icbf

Role of Breeding in Addressing GHG Mitigation Opportunities.

Teagasc Signpost Farm Webinar.

29 April 2022

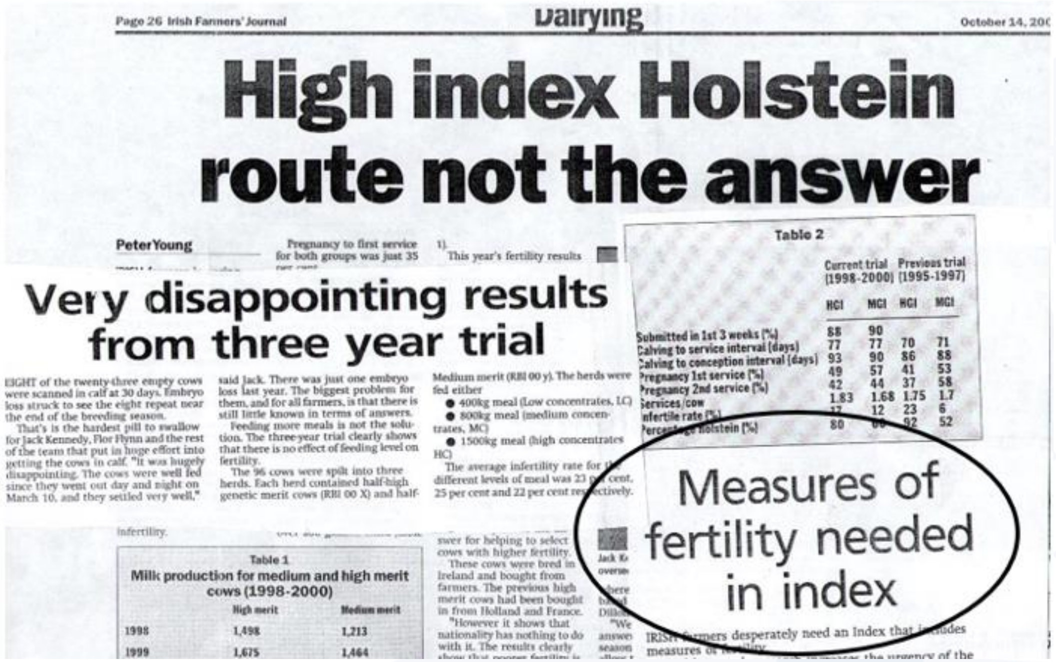
AgTech - it's in our DNA

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Overview of Talk.

- Genetics & GHG mitigation; what are current indexes/approaches delivering?
- Where are the "new" opportunities in the future?
  - Carbon sub-indexes.
  - Direct selection for methane.
  - Earlier finishing age.
  - New carbon farming models.
  - Genotyping the National cattle herd.
    - Dairy Beef Integration.
- Key decisions for dairy and beef farmers this Spring.
- Summary & discussion.

Current EBI => Profit + Sustainability.



J. Dairy Sci. 102:2560–2577
https://doi.org/10.3168/jds.2018-15559

Milk production of Holstein-Friesian cows of divergent Economic Breeding Index evaluated under seasonal pasture-based management

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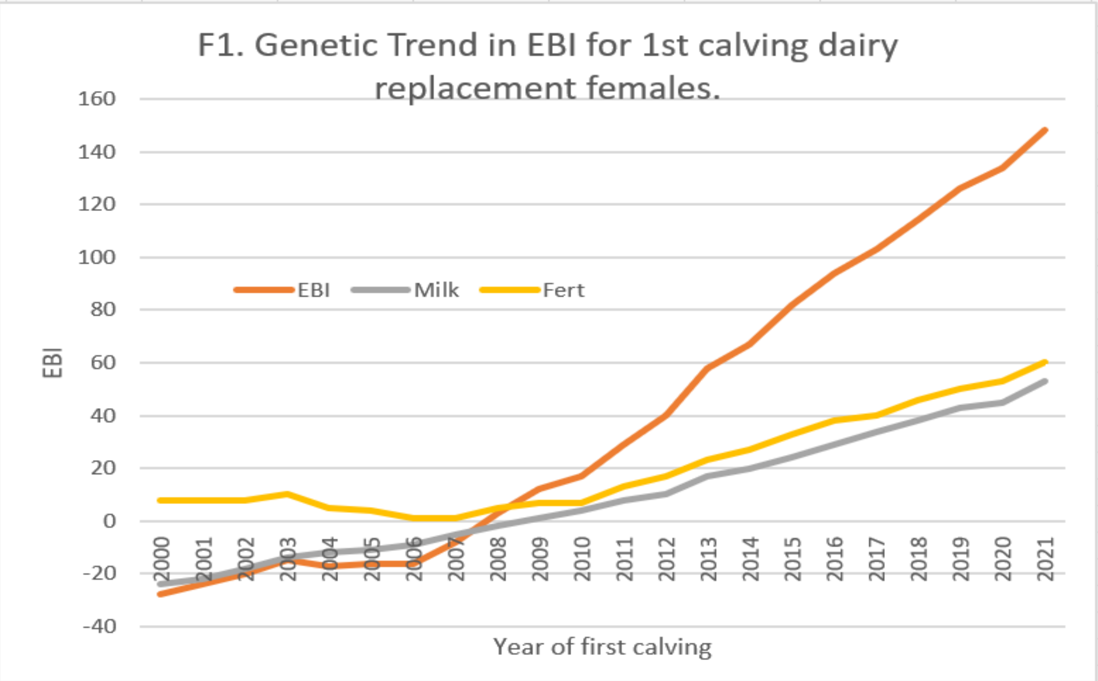
- Current EBI Trends will deliver **658** KT of reduction in CO_2e by 2030 (of 4.5-6.5 MT target).



T1. Key performance Indicators (KPI's) broken down by Herd EBI.

KPI	Btm 20%	21-40%	41-60%	61-80%	Top 80%
Average EBI	€61	€102	€121	€139	€165
Milk litres/cow	5,364	5,146	5,268	5,500	5,648
MS/cow	410	402	416	441	466
CI Days	407	394	389	382	374
6 week calv rate %	56%	61%	65%	70%	79%
Kg CO2e/Kg FPCM	1.04	1.00	0.98	0.95	0.90

Current Rep Index => Profit + Sustainability.


IRISH FARMERS JOURNAL BEEF DAIRY SHEEP AGRIBUSINESS MACHINERY TILLAGE PEDIGREE BUILDINGS

Farmer uproar over BDGP

Anger erupts at Claremorris farmer meeting

NATHAN TUFFY
WESTERN LIVESTOCK SPECIALIST
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Brian Farrell

One thousand farmers left a meeting on Tuesday night frustrated and disappointed after Minister for Agriculture Simon Coveney announced that no changes

ANIMAL GENETICS AND GENOMICS

Validation of a beef cattle maternal breeding objective based on a cross-sectional analysis of a large national cattle database

AMERICAN SOCIETY OF ANIMAL SCIENCE

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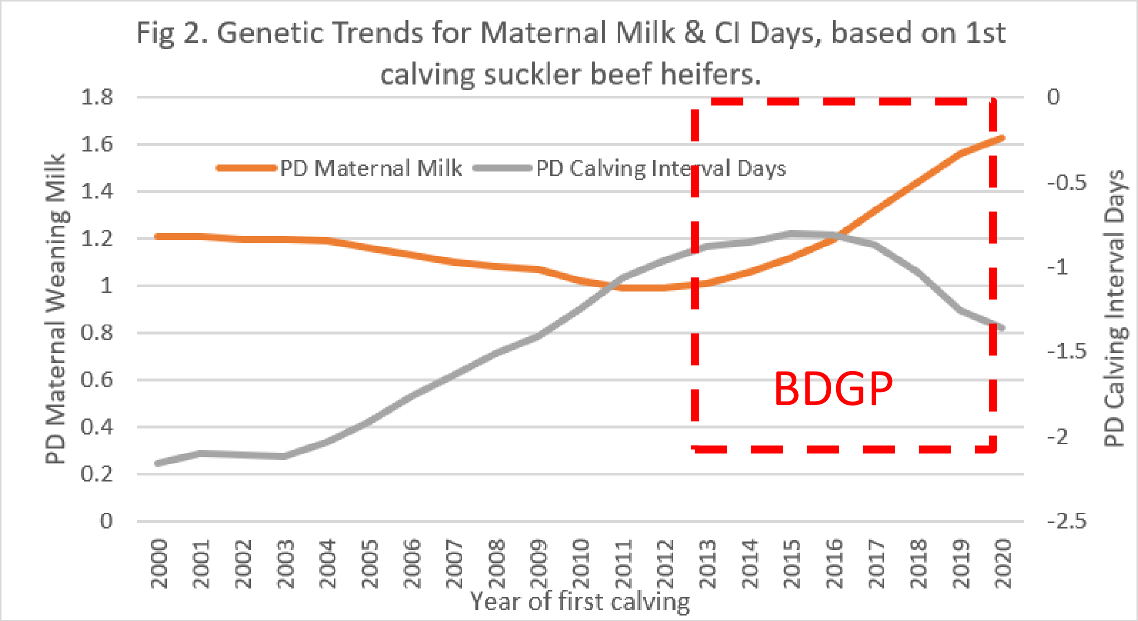
- **Current Rep Index trends will deliver 181 KT of reduction in CO2e by 2030 of 4.5-6.5 MT target.**



T1. Impact of Herd Replacement Index on key performance & sustainability metrics*

		Replacement Index €urostars					
Herd Average Trait	Source	SD	Btm 20%	Btm 21-40%	Average	Top 21-40%	Top 20%
Average Replacement Index	ICBF/BDGP		€42	€63	€80	€96	€122
Cow Liveweight (All parities; kg)	BEEP	56.0	688.8	669.5	664.3	655.5	651.6
Calf 200 day Liveweight (kg)	BEEP	34.8	279.7	280.1	284.9	286.3	287
Weaning Efficiency (%)	BEEP	5.5	40.8	42.0	43.0	43.9	44.3
Calving Interval (days)	ICBF	28.7	399.1	394.2	389.8	384.6	387.7
Calves/cow/year	ICBF	0.12	0.85	0.88	0.89	0.91	0.91
Profit/livestock unit	Teagasc		€207	€219	€238	€244	€262
Carbon Footprint (GHG/kg)	Bord Bia	1.82	13.16	12.97	12.82	12.42	11.91

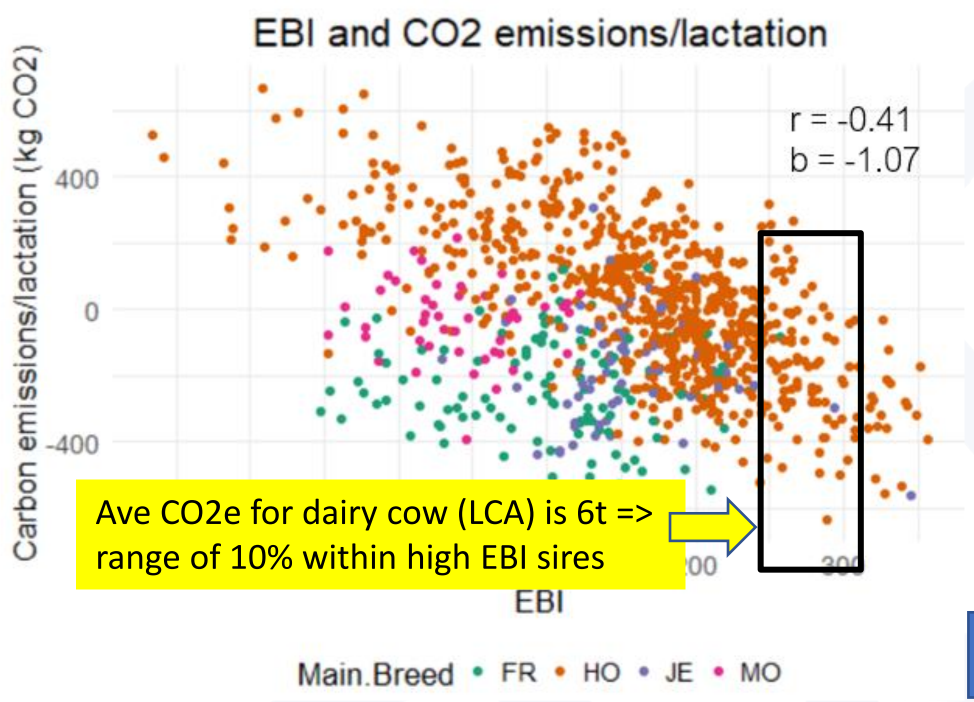
David Kelly, PhD, Teagasc.

Potential of Breeding to reduce GHG emissions

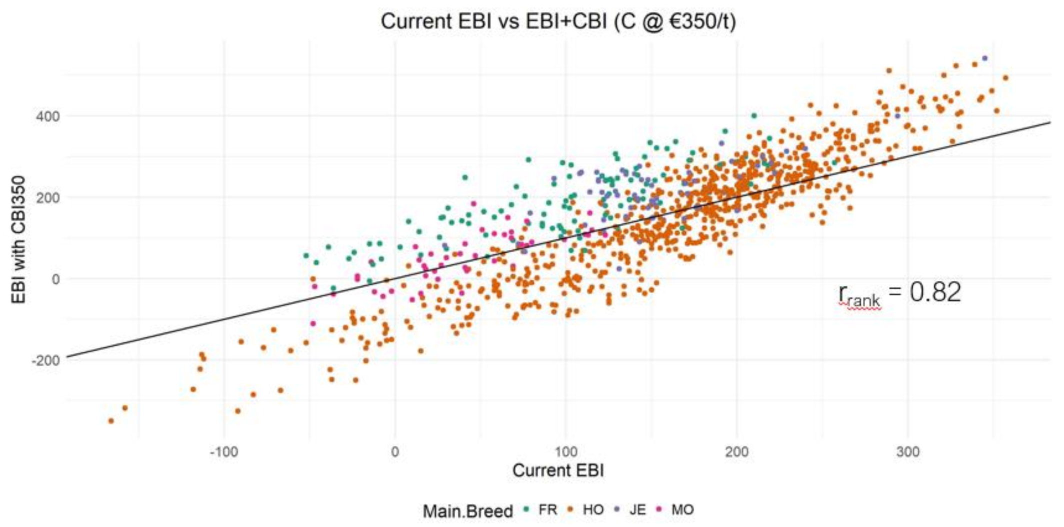
T1. Options for increasing genetic gain in the dairy herd for GHG traits.	Fix Output	Stable herd
Current EBI Trends	658	69
+ Carbon Sub Index (i.e., additional weighting on female fertility traits)	96	108
++ Methane Yield Traits	67	77
+++ Methane Yield Traits @ 30% weighting in Index	85	207
++++ Methane Yield Traits @ 30% weighting in Index & Top 40% threshholds	97	101
Sub-total	1003	562
+ DNA calf reg (20% increase in accuracy => additional genetic gain)	200.6	112.4
Total	1203.6	**674.4**
T2. Options for increasing genetic gain in the beef herd for GHG traits.	**Fix Output**	**Stable herd**
Current Euro-Star Trends	181	71
+ Methane Yield Traits	74	78
+++ Methane Yield Traits @ 30% weighting in Index	91	110
Sub-total	346	259
+ DNA calf reg (20% increase in accuracy => additional genetic gain)	69.2	51.8
Total	415.2	**310.8**
T3. Overall (Dairy + Beef)	1618.8	**985.2**

- Under fixed output scenario (as per MACC), breeding had potential to mitigate ~1.6T CO2e over 10 year period => **enabling.**
- But goal-posts have now shifted => away from cap on output & instead "stable" herd => **direct.**
- Breeding now has potential to mitigate ~1mT CO2e.
- Conditional on implementation of various "enhancements" to our breeding indexes & strategies.

i. EBI & New Carbon Sub Index.



EBI and EBI+CBI (when C @ €350/t)



- Current EBI is delivering -19 Kg reduction in CO_2e/lactation (0.3% of total).
- Benefits of cumulative gains; after 10 years => 3% reduction.
- Can we increase this rate gain further?

- Opportunity to double the gain (-39 kg CO_2e/lact) but will require us shift 33% of index onto a new "carbon sub-index" => expect 0.6% gain/year.
- Relative gain in "profit" from EBI will be reduced by 15%, with gain in milk sub-index reduced and gain on fertility increased.
- Expect significant re-ranking (r=0.82), with animals of higher genetic merit for female fertility benefiting most.
- Expect

ii. EBI & Breeding for lower methane animals.

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Environmental Animal Science

ENVIRONMENTAL ANIMAL SCIENCE

Effect of divergence in residual methane emissions on feed intake and efficiency, growth and carcass performance, and indices of rumen fermentation and methane emissions in finishing beef cattle

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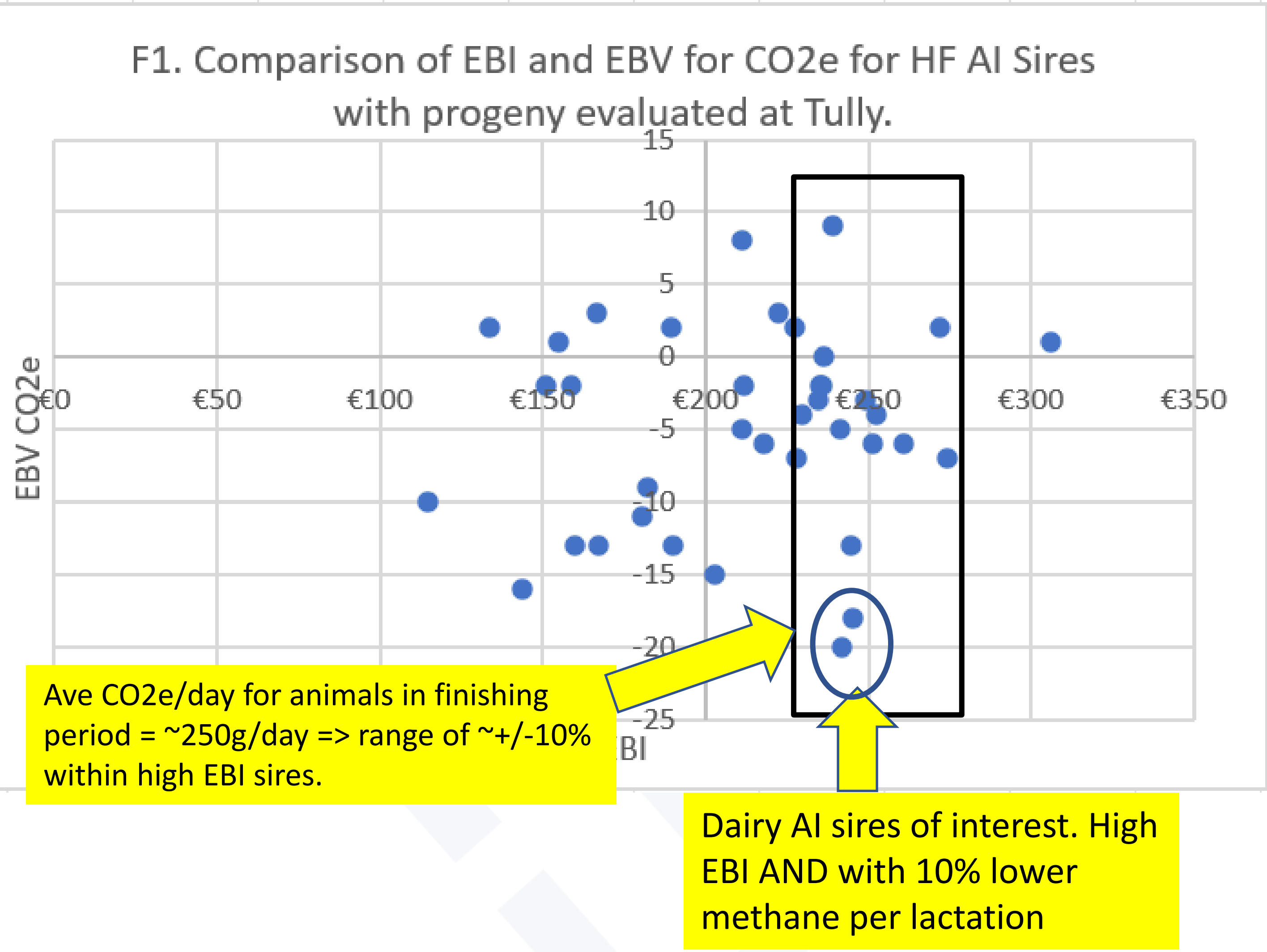
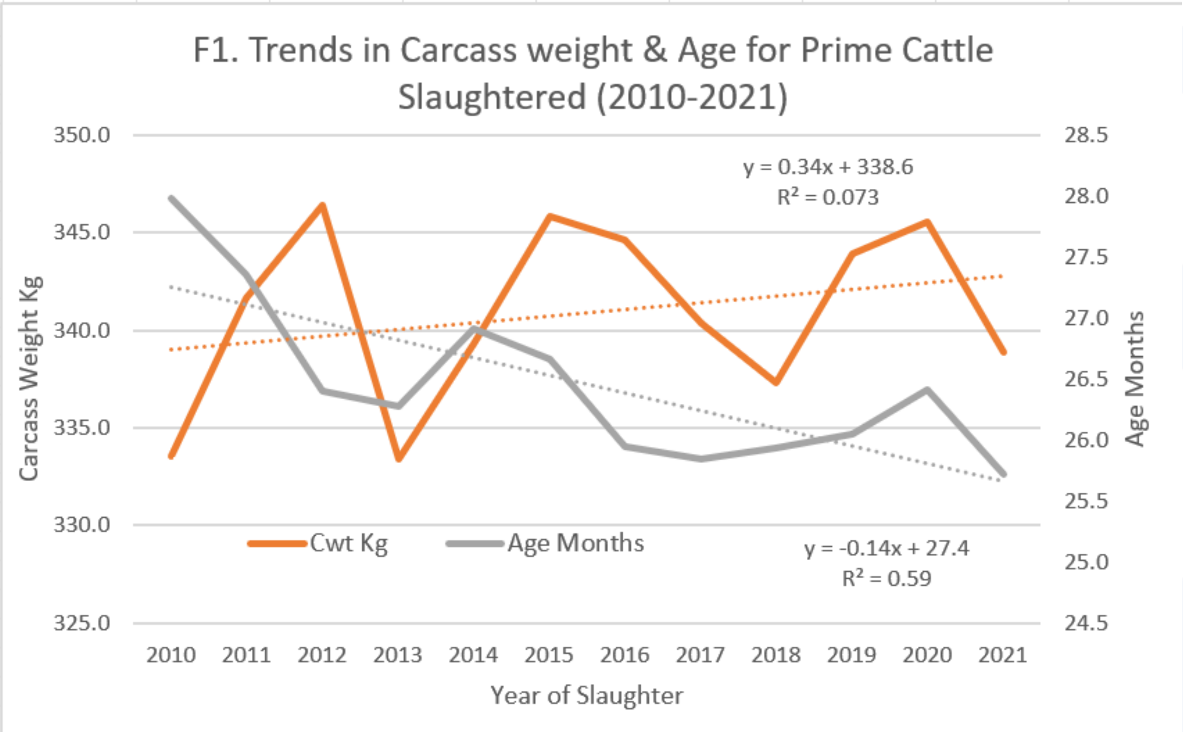
- To date ~1000 animal's have measurements on growth, DMI & CH4/day from Tully *(largest dataset globally).*
  - Progeny of Beef & Dairy AI sires from the G€N€ IR€LAND breeding program.
- Funded through a range of research programs including DAFM GreenFeed, Master & by ICBF/DAFM directly.
- Initial results now available => Average CH4/day = 250 g/day & clear evidence of differences across genders, systems & breeds, including within breed.

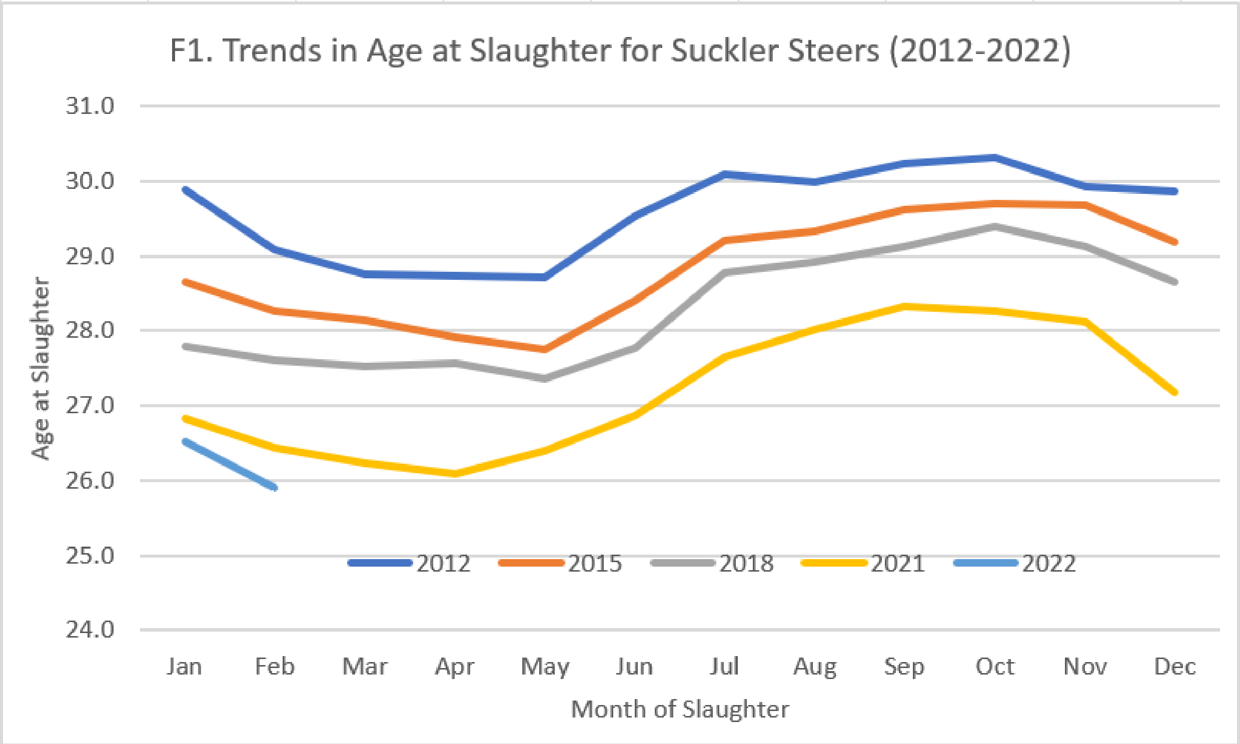
Initial Results – What are we seeing?



- Early evidence of new genetic variation => dairy AI sires that are higher (+10 g/day) & lower (-20 g/day) in terms of genetic merit for CH_4/day. Similar results observed for beef breeds.
- Goal of having genomic predictions for methane traits from Tully in 2022.
- Opportunity to apply within our beef indexes.
- What about dairy?
  - Differences between cows at grass and dairy steers finished indoors?
- New program to collect CO_2e data directly on dairy farms in 2022+, as part of the G€N€ IR€LAND breeding program.
  - Better alignment of research partners & projects into an overall National strategy.
- Potential to increase CO_2e mitigation to 1%/year through breeding.

(iii) Age at Slaughter – High Level Trends.

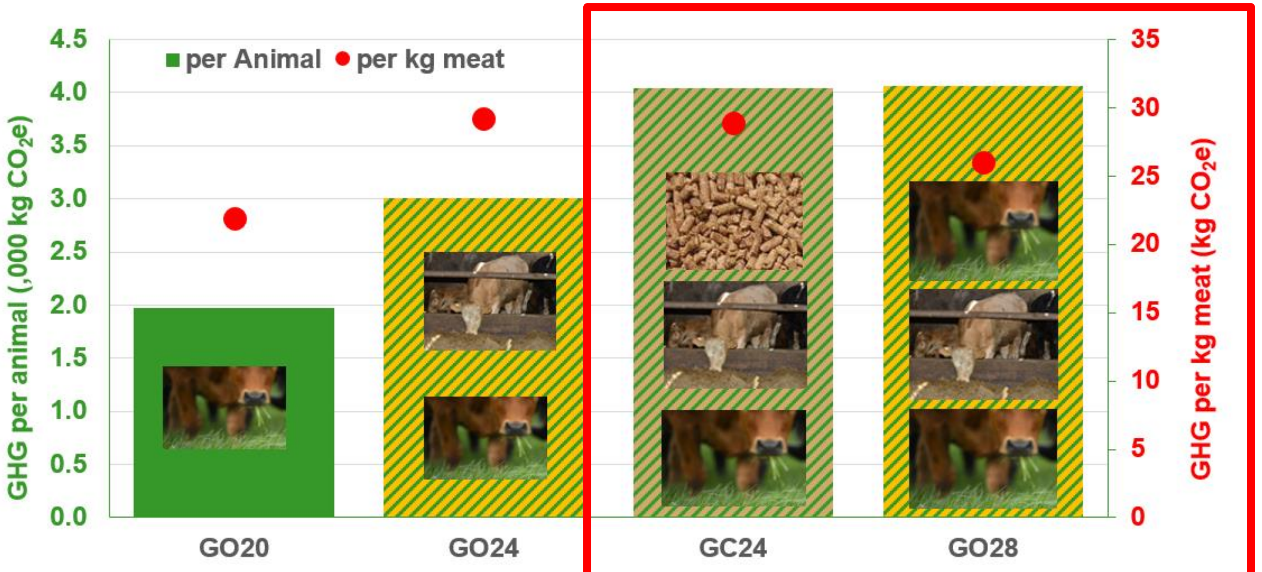




- Average age at slaughter has reduced by ~45 days since 2010, with additional gains in carcass weight => benefits of selecting for growth rate in our indexes. Gains in last 12 months of particular note.
- Evident across all key groups of animals AND across system, e.g., suckler beef steers.
- Can we go faster and help achieve our GHG targets?

Promoting an Earlier Finishing Age.

Implications for weanling to beef systems



	GO20	GO24	GC24	GO28
Carcass weight (kg)	295	319	375	397
Fat score	2-	2+	3=	3=

10 Source: Herron et al., 2021

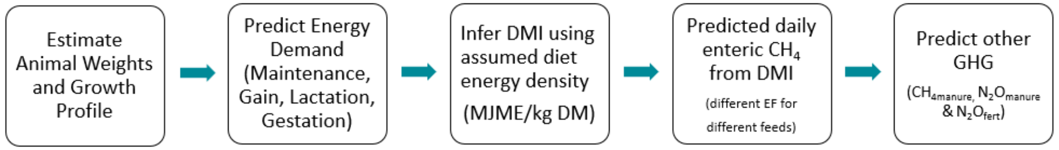
Teagasc Agriculture and Food Development Authority

- Teagasc research => Grass + Concentrates and slaughtered at 24 months had the same gross emissions (4 T CO2e/animal) as a "Grass Only" system where the animal was slaughtered at 28 months. *Dr Paul Crosson, Teagasc National Beef Conference, Nov 2020*

- Critical that any initiative is supported by science, and simply doesn't result in farmers incurring more costs (i.e., feed & fertilizer).
- First step is to;
  - Establish a "science-based" approach to optimizing finishing age and then,
  - Utilize this approach in future programs/initiatives aimed at promoting a younger age at slaughter, e.g., benchmark reports, RDP initiatives, pricing bonuses etc.
- Defining key "systems" a critical part of this overall strategy.

Key requirement - Science-based approach.

Gender * System	Count	%	Cwt kg	Age M	CO2e (kg/animal	Carbon FP (CO2e/kgCwt)
STEERS	663,455	53%	350	26.8	4,668	13.2
- No clear system	65,045	5%	381	35.1	6,699	17.6
- Spr born & slau off grass 3rd summer	277,984	22%	360	28.8	5,077	14.1
- Spr born & slau out of house @ 2 yrs	199,783	16%	337	23.9	3,997	11.9
- Aut born & slau @ ~2yrs	70,782	6%	358	24.9	4,342	12.1
- Spr born & slau off grass 2nd summer	45,994	4%	295	19.5	2,948	9.9
- Slau young age	3,867	0%	284	15.0	2,242	7.9
HEIFERS	471,246	37%	308	25.3	4,101	13.1
- No clear system	42,833	3%	332	35.3	6,249	18.5
- Spr born & slau off grass 3rd summer	134,530	11%	320	28.2	4,642	14.5
- Spr born & slau out of house @ 2 yrs	146,027	12%	306	23.7	3,769	12.3
- Aut born & slau @ ~2yrs	62,572	5%	320	24.2	3,970	12.3
- Spr born & slau off grass 2nd summer	80,843	6%	272	19.8	2,877	10.5
- Slau young age	4,441	0%	252	14.8	2,075	8.3
YOUNG BULLS	124,949	10%	369	19.0	3,544	9.6
> 20 months	35,784	3%	378	22.6	4,283	11.2
16-20 months	51,035	4%	362	19.4	3,524	9.8
< 20 months	38,130	3%	371	15.2	2,875	7.8
Grand Total	**1,259,650**	**100%**	**336**	**25.5**	**4,345**	**12.8**



- New Animal carbon footprint developed in conjunction with Teagasc & AbacusBio => CO2e in the animal's lifetime.
- Based on building a growth profile for all animals and then overlaying feed & fertilizer requirements + other GHG => lifetime CO2e.
- Allows comparison of animals across genders, breeds, systems etc.
- Available via a new benchmark report at the time of slaughter, via meat processor, web tools etc.
  - Work being piloted with ABP & then rolled nationally.
- Further developments in pipeline, e.g., integrating growth profile data into Teagasc/Bord Bia Carbon Footprint Model.
- Can we utilize new metric to help promote an earlier age at finish?

What are the potential reductions in CO2e.

T1. Strategies to promote earlier age at finish in Steers.

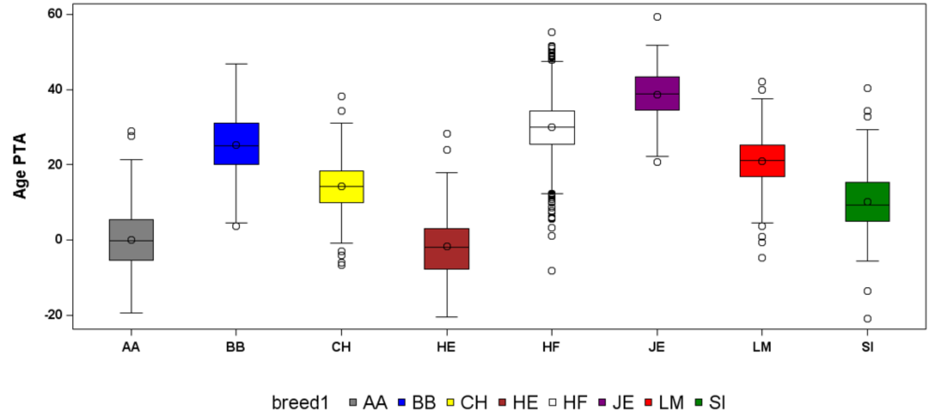
Description of Strategy	Current animals	Future animals	Level of Uptake	CO2e Diff (T/animal)	Change (KT CO2e)
1. Move animals from "no system" (note: one off gain)	65	15	50	-2.0	-100
2. Move from finishing off grass in 3rd summer to finishing of gass in 2nd summer	278	178	100	-2.1	-210
3. Achieve a 1 month reduction in age at finish through greater technical performance	663	663	500	-0.21	-105
Total Reduction					-415

- Opportunity to develop strategies that will promote an earlier age at finish;
  - Move 50k animals from "no system"
  - Move 100k animals from finishing off grass in 3rd summer to finishing off grass in 2nd summer.
  - Encourage 500k animals (i.e., 75% of current steer cattle kill) to achieve a 1 month reduction in age at slaughter within their current defined system.

- Combined potential to reduce CO2e by -415 KT in Steers.
- An additional 350 KT is achievable via similar strategies in heifers and young bulls => 800 KT CO2e reduction. Gains are repeatable, e.g., every 100k animals moved to slaughtering off grass in second summer => 200KT.
- What are the enabling factors to help make this happen?

Earlier Finishing Age - Enabling Factors.

Breed averages & range for age at slaughter



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Beef Benchmarking Report

Slaney Foods The Beef Specialists

Beef x Dairy Steers

Print Date:
Herd Owner:
Herd Number:
Report Period:

Carbon footprint / Carbon efficiency					
Greenhouse Gas Output per animal Expressed in kg of CO2 equivalent	128	3249	5126	3574	95% ★★★★★
Greenhouse Gas Output per kg Carcass Weight Expressed in kg of CO2 equivalent per kg Carcass Weight	128	10.38	15.10	11.19	96% ★★★★★
Greenhouse Gas Output per kg Liveweight Expressed in kg of CO2 equivalent per kg Liveweight	128	5.49	8.00	5.91	96% ★★★★★

- **New genetic evaluations for age at slaughter.**
  - **Current "growth traits" are a good start, but opportunity to accelerate through additional direct selection for earlier finishing age.**
- New Commercial Beef Value (CBV).
  - New index launched this Spring to help rearer's identify more profitable animals for rearing/finishing.
- National DNA calf registration.
  - Surety re: purchased animal, including CBV. 50k calves in 2022. Can we grow?
- Sexed Semen.
  - Moving out dairy males and replaced with high beef merit calves.
- New Beef Benchmarking Reports, piloted with ABP.
  - Supporting/promoting greater technical efficiency at farm level.
- DAFM/RDP programs focused on GHG mitigation..
  - BDGP, BEEP, new Dairy Beef Program……future dairy programs.
- Meat/dairy industry promotion of an earlier finishing age.
  - Starting to happen (e.g., ABP Advantage, Glanbia-Kepak). Can we grow?

(iv) New Carbon Farming Models.

SEARCH

IRISH FARMERS JOURNAL AGRIBUSINESS MACHINERY TILLAGE PEDIGREE BUILDINGS PROPERTY

Moorepark: Irish dairy's carbon footprint among lowest in the world

Laurence Shalloo was positive that Irish dairy farms can continue to reduce their carbon footprint at the Teagasc Moorepark open day.

The Irish dairy industry's carbon footprint stands at 0.99kg CO2/kg FPCM (kg of carbon dioxide equivalents per kg of Fat and Protein Corrected Milk)

When carbon sequestration is added in that figure drops to 0.86kg CO2/kg FPCM.

Past;

- ICBF provided Bord Bia with data for the herd carbon footprint.
- Calculations undertaken by Bord Bia, based on the Teagasc Carbon footprint model. A better way to work together?

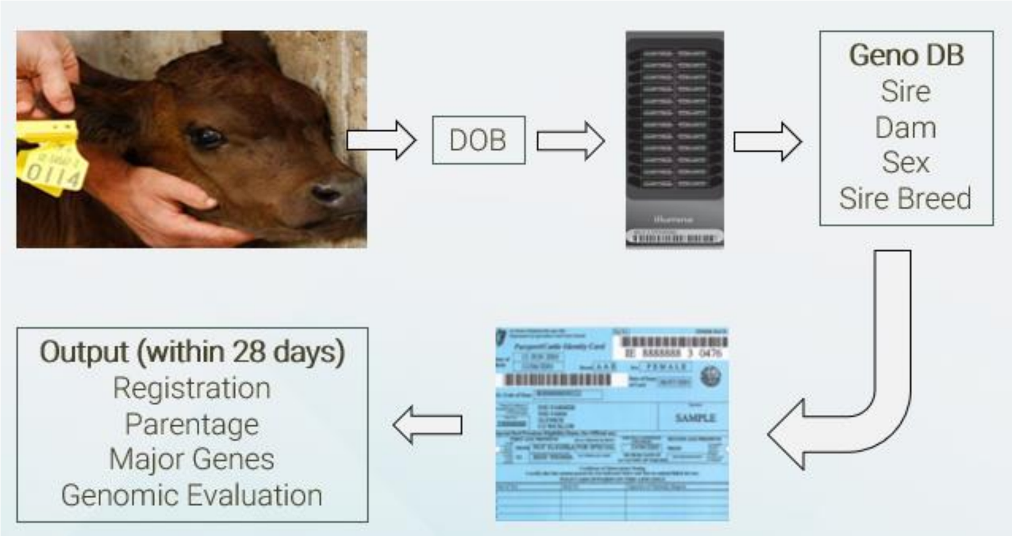
Present;

- ICBF now undertake the calculations on Bord Bia's behalf (Oct 2021), based on the very latest Teagasc model.
- Reports provided by Bord Bia, but "back end" data & calculations provided by ICBF, with model from Teagasc.
- Same principles now being allied for beef => summer roll-out.

Future;

- Automated data feeds from co-op's etc => Surety re: the figures.
- Move towards "gross emissions" at the farm level => promote greater innovation around the actions that reduce GHG at the farm and industry level.

(v) **Cross-cutting** => Genotyping National Cattle Herd.



- Ireland is now recognized as a world leader in the use of DNA within our agri-food industry. Can we become the number 1 and create a real "point of difference" for industry.
- Very difficult for others to mimic.

- 20% gain in accuracy from having animals genotyped at birth => "outliers" for the breeding program, removing parentage errors (~10-15….up to 30%), more accurate data for genomics.
- Having the herd genotyped => surety re: genetic merit for climate/env => available for all herds. Important for any future "carbon farming/trading" programs (i.e., surety).
- Other wider benefits for industry, e.g., **dairy-beef integration,** enhanced traceability, labour saving, SCC (genocells), future R&D, & market point of difference etc.
- Can we transition our National cattle herd to DNA based calf registration over next 3-5 years?
- Example of a win:win for government + industry?
  - Capital/infra-structure cost to genotype cow herd covered by government (one-off) and ongoing costs covered by all stakeholders.
  - Farmers are already contribution €5 for tags & postage. Additional €10/calf required for full DNA calf registration => genotyping National cattle herd.

Genotyping & Dairy Beef Integration.

SEARCH

BEEF DAIRY SHEEP AGRIBUSINESS MACHINERY TILLAGE PEDIGREE BUILDINGS PROPERT

Sourcing a calf to suit your system

Starting with the correct calf type that will suit your farm system is critical to the success of a dairy beef enterprise. Declan Marren reports.

The addition of the commercial beef value (CBV) from ICBF will offer further information to farmers on this very topic, but we are not there yet.

Until we are at a level where every calf is genotyped at birth, the reliability of these figures will be questioned.

SEARCH

BEEF DAIRY SHEEP AGRIBUSINESS MACHINERY TILLAGE PEDIGREE BUILDINGS PROPERT

Dairy beef issues remain

Adam Woods takes a look at issues with dairy beef and what the Irish Limousin Cattle Society is hoping to do about it

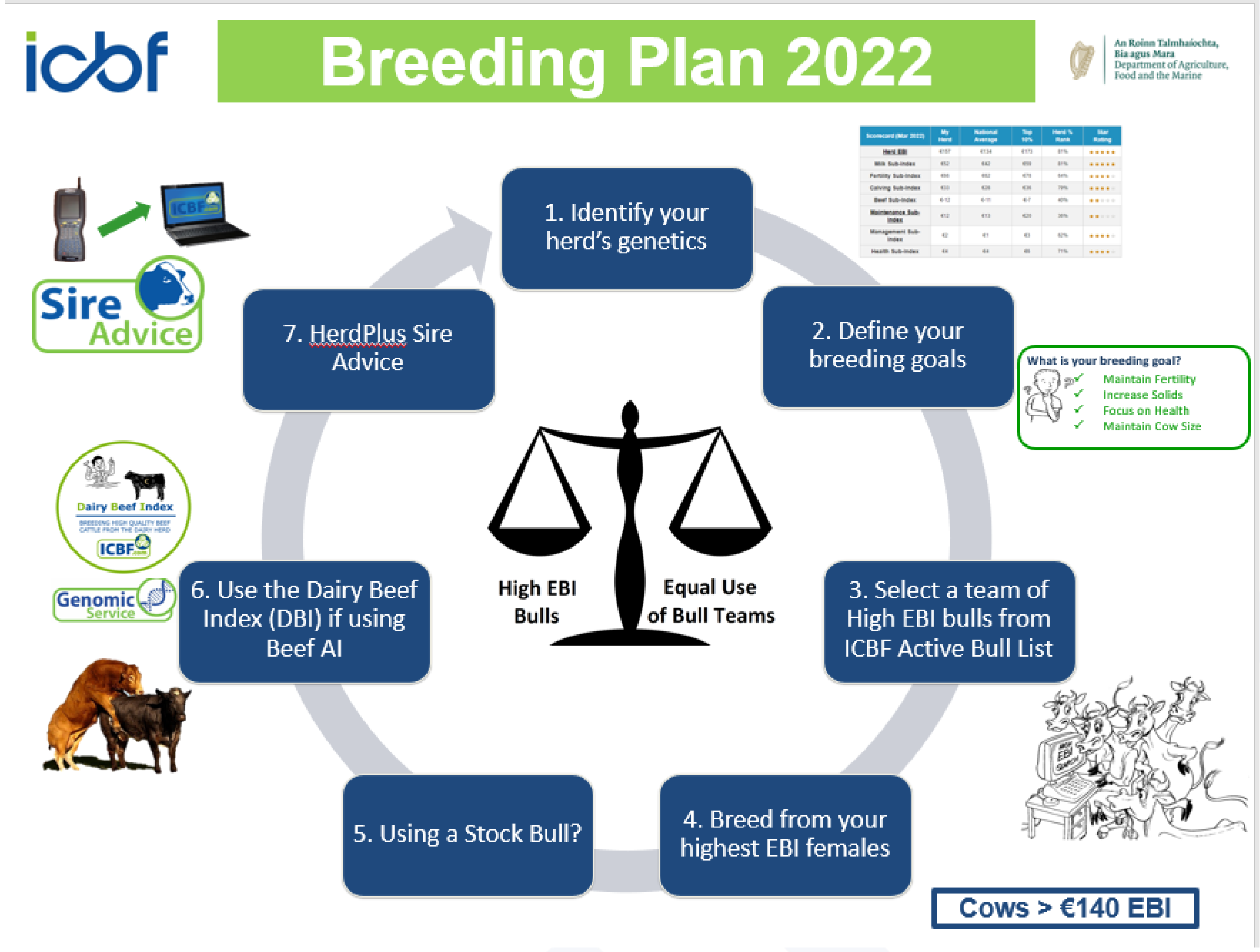
Many dairy farmers have chosen high-DBI bulls, but the reason many of these bulls have a high DBI index is that they are very short gestation and easy calving without paying any attention to the beef values of the bull.

On the latest round of the DBI, three out of the top five beef bulls based on dairy calving records are negative for carcase weight.

If we take a look at the latest evaluation in terms of how the top bulls on the dairy beef index are being used on farms, we can see that there are 3,880 calf registrations to dairy cows from the top five bulls on the DBI list in March 2022. Is the index being embraced by dairy farms?

- Having the herd genotyped will help build greater confidence for dairy beef integration => surety re: what we are buying.
- Help identify outliers for the breeding program;
  - Beef bulls that are good for calving AND beef.
  - Dairy bulls that are good for efficiency and Beef.

Key Decisions for Dairy & Beef Farmers – This Spring.



- Regardless of whether a dairy farmer or beef farmer;
  - Identify your herds genetics.
  - Set your breeding goal (move more towards "cost" traits).
  - Select a team of AI bulls.
  - Breed from your best cows to generate replacements.
- Next Spring……?
  - New carbon sub index in EBI.
  - New methane traits for beef indexes (based on Tully data).
  - Early finish sub index across all indexes.

Summary.

- Genetics is delivering for farmers & industry.
    - Profitability, sustainability, climate & environment.
- Genetics has the potential to deliver 1 MT of mitigation across dairy, beef and dairy beef.
- Earlier finish => an additional 1 MT, mainly through management & system changes.
- Gross emissions will be the new carbon metric at farm level => close collaboration between Teagasc, Bord Bia, ICBF and stakeholders.
- Genotyping the national cattle herd is a cross-cutting measure that has the potential to deliver for all stakeholders in many areas, including crucially GHG mitigation.