Future scientific research directions: Pests & diseases

TUART SCIENCE WORKSHOP

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Conserving the nature of WA

Sustainable management of tuart forest & woodland

Approach advocated:

- adaptive, not benign neglect
- cross-disciplinary
- co-ordinated
- integrated
- for microbiota component, focused on potential pest & disease species

Pitfalls to avoid

- *Ad hoc*, unstructured surveys
- General collecting of fungi, bacteria, viruses & invertebrates
- Ignoring historical information - pre- & post European
- Not considering the full range of relevant environmental disturbances

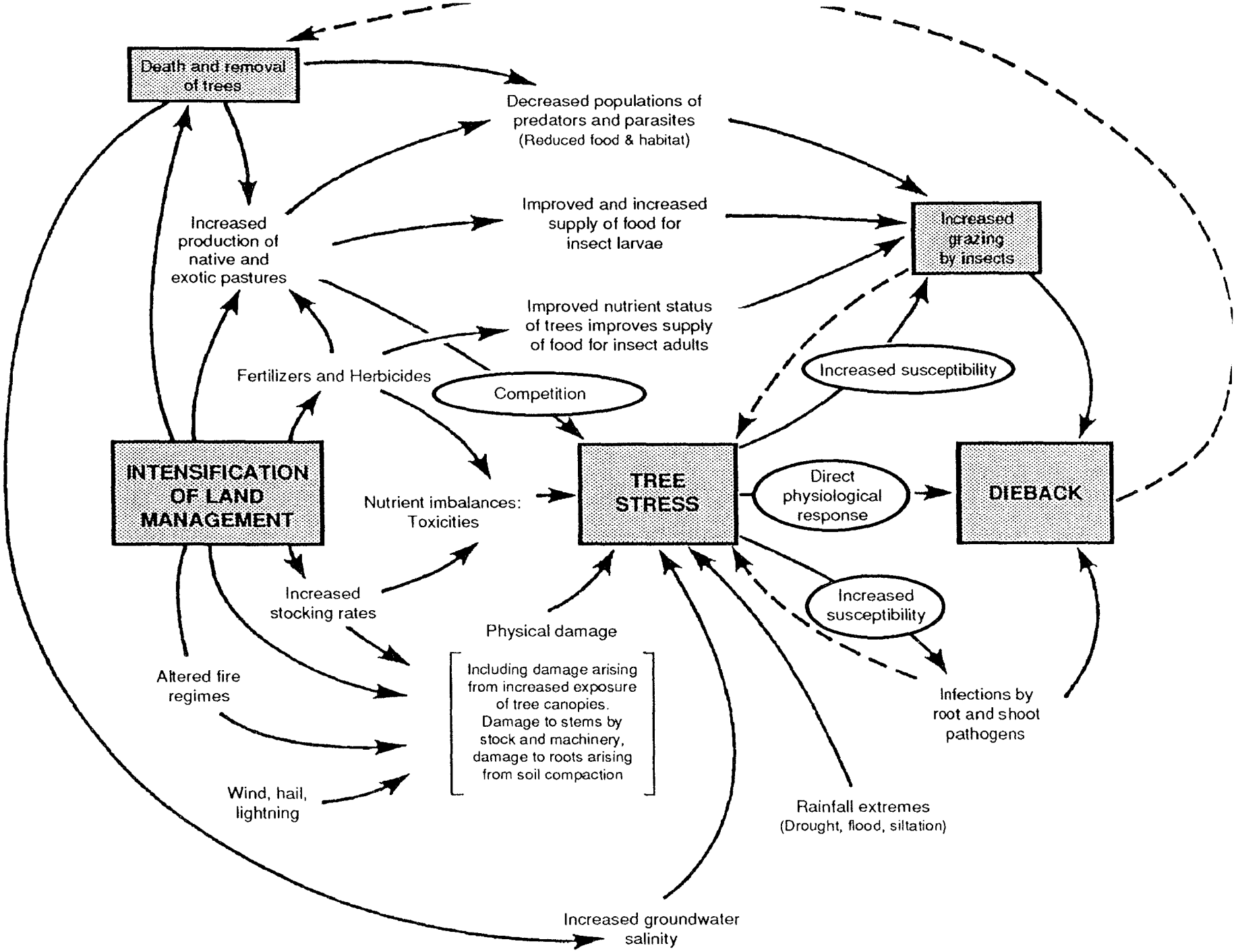
A way forward - 1

Impose a variety of relevant disturbances (treatments), including:

- thinning of tuart
- thinning of wonil (peppermint)
- thinning of both species
- a range of fire intensities and fire frequencies

A way forward - 2

- Apply clear thinking to understanding mechanisms and patterns of decline
- Apply Ockham's razor: hypothesize single overarching cause rather than multiple causes
- Avoid ECWEE mindset, otherwise you'll produce...


Death and removal of trees
Decreased populations of predators and parasites (Reduced food & habitat)
Increased production of native and exotic pastures
Improved and increased supply of food for insect larvae
Increased grazing by insects
Improved nutrient status of trees improves supply of food for insect adults
Fertilizers and Herbicides
Competition
Increased susceptibility
INTENSIFICATION OF LAND MANAGEMENT
Nutrient imbalances: Toxicities
TREE STRESS
Direct physiological response
DIEBACK
Increased stocking rates
Physical damage
Increased susceptibility
Altered fire regimes
Including damage arising from increased exposure of tree canopies. Damage to stems by stock and machinery, damage to roots arising from soil compaction
Infections by root and shoot pathogens
Wind, hail, lightning
Rainfall extremes (Drought, flood, siltation)
Increased groundwater salinity

A way forward - 3

- Identify causation chains
- Formulate hypotheses that distinguish indirect/secondary/contributing factors from those that are direct/primary/inciting
- Simplify by setting aside 2nd & 3rd order interactions
- Work out major cross-linkages

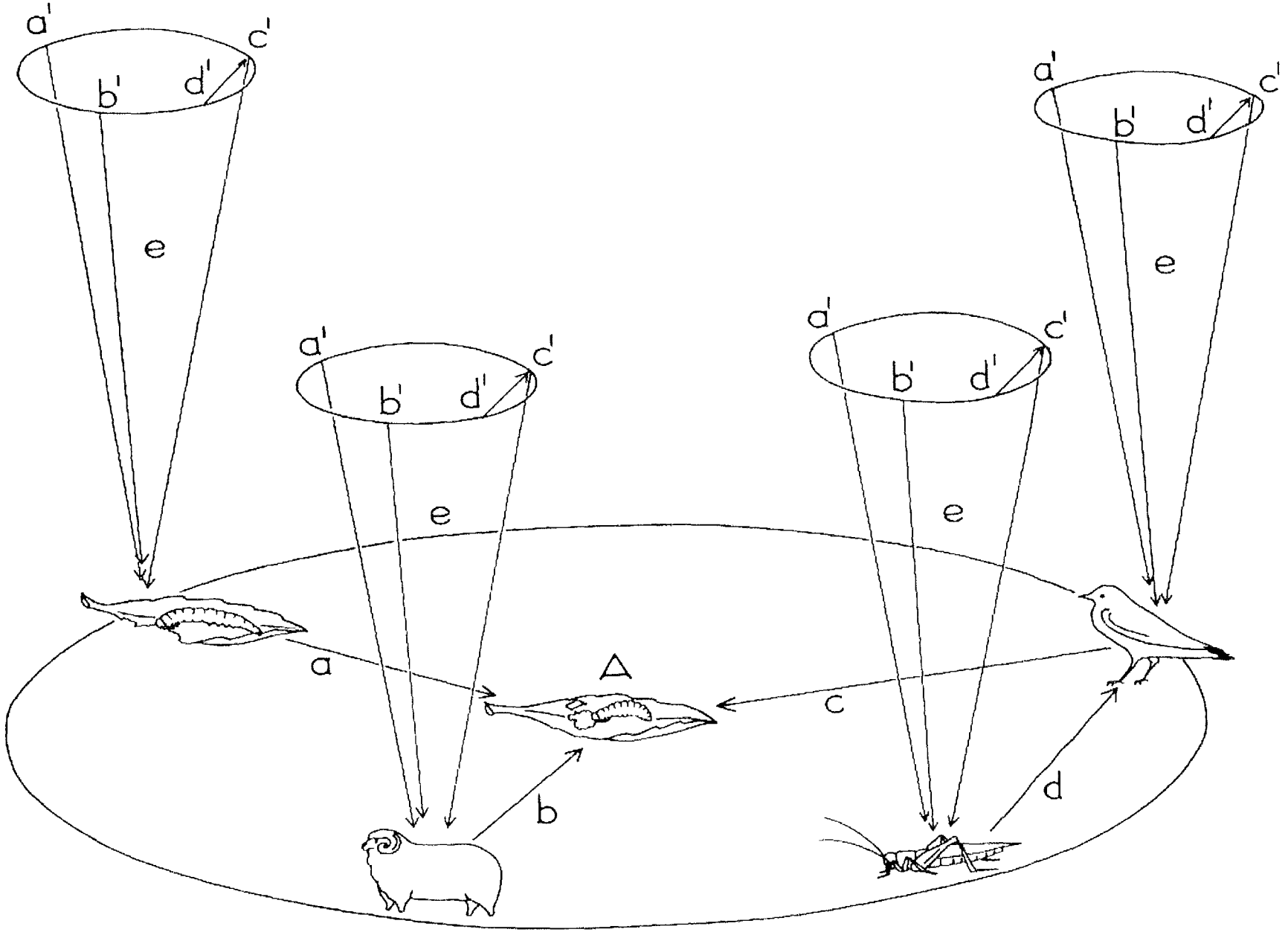
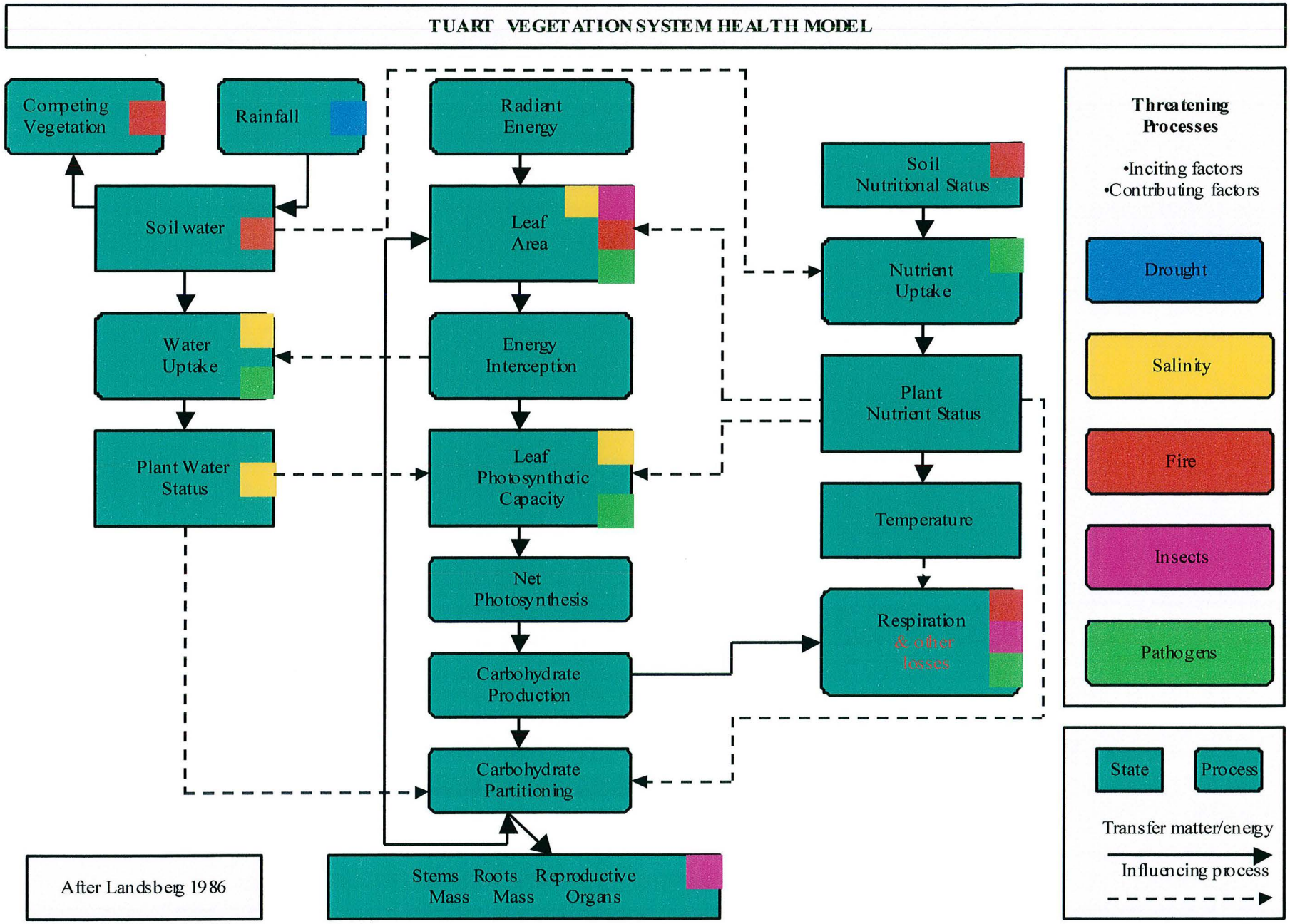


FIG. 10.01.—A diagrammatic representation of the categories of other animals. Those on the upper planes are considered to come into the environment less directly than those on the lower plane. For further explanation see sec. 10.01.


TUART VEGETATION SYSTEM HEALTH MODEL
Competing Vegetation
Rainfall
Radiant Energy
Soil Nutritional Status
Soil water
Leaf Area
Nutrient Uptake
Water Uptake
Energy Interception
Plant Nutrient Status
Plant Water Status
Leaf Photosynthetic Capacity
Temperature
Net Photosynthesis
Respiration & other losses
Carbohydrate Production
Carbohydrate Partitioning
Stems Mass
Roots Mass
Reproductive Organs
After Landsberg 1986
Threatening Processes
•Inciting factors
•Contributing factors
Drought
Salinity
Fire
Insects
Pathogens
State
Process
Transfer matter/energy
Influencing process

An appropriate working hypothesis

Pest insects & diseases are secondary, not primary, factors in the current decline of tuart

Research gaps - 1

Need basic environmental information on

- groundwater levels (both current and before decline became evident)
- soil fertility gradients

Research gaps - 2

Uncertainty about appropriate scale at which to apply treatments (? several hundreds of ha) in order to obtain:

- mosaic and adequate replication
- thinning of tuart and/or wonil
- fire intensities & frequencies

Research gaps -3

Is current decline of tuart a natural phenomenon?

- Dendrochonological studies

Highest priority P&D research

Investigate the effect of these treatments on activity/population size of potential insect pests and disease-causing organisms

Case study - 1

New England (NSW) eucalypt dieback, 1970s

- No common set of plots
- Single discipline-based studies
- No genuine integration
- Satisfaction of personal research interests

Case study - 2

Jarrah leafminer & Gumleaf skeletonizer outbreaks in WA forests, 1980s

- Difficulty in establishing historical precedents (? natural or anthropogenic)
- Fire & logging not causal
- Climate/weather important, but hard to demonstrate

Case study - 3

Jarrah dieback

- First described 1920s
- Much speculation as to the causal agent
- Introduced pathogen identified 1965
- Forest management responses