REVIEWING THE AUSTRALIAN NATIONAL RESERVE SYSTEM

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- DEM development: John Stein

OUTLINE OF TALK

1. The National Reserve System (NRS)
2. A review of the NRS for freshwater biodiversity conservation
   - Information needs / realities
   - Results
3. Issues for future reviews
   - Reducing uncertainty
   - Choosing biodiversity surrogates
   - Measuring adequacy
4. Conclusions

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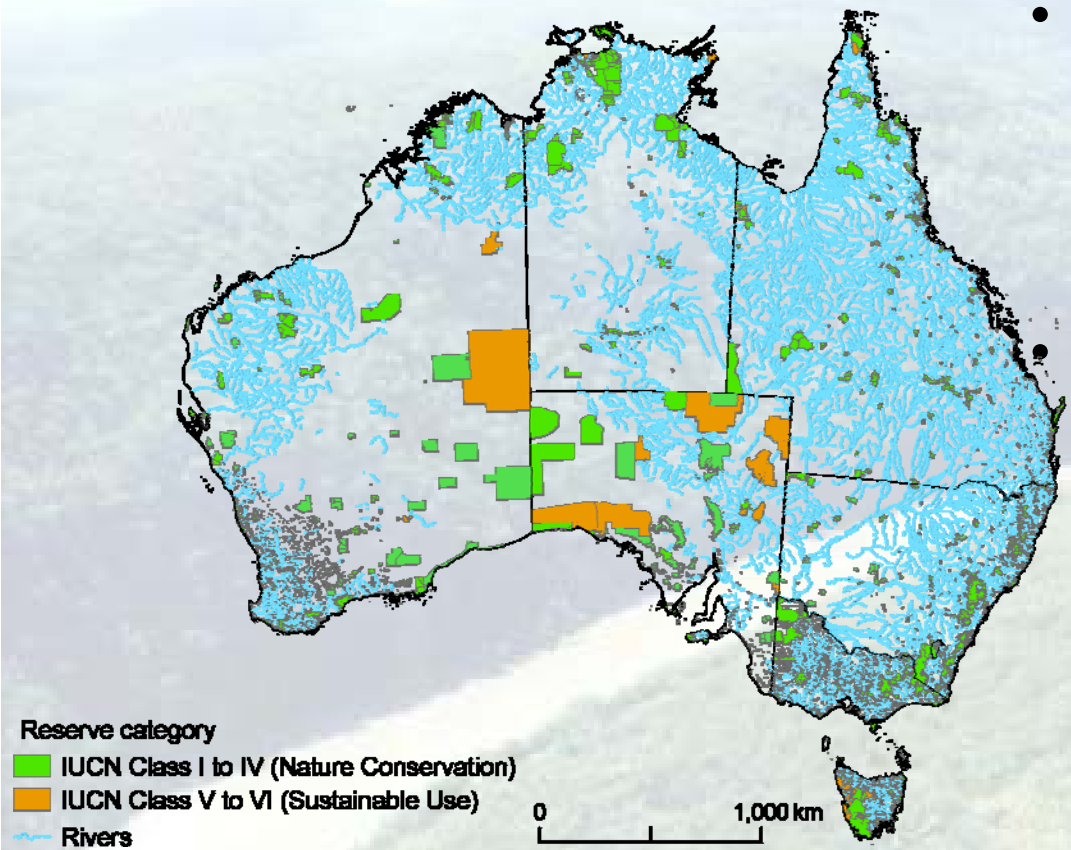
THE AUSTRALIAN NATIONAL RESERVE SYSTEM (NRS)

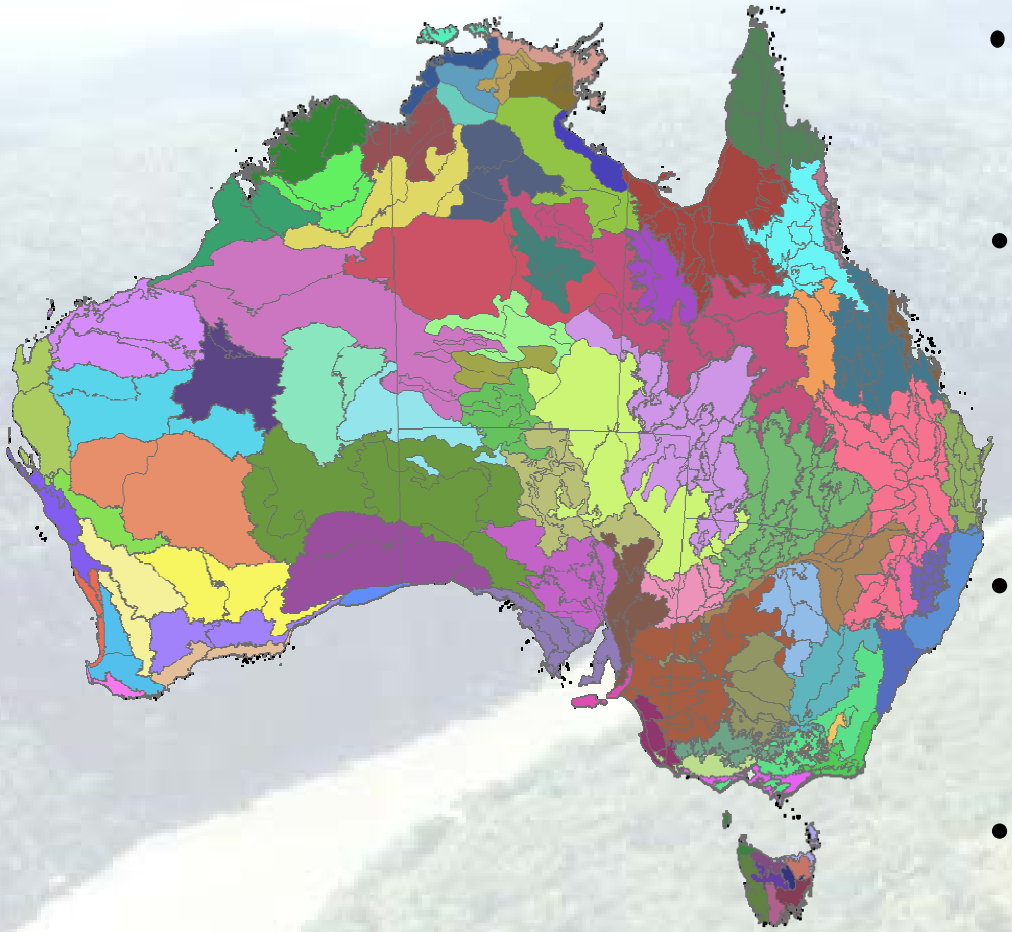


- Protected area systems of the states and territories developed independently

- NRS program established in 1992 “to assist with the establishment of a comprehensive, adequate and representative system of protected areas to conserve Australia's native biodiversity”

(NRS Guidelines, 1999

IBRA (Interim Biogeographic Regionalisation for Australia)



IBRA regions with sub-regional boundaries

- Planning framework for the NRS
  - 85 regions, 354 sub-regions (version 5)
- Regions variably derived using climate, landform, geology, vegetation and faunal distributions
- NRS Goal: 80% of extant (sub-) regions to be represented by 2015
- Terrestrial ecosystems focus
  - Biogeographic constraints for obligate freshwater taxa (e.g. drainage divides) not recognized

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INFORMATION NEEDS

Comprehensiveness and representativeness:

- description and mapping of all elements of freshwater biodiversity (at all levels) and where it occurs (in both space and time)

Adequacy:

- knowledge of how much and where it must be protected to ensure long term persistence
  - patterns of connectivity and linkages with the surrounding landscape
  - spatial surrogates for critical processes (hydrological, geomorphological, ecological and evolutionary)
  - threatening processes

INFORMATION REALITIES

- Mapping of freshwater environments, their contributing areas (surface and groundwater) and patterns of connectivity is incomplete
  - review focussed on rivers and streams
  - a new national stream and nested catchment reference system maps rivers and streams, their contributing areas (surface drainage) and patterns of connectivity

ASSESSING COMPREHENSIVENESS

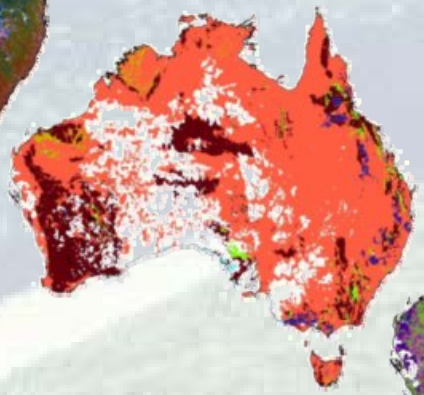
- No complete, national inventory of freshwater biota
  - surveys focus on bio-assessment needs (fish, macroinvertebrates)
  - most often in disturbed streams
- River ecosystems delineated continent-wide by classifying and mapping River Environment Types
  - attributes describing key landscape factors that drive river ecosystem patterns and processes
  - compared 2 classification approaches

RIVER ENVIRONMENT TYPES 1

Hierarchically combined 10 group classifications of stream segments

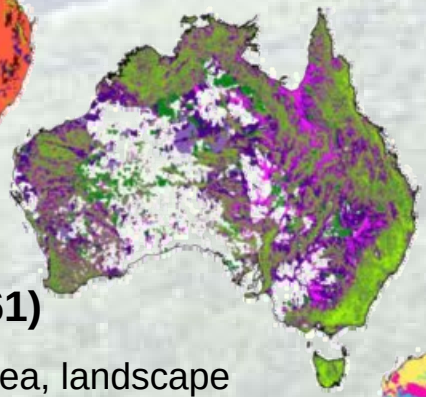
Level 1: Climate (10) (Annual means and extremes of rainfall and temperature, radiation, rainfall erosivity, growth index)

Level 2: Catchment Water Balance-"Flow" (81)
(Annual and seasonal means, inter and intra- year variability, snow contribution)



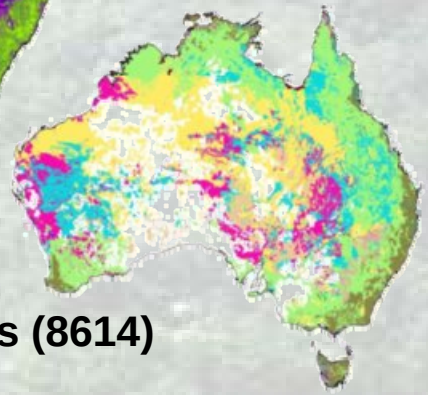
Level 3: Geology (420)

(nutrient supply potential, alkalinity,grainsize,hardness)



Level 4: Topography (2361)

(catchment shape and area, landscape position, valley confinement, slope, relief ratio)



Level 5: Vegetation class (8614)

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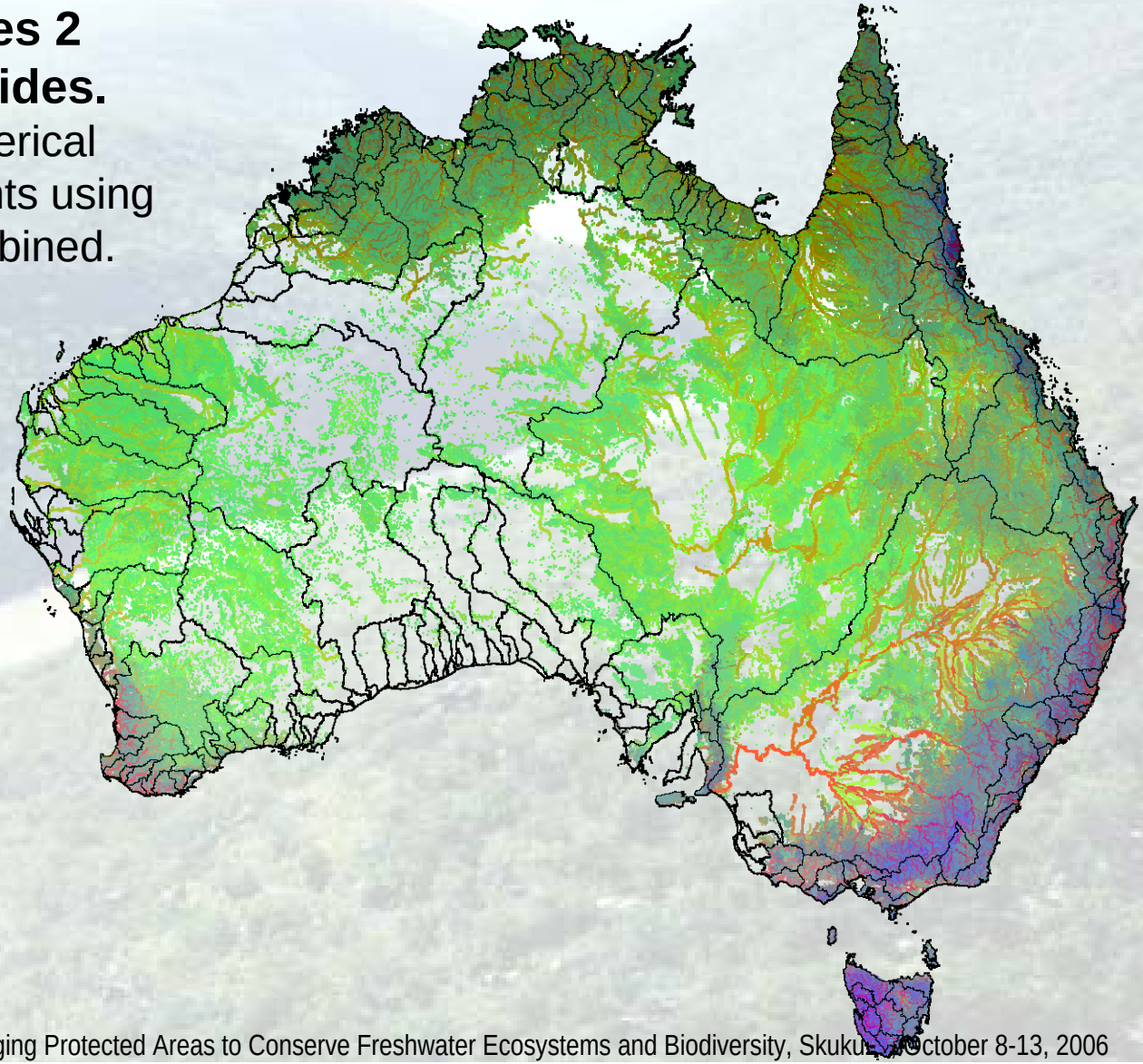
RIVER ENVIRONMENT TYPES 2
Single combined classification

River Environment Types 2 with major drainage divides.
Types were defined by numerical clustering of stream segments using all landscape attributes combined. Colours are indicative of the similarity between groups.

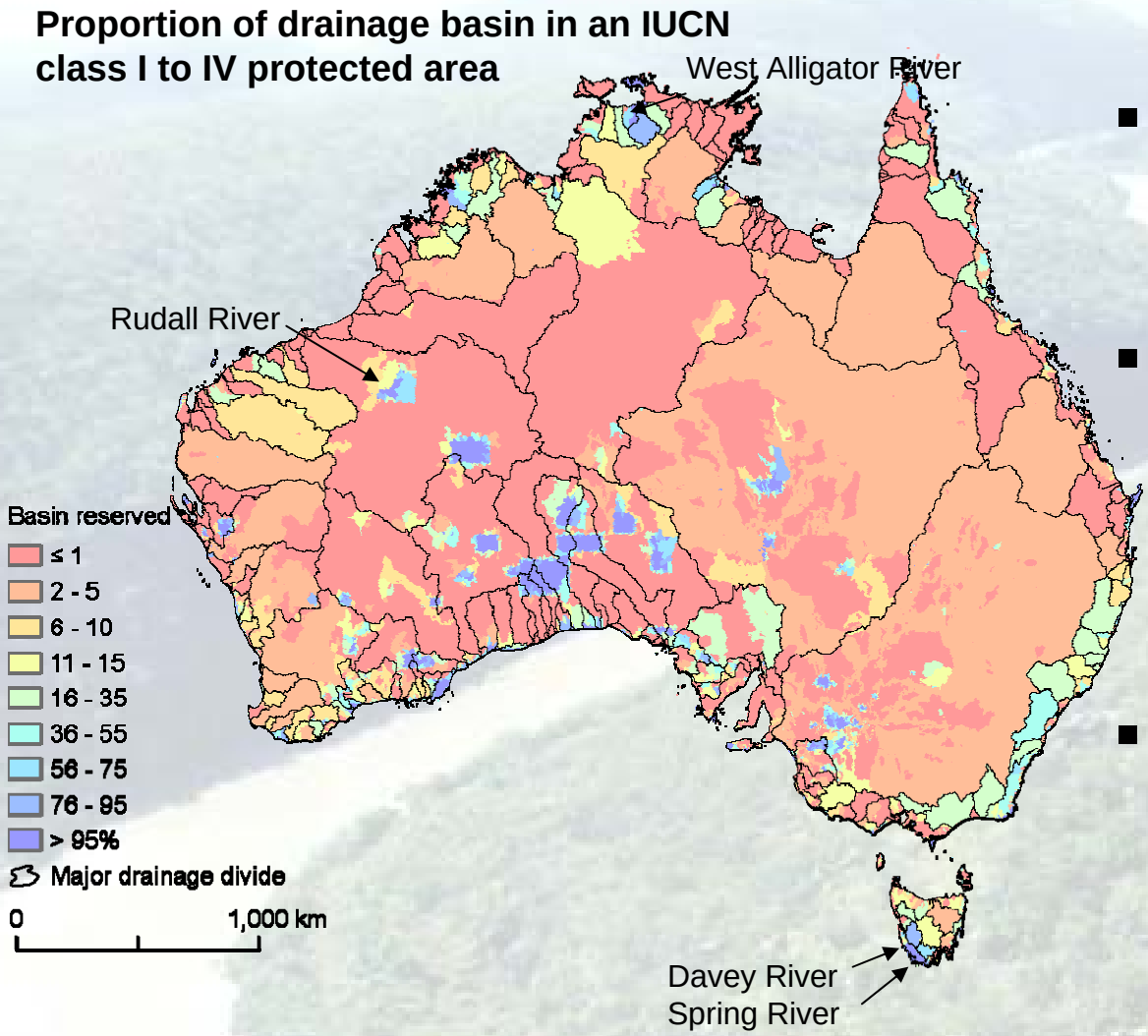


MEASURING ADEQUACY

- Little is known of the requirements for long term persistence of most Australian freshwater biota
  - Adequacy measured with simple percentage targets, adjusted for natural rarity and vulnerability (Pressey and Taffs, 2001) and the degree of replication
  - Threatening processes indicated by indices that characterise the intensity and extent of human activities at both local and catchment scales (Stein et al. 2002)
    - River Disturbance Index (RDI) indicates overall disturbance (instream and catchment) - RDI threshold indicates extant River Environment Types

RESULTS

PROTECTED STREAMS AND BASINS

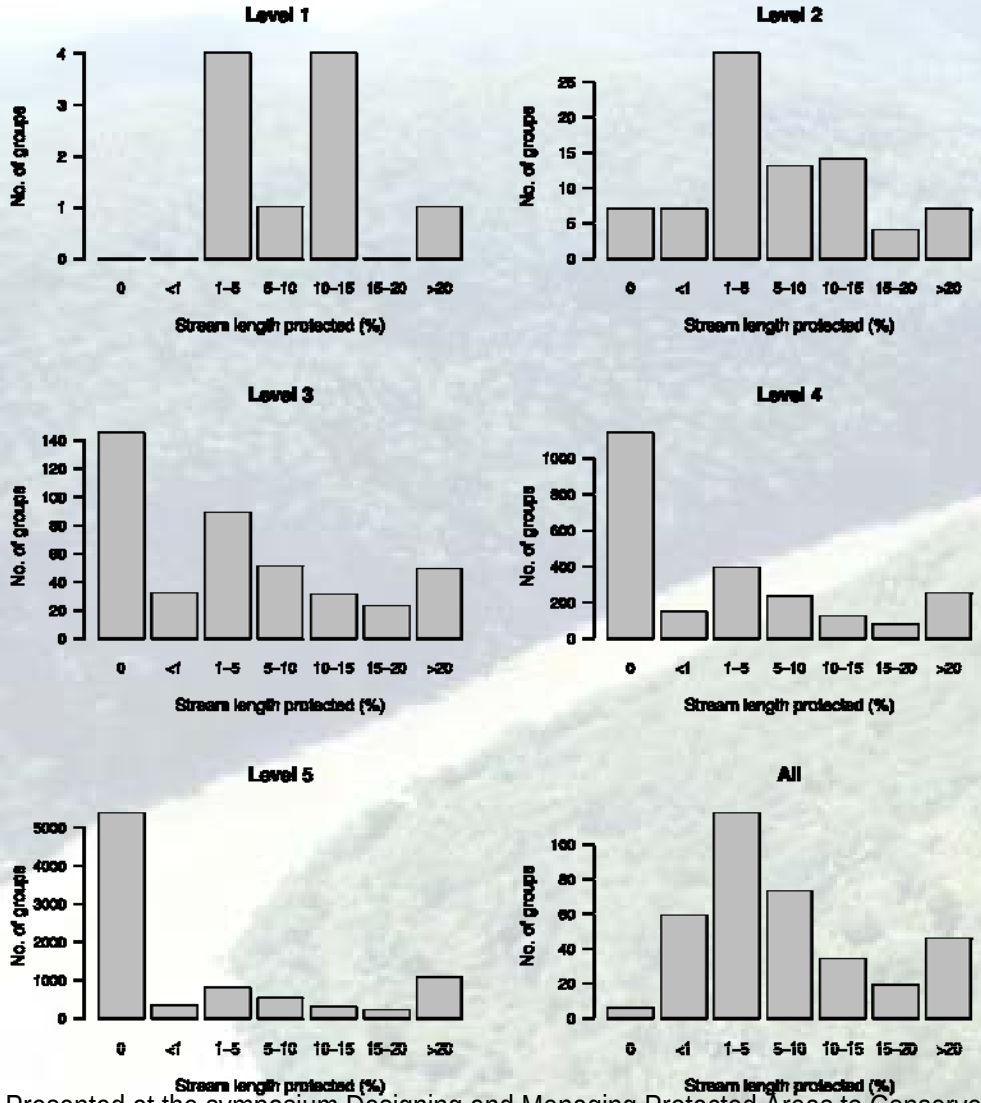


- 190,000 (6.7%) of 2.8M km of stream in an IUCN I to IV protected area
- Nearly half of this length potentially threatened by major instream barriers and/or has unprotected headwater sections
- Entire river systems rarely protected - only 4 basins with area > 500km^2 protected from source to outlet

RESULTS: COMPREHENSIVENESS

RIVER ENVIRONMENT TYPES

Proportion of stream length within an IUCN class I to IV protected area



- Many of the hierarchically defined types represented poorly or not at all – more so at finer levels of partitioning
- Few types > 15% of stream length protected
- Types from the combined classification are relatively better represented – but these are also more heterogeneous

RESULTS: COMPREHENSIVENESS

RARE AND THREATENED ECOSYSTEMS

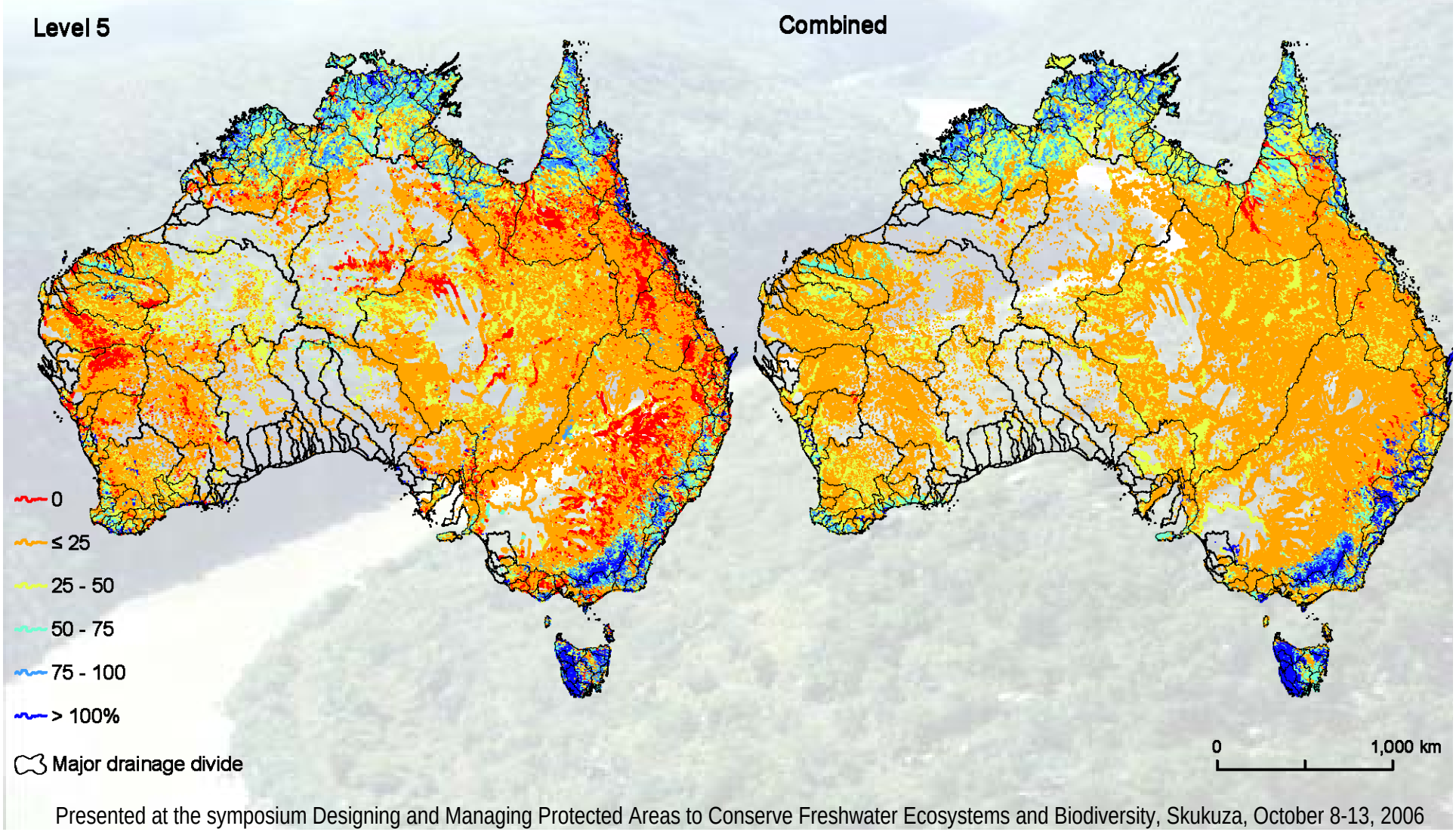
Numbers of rare, threatened and endangered types represented within an IUCN class I to IV protected area

	Level 5	Combined
Rare	1585 (6934)	8 (14)
Threatened	17 (51)	5 (5)
Endangered	30 (116)	6 (6)

- Status assigned using NRS criteria developed for forest types
- Rare: occupies area < 1000ha
  - total sub-catchment area of type
  - large proportion of Level 5 types
- Threatened: < 30% original extent
  - River Disturbance Index (RDI) threshold used to identify extant examples of River Environment Types
- Endangered: < 10% original extent

RESULTS: ADEQUACY

PROGRESS TOWARDS CONSERVATION TARGETS



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RESULTS: ADEQUACY

REPLICATION OF RIVER ENVIRONMENT TYPES

Types protected in more than one drainage basin

Number of types	Level 5	Combined
Represented in NRS at least once	3242	349
Occurs in > 1 drainage basin	2843	345
Represented in NRS from > 1 drainage basin	1745	330
Total	8614	355

ISSUES FOR FUTURE REVIEWS 1:
REDUCING UNCERTAINTY

- Spatial data uncertainty
  - compromises on data quality and consistency to achieve continental coverage
  - variety of map scales (1:100,000 to 1:2,500,000)
  - errors and artefacts e.g. spurious River Environment Types?
- Applicability of NRS rare and threatened criteria originally developed for forest types?
- Classifying River Environment Types
  - effect of classification method and numbers of types on outcomes
  - characterizing landscape processes
    - e.g. attributing the influence of catchment geology (dominant or areal proportions of mapping units or process models?)

ISSUES FOR FUTURE REVIEWS 2:
CHOOSING BIODIVERSITY SURROGATES

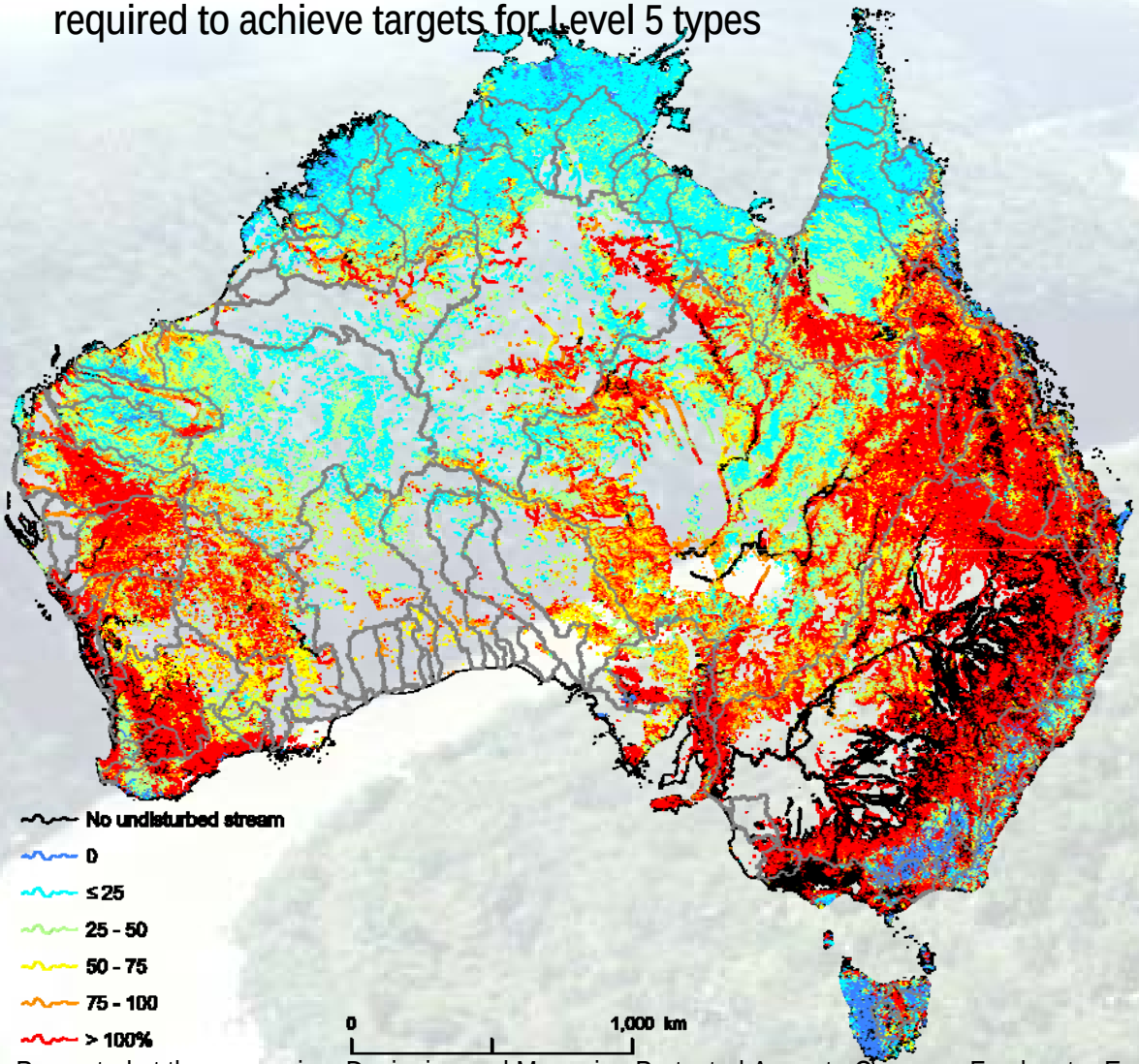
- Surrogacy value of River Environment Types
  - significant differences in community composition (fish, macroinvertebrates)
  - variability among types
- Biogeographic regionalisation(s) to represent influence of past barriers, glaciations etc.
  - for different functional groupings of taxa eg reflecting variable dispersal capabilities?
- Employing multiple biodiversity surrogates?
  - e.g. freshwater conservation planning project in Tasmania used geomorphic types, hydrological regions, modelled distributions biological assemblages

ISSUES FOR FUTURE REVIEWS 3:
MEASURING ADEQUACY

- Moving beyond single, arbitrary percentage targets
  - information needs prohibitive?
- Targets based solely on requirements for persistence?
  - vulnerability to assist in prioritizing conservation actions
- Measuring the adequacy of protection for ecological processes?

CONCLUSIONS

Proportion of undisturbed and unprotected length of stream required to achieve targets for Level 5 types



- NRS is currently neither comprehensive nor adequate for riverine biodiversity