



NITROUS OXIDE EMISSIONS FROM CROP RESIDUE AND SAVANNAH BURNING

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Main Purpose: Decide Discuss Note

Purpose of Report

- 1.1 The purpose of this paper is to summarise the work commissioned by MAF on direct N₂O emissions from crop residue and savannah burning.
1. Attached to this paper is the report “*Review of nitrous oxide emission factors and activity data for crops*”.

Summary

2. The report reviews emission factors and activity data for cropping, stubble and savanna (tussock) burning. A number of areas where activity data needs to be collected and further field studies are required are recommended. Not all recommendations are being put forward this year.
3. The report still needs to be peer reviewed. Due to this, the need for further research on emission factors and the requirement for more years of activity data collection, this briefing will concentrate on the use of harvest index's in direct nitrous oxide (N₂O) emission from crops (section 6.1), using a revised methodology to estimate the fraction of crop residue burned (section 6.8 and 8) and using the *Statistics New Zealand Agricultural Production Survey* (APS) activity data for savanna burning (section 8).

Recommendations for discussion

Harvest indexes

4. The methodology currently used to determine direct N₂O emissions from crop residues is the 1996 Guidelines Tier 1A methodology which uses a default value of 2 to convert crop yield to above-ground biomass. This default value is another form of the harvest index, at a value of 0.5.
5. The report recommends the inclusion of crop specific harvest index's into the existing *Intergovernmental Panel on Climate Change* (IPCC) default equation. These ratio's

have been scientifically determined for New Zealand and are commonly used in the industry. These are:

- a. Barley, wheat, maize and peas = 0.5
- b. Oats = 0.45
- c. Lentils = 0.4
- d. Potatoes = 0.85

Calculated $\text{Frac}_{\text{BURN}}$

6. Currently New Zealand uses country specific fractions for the amount of crop residue burned. The values used are 0.5 until 2004 and then 0.3 onwards. This data is reported as “expert opinion”. However there is no documentation on what this opinion is based on.
7. The current report details assumptions used to estimate the amount of crop residue burned for barley, oats and wheat. It is proposed to use the assumption of the proportion of residue burned in a field (0.7) and APS data for crop burning to estimate a value for $\text{Frac}_{\text{BURN}}$. For 2009 this would give a $\text{Frac}_{\text{BURN}}$ of 0.27 (using APS data 39% of land in wheat, barley and oats was burned).
8. APS data is available for 2003, 2005 – present. For years where APS data is not available current assumed fractions are suggested to be used.
9. It is expected therefore that due to the minimal change in $\text{Frac}_{\text{BURN}}$ and small size of this category in the agricultural inventory that this change will make very little difference to the over agricultural emissions.

Savannah burning

10. Activity data on the burning of tussock was included since 2007 and therefore activity data is available for the last three consecutive years. It is proposed that this data be used in the Inventory calculations.
11. Although there was concern within the report that the area of tussock burning reported in the 2007 APS was 10 fold that estimated by resource consents, the 2009 APS figure much lower than the 2007 APS figure. This suggests that between years, the variability in tussock land area burned is high.
12. It is proposed to use APS data for the area of tussock burning from 2007, and prior to 2004 to use resource consents. For the years 2005 and 2006 is proposed that resource consents for 2007 – 2009 be obtained and to determine if there is a relationship between the two. This can then be applied to the 2005 and 2006 years.

Recommendations on hold

Key crops

13. The report recommends the inclusion of more key crops in the Inventory. Of these key crops potatoes were included for the first time in the 2010 submission of the Inventory.
14. The collection of activity data on forage brassica's was included in the APS from 2008. However, further years of activity data are required for forage brassica's before they can be included. This is so a time series can be developed to aid in the estimation of forage brassica's back to 1990.
15. Clover seed was separated out from grass seed in the 2008 APS but was rejected as not being robust. Collection of this data from this source is therefore not possible. Further investigation into other means of collecting this activity data is required before it can be included in the agricultural inventory.

Direct emissions from crop residues

16. The report recommends the use of a modified equation to determine direct N₂O emissions from crop residues. Until this methodology is reviewed it is not proposed to be used.

Indirect emissions from leached N

17. The report recommends the use of an IPCC 2006 EF₅ default value. This is not allowable by the IPCC unless there is scientific information to verify that this value is more appropriate. Until such time as reviewed scientific research can confirm this value for New Zealand, this value will not be changed.

Emissions from savanna burning

18. It is recommended in the report to use IPCC 2006 Tier 1 methodology and default values for the burning of savanna land. Again, this is not allowable by the IPCC and therefore will not be implemented. Until such time as this report is reviewed and further scientific evidence such as dry matter values, N content etc is available, the methodology for savanna burning calculation will not be changed.

Proposed changes to inventory

19. *Due to a delay in commissioning an external review of the following changes, it is suggested that any decision concerning these changes be deferred until the 2011 panel meeting.*
20. Incorporate crop specific New Zealand derived harvest index's in the calculation of direct N₂O emissions from crop residues. Barley, wheat, maize and peas = 0.5, Oats = 0.45, Lentils = 0.4 and Potatoes = 0.85.
21. Use a $Frac_{BURN}$ derived from APS data and the assumption of the proportion of residue burned in a field = 0.7 for years 2003, 2005 onwards. For other years use current values in use.

22. Use APS data for area of tussock land burned 2007 onwards. Use 20% of area with council consents for burning for the years 1990 – 2004. For 2005 and 2006 determine if there is a relationship between the area of land consented for tussock burning and the area reported as burnt in 2007 – 2009. Apply this relationship to 2005 and 2006 consent data.

Response to reviewer comments

23. Currently no review has been carried out on this report. Before any major methodological changes or changes to emission factors or fractions are presented to the panel this review will be undertaken.

Strategic Risks

24. The changes may not be accepted by the *United Nations Framework Convention on Climate Change* (UNFCCC) reviewers. However, if this is the case there is an extensive process which is followed in which New Zealand can state its case or change back to the IPCC default before any penalty would be applied.

Strategic Opportunities

25. New Zealand will be meeting the UNFCCC obligations of continual improvement of the National inventory
26. More accurate activity data will be used for calculating the inventory.

Recommendations

It is recommended that the Agricultural Inventory Advisory Panel:

27. *Agree that the section of the current report on the fraction of crops burned ($Frac_{BURN}$) should be reviewed.*

Agree / not agreed

28. *Agree to defer the discussion and decision around the recommendations in the report until a review has been carried out and then be presented to the 2011 Agricultural Advisory Panel meeting.*

Agree / not agreed

29. *Agree that further work in the areas of the crop specific New Zealand derived harvest index's be undertaken and reviewed before presentation to the panel.*

Agree / not agreed

30. *Agree that further work in the area of tussock land burned needs to be undertaken and reviewed to take into account the new short time series of activity data now available.*

Agree / not agreed

31. **Note** that further recommendations in the report will not be presented to the panel until the report is peer reviewed and further data is collected. *This is expected to be in 2011.*

Noted

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Approved/ Not Approved/ Approved as Amended

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Date