

Balancing water quality and ecosystem health with water yield

— ecosystem response to forest thinning
in the Wungong Catchment



Project Goals

Water yield is achieved with an assured water quality and minimal impact on ecosystems.

Focus on nutrient cycling, vegetation response and nutrient export potential

Understand and predict transient and longer-term responses to thinning

Research Questions

How are thinning impacts reflected in the ecosystem composition, structure and function?

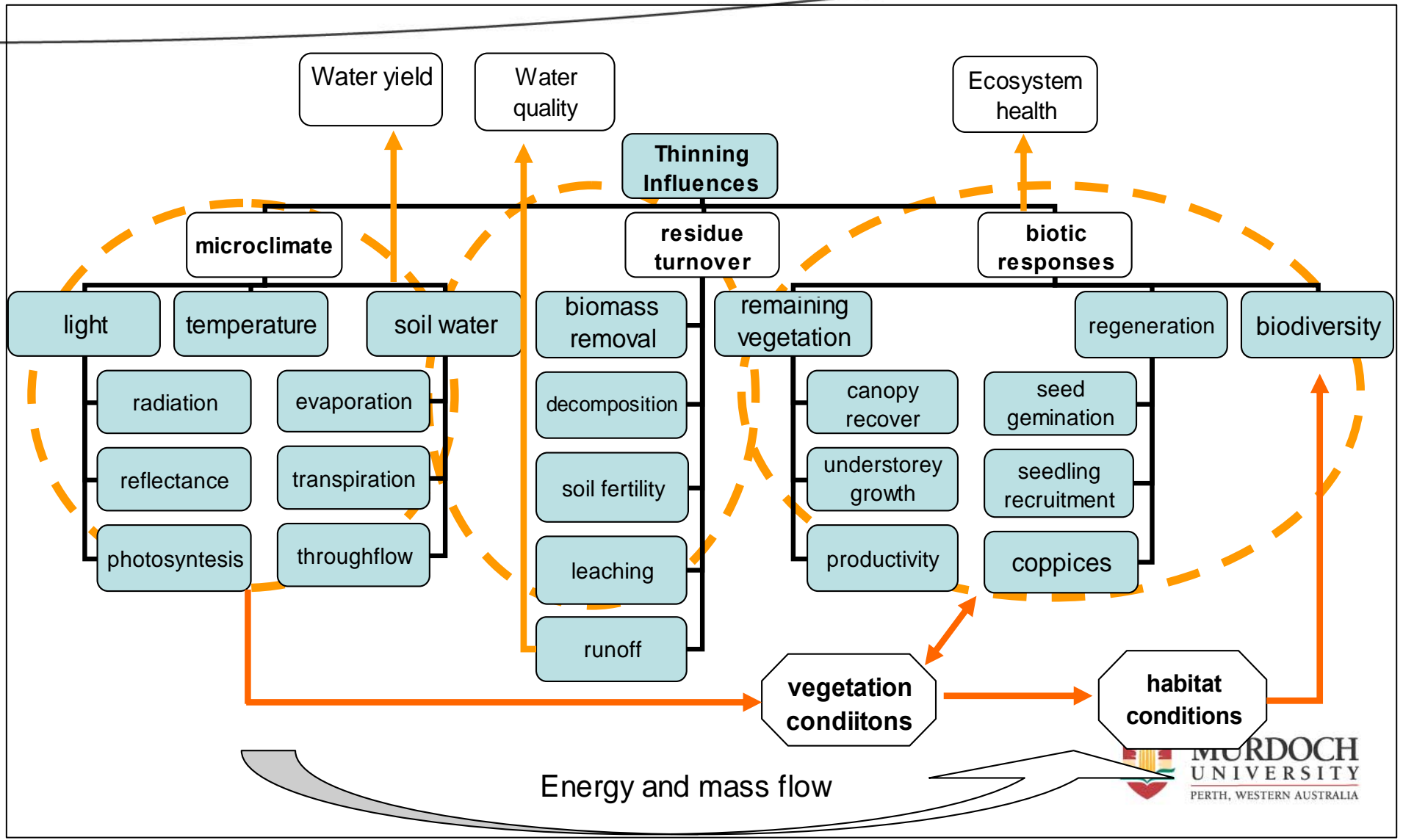
What are underlying processes regulating post-thinning vegetation change and ecosystem dynamics?

How do vegetation dynamics after thinning impinge on stream water quality?

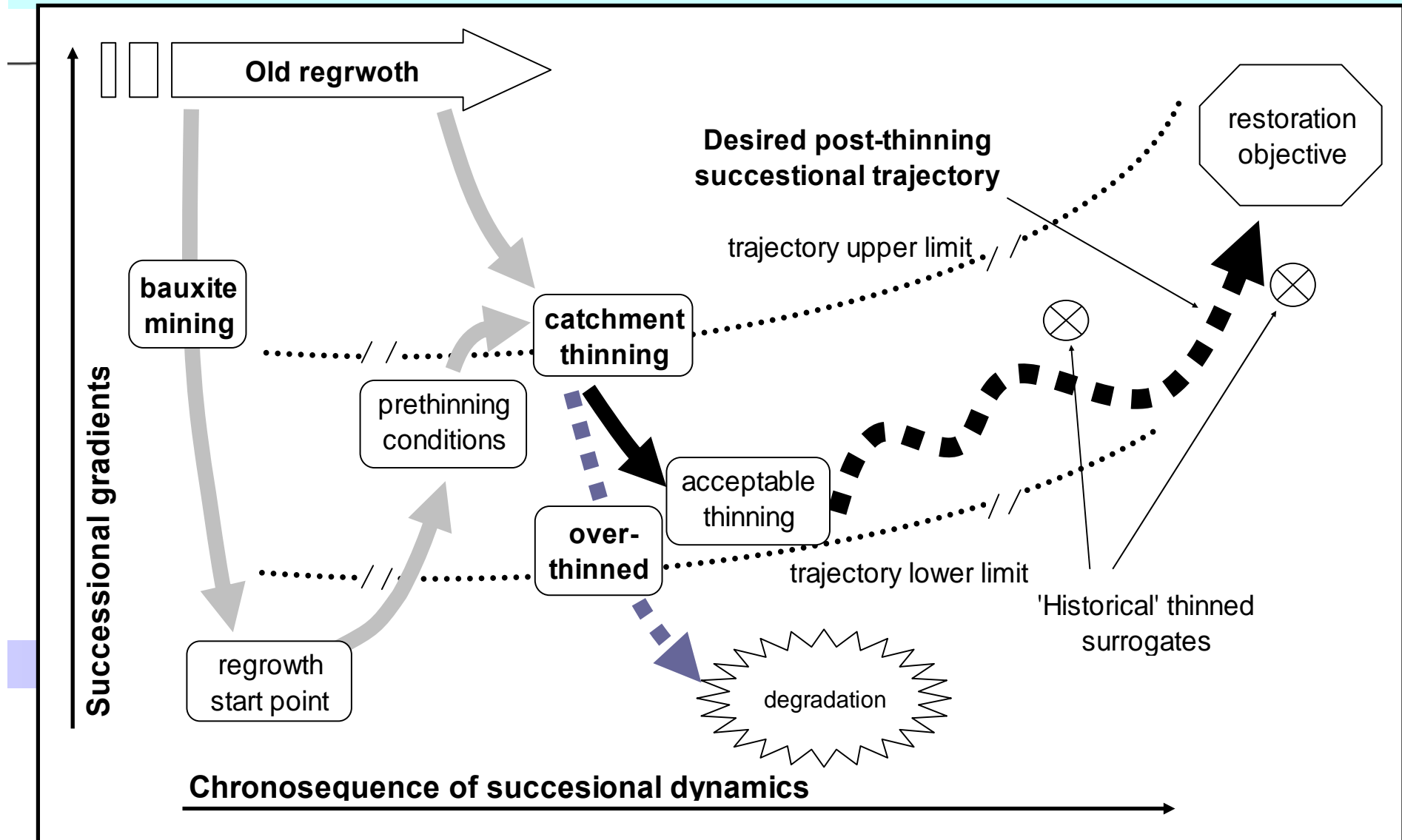
Can post-thinning successional trajectories be predicted?



Expected links between thinning effects and water yield, water quality and ecosystem health



Postulated transitional states and restoration trajectory of thinned ecosystem.



Approach

Inter-relationships between changes in micro-climate, water and nutrient supply and vegetation response

Follow up residue turnover and nutrient leaching & runoff

“Space-for-time” substitution to gain “surrogates” for longer-term ecosystem behaviour

Develop ‘state-and-transition’ models to predict restoration trajectories of the post-thinning ecosystem.

Subproject-1 (Part A)

Understand post-thinning vegetation dynamics

Network of sites across major sub-catchments will be selected

Time-series measurements

Focus on a range of qualitative, semi-quantitative 'indicators'

Some soil and water sampling for quantitative information

Subproject-1 (Part B)

Short- to medium-term dynamics

**trends of post-thinning energy and nutrient flow
through residue turnover;**

**interrelations between thinning intensity and
biological responses.**



Subproject-2

Examine connection of thinning/nutrient cycling to water quality

Approach

**use “forest-stream buffer-stream” transects on catchment units
thinned by
stem-injection
commercial harvest**

install ‘runoff/ throughflow plots’ to collect water samples



Sub-project 3.

Predicting restoration pathways for thinned jarrah forest:

past-thinned jarrah forest sites within or near Wungong Catchment will be studied.

mine-rehabilitation trials in WA jarrah forest will be further reviewed in relation to this project.

define useful attributes to successional pathways

explore post-thinning restoration trajectory

examine constraints and connectivity between the prior- and post-thinning restoration trajectories



Potential surrogate sites

Historically-thinned, logged sites

Higgins Catchment, thinned 1989 from 37 to 15 m²/ha;

Hansens Catchment, thinned by stem-injection in 1985/86.

Old regrowth sites in and near Cobiac (1940-1950);

Sites of old/matured growth.

Management history to be checked

Team/Resources

People: Richard Bell, Richard Hobbs, Arthur McComb, Song Qiu, and PhD, Masters and Honour students

Project duration: 4 years

Funding source: Water Corporation; requested support from ARC Linkage program

Current Status

**Collecting and reviewing background
information from other research groups**

Project planning

Preliminary site visits

Discussion with Water Corp

Time-frame of the project

Time plan	Year 1			Year 2			Year 3			Year 4		
Monitor catchment vegetation responses												
Field plot experimentation												
Transect study for export potential												
Restoration trajectory study												
Report and communication												

Subproject-1 (Part B)

Method

Field plot experimentation

test effects of stem-injection, commercial harvest, thinning intensity on nutrient cycling and biological responses

measure microclimate, forest floor conditions, residue turnover, tree response, understory properties.

Examin isotopic ratios ($\delta^{2}\text{H}$, $\delta^{18}\text{O}$) of soil water, plant and groundwater

Basic assumptions

Thinning as a ecosystem disturbance or stressor

Adequate thinning do not cause system degradation

Post-thinning ecosystem is under non-equilibrium state

Longer-term restoration can be surrogated