Greenhouse Gas Emission Inventory For Agriculture – Ireland's Approach

Bernard Hyde, Environmental Protection Agency, Ireland

Outline of presentation

- Info. On Irish Agriculture
- Agricultural GHG emissions
- Overall Approach
- CH_4 emission estimation – enteric fermentation & manure management
- N_2O emission estimation – manure management, direct soil emissions & indirect soil emissions
- Summary

Info. on Irish Agriculture

- Land area ~ 6.9 million ha
  - Agriculture ~ 4.3 million ha
  - Forestry ~ 0.71 million ha
- ~ 80% of agricultural area = pasture, hay and silage
- ~ 11% = rough grazing
- ~ 9% = crop production
- Beef and milk output a/c for 55% of agricultural output at producer prices

Info. on Irish Agriculture (contd.)

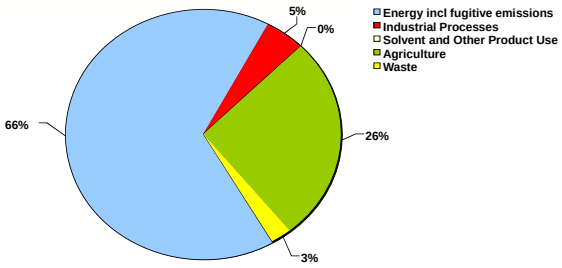
		1990	2000	2007
Dairy Cattle*	'000 head	1,341	1,165	1,087
Other Cattle*	'000 head	5,117	5,519	5,219
Sheep*	'000 head	7,986	8,067	5,766
Pigs*	'000 head	1,221	1,727	1,581
Fertilizer N	kt	379	408	322
Organic N	kt	437	456	420
Crops	'000 ha	395	401	379

* Average of June & December census

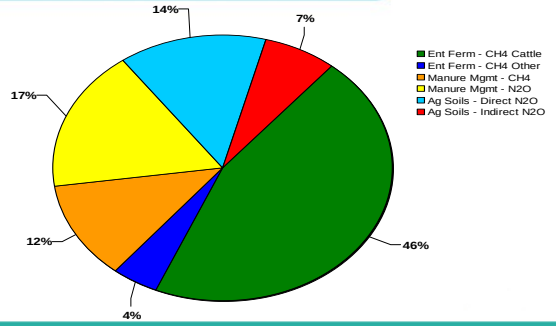
Agricultural GHG emissions - the facts

- Agriculture accounts for 26.4% of national total
- Second largest source
- Highest contribution within the EU
- Agricultural CH_4 ~ 86% of national CH_4 (cattle ~ 90%)
- Agricultural N_2O ~ 83% of national N_2O

National Emissions – Sectoral breakdown



Breakdown of Agricultural Emissions



Overall Approach

- 1996 IPCC GL and 2000 IPCC GPG
- Country specific Tier II for CH_4 – Enteric fermentation & Manure management – Cattle
- Tier I – Other Livestock ~ animal weight
- Country specific & Tier 1 for N_2O – Agricultural Soils & Manure Management
- NH_3 emissions from agriculture – Indirect emissions

Approach – Activity data

- June and December livestock census – Central Statistics Office
- Cattle Movement Monitoring System – Department of Agriculture
- Crop production statistics – Central Statistics Office

Cattle
Dairy cows
Suckler (Beef) cows
Male cattle < 1 year
Male cattle 1-2 years
Male cattle > 2 years
Female cattle < 1 year
Female cattle 1-2 years
Female cattle > 2 years
Bulls for breeding
Dairy in-calf heifers
Beef in-calf heifers

Sheep
Ewes
Rams
Lambs
Other sheep

Pigs
Sows in pig
Sows for breeding
Gilts in pig
Gilts notyet served
Fattening pigs < 20kg
Fattening pigs > 20kg

Poultry
Layers
Broilers
Turkeys

Other livestock
Horses
Mules and Asses
Goats

Approach – Activity data (contd.)

- Manure management statistics – Farm Facilities Survey
- Fertilizer sales statistics – Quaterly & Annually
- Fertilizer Use Surveys – Annually/Bi-annually
- Tier II NH_3 emission estimates
- Other N sources – e.g. sewage sludge application to land

Tier II estimation of CH_4 emissions from cattle – enteric fermentation

- Irish Cattle herd characterised by 11 principal animal categories

	Classification		
Cows	Dairy cows	Suckler cows	
Beef cattle	Male < 1 year	Male 1-2 years	Male > 2 years
	Female < 1 year	Female 1-2 years	Female > 2 years
Other cattle	Breeding bulls	Dairy in-calf heifers	Beef in-calf heifers

- In-depth analysis of production systems, animal feed and energy requirements
- Dairy cows – 12 sub systems
- Beef cows – 18 sub systems
- Beef cattle (male & female) – 30 sub systems

Tier II estimation of CH_4 emissions from cattle – enteric fermentation (contd.)

- Dairy and Beef cows - Country divided into three regions – NO_3 Directive Action Programme – systems in each region
- Production system defined in terms of calving date, housing, spring turn out, milk yield & composition, feeding practices, liveweight (change) and lactation period for each region
- Other cattle – partitioning of lifetime emissions between 1st, 2nd & 3rd year
- Housing, turnout, liveweight gain, energy requirements & feed intake

Tier II CH_4 emissions from manure management

- Info on quantity of manure and waste management systems – Farm facilities survey
  - Improved representation of animal waste allocation
- Enteric fermentation CH_4 emission factors
  - Calculation of feed & energy requirements
  - Analysis of feeding regimes – full evaluation of OM of feeds applicable to the 11 principal categories of cattle
  - Excretion of organic matter as VS
- High proportion of liquid manure management systems

Estimation of N_2O from Manure management

- National N excretion rates for all categories
- Consistent with Tier II CH_4 emission factor calculations
- June vs December livestock statistics
- Allocation of manures – Farm facilities survey
- Approx. two thirds of N is excreted at pasture
- Majority of managed manure is liquid
- GPG (2000) e.f.'s applied

Estimation of soil N_2O emissions

- IPCC methods, accounting for all N inputs
- Default e.f.'s – direct and indirect emissions
- Default and country-specific for other variables
  - CSO census in June and December
  - FRAC's
  - $FRAC_{GASF}$ & $FRAC_{GASM}$ - Tier II NH_3 Inventory
- Crop N (N-fixing & other) included – default Tier I appraoch
- N-fixing in grasslands not included

Direct soil N_2O emissions

- Full accounting of N – consistent with Tier II NH_3
- Fertilizer statistics – Department of Agriculture
- $FRAC_{GASF}$ & $FRAC_{GASM}$ – Tier II NH_3 inventory
- $FRAC_{GASM1}$ - NH_3-N from housing, storage and spreading
- $FRAC_{GASM2}$ - NH_3-N from pasture/grazing
- Additional N source – sewage sludge application
- Cultivation of organic soils negligible

Indirect soil N_2O emissions

- NH_3 deposition only, NO_x assumed negligible
- $FRAC_{LEACH}$ – Country specific studies
- $FRAC_{GASM1}$ - NH_3-N from housing, storage and spreading
- $FRAC_{GASM2}$ - NH_3-N from pasture/grazing
- *GPG* (2000) default e.f.'s

Summary

- Activity data
- CH_4 – Tier II country specific models for cattle
  - Tier I for other livestock
- N_2O – country specific and default data
- Research is on-going
  - Inventory development
  - Mitigation

Further details

b.hyde@epa.ie

http://coe.epa.ie/ghg/nirdownloads.jsp