Ketil Stoknes
forsker

Source: #faccwtha

40 km bilkjøring / dag

=

ca 6 kg CO2 /dag

gjennomsnittlig globalt mat-avtrykk /dag

Sarah Bridle

Source: #faccwtha

Vi må hit

Én biff til middag

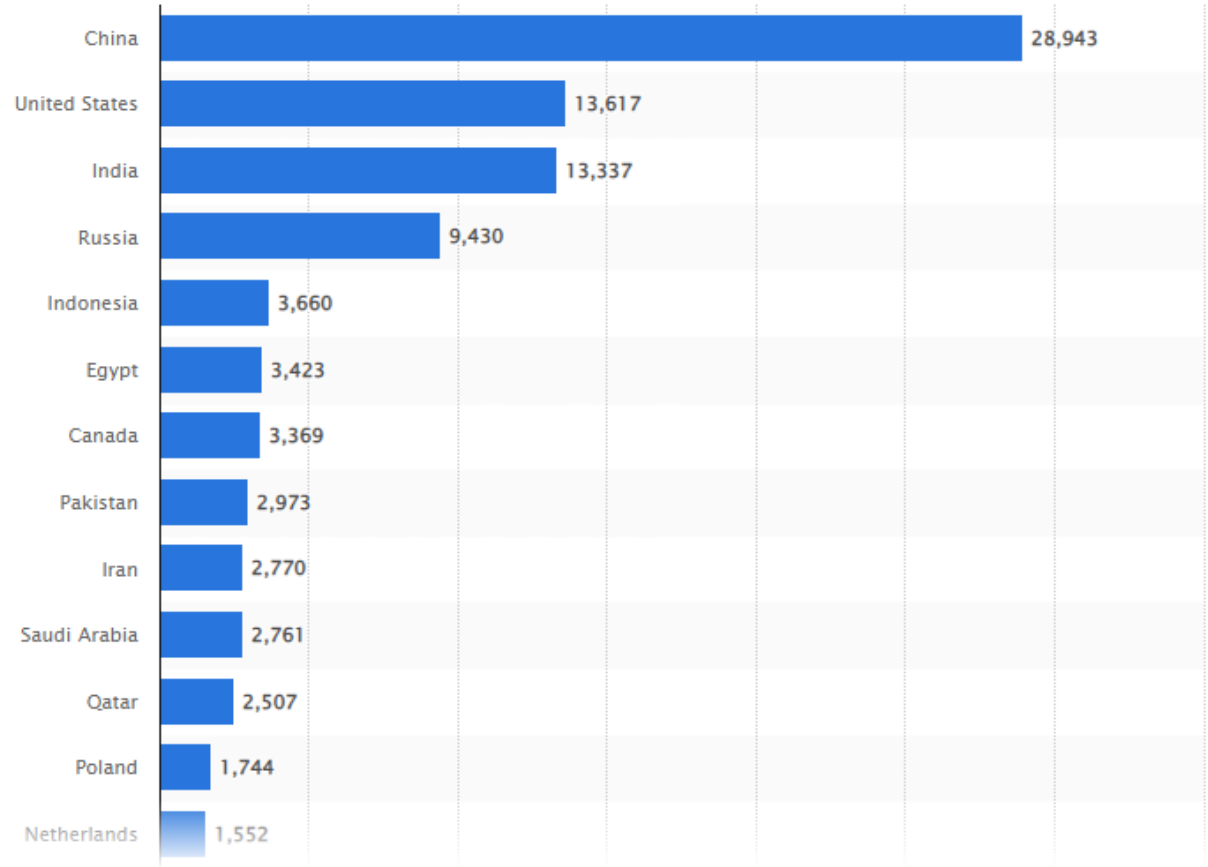
Vi må hit

Planters relative behov	100	16	60
Eks innhold mineralgjødsel	22 %	3 %	10 %
Forbruk mineralgjødsel, norsk landbruk, tonn 2020	106 000	9 000	34 000

I tillegg dekkes en mye av gjødselbehovet i landbruket av husdyrgjødsel, der netto næringsinput kommer fra importert fór

Production volume of nitrogen fertilizer worldwide in 2018, by country

(in thousand metric tons)



The nitrogen emergency: How to fix our forgotten environmental crisis

Nitrogen pollution poisons our water and clogs our air – and it exacerbates other environmental problems. But if we organise now, we can fight back before it's too late

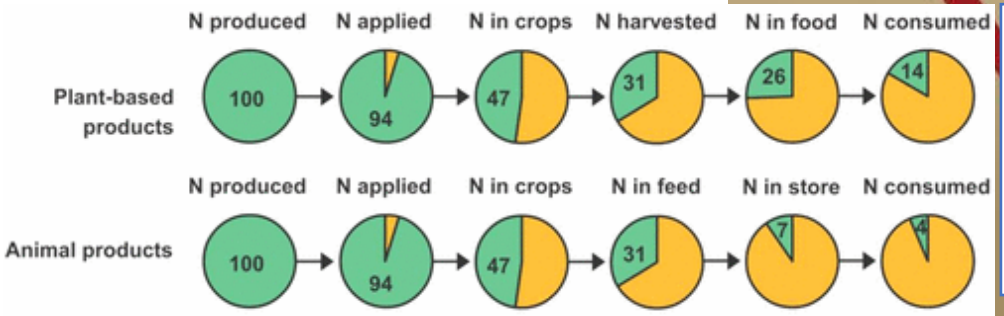
ENVIRONMENT 12 May 2021

By Andrew Zaleski

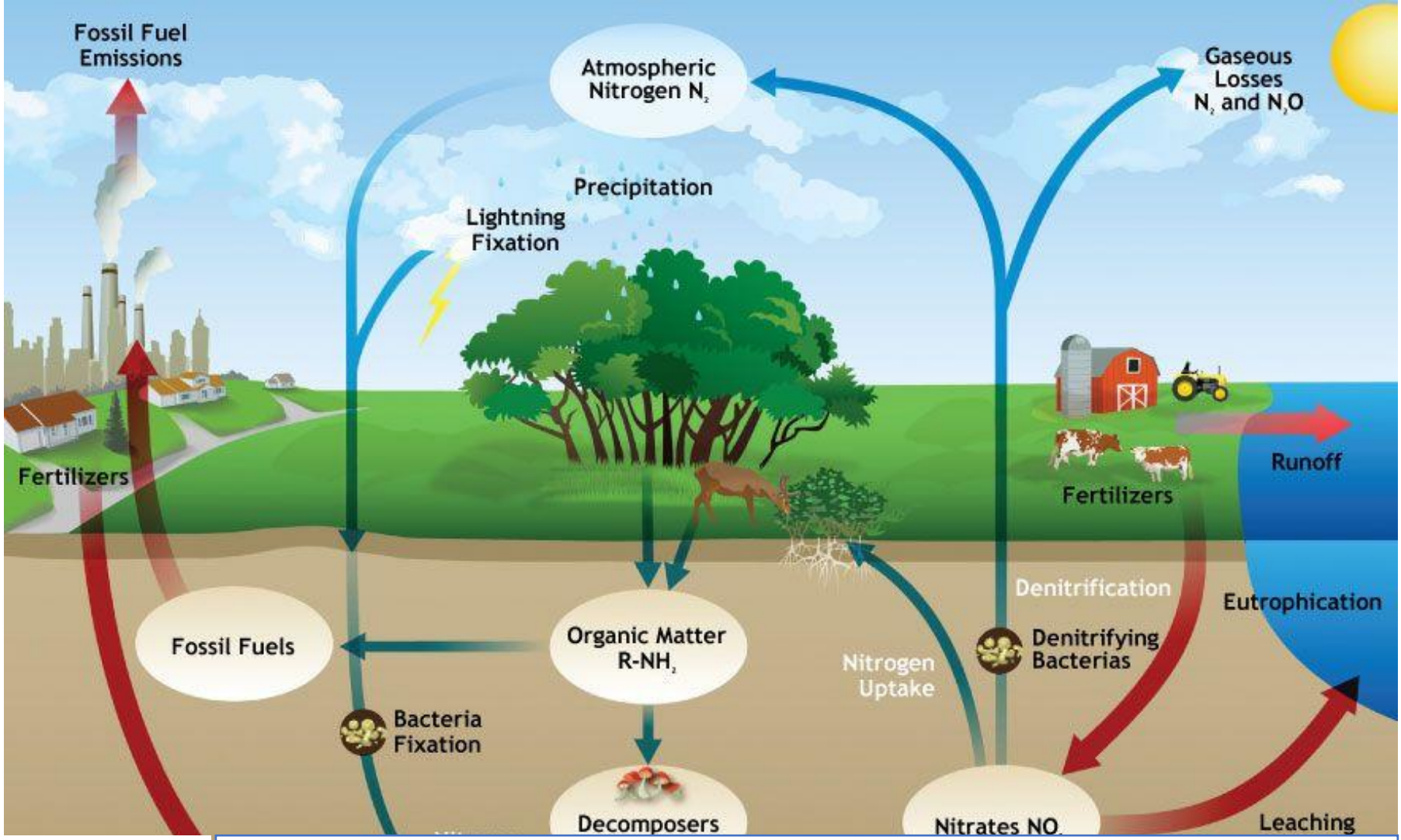
140 mill tons

Nitrogen natural cycle – and human over-fertilisation problem

+150 mill tons

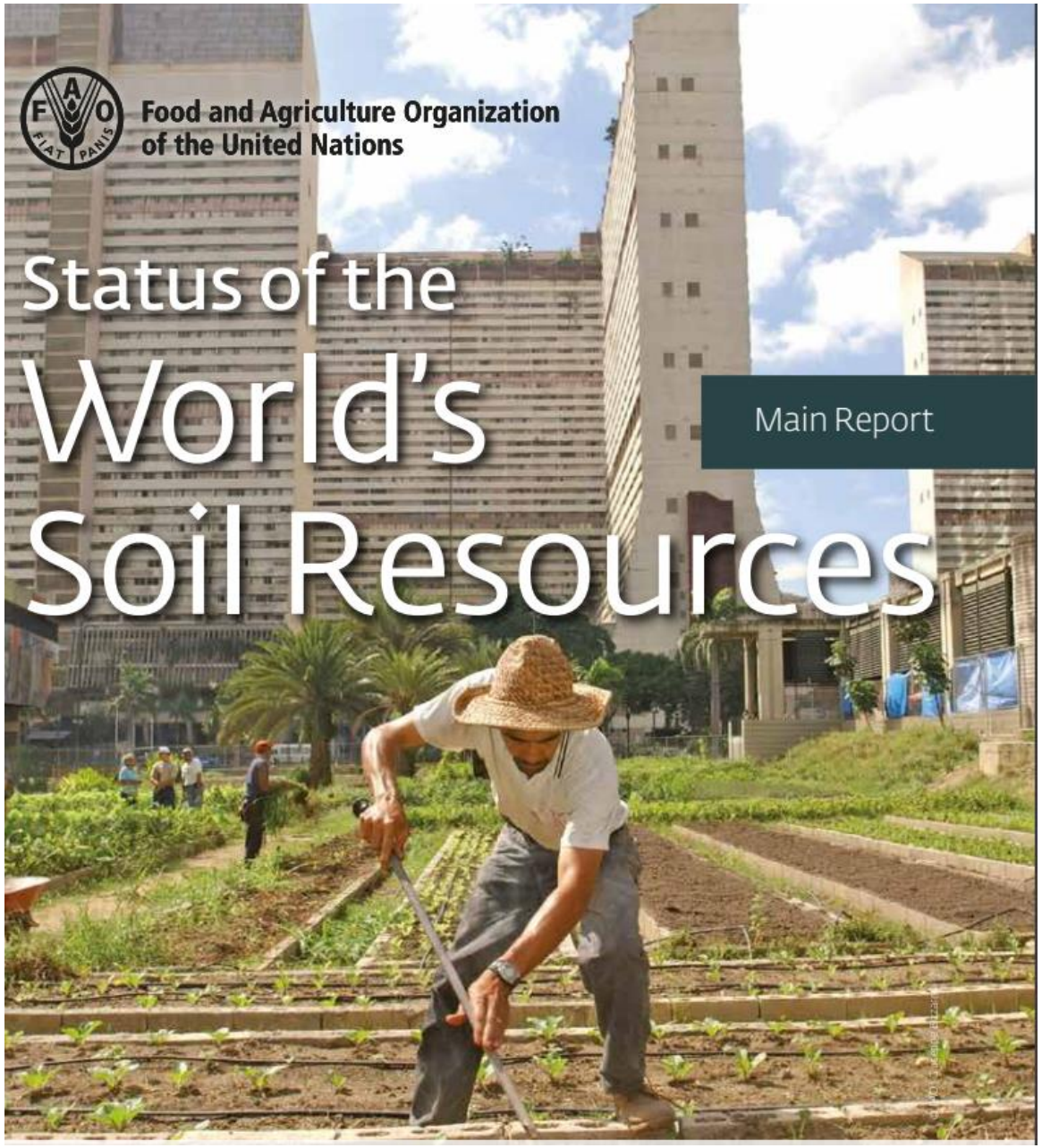


Pikaar 2017. Microbes and the next nitrogen revolution



Mengden nitrogen og fosfor som tilføres norske gårder gjennom kraftfôr og gjødsel er betydelig større enn mengden som fjernes i solgte produkter. Norsk landbruk har et årlig overskudd av nitrogen på 12 - 13 kg per daa i gjennomsnitt, størst er dette overskuddet i husdyrområdene. Basert på dekningsbidragskalkyler fra NILF i 2007 har beregninger vist et gjennomsnittlig nitrogenoverskudd på melkeproduksjonsbruk i husdyrdistrikt på rundt 17 kg nitrogen per daa og år. På Jæren var overskuddet hele 26 kg per daa og år.

https://no.pinterest.com/pin/497999671268456099/

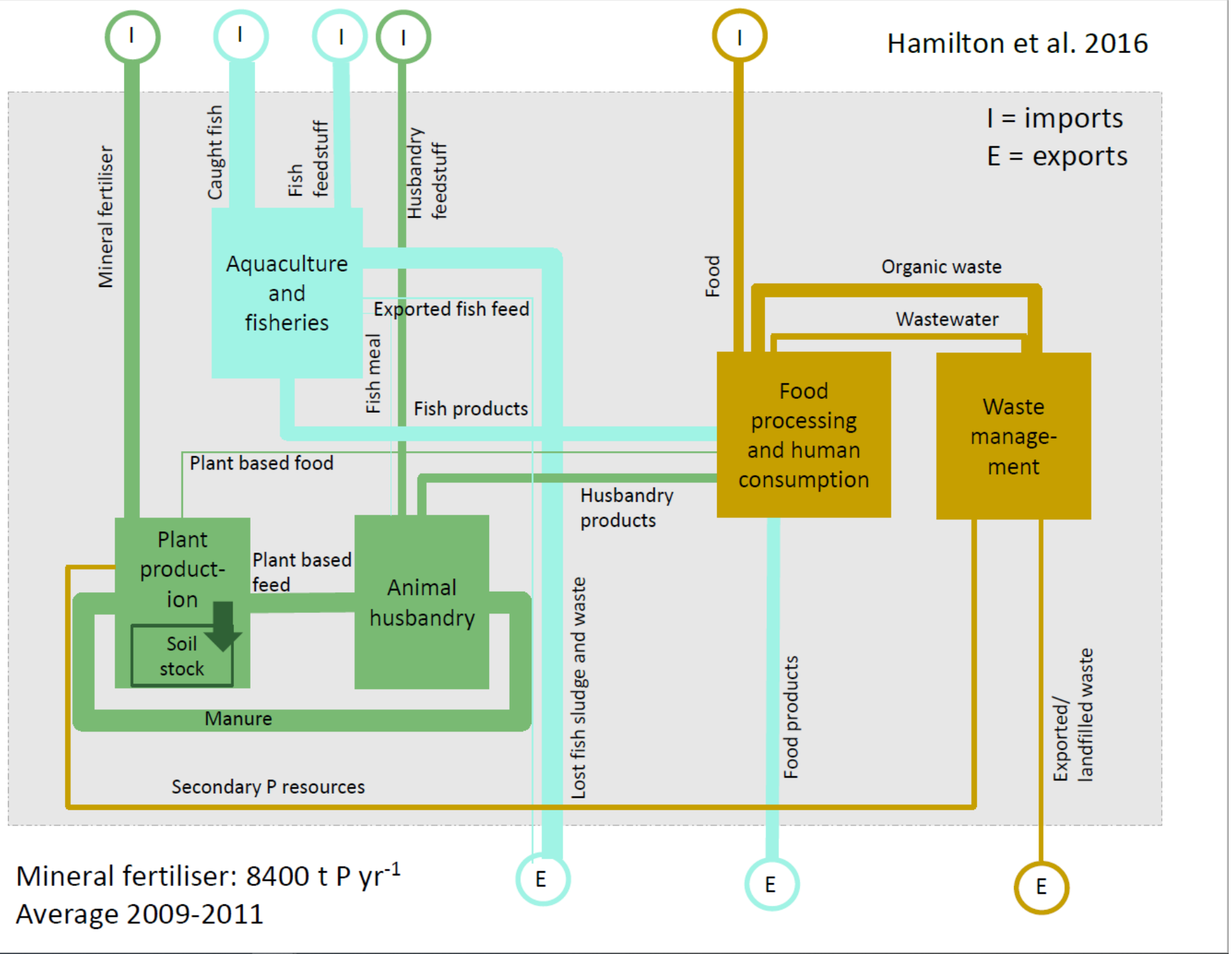


...while there is cause for optimism in some regions, the majority of the world's soil resources are in only fair, poor or very poor condition. Today, 33 percent of land is moderately to highly degraded due to the erosion, salinization, compaction, acidification and chemical pollution of soils....

Selv om det ligger bra an i Norge foreløpig er vi på vei dit:

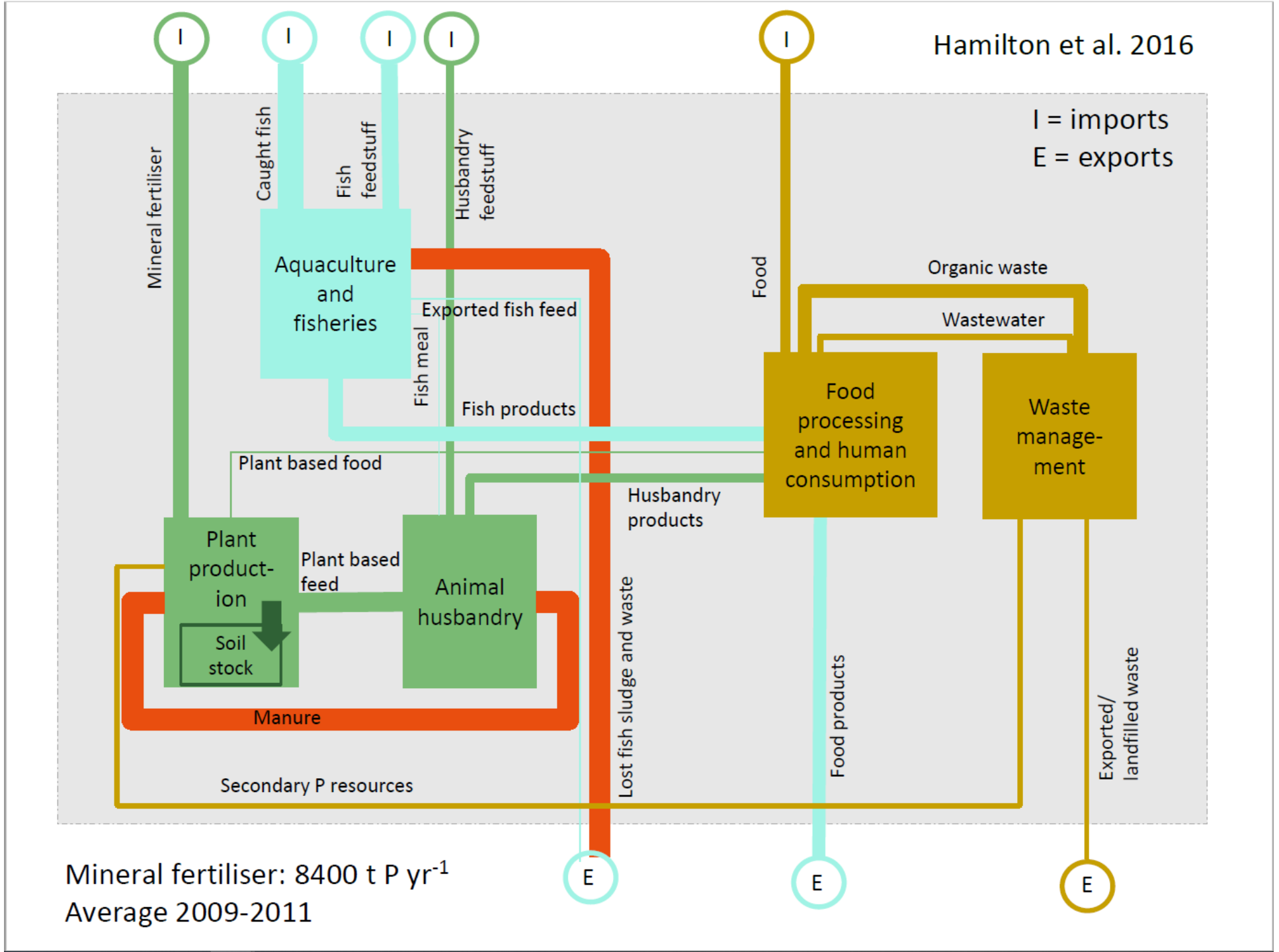
P

Norge


Hamilton et al. 2016
I = imports
E = exports
I
I
I
I
I
Mineral fertiliser
Caught fish
Fish feedstuff
Husbandry feedstuff
Food
Aquaculture and fisheries
Exported fish feed
Fish meal
Fish products
Organic waste
Wastewater
Food processing and human consumption
Waste manage-ment
Plant based food
Husbandry products
Plant product-ion
Soil stock
Plant based feed
Animal husbandry
Manure
Secondary P resources
Lost fish sludge and waste
Food products
Exported/ landfilled waste
E
E
E
Mineral fertiliser: 8400 t P yr-1
Average 2009-2011

P

Norge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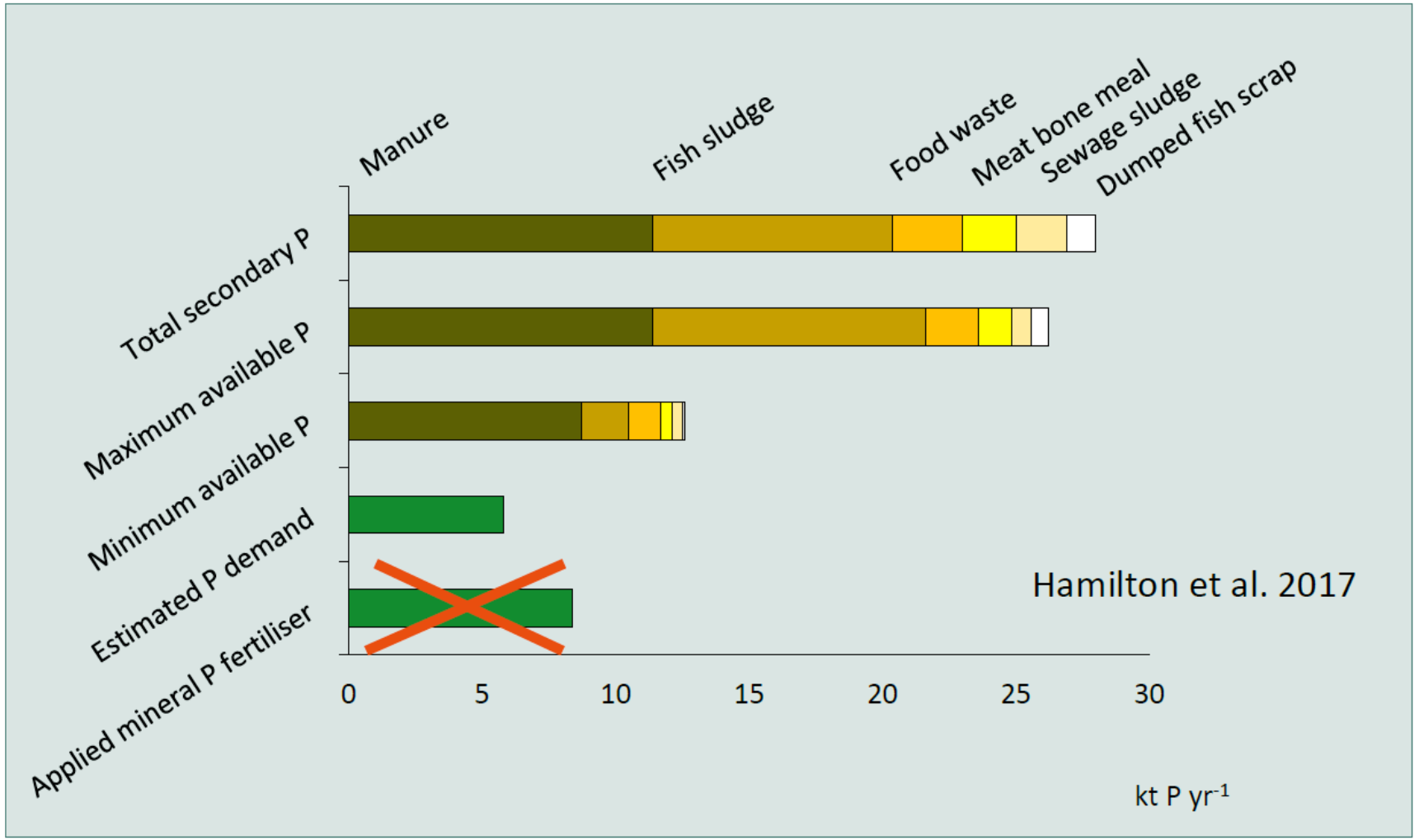
Manure
Lost fish sludge and waste
Food products
Exported/ landfilled waste
Secondary P resources
E
E
E
Mineral fertiliser: 8400 t P yr-1
Average 2009-2011

P

Norge

NORWEGIAN P RECYCLING POTENTIAL

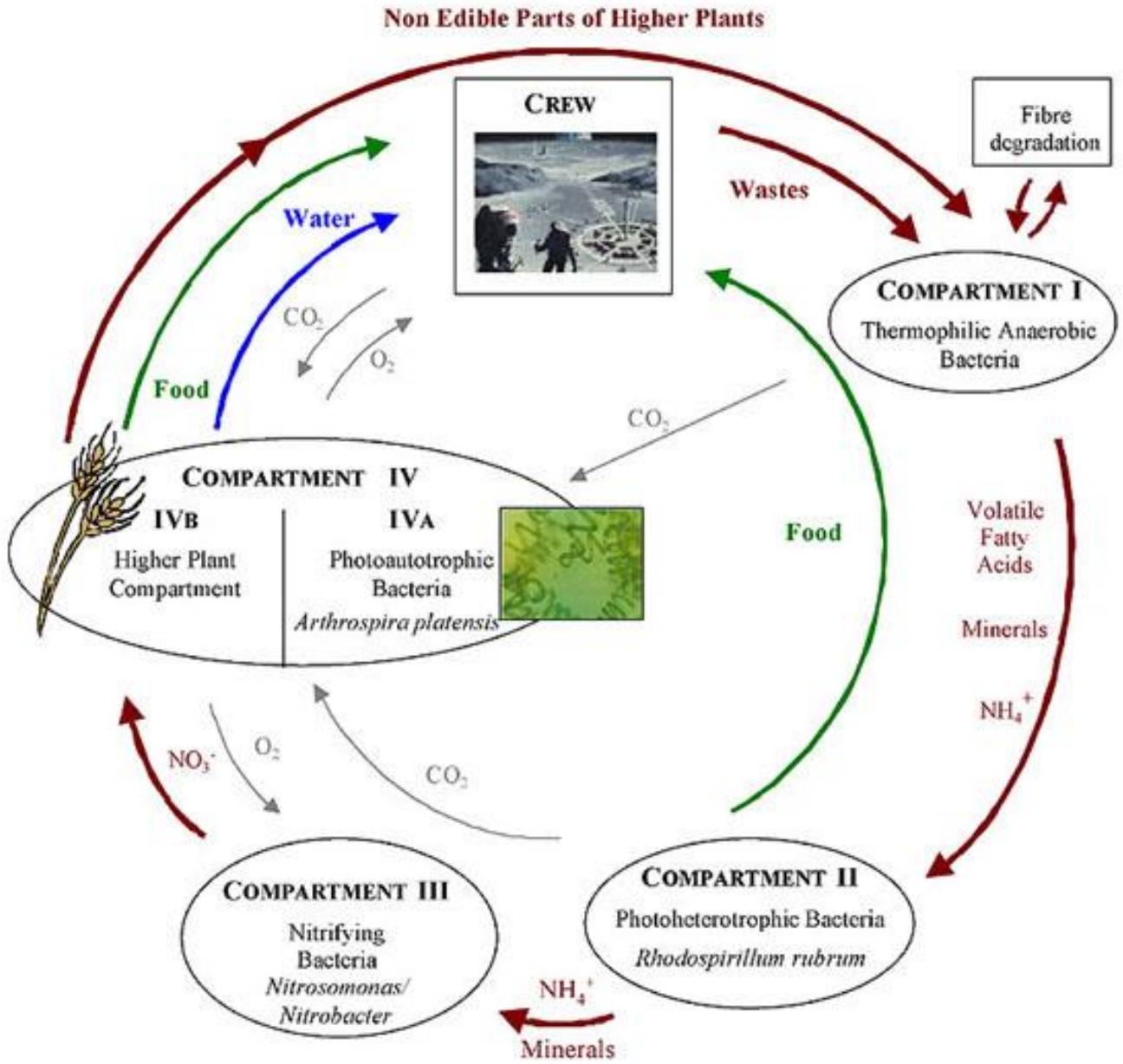



farming
processing& packaging
distribution
retail
consumption

Lindum

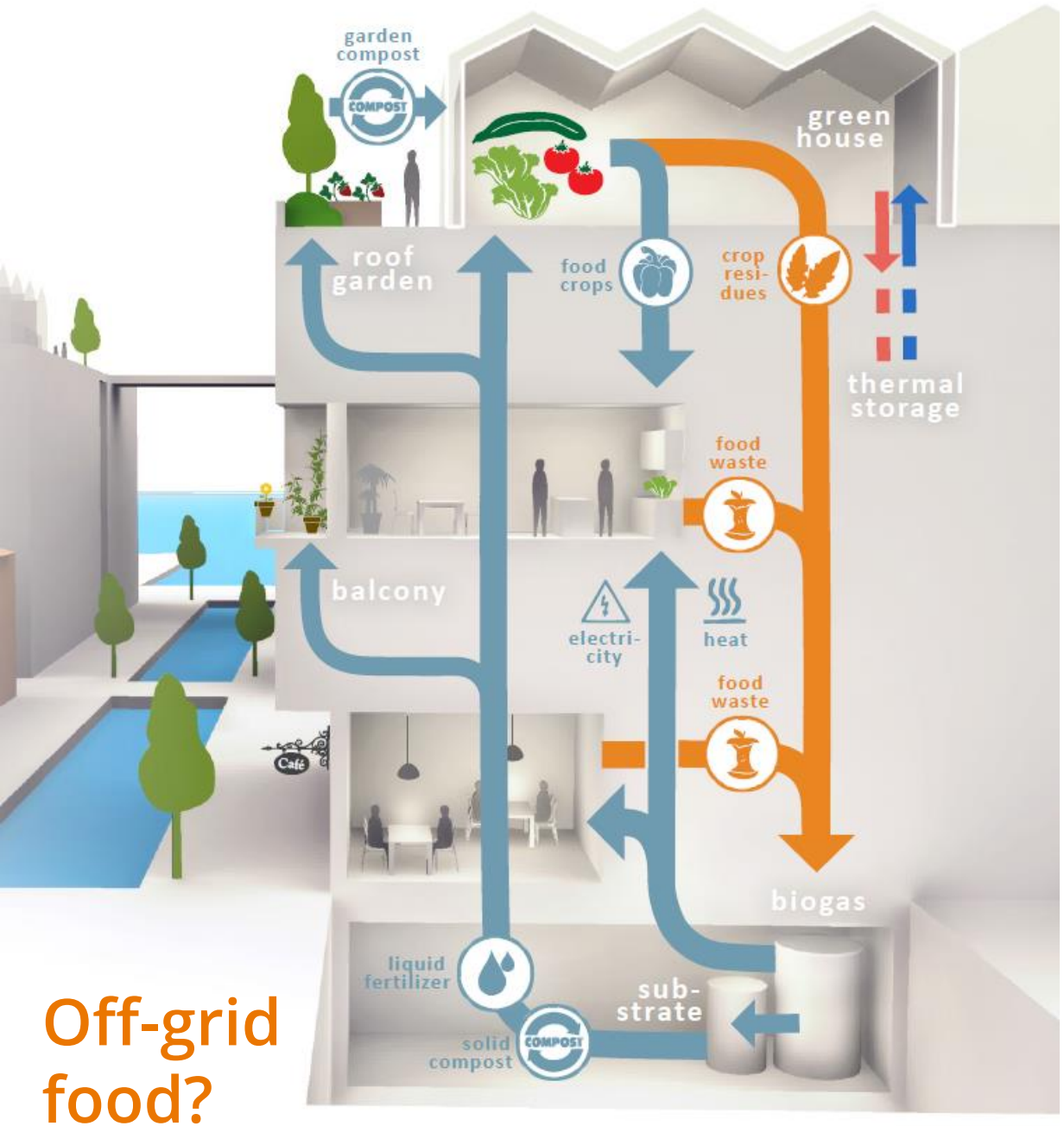
GREVE
BIOGASS

Reklima


Non Edible Parts of Higher Plants
CREW
Fibre degradation
Wastes
Water
Food
CO_2
O_2
COMPARTMENT I
Thermophilic Anaerobic Bacteria
CO_2
COMPARTMENT IV
IVB
Higher Plant Compartment
IVA
Photoautotrophic Bacteria
Arthrospira platensis
Food
Volatile Fatty Acids
Minerals
NH_4^+
NO_3^-
O_2
CO_2
COMPARTMENT III
Nitrifying Bacteria
Nitrosomonas/ Nitrobacter
COMPARTMENT II
Photoheterotrophic Bacteria
Rhodospirillum rubrum
NH_4^+
Minerals

The complete value chain:

Off-grid food?

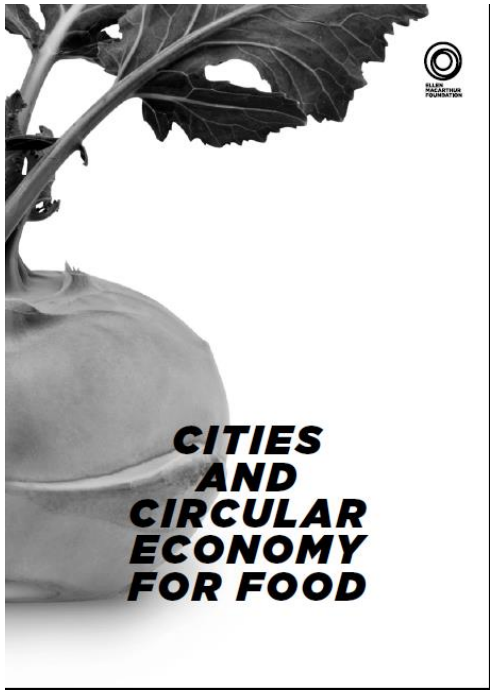


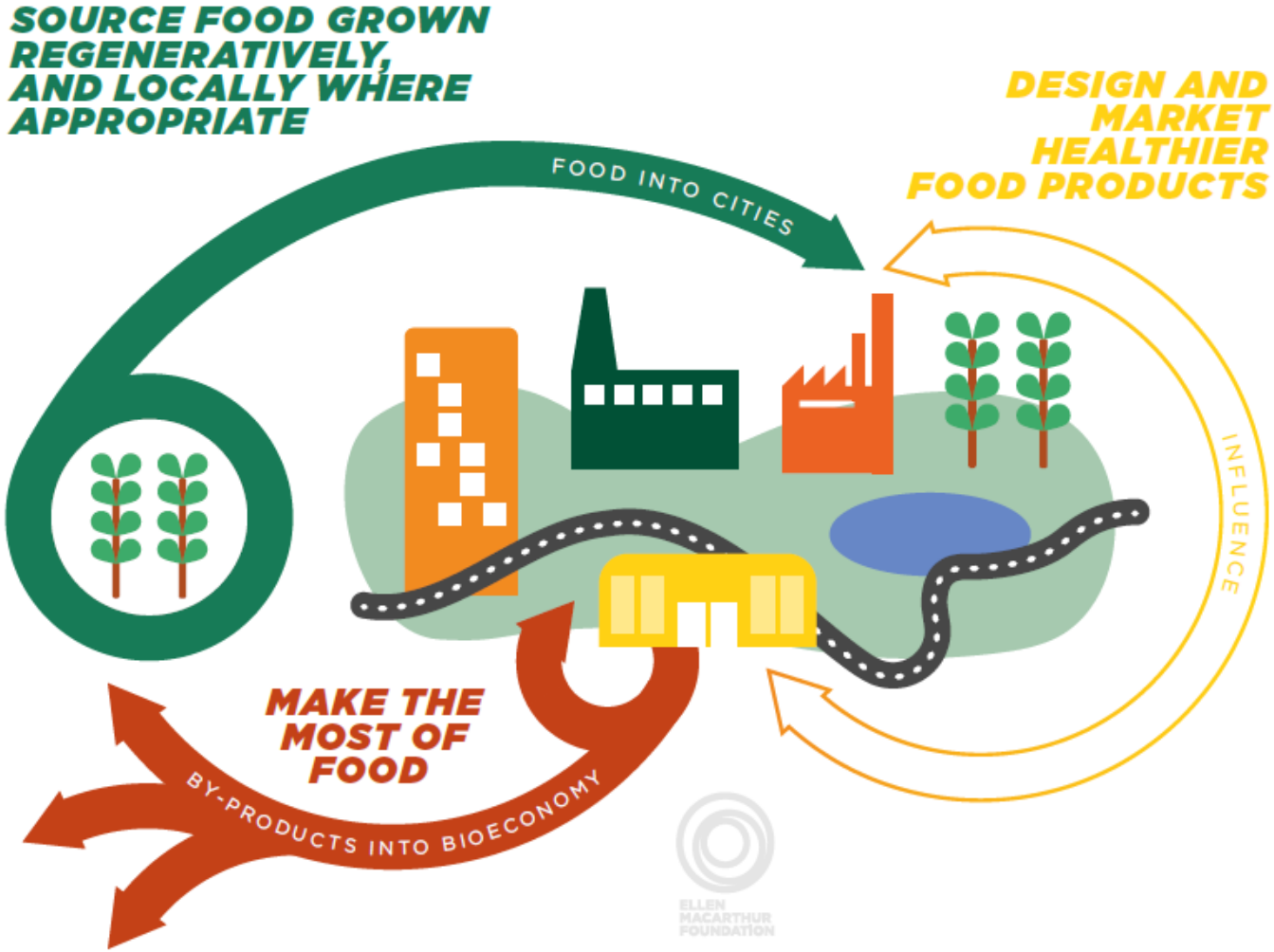
Community greenhouse

Community rooftop garden

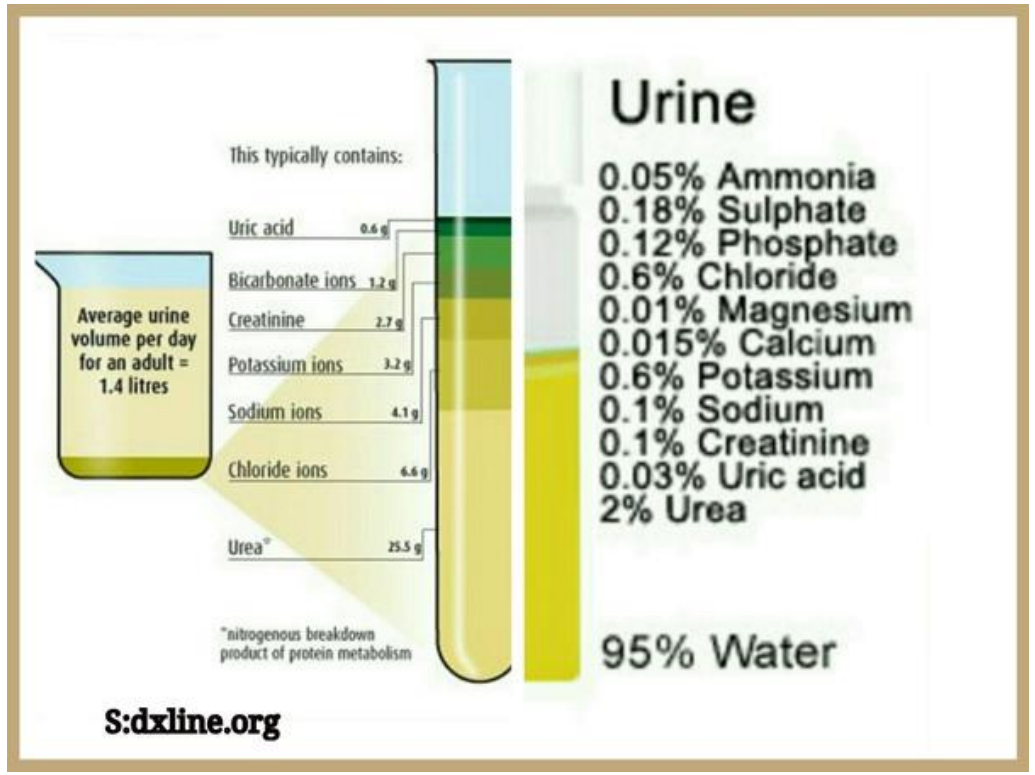
Professional greenhouse and/or mushroom farm

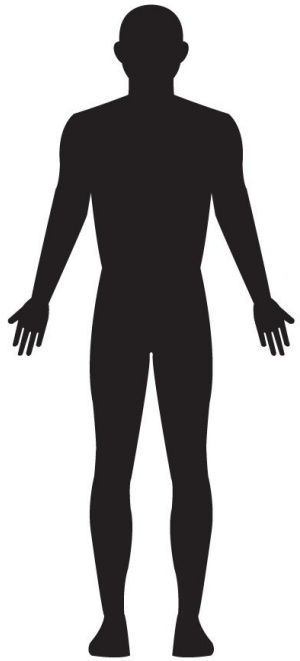
Cities should work towards three ambitions for a circular economy for food (MacArthur Foundation, 2019):

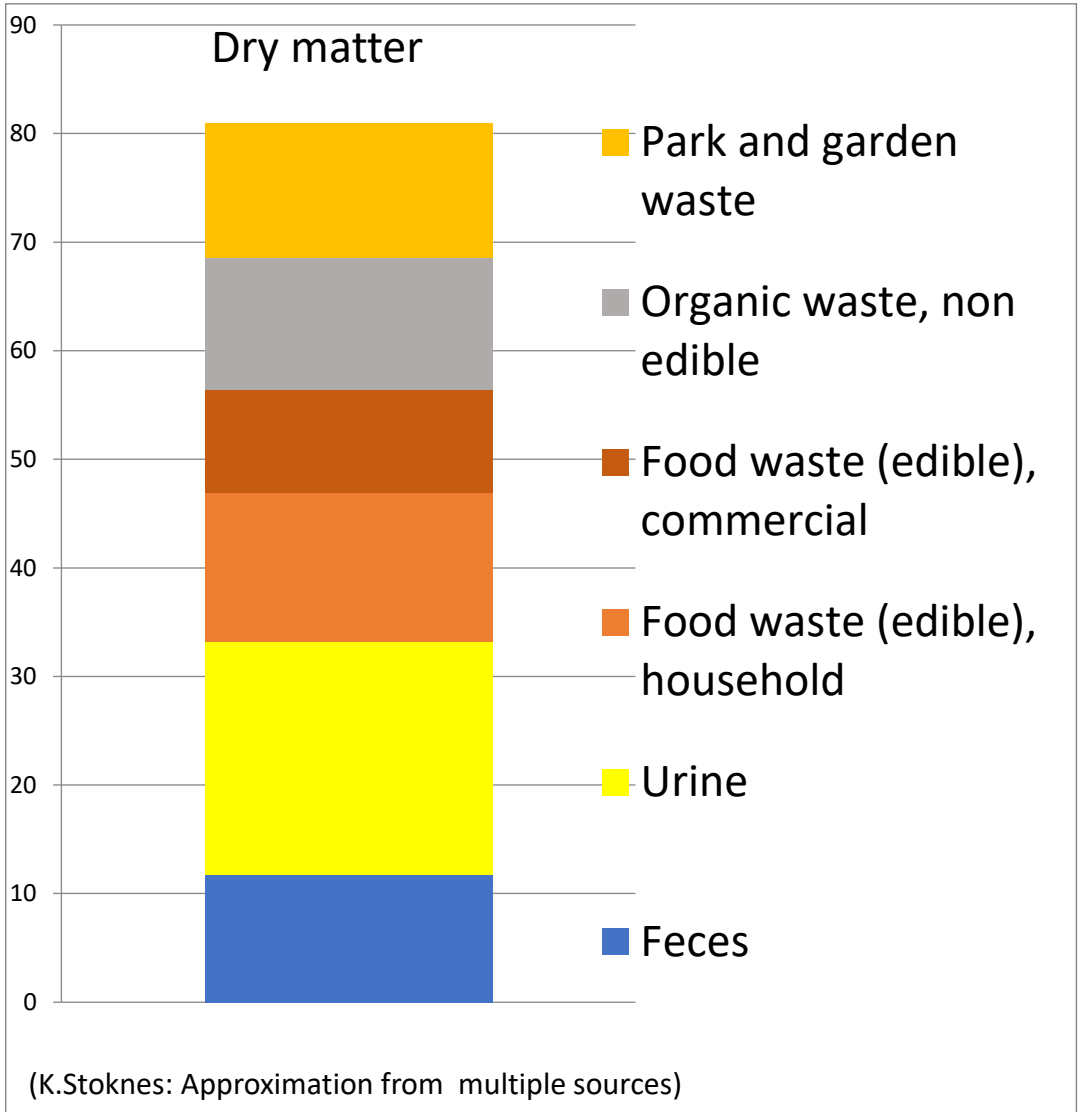




Your organic footprint, kg dry matter/ year







(K.Stoknes: Approximation from multiple sources)

What can and should be grown in the city?

Feeding One Million People on Mars

Kevin M. Cannon and Daniel T. Britt

University of Central Florida, Orlando, Florida.

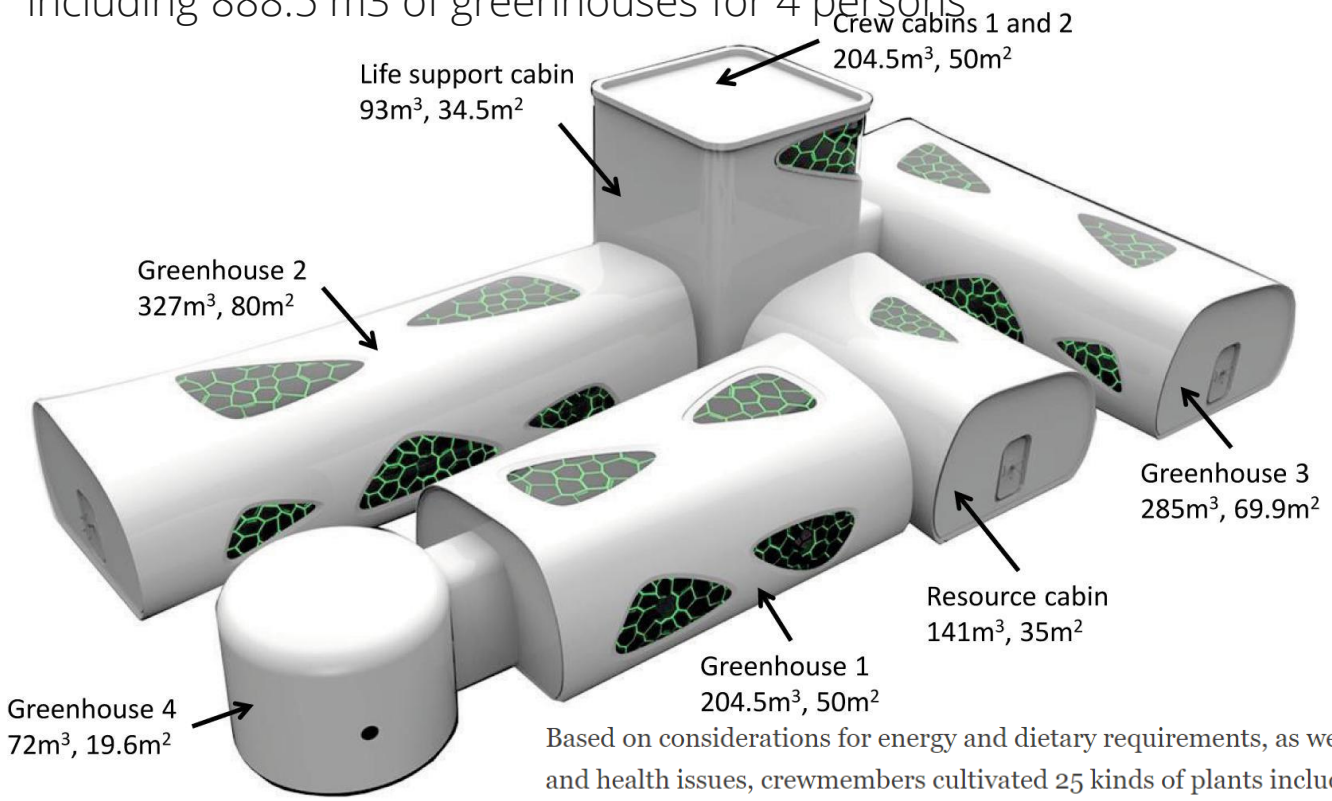
ABSTRACT

Food production on Mars is usually thought of in terms of growing plants to partially support small exploration crews for short- to medium-term stays. Here, we consider the more radical goal of producing enough food on Mars to sustain a permanent settlement of private citizens that increases to 1 million people within 100 Earth years. We modeled a population that grows from immigration as well as naturally. Calorie needs were calculated on a per-person basis, and land use was modeled with a diet that includes staple crops, insect products, and cellular agriculture. Food self-sufficiency can be attained within 100 years with reasonable inputs, but massive amounts of imported food would be needed in the interim. Various strategies can reduce the amount of imported food significantly, balanced

(ISRU), except in a limited case to generate propellant for a Mars Ascent Vehicle.[1,2] Plants or other foods produced on the martian surface would serve a psychological purpose and as a minor dietary supplement, as they do on the International Space Station (ISS).[3] The more recent NASA Evolvable Mars Campaign took steps toward a sustainable presence, but it still imagines small crews and brief sorties, and has now taken a backseat to a lunar return.

The rise of commercial space companies with ambitious goals and agile development practices will likely disrupt these canonical architectures. The stated objective of SpaceX is to establish an independent civilization on Mars, with cargo and then crewed ships projected to start launching within 3–5 years. Vehicles for the transportation system are already being built and tested. Detailed plans have not been published, but a rough sketch of the SpaceX campaign calls for: (1) an initial crew of ~12 people; (2) multiple ships of ~100–200 passengers sent at every 26-month launch opportunity; and (3) an eventual population of 10^6 living on the planet within 50–100

Relatively spacious CELSS (1,340 m3, 370 m2) including 888.5 m3 of greenhouses for 4 persons



Based on considerations for energy and dietary requirements, as well as multiple taste preferences and health issues, crewmembers cultivated 25 kinds of plants including wheat, potatoes, sweet potatoes, soybeans, peanuts, lettuce, cabbage, edible amaranth, cherry radish, tomatoes and strawberries (for more details on plant species, see Supplementary Table in Dai et al., 2018a).

ORIGINAL RESEARCH ARTICLE
Front. Physiol., 21 May 2019 | https://doi.org/10.3389/fphys.2019.00575

Check for updates

Multi-System Adaptation to Confinement During the 180-Day Controlled Ecological Life Support System (CELSS) Experiment

Ming Yuan[1,2], Marc-Antoine Custaud[3,4], Zi Xu[2], Jingyu Wang[1], Min Yuan[1],

smartcitiesdive.com/ex/sustainablecitiescollective/chinas-indoor-farming-research-feed-cities-leads-world

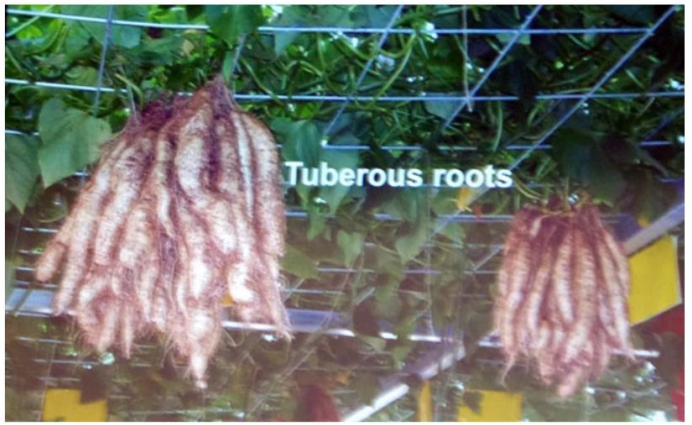
StrømHytta | Langtidsvarsel for D... | Dokumenter | R | Hyperthermics | Microbe crops | SMC SM

SMARTCITIESDIVE Deep Dive Opinion Library Events Topics

How China Leads the World in Indoor Farming

AUTHOR
David Thorpe
@DavidKThorpe

Sweet potatoes in this system can be harvested individually and repeatedly from the plant without lifting the entire plant. The team has succeeded in doing this with one soilless plant that is 10 years old and has produced a scarcely believable 500 potatoes.



Game and Primus, 2015:

Urban and peri-urban agriculture

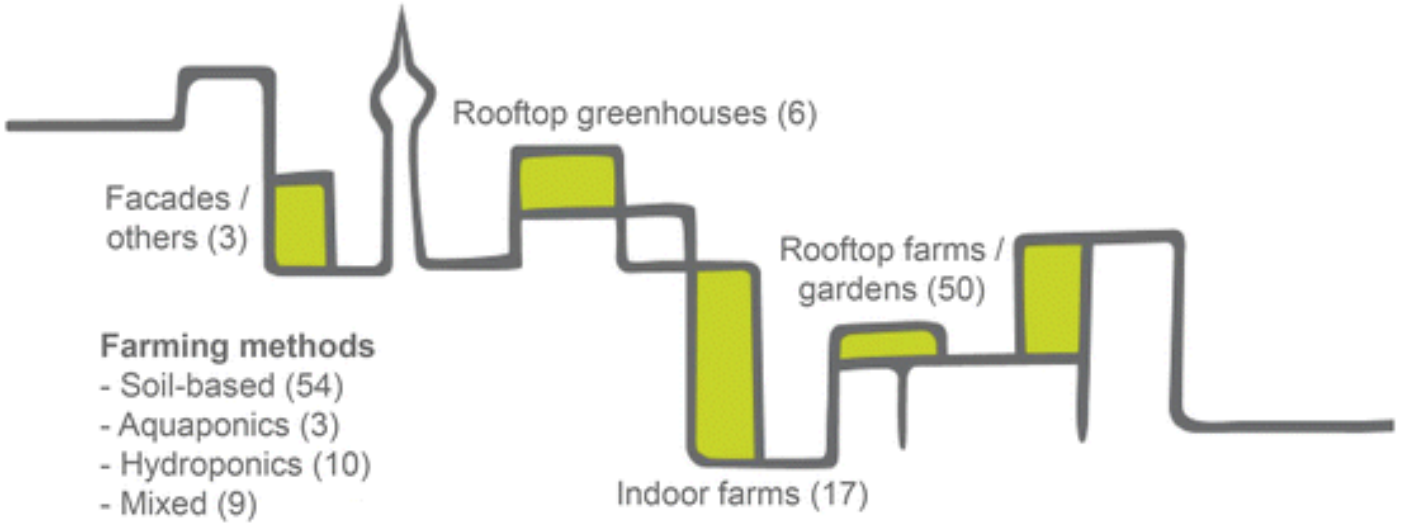
UA

Controlled Environment Agriculture
CEA («indoors»)

Uncontrolled Environment Agriculture (outdoors)
community gardens, vegetable gardens and rooftop farms

Greenhouses
Tunnels

Vertical farming/high tech plant factories



Types of UA to

- maximise human quality of life
- maximise environmental benefits

	Small scale Psychological/social/ spiritual	Large scale Recycle nutrients and feed the population
Outdoor	Community gardens Community rooftop Bees, biodiversity	Commercial peri-urban vegetable, fruit and berries. Dairy
Indoor	Commercial herb walls and mushrooms in restaurants, cafes  	Greenhouses Aquaponics Digeponics Mushroom farms Year round sink for nutrients Insect farms from vegetable waste

The potential of urban agriculture in combination with organic waste valorization: Assessment of resource flows and emissions for two european cities

Till Weidner, Aidong Yang*

Journal of Cleaner Production 2020, 244

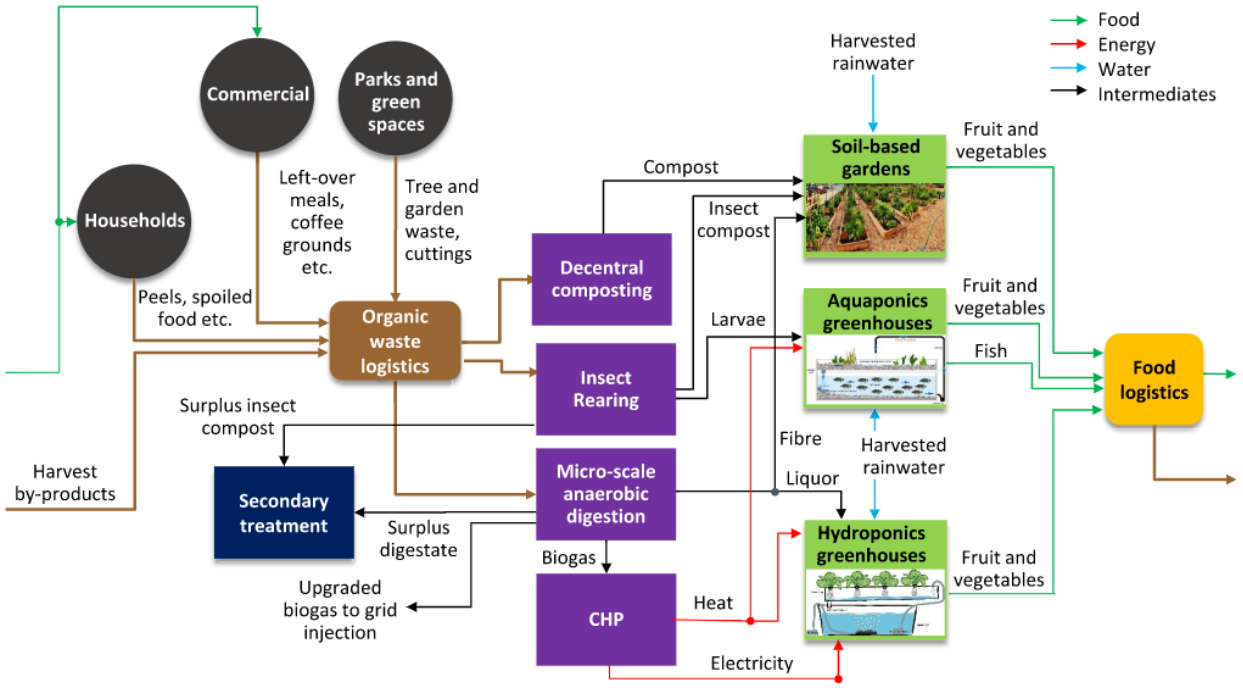
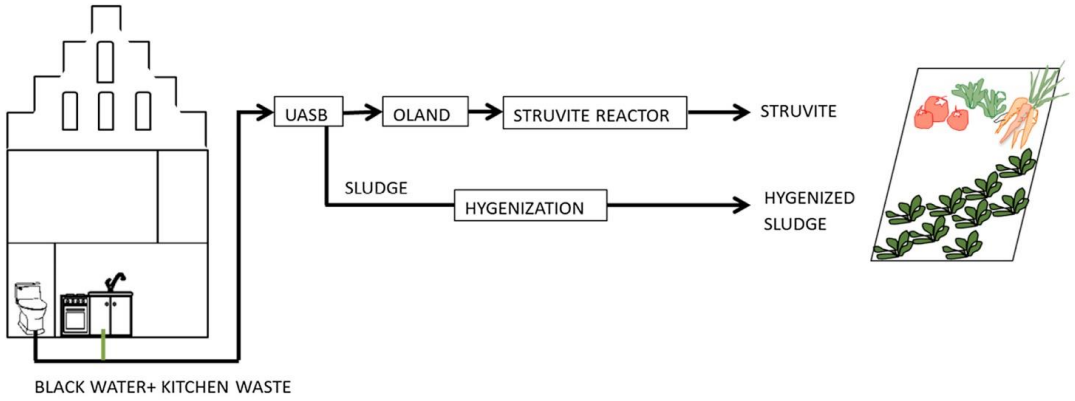


Fig. 3. Resource nexus of integrated UA and waste management system.

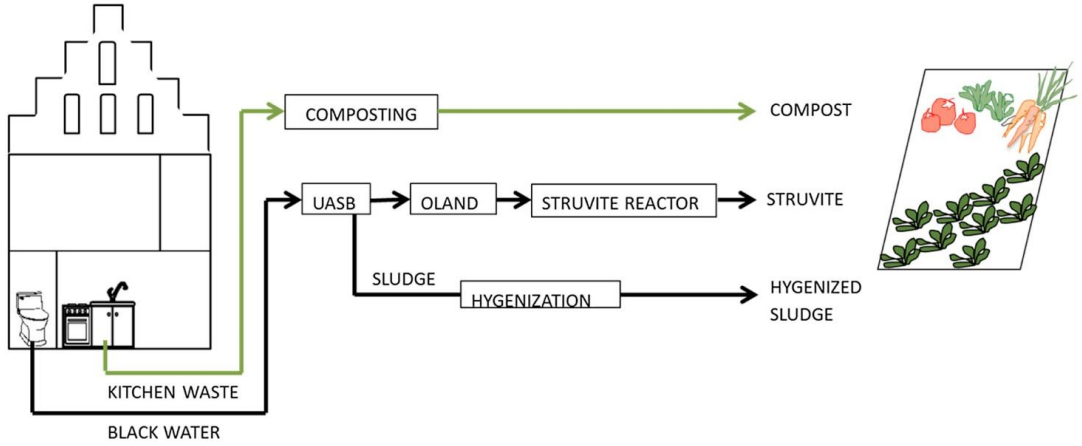
- Professional greenhouses necessary to assimilate a large portion of the organic waste
- Conventional greenhouses are very energy-demanding during winter resulting in a high footprint (improved if operated on low-carbon electricity)
- Even fully scaled up UA unlikely to assimilate all urban food and green waste digestate /compost
- Small-scale biogas co-located with heat sinks such as bakeries
- Insect rearing on food waste for aquaponic fish feed a promising combination for increased protein self-sufficiency

Circular UA

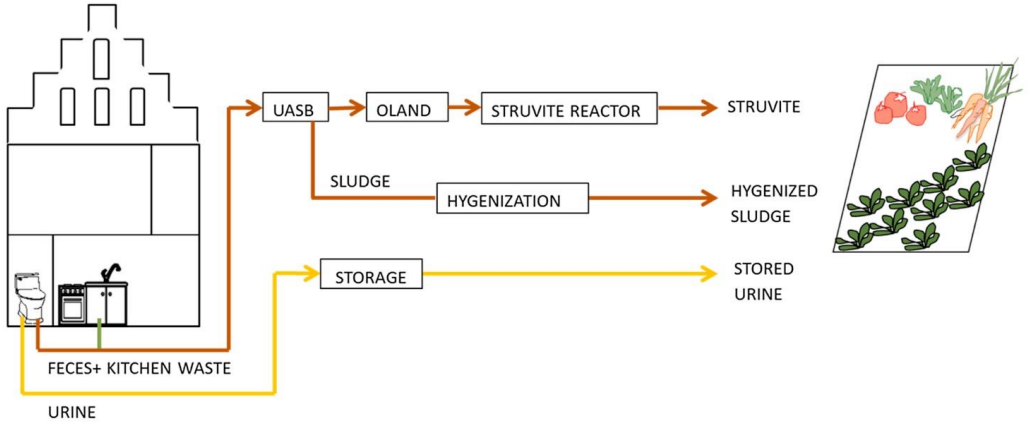
Concept 1



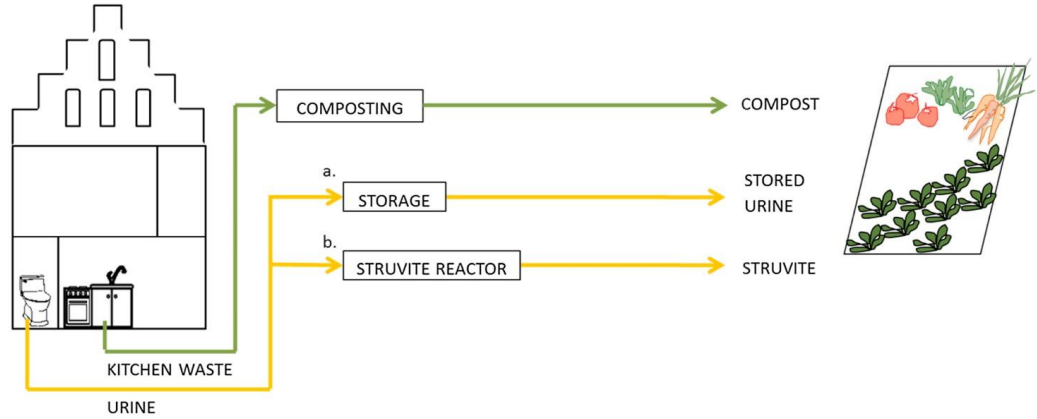
Concept 2



Concept 3



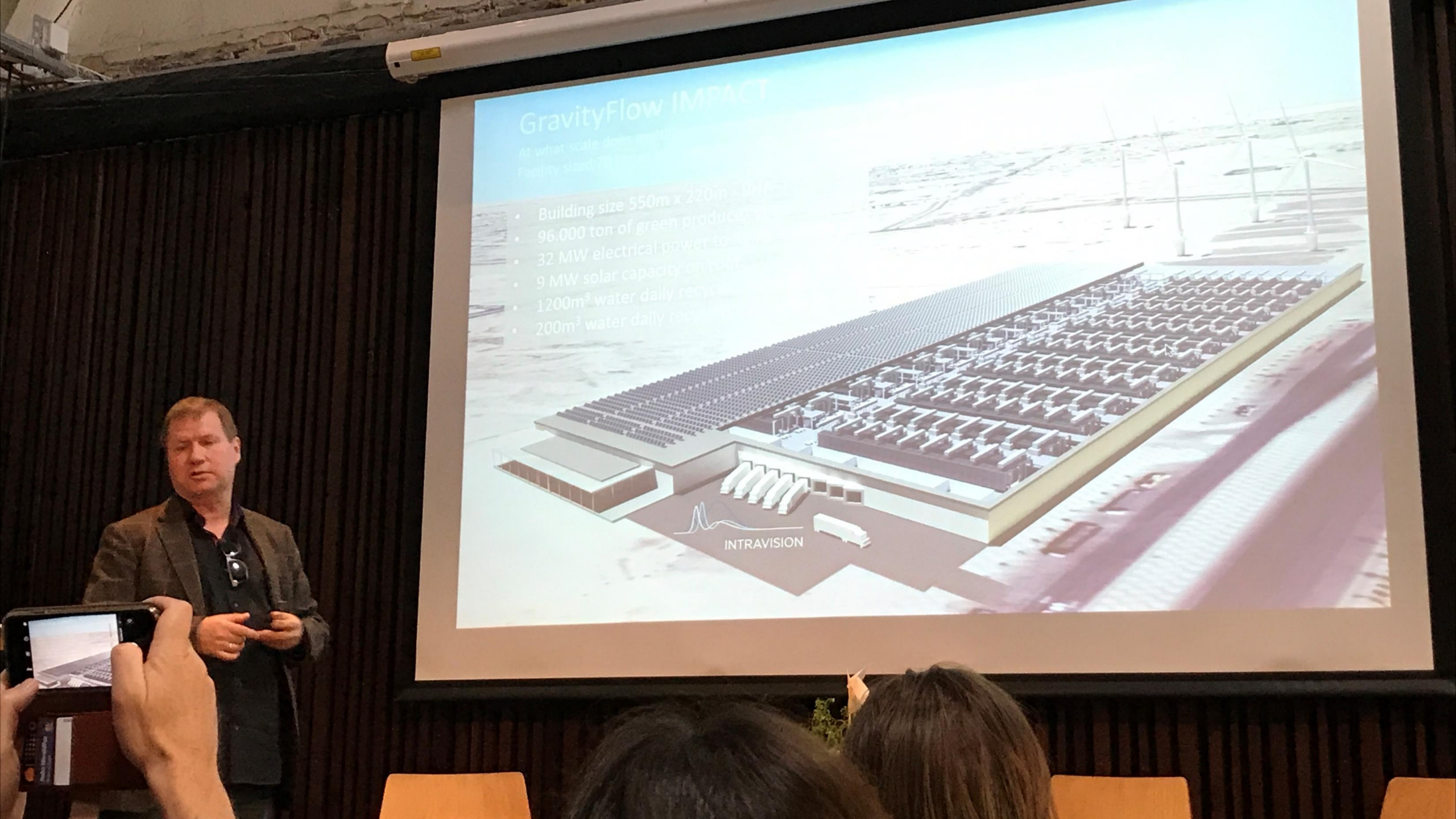
Concept 4a/4b



From Wielemaker 2018 Harvest to harvest…

ØKERN PORTAL


EXIT


GravityFlow IMPACT
INTRAVISION

Anneli Ritala

RESOURCE UTILISATION COMPARISONS

		GREENHOUSE GAS EMISSIONS kg of CO_2 equivalent per kg	FRESHWATER WITHDRAWALS litres per kg	LAND USE m^2 per kg
MEAT*	Beef (herd)	99.5	1 451	326
	Pork	12.3	1 796	7.8
	Chicken	9.9	668	6.7
	BEYOND MEAT	3.5	9.7	2.7
	IMPOSSIBLE BURGER	3.5	107	2.5
	SOLEIN**	0.2	5.5***	max. 1.0

*Global average, 1 kg of fat and bone-free meat and edible offal. **assuming 50% moisture ***withdrawals for Solein factory
Source: The Economist