La Ganadería Bovina de Carne Australiana y Los Gases de Efecto Invernadero - Carbono neutro, Tecnologías e Investigación

Gonzalo Martinez Fernandez| Dr

8 de julio 2021

Agencia Nacional de Investigación en Australia

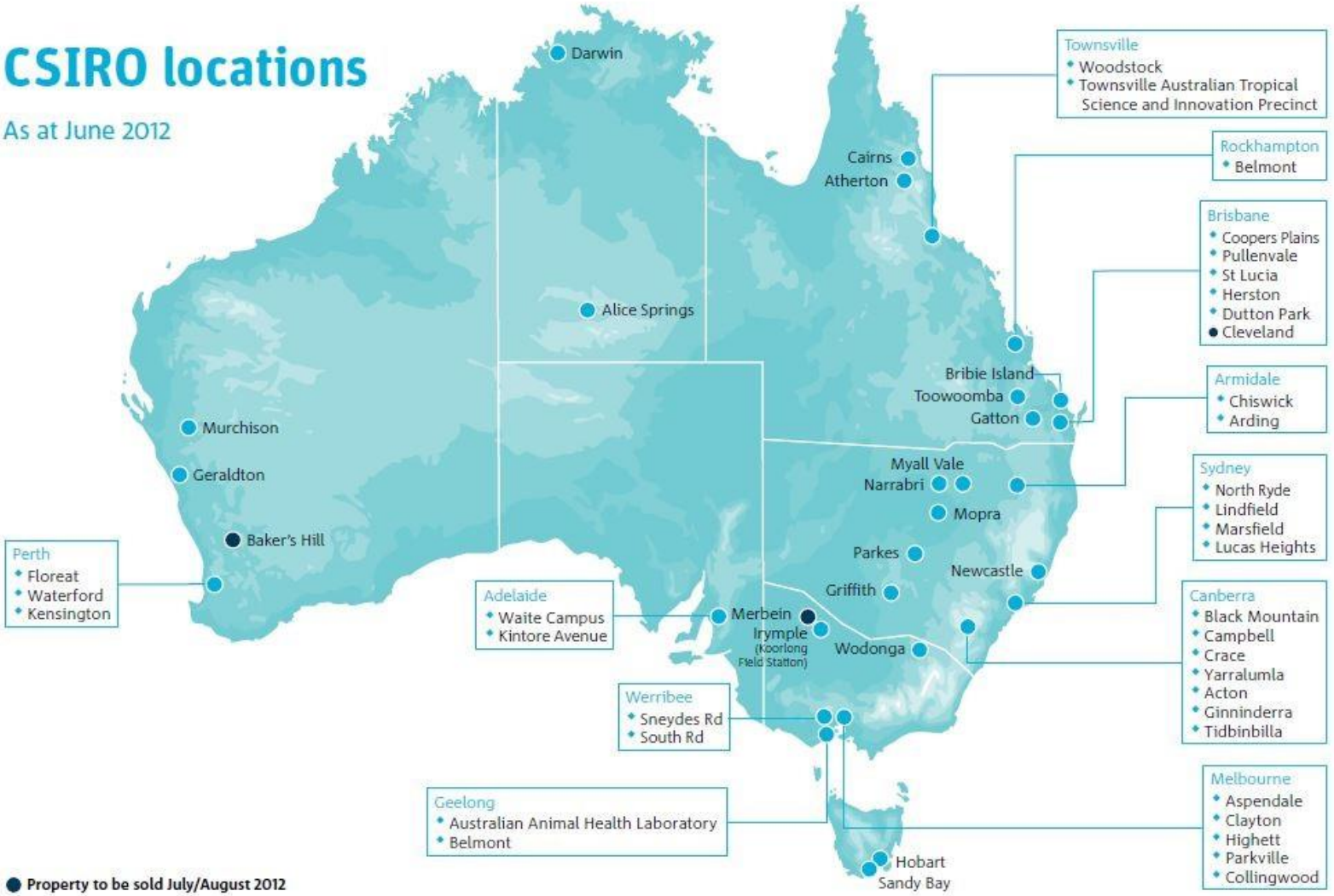
Departamentos e investigación

- Salud y Bioseguridad
- Agricultura & Alimentación
- Data 61
- Energía
- Ecosistemas Terrestres y Acuáticos
- Manufactura
- Recursos naturales
- Océanos y atmósfera
- Astronomía y espacio

https://www.csiro.au/

CSIRO locations

As at June 2012



● **Property to be sold July/August 2012**

Rumiantes

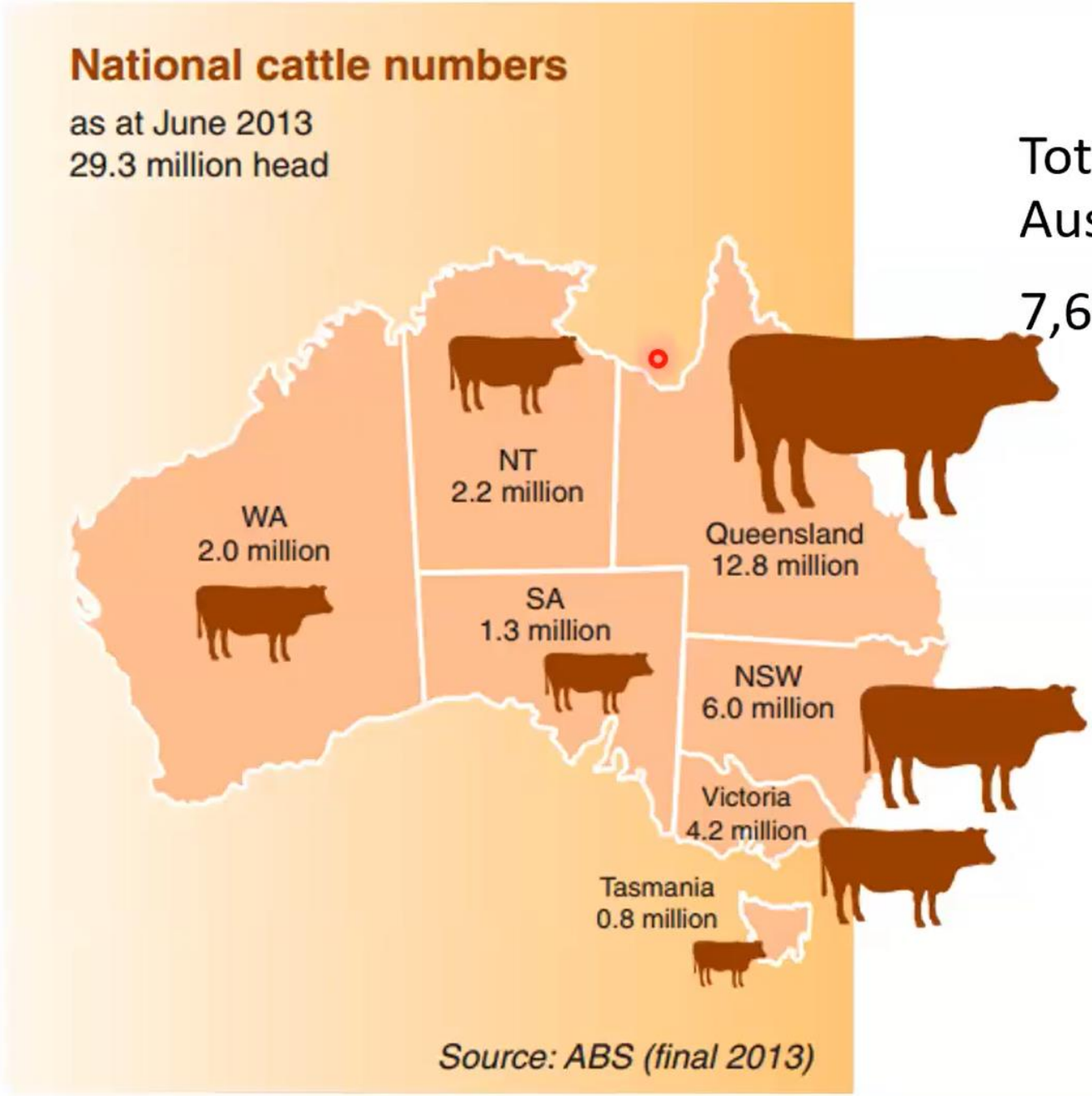
Extraordinaria importancia económica y social

- Capacidad de transformar alimentos fibrosos en alimentos para los humanos

- No apropiado comparar los sistemas de producción de monogástricos (cerdo, aves) con los rumiantes

>50% del ganado en Australia se encuentra en el Norte

- Sistema de pastoreo extensivo influenciado por la climatología (Estación seca y lluviosa)

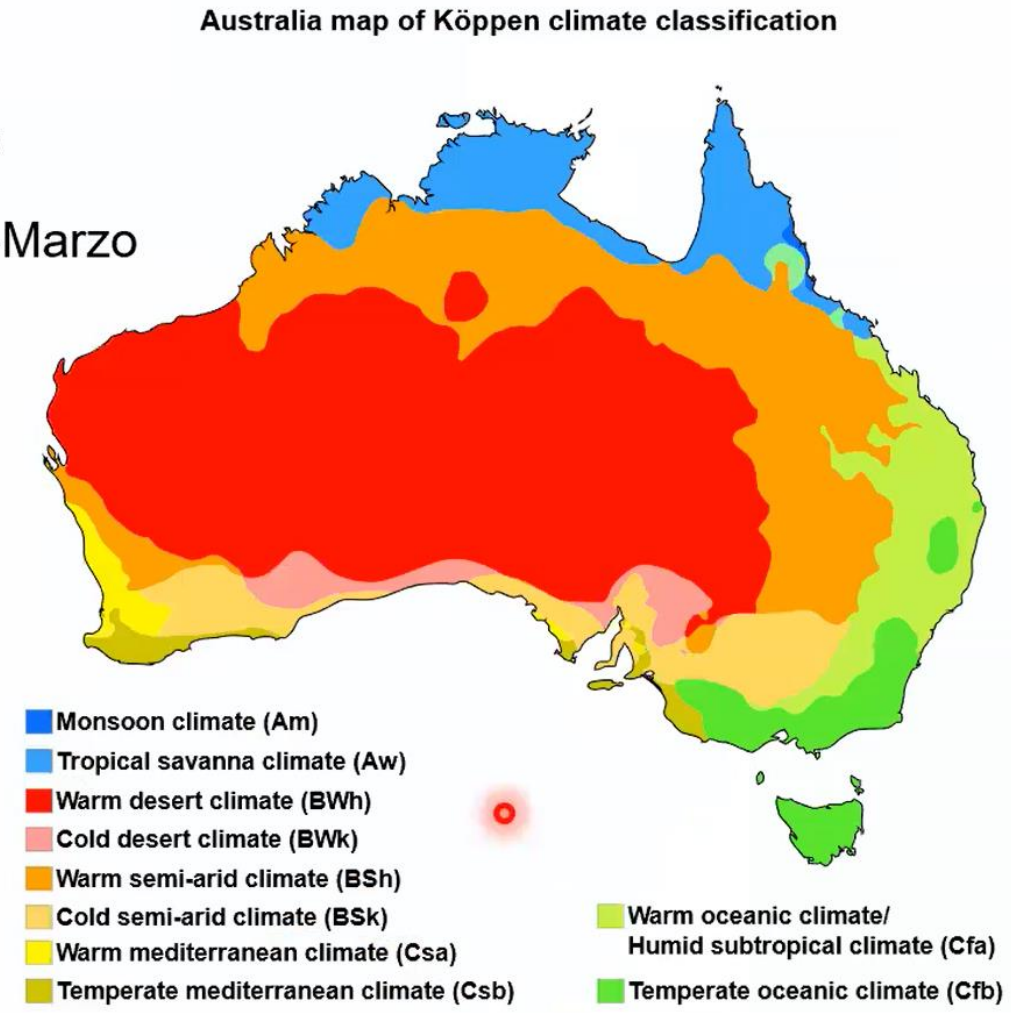


Total Área Australia

7,692,024 km^2

https://www.thebeefsite.com/articles/4085/fast-facts-on-australian-beef-2013/

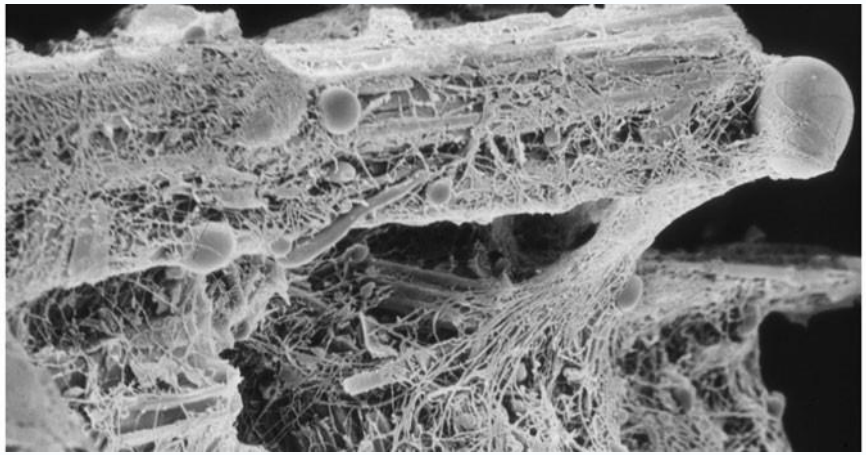
- Estación seca Mayo-Octubre
- Estación húmeda Diciembre-Marzo

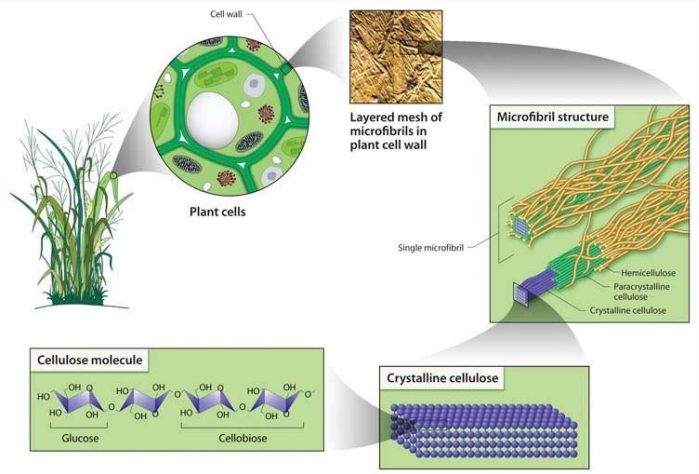


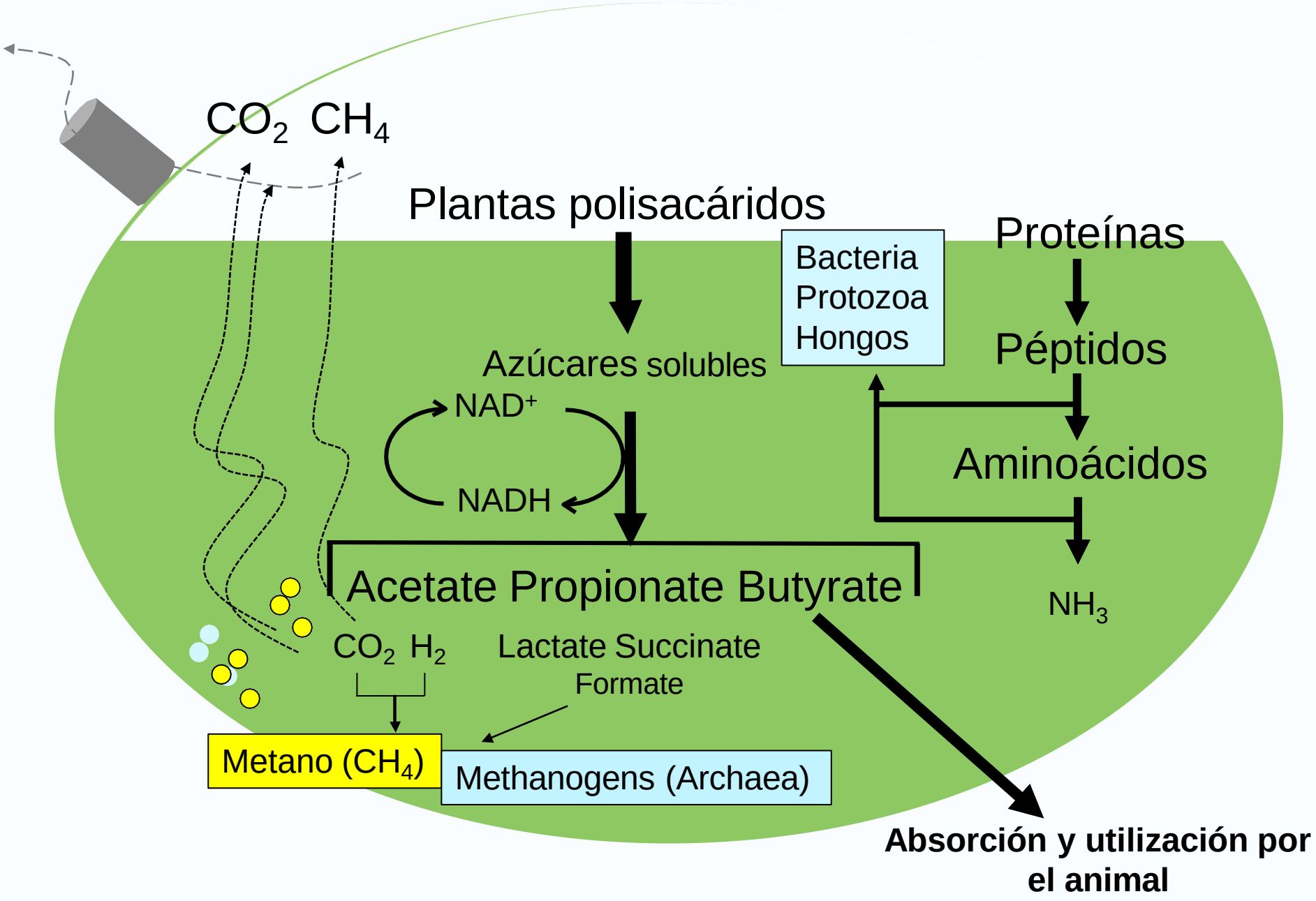
By Enhanced, modified, and vectorized by Ali Zifan. - Derived from World Köppen Classification (with authors).svg., CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=47085250

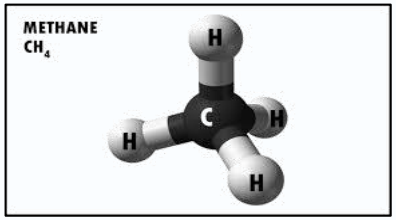
Ecosistema microbiano Rumen:

- Complejo ecosistema microorganismos:
  - Bacteria/Archaea
  - Protozoa
  - Hongos
  - Virus
- Responsables de degradar el componente fibroso y de la conversión de los carbohidratos (celulosa/hemicelulosa) en ácidos grasos volátiles para el animal.
- Principal fuente de proteína para el animal.






CO_2 CH_4
Plantas polisacáridos
Bacteria
Protozoa
Hongos
Proteínas
Azúcares solubles
Péptidos
NAD^+
NADH
Aminoácidos
Acetate Propionate Butyrate
NH_3
CO_2 H_2
Lactate Succinate
Formate
Metano (CH_4)
Methanogens (Archaea)
Absorción y utilización por el animal



28 veces mas potente CO_2

IPCC,2014

~10-15 % de las emisiones agrícolas

Davison et al., 2020

2 – 12 % pérdida de energía para el animal

Johnson & Johnson, 1995

Una reducción de la producción de metano, permitiría optimizar la eficiencia energética y reducir el impacto de la ganadería sobre las emisiones de gases de efecto invernadero

AGU ADVANCING EARTH AND SPACE SCIENCE

AGU Advances

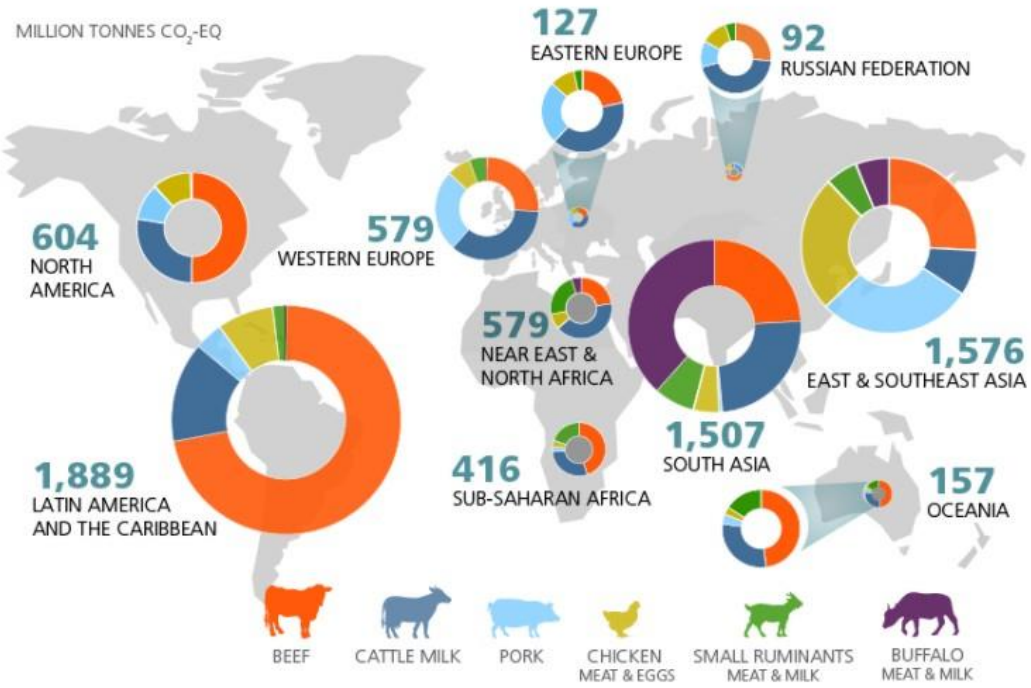
RESEARCH ARTICLE
10.1029/2021AV000391

The Key Role of Production Efficiency Changes in Livestock Methane Emission Mitigation

Key Points:

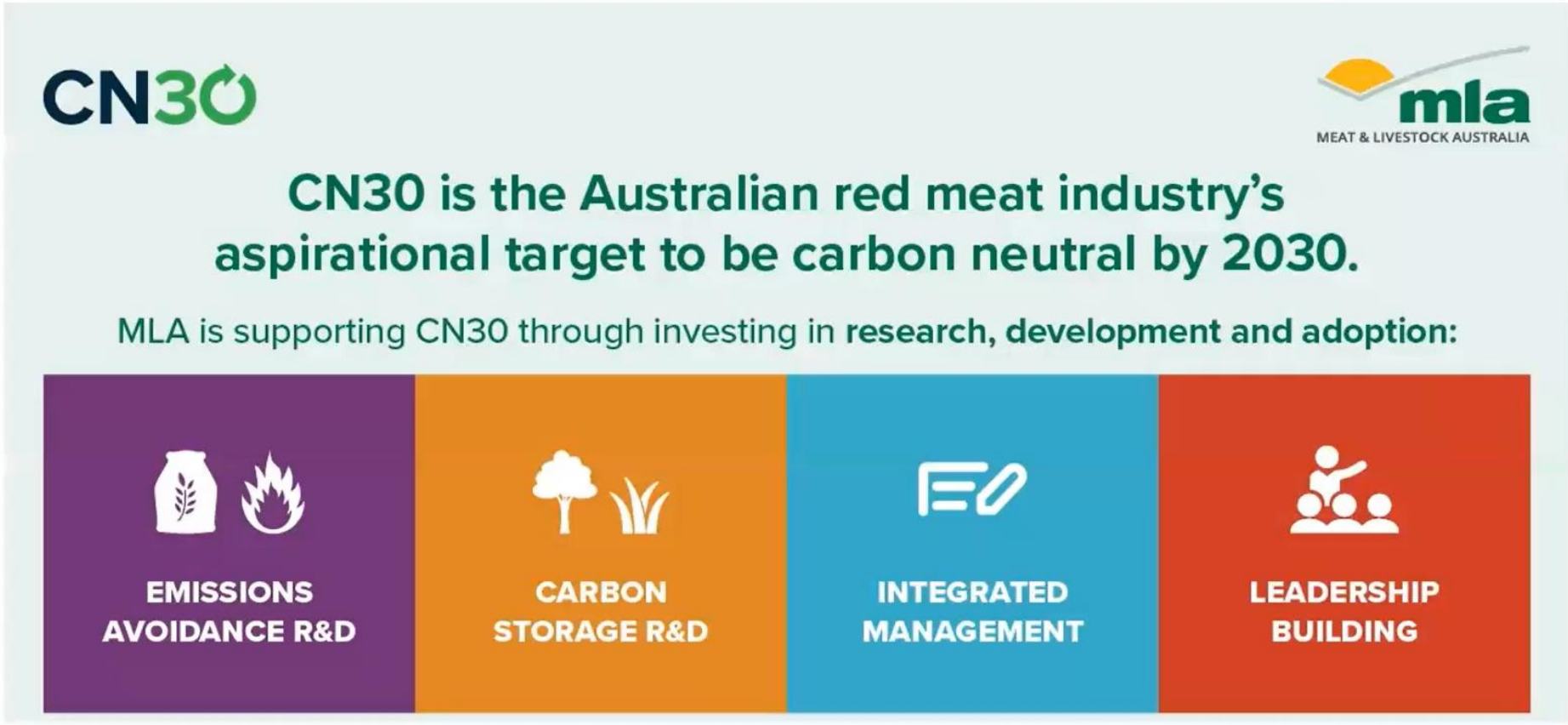
- Emission intensity decreased for most livestock categories

Jinfeng Chang[1,2], Shushi Peng[3], Yi Yin[4], Philippe Ciais[5], Petr Havlik[2], and Mario Herrero[6]



Greenhouse gas emissions from livestock production vary greatly in different parts of the world due to farming practices as well as animal numbers, type and food product. A new study finds emission intensity for the amount of protein produced could be reduced through more efficient farming practices, even as demand rises worldwide.

Credit: ***Food and Agriculture Organization of the United Nations*** *CC BY-NC-SA 3.0 IGO*



https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/cn30/

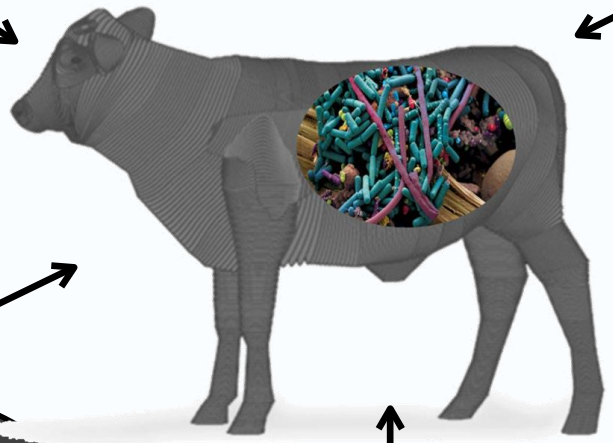
Estrategias reducción metano

Dieta

- Leucaena
- Desmanthus
- Pasto vs Cebadero

Suplementos

- 3-NOP
- Asparagopsis (Alga)
- Nitratos
- Lipidos
- Extractos de plantas



Manipulación ruminal

- Inoculación de microorganismos
- Vacunación

Manejo

Genética

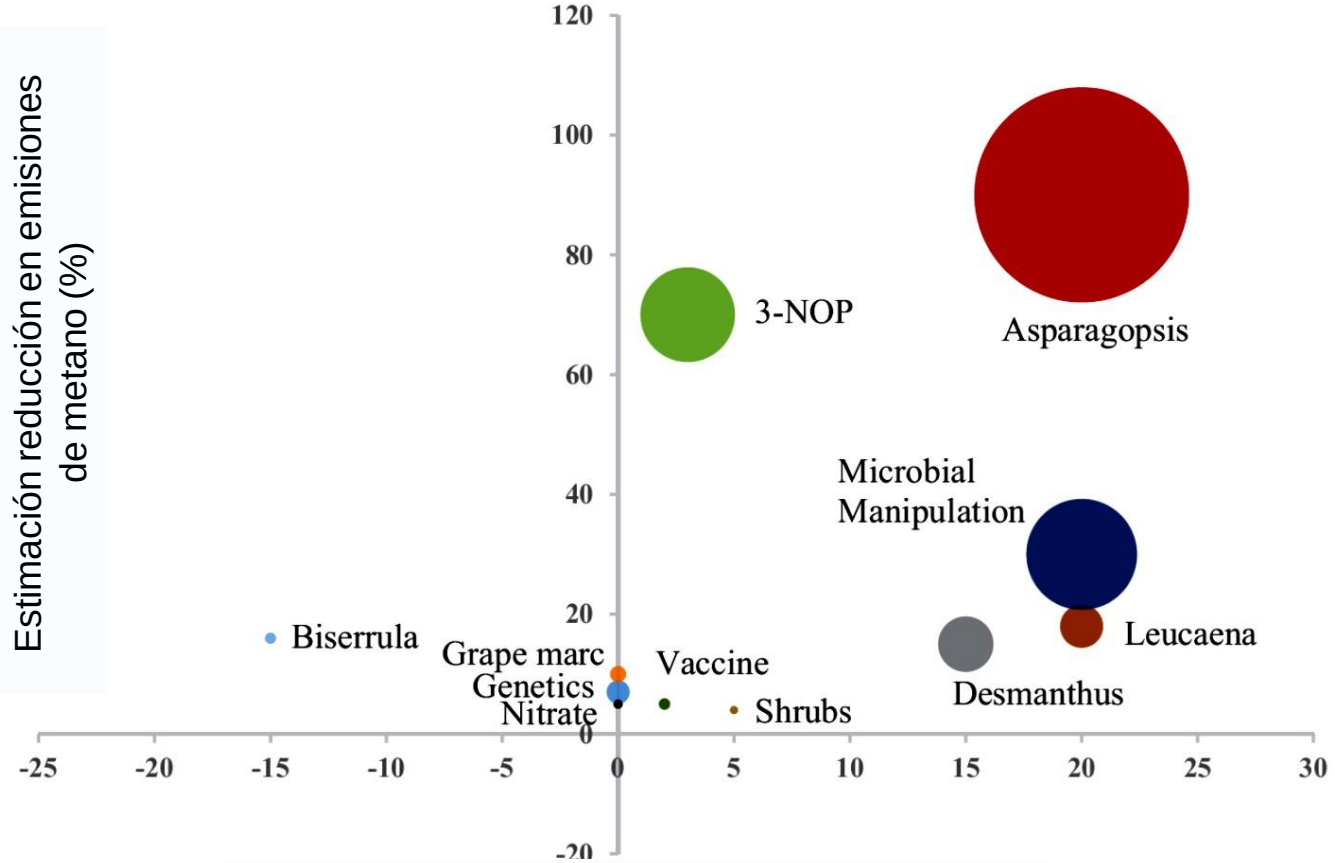
Feature Article

Red meat—an essential partner to reduce global greenhouse gas emissions

Thomas M. Davison,[†] John L. Black,[‡] and Jonathan F. Moss[||]

[†]Livestock Productivity Partnership, University of New England, Armidale, New South Wales, Australia
[‡]John L. Black Consulting, Warrimoo, New South Wales, Australia
[||]UNE Business School, University of New England, Armidale, New South Wales, Australia

Davison *et al.*, 2020



- ***Nitratos***

Reducción del metano

~10-15%

CSIRO PUBLISHING
Animal Production Science, 2016, **56**, 1605–1611
http://dx.doi.org/10.1071/AN14886

The effect of feeding frequency and dose rate of nitrate supplements on blood haemoglobin fractions in *Bos indicus* cattle fed Flinders grass (*Iseilemia* spp.) hay

I. Benu[A,B], *M. J. Callaghan*[C], *N. Tomkins*[D], *G. Hepworth*[E], *L. A. Fitzpatrick*[A] and *A. J. Parker*[A,F]

CSIRO PUBLISHING
Animal Production Science, 2014, **54**, 1300–1304
http://dx.doi.org/10.1071/AN14270

How feasible is it to replace urea with nitrates to mitigate greenhouse gas emissions from extensively managed beef cattle?

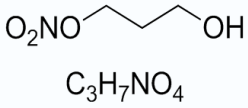
M. J. Callaghan[A,E], *N. W. Tomkins*[B], *I. Benu*[C] and *A. J. Parker*[D]

Principal problema:
Toxicidad
Nitrito ➡ Metahemoglobina

Australian Government
Department of Agriculture

mla
MEAT & LIVESTOCK AUSTRALIA

- ***3-NOP***



3-nitrooxypropanol

Mecanismo de acción especifico:

methyl-coenzyme M reductase (Archaeas)

Reducción de metano 30-90%

No efecto adverso en la fermentación ruminal

CSIRO PUBLISHING
Animal Production Science
http://dx.doi.org/10.1071/AN15705

Optimal dose of 3-nitrooxypropanol for decreasing enteric methane emissions from beef cattle fed high-forage and high-grain diets

D. Vyas[A], *S. M. McGinn*[A], *S. M. Duval*[B], *M. K. Kindermann*[C] *and K. A. Beauchemin*[A,D]

[A]Agriculture and Agri-Food Canada, Lethbridge Research and Development Center, Lethbridge, Alberta, T1J 4B1, Canada.
[B]DSM Nutritional Products France, Research Center for Animal Nutrition, BP170, 68305 Saint Louis Cedex, France.
[C]DSM Nutritional Products, PO Box 2676, Building 241/865, CH-4002 Basel, Switzerland.
[D]Corresponding author. Email: karen.beauchemin@agr.gc.ca

PNAS

An inhibitor persistently decreased enteric methane emission from dairy cows with no negative effect on milk production

Alexander N. Hristov[a,1], Joonpyo Oh[a], Fabio Giallongo[a], Tyler W. Frederick[a], Michael T. Harper[a], Holley L. Weeks[a], Antonio F. Branco[b], Peter J. Moate[c], Matthew H. Deighton[c], S. Richard O. Williams[c], Maik Kindermann[d], and Stephane Duval[e]

J. Dairy Sci. 97:3777–3789
http://dx.doi.org/10.3168/jds.2013-7397
© American Dairy Science Association®, 2014.

Effects of 3-nitrooxypropanol on methane emission, digestion, and energy and nitrogen balance of lactating dairy cows

C. K. Reynolds,*[1] D. J. Humphries,* P. Kirton,* M. Kindermann,† S. Duval,‡ and W. Steinberg†[1]
*School of Agriculture, Policy and Development, University of Reading, PO Box 237, Earley Gate, Reading, RG6 6AR, United Kingdom
†DSM Nutritional Products Ltd., PO Box 2676, CH-4002 Basel, Switzerland
‡DSM Nutritional Products, Research Centre for Animal Nutrition and Health, BP 170, F-68305 Saint-Louis Cedex, France

J. Dairy Sci. 97:3790–3799
http://dx.doi.org/10.3168/jds.2013-7398
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Effects of ethyl-3-nitrooxy propionate and 3-nitrooxypropanol on ruminal fermentation, microbial abundance, and methane emissions in sheep

G. Martínez-Fernández,* L. Abecia,* A. Arco,* G. Cantalapiedra-Hijar,*[1] A. I. Martín-García,* E. Molina-Alcaide,* M. Kindermann,† S. Duval,‡ and D. R. Yáñez-Ruiz*[2]
*Estación Experimental del Zaidín (Consejo Superior de Investigaciones Científicas), Camino del Jueves s/n, 18100 Armilla, Granada, Spain

PNAS

Mode of action uncovered for the specific reduction of methane emissions from ruminants by the small molecule 3-nitrooxypropanol

Evert C. Duin[a], Tristan Wagner[b], Seigo Shima[b], Divya Prakash[a,1], Bryan Cronin[a], David R. Yáñez-Ruiz[c], Stephane Duval[d], Robert Rümbeli[e], René T. Stemmler[e], Rudolf Kurt Thauer[b,2], and Maik Kindermann[e,2]

[a]Department of Chemistry and Biochemistry, Auburn University, Auburn, AL 36849; [b]Max Planck Institute for Terrestrial Microbiology, D-35043 Marburg, Germany; [c]Estación Experimental del Zaidín, Consejo Superior de Investigaciones Científicas, 18008 Granada, Spain; [d]Research Centre for Animal Nutrition and Health, DSM Nutritional Products France, 68305 Saint Louis, France; and [e]Research and Development, DSM Nutritional Products, 4002 Basel, Switzerland

- ***Asparagopsis (alga roja)***

Reducción de metano 40-90%

No efecto adverso en la fermentación ruminal

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Mitigating the carbon footprint and improving productivity of ruminant livestock agriculture using a red seaweed

Robert D. Kinley [a, *], Gonzalo Martinez-Fernandez [a], Melissa K. Matthews [a], Rocky de Nys [b], Marie Magnusson [b, c], Nigel W. Tomkins [a, d]

Red seaweed (*Asparagopsis taxiformis*) supplementation reduces enteric methane by over 80 percent in beef steers

Seaweed supplementation reduces enteric emissions

B.M. Roque[1], M. Venegas[1], R. Kinley[2], R. deNys[3], T. L. Neoh[3], T.L. Duarte[1], X. Yang[1], J. K. Salwen[4], E. Kebreab[1]

Journal of Cleaner Production 234 (2019) 132–138

Contents lists available at ScienceDirect

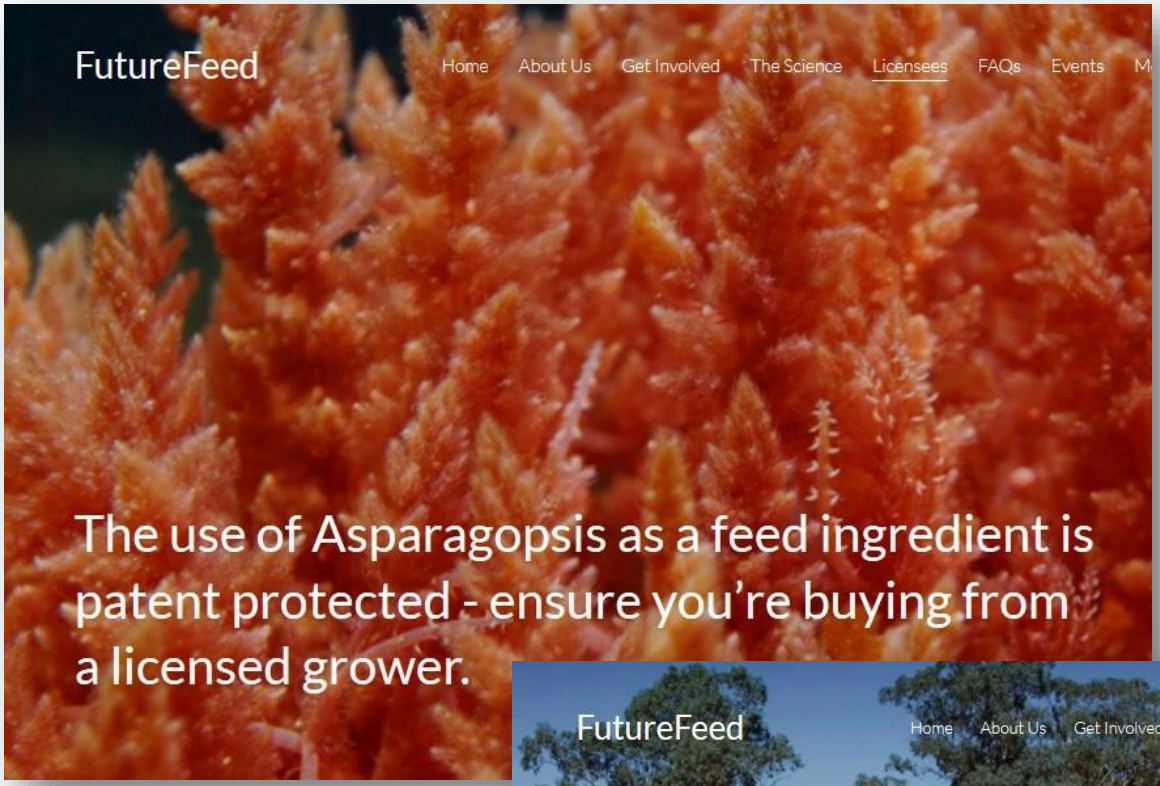
Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Inclusion of *Asparagopsis armata* in lactating dairy cows' diet reduces enteric methane emission by over 50 percent

Breanna M. Roque [a], Joan K. Salwen [b], Rob Kinley [c], Ermias Kebreab [a, *]

[a] Department of Animal Science, University of California, Davis, CA, 95618, USA
[b] Stanford University, Palo Alto, CA, 94305, USA
[c] CSIRO Agriculture and Food, Townsville, QLD, Australia


FutureFeed
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The use of Asparagopsis as a feed ingredient is patent protected - ensure you're buying from a licensed grower.


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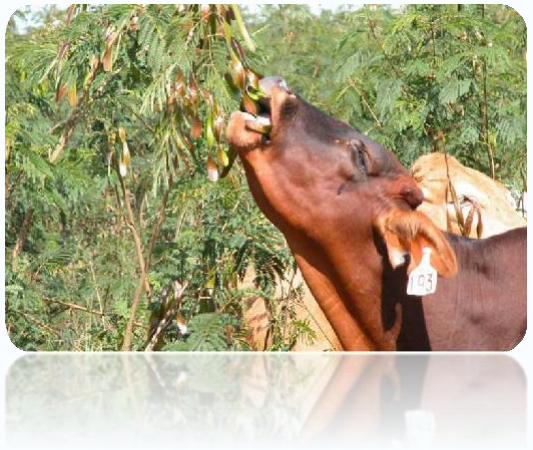
in
The team at FutureFeed are investing in further research and development which will optimise the production and delivery of the product to industry.

▪*Leucaena*

Source beefcentral.com



Article

Effect of Dried Leaves of *Leucaena leucocephala* on Rumen Fermentation, Rumen Microbial Population, and Enteric Methane Production in Crossbred Heifers

María Denisse Montoya-Flores [1,2,*], Isabel Cristina Molina-Botero [1,3], Jacobo Arango [3], José Luis Romano-Muñoz [2], Francisco Javier Solorio-Sánchez [1], Carlos Fernando Aguilar-Pérez [1] and Juan Carlos Ku-Vera [1]

Agricultural Systems 136 (2015) 138–146

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Improving greenhouse gas emissions intensities of subtropical and tropical beef farming systems using *Leucaena leucocephala*

Matthew T. Harrison [a,*], Chris McSweeney [b], Nigel W. Tomkins [c], Richard J. Eckard [d]

Reducción de metano ~10-20%

Aumento de la productividad 5-20%

▪ *Desmanthus*

Article

Supplementing Northern Australian Beef Cattle with *Desmanthus* Tropical Legume Reduces In-Vivo Methane Emissions

Bénédicte Suybeng [1], Edward Charmley [2], Christopher P. Gardiner [1], Bunmi S. Malau-Aduli [3] and Aduli E.O. Malau-Aduli [1,*]

Mejora de la productividad

Reducción de metano ~10%

Investigación en desarrollo

- **Intervención en edad temprana**

Efectos permanentes en el animal adulto

scientific reports

Check for updates

OPEN

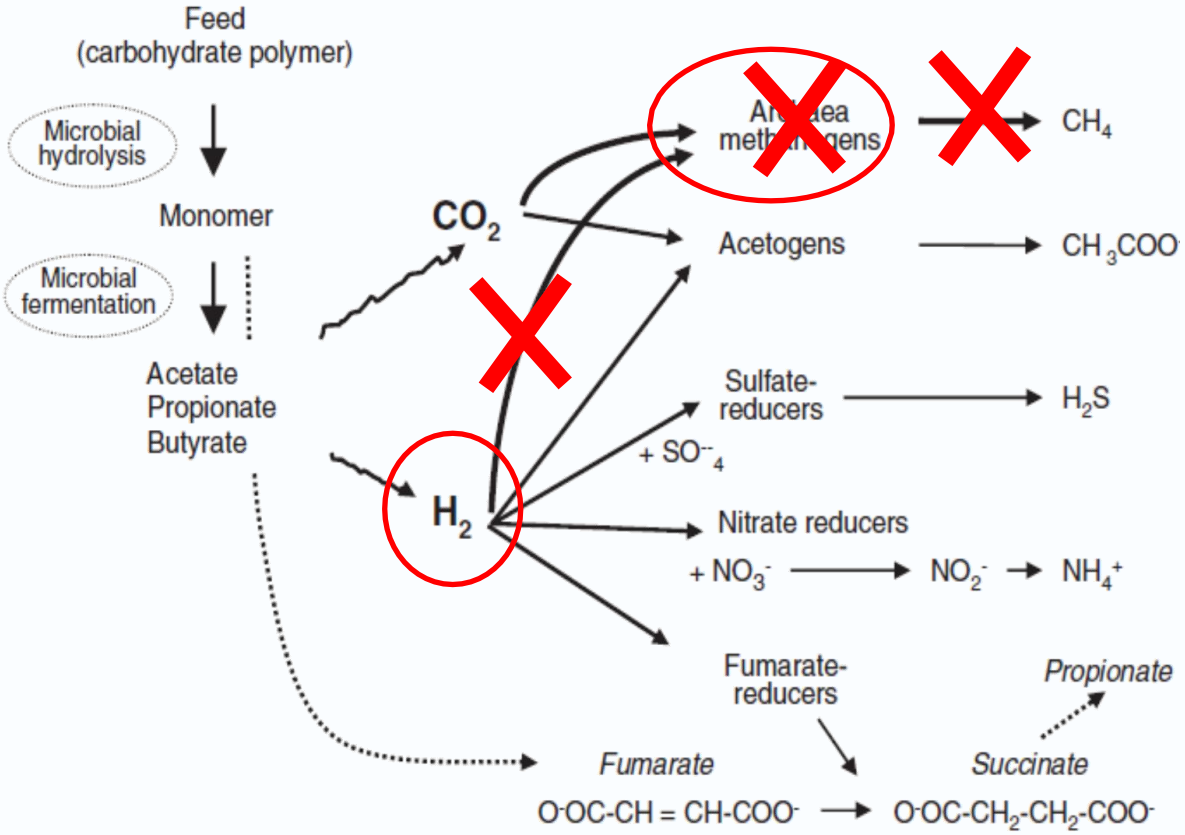
Early life dietary intervention in dairy calves results in a long-term reduction in methane emissions

S. J. Meale[1,2], M. Popova[1], C. Saro[1,3], C. Martin[1], A. Bernard[1], M. Lagree[4], D. R. Yáñez-Ruiz[5], H. Boudra[1], S. Duval[6] & D. P. Morgavi[1]✉

Investigación en desarrollo

- **Redireccionamiento de la energía para aumentar la productividad**

2 – 12 % pérdida de energía para el animal

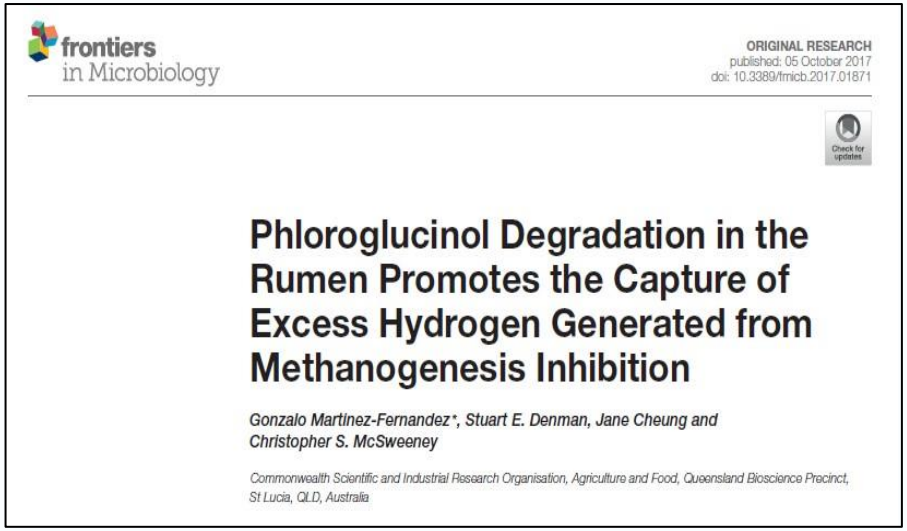


Morgavi et al., 2010

Metano 40%

Redireccionamiento

H_2 → **Ácido acético**



frontiers in Microbiology

ORIGINAL RESEARCH
published: 05 October 2017
doi: 10.3389/fmicb.2017.01871

Check for updates

Phloroglucinol Degradation in the Rumen Promotes the Capture of Excess Hydrogen Generated from Methanogenesis Inhibition

Gonzalo Martínez-Fernández, Stuart E. Denman, Jane Cheung and Christopher S. McSweeney*

Commonwealth Scientific and Industrial Research Organisation, Agriculture and Food, Queensland Bioscience Precinct, St Lucia, QLD, Australia

Ganancia de peso

> 400 g/día

Investigación en desarrollo

- **Vacunación??**

Methane vaccine

The NZAGRC is partnering with PGgRc to develop a vaccine that reduces methane emissions from ruminant livestock.

Current projects

Project title	Lead organisation/s
Development of an effective anti-methanogen vaccine	AgResearch

Retos

- **Ganadería extensiva en pastoreo: modo de distribución suplementos y como intervenir.**
- **Dosificaciones dependiendo del estado productivo y dieta.**
- **Combinaciones de estrategias.**
- **Desarrollo de metodologías para implementar las tecnologías en la práctica.**

Muchas gracias

Gut Ecosystem & Function

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Department of Agriculture

CSIRO

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México