Senate Standing Committee on Economics
ANSWERS TO QUESTIONS ON NOTICE
Innovation, Industry, Science and Research Portfolio
Supplementary Budget Estimates Hearing 2009-10
21 October 2009

AGENCY/DEPARTMENT: CHIEF SCIENTIST FOR AUSTRALIA

TOPIC: Carbon Sequestration

REFERENCE: Question on Notice (Hansard 21 October 2009, E35-36)

QUESTION No.: SI-27

Senator BARNABY JOYCE– I suppose on the other side of carbon emissions is carbon sequestration. You would be aware of the well-reported papers by Dr Christine Jones on carbon sequestration through perennial summer grasses. Is it a fact that more carbon is sequestrated through summer grasses than through dry sclerophyll forests, knowing that Australia's predominant forest capacity is dry sclerophyll forests?

Prof. Sackett—I would want to take that on notice.

ANSWER

The Chief Scientist's Office has researched some of the work presented by Dr Christine Jones at workshops[1] and Parliamentary committees on carbon sequestration through perennial summer grasses[2]. Her work presents useful insights into interesting innovations in agricultural practices to sequester more carbon and improve soils and arrest the historic loss of top soils.

The Chief Scientist's Office has not been able to find any comparisons in Dr Jones's articles and website of the ability of summer grasslands to sequester more carbon than dry sclerophyll forests (assuming these include native Australian grasslands as listed in the Australian Farm Journal 2009 summer pastures and forages varieties guide). Dr Jones's web page[3] does advocate planting 100 million trees. She advocates styles of agricultural practices to reduce bare soil with appropriate vegetation plantings including perennial grasses to provide permanent soil cover and carbon sequestration and storage. She also advocates better management of grazing to enhance growth of pasture roots to sequester carbon and increase water holding capacities of soils and to overcome overgrazed pasture cover.

The Chief Scientist's office agrees that forests in Australia are mainly made up of dry sclerophyll forests. Australia has 149 million hectares of forest. Of this, 147 million hectares is native forest, dominated by eucalypt (79 per cent) and acacia (7 per cent) forest types and 1.82 million hectares is in plantations[4]. Remaining grassland covers around 440 million hectares of land in Australia[5].

Carbon sequestration or net annual carbon uptake is likely to be in the range 0.5-2 carbon tonnes per hectare per year for dry sclerophyll forest and would vary greatly with weather conditions and age of trees. While grassland may have a similar annual rate of net carbon uptake[6], long-term storage of the carbon pool in the biosphere would be much less for grasslands than in woody trees. Australian native eucalyptus forests that include dry sclerophyll forests, store up to ten times more

carbon per hectare than Australian native and introduced grasslands - both above and below ground biomass[7].

The Co-operative Research Centre for Greenhouse Accounting has estimated that forests in Australia store about 10.5 billion tonnes of carbon (excluding soil carbon)[8]. This store of carbon has accumulated over an assumed life of 100 years for native eucalypt regrowth through the forest plants removing almost 38.5 billion tonnes of carbon dioxide from the atmosphere and that is about 70 times Australia's annual net greenhouse gas emission.

In comparison, a study by the Queensland Department of Primary Industry in 1981 showed that in semi-arid Australian grasslands, the maximum daily above ground live biomass for the perennial grass component during summer was only 39 kilograms per hectare per day and this reduced down to 1 kilogram per hectare per day in winter[9]. Across a four month period of summer this would only represent about 5 tonnes per hectare; very much less than a forest even if this sequestration was to continue with little grazing or wildfire pressure.

The key issue is the size and longevity of carbon stocks, and not the flux rates of carbon production by the plants and consumption by stock or wildlife. For example, carbon stocks of mature dry sclerophyll forest contain about 100-200 tonnes of carbon per hectare. For a grassland to have a greater carbon stock than a forest, the root to shoot ratio would have to be 10 or more, which is unlikely. To achieve this it would mean the roots of a summer pasture grass such as kangaroo grass, panic or weeping grass, would have to be much more than 10 times the mass of the grass that you can see above the ground[10]. This is not the case. The capacity of soils to store carbon from decomposing roots is limited by the availability of water, nutrients[11], particularly nitrogen and phosphorus[12] and the soil compaction[13]. In any case, if the objective was to combine production and carbon storage, these summer pastures would not be expected to support a high density of grazing livestock because of their low nutritional quality and the flow on effects of such grazing on carbon.

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[1] Jones C, (2009), Carbon and Salt, http://carbonandsalt.blogspot.com/

[2] Jones C, (2009), Submission to House of Representatives Standing Committee on Primary Industries and Resources, http://www.aph.gov.au/house/committee/pir/australianfarmers/subs/sub052.pdf

[3] http://renewablesoil.com/dr-christine-jones.html

[4] Bureau of Rural Science, (2008) http://adl.brs.gov.au/forestsaustralia/facts/type.html

[5] Australian Government, (2007), National Inventory Report Vol 2 Part g, Department of Climate Changehttp://www.climatechange.gov.au/publications/greenhouse-acctg/~/media/publications/greenhouse-acctg/national-inventory-report-vol-2-part-g.ashx

[6] Potter KN, Potter SR, Atwood JD and Williams JR, (2004) Comparing Simulated and Measured Soil Organic Carbon Content of Clay Soils for Time Periods Up to 60 Years, *Environmental Management* Vol. 33, Supplement 1, pp. S457–S461, http://www.springerlink.com/content/8u6h76lr73p8eh6c/

Potter, K. N.; Torbert, H. A.; Johnson, H. B.; Tischler, C. R. (1999), Carbon Storage After Long-Term Grass Establishment on Degraded Soils, Soil Science: October 1999 - Volume 164 - Issue 10 - pp 718-725 http://journals.lww.com/soilsci/Abstract/1999/10000/Carbon_Storage_After_Long_Term_Grass_Establishment.2.aspx

Scurlock, J.M.O.; Johnson, K. and Olson, R.J. (2002). "Estimating net primary productivity from grassland biomass dynamics measurements". Global Change Biology 8: 736. doi:10.1046/j.1365-2486.2002.00512.x, http://www3.interscience.wiley.com/journal/118961406/abstract?CRETRY=1&SRETRY=0

[7] Mackey BG, Keith H, Berry SL and Lindenmayer DB, (2008) Green Carbon - The role of natural forests in carbon storage, A green carbon account of Australia's south-eastern Eucalypt forest, and policy implications, ANU E Press, http://epress.anu.edu.au/green_carbon/pdf/whole_book.pdf

Keith H, Mackey BG and Lindenmayer DB, (2009), Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests, *PNAS* Early Edition, http://www.pnas.org/content/early/2009/06/24/0901970106.full.pdf

[8] Ximenes F, Robinson M, and Wright B, (2007) Forests, Wood and Australia's carbon balance, Australian Government Forest and Wood Products Research and Development Corporation and Cooperative Research Centre for Greenhouse Accounting , http://www.plantations2020.com.au/assets/acrobat/Forests,Wood&CarbonBalance.pdf

[9] Christie EK, (1981), Biomass and nutrient dynamics in a c4. semi-arid Australian grassland community, Journal of Applied Ecology (1981), 18, 907-918, http://www.jstor.org/pss/2402381

[10] CSIRO Sustainable Agriculture Flagship, (2009), *An Analysis of Greenhouse Gas Mitigation and Carbon Sequestration Opportunities from Rural Land Use*, edited by Sandra Eady, Mike Grundy, Michael Battaglia and Brian Keating, http://www.csiro.au/files/files/prdz.pdf

[11] Clarke PJ, (1985) Nitrogen Pools and Soil Characteristics of a Temperate Esturine Wetland in Eastern Australia, *Aquat. Bot.* 23: 275-290, http://www.une.edu.au/ers/staff-profile-doc-folders/peter-clarke/1985-clarke-aquatic-ecology.pdf

[12] Australian Government, (2001) Australian Agriculture Assessment 2001 - Landscape balances: water, carbon, nitrogen and phosphorus, *Australian Natural Resource Atlas*, http://www.anra.gov.au/topics/soils/pubs/national/agriculture_landscape.html

[13] Walcott, J., Bruce, S. and Sims, J. (2009). Soil carbon for carbon sequestration and trading: a review of issues for agriculture and forestry. Bureau of Rural Sciences, Department of Agriculture, Fisheries & Forestry, Canberra. Soil Carbon Review, p12, http://adl.brs.gov.au/brsShop/data/soil_carbon_report_final_mar_2009.pdf

Keith et al (2009) p 11637