve connectivity & better manage flow regime**
- **Physical habitat improvements (eg. re-snagging, cold water)**
- **Possible increased flow volumes**

Fish passages

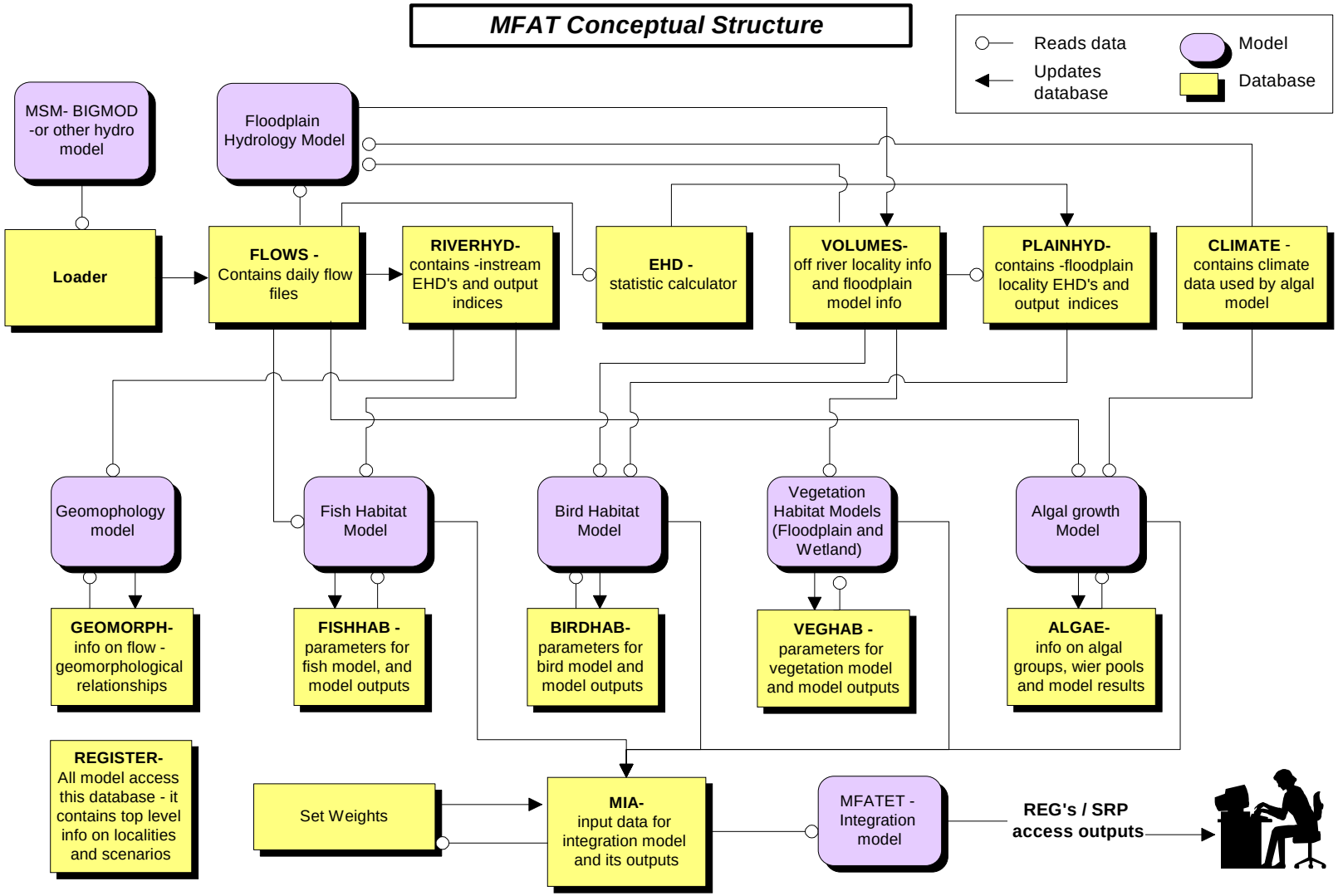
Floodplain regulators

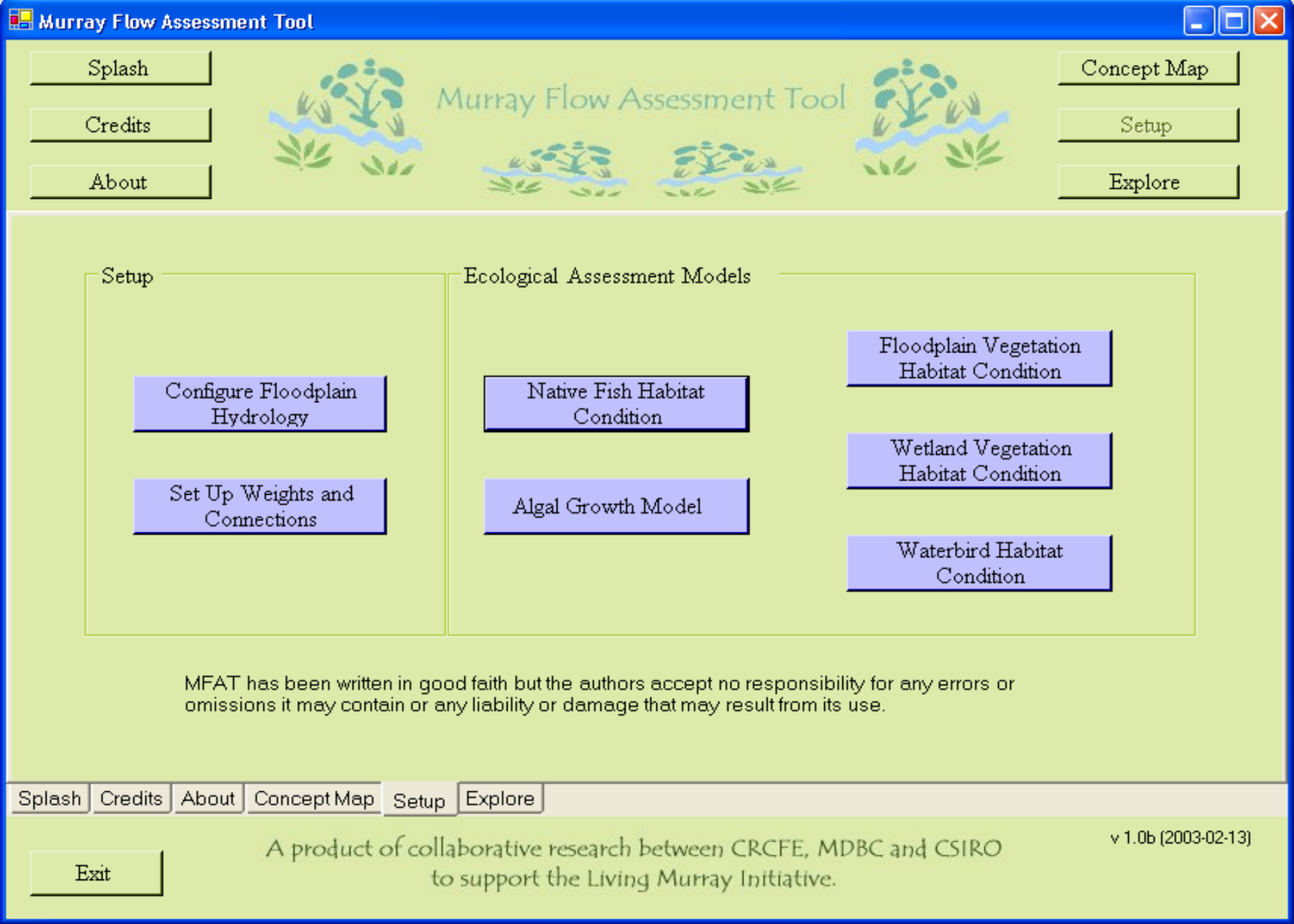
Minimise unnatural flooding

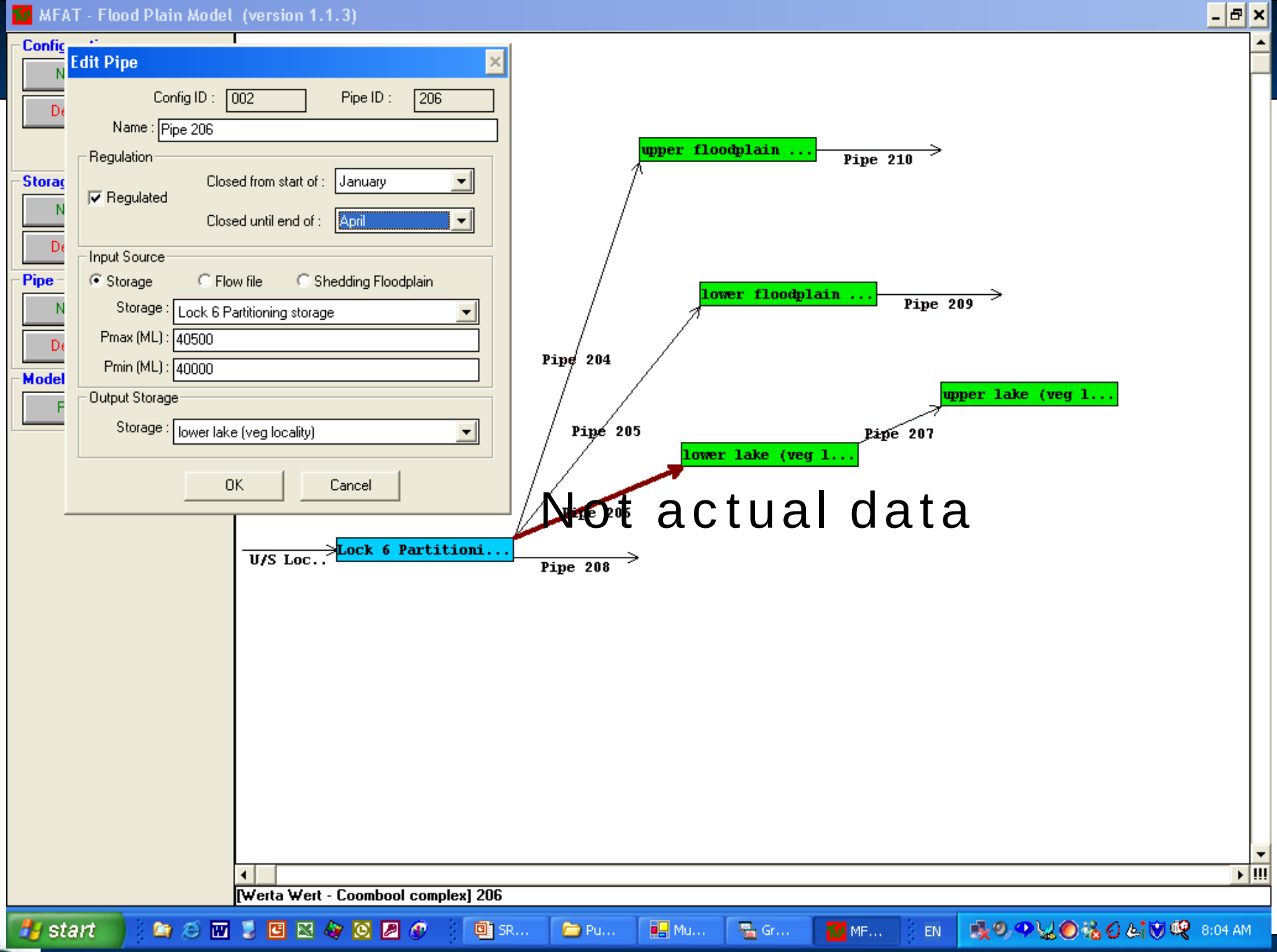
Re-snagging

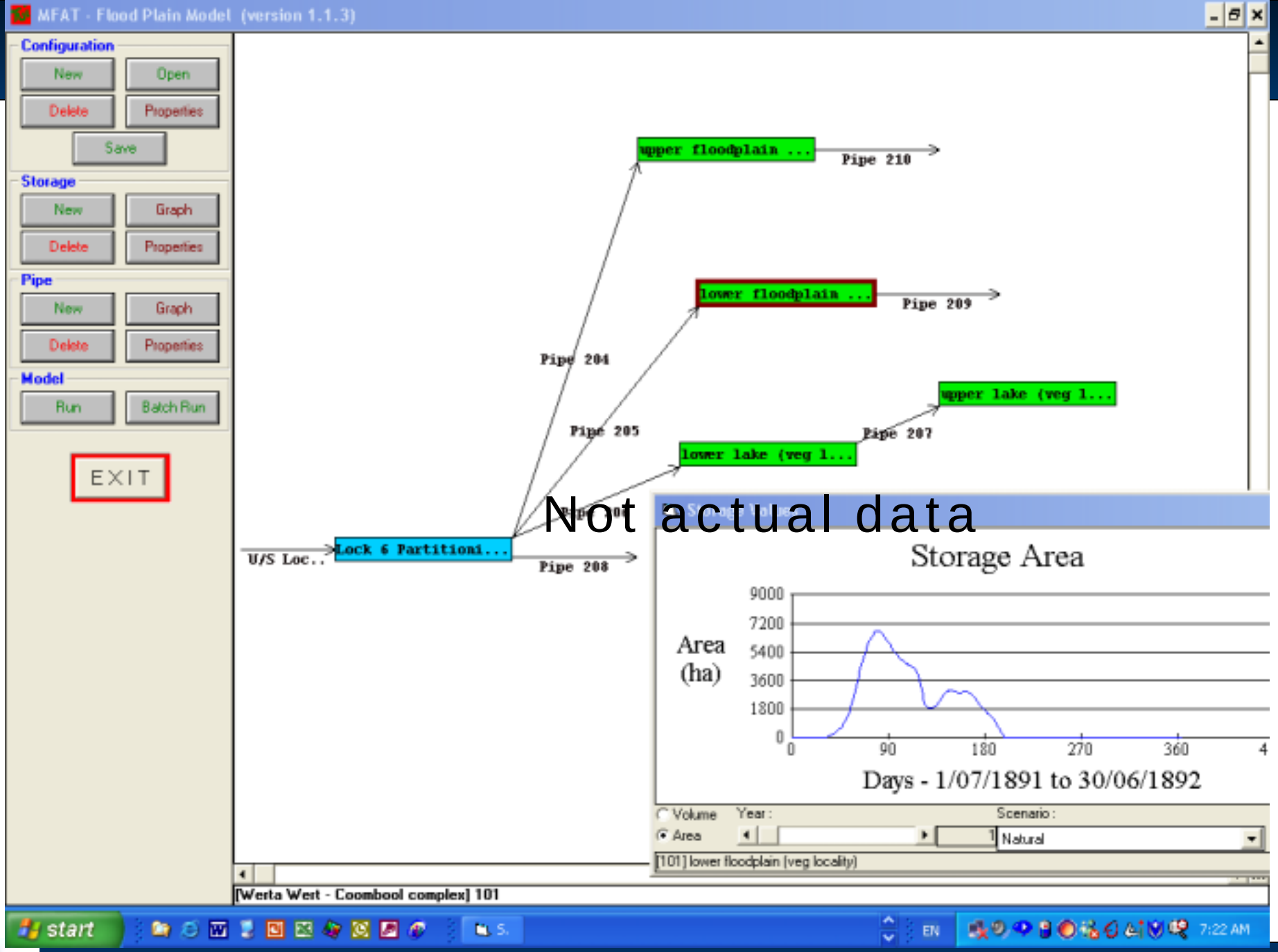
MFAT Decision Support System

- Links modelled flow data to ecological conceptual models to assess benefits
- Produces annual ecological condition indices
- Indices can be aggregated by spatial or ecological scale
- Optional weightings of components according to significance and certainty
- Captures all evidence and confidence levels
- Transparent - allows all scientific evidence to be viewed in one location

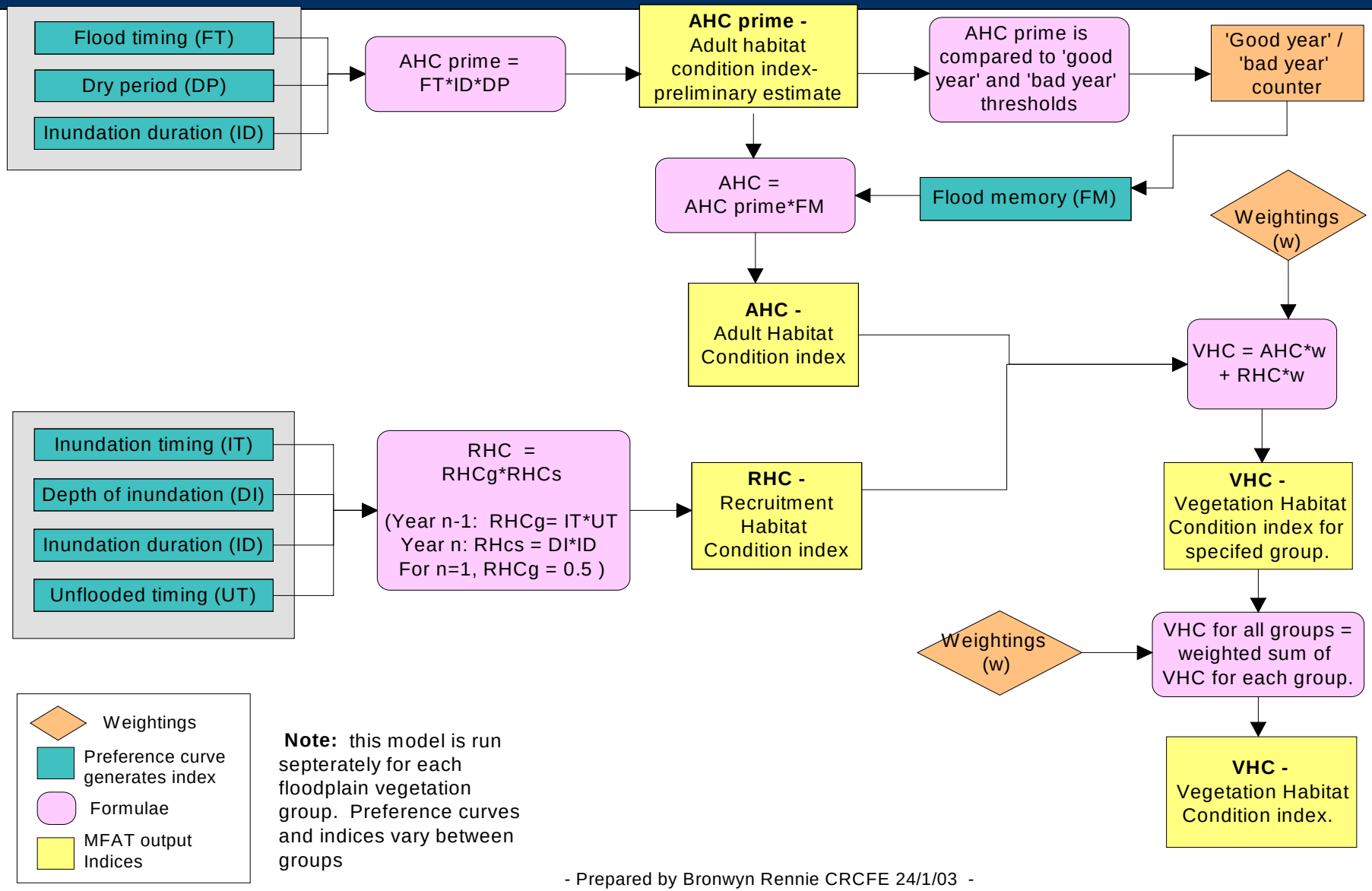






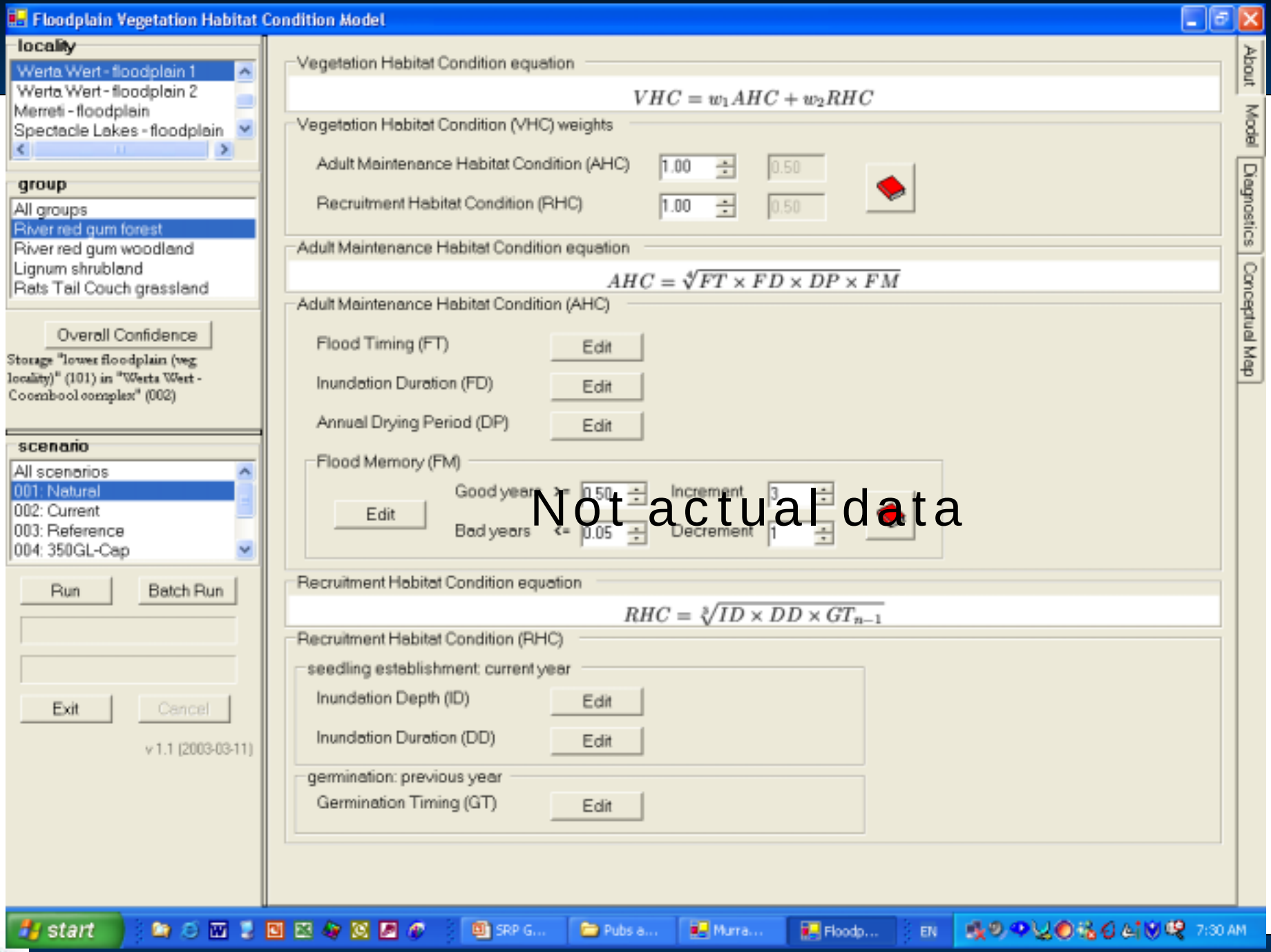


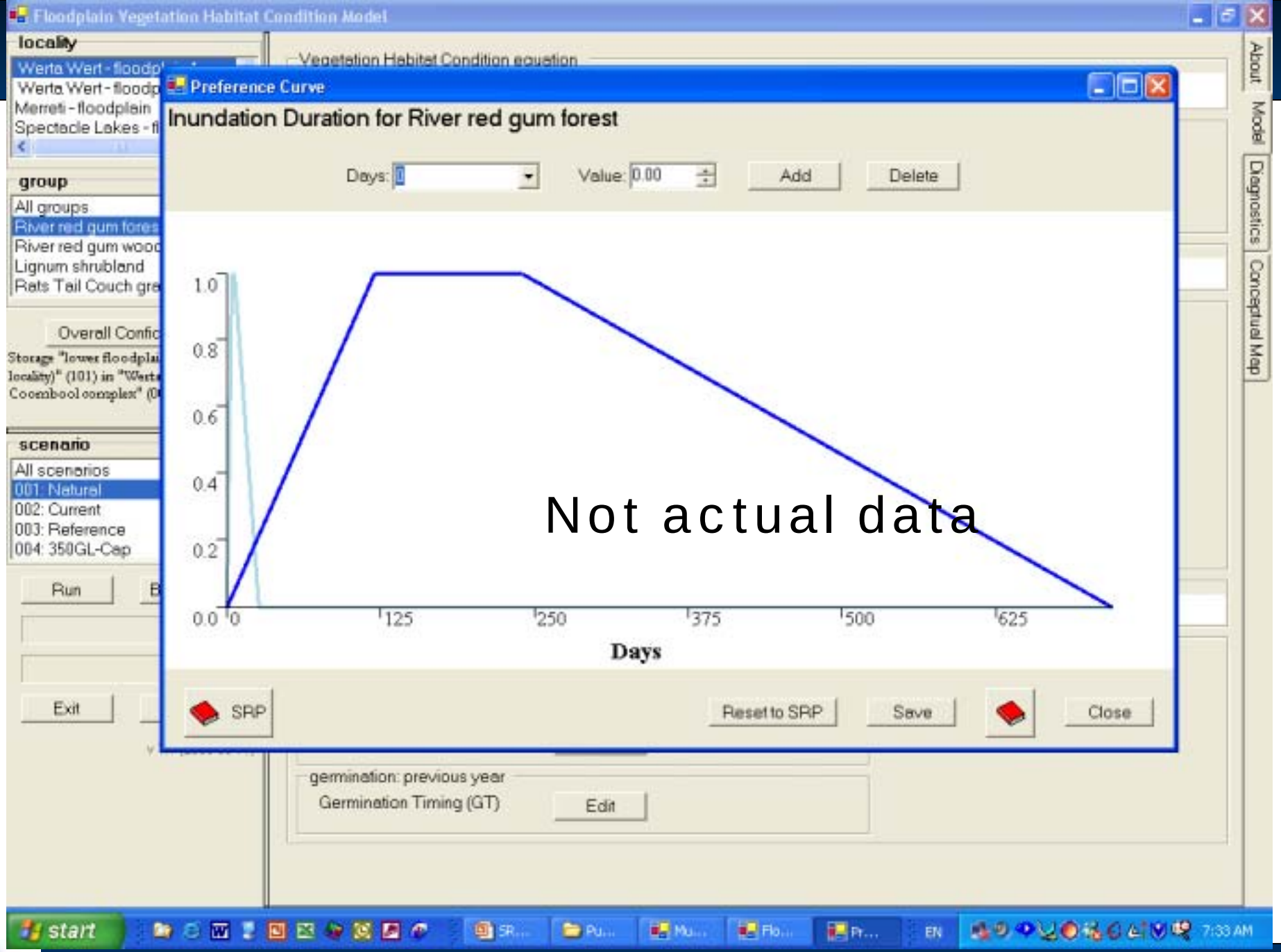
Floodplain Vegetation Habitat Condition Model - conceptual structure and process

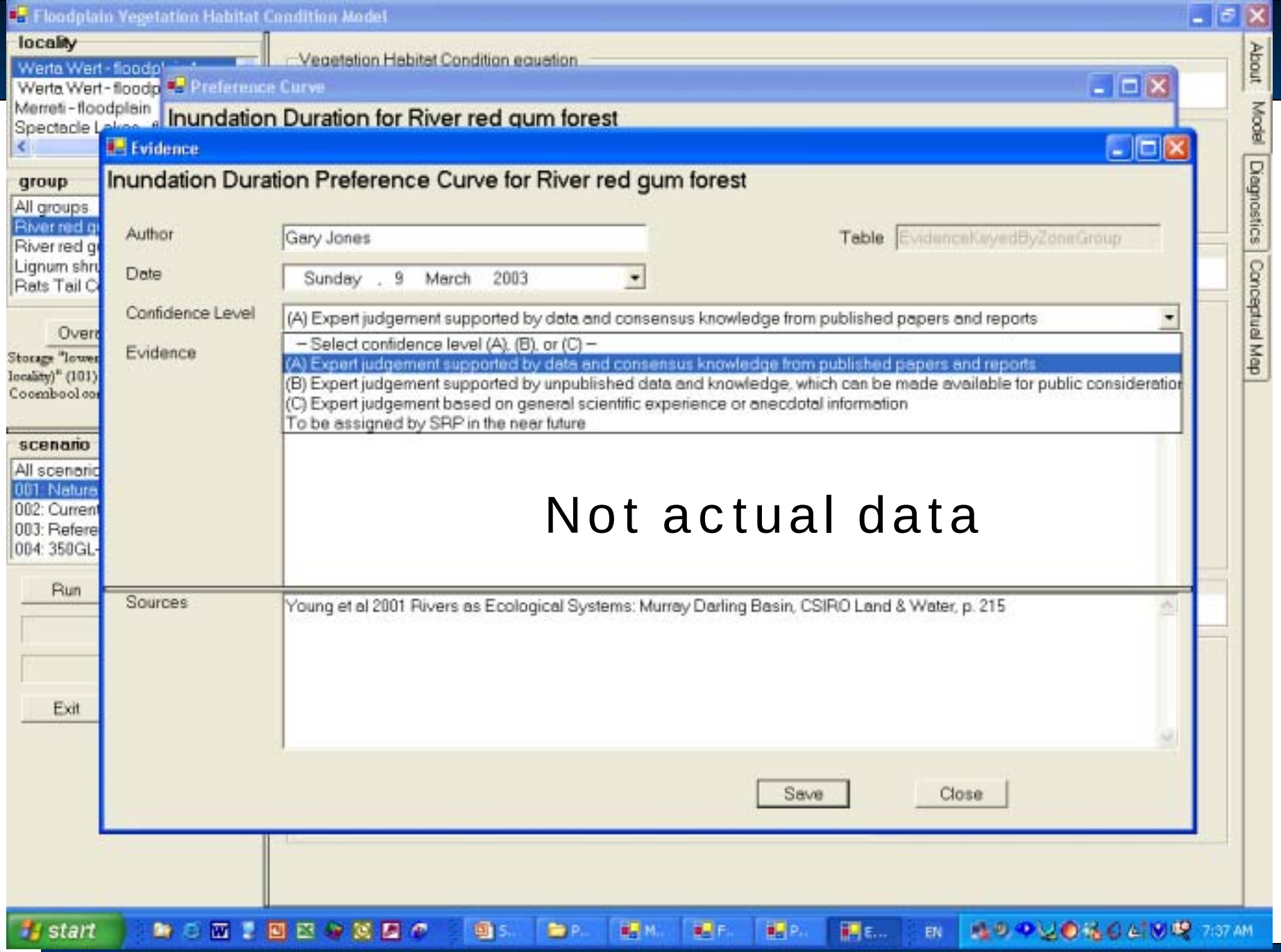


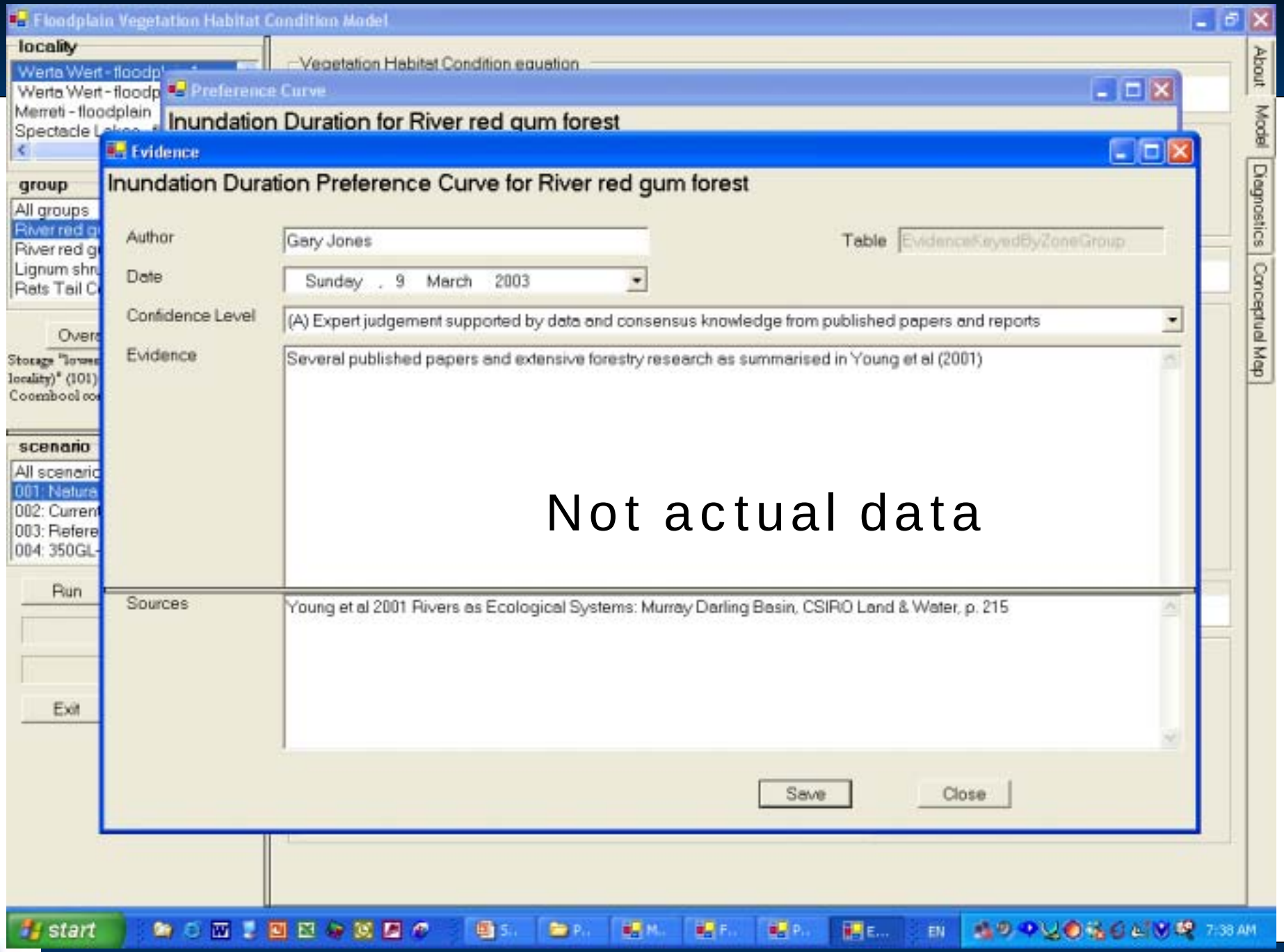
Note: this model is run septerately for each floodplain vegetation group. Preference curves and indices vary between groups

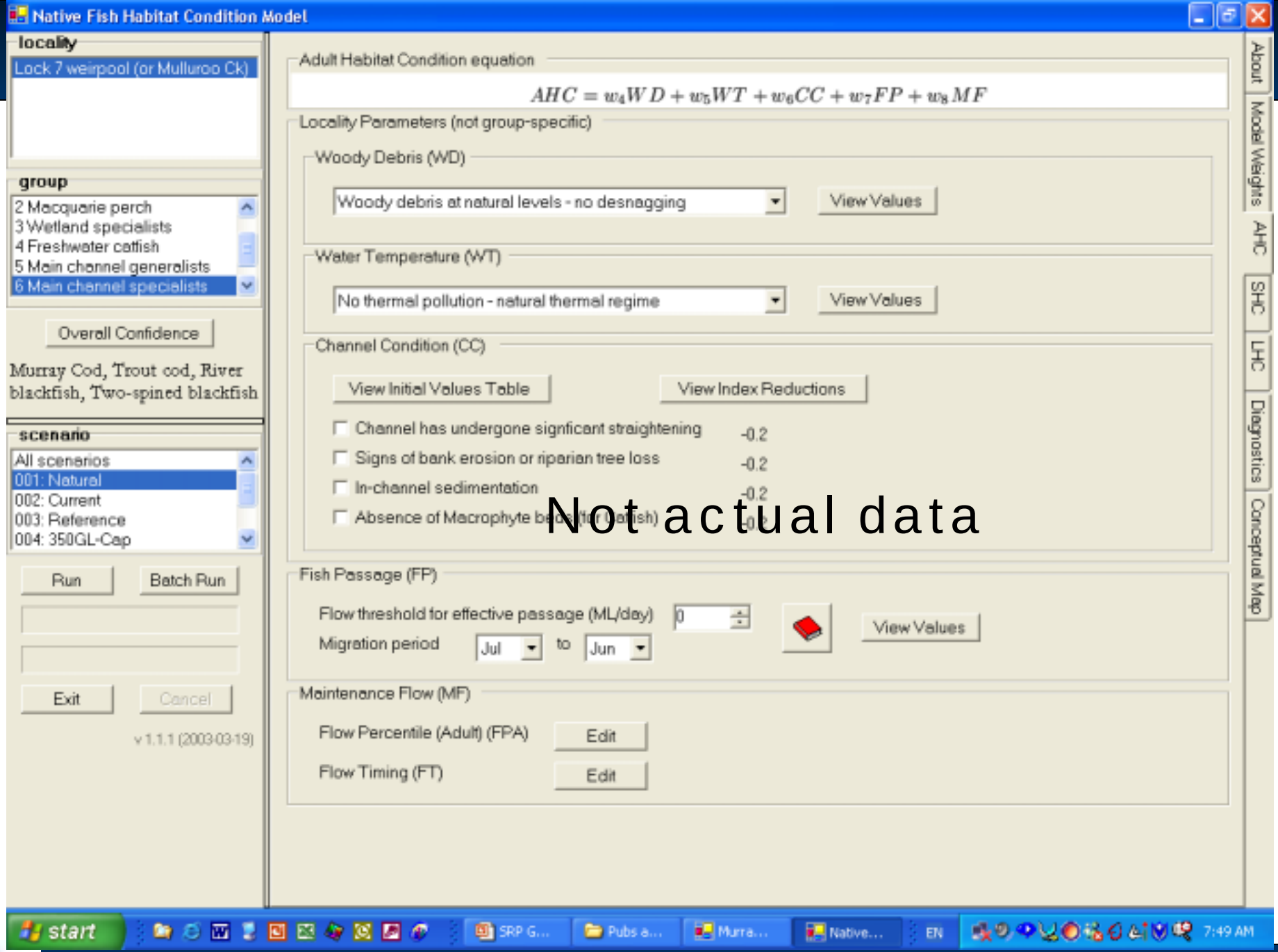
- Prepared by Bronwyn Rennie CRCFE 24/1/03 -

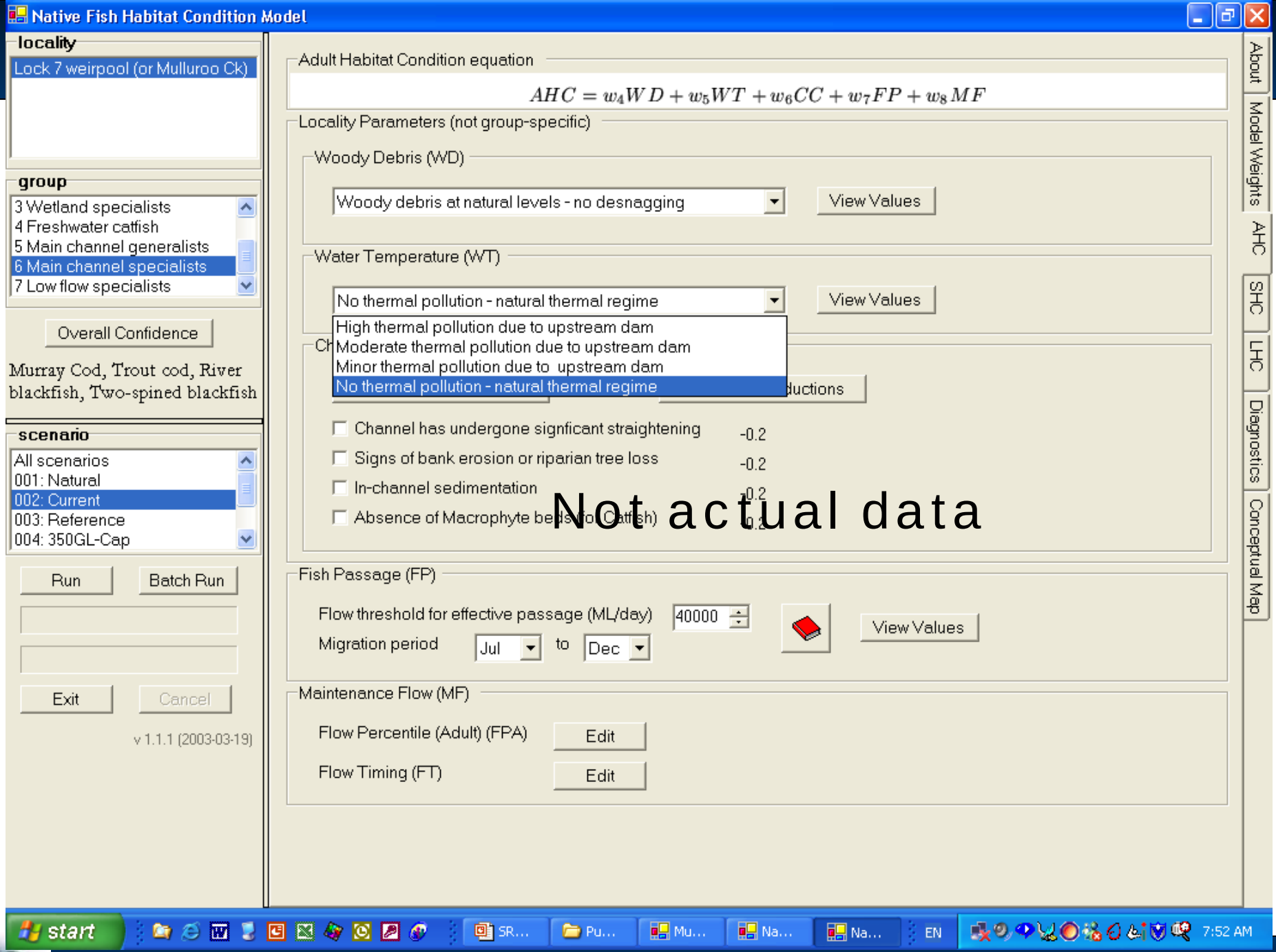


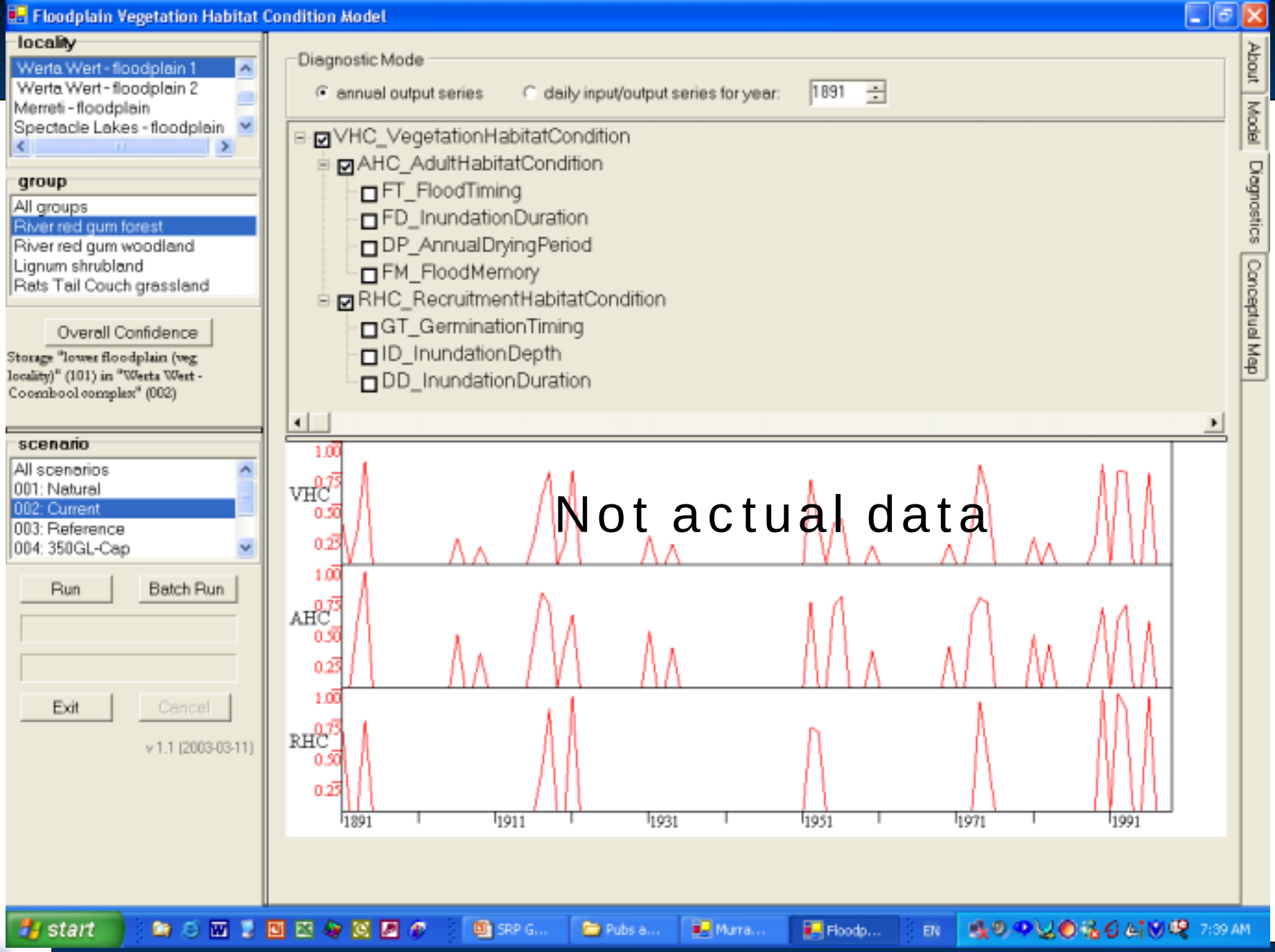












MFAT Exploratory Tool

- within zone comparison
- between zone comparison
- floodplain investigation

zone (one or all)
- E: Lock 11 to Lock 3
- Murray River

locality (one, all or several)
- Werta Wert - billabong/lagoon
- Werta Wert - lake
- Werta Wert - floodplain 2
- Werta Wert - floodplain 1
- Werta Wert - Coombool

assessment type
- Floodplain Vegetation Habitat Cor
- Inundation Volume
- Inundation Area

test scenario (>)
- 001: Natural
- 002: Current
- 003: Reference
- 004: 350GL-Cap
- 005: 750GL-Cap

reference scenario
- 003: Reference
- 004: 350GL-Cap
- 005: 750GL-Cap
- 006: 1500GL-Cap
- 013: Actual

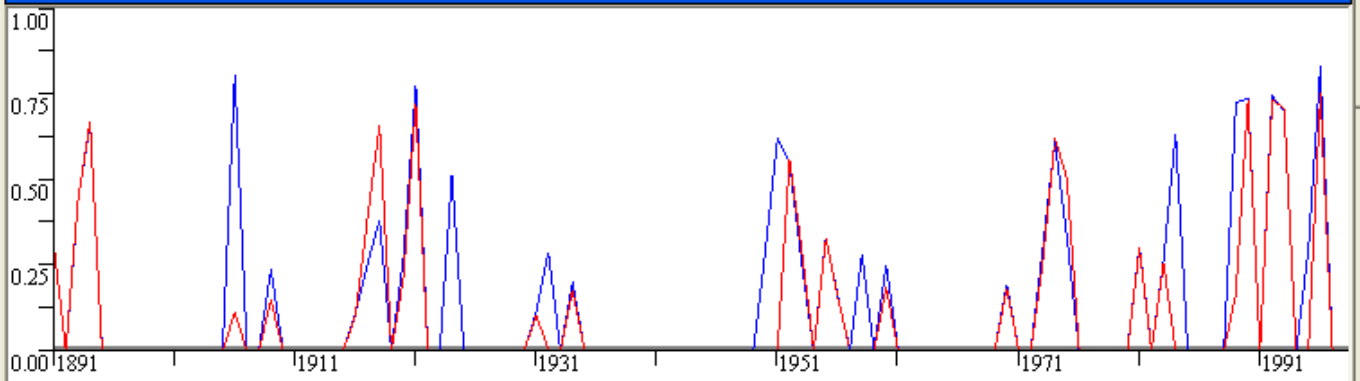
threshold value 0.01 index time unit year

threshold duration 1 years

time series / CDF log scale / seasonal average export graph export table

About | Data | Indicators

Yearly Time Series for Floodplain Vegetation Habitat Condition at Werta Wert - floodplain 1 (Year 1 July - 30 June)



Yearly Statistics for Floodplain Vegetation Habitat Condition at Werta Wert - floodplain 1 with threshold 0.01 index a

scenar	mean	median	min	max	S80	CV	% above	spells	above: m	above: lon	below: me	below: lo
001	0.34	0.31	0	0.8	2.57	0.76	52	26	2.45	26	1.76	25
002	0.1	0	0	0.75	Infinity	2.05	25	18	1.56	18	4.44	18
003	0.12	0	0	0.76	Infinity	1.94	26	18	1.61	18	4.39	18
004	0.12	0	0	0.76	Infinity	1.81	30	19	1.74	19	3.95	19
005	0.14	0	0	0.83	Infinity	1.71	32	20	1.75	20	3.65	20
006	0.14	0	0	0.85	Infinity	1.7	32	19	1.84	19	3.84	19
013	0.26	0	0	0.84	Infinity	1.29	44	6	2	6	2.14	7

Not actual data

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MFAT Exploratory Tool

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reference scenario

- 003: Reference
- 004: 350GL-Cap
- 005: 750GL-Cap
- 006: 1500GL-Cap
- 013: Actual

threshold value 0.25 index time unit year

threshold duration 1 years

time series export graph

CDF log scale export table

seasonal average

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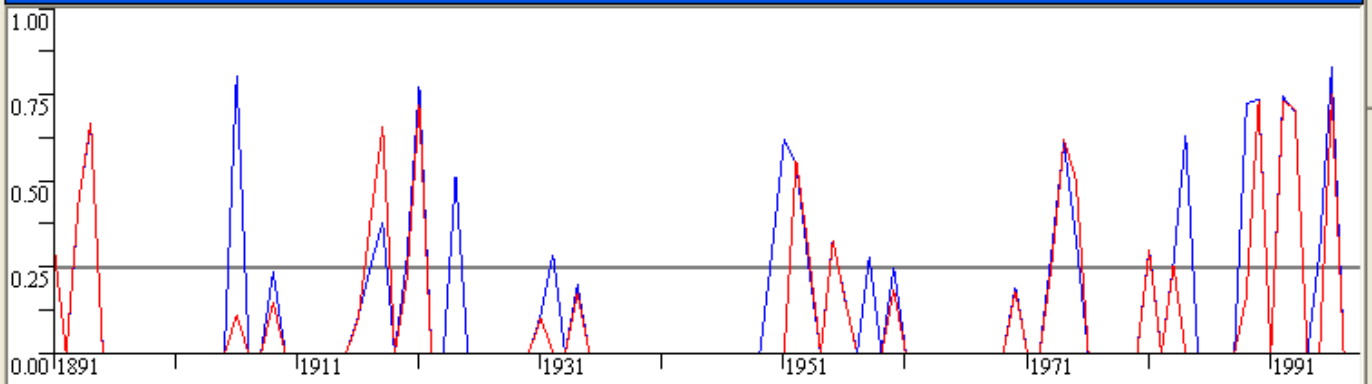

Yearly Statistics for Floodplain Vegetation Habitat Condition at Werta Wert - floodplain 1 with threshold 0.25 index a

scenari	mean	median	min	max	S80	CV	% above	spells	above: mean spell duratio	above: long spells	b
001	0.34	0.31	0	0.9	2.5	0.95	52	2	26	27	
002	0.1	0	0	0.75	Infinity	2.05	16	12	1.5	12	
003	0.12	0	0	0.76	Infinity	1.94	18	12	1.67	12	
004	0.12	0	0	0.76	Infinity	1.81	19	13	1.62	13	
005	0.14	0	0	0.83	Infinity	1.71	26	17	1.71	17	
006	0.14	0	0	0.85	Infinity	1.7	25	16	1.69	16	
013	0.26	0	0	0.84	Infinity	1.29	40	6	1.83	6	

Not actual data

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Scientific Assessment Summary

- Integrated hydrological and ecological analysis, with benefits compared with current (do nothing more) and 93/94 conditions (to assess recent improvements)
- 3 reference volumes x 3 operational scenarios (for better use of available water) + structural improvements
- Zone based assessments by REGs integrated to whole of river scale by SRP
- Levels of certainty explicitly represented
- Non-flow constraints to recovery identified
- All supporting scientific evidence captured in one location – MFAT

Scientific Reference Panel (SRP)

➢Develop River **M**urray **F**low **A**ssessment **T**ool (MFAT)

➢Establishment of regs REG's
➢Regs REG's assemble ecological data required to run the FAT
➢FAT training workshops for REG'sregs

Interaction with MDBC Project Team (modelling, ecologist)
➢Model optimisation: 350, 750 & 1500GL & the 'Do Nothing' benchmark

River Murray reaches and regional evaluation groups (regs)

reg REG A	Reg REG B	reg REG C	reg REG D	reg REG E	reg REG F	reg REG G
Dartmouth Dam to Hume Dam (Mitta Mitta River)	Hume Dam to Yarrawonga Weir	Yarrawonga Weir to d/s Wakool Junction. Reach includes Edward/Wakool River system + tributary inflows from the Goulburn River	d/s Wakool Junction to u/s Darling Junction (i.e. Lock 11). Reach includes tributary inflows from the Murrumbidgee River	u/s Darling Junction (i.e. Lock 11) to Lock 3. Reach includes tributary inflows from the Darling River	Lower Darling River & the Great Anabranch of the Darling River below Menindee Lakes	Lock 3 to Wellington

The Lower Lakes & Coorong

➢Regs REG's apply the FAT to develop their reach assessments
➢Regs REG's prepare draft and final reach assessment reports

+

Goulburn River	Murrumbidgee River?
Reg REG I	**Reg REG J**

Interaction with MDBC Project Team (modelling, ecologist)

➢SRP integrate and synthesise final reg REG reach assessments

➢SRP prepare final report to the Project Board

Murrumbidgee REG

- Led by Dr. Robyn Watts, CSU
- Scientific specialists in hydrology & geomorphology, fish & bird biology, vegetation, wetlands, algae & water quality
- Scientists from CSU, UNE, VDSE, DLWC, NSW Fisheries

Advice not advocacy