

CRC Spatial Information (Project 2.07)

Australian Woody Vegetation Landscape Feature Generation from Multi-Source Airborne and Space-Borne Imaging and Ranging Data

Data primitives

Canberra, 21st February 2013

Data primitives

- Set of landscape metrics that are functional descriptors of woody vegetation
- In the context of the project:
 - Scalable up to the landscape level
 - of utility in Australian sclerophyll environments

Selection of Data primitives

Data primitives have been selected according to:

- 28 biological indicators in the Santiago declaration from the Montreal process working group
- Essential Climate Variables (*ISLSCP – GCOS ECVs*)
- Survey of Australian and New Zealand federal and state agencies, universities and NGOs

Data primitives. Santiago declaration

		Tree/canopy height	Canopy coverage	Canopy/Understorey	Functional type	Flora species (Canopy / understorey)	Ground cover	Stem density	Basal area	CWD	Chlorophyll	Discolouration	Crown dieback	Non-woody metric
	Needs analysis for the assessment of the 28 biological indicators (Miles, 2002) as described by the Santiago Declaration at the sixth meeting of the Montreal Process Working Group (Montreal Process Working Group, 1995). The needs analysis assumes equal weight to each indicator. Metrics used to derive non-woody indicators are not included in this table and are labelled in the last column accordingly.													
1	Extent of area by forest type relative to total forest area	x	x	x	x									
2	Extent of area by forest type and by age class or successional stage	x	x	x	x									
3	Extent of area by forest type in protected area categories	x	x	x	x									
4	Extent of areas by forest type in protected areas defined by age class or successional stage	x	x	x	x									x
5	Fragmentation of forest types	x	x	x	x									
6	The number of forest dependent species					x	x							x
7	The status (rare, threatened, endangered, or extinct) of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment					x	x							x
8	Number of forest dependent species that occupy a small portion of their former range	x	x	x	x	x	x							x
9	Population levels of representative species from diverse habitats monitored across their range				x	x	x							x
10	Area of forest land and net area of forest land available for timber production	x	x	x	x			x	x					
11	Total growing stock of both merchantable and non-merchantable tree species on forestland available for timber production	x						x	x					
12	The area and growing stock of plantations of native and exotic species	x						x	x					
13	Annual removal of wood products compared to the volume determined to be sustainable	x						x	x					
14	Annual removal of non-timber forest products (e.g. fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable													x
15	Area and percent of forest affected by processes or agents beyond the range of historic variation, e.g. by insects, disease, competition from exotic species, fire, storm, land clearance, permanent flooding, salinization, and domestic animals	x	x	x		x	x	x	x		x	x	x	
16	Area and percent of forest land subjected to levels of specific air pollutants (e.g. sulfates, nitrate, ozone) or ultra violet B that may cause negative impacts on the forest ecosystem													x
17	Area and percent of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g. soil, nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as nematodes, arboreal epiphytes, beetles, fungi, wasps, etc.)				x	x	x			x	x	x	x	x

Data primitives. Santiago declaration

	Needs analysis for the assessment of the 28 biological indicators (Miles, 2002) as described by the Santiago Declaration at the sixth meeting of the Montreal Process Working Group (Montreal Process Working Group, 1995). The needs analysis assumes equal weight to each indicator. Metrics used to derive non-woody indicators are not included in this table and are labelled in the last column accordingly.	Tree/canopy height	Canopy coverage	Canopy/Understorey	Functional type	Flora species (Canopy / understorey)	Ground cover	Stem density	Basal area	CWD	Chlorophyll	Discolouration	Crown dieback	Non-woody metric
18	Area and percent of forest land with significant soil erosion						x							x
19	Area and percent of forest land managed primarily for protective functions, e.g. watersheds, flood protection, riparian zones													x
20	Percent of stream kilometres in forested catchments in which stream flow and timing has significantly deviated from the historic range of variation													x
21	Area and percent of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties													x
22	Area and percent of forest land with significant compaction or change in soil physical properties resulting from human activities						x							x
23	Percent of water bodies in forest areas (e.g. stream kilometres, lake hectares) with significant variance of biological diversity from the historic range of variability													x
24	Percent of water bodies in forest areas (e.g. stream kilometres, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals(electrical conductivity), sedimentation or temperature change													x
25	Area and percent of forest land experiencing an accumulation of persistent toxic substances													x
26	Total of forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age class, and successional stages	x	x	x	x			x	x	x				
27	Contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon (standing biomass, coarse woody debris, peat and soil carbon)	x	x	x	x			x	x	x				
28	Contribution of forest products to the global carbon budget	x	x	x	x			x	x					x
	SCORE	14	11	11	12	6	8	8	8	3	2	2	2	17

Data primitives. Essential climate variables

The Essential Climate Variables

Domain

Essential Climate Variables

Atmospheric
(over land, sea and ice)

Surface: Air temperature, precipitation, air pressure, surface radiation budget, wind speed and direction, water vapour.

Upper air: Earth radiation budget (including solar irradiance), upper air temperature (including MSU radiances), wind speed and direction, water vapour, cloud properties.

Composition: Carbon dioxide, methane, ozone, other long-lived greenhouse gases, aerosol properties.

Oceanic

Surface: Sea surface temperature, sea surface salinity, sea level, sea state, sea ice, currents, ocean colour (for biological activity), carbon dioxide partial pressure.

Sub-surface: Temperature, salinity, currents, nutrients, carbon, ocean tracers, phytoplankton.

Terrestrial

River discharge, water use, ground water, lake levels, snow cover, glaciers and ice caps, permafrost and seasonally-frozen ground, albedo, land cover (including vegetation type), fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), biomass, fire disturbance, soil moisture.

ISLSCP – GCOS ECVs

Data primitives. Essential climate variables

Terrestrial essential climate variables

- Cover type & extent
- Phenology
- FAPAR)
- Leaf area index (LAI)
- Disturbance – Degradation: type/extent/intensity
- Biomass
- Net primary productivity

ISLSCP – GCOS ECVs

Data primitives. Monkey survey

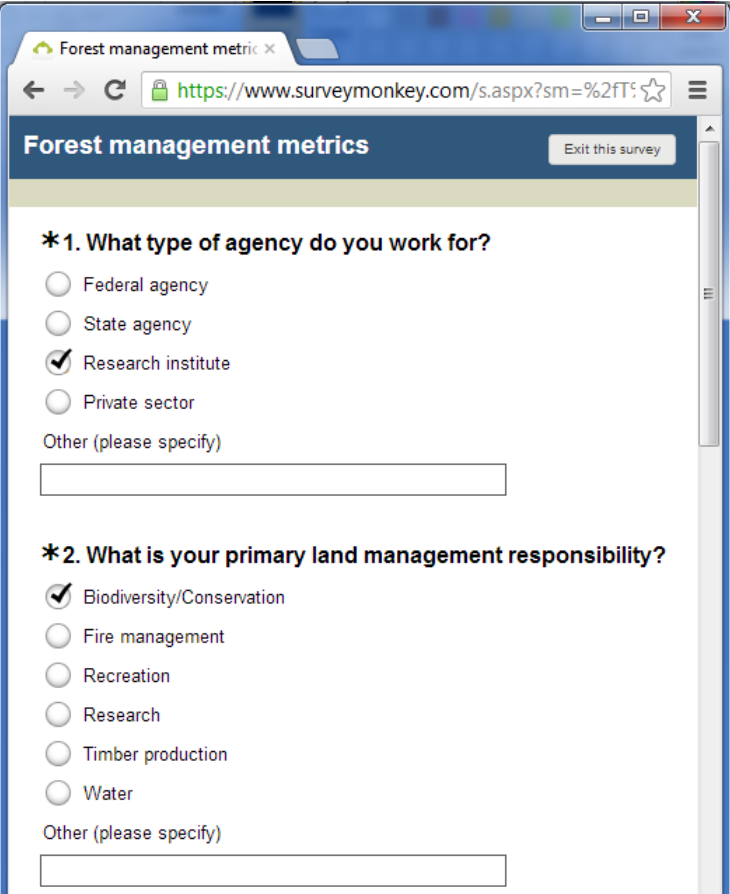
SurveyMonkey web survey
(www.surveymonkey.com)

Sent in May 2012

Sent to 81 people (32 responded)

Representing a variety of
agencies

- Federal agencies
- State agencies
- Universities
- NGOs



The screenshot shows a web browser window with the URL <https://www.surveymonkey.com/s.aspx?sm=%2Ft5>. The survey title is "Forest management metrics" and there is an "Exit this survey" button. The survey contains two questions:

***1. What type of agency do you work for?**

- Federal agency
- State agency
- Research institute
- Private sector
- Other (please specify)

***2. What is your primary land management responsibility?**

- Biodiversity/Conservation
- Fire management
- Recreation
- Research
- Timber production
- Water
- Other (please specify)

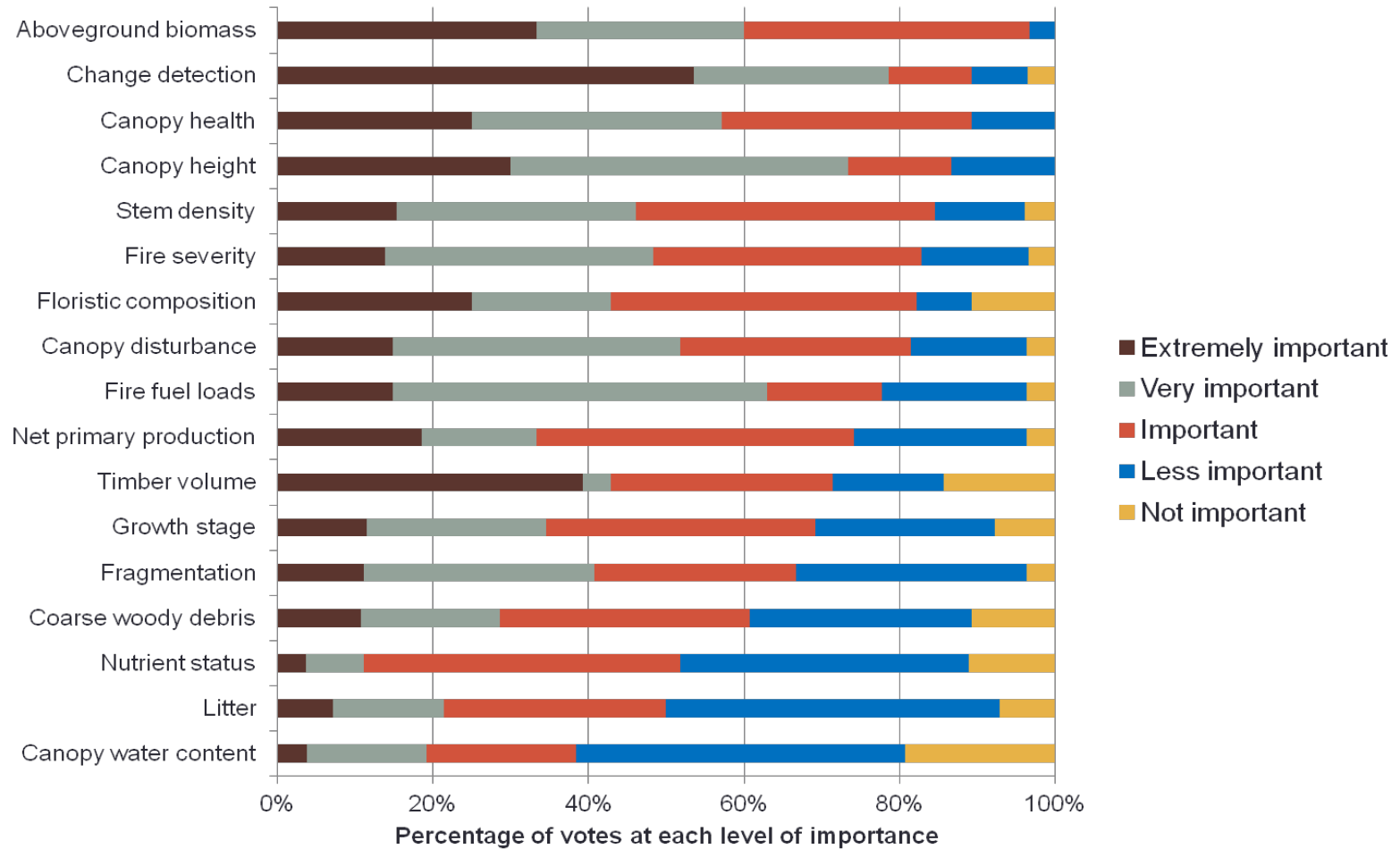
Data primitives. Survey respondents

Primary responsibility \ Employment type	Federal agency	State agency	Research institute	Private sector	Total
Timber production	1	5	1	1	8
Biodiversity/ Conservation	1	7	-	1	9
Water	1	-	-	-	1
Fire management	-	2	-	-	2
Research	2	3	6	1	12
Total	5	17	7	3	32

Data primitives. Importance of attributes

Forest attribute	Total
Tree height	14
Forest condition and health	11
Density of tree crowns (LAI or FPC)	10
Species/type mapping	10
Change detection	9
Forest cover extent	8
Fire frequency and severity	8
Timber volumes	5
Vertical foliage density profile	5
Biomass/carbon	5
Basal area	4
Productivity	4
Growth stage mapping	3
Canopy disturbance	3
Fragmentation	3

Data primitives. Attribute ranking



CRC SI 2.07. Data primitive selection

Vertical descriptors

Canopy height
Vertical structure

Horizontal descriptors

Tree diameter
Tree spacing
Forest cover/Leaf area
Course Woody Debris

Function/ Floristics

Forest typology
Foliage chemistry

CRC SI 2.07. Deliverable 1

Australian Woody Vegetation Landscape Feature Generation from Multi-Source Airborne and Space-Borne Imaging and Ranging Data (CRC-SI 2.07)



Deliverable 1. Literature review for determining optimal data primitives for characterising Australian woody vegetation and scalable for landscape-level woody vegetation feature generation.

- Metrics for woody landscape attribution
 - Definition
 - Characterisation
 - Methods and applications
 - Australian context
- Annex: Survey monkey

CRC SI 2.07. Data primitive selection

Are all those primitives scalable?

Can we create regional quantitative maps of all of them?

CRC SI 2.07. Data primitive selection

		Baseline /M&R	Spatial resolution	Direct/ Indirect	Auxiliary data needs	Accuracy
Vertical descriptors	Canopy height Vertical structure					
Horizontal descriptors	Tree diameter Tree spacing Forest cover/Leaf area Course Woody Debris					
Function/ Floristics	Forest typology Foliage chemistry					



Agreement on data primitives