PROGRAM B

Effects of vegetation type (via fire) on soil respiration and release of CO_2 to the atmosphere

M. E. Jenkins and M. A. Adams

Faculty of Agriculture, Food and Natural Resources, The University of Sydney, NSW

© BUSHFIRE CRC LTD 2010

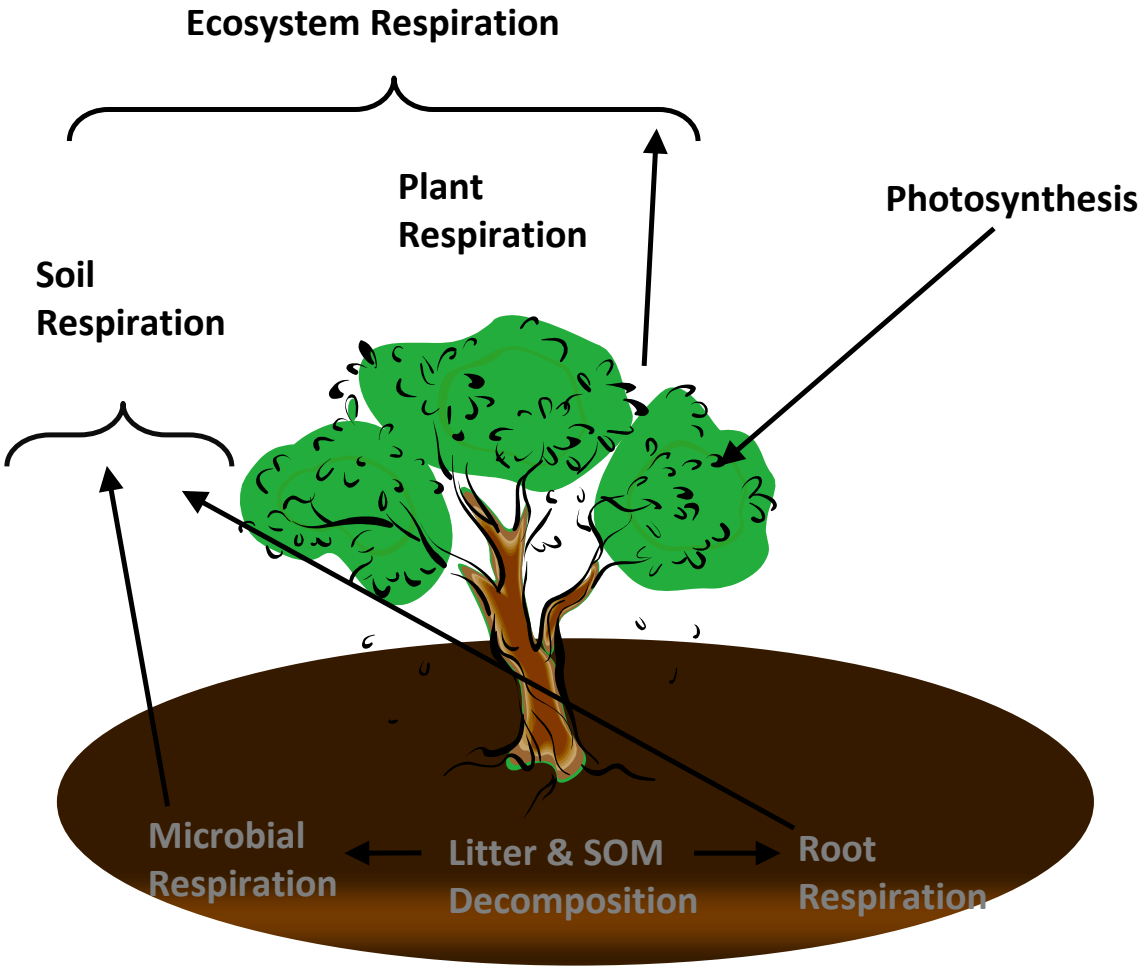
Introduction

What is soil respiration and why are we interested?

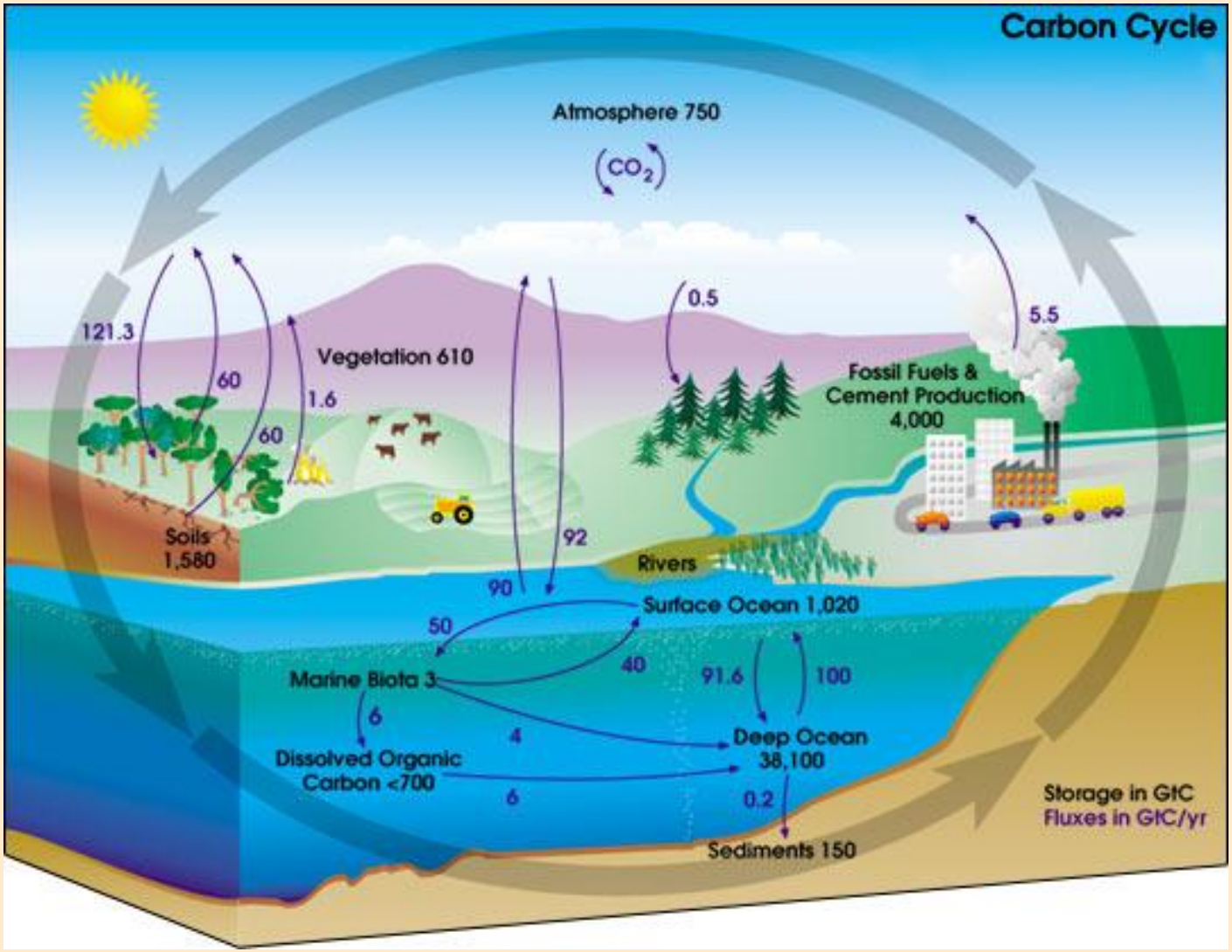
Factors that influence soil respiration

- Vegetation
- Temperature
- Moisture

© BUSHFIRE CRC LTD 2010



© BUSHFIRE CRC LTD 2010

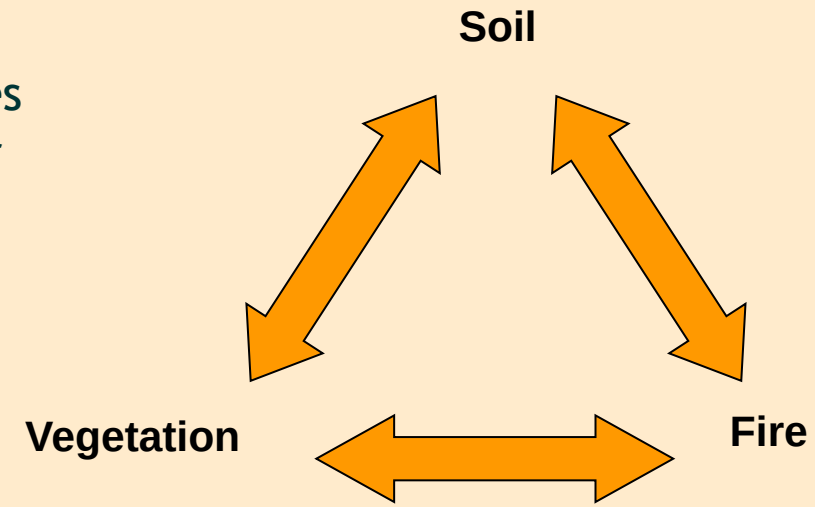


Carbon cycle: The annual flux of CO_2 in Gigatonne (Gt) or billions of tonnes between each of the Earth's reservoirs. NASA Earth Science Division.

© BUSHFIRE CRC LTD 2010

Fire Influences soil processes through:

- Distribution of vegetation types
- Composition and abundance of plant species
- Changes to litter inputs
- Increased soil temperatures
- Changes in the chemical composition of soil
- Changes to moisture content



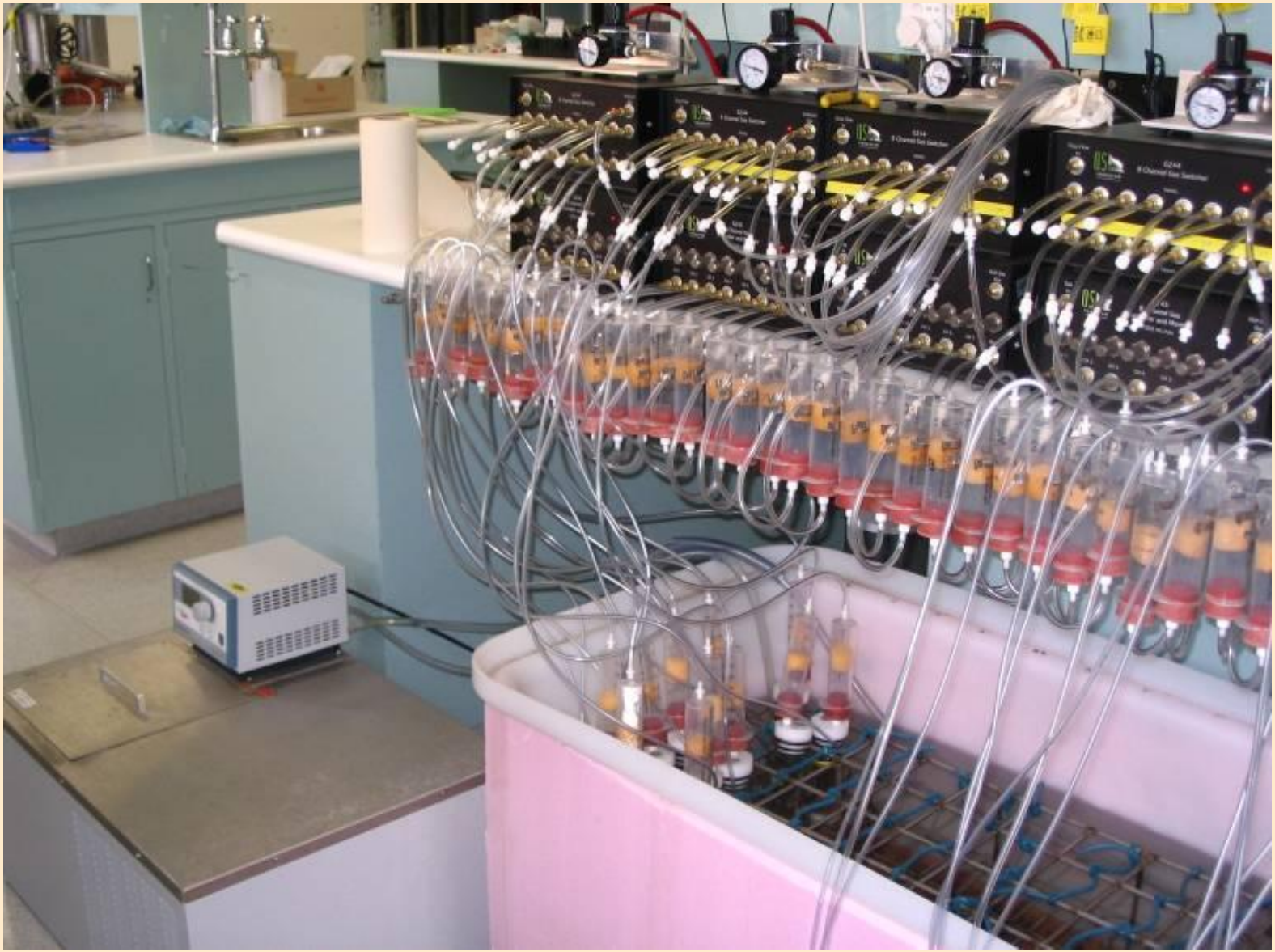
© BUSHFIRE CRC LTD 2010

Field and Laboratory experiments

Snowy Plains, NSW

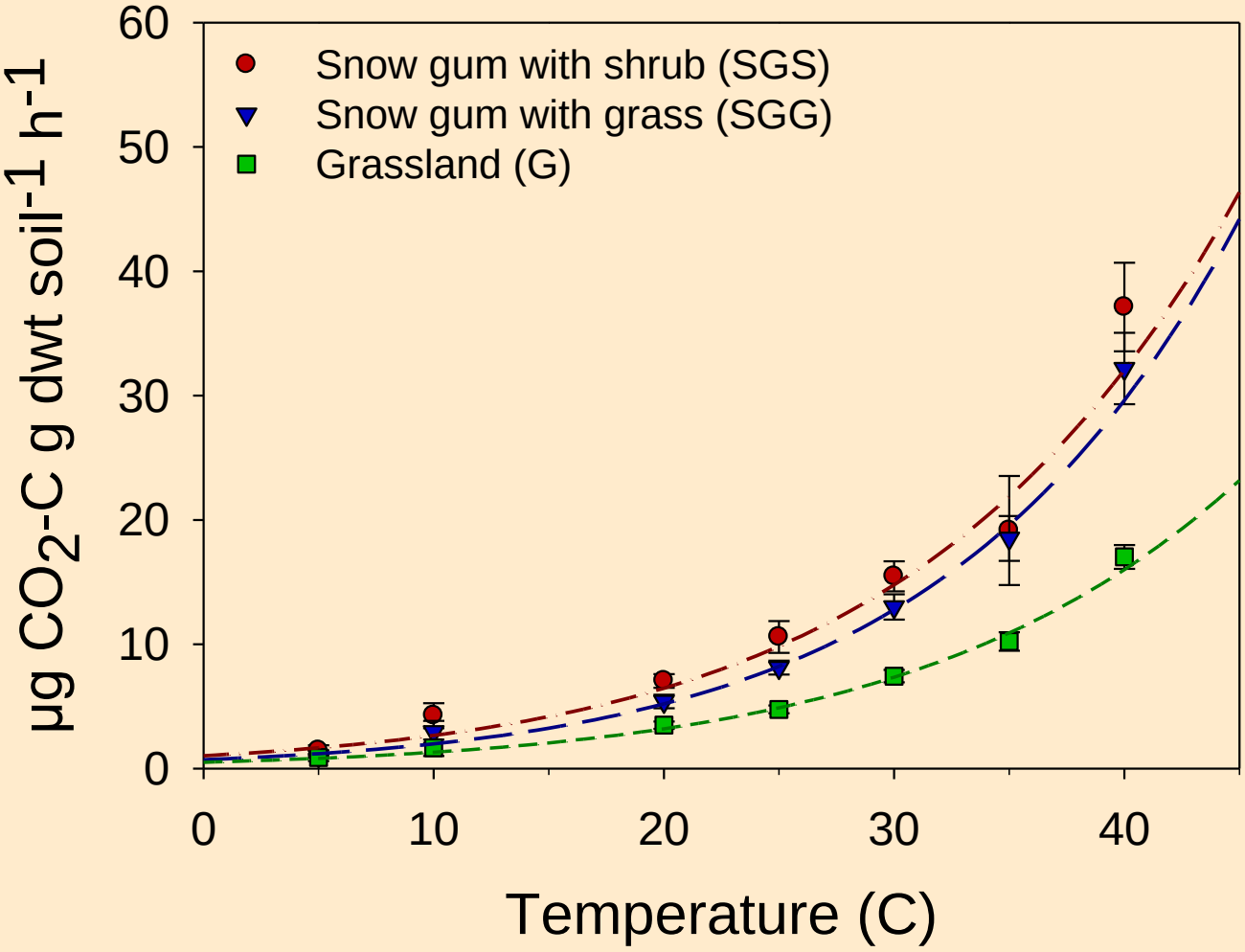
- Woodland
  - With a shrub Understorey
  - With a grassy Understorey
- Grassland

© BUSHFIRE CRC LTD 2010



© BUSHFIRE CRC LTD 2010

Soil Respiration



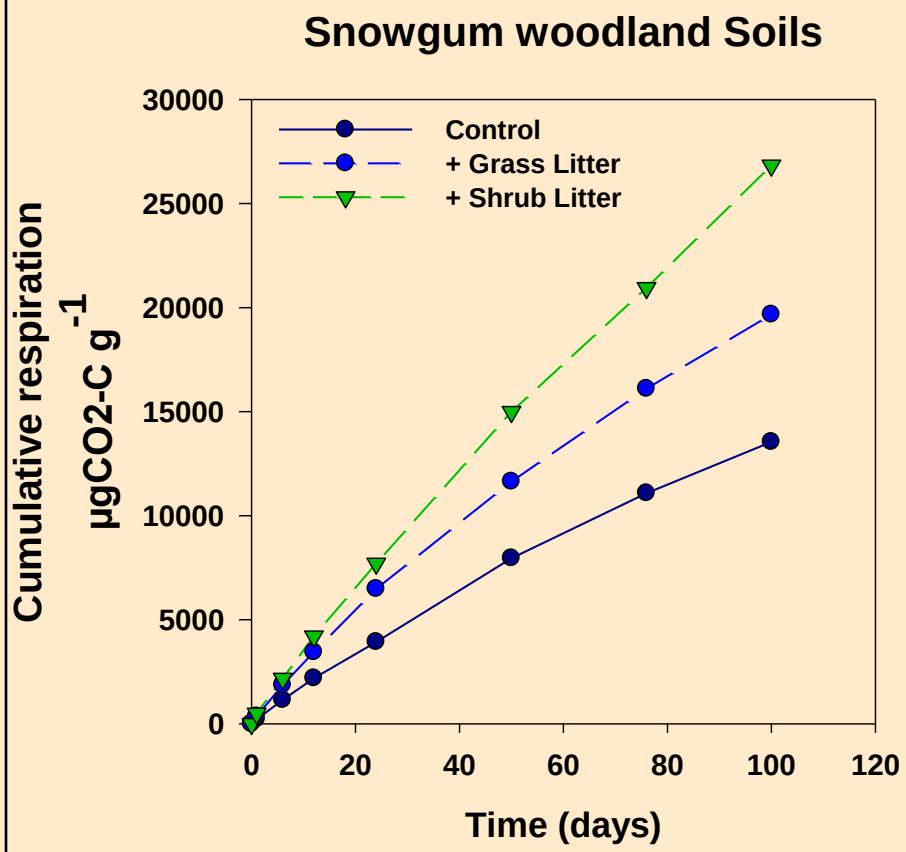
© BUSHFIRE CRC LTD 2010

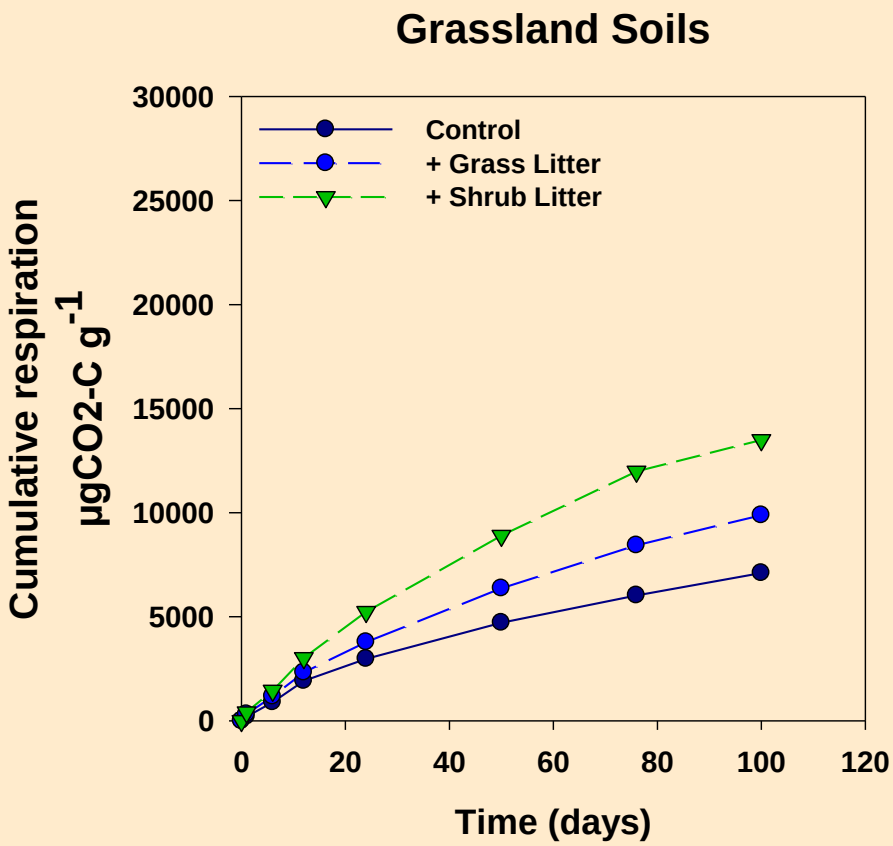
Estimated above-ground biomass (tonnes ha^{-1}) of the snow gum woodland and adjacent grassland.

Components	Grassland		Woodland	
	Mean	SE	Mean	SE
Coarse litter	NA		1.9	0.6
Fine litter	1.7	0.4	5.1	1.5
Grass	4.8	1.3	1.5	0.7
Herb	1.4	0.2	0.2	0.1
Shrub	0.1	0.05	4.8	1.2
Tree leaf	NA		14.0	0.1
Tree wood	NA		82.2	1.1
Sum of readily decomposable[1]	8.0		25.6	
Sum of all components[2]	**8.0**		**84.1**	

Jenkins & Adams 2010 Unpublished data

© BUSHFIRE CRC LTD 2010





Addition of differing C substrates: grassland litter and woodland litter

a) Woodland litter contained twice the C added at equal rates of N.

b) Woodland soils had faster rates of respiration than grassland soils across all treatments

© BUSHFIRE CRC LTD 2010

Projected change in rates of CO_2 released from Sub-alpine soils with an increase in temperature of +1, +3, and +5^oC.

*Percentage change from rates at 10^oC, calculated using fitted Arrhenius functions.

Vegetation type	% increase at		
	+1^oC	+3^oC	+5^oC
Woodland	9.6	31.3	57.0
Grassland	9.6	31.5	57.3

© BUSHFIRE CRC LTD 2010

Most species in sub-alpine areas are already tightly constrained by climate and vulnerable to changes in distribution and abundance.

Plant species distribution and abundance may also be altered by changes in land use and management such as fire.

This will all impact on soil processes such as the release of CO_2 via respiration.

© BUSHFIRE CRC LTD 2010

Acknowledgements

Megan Webb, Steven Roxburgh, Maria Taranto & Chantelle Doyle
for field & lab assistance

Barry Aitchison & Darvall Dixon

Department of Environment & Climate Change

Berridale Rural Fire Service

© BUSHFIRE CRC LTD 2010