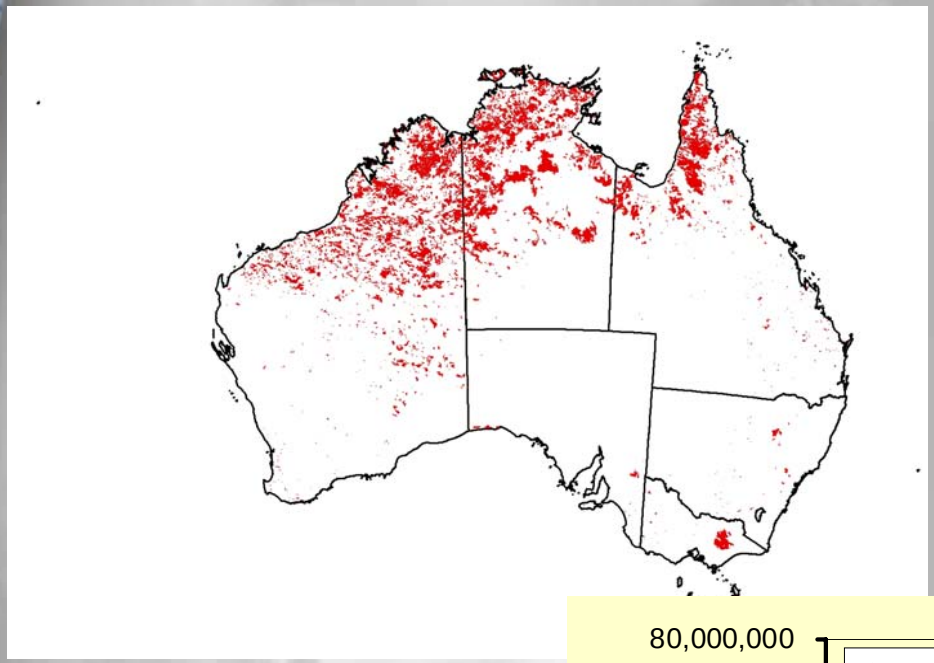
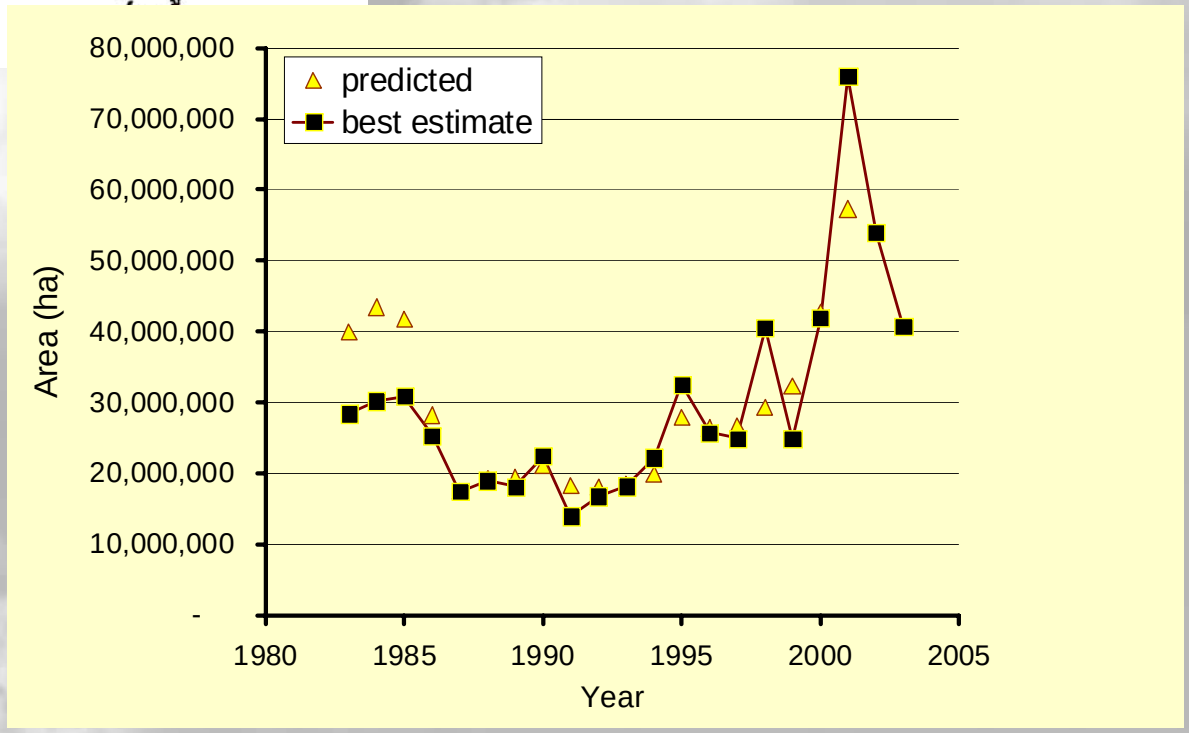
Inventory Methodology Issues and Developments



In 2006: 66 Mha

16% of NT,10% of WA, 6% of Qld.

8% of Australia



Outline

1. General background on inventories
2. Timeseries of emissions
3. New developments in IPCC methodology
    1. Adds a new dimension: TIME

Background (1)

Range of Inventories

- Total accounting- all sources and sinks (natural and anthropogenic)
- Anthropogenic emissions inventories
  - Air quality (air pollutants (CO, NOx,VOCs, aerosols, air toxics, POPS etc)
    - Corinair
    - National Pollutant Inventory
  - Greenhouse gases (CO_2, CH_4, N_2O, PFC, CO, NOx, VOCs)
    - IPCC
    - Country specific
  - Special purpose: detailed highly resolved activities
    - Mitigation accounting e.g. farm/industry inventories
    - Carbon credits/carbon offsets

Background (1)

IPCC/UNFCC Inventories

- Anthropogenic
  - Emissions associated with human activity
  - NOT natural emissions
- Time base - annual
- Area-base – national
- Gases
  - Direct i.e. Infra red absorbers (CO_2, CH_4, N_2O, PFC)
  - Indirect -> Ozone (CO, NOx, VOC)
  - Emissions weighted by GWP (CH_4=21; N_2O=310; CO_2=1)

Background (4)

Anthropogenic CO_2 is CO_2 that is added to the atmosphere due to human activity

- e.g. release of CO_2 from geological C
- Fossil fuels

BIOGENIC CO_2 is CO_2 cycles naturally through the biosphere. Only the human induced change is accounted

- Biogenic CO_2 a change in the mass of carbon stored in the ecosystem over time
  - forest clearing,
  - land-use change
- NOT CO_2 from forest fuels which are replaced by forest regeneration

Rules

- IPCC Revised 1996 Guidelines
- Kyoto
  - Apply until 2012

Good Practice Guidance, 2000, 2003

IPCC 2006 Guidelines

DOCUMENTS;

IPCC website - IPCC96, GPG, IPCC2006

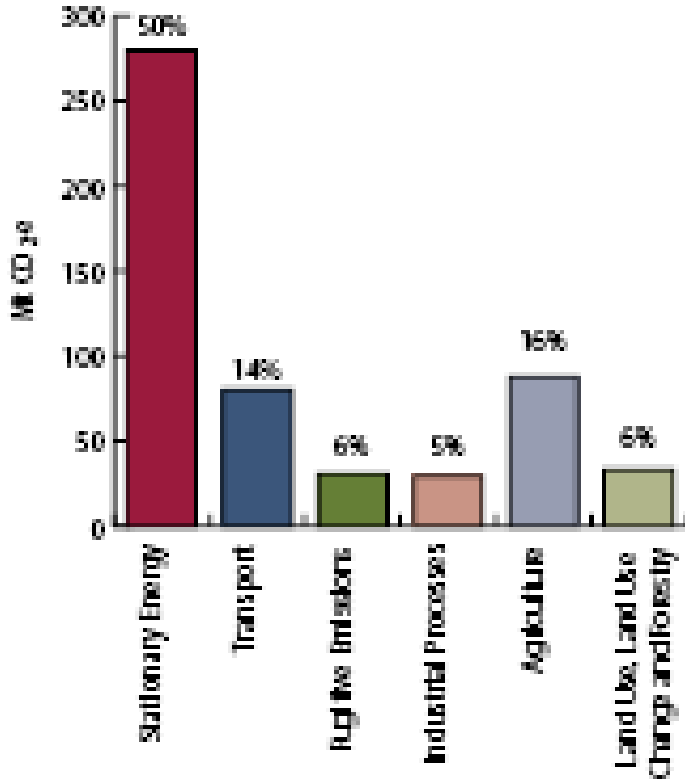
AGO website – NGGI methodology 2005

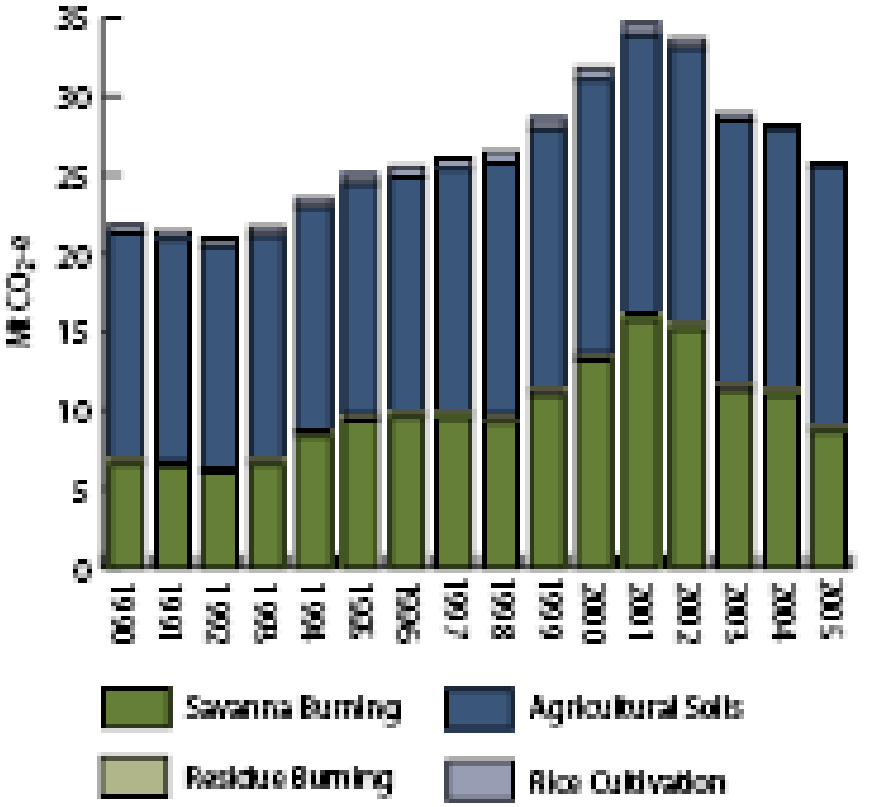
NGGI

Inventory facts

- Australia is the only annex 1 party for which fires, particularly Savanna fires, are a major emission source
- Currently reported in two places
  - Sector 4E (Agriculture): Savanna burning
  - Sector 5D (Land Use, Land use change and Forestry: Prescribed burning and wildfires
- ***The methods assume the systems are at equilibrium***

NGGI -2005 Emissions





NGGI: Atmospheric Composition issues

Savanna: Major emission source of many constituents

	Mass (Gg)	% National
CH_4	477	8%
N_2O	24	24%
NO_x	1410	44%
CO	18600	66%
VOC	1085	52%
Total C	**102198**	**85%**

- High inter-annual variability (CV= 45%)
- Large global contribution (16% total fire area in 2000)
- Significant proportion of GPP.

Emission = Activity * Emission factor

Emission = Fuel burned x emission factor

$Fuel_{burned}$ = Area x fuel load x combustion efficiency

Ideally:

- Fire areas (time resolved)
- Fuel loads (regional)
- Burning efficiencies (seasonal, regional)
  - patchiness, fuel classes
- Emission factors (seasonal, regional)
  - Fire intensity (i.e oxidation efficiency)

In practice:

annual, state means, global parameters

Fuel loads

Woodland -Central Arnhem Land (Russell-Smith et al.)

Forest type	%total area	*Fuel load (t ha^{-1})*			
		Fine fuel	Coarse fuel	Heavy fuel	Shrub
Eucalypt open forest	6%	5.9	1.3	18.9	0.6
Eucalypt open woodland	52%	3.9	1.1	4.0	0.9
Sandstone woodland	20%	6.0	1.0	12.9	0.6
Sandstone heath	23%	4.0	0.4	4.0	0.7
Weighted mean		**4.4**	**0.9**	**6.6**	**0.8**

Forests:

- ***Review by Kevin Tolhurst (~1991) of measured fuel loads from forestry departments, forest research in Universities, CSIRO etc***
- ***Supplemented by newer studies as they become available***

Burning efficiency

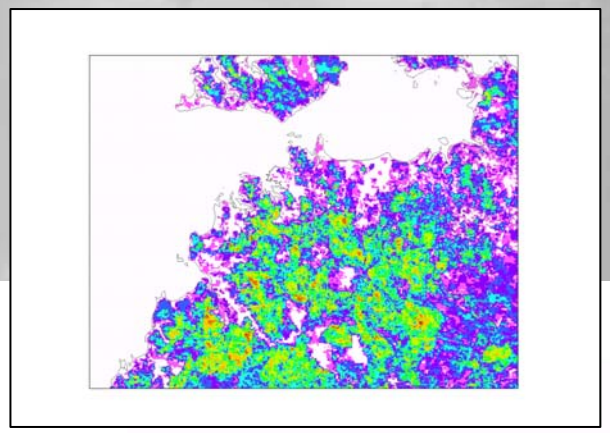
Woodland -Central Arnhem Land (Russell-Smith et al.)

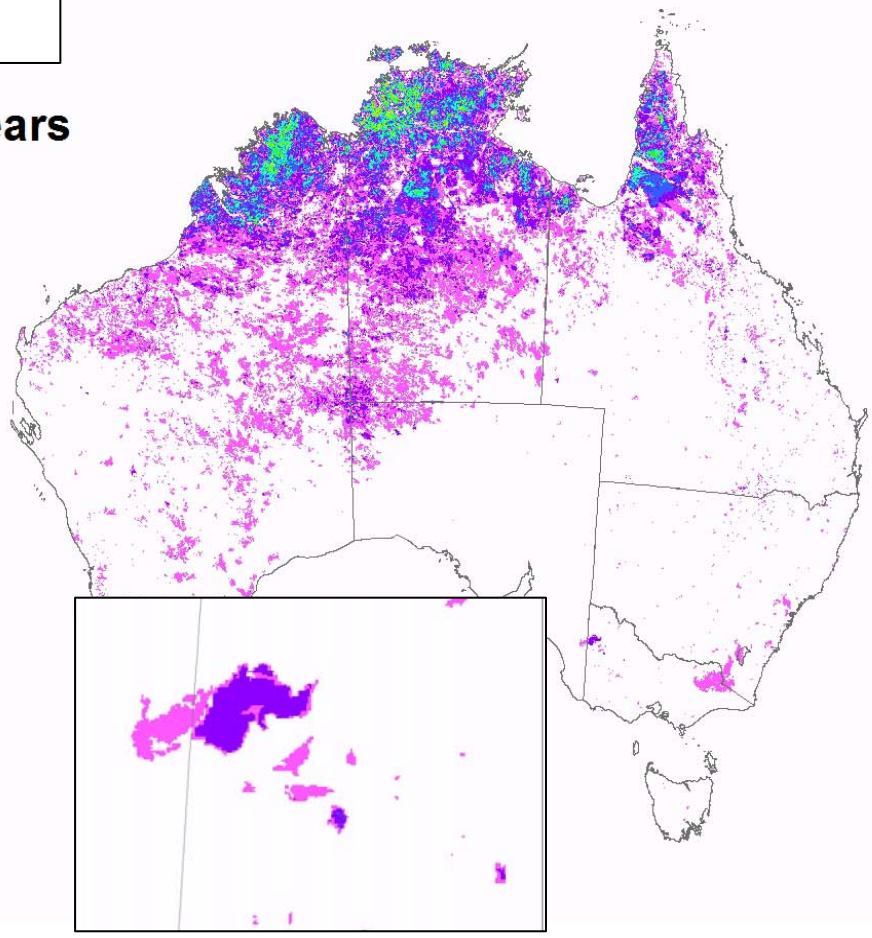
	%	Patchiness	*Pyrolysis efficiency*			
			Fine fuel	Coarse fuel	Heavy fuel	Shrub
Early season	5%	0.71	0.70	0.03	0.05	0.45
Mid season	20%	0.8	0.70	0.03	0.05	0.45
Late season	75%	0.84	1.00	0.25	0.25	0.75
weighted mean		0.83	**0.92**	**0.19**	**0.20**	**0.67**

Fine Fuels BE= 0.76, Coarse woody fuels= 0.24

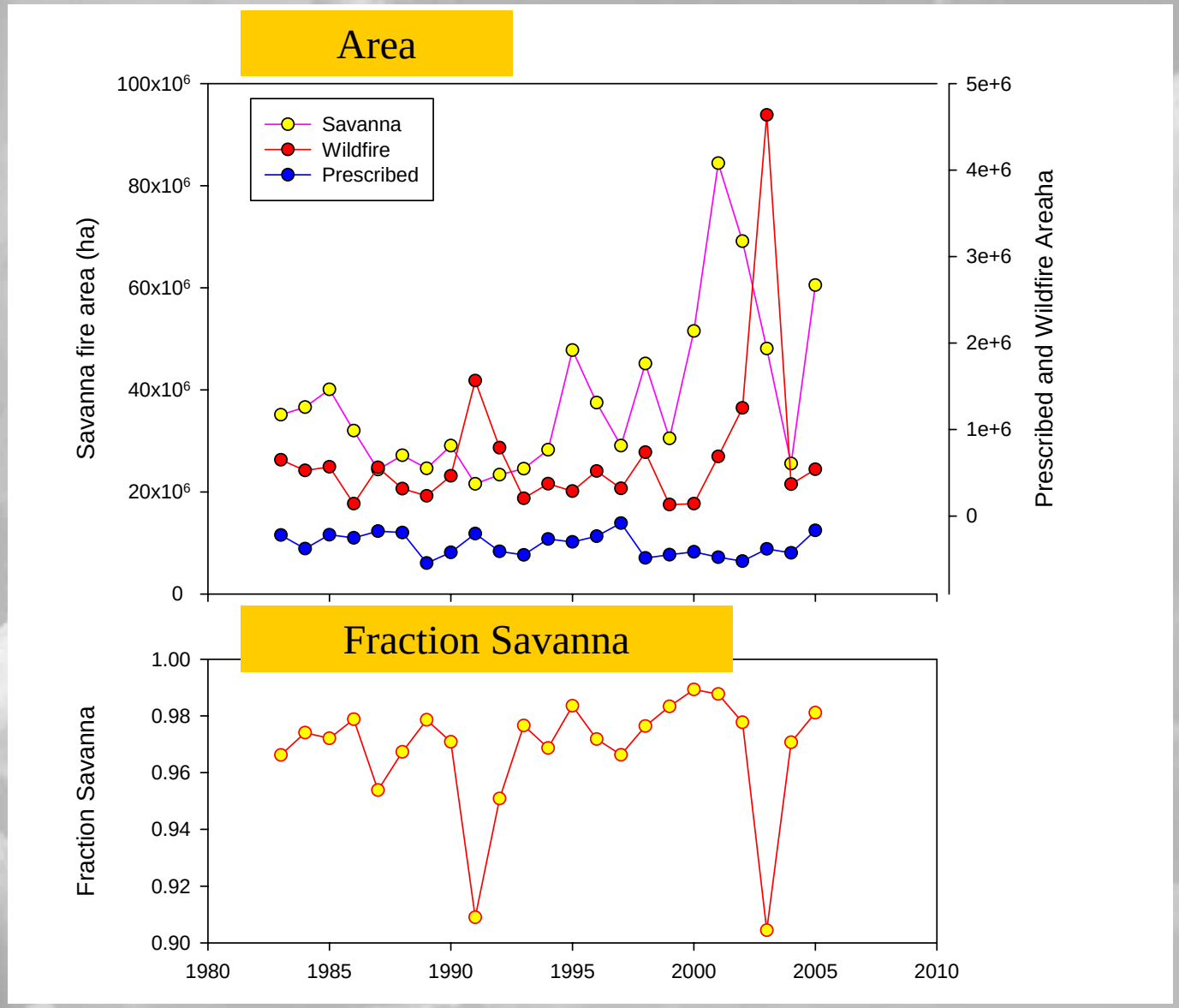
Not much change from 0.72/0.3

Fire frequency 1998 to 2006

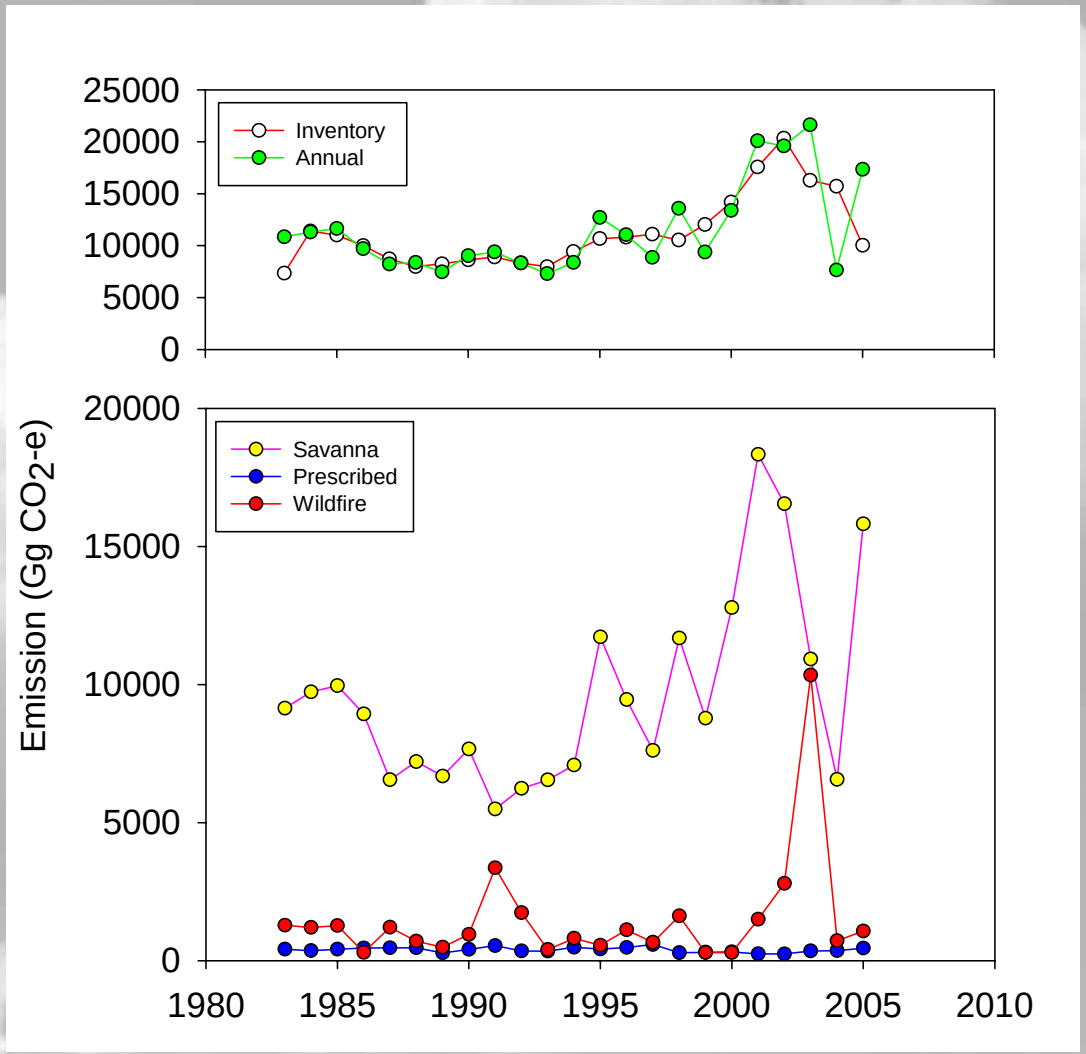




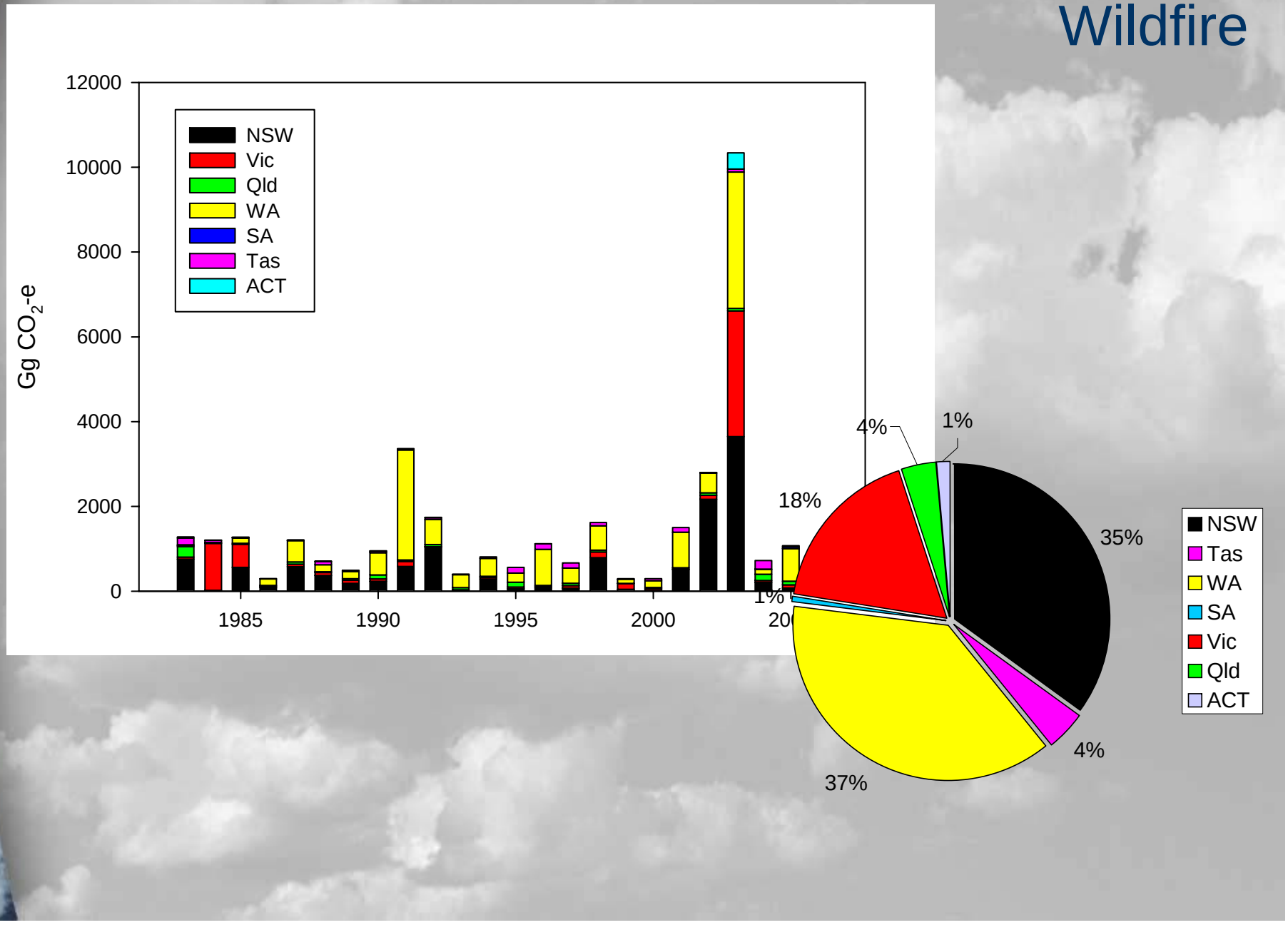
Fire Area


Area
Savanna
Wildfire
Prescribed
Savanna fire area (ha)
Prescribed and Wildfire Areaha
100x10⁶
80x10⁶
60x10⁶
40x10⁶
20x10⁶
0
5e+6
4e+6
3e+6
2e+6
1e+6
0
Fraction Savanna
Fraction Savanna
1.00
0.98
0.96
0.94
0.92
0.90
1980
1985
1990
1995
2000
2005
2010

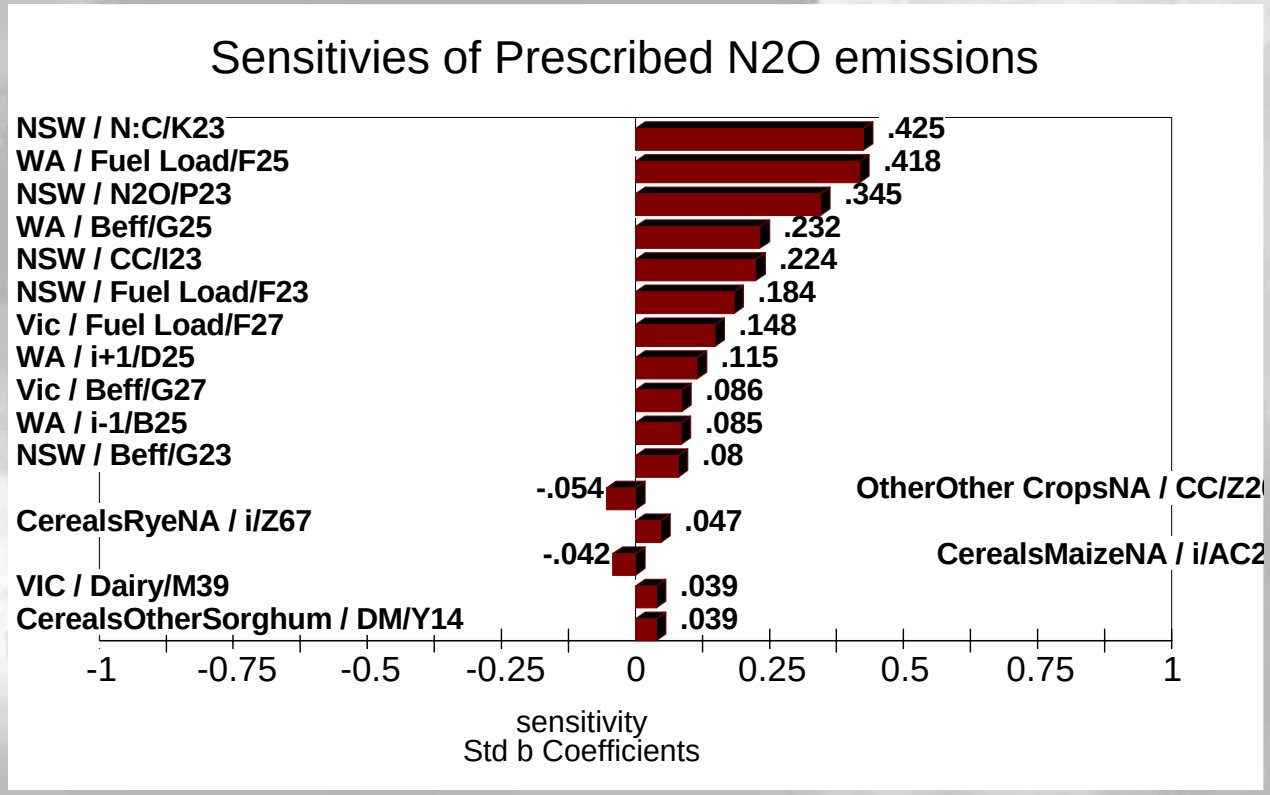
National Emission Timeseries



Wildfire

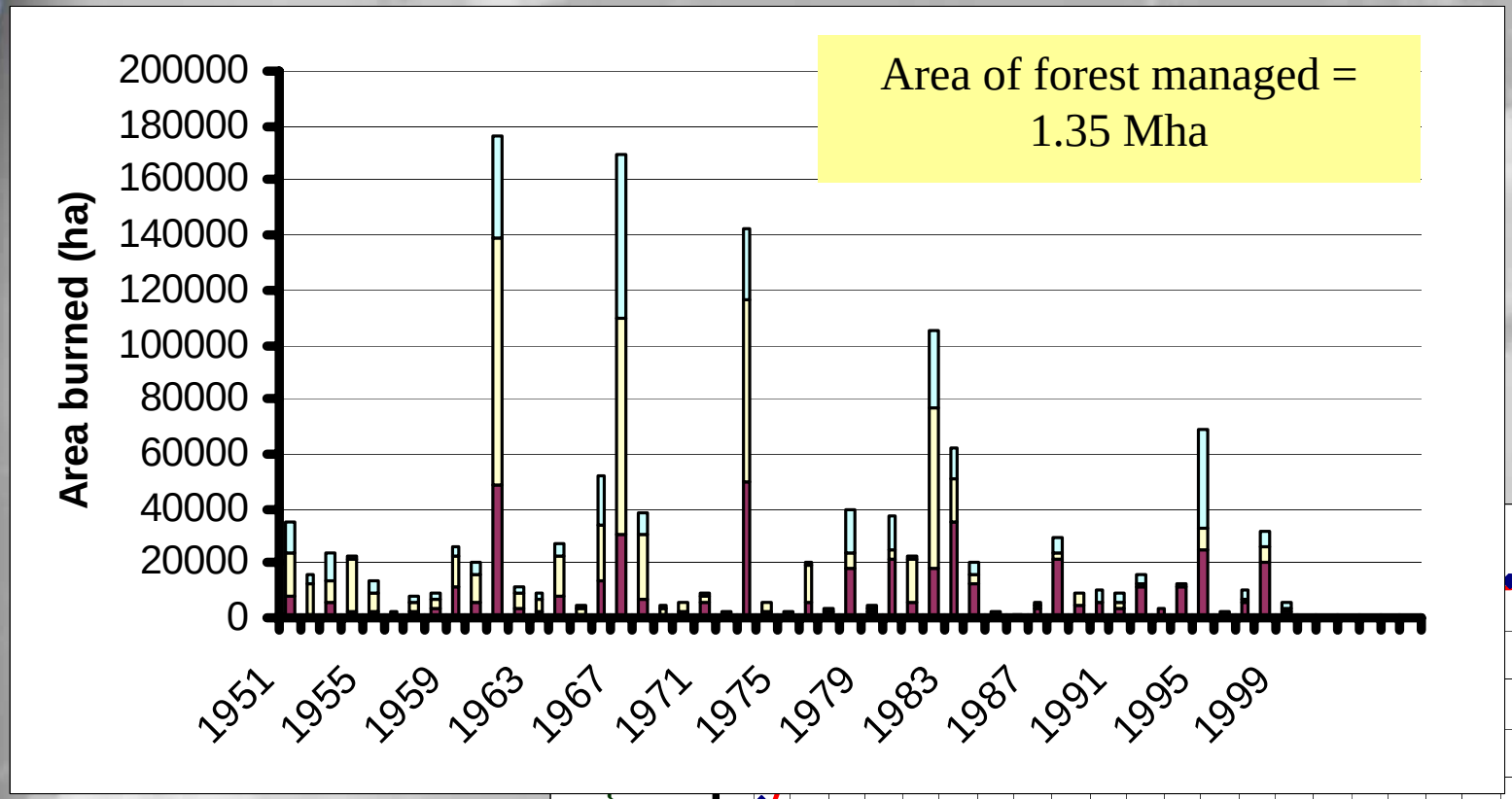

12000
10000
8000
6000
4000
2000
0
Gg CO_2-e
NSW
Vic
Qld
WA
SA
Tas
ACT
1985
1990
1995
2000
4%
1%
18%
35%
1%
4%
37%
NSW
Tas
WA
SA
Vic
Qld
ACT

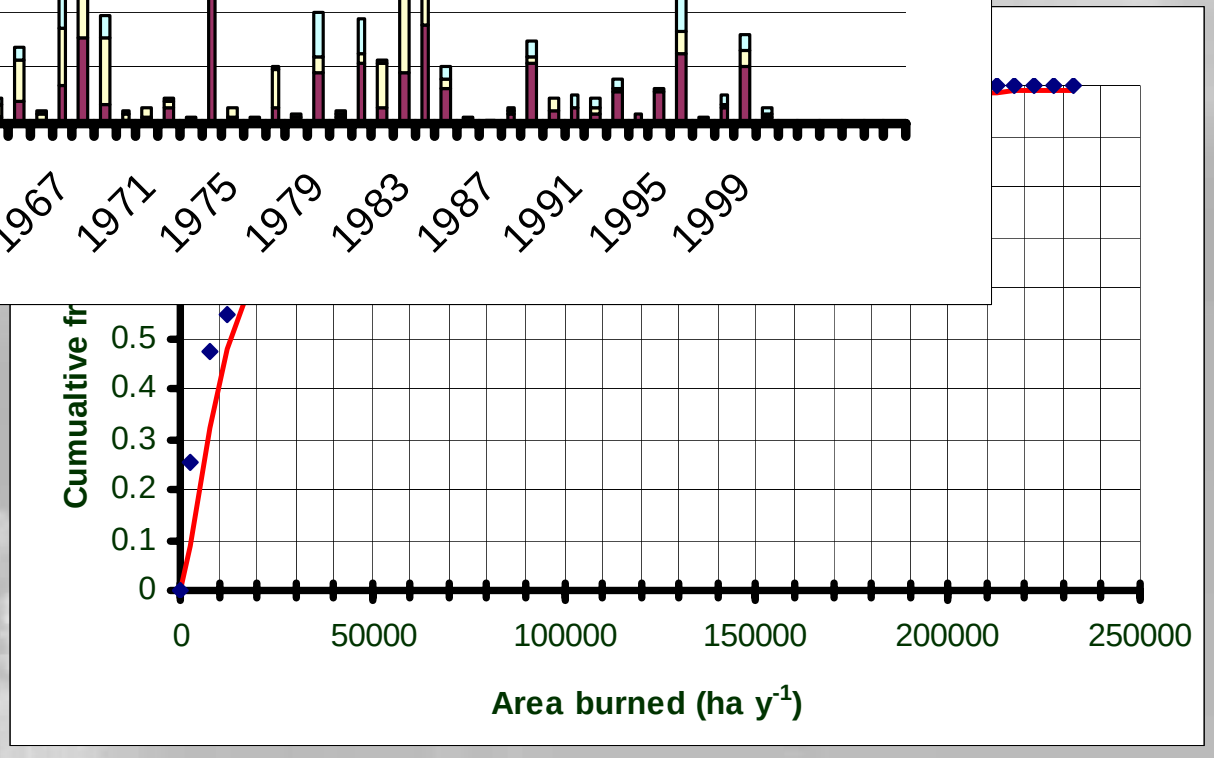
Uncertainties –N_2O emissions 1990



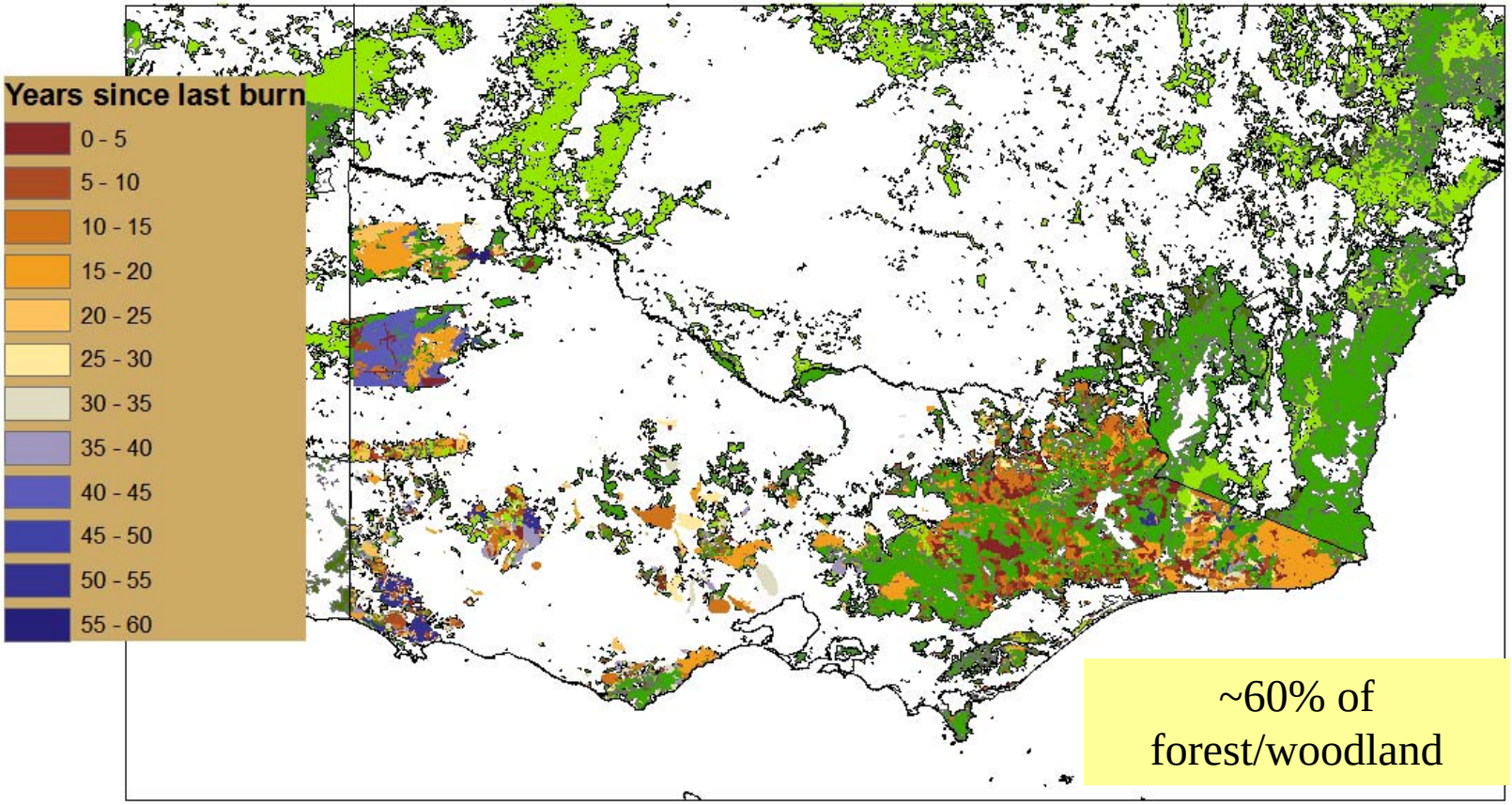
0.3 (0.1 – 0.7) Gg

Fire History in Tasmania





Fire History in Victoria 1940-1999



~60% of forest/woodland

Developments

2006

1990 Baseline emissions are declared

Inventory methodology is frozen until 2012

2006 IPCC Guidelines for GHG Inventories accepted by IPCC plenary

IPCC Annual review process for NGGI is formalised with independent expert review panels following formal IPCC review guidelines:

- Revisions to methodologies that deviate from GPG
- Require adjustments to emission estimates where errors, or deviations from good practice occur

Implications of 2006 Guideline

- Very comprehensive revision incorporating:
  - 2000 Good Practice Guidance
  - 2003 GPG for LULUCF
- Clear guidance (i.e. specification) of most details.
- For AgForestry&OtherLandUse (AFOLU)- a comprehensive C and N cycle philosophy

Tiers

- Tier 1 - default emissions factors and other parameters, minimal disaggregation, country specific activities
- Tier 2- country specific EFs & parameters, disaggregation to regions, industry classes etc., country specific activities
- Tier 3- high level of disaggregation, country specific data, mostly model based (e.g. NCAS)

Tier 2 +

- All parameters and EFs in open, peer- reviewed literature
- Annual activity data
- Verification of parameter values and emission estimates encouraged

Key Source Identification leads to pressure to move to a higher- tier methodology

Comprehensive guidance on

Data sources, QA/QC, Uncertainty estimation, Trends and Time series

For biomass combustion

- The basic emission algorithms remain
- But
  - Apply mostly to “managed land”
  - CO_2 is now accounted for by explicitly including dynamics of dead organic matter in Tier 2 and Tier 3 methodologies except where CO_2 emissions are removed within the same year (e.g. grasslands).
  - Tier 3 will account for changes in ecosystem structure, e.g. C pools such as soil C, post fire emissions etc

Concluding Issues

- Current emissions require verification. Savanna is looking good. Forest fires are less confident
- 2006 Guidelines-Improved dynamics
  - The impact of fires will be both emissions and uptake. It will have a long time constant, potentially centuries
  - Fire is a disturbance as complex for accounting as timber harvesting or land clearing
  - Attribution of fluxes will be strongly time dependent