# Grasslands, Future Food Demand and Environmental Impact

## Grazing in a Changing Nordic Region

## Tuesday 13sth September 2016

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# Outline of Presentation

1. Introduction
2. Future Challenges and Why Grassland is Important
3. Irish Grass-based System
4. Key Components of a Resilient Grass-based System
5. Role of Less Productive Grasslands
6. Conclusion

# Introduction

1. Population growth, Urbanisation and Income will result in significant growth in demand for food-especially in developing countries
2. Competition for plant starch, protein & sugars for animal feed, bio-fuel and human food will increase the competitiveness pasture- based farming
3. Grassland are important carbon reservoir- potential to cope with climate change
4. But pasture-based systems suffer from low productivity; slow adoption of grazing technologies and the disconnect between animal genotype and feeding system

# 2. Future Challenges and Why Grassland is Important

# Two Goals of Our Time

1. Achieving Food and Nutritional Security
   - 800 million chronically undernourished, more with micronutrients deficits,
   - Far reaching implications of obesity on chronical diseases,
   - Food production to increase 50-70% by 2050,
   - Adaptation to climate change is critical

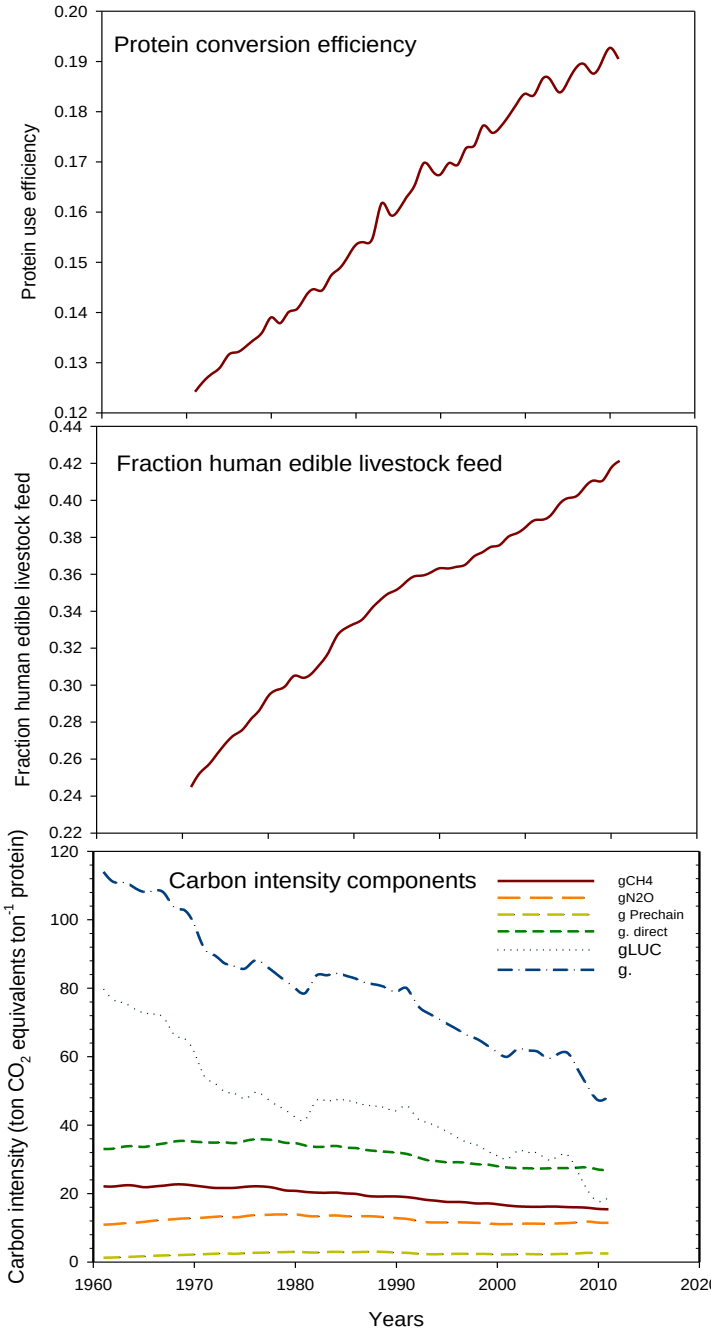
2. Avoiding Dangerous Climate Change
   - Requires major greenhouse gas emission cuts,
   - Agriculture and land use contribute to 24% of GHG emissions...

...and need to be part of the solution

# A more efficient global food system (1961-2011)

- The conversion efficiency into plant and animal food of total raw (arable and grassland) proteins has increased from 12 to 19%,
- The fraction of feed which is edible by humans has increased from 24 to 42% (increased reliance on grains of livestock system)
- Since the 1990's, direct GHG emissions per unit food have declined (i.e. lower carbon intensity of agricultural production) at a slow pace (0.75% per year)

**Note that global grassland and arable soil carbon stock changes since 1961 are not known*

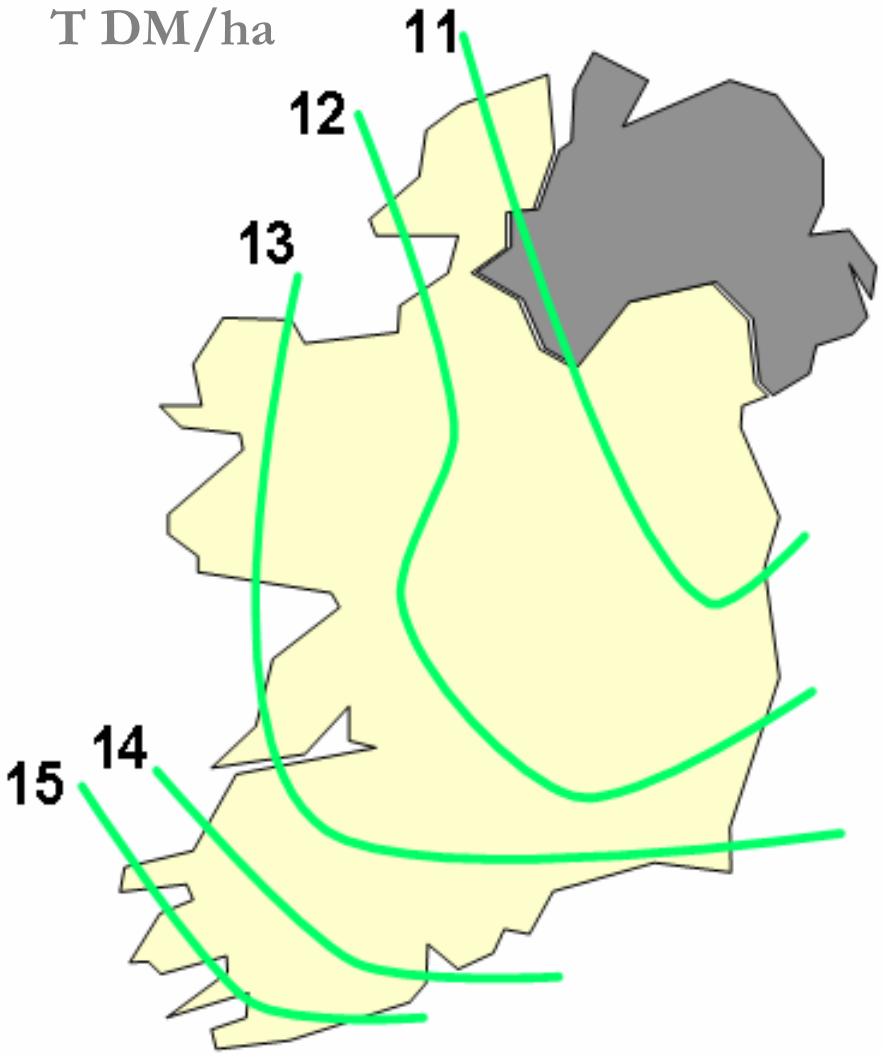


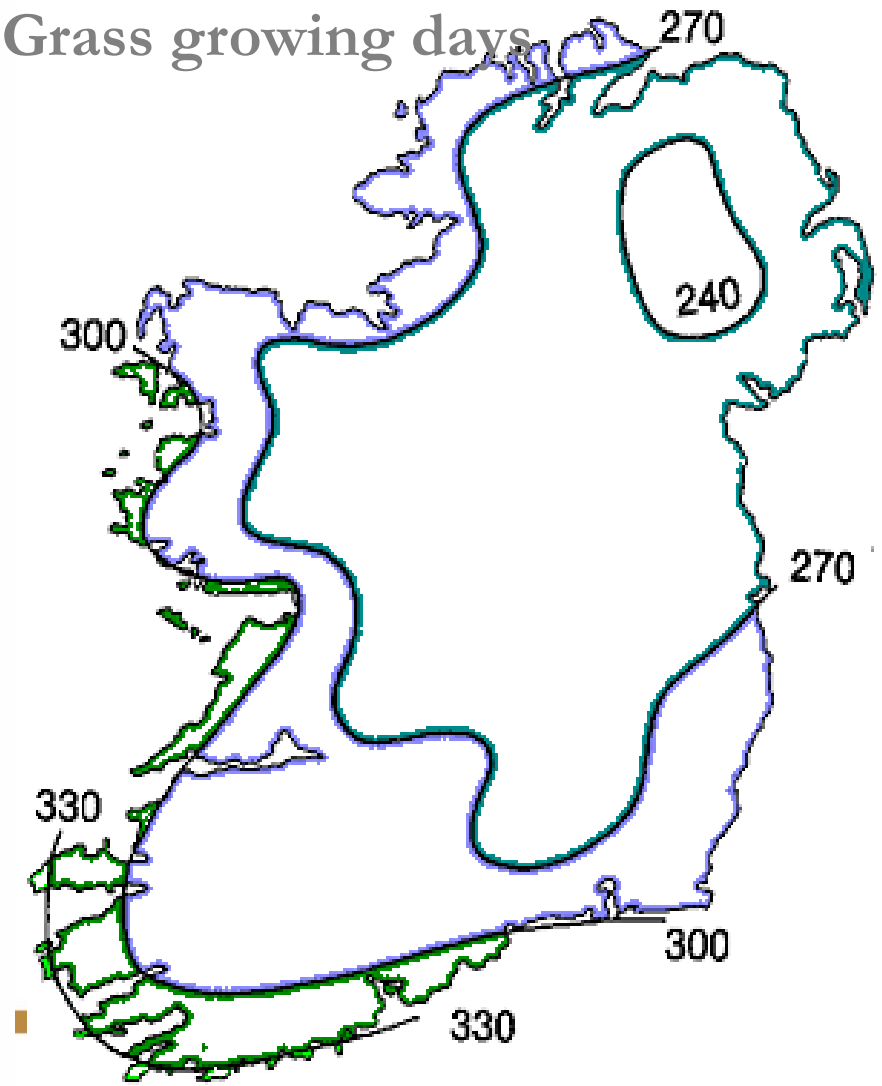
# What is the Case for Grassland Based Meat and Milk Production?

- Reduced competition between food and feed demands for grains?
- Better resilience to climatic variability?
- Lower GHG emissions through soil carbon sequestration?
- Healthier products in terms of fatty acids composition?
- This would require increasing herbage use efficiency and herbage quality

# 3. Irish Grass-based System

# Grassland production and grass growing season



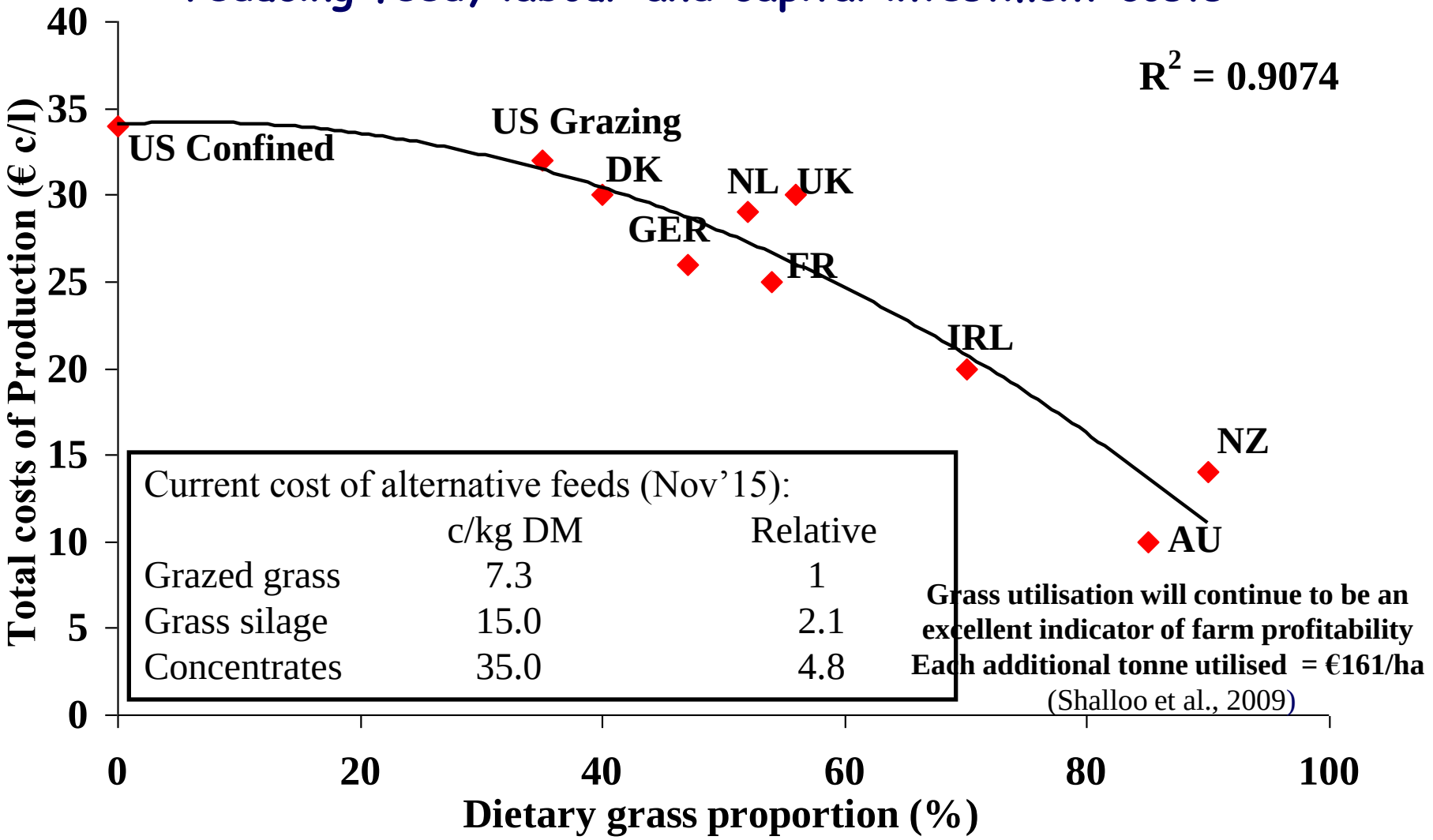






*(Brereton, 1995)*

# Feed Costs

## Increased grazed grass proportion in the animal diet increases farm profitability by reducing feed, labour and capital investment costs



# 4. Key Components of a Resilient Grass-based System

# Key Components of a Successful Grass-based Systems of Milk & Meat Production

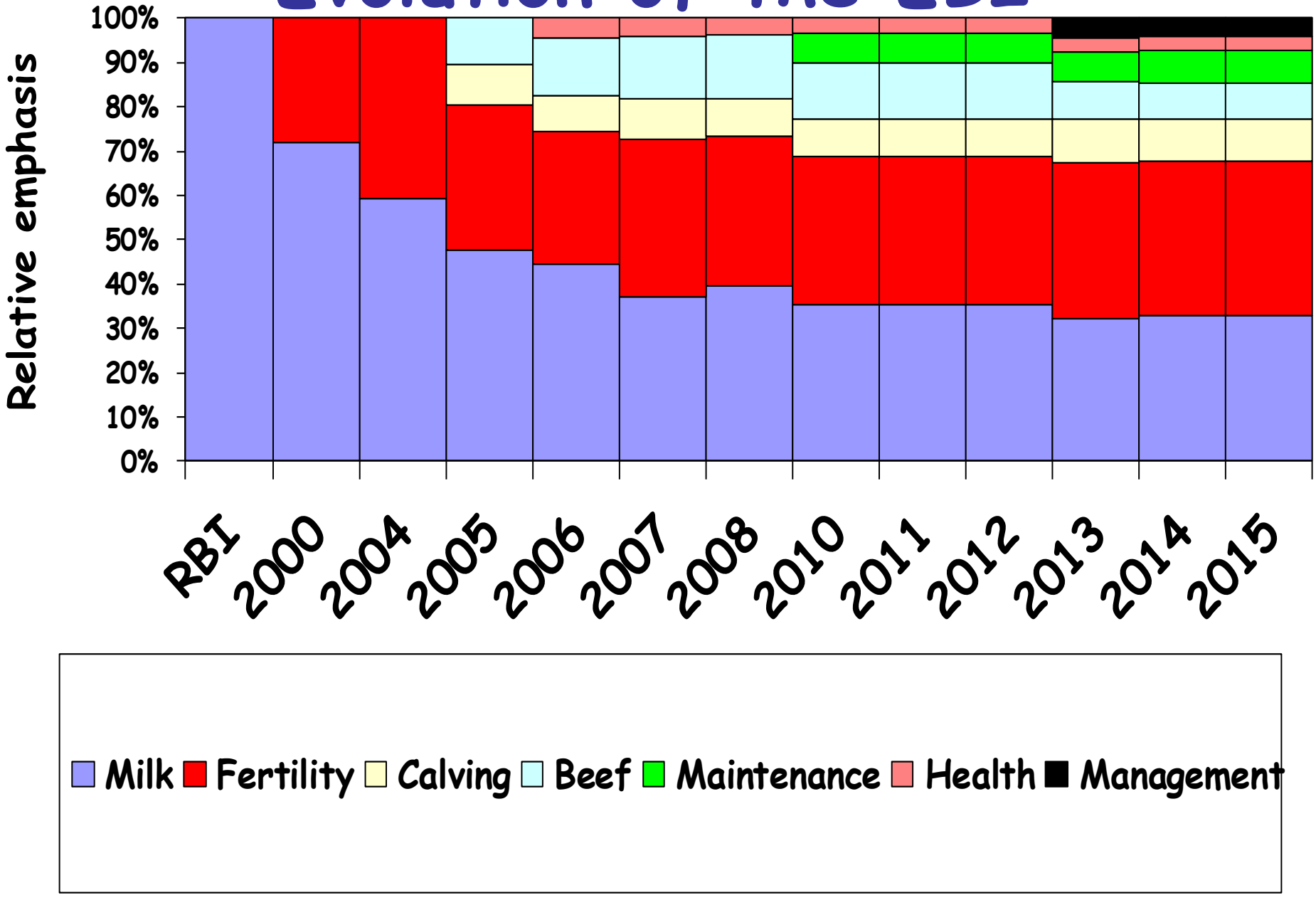
1. Animal genotype
2. Adoption of key grazing management principals
3. Sward species composition
4. Grass budgeting
5. Sustainable- broader that environment

# 1. Animal Genotype

## Grass-based Genetics is a Requirement of Profitable Pasture-based System: Characteristics

1. Propensity for high grass DM intake- %BW
2. High health status
3. High fertility and longevity
4. Easy care and docile
5. Finished off (predominantly) pasture
6. Robust to fluctuations in pasture quality and quantity

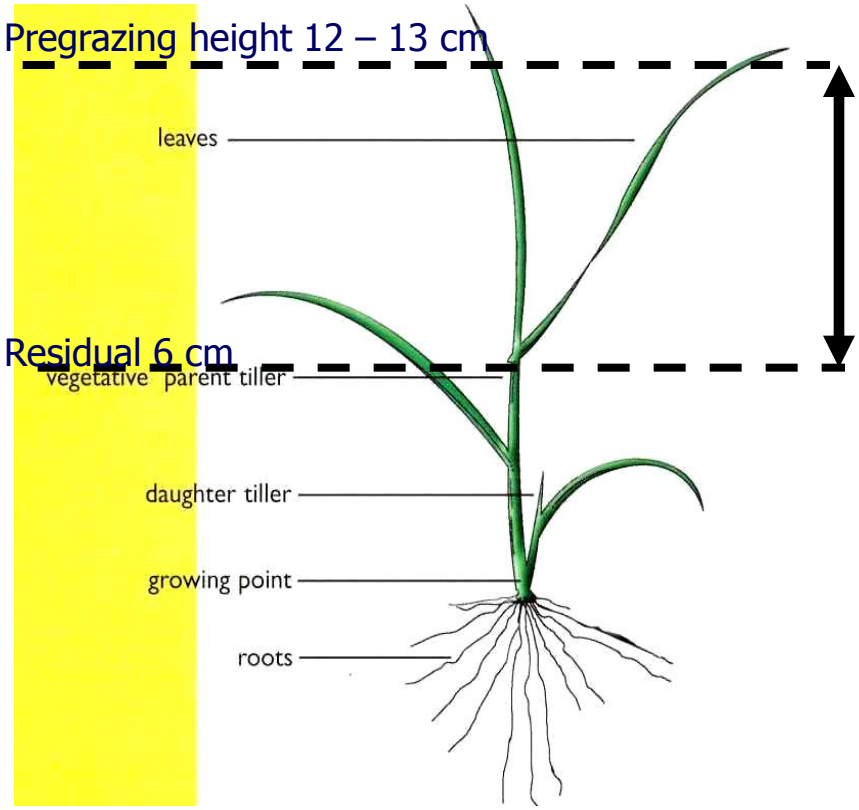
# Evolution of the EBI



# 2. Adoption of Key Grazing Management Principals

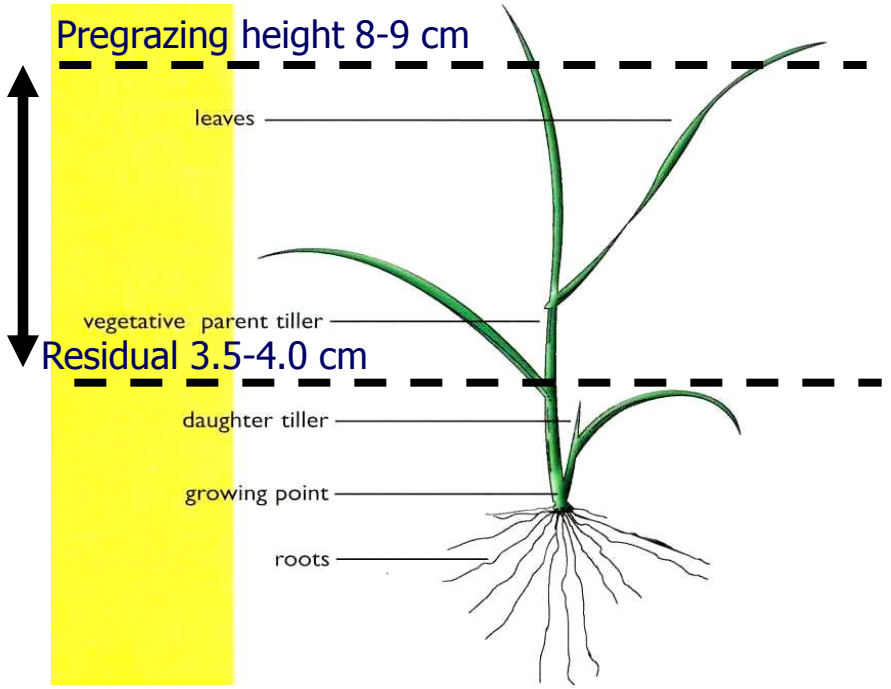
**Avoid leaf death-Create Green Leafy Base**

**2001 - 2005**




**Growth 14.5 tons /ha**

**Current**

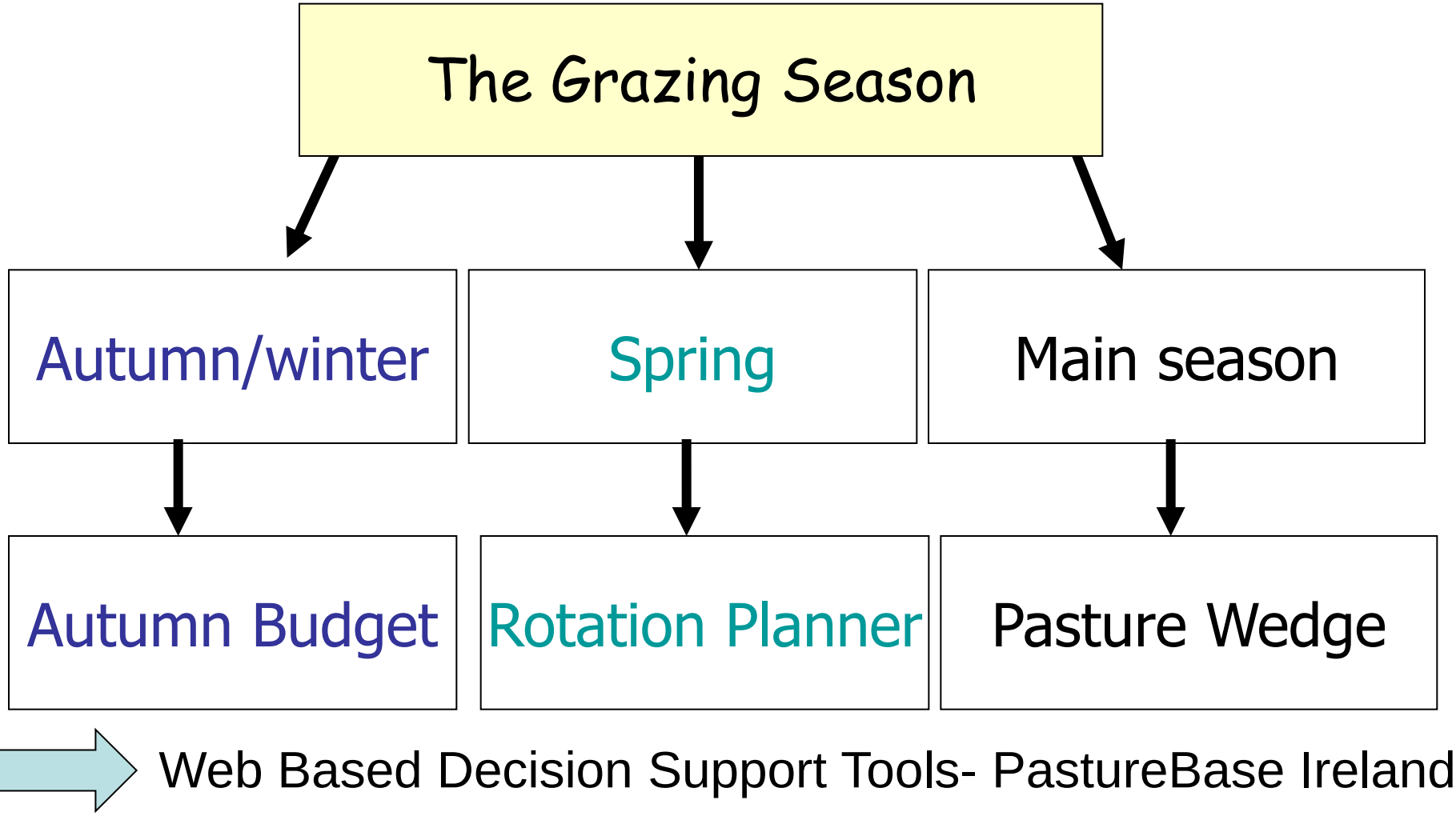



**Growth 15.5 tons /ha**

# Importance of Grass Measurement

# 3. Sward Species Composition

# 4. Grass Budgeting

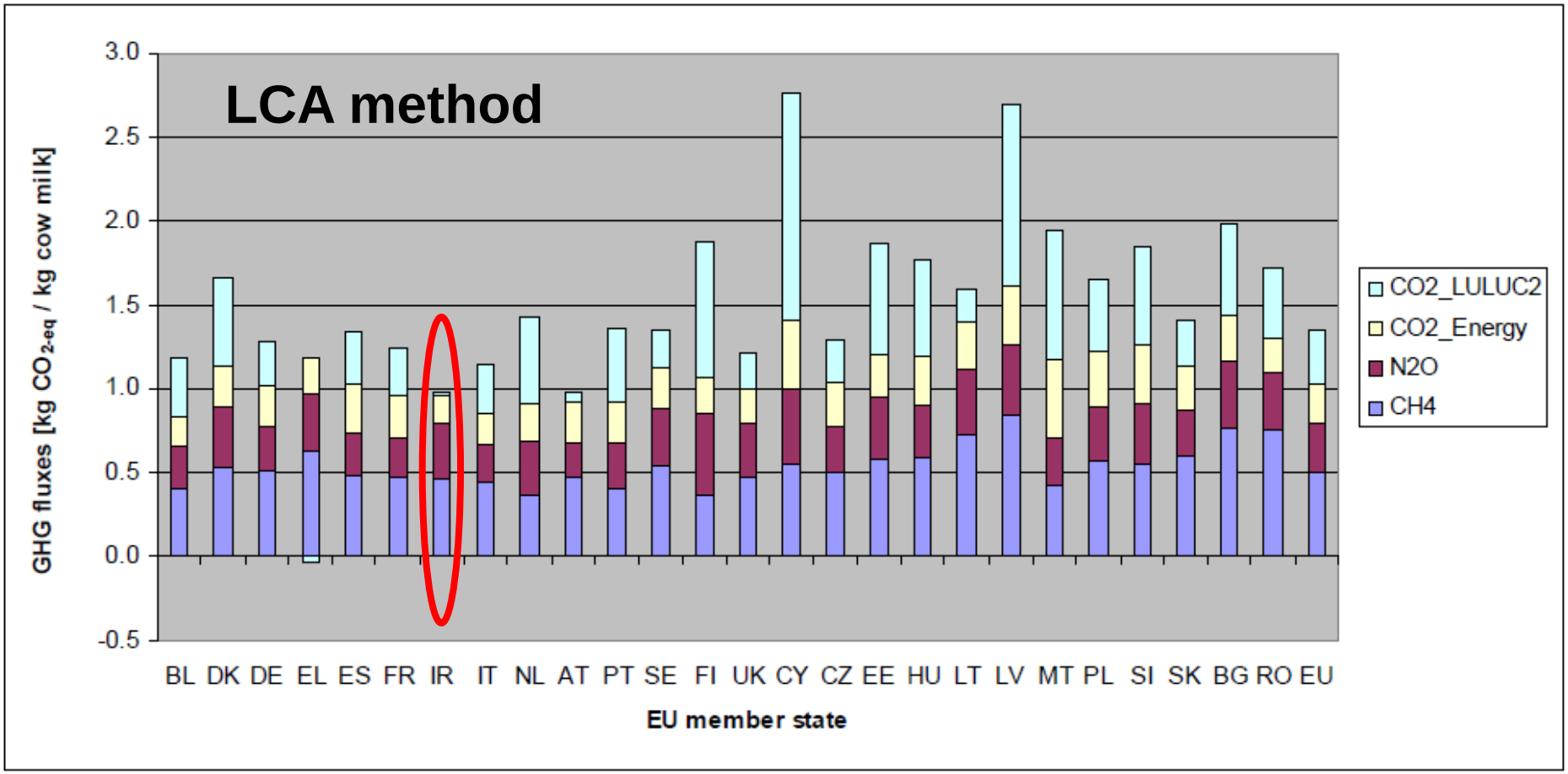



Web Based Decision Support Tools- PastureBase Ireland

# PastureBase Ireland- National Grassland Database

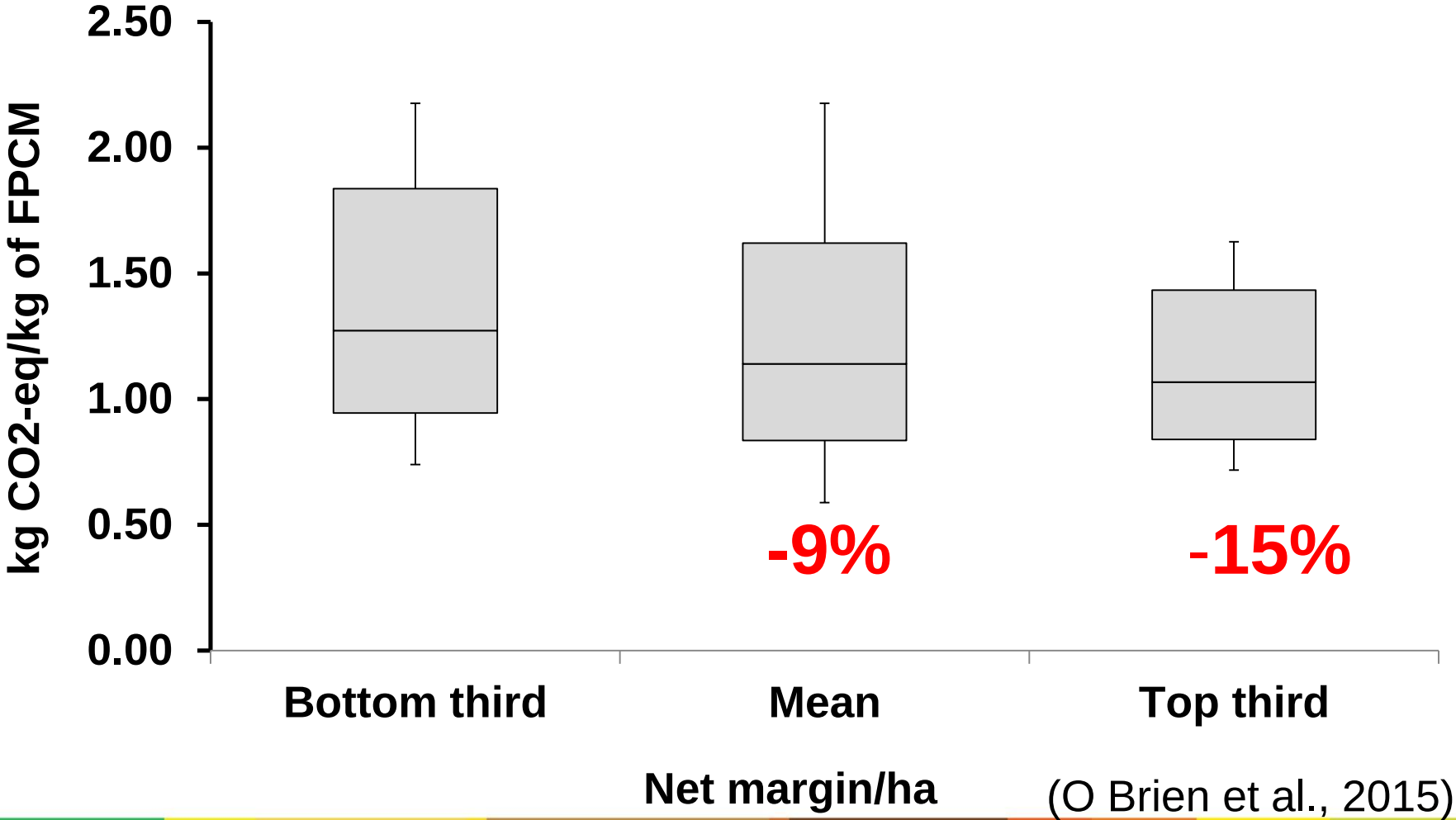

**Head Office:** Teagasc, Oak Park, Carlow, Ireland Tel: +353 59 917 0200 Fax: +353 59 918 2097 **PastureBase Administrator:** Tel: +353 25 42683 Email: PastureBaseAdmin@teagasc.ie 

# 5. Sustainability: Emissions per kg milk produced in different EU countries



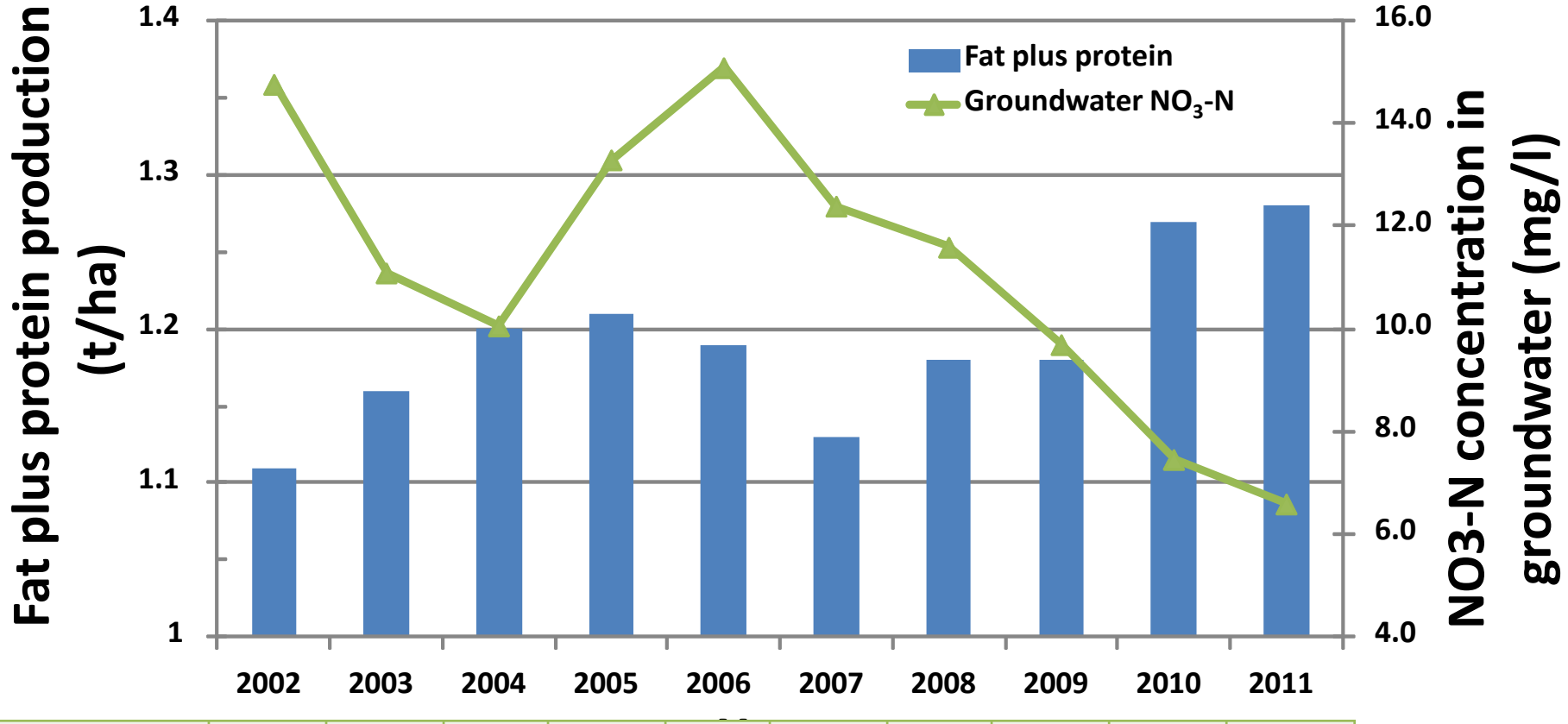

Source: Evaluation of the livestock sector's contribution to the EU GHG emissions (GGELS) **EC, Joint Research centre, 2010.**

# Farm Profit and Carbon Footprint of Irish Milk (NFS)




(O Brien et al., 2015)

# Increasing stocking rate/output can be compatible with good environmental performance in a pasture-based system




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SR (cows/ha) | 2.4 | 2.4 | 2.4 | 2.6 | 2.6 | 2.7 | 2.9 | 2.9 | 2.9 | 2.9 |
| Conc (kg/cow) | 741 | 716 | 645 | 636 | 1202 | 590 | 617 | 288 | 450 | 430 |
| N fertilizer (kg/ha) | 294 | 289 | 296 | 331 | 259 | 313 | 244 | 248 | 252 | 249 |

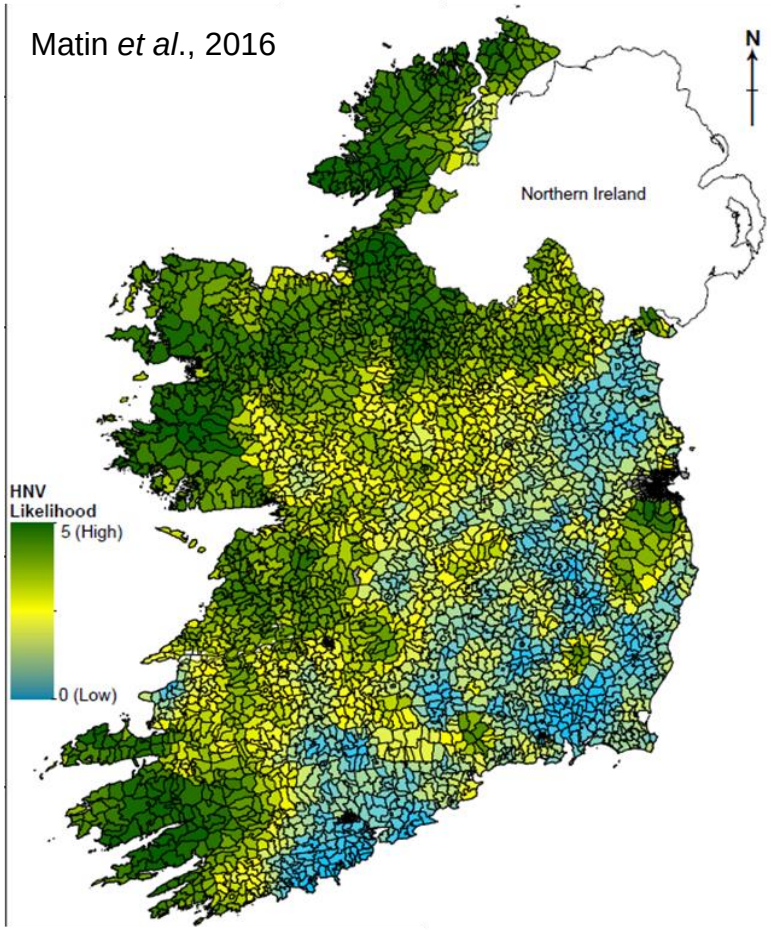
# 5. Role of Less Productive Grasslands

# Sustainable management of extensive grasslands

**High Nature Value farmland-**

**low intensity farming + high biodiversity**

**The ecological quality of the grassland habitat depends on continued appropriate grazing**




**20-30% of Irish farmland is believed to be High Nature Value farmland**

# Threats to Extensive Grasslands

**Abandonment**

**Removal of grazers results in scrub and loss of grassland habitats**

**Negative impact on:**

- **Production**
- **Biodiversity**
- **Rural Communities**


# Role of extensive grassland

## Ecosystem Services

1. **Provisioning Services:**
   - **Food and fuel**
2. **Regulatory Services:**
   - **Climate, flood mitigation, water**
3. **Cultural Services:**
   - **Aesthetic, recreational.**
4. **Supporting Services:**

   **Soil formation, nutrient cycling**

# New Opportunities for Less Productive Grasslands

1. Can be Competitive: per unit of production
2. Premium for pasture-based meat/milk
3. Important in terms of climate change mitigation
4. Promotion of a clean, animal welfare friendly image

**But Requires greater innovation in animal and grassland technology to enhance competitiveness while maintaining its public good roles**

# 6. Important Conclusion

# Concluding comments

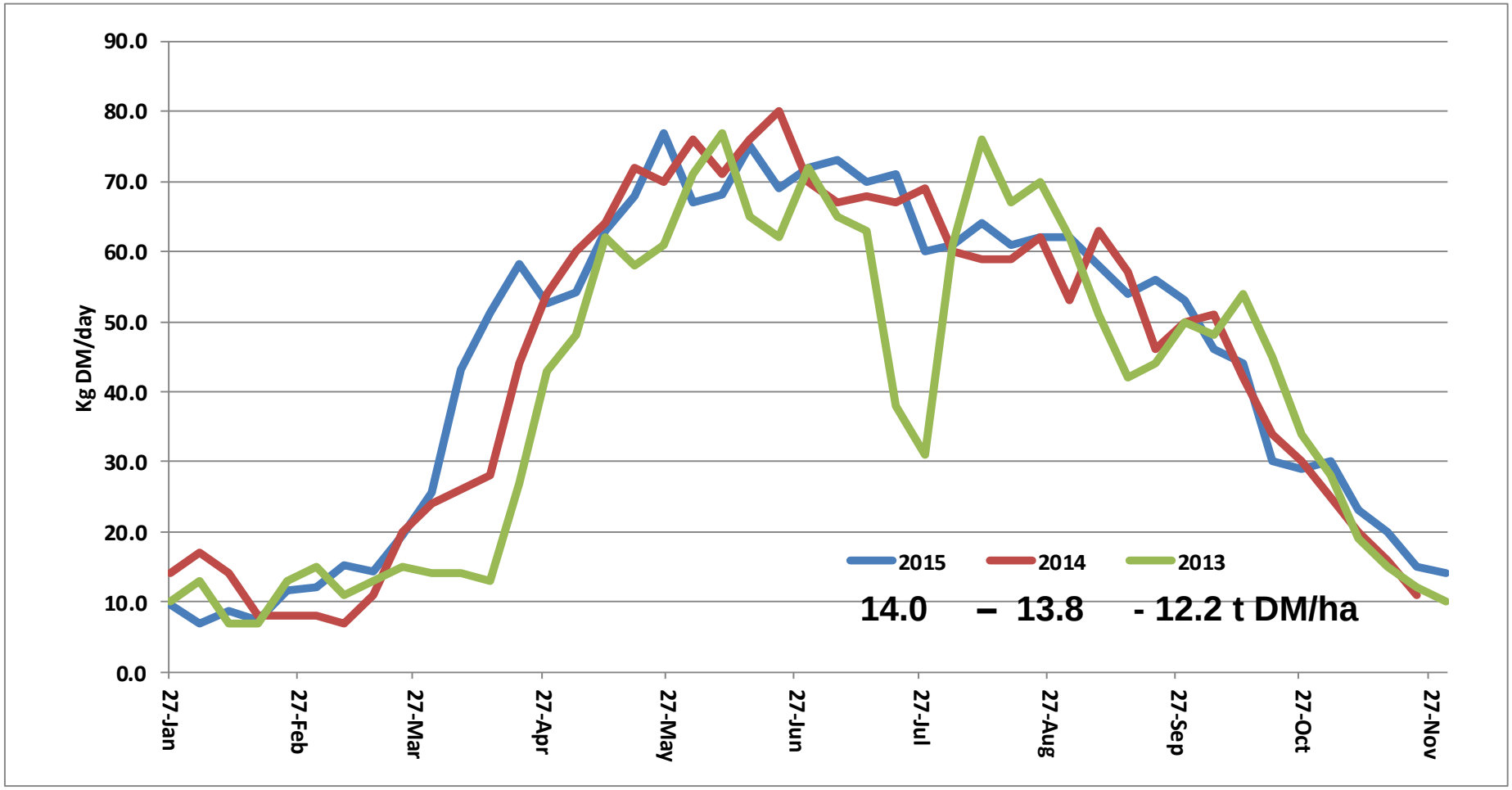
- Grasslands could deliver significant food security, environmental and nutrition benefits while facilitating GHG mitigation and adaptation in the livestock sector,

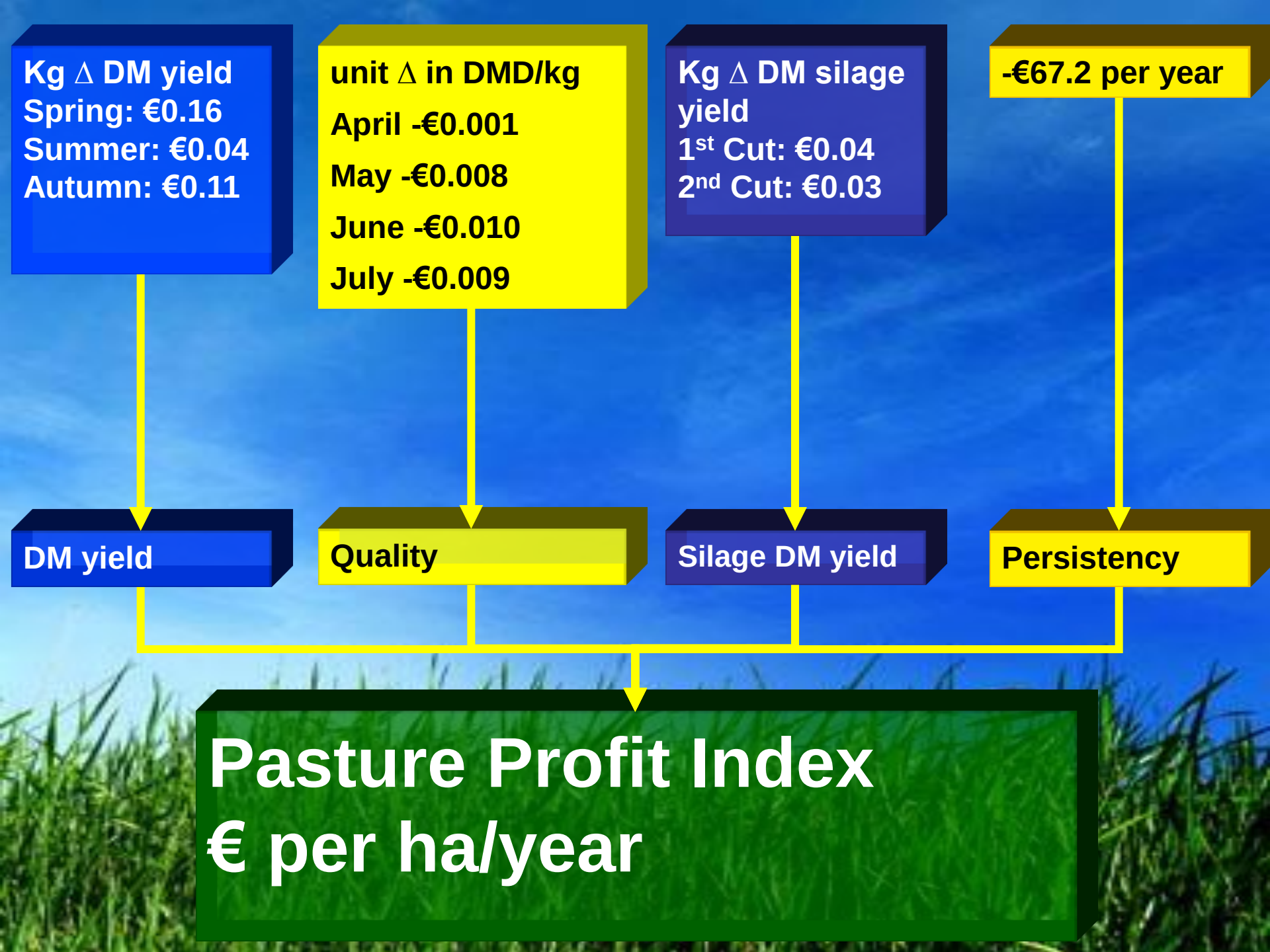
- However, this would require current trends in investments to be changed, moving away from the grain based intensification of ruminant livestock,

- Such changes could happen provided that carbon funds and healthy diets concerns shift the economic balance towards increased use of grasslands

# Why grass-based systems ?

- Lower cost per unit of milk & meat production
- Superior in milk & meat composition
- Grass based systems have greater sustainability:
  - Economic- family farming business
  - Social- both internal and external
  - Ecological- climate, water, soil, fauna & flora


90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Kg DM/day
27-Jan
27-Feb
27-Mar
27-Apr
27-May
27-Jun
27-Jul
27-Aug
27-Sep
27-Oct
27-Nov
2015
2014
2013
14.0 – 13.8 - 12.2 t DM/ha

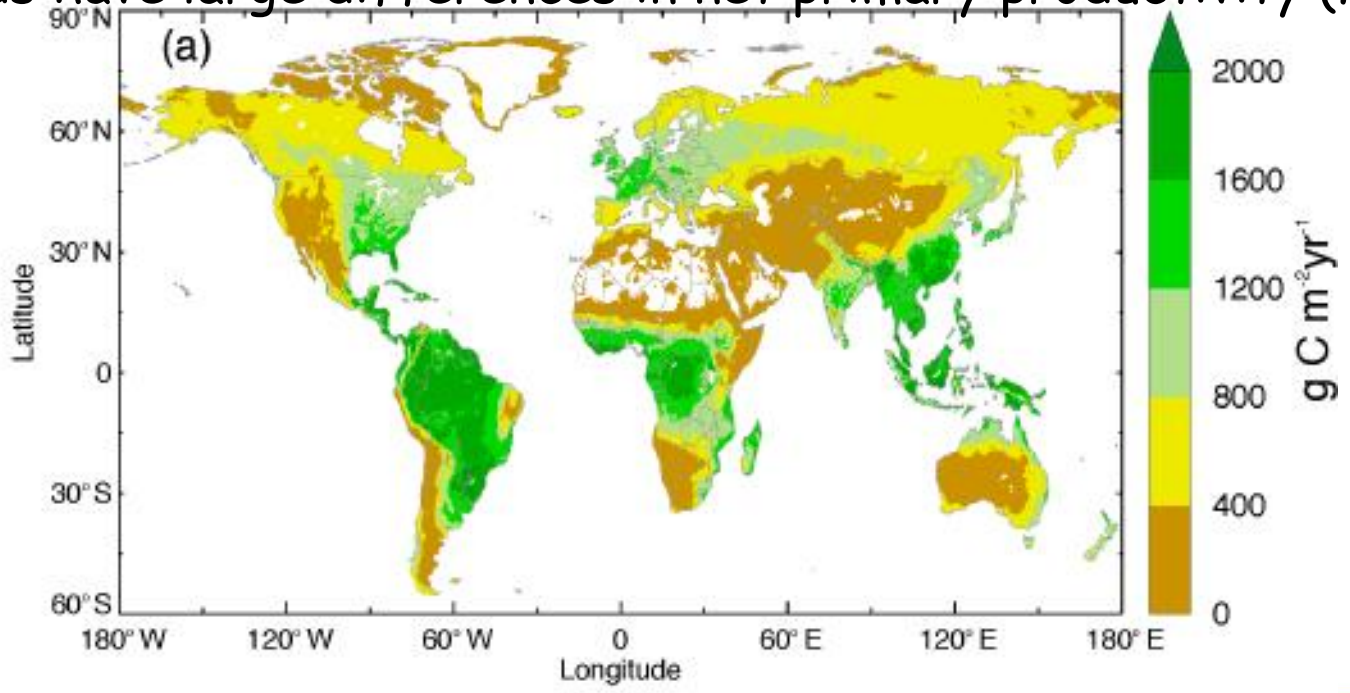

Kg Δ DM yield
Spring: €0.16
Summer: €0.04
Autumn: €0.11
unit Δ in DMD/kg
April -€0.001
May -€0.008
June -€0.010
July -€0.009
Kg Δ DM silage yield
1st Cut: €0.04
2nd Cut: €0.03
-€67.2 per year
DM yield
Quality
Silage DM yield
Persistency
Pasture Profit Index
€ per ha/year

# Grasslands: a key global resource

Grasslands (grazing lands):

- Provide half of global gross energy intake by ruminants,
- Are a key resource which cannot be directly used by humans,
- Contribute through manure to crop fertilisation,
- Account for ~ 20% of ice free land area & 25% global soil carbon stock

Grasslands have large differences in net primary productivity (NPP)




**Grasslands NPP: up to 40 t DM/yr**



(Chang et al., 2016. Biogeosciences)

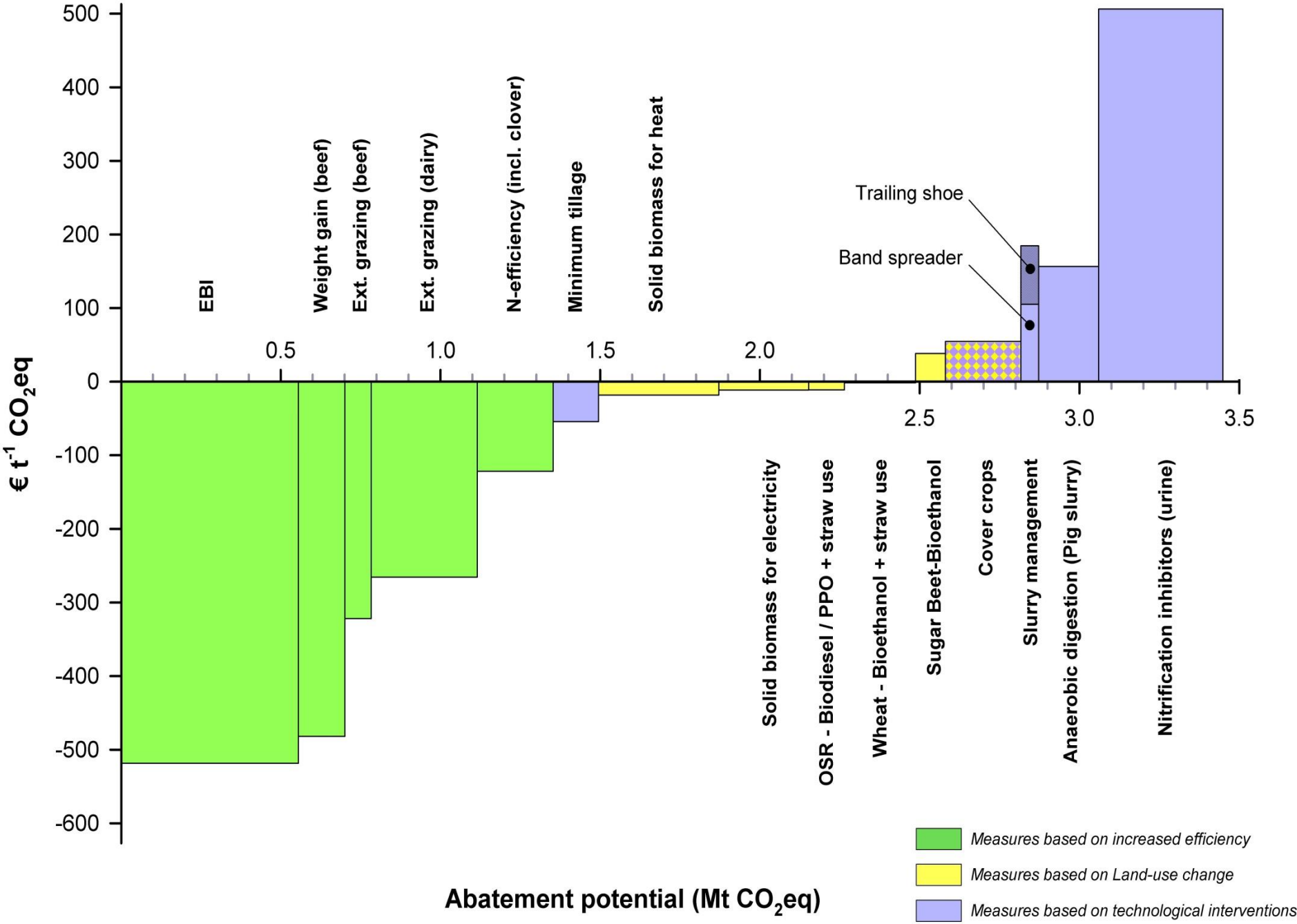
# Importance of extensive grasslands

- Ireland's landscape and biodiversity has been shaped by millennia of agricultural activity.
- Irish farmland is characterised by a diversity of habitats such as hedgerows, streams and species-rich pastures.
- Irish biodiversity depends on agricultural management and grazing of farmland habitats

# Supports for extensive farmers

- Technology Support
  - Best practice and advice
- Marketing opportunities
  - Branding
- Additional opportunities
  - Agri-tourism
- Agri-environment supports
  - Payment for ecosystem services


# LCA MACC Results



# Grazing Management

# 4. Opportunities to Further Increase Food Production by Increased Reliance on Grazing Systems

# Milk Production Results 2014-2015

| | Tetraploid | Diploid | Tetraploid + clover | Diploid + clover |
|---|---|---|---|---|
| Concentrate fed (kg/cow) | 336 | 336 | 339 | 338 |
| Silage fed (kg/cow) | 327 | 302 | 340 | 381 |
| Milk yield (kg/cow) | 4972 | 4994 | 5783 | 5750 |
| Fat (%) | 4.69 | 4.64 | 4.62 | 4.61 |
| Protein (%) | 3.82 | 3.74 | 3.74 | 3.74 |
| Milk solids (kg/cow) | 420 | 423 | 481 | 478 |
| Milk solids yield (kg/ha) | 1,162 | 1,145 | 1,328 | 1,316 |

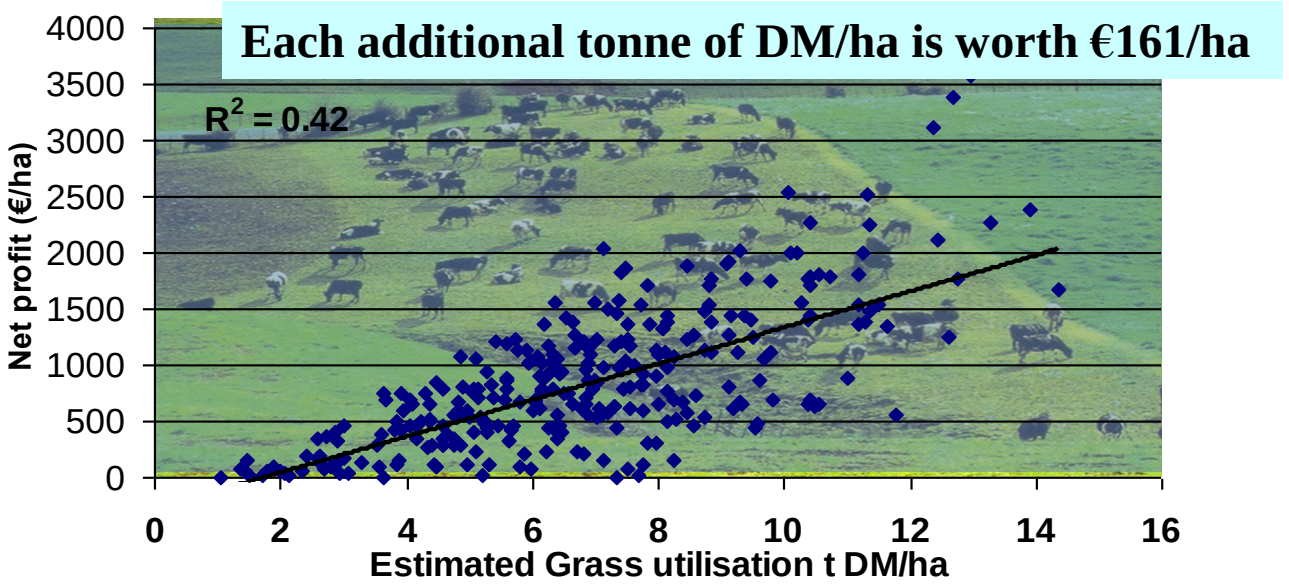
784 kg/cow

58 kg/cow

168 kg/ha

# Stock the Farm Appropriately for 2016

- **Profitability of grazing is closely linked to grass utilisation (tons DM/ha)**
  - **Increasing SR will only be profitable when grass utilisation increases**




- **Optimum Stocking rate for Dairy Farms in 2016**

| | *Pasture grown, t* | | | |
|---|---|---|---|---|
| t supplement DM/cow | 10 | 12 | 14 | 16 |
| 0.00 | 1.5 | 2.0 | 2.3 | 2.6 |
| 0.25 | 1.7 | 2.1 | 2.4 | 2.8 |
| 0.50 | 1.8 | 2.2 | 2.5 | 3.0 |
| 0.75 | 1.9 | 2.3 | 2.7 | 3.1 |