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Transición a un sistema agroalimentario sostenible, saludable, productivo, incluyente, resiliente y con responsabilidad climática en México

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Ana Beatriz Gutiérrez Hernández
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2022 Reuniones científicas
09 - 12 NOV TABASCO
REUNIONES NACIONALES DE INVESTIGACIÓN E INNOVACIÓN PECUARIA, AGRÍCOLA, FORESTAL Y ACUÍCOLA PESQUERA

2022 Año de Ricardo Flores Magón
PRECURSOR DE LA REVOLUCIÓN MEXICANA

Villahermosa, Tabasco, 09 de noviembre de 2022

Sistema alimentario global

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UNITED NATIONS
FOOD SYSTEMS SUMMIT 2021

Nueva York, septiembre 2021
Pre-summit, Roma, julio 2021

- Usa el 36.5% de la superficie[/1] y 70% del agua renovable del planeta para alimentar a cerca de 8,000 millones de personas, 800 millones de ellas desnutridas y más de 2,000 millones con sobrepeso y obesidad.
- Con la mecanización y uso de fertilizantes, herbicidas y pesticidas se han aumentado los rendimientos y la producción, pero se han contaminado el suelo, el agua y el aire.
- La expansión de la agricultura ha resultado en deforestación y afectado a los ecosistemas naturales, servicios ecosistémicos, la biodiversidad y la vida silvestre.
- La agricultura es una fuente importante de gases de efecto invernadero contribuyendo al calentamiento global y al cambio climático.
- A través de sequías, inundaciones, incendios, plagas y enfermedades, el cambio climático impacta negativamente en la producción de alimentos.
- La pandemia COVID-19, la invasión de Rusia a Ucrania y la inflación actual han hecho más vulnerable al sistema alimentario global.
- Con el aumento esperado de la población mundial, es imperante transformar el sistema agroalimentario global.

/1 Fuente Databank, The World Bank, Tierras agrícolas (% del área de tierra)

Sistema agroalimentario de México

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Superficie cultivos agrícolas: 18.4 millones ha

Superficie ganadera:
108,936,165 ha pastoreo
5.0 millones ha cultivadas

Litoral 11,122 km
Aguas interiores: 6,500 km²

Ganado:
35.6 millones bovinos
17.5 millones ovinos, caprinos
18.8 millones porcinos,
595.4 millones aves,
2.1 millones colmenas

UPA: 3.7 millones
UPP: 1.1 millones
UAyP: 232,230

Agroindustria, transporte, almacenamiento, logística

Proveedores de insumos: Semilla, maquinaria y equipo, agroquímicos, biológicos, etc.

Servicios públicos: innovación, investigación, extensión, sanidades, financiamiento, etc.

Políticas y programas públicos

Fuentes: INEGI, Censo de población y vivienda 2020, SIAP 2021, BANXICO 2021

Interacciones del sistema agroalimentario de México

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Economía 2021 △ 2.7%

Valor producción: 1,241,676 mdp	Empleo: ▪ Agrícola: 5.3 millones ▪ Pecuaria: 838,000 ▪ Pesca: 174,000
Exportación: 44,687 mdd Importación: 37,249 mdd	Inflación ene-sep 2022: 5.6%

Fuente: SIAP, 2021, INEGI, 2022

Autosuficiencia alimentaria 2021

AA_{total}2021: 113.8%

Maíz blanco: 97.8%	Leche: 85 %
Trigo y arroz: 33.5%	Alimento ganado: 31.6%
Carne bovino: 113.5%	

Fuente: SIAP, BANXICO 2021

Seguridad alimentaria 2020 población con ingreso menor al costo de la canasta básica

Urbana: 33.9%	Rural: 52.0%
ZAP Rurales: 73.2%	Indígenas: 78.3%

Fuente: CONEVAL, 2020

Desarrollo y bienestar rural Población en pobreza extrema 2020

Urbana: 6.1%	Rural: 16.7%
ZAP Rurales: 23.9%	Indígenas: 35.7%

Fuente: CONEVAL, 2020

Salud Humana Sobrepeso y obesidad 2021:

Adultos: 75%	Jóvenes: 72.4%	Infantes: 37.4%

Deficiencia de micronutrientes: 57.9%

COVID-19 relación con salud nutricional

Fuente: ENSANUT, 2021; coronavirus.gob.mx/

Sustentabilidad recursos naturales

Erosión suelos 2019 Hídrica: 52.9% Eólica: 2.4%	Incendios/año 2019-2021: 6,887 eventos 587,780 ha
76% del agua usada en agricultura de riego	Deforestación 2021 por agricultura y ganadería: 233,597 ha

Fuente: INEGI, CONAFOR, 2021

Vulnerabilidad a riesgos 2022

Sequía frontera agrícola: 7.5 millones ha*	Ciclones a Oct: 30
Plagas y enfermedades: 91 plagas de mayor riesgo fitosanitario e importancia cuarentenaria	Inflación ene-sep 2022: 5.6%

* Considera los grados de sequía (D1 a D4)
Fuente: SIAP, abril 2022. CONAGUA, SMN 2022

Emisión de gases efecto invernadero, AFOLU. 2019

Gg de CO_2e y % del total Nacional

CO_2: 1,038 Gg 0.4%	N_2O: 8,953 Gg 21.7%
CH_4: 104,312 Gg 59.4%	

Fuente: INECC, 2019

Cómo transitar a un sistema alimentario saludable, productivo, sostenible, incluyente, resiliente y con responsabilidad climática en México

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1. Promover modelos de consumo sostenibles para mejorar la salud humana y la del planeta.
2. Impulsar la intensificación sostenible de la producción de alimento para lograr la seguridad alimentaria de la población conservando los recursos naturales.
3. Promover en el sistema alimentario la inclusión de grupos sociales históricamente excluidos para reducir las desigualdades.
4. Generar resiliencia a riesgos climáticos, sanitarios y de mercado para disminuir la inestabilidad en el abasto de alimento y minimizar las pérdidas económicas de las y los productores.
5. Disminuir la emisión de gases de efectos invernadero producidas por las actividades agropecuarias para reducir el impacto del sistema alimentario en el cambio climático.

1 Transición a modelos de consumo que mejoren la salud humana y del planeta

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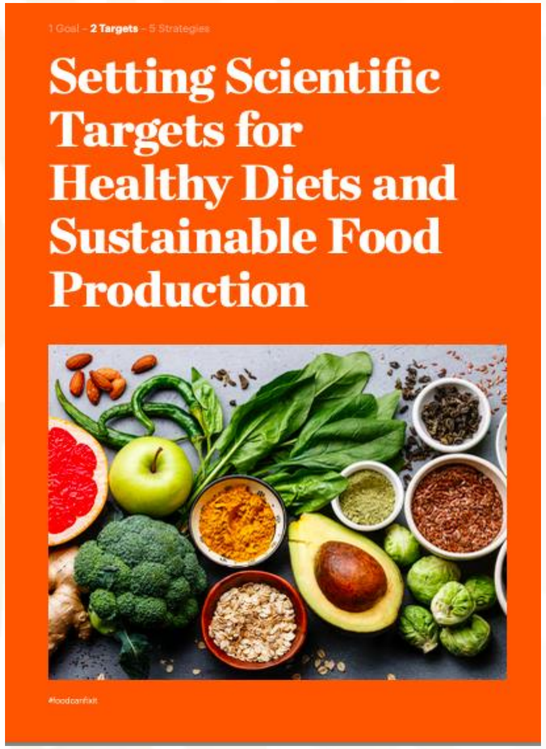
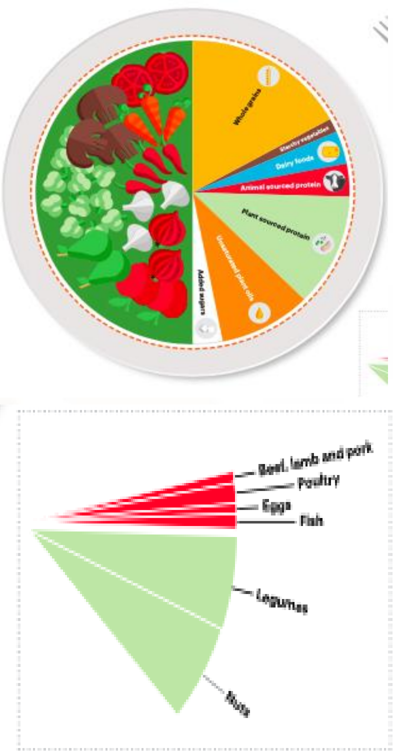
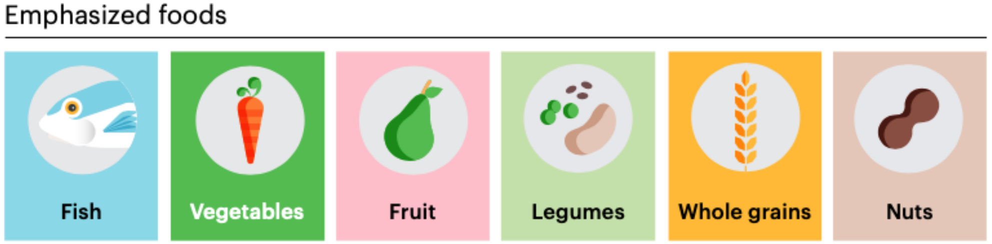
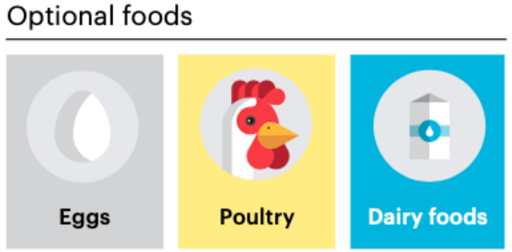
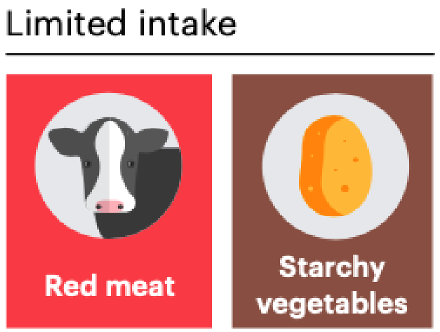


Target 1
Healthy Diets









Para 2050: Duplicar el consumo de frutas, hortalizas, legumbres y nueces

Reducir >50% el consumo de carnes rojas y azúcares.

Willet et al. 2019. Food in The Anthropocene: the EAT-Lancet Commission on Healthy Diets From Sustainable Food Systems. The Lancet 39:447-492

Willet et al. 2019. Summary Report of the EAT Lancet Commission - Healthy diets from sustainable food systems, 32 p.

1 Emisiones de GEI en cadenas de suministro de alimento

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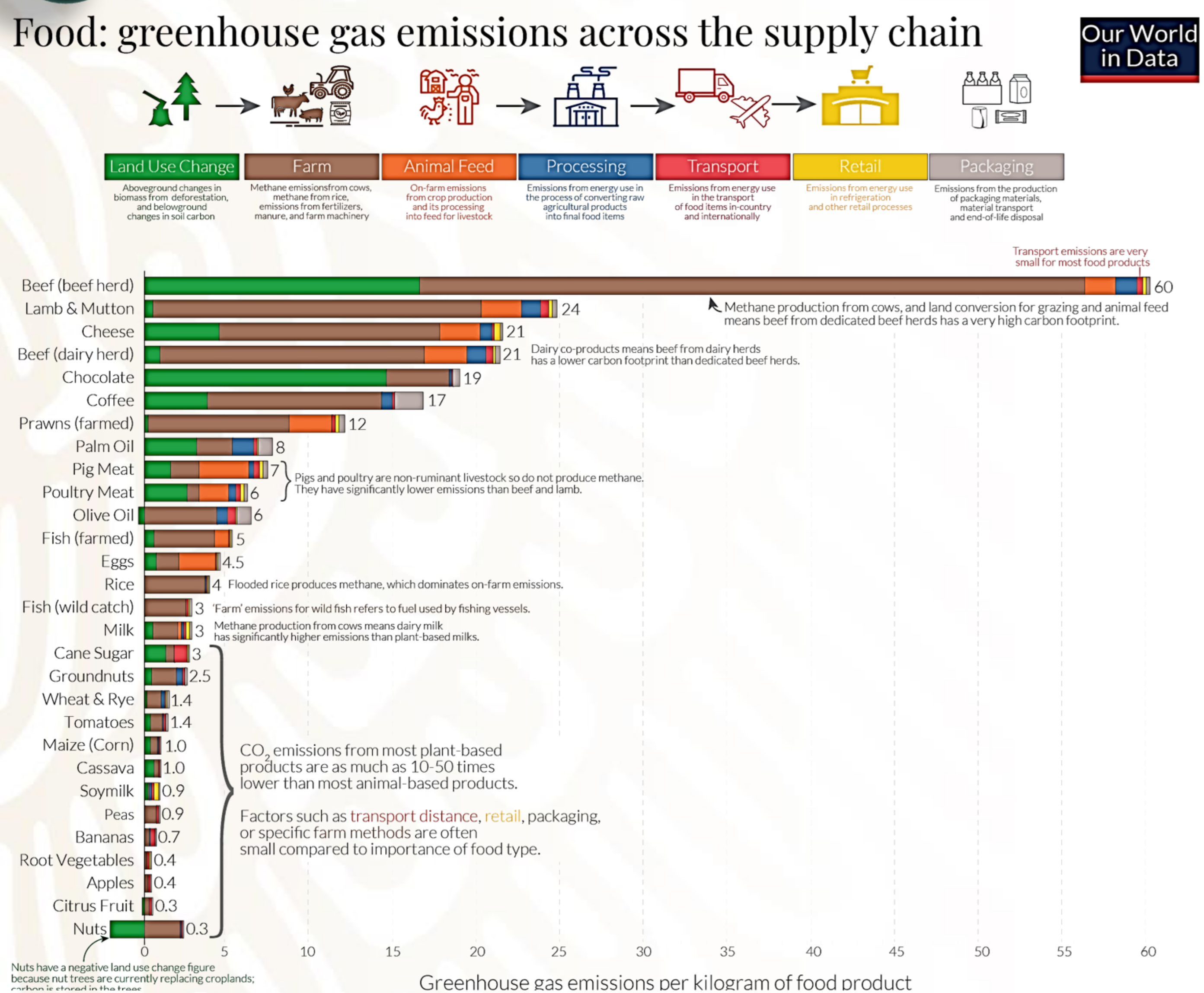

Note: Greenhouse gas emissions are given as global average values based on data across 38,700 commercially viable farms in 119 countries.
Data source: Poore and Nemecek (2018). Reducing food's environmental impacts through producers and consumers. *Science*. Images sourced from the Noun Project.
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Erratum 22 February 2019. See Erratum.

RESEARCH

SUSTAINABILITY

Reducing food's environmental impacts through producers and consumers

J. Poore[1,2]* and T. Nemecek[3]

Food's environmental impacts are created by millions of diverse producers. To identify solutions that are effective under this heterogeneity, we consolidated data covering five environmental indicators; 38,700 farms; and 1600 processors, packaging types, and retailers. Impact can vary 50-fold among producers of the same product, creating substantial mitigation opportunities. However, mitigation is complicated by trade-offs, multiple ways for producers to achieve low impacts, and interactions throughout the supply chain. Producers have limits on how far they can reduce impacts. Most strikingly, impacts of the lowest-impact animal products typically exceed those of vegetable substitutes, providing new evidence for the importance of dietary change. Cumulatively, our findings support an approach where producers monitor their own impacts, flexibly meet environmental targets by choosing from multiple practices, and communicate their impacts to consumers.

With current diets and production practices, feeding 7.6 billion people is degrading terrestrial and aquatic ecosystems, depleting water resources, and driving climate change (1, 2). It is particularly challenging to find solutions that are effective across the large and diverse range of producers that characterize the agricultural sector. More than 570 million farms produce in almost all the world's climates and soils (3), each using vastly different agronomic methods; average farm sizes vary from 0.5 ha in Bangladesh to 3000 ha in Australia (3); average mineral fertilizer use ranges from 1 kg of nitrogen per ha in Uganda to 300 kg in China (4); and although four crops provide half of the world's food calories (4), more than 2 million distinct varieties are recorded in seed vaults (5). Further, products range from minimally to heavily processed and packaged, with 17 of every 100 kg of food produced transported internationally, increasing to 50 kg for nuts and 56 kg for oils (4).

Previous studies have assessed aspects of this heterogeneity by using geospatial data sets (6–8), but global assessments using the inputs, outputs, and practices of actual producers have been limited by data. The recent rapid expansion of the life cycle assessment (LCA) literature is providing this information by surveying producers around the world. LCA then uses models to translate producer data into environmental impacts with sufficient accuracy for most decision-making (9–11).

To date, efforts to consolidate these data or build new large-scale data sets have covered greenhouse gas (GHG) emissions only (8, 12, 13), agriculture only (13–16), small numbers of products (8, 14–16), and predominantly Western European producers (12–16) and have not corrected for important methodological differences between LCAs (12–16). Here, we present a globally reconciled and methodologically harmonized database on the variation in food's multiple impacts. Our results show the need for far-reaching changes in how food's environmental impacts are managed and communicated.

Building the multi-indicator global database

We derived data from a comprehensive meta-analysis, identifying 1530 studies for potential inclusion, which were supplemented with additional data received from 139 authors. Studies were assessed against 11 criteria designed to standardize methodology, resulting in 570 suitable studies with a median reference year of 2010 (17). The data set covers ~38,700 commercially viable farms in 119 countries (fig. S2) and 40 products representing ~90% of global protein and calorie consumption. It covers five important environmental impact indicators (18): land use; freshwater withdrawals weighted by local water scarcity; and GHG, acidifying, and eutrophying emissions. For crops, yield represents output for a single harvest. Land use includes multicropping (up to four harvests per year), fallow phases (uncultivated periods between crops), and economic allocation to crop coproducts such as straw. This makes it a stronger indicator of both farm productivity and food security than yield.

The system we assess begins with inputs (the initial effect of producer choice) and ends at retail (the point of consumer choice) (fig. S1). For each study, we recorded the inventory of outputs and inputs (including fertilizer quantity and type, irrigation use, soil, and climatic conditions). Where data were not reported, for example, on climate, we used study coordinates and spatial data sets to fill gaps. We recorded environmental impacts at each stage of the supply chain. For GHG emissions, we further disaggregated the farm stage into 20 emission sources. We then used the inventory to recalculate all missing emissions. For nitrate leaching and aquaculture, we developed new models for this study (17).

Studies included provided ~1050 estimates of postfarm processes. To fill gaps in processing, packaging, or retail, we used additional meta-analyses of 153 studies providing 550 observations. Transport and losses were included from global data sets. Each observation was weighted by the share of national production it represents, and each country by its share of global production. We then used randomization to capture variance at all stages of the supply chain (17).

We validated the global representativeness of our sample by comparing average and 90th-percentile yields to Food and Agriculture Organization (FAO) data (4), which reconcile to within ±10% for most crops. Using FAO food balance sheets (4), we scaled up our sample data. Total arable land and freshwater withdrawals reconcile to FAO estimates. Emissions from deforestation and agricultural methane fall within ranges of independent models (17).

Environmental impacts of the entire food supply chain

Today's food supply chain creates ~13.7 billion metric tons of carbon dioxide equivalents (CO_2eq), 26% of anthropogenic GHG emissions. A further 2.8 billion metric tons of CO_2eq (5%) are caused by nonfood agriculture and other drivers of deforestation (17). Food production creates ~32% of global terrestrial acidification and ~78% of eutrophication. These emissions can fundamentally alter the species composition of natural ecosystems, reducing biodiversity and ecological resilience (19). The farm stage dominates, representing 61% of food's GHG emissions (81% including deforestation), 79% of acidification, and 95% of eutrophication (table S17).

Today's agricultural system is also incredibly resource intensive, covering ~43% of the world's ice- and desert-free land. Of this land, ~87% is for food and 13% is for biofuels and textile crops or is allocated to nonfood uses such as wool and leather. We estimate that two-thirds of freshwater withdrawals are for irrigation. However, irrigation returns less water to rivers and groundwater than industrial and municipal uses and predominates in water-scarce areas and times of the year, driving 90 to 95% of global scarcity-weighted water use (17).

Highly variable and skewed environmental impacts

We now group products by their primary dietary role and express impacts per unit of primary nutritional benefit (Fig. 1 and fig. S3). Immediately apparent in our results is the high variation in impact among both products and producers. Ninetieth-percentile GHG emissions of beef are 105 kg of CO_2eq per 100 g of protein, and

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Poore et al., *Science* **360**, 987–992 (2018) 1 June 2018

https://ourworldindata.org/food-choice-vs-eating-local

1

Modelos sostenibles de consumo:
Fuentes alternas de proteína

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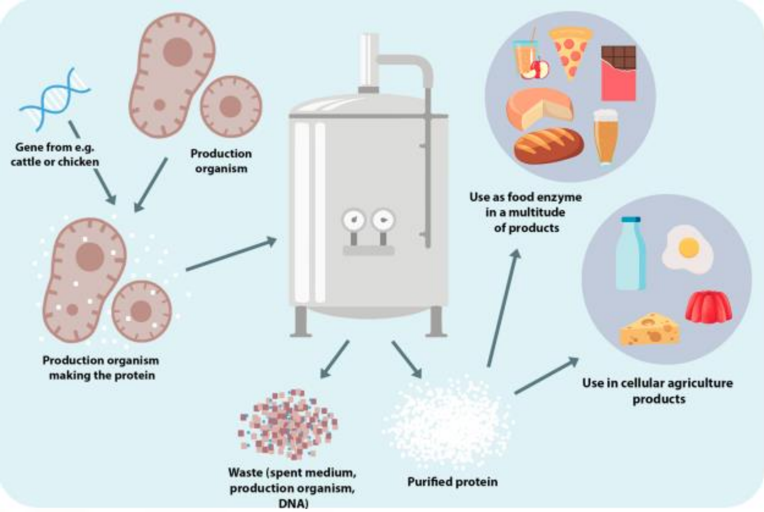
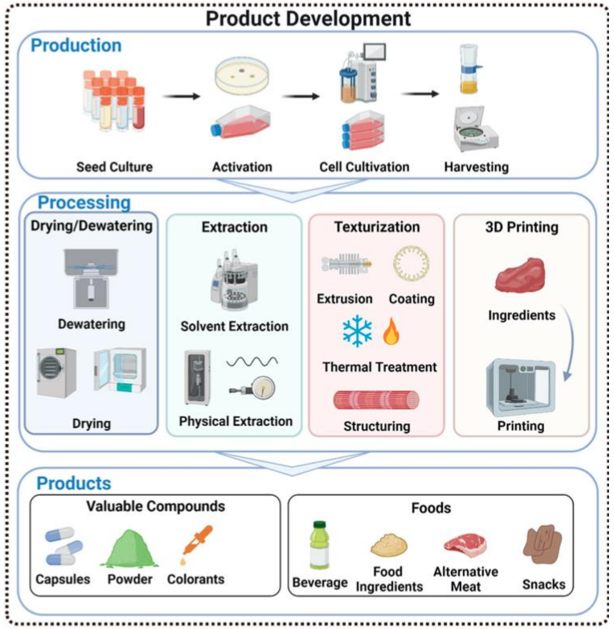
Sustitución por proteína vegetal



Fermentación de alta precisión
Waschulen and Specht 2018 Cellular agriculture

In this process, the encoding genetic material for the desired animal protein is integrated into an efficient host organism (which may be a strain of yeast, other fungi, or bacteria). This host is then cultivated in fermentation tanks where it produces the desired protein in large amounts. The protein is subsequently separated from the host cells and purified. The resulting protein is the same protein as in the original animal-derived product and will exhibit substantially equivalent sensory and functional characteristics in foods in which it is incorporated.



Cultivo de células animales para la producción de tejido animal

Barzee et al. 2022 Cell-cultivated food production

Received: 3 March 2022 | Accepted: 28 March 2022
DOI: 10.1002/fbe2.12009

REVIEW ARTICLE

Food Bioengineering WILEY

Cell-cultivated food production and processing: A review

Tyler J. Barzee[1] | Hamed M. El Mashad[2,3] | Lin Cao[2] | Allan Chio[2] | Zhongli Pan[2] | Ruihong Zhang[2]

1 Consumo de proteína animal en México

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Gasto en alimentación trimestral:
$29,910, 38% del gasto total

Rural: $20,706   Urbana: $32,441

Grupo de alimentos	$/hogar
Carnes	2,243
Cereales	1,650
Verduras y legumbres	1,162
Leche y derivados	893
Bebidas c/s alcohol	854
Frutas	461
Huevo	373

Fuente: INEGI. Encuesta Nacional de Ingresos y Gastos de los Hogares. ENIGH 2020. Tabulados básicos. 2020

Consumo anual per cápita, kg

Producto	Nacional
Carne de ave, kg	34.5
Carne de cerdo, kg	17.9
Carne de res, kg	15.0
Productos acuáticos, kg	8.9
Huevo, kg	24.1
Leche, lts.	124.3

Fuente: SIAP, 2021.

1

Modelos sostenibles de consumo:

Disminuir las pérdidas y el desperdicio de alimento

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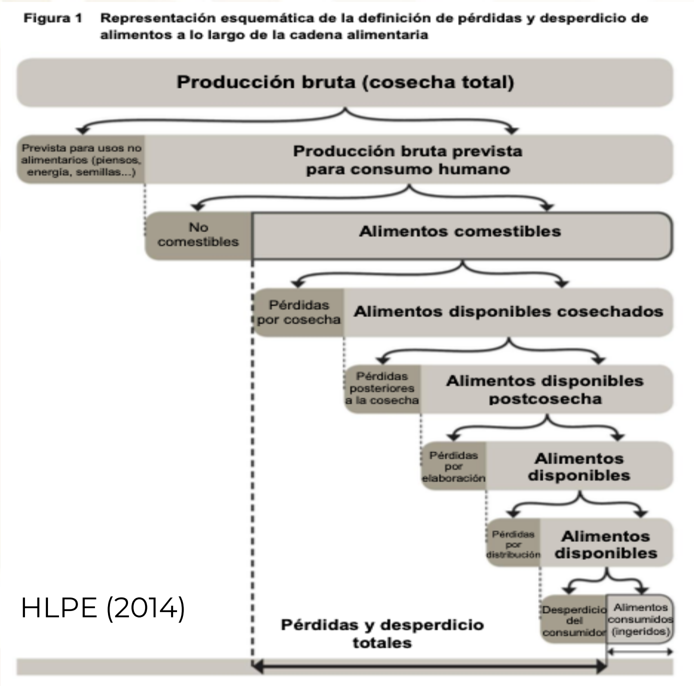
PDA: La disminución de la masa de alimentos destinados originalmente al consumo humano, independientemente de la causa y en todas las fases de la cadena alimentaria, desde la cosecha hasta el consumo (HLPE, 2014).



HLPE (2014)

Estrategia en función del tipo, fuente, origen y características del alimento

- **Almacenes, bodegas, tiendas**: sistemas de frío, sensores, etc.
- **Centrales de abasto, mercados:** alimento para animales, composta, etc.
- **Tiendas de conveniencia:** donaciones altruistas a bancos de alimentos para distribución en zonas de atención prioritaria – legislación y normatividad
- **Hogares:** campañas educativas a amas de casa

PDA mundial: 1,300 millones de ton anuales

PDA en México: 20 millones de ton anuales, 25,000 millones USD, 35% de la producción, 2.5% del PIB

2

Transición a una intensificación sostenible de la producción de alimentos: Agroecología

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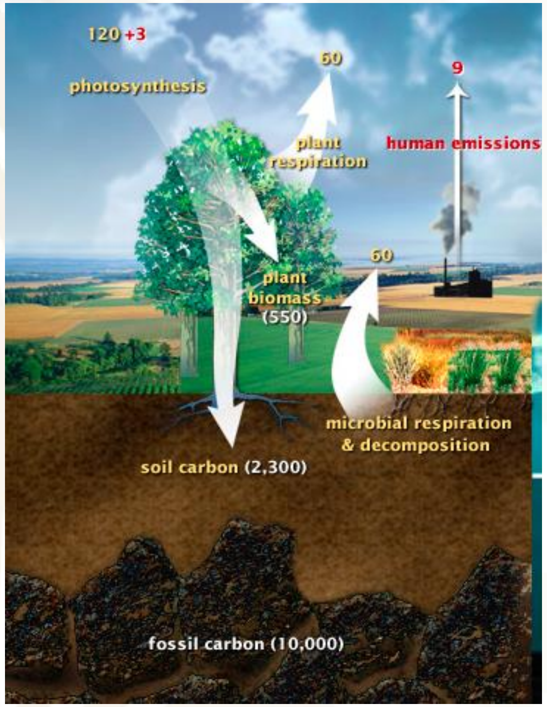
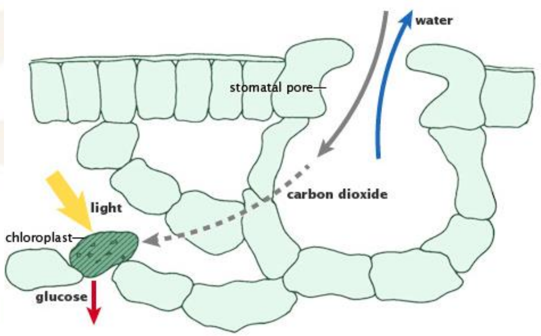
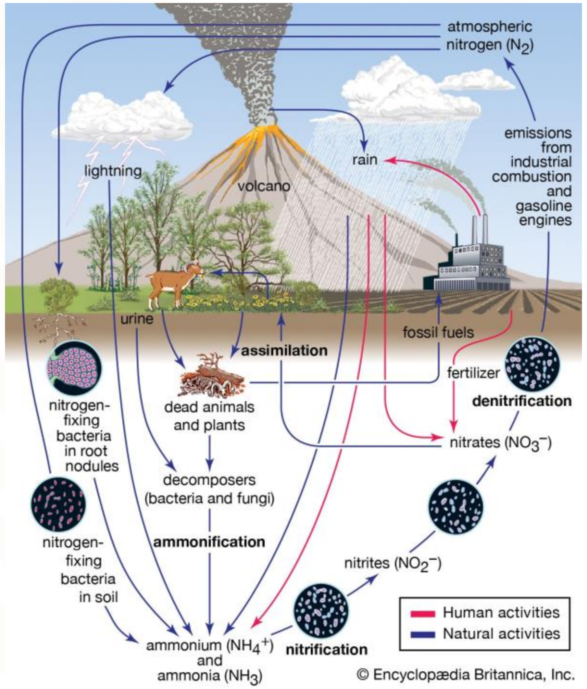




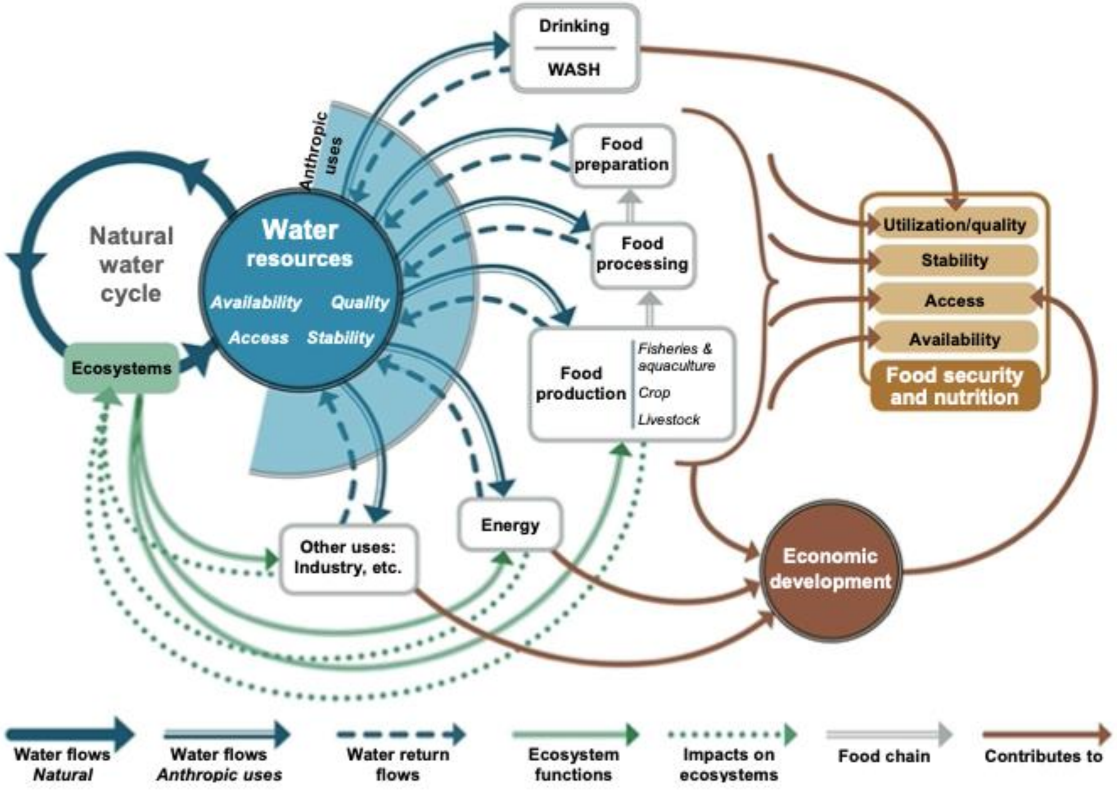
https://earthobservatory.nasa.gov/features/CarbonCycle



https://www.britannica.com/science/nitrogen-cycle

Estrategia Nacional de Suelo para la Agricultura Sostenible

Figure 1 The multiple interfaces between water and food security and nutrition (FSN)



HLPE (2015) Water for food security and nutrition

2

Transición a una intensificación sostenible de la producción de alimentos: huella hídrica

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Hydrol. Earth Syst. Sci., 15, 1577–1600, 2011
www.hydrol-earth-syst-sci.net/15/1577/2011/
doi:10.5194/hess-15-1577-2011

Hydrology and Earth System Sciences

The green, blue and grey water footprint of crops and derived crop products

M. M. Mekonnen and A. Y. Hoekstra
Twente Water Centre, University of Twente, Enschede, The Netherlands

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Revised: 31 March 2011 – Accepted: 18 May 2011 – Published: 25 May 2011

Abstract. This study quantifies the green, blue and grey water footprint of global crop production in a spatially-explicit way for the period 1996–2005. The assessment improves upon earlier research by taking a high-resolution approach, estimating the water footprint of 126 crops at a 5 by 5 arc minute grid. We have used a grid-based dynamic water balance model to calculate crop water use over time, with a time step of one day. The model takes into account the daily soil water balance and climatic conditions for each grid cell. In addition, the water pollution associated with the use of nitrogen fertilizer in crop production is estimated for each grid cell. The crop evapotranspiration of additional 20 minor crops is calculated with the CROPWAT model. In addition, we have calculated the water footprint of more than two hundred derived crop products, including various flours, beverages, fibres and biofuels. We have used the water footprint assessment framework as in the guideline of the Water Footprint Network.

Considering the water footprints of primary crops, we see that the global average water footprint per ton of crop increases from sugar crops (roughly 200 $m^3\,ton^{-1}$), vegetables (300 $m^3\,ton^{-1}$), roots and tubers (400 $m^3\,ton^{-1}$), fruits (1000 $m^3\,ton^{-1}$), cereals (1600 $m^3\,ton^{-1}$), oil crops (2400 $m^3\,ton^{-1}$) to pulses (4000 $m^3\,ton^{-1}$). The water footprint varies, however, across different crops per crop category and per production region as well. Besides, if one considers the water footprint per kcal, the picture changes as well. When considered per ton of product, commodities with relatively large water footprints are: coffee, tea, cocoa, tobacco, spices, nuts, rubber and fibres. The analysis of water footprints of different biofuels shows that bio-ethanol has a lower water footprint (in $m^3\,GJ^{-1}$) than biodiesel, which supports earlier analyses. The crop used matters significantly as well: the global average water footprint of bio-ethanol based on sugar beet amounts to 51 $m^3\,GJ^{-1}$, while this is 121 $m^3\,GJ^{-1}$ for maize.

The global water footprint related to crop production in the period 1996–2005 was 7404 billion cubic meters per year (78 % green, 12 % blue, 10 % grey). A large total water footprint was calculated for wheat (1087 $Gm^3\,yr^{-1}$), rice (992 $Gm^3\,yr^{-1}$) and maize (770 $Gm^3\,yr^{-1}$). Wheat and rice have the largest blue water footprints, together accounting for 45% of the global blue water footprint. At country level, the total water footprint was largest for India (1047 $Gm^3\,yr^{-1}$), China (967 $Gm^3\,yr^{-1}$) and the USA (826 $Gm^3\,yr^{-1}$). A relatively large total blue water footprint as a result of crop production is observed in the Indus river basin (117 $Gm^3\,yr^{-1}$) and the Ganges river basin (108 $Gm^3\,yr^{-1}$). The two basins together account for 25% of the blue water footprint related to global crop production. Globally, rain-fed agriculture has a water footprint of 5173 $Gm^3\,yr^{-1}$ (91% green, 9 % grey); irrigated agriculture has a water footprint of 2230 $Gm^3\,yr^{-1}$ (48 % green, 40 % blue, 12 % grey).

1 Introduction

Global freshwater withdrawal has increased nearly sevenfold in the past century (Gleick, 2000). With a growing population, coupled with changing diet preferences, water withdrawals are expected to continue to increase in the coming decades (Rosegrant and Ringler, 2000; Liu et al., 2008). With increasing withdrawals, also consumptive water use is likely to increase. Consumptive water use in a certain period in a certain river basin refers to water that after use is no longer available for other purposes, because it evaporated (Perry, 2007). Currently, the agricultural sector accounts for about 85 % of global blue water consumption (Shiklomanov, 2000).

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Published by Copernicus Publications on behalf of the European Geosciences Union.

Mekonnen and Hoekstra (2011) The green, blue and water footprint of crops and derived crop products, *Hydrol. Earth Syst. Sci.*

Producto	l/kg	l/kcal
Tubérculos	400	0.5
Cereales	1,600	0.5
Caña azúcar	200	0.7
Leguminosas	4,000	1.1
Hortalizas	300	1.3
Frutas	1,000	2.1
Carne cerdo	6,000	2.2
Carne ave	4,000	3.0
Carne res	15,000	10.2

Ecosystems
DOI: 10.1007/s10021-011-9517-8

ECOSYSTEMS

A Global Assessment of the Water Footprint of Farm Animal Products

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Abstract

The increase in the consumption of animal products is likely to put further pressure on the world's freshwater resources. This paper provides a comprehensive account of the water footprint of animal products, considering different production systems and feed composition per animal type and country. Nearly one-third of the total water footprint of agriculture in the world is related to the production of animal products. The water footprint of any animal product is larger than the water footprint of crop products with equivalent nutritional value. The average water footprint per calorie for beef is 20 times larger than for cereals and starchy roots. The water footprint per gram of protein for milk, eggs and chicken meat is 1.5 times larger than for pulses. The unfavorable feed conversion efficiency for animal products is largely responsible for the relatively large water footprint of animal products compared to the crop products. Animal products from industrial systems generally consume and pollute more ground- and surface-water resources than animal products from grazing or mixed systems. The rising global meat consumption and the intensification of animal production systems will put further pressure on the global freshwater resources in the coming decades. The study shows that from a freshwater perspective, animal products from grazing systems have a smaller blue and grey water footprint than products from industrial systems, and that it is more water-efficient to obtain calories, protein and fat through crop products than animal products.

Key words: meat consumption; livestock production; animal feed; water consumption; water pollution; sustainable consumption.

Introduction

Global meat production has almost doubled in the period 1980–2004 (FAO 2005) and this upward trend will continue given the projected doubling of meat production in the period 2000–2050 (Steinfeld and others 2006). To meet the rising demand for animal products, the on-going shift from traditional extensive and mixed to industrial farming systems is likely to continue (Bouwman and others 2005; Naylor and others 2005; Galloway and others 2007). There is a rich literature on the expected environmental consequences of increased consumption of animal products (Naylor and others 2005; Myers and Kent 2003; McAlpine and others 2009; Pelletier and Tyedmers 2010; Sutton and others 2011), and on the pros and cons of industrial versus conventional farming systems (Lewis and others 1990; Capper and others 2009). Specific fields of interest include, amongst others, animal welfare (Fraser 2008; Thompson 2008), excessive use of antibiotics (Gustafson and Bowen 1997; Witte 1998; Smith and others 2002; McEwen 2006), the demand for scarce lands to produce the required

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Author Contributions: MMM designed the study, performed research, analysed data and wrote the paper; AYH designed the study, contributed new methods, analysed data and wrote the paper.
Corresponding author; e-mail: m.m.mekonnen@ctw.utwente.nl

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Mekonnen and Hoekstra (2012) A global assessment of the water footprint of farm animal products, *Ecosystems*

2

Transición a una intensificación sostenible de la producción de alimentos: huella hídrica en México

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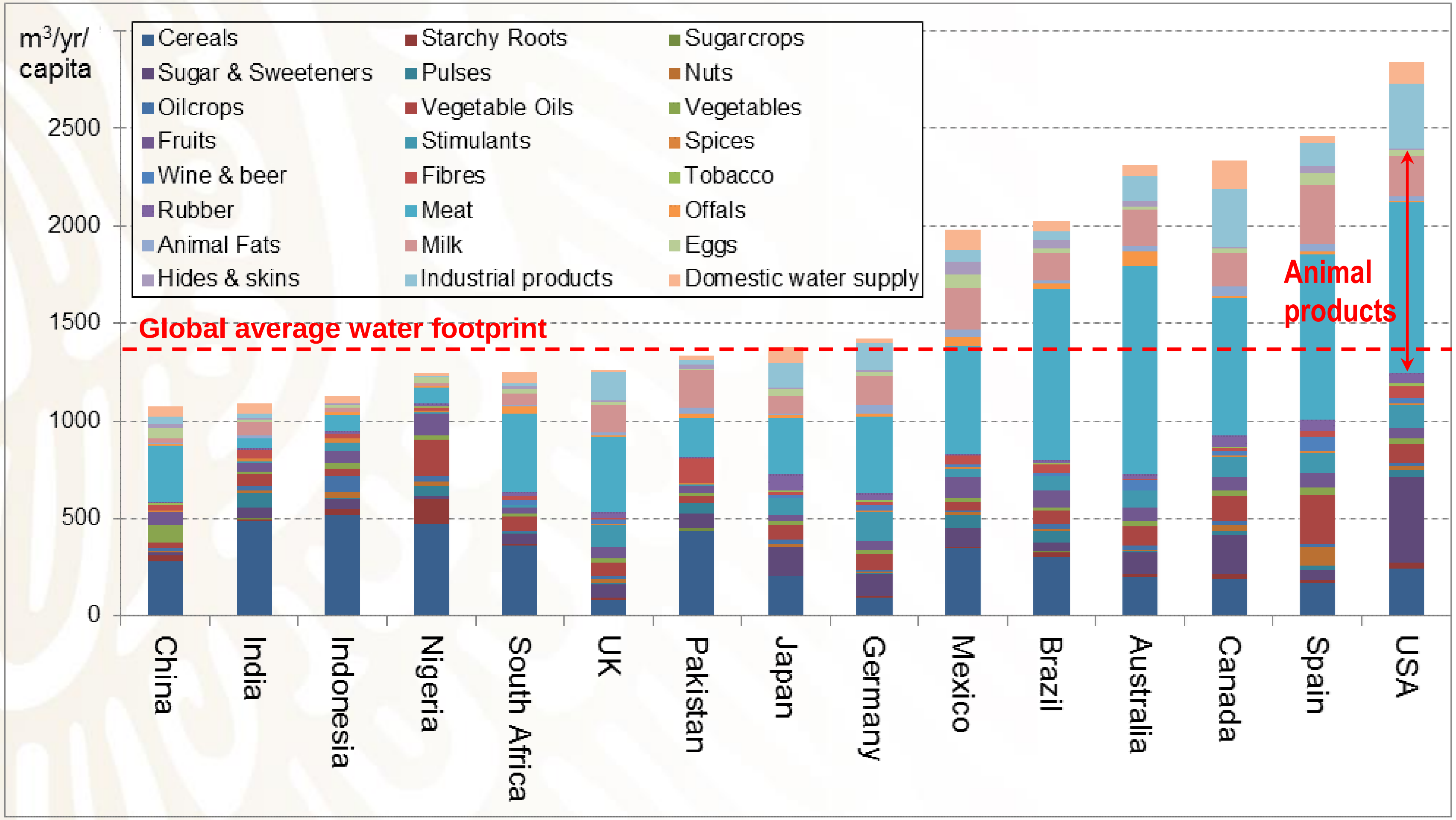

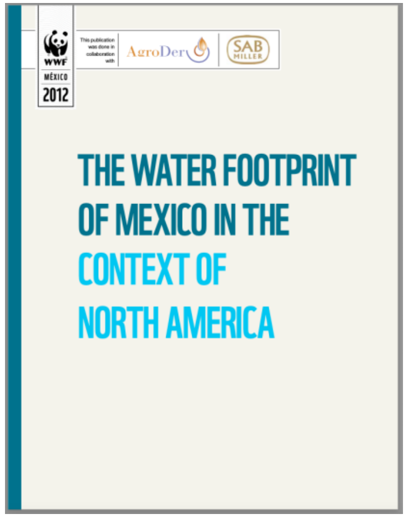

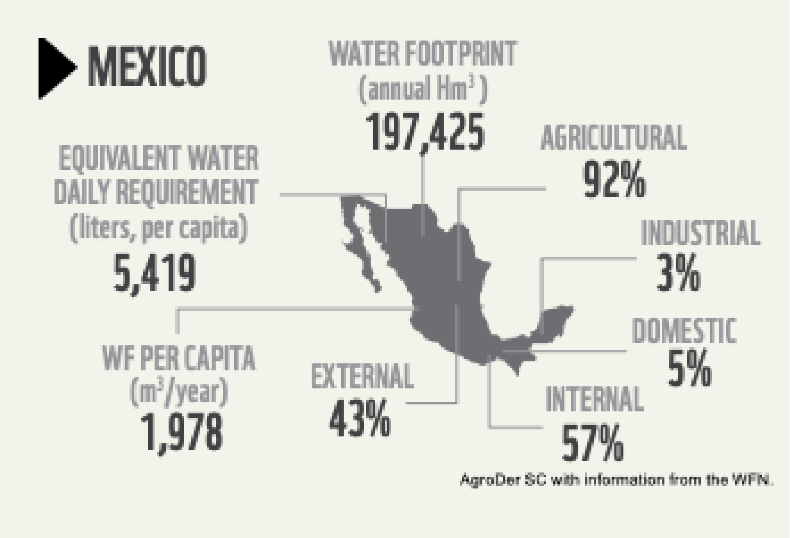

Hoekstra and Mekonnen (2012) The water footprint of humanity, *PNAS*

Fondo Mundial para la Naturaleza (2012)

2

Transición a una intensificación sostenible de la producción de alimentos: Agricultura de precisión, economía circular, certificación de buenas prácticas

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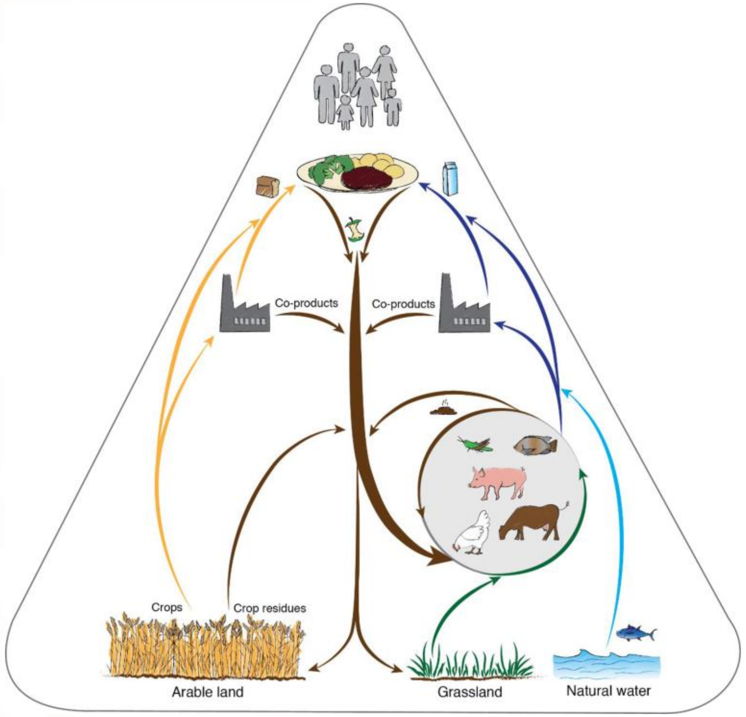
https://masdemx.com/2017/05/paisajes-mexico-imagenes-alturas-aereas/

Agricultura de precisión basada en sistemas de información y digitalización para mejorar la eficiencia de uso de insumos de la producción.



Van Zanten et al. 2019. Global Good Security 21: 18-22

Promoción de sistemas basados en economía circular y circuitos cortos.

Certificación de prácticas que conserven la biodiversidad y los recursos naturales.

Contabilización del costo real (True Cost Accounting) de la producción de alimentos.

3

Transición a un sistema agroalimentario incluyente

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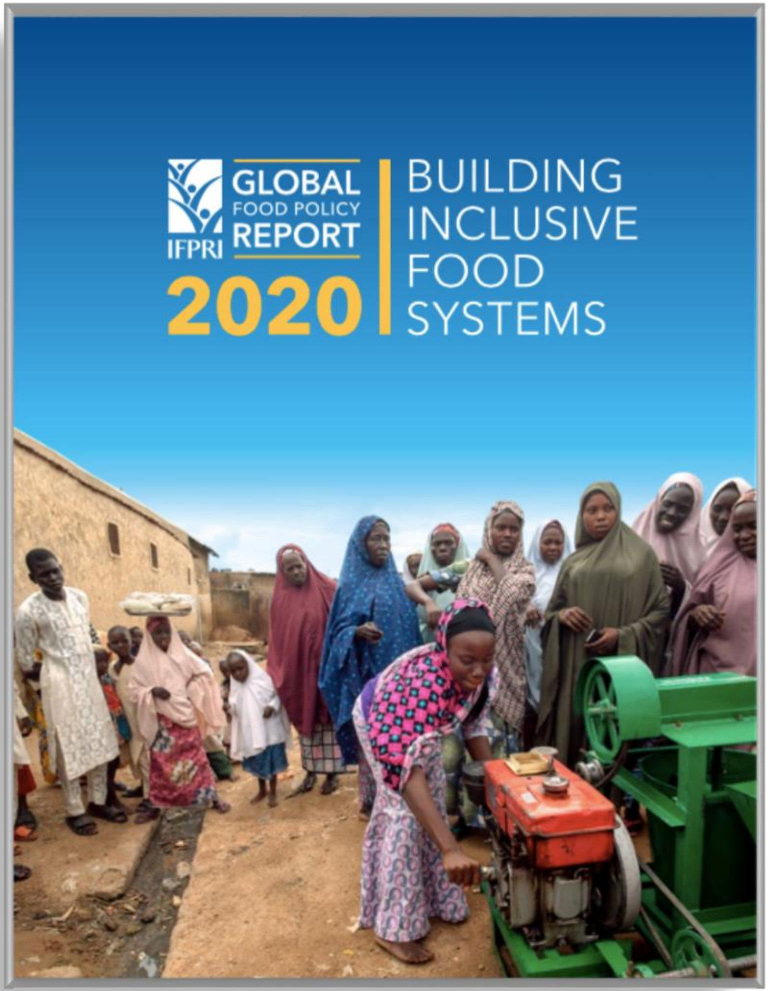
- ZAP rurales y pueblos indígenas, desarrollo integral.
- ZAP urbanas, acceso a alimentos a través de mayores ingresos.
- Mujeres, acceso a bienes de producción e inclusión justa en todos los eslabones de las cadenas de suministro.
- Jóvenes rurales, oportunidades de educación, empleo y acceso a bienes de producción.
- Adultos mayores, protección social e incentivos para transferir bienes de producción a jóvenes.
- Jornaleros, trabajo digno y salarios justos.



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4 Transición a un sistema agroalimentario resiliente

- Sistemas de información y pronósticos mensuales del clima para la toma de decisiones
- Sistemas de información de disponibilidad de agua y pronósticos mensuales de lluvias
- Sistemas de alerta temprana y monitoreo de sequía y huracanes
- Programas de atención integral a eventos de sequía
- Sistemas de alerta temprana de riesgos sanitarios
- Sistemas de alerta temprana y gestión de riesgos de incendios
- Sistemas de inteligencia de mercados
- Mecanismos de aseguramiento

5

Transición a un sistema agroalimentario con responsabilidad climática

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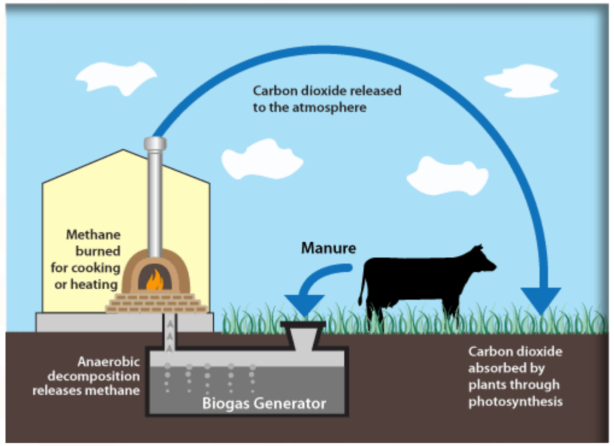
GRA - Global Research Alliance on Agricultural Greenhouse Gases




Review: Strategies for enteric methane mitigation in cattle fed tropical forages

J. C. Ku-Vera[1], O. A. Castelán-Ortega[2], F. A. Galindo-Maldonado[3], J. Arango[4], N. Chirinda[4], R. Jiménez-Ocampo[1,5†], S. S. Valencia-Salazar[6], E. J. Flores-Santiago[1], M. D. Montoya-Flores[7], I. C. Molina-Botero[1], A. T. Piñeiro-Vázquez[8], J. I. Arceo-Castillo[1], C. F. Aguilar-Pérez[1], L. Ramírez-Avilés[1] and F. J. Solorio-Sánchez[1]


SCIENTIFIC OPINION

EFSA Journal

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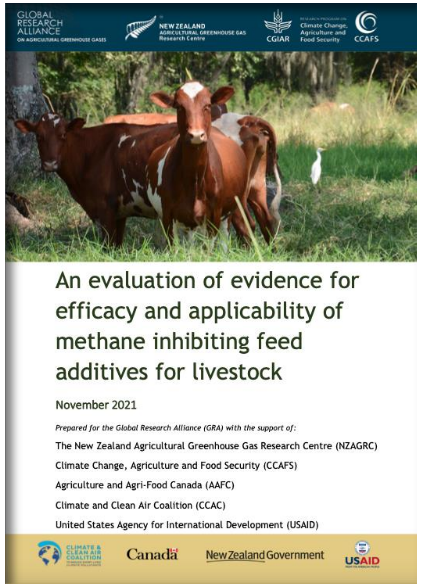
doi: 10.2903/j.efsa.2021.6905

Safety and efficacy of a feed additive consisting of 3-nitrooxypropanol (Bovaer® 10) for ruminants for milk production and reproduction (DSM Nutritional Products Ltd)

EFSA Panel on Additives and Products or Substances used in Animal Feed (FEEDAP), Vasileios Bampidis, Giovanna Azimonti, Maria de Lourdes Bastos, Henrik Christensen, Birgit Dusemund, Mojca Fašmon Durjava, Maryline Kouba, Marta López-Alonso, Secundino López Puente, Francesca Marcon, Baltasar Mayo, Alena Pechová, Mariana Petkova, Fernando Ramos, Yolanda Sanz, Roberto Edoardo Villa, Ruud Woutersen, Gabriele Aquilina, Georges Bories, Paul George Brantom, Jürgen Gropp, Kettil Svensson, Luca Tosti, Montserrat Anguita, Jaume Galobart, Paola Manini, Jordi Tarrès-Call and Fabiola Pizzo


An evaluation of evidence for efficacy and applicability of methane inhibiting feed additives for livestock

November 2021

Prepared for the Global Research Alliance (GRA) with the support of:
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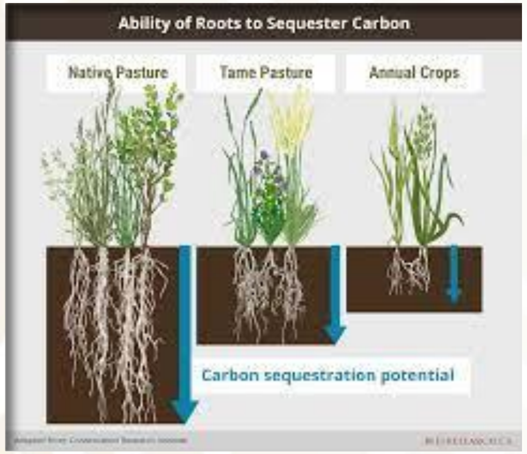
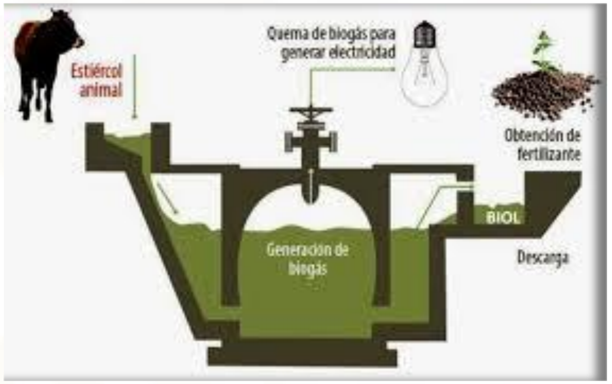
Climate Change, Agriculture and Food Security (CCAFS)
Agriculture and Agri-Food Canada (AAFC)
Climate and Clean Air Coalition (CCAC)
United States Agency for International Development (USAID)






RESEARCH ARTICLE

Vaccination of Sheep with a Methanogen Protein Provides Insight into Levels of Antibody in Saliva Needed to Target Ruminal Methanogens

Supatsak Subharat[1]*, Dairu Shu[1], Tao Zheng[1], Bryce M. Buddle[1], Kan Kaneko[2], Sarah Hook[2], Peter H. Janssen[1], D. Neil Wedlock[1]

1 AgResearch, Hopkirk Research Institute, Grasslands Research Centre, Palmerston North, New Zealand, 2 School of Pharmacy, University of Otago, Dunedin, New Zealand

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Impact of breeding for reduced methane emissions in New Zealand sheep on maternal and health traits

Sharon M. Hickey[1], Wendy E. Bain[2], Timothy P. Bilton[2], Gordon J. Greer[2], Sara Elmes[2], Brooke Bryson[2], Cesar S. Pinares-Patiño[3†], Janine Wing[2], Arjan Jonker[3], Emily A. Young[2], Kevin Knowler[2], Natalie K. Pickering[2†], Ken G. Dodds[2], Peter H. Janssen[3], John C. McEwan[2] and Suzanne J. Rowe[2*]

Secuestro de carbono en suelos con agricultura de conservación y pastoreo controlado.

Estiércol para generar metano, calor, electricidad y fertilizante.

Tecnologías para disminuir las emisiones de metano por rumiantes.

Grupo Consultivo para la Impulsar la Innovación en el Sector Agroalimentario
COLPOS, INAPESCA, INCA Rural, INIFAP, SADER

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Objetivo:

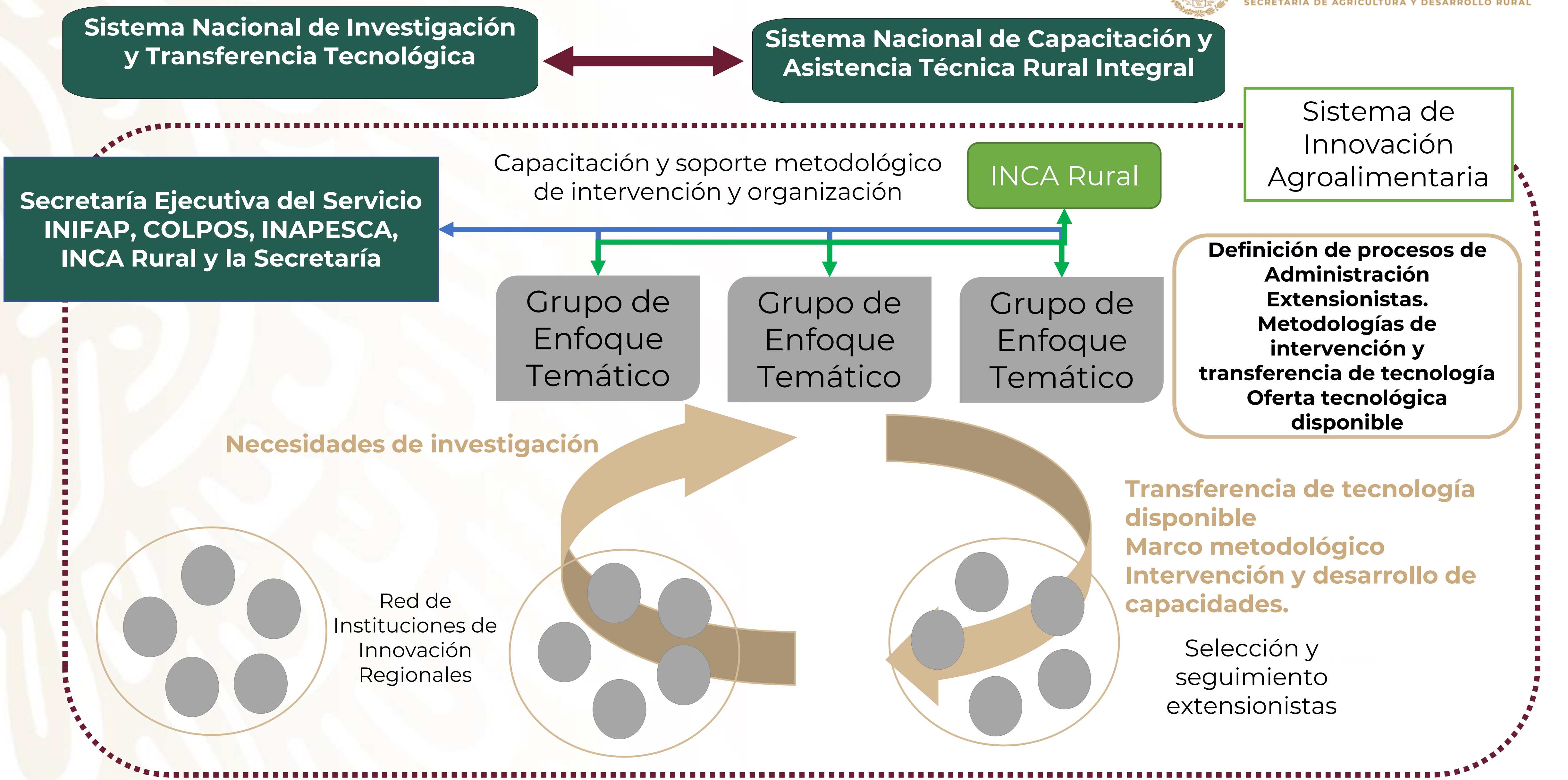
Proponer a la Secretaría planes, programas y acciones en el ámbito de la innovación que permita la articulación de los actores que intervienen en este proceso y mejorar los procesos de investigación, desarrollo tecnológico, transferencia de tecnología e innovación en el sector agroalimentario.

Equipos de Trabajo:

Problemáticas y prioiridades de investigación para una transformación del sistema agroalimentario	Fortalecimiento de la capacidad de investigación, desarrollo tecnológico, transferencia de tecnología e innovación de las instituciones del sector agroalimentario
1. Producción sostenible de alimentos sanos y nutritivos para todos 2. Modelos sostenibles de consumo 3. Producción favorable con la naturaleza 4. Medios de vida equitativos 5. Resiliencia ante vulnerabilidades, tensiones y conmociones	1. Análisis del marco jurídico e institucional para fortalecer el proceso de innovación en el sector agroalimentario 2. Oficinas de transferencia de tecnología 3. Vinculación de la investigación con el extensionismo 4. Términos de referencia para proyectos integrales de innovación.

Definición de Prioridades, Proyectos Interinstitucionales, Vinculación y Coordinación de Actores

Sistema de Innovación Agroalimentaria



¡Muchas gracias!