

Down to earth: Accounting for carbon stocks

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HC Coombs Policy Forum Crawford School of Public Policy

Stocks and flows are familiar – every day Our aims are usually focussed to stocks



Public Transport Users Association



- Stocks are accumulations
- Stocks characterise the state of a system
- Size of a stock can only change through inflow and outflow
- In equilibrium, inflows to a stock equal its outflows - stock amount remains unchanged

Stocks provide us with the information that tells us we need to act



Suzi Bond



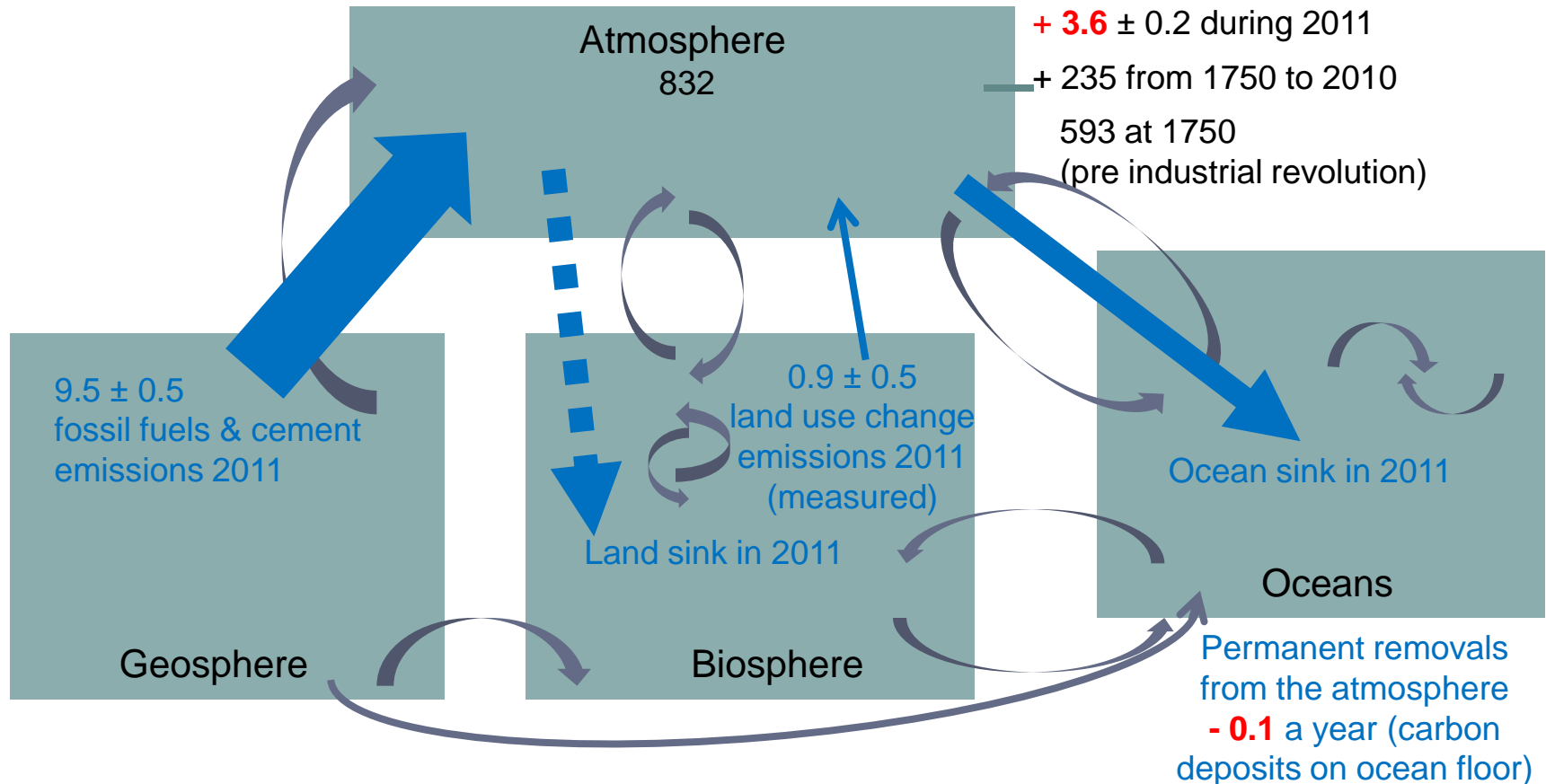
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- When inflows and outflows differ, the system moves into disequilibrium
- Often we don't see this immediately because stocks work like buffers: they accumulate the difference between the inflows and outflows, until feedbacks kick in.
- Stocks give systems inertia.

Sterman J.D. 2000, *Business Dynamics: Systems Thinking and Modeling for a Complex World*, Irwin McGraw-Hill.

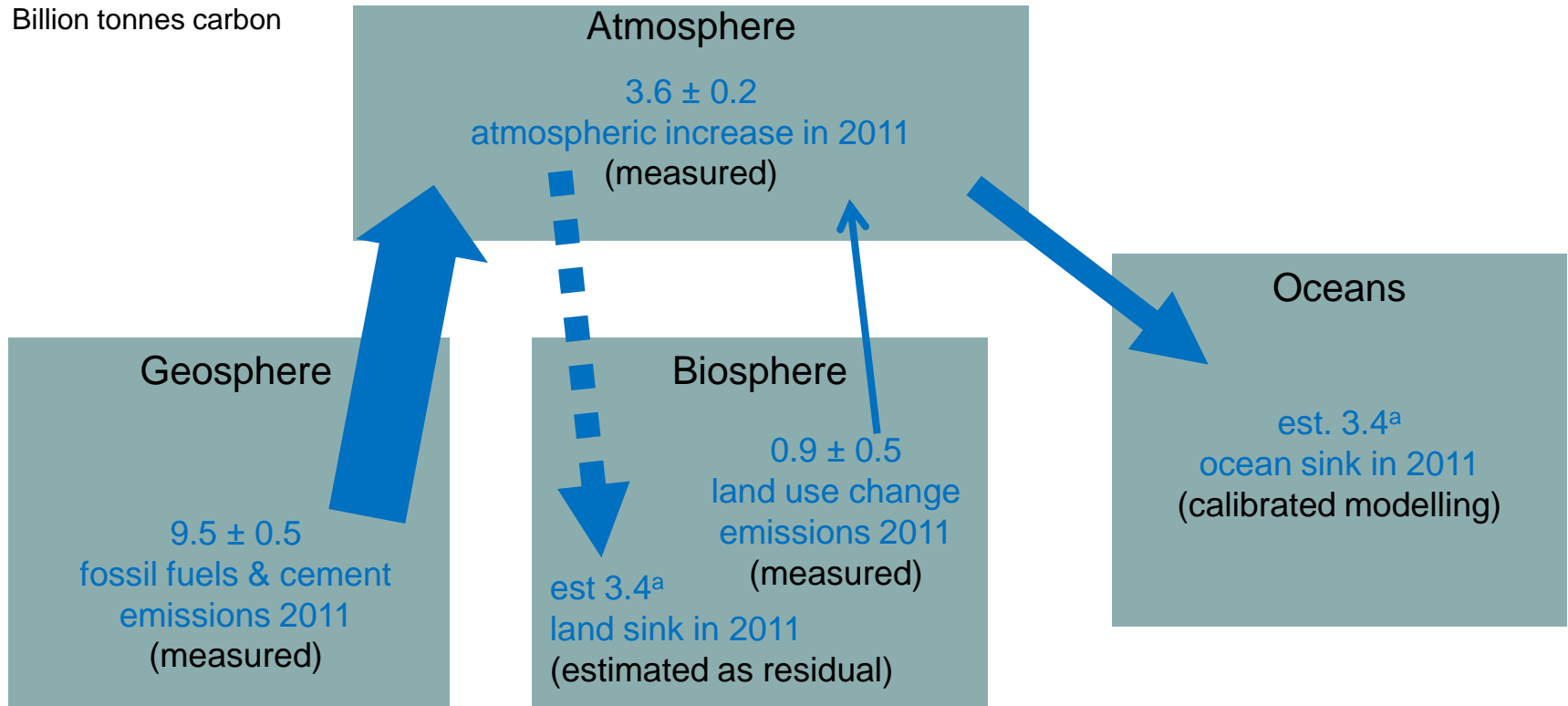
Global carbon cycle, decoupled flows, stock buffers and climate system inertia

All figures are billion tonnes carbon



To scale reservoirs: multiple Atmosphere by:
45 for Oceans; 12 for Fossil fuels in geosphere; 3 for Biosphere (biomass + SOC).

Global carbon cycle is a closed system and reported carbon flows balance using a large residual item

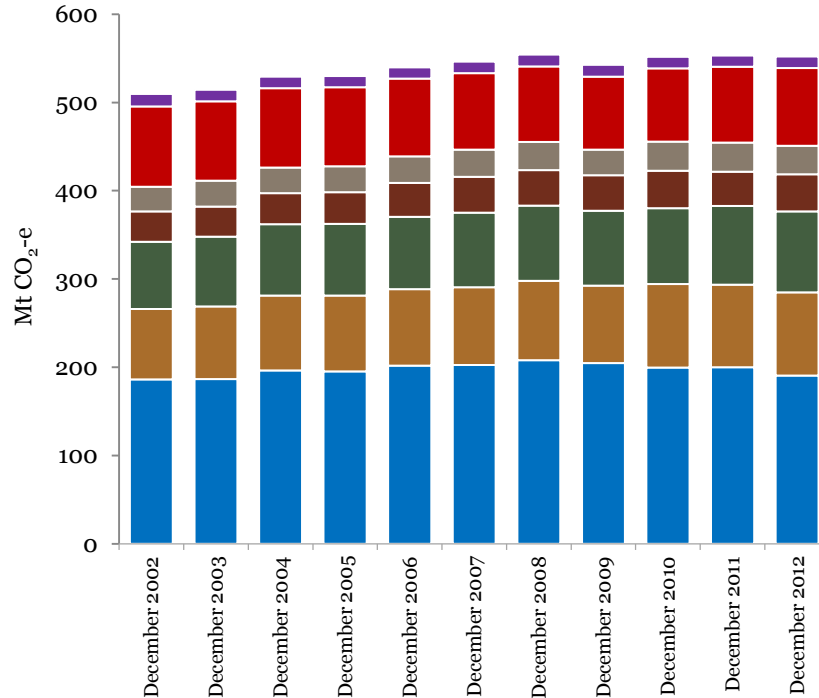


a. Applying reported removals of anthropogenic emissions by natural sinks during 2002-2011, in percentage terms.

Global Carbon Project; Houghton 2007.

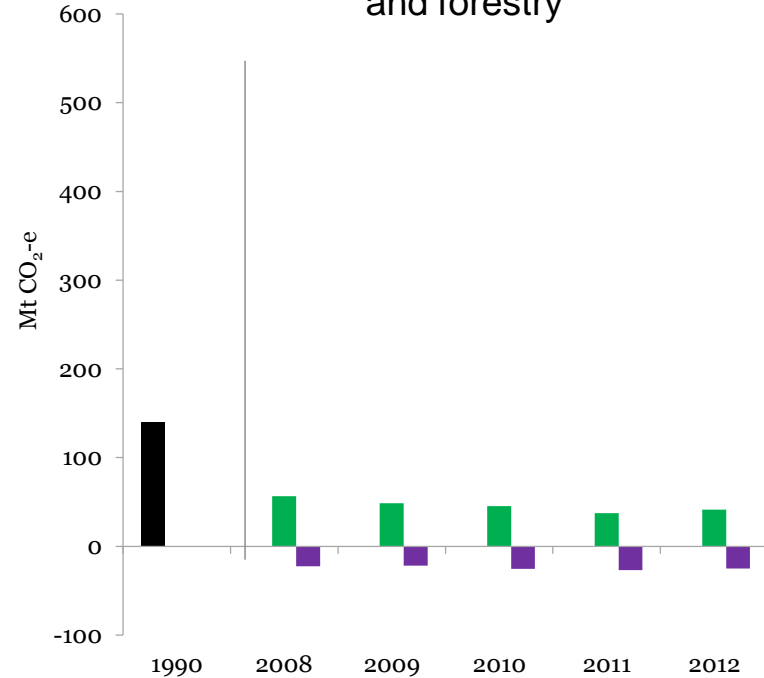
Australia currently reports carbon flows

Emissions by sector



- Waste
- Agriculture
- Industrial processes
- Fugitive emissions
- Transport
- Stationary energy excluding electricity
- Electricity

Net emissions from land use change and forestry



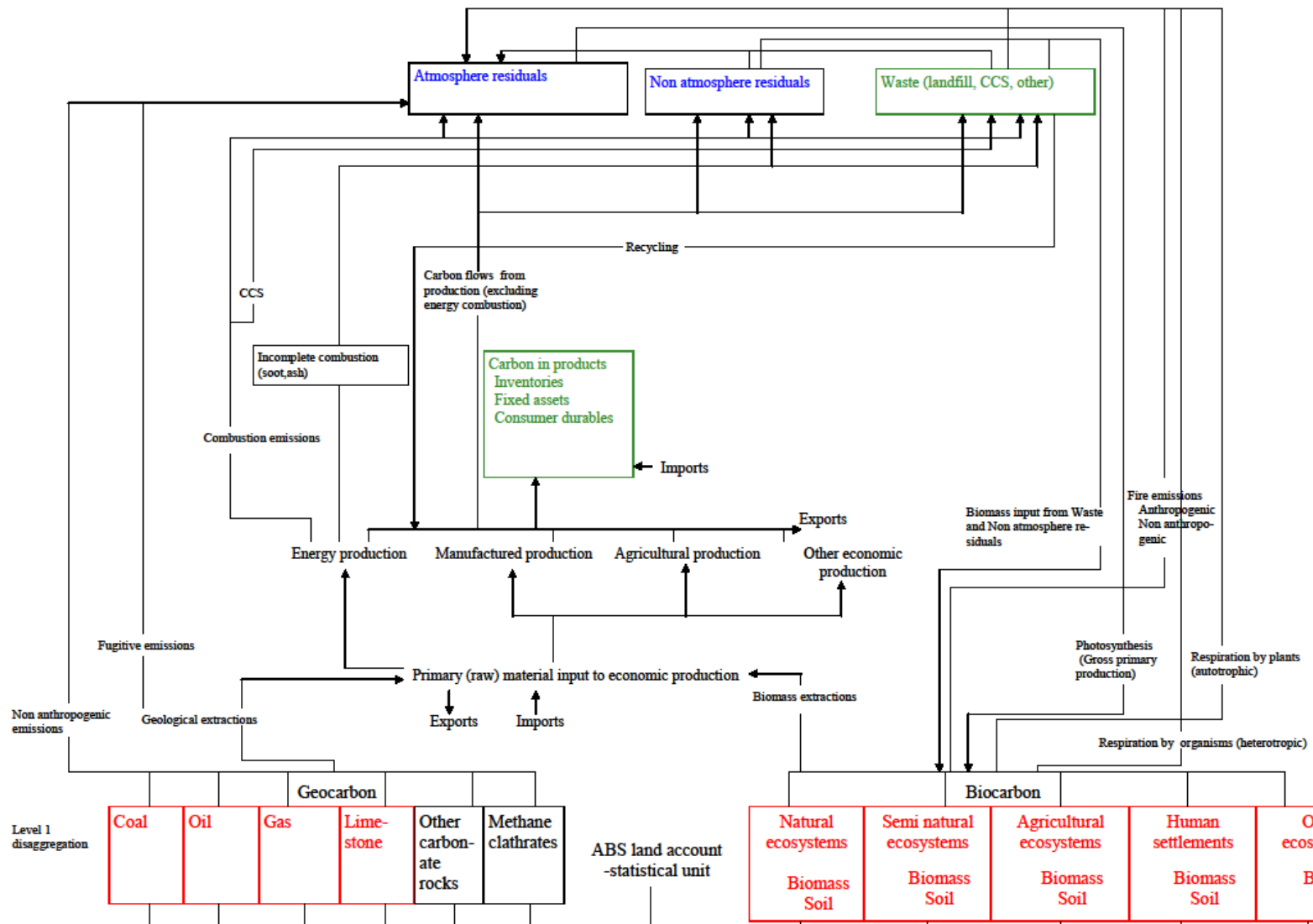
- Land use change
- Deforestation
- Afforestation & reforestation

Australian Government 2013, *Australian National Greenhouse Accounts Quarterly Update December Quarter 2012*.

Stock information is consistent with the UNFCCC over-arching goal – stabilising GHG atmospheric concentrations (a stock).

1. Supporting public understanding – connecting our familiarity with system dynamics and inertia gained through everyday experiences to make accessible important information about the global carbon cycle and climate system. We need stock information to do this.
2. Information for public debate and policy:
 - Providing a complete picture – enabling perspective
 - Climate change policy
 - countries taking responsibility for their carbon stocks
 - sectoral policy and monitoring
 - Agricultural policy – monitoring soil organic carbon stocks for food production.
3. Supporting public debate and policy as competing claims on limited land and water for food production, biodiversity conservation and carbon storage intensify.
4. Enhancing and complementing current carbon flow information.

Carbon stock and flow mapping



Primary reservoirs differ in important ways

Reservoir		Criteria		
		Stability	Restoration Time	Carbon Density
Geocarbon		High	Geological	High
Biocarbon	Natural ecosystems	High – moderate	Decades to millennia	High
	Semi-natural ecosystems	Moderate	Years to centuries	Potentially high
	Agricultural systems	Low	Annual to decades	Low - moderate

Note: Biocarbon includes carbon in biomass and soils.

Ajani J.I., Keith H., Blakers M., Mackey B.G., King H.P. 2013, Comprehensive carbon stock and flow accounting: A national framework to support climate change mitigation policy, *Ecological Economics* 89: 61-72.

UN Statistics Division SEEA EEA carbon stock account

Gigagrams carbon(GgC)		Geocarbon					Biocarbon			Atmosphere	Water in Oceans	Accumulation in economy				TOTAL
		Limestone	Oil	Gas	Coal	Other	Terrestrial ecosystems	Aquatic ecosystems	Marine ecosystems			Inventories *	Fixed assets	Consumer durables	Waste	
Opening stock																
Additions to stock																
	Natural expansion															
	Managed expansion															
	Discoveries															
	Upwards reappraisals															
	Reclassifications															
	Total additions to stock															
Reductions in stock																
	Natural contraction															
	Managed contraction															
	Downwards reappraisals															
	Reclassifications															
Total reductions in stock																
Imports and exports																
	Imports															
	Exports															
Closing stock																
*Excludes inventories included in biocarbon (e.g. plantation forests, orchards, livestock, etc)																

Reservoir and pool classifications for a carbon stock account

Level 1	Level 2	Level 3	Level 4	Level 5
Geocarbon	Oil Gas Coal Limestone Other	Further disaggregation using science criteria and policy relevance		
Biocarbon	Terrestrial Aquatic Marine	Natural ecosystems Semi-natural ecosystems Agricultural ecosystems Other	Biomass Soil	Further disaggregation using science criteria and policy relevance
Accumulations in economy	Inventories Fixed assets Consumer durables Waste	Further disaggregation using SNA		

Stock change classification system

Research area for scientists, former DCC & ABS

<u>Opening stock</u>	Geocarbon	Biocarbon	Accumulation in economy
Additions to stock			
Natural expansion		Y	
Managed expansion		Y	Y
Discoveries	Y		
Upwards reappraisals	Y	Y	Y
Reclassifications		Y	
Reductions in stock			
Natural contraction		Y	
Managed contraction	Y	Y	Y
Downwards reappraisals	Y	Y	Y
Reclassifications		Y	
Imports			Y
Exports			Y

Closing stock

Y = stock change measure definitely relevant to the reservoir.

References

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EU, FAO, IMF, OECD, UN, WB 2012, *System of Environmental-Economic Accounting Central Framework* <http://unstats.un.org/unsd/envaccounting/White_cover.pdf>

UN Statistics Division 2013, *SEEA Experimental Ecosystem Accounting* <<http://unstats.un.org/unsd/statcom/doc13/BG-SEEA-Ecosystem.pdf>>