Extension of the ABC system to include Bayesian Network Models

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The problem

- DSE is responsible for recovery of threatened species in Victoria
- Hundreds of species on the list
- Focus on planning
- Limited resources for implementation
- Need to improve tracking of activity and outcomes
- Need to improve resource allocation

The solution (part 1)

- ABC = Actions for Biodiversity Conservation
- Web-based application
- Records species, locations, threats, actions and results
- Annual updating by more than 100 “monitors”
- Simple priority setting
- Location and action
- Advice provided to funders and land managers

Actions for Biodiversity Conservation

Menu

My Portfolio

Item

Item Search

System Administration

Add Action
Edit Action
Add Item
Add Special Location
Edit Special Location
System Status
Reference Tables
Users
Bulk Generate Results

General

Add Adhoc Location
Edit Adhoc Location
Bulk Enter Results
Change Password
Logout
Help

Reporting

Standard User Reports

Flora: Astelia australiana, Tall Astelia; Moorrees, Adrian

Item | ABC Priorities | Action Statement

Locations | Unlinked Biosites | Item Notes

Location List

Add new location for item

17 locations found

Location Code	Location Type	Location Name	Location Monitor	Location Priority
1620	Biosite	Tomahawk and McCrae Creeks	Moorrees, Adrian	M
7271	Biosite	Worlley Creek	Moorrees, Adrian	M
6796	Biosite	Woodall Creek Headwaters	Willig, Rolf	M
6803	Biosite	Middle Branch Pioneer Creek (west)	Willig, Rolf	M
6806	Biosite	Dave Ashton site	Willig, Rolf	M
7267	Biosite	Middle Branch Pioneer Creek (east)	Willig, Rolf	M
7268	Biosite	Pioneer Creek Confluence	Willig, Rolf	M
7269	Biosite	Pioneer Creek Lower	Willig, Rolf	M
7270	Biosite	Woodall Creek Roadside	Willig, Rolf	M
196	Aspatial	Not geographically specific	Moorrees, Adrian	H

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Displaying 1 to 10 of 17 Records

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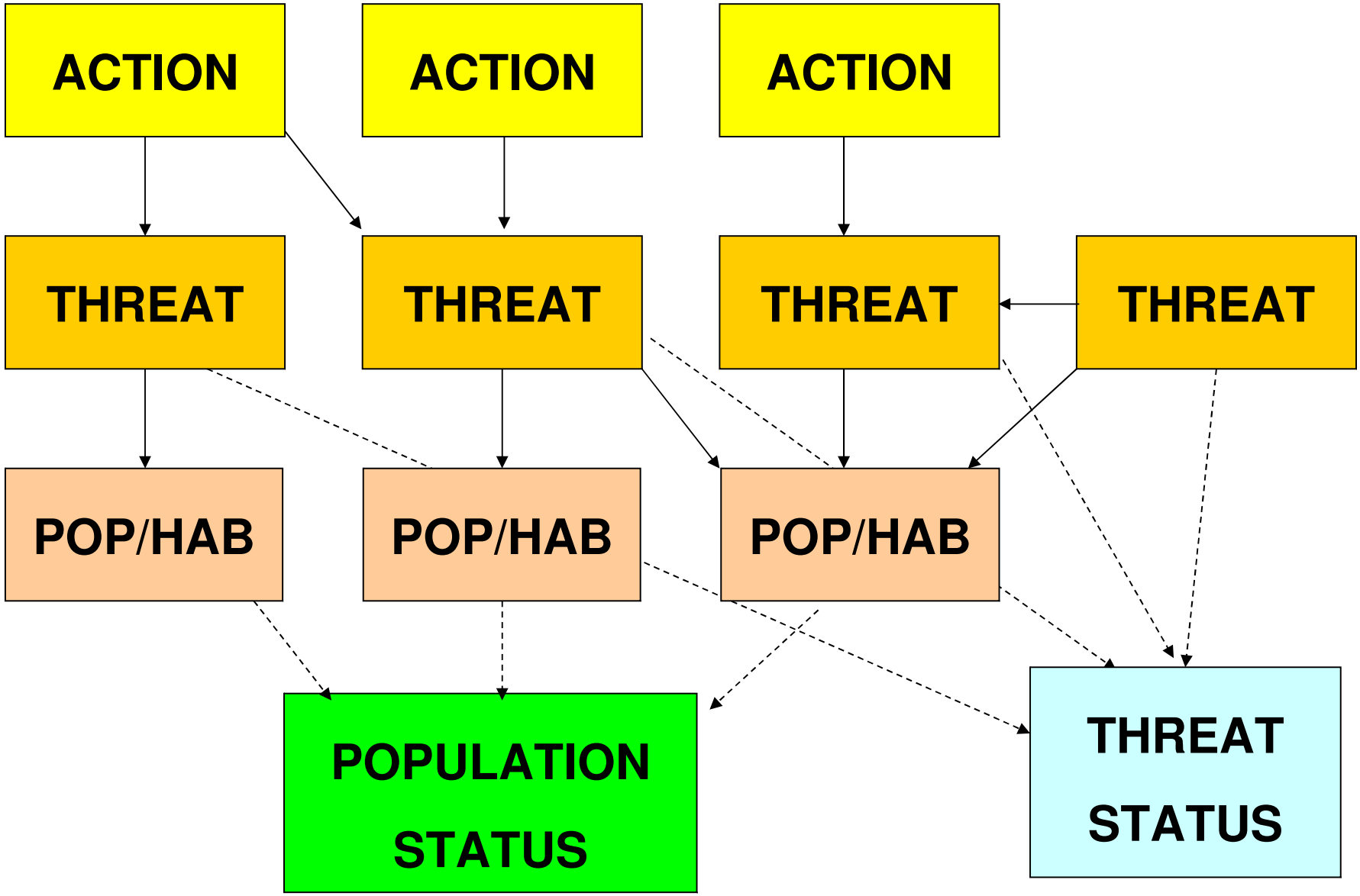
The solution (part 2)

- Incorporate Bayesian Network models
- Use existing information to build standard models
- Import non-standard models from Netica
- Actions – Threats – Population/Habitat parameters
- Query nodes = status of population and threats
- Use as a reporting tool
- Use as a predictive tool – simple cost - benefit


ACTION
ACTION
ACTION
THREAT
THREAT
THREAT
THREAT
POP/HAB
POP/HAB
POP/HAB
POPULATION STATUS
THREAT STATUS

Flora: Grampians Bitter-pea, Daviesia laevis; Rudolph, Pauline >> Biosite: Grampians NP, Bovine Creek >> Model: Daviesia_laevis_Bovine

Which threats do you want to include?

	Standard Threat	*Source of Threat*	*Likelihood*	*Impact*
☑	Inappropriate fire regimes	Fire - frequency	Almost Certain	Catastrophic
☑	Disease	Disease - Phytophthora cinnamoni	Likely	Major
☑	Herbivory	Animals - native species	Likely	Major
☑	Herbivory	Animals - introduced herbivores	Unlikely	Minor

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Models | Structure | Likelihoods (130/130) | Scenarios

Name | Threats | Actions and Outcomes | Short Names | States | Additional Links

Fire_frequency | Goats | PC | Swamp_wallabies

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Consider the threat: Goats

What actions affect this threat?

Control introduced animals — Control goats — Remove

Erect/maintain cages, fences or other structures to exclude nativ — Erect/maintain cages, fences or other structures to exclude native animals — Remove

Add Another

What outcome factors are affected by this threat?

Abundance — Total number of individuals — Remove

Add Another

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What are the states for each of the factors?

Actions:

Caging	Choice	Yes, No	Yes	>10% of seedlings caged.
			No	<10% caged or not caged at all.
FOPs	Choice	Yes, No	Yes	FOP matches preferred fire interva
			No	FOP matches preferred fire interva
Goat_control	Choice	Yes, No	Yes	Implemented control program fully
			No	None or partial implementation.
Hygiene	Choice	Yes, No	Yes	Hygiene program fully implemente
			No	None or partial implementation.

Threats:

Fire_frequency	Frequency	Too_frequent, Appropriate, Too_infrequent	Too_frequent	<10 year fire interval
			Appropriate	10-25 year fire interval
			Too_infrequent	>25 year fire interval
Goats	Impact	Severe, Moderate, Negligible	Severe	>25% of seedlings browsed
			Moderate	5-25% of seedlings browsed
			Negligible	<5% of seedlings browsed
PC	Presence	Present, Absent	Present	Evidence from soil testing
			Absent	No evidence from soil testing
Swamp_wallabies	Impact	Severe, Moderate, Negligible	Severe	>25% of seedlings browsed
			Moderate	5-25% of seedlings browsed
			Negligible	<5% of seedlings browsed

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Models | Structure | **Likelihoods (130/130)** | Scenarios

Fire_frequency (2/2) | Goats (4/4) | PC (2/2) | Swamp_wallabies (2/2) | HabitatStructure (3/3)

Total_Number (54/54) | Outcome_Trend (9/9) | Threat_Trend (54/54)

Question 1/54 - Consider that:

Fire_frequency is Too_frequent,

Swamp_wallabies is Severe,

Goats is Severe and

PC is Present.

How likely is it that Total_Number will be:

Increasing? Improbable

Stable? Unlikely

Decreasing? Likely

Make equally likely | Restore Likeli

Certain
Probable
Likely
Equally Likely
Unlikely
Improbable
Impossible

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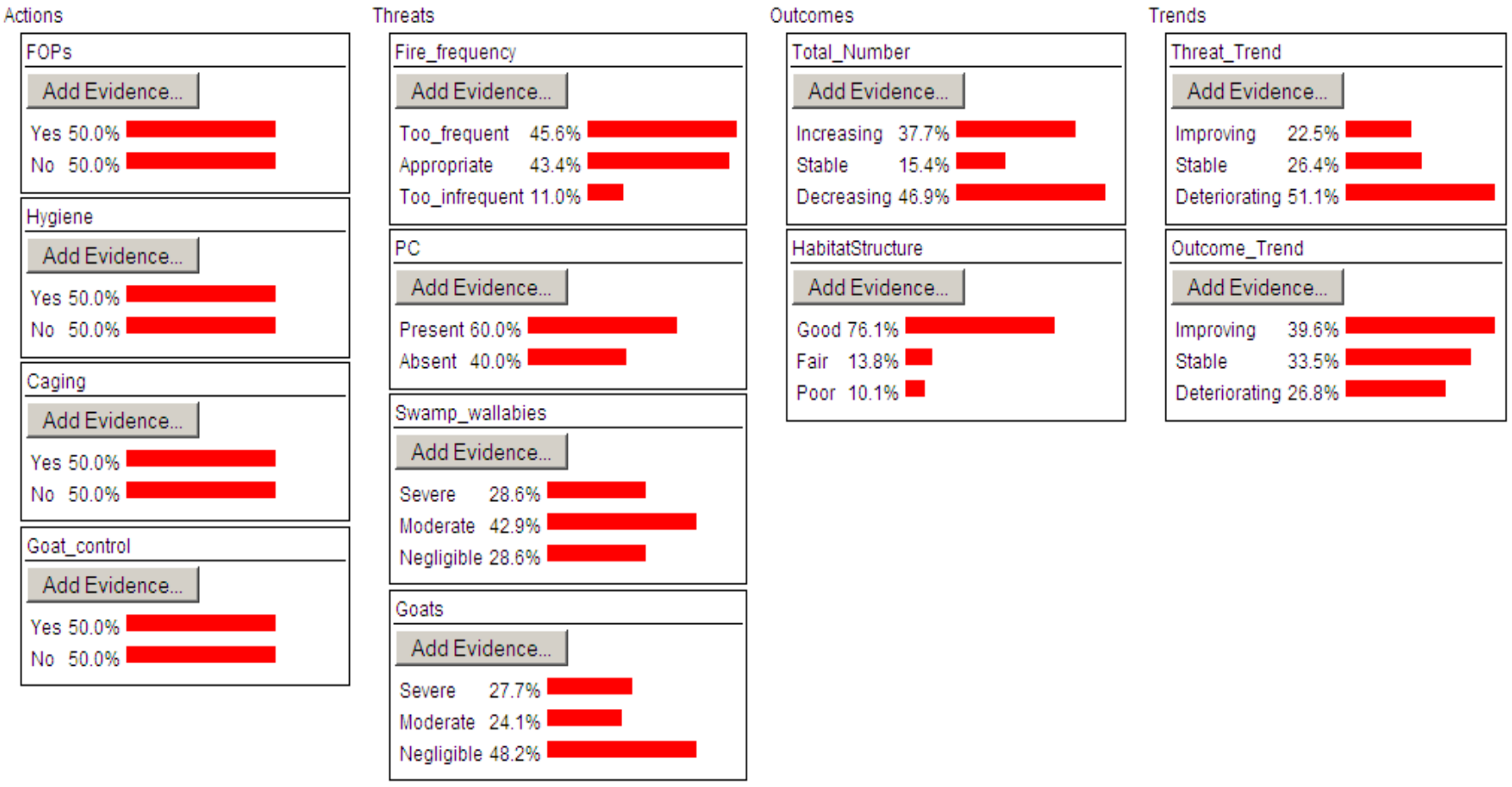
Elicitor | Scenarios



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Elicitor | Scenarios

Actions

FOPs
Yes 100 %
No 0 %
Close | Remove Evidence

Hygiene
Yes 100 %
No 0 %
Close | Remove Evidence

Caging
Yes 100 %
No 0 %
Close | Remove Evidence

Goat_control
Yes 100 %
No 0 %
Close | Remove Evidence

Threats

Fire_frequency
Add Evidence...
Too_frequent 14.3%
Appropriate 71.4%
Too_infrequent 14.3%

PC
Add Evidence...
Present 35.0%
Absent 65.0%

Swamp_wallabies
Add Evidence...
Severe 14.3%
Moderate 42.9%
Negligible 42.9%

Goats
Add Evidence...
Severe 7.7%
Moderate 15.4%
Negligible 76.9%

Outcomes

Total_Number
Add Evidence...
Increasing 57.1%
Stable 15.4%
Decreasing 27.5%

HabitatStructure
Add Evidence...
Good 69.5%
Fair 16.8%
Poor 13.6%

Trends

Threat_Trend
Add Evidence...
Improving 32.7%
Stable 34.7%
Deteriorating 32.6%

Outcome_Trend
Add Evidence...
Improving 50.2%
Stable 29.1%
Deteriorating 20.7%

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The challenges

- Defining ecologically significant states
- Unbiased sample – managed and unmanaged sites
- ?ethical questions?
- Large sample – meaningful reporting across groups and habitats
- Incorporating costs to allow cost – benefit analysis
- Maintaining the system and data through time
- Shifting balance towards empirical data and away from expert opinion

Acknowledgements

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