Livet i jorda og torvfri jord

- Mikrobiologien – hva skjer i jorda? –
- Hvorfor torvfri jord? Hvordan redusere bruken av torv?

Ketil Stoknes, AVFALL NORGES BIOSEMINAR 2017, BERGEN

- Mikrobiologien – hva skjer i jorda? –

Jonathan Watts

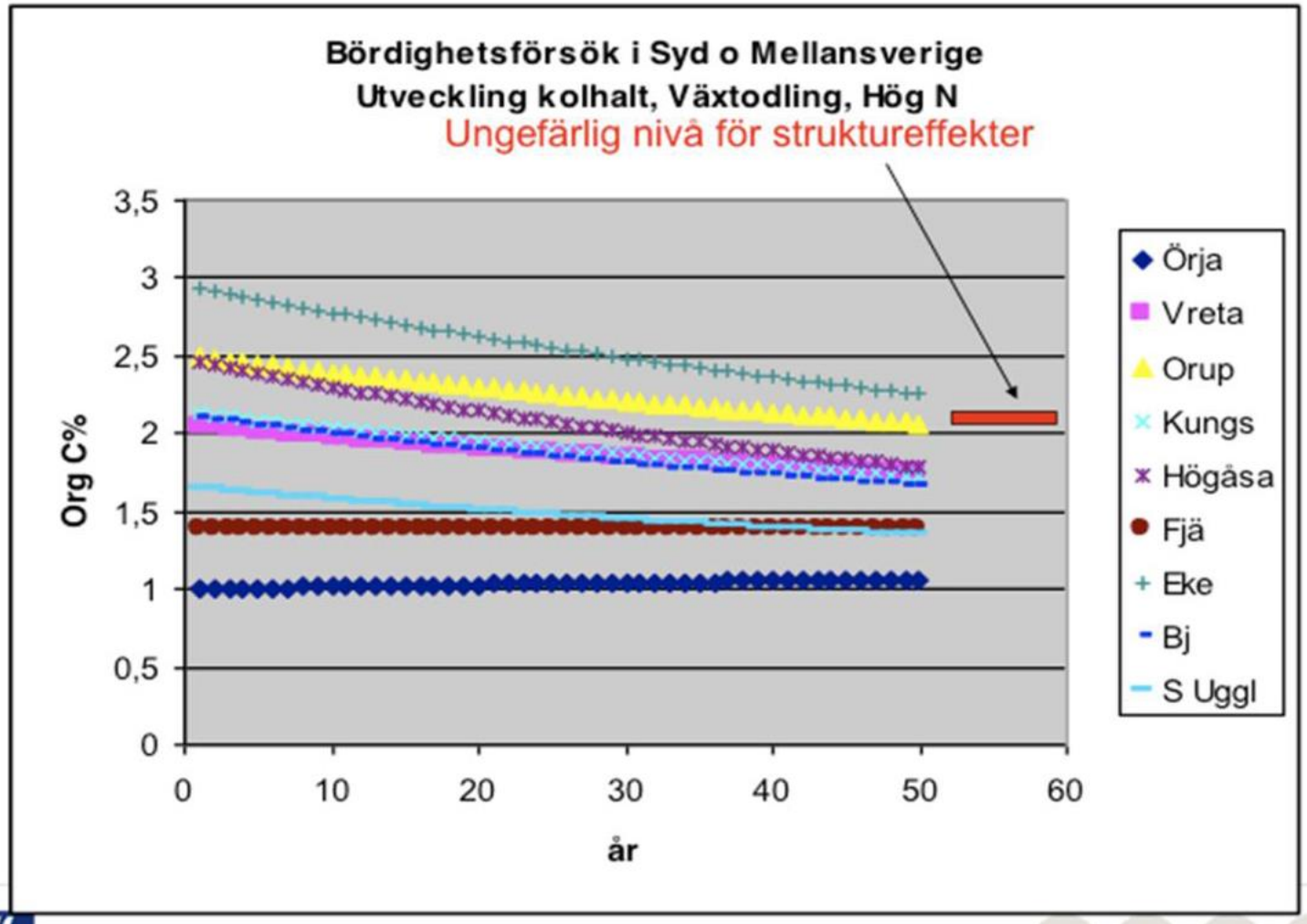
Tuesday 12 September
2017 18.18 BST

Third of Earth's soil is acutely degraded due to agriculture

Fertile soil is being lost at rate of 24bn tonnes a year through intensive farming as demand for food increases, says UN-backed study

Lindum - for miljøets skyld

Moldinnholdet går ned i landbruksjord



Yara Norge « Mikroperspektiv, hvordan forbedre jordas fruktbarhet», http://www.yara.no/doc/34252_Fruktbar%20jord,%20karbon%20i%20jorda.pdf

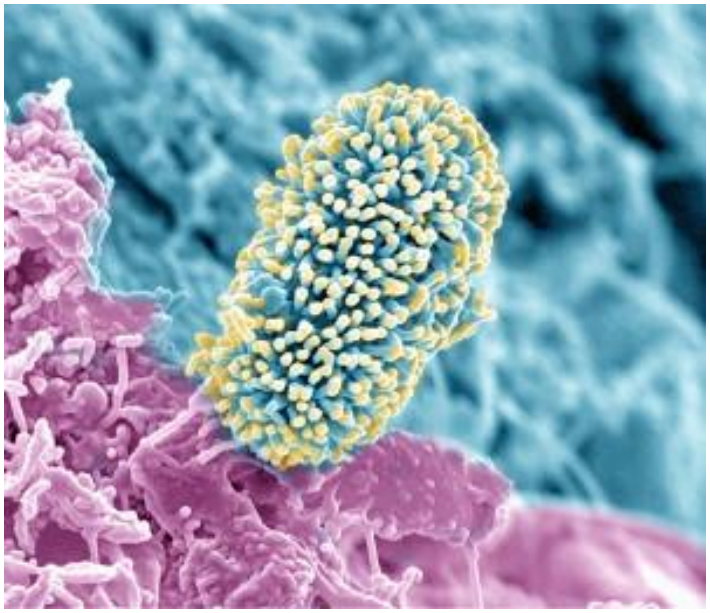
Lindum – for miljøets skyld

Antall mikroorganismer i jord

Organismer	Jordbruks jord	Jordbruks jord rundt røttene	"Frisk" jord	"Frisk" jord rundt røttene
Totalt bakterier (antall/gram tørr soil)	1×10^6	1×10^{12}	6×10^8	1×10^{12}
Antall av bakterie arter/g jord	5000	5000	75000	75000
Totalt sopper (ug pr g tørr jord)	5	20	150	300 – 500
Antall sopp - arter /g jord	500	?	25000	25000
VAM symbiose	0	0	55%	55%

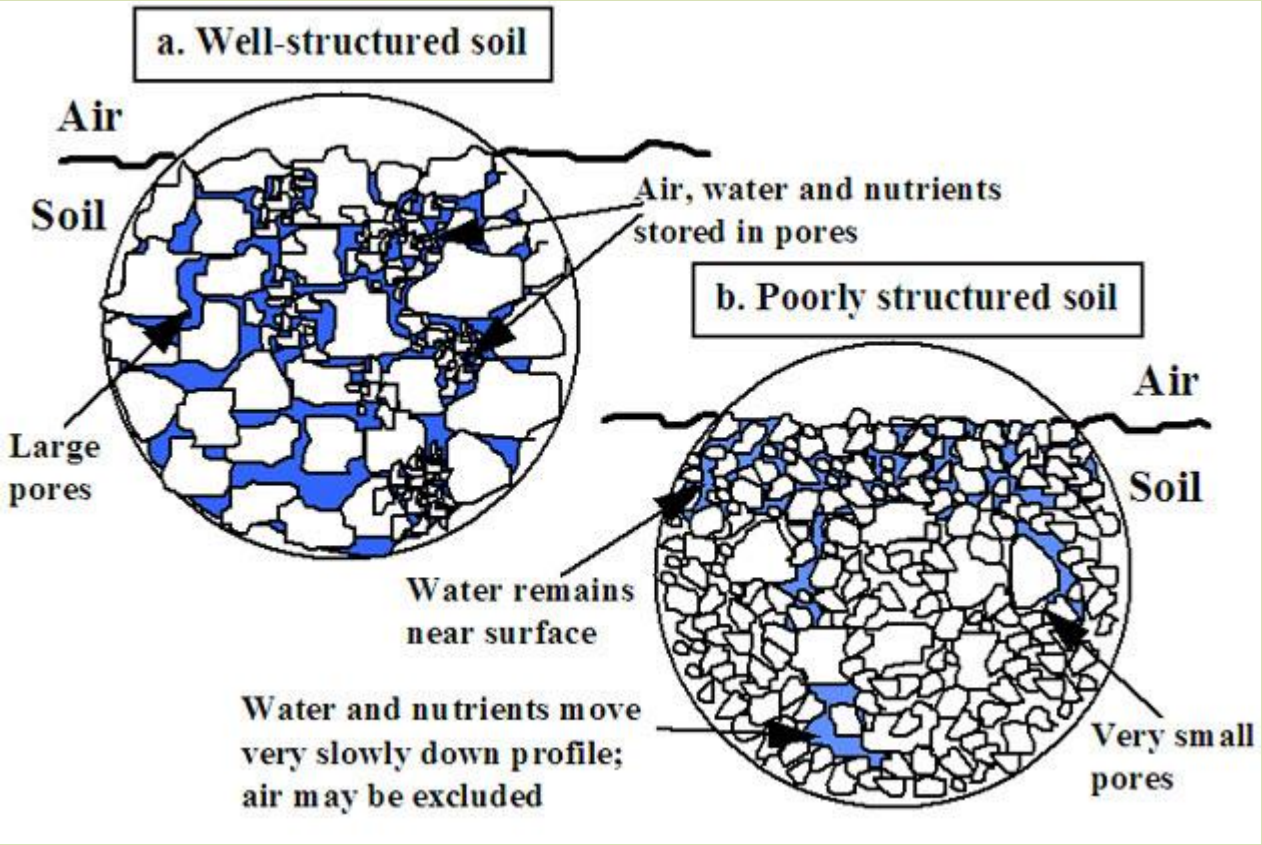
Etter Elaine Ingham

Rothår dekket med bakterier



http://jgi.doe.gov/unearthing-cornerstones-in-root-microbiomes/

Tap av mold og liv går hånd i hånd med dårligere jordstruktur



http://agriculture.vic.gov.au/agriculture/dairy/pastures-management/fertilising-dairy-pastures/how-do-the-properties-of-soils-affect-plant-growth

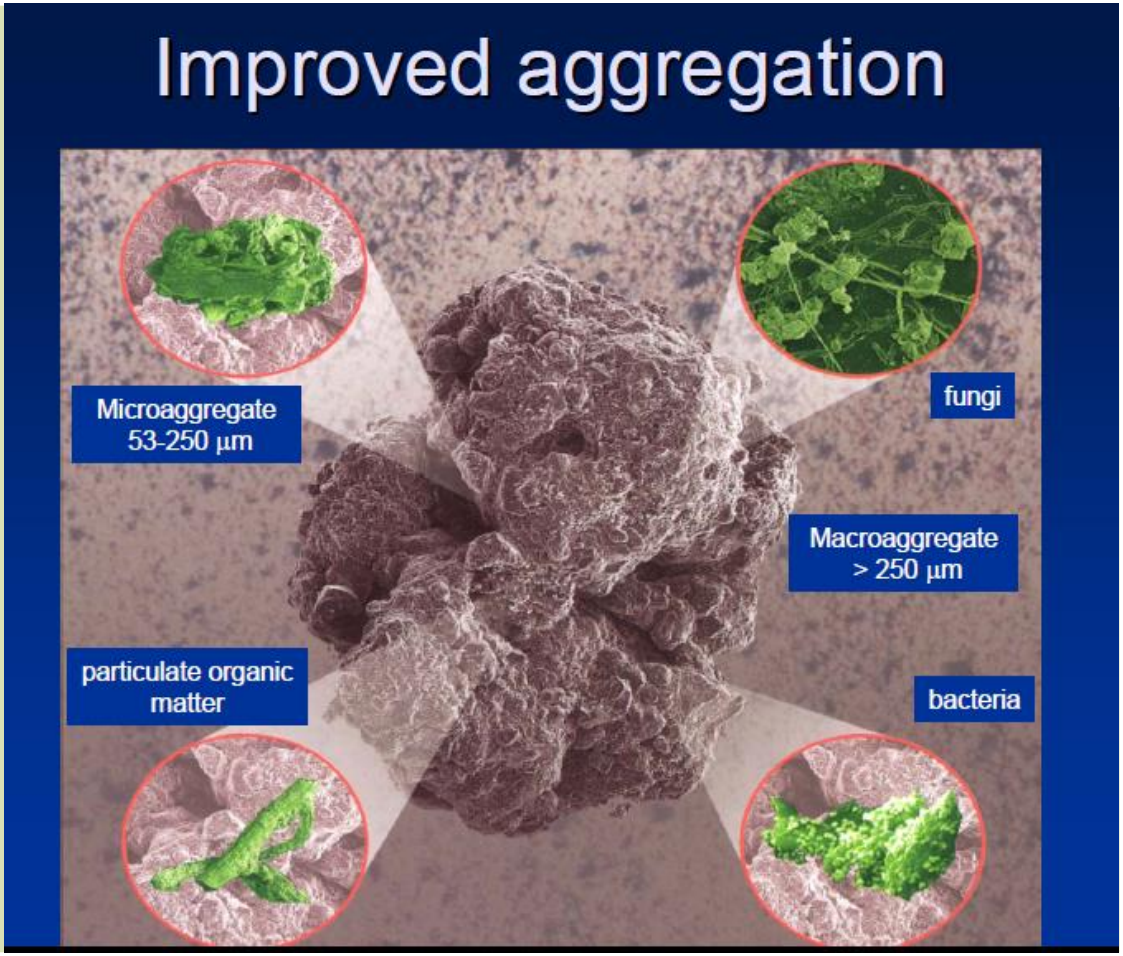
Lindum – for miljøets skyld

Jordlivet skaper strukturen

Mary Stromberger
Assistant Professor, Soil Microbiology
Dept. Soil and Crop Sciences, CSU

Bakterie - slim og sopphyfer…

Aggregater av leire og humus…



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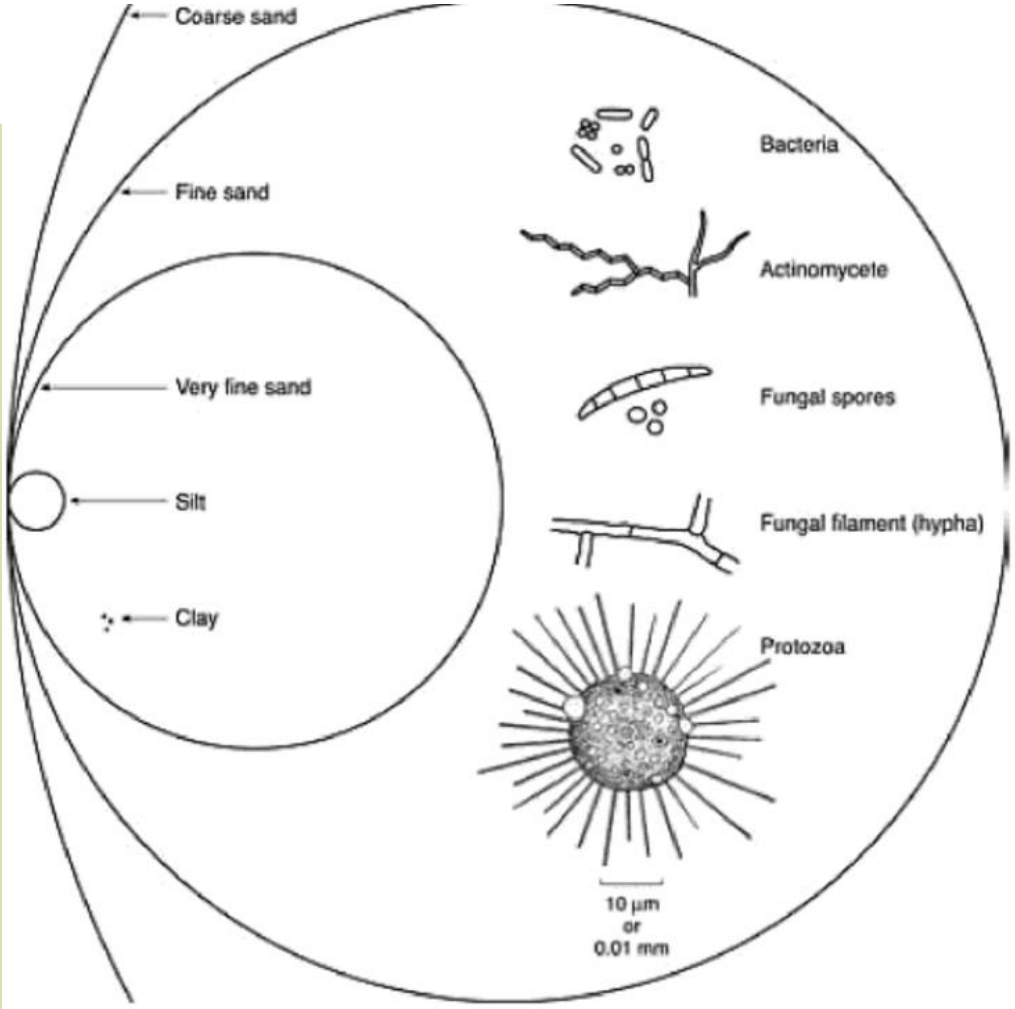
Livet i jorda

- Hvor stort er det?

Mikroorganismer

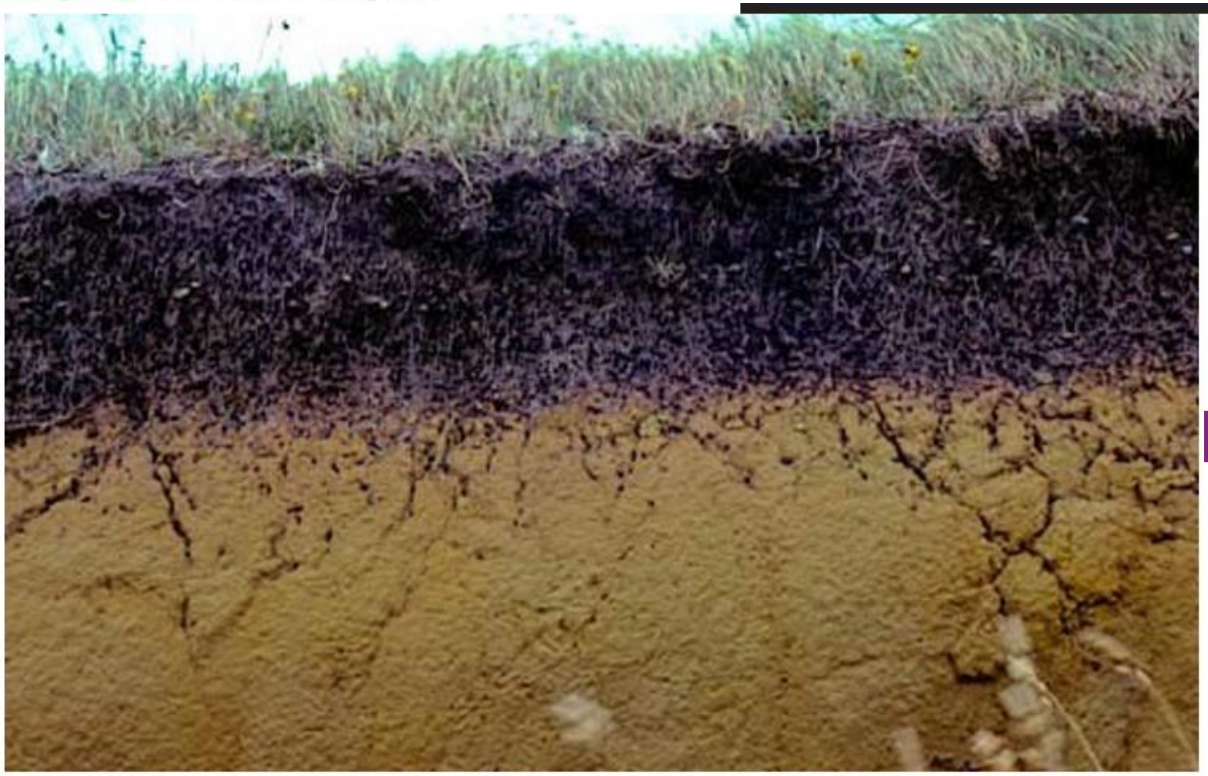


3. A world of soil creatures can live on a grain of sand. Here the sizes of soil particles are compared with those of soil microbes.

Life in the soil, James B. Nardi

www.ecowatch.com/10-interesting-facts-about-earthworms-1881871982.html

EcoWatch

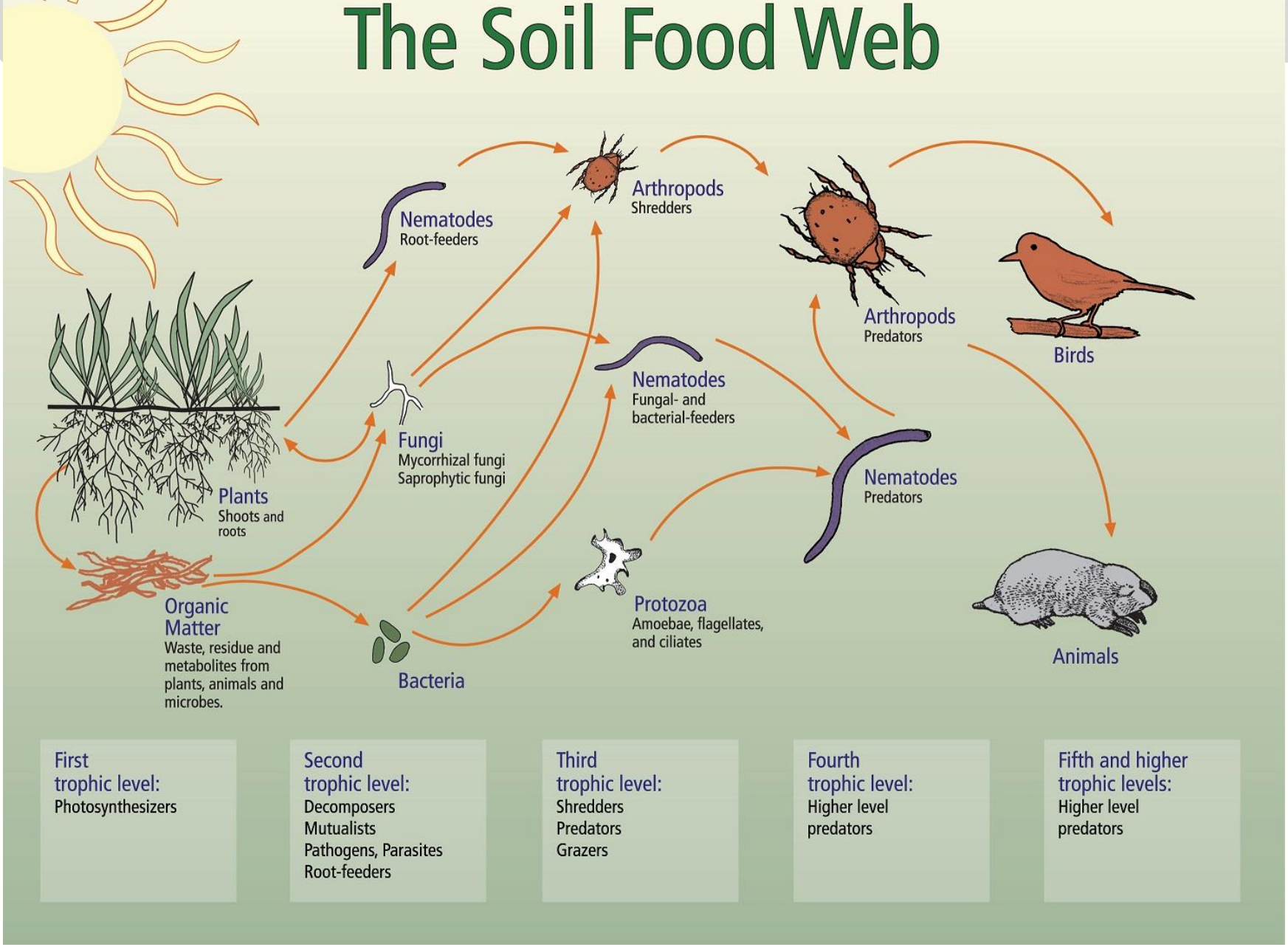


Makroorganismer

Earthworm movements within the Earth create burrows that encourage the passage of air and loosening of the soil.

Lindum - for miljøets skyld

The Soil Food Web



First trophic level:	Second trophic level:	Third trophic level:	Fourth trophic level:	Fifth and higher trophic levels:
Photosynthesizers	Decomposers Mutualists Pathogens, Parasites Root-feeders	Shredders Predators Grazers	Higher level predators	Higher level predators

https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs142p2_049822.jpg

Siden opddagelsen av antibiotika, har medisinsk forskning vært dominert av bazooka-mentalitet, og det har også jordbruksforskning, sier (forsker ved Göttingen-universitet). Tradisjonelt har mikrober blitt negativt vurdert, noe man måtte eliminere. I dag har forskere og leger blitt stadig mer klar over hvor nyttige de er for helsa, og botaniske forskere har begynte å diskutere om det samme må være sant for planter…..

Lindum – for miljøets skyld

Terroir…

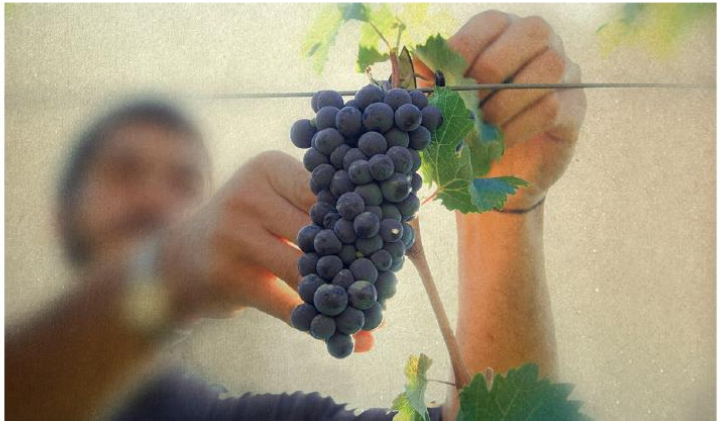
Sitter smaken i jordsmonnet? Berggrunnen?

Home | Life | Environment | In-Depth Articles | Back to article

Au revoir, terroir? The science of what makes great wines tick

10 May 2015 by **Chris Simms**
Magazine issue 3020. **Subscribe and save**
For similar stories, visit the **Food and Drink** and **Drugs and Alcohol** Topic Guides

A vineyard's unique traits makes a wine – but not as expected. From minerals to microbes, we uncover the forces at work behind the world's favourite tipple



CA.GOV CalRecycle

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- On-Farm Composting
- Case Studies
- Agricultural Demos
- Compost and Mulch
- Organics Home

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- Publications and Videos

Organic Materials Management

Joseph Phelps Winery: Using Compost to Help Capture "Terroir"

Winemakers manage their vineyards to cultivate particular characteristics in their wine, including flavors and aromas unique to their soils and climate, sometimes known as "terroir." For Sarah Black, viticulturist, tending the vineyards and managing 600 tons of organic waste material each year and applying its compost for soil restoration is a full-circle labor of love for the land and the wine.

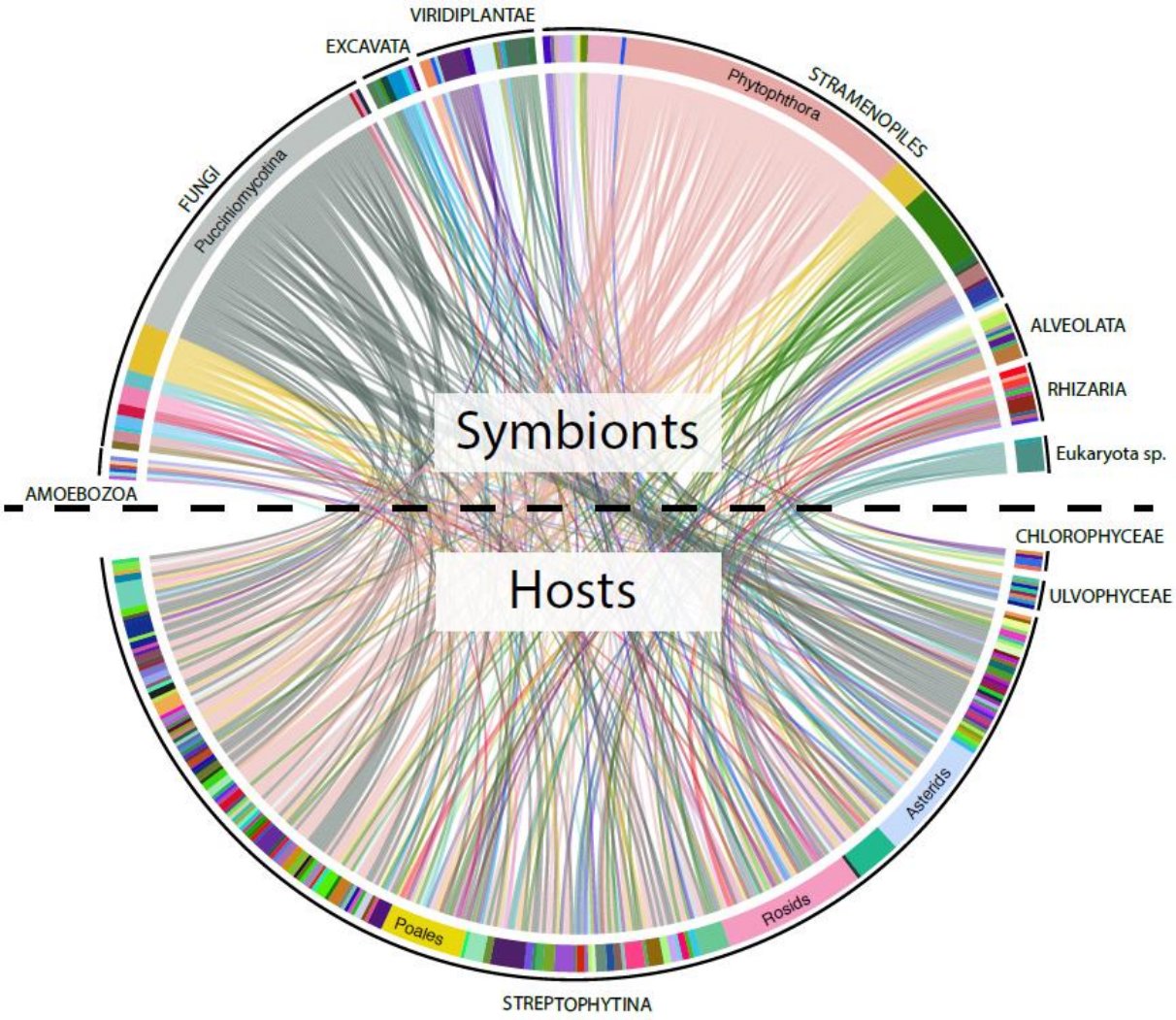
Sarah operates a compost facility at the Joseph Phelps Vineyards winery in Napa.

Located on what was once a cattle ranch on the rolling hills of the eastern slopes in Napa Valley, the winery has 120 acres planted and is home to a compost site that sits among mustards, poppies, daisies, soaring blue oak trees, and other native species that provide a habitat for birds and a host of beneficial insects.

The compost project site sits in a small valley on the property—not far from the wine tasting room and surrounded by vineyards on all sides. Feedstock for composting includes manure from an organic dairy, wood chips, and grape seeds, skins, and stems (sometimes called pomace) from winemaking. After building a windrow, the pile

Lindum – for miljøets skyld

Kostnaden på DNA-metodene faller eksponentielt..



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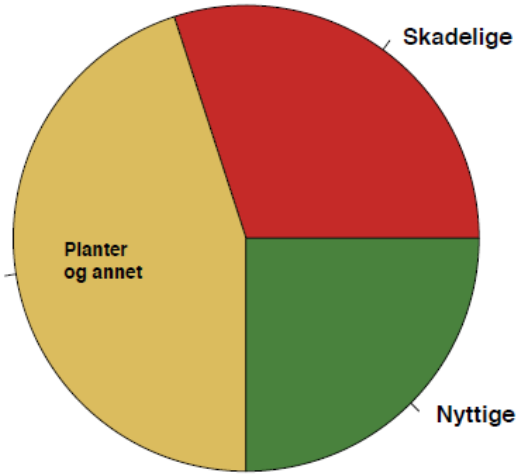
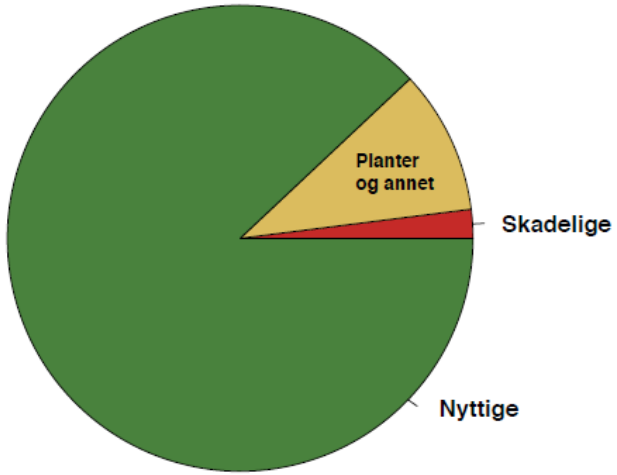
UiO : Morphoplex

Mikroorganismer i jord

Syk jord



Kompost fra hageavfall



Lindum – for miljøets skyld

Man må stelle i stand fest for jordorganismene!

Ved å bruke kompost
-men hva med biorest?

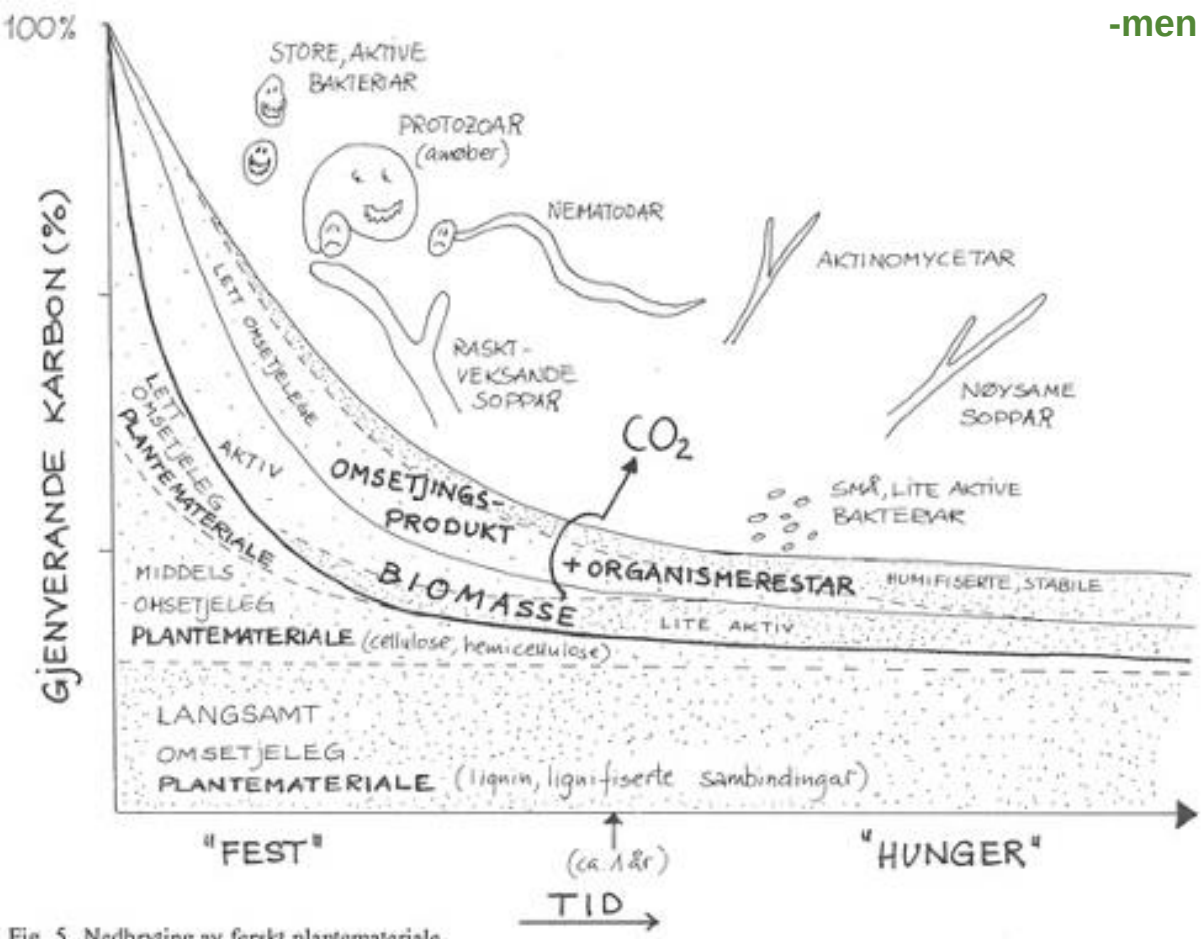


Fig. 5. Nedbryting av ferskt plantemateriale

Illustrasjon av Professor Tor Arvid Breland, UMB «Nedbryting av ferskt plantemateriale»

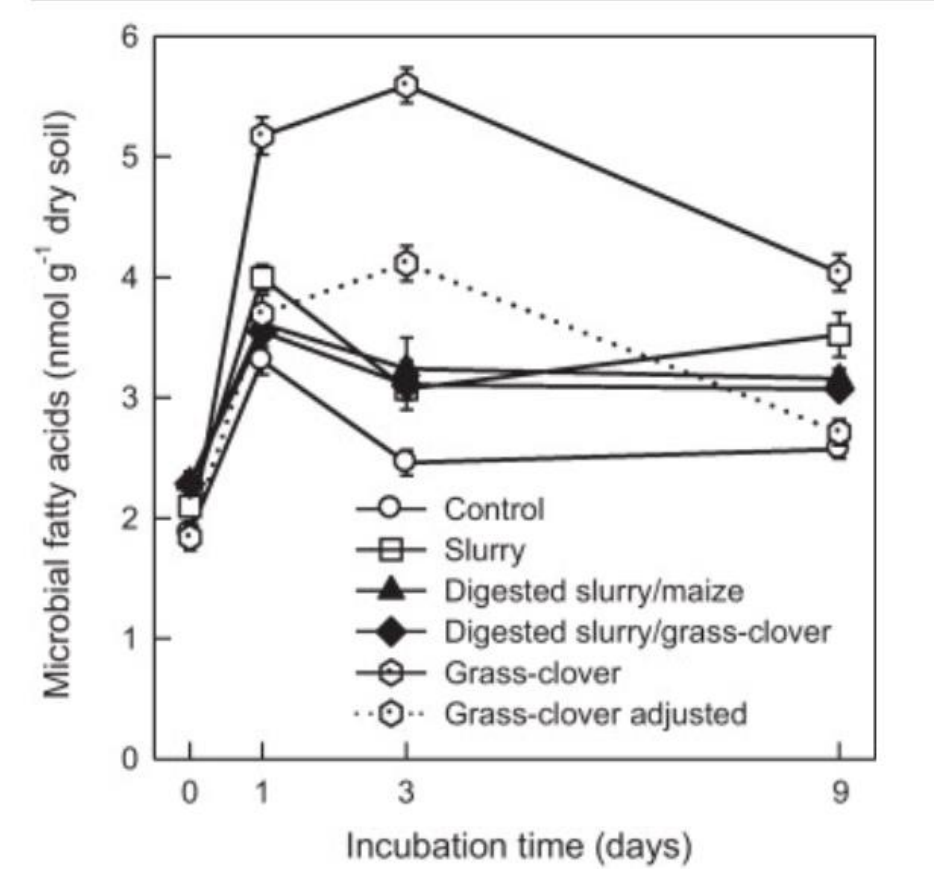
Lindum – for miljøets skyld

Applied Soil Ecology
Volume 63, January 2013, Pages 36-44
ELSEVIER

Effekt på jorda

Effects of digestate from anaerobically digested cattle slurry and plant materials on soil microbial community and emission of CO_2 and N_2O

Anders Johansen [a], Mette S. Carter [b], Erik S. Jensen [c], Henrik Hauggard-Nielsen [b], Per Ambus [b]



- Incorporation of grass-clover in soil causes increased emission of N_2O.
- Interaction of available organic C and mineral N governs release of greenhouse gas.
- Anaerobically digested manures/biomass do not impact soil fertility and microbiota.

Lindum – for miljøets skyld

Effekt av god kompost

Lindum – for miljøets skyld

Contents lists available at ScienceDirect

Soil Biology & Biochemistry

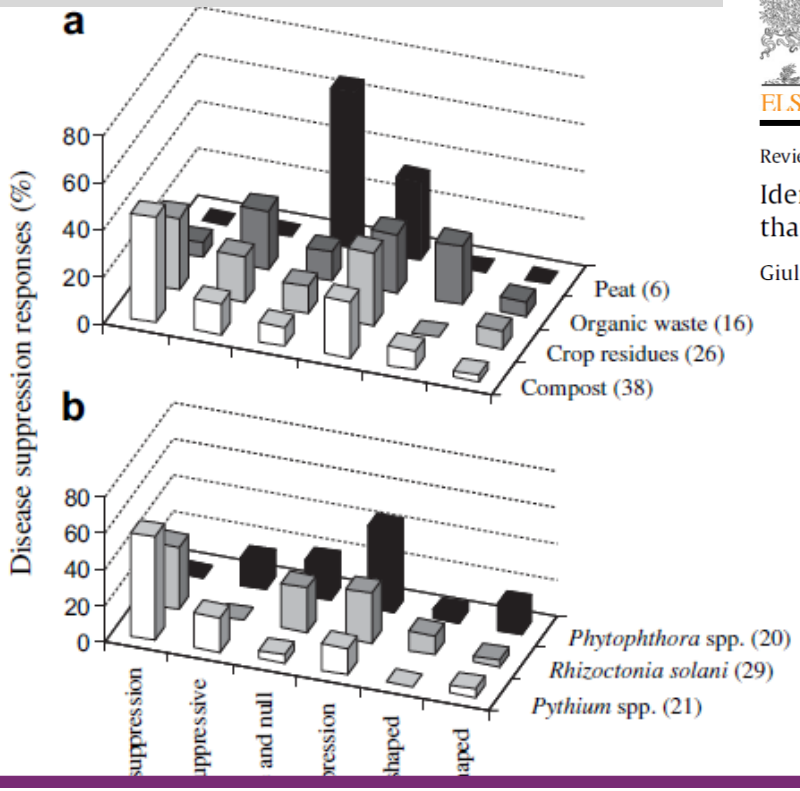
journal homepage: www.elsevier.com/locate/soilbio

Review

Identifying the characteristics of organic soil amendments that suppress soilborne plant diseases

Giuliano Bonanomi*, Vincenzo Antignani, Manuela Capodilupo, Felice Scala

In Fig. 4 we propose a synthesis of the relationship between OM decomposition and disease suppression. Crop residues, composts



Sammenhengen mellom et organisk produkts nedbrytningsgrad og dets effekt på jordbårne sykdommer når brukt på et dyrkingsareal

Fig. 3. Effect of organic matter decomposition on disease suppression in relation to the organic matter type (a) and pathogen species (b). Data are expressed as percentage values calculated from the total number of studies within each OM type (a) and pathogen species (b). The number of studies is reported in brackets.

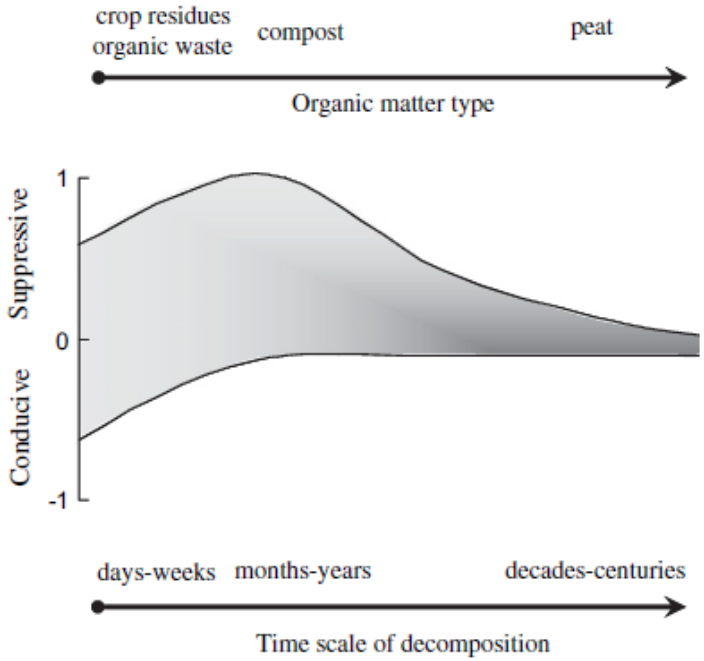


Fig. 4. Schematic representation of disease suppression dynamics during organic matter decomposition.

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Flest av de nyttige organismene ved dag 100-150

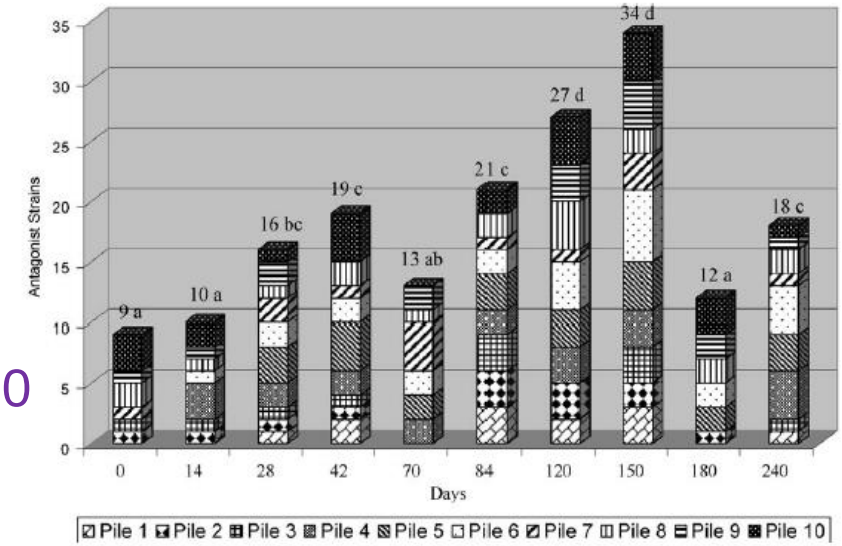


Fig. 1. Numbers of antagonist strains recovered over time from ten different compost piles. Different letters denote significant difference according to Fisher's LSD test at $P<0.05$.

Antall sykdomshemmende arter. Ikke-vendte ranker til venstre, vendt + luftet til høyre

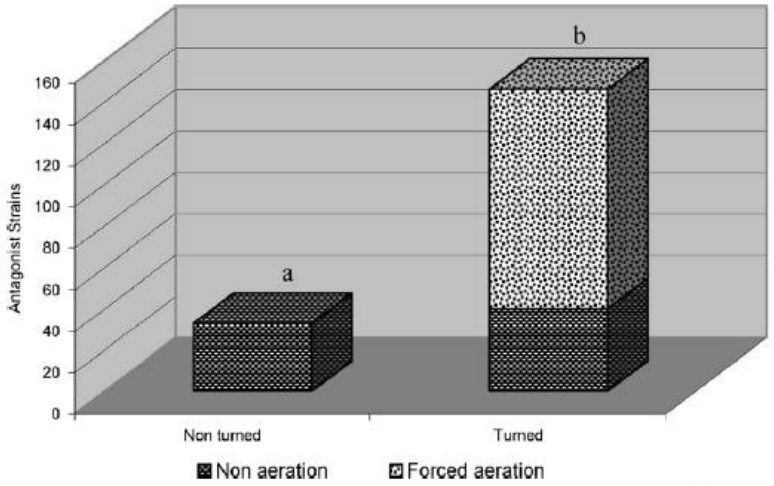
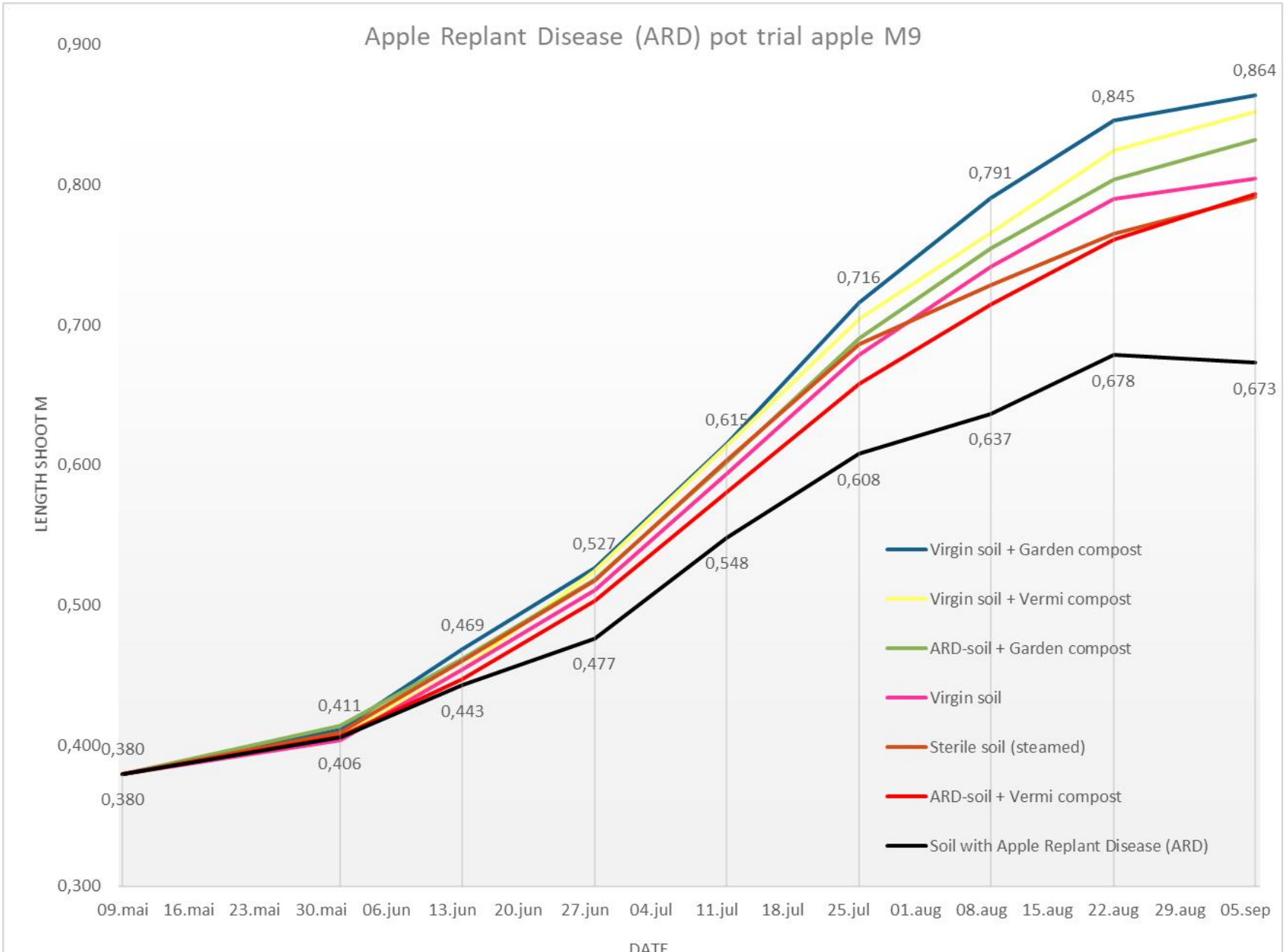


Fig. 2. Number of antagonist strains recovered from compost that was forced aerated or mechanically turned. Different letters denote significant difference according to Fisher's LSD test at $P<0.05$.

Ketil Stoknes

Lindum – for miljøets skyld

CompostInWest Prosjekt med SIMAS, Lindum og Njøs Næringsutvikling



Forsøksrapport

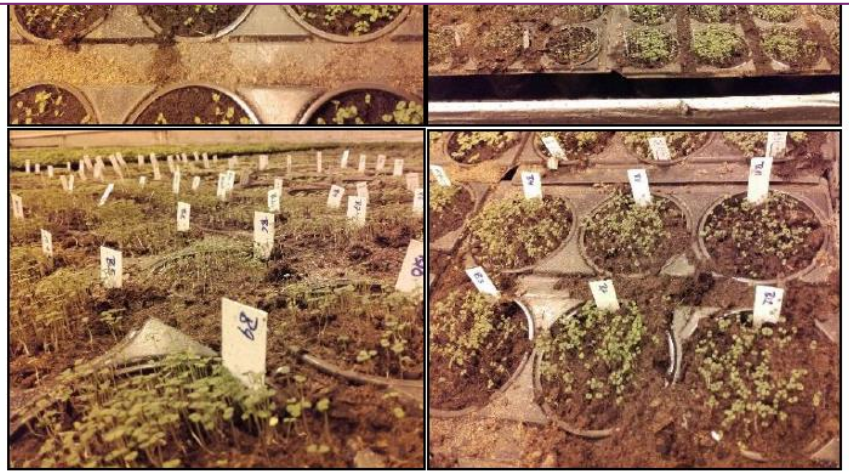
Utprøving av dyrkingsmedia hos Den lille krydderhaven

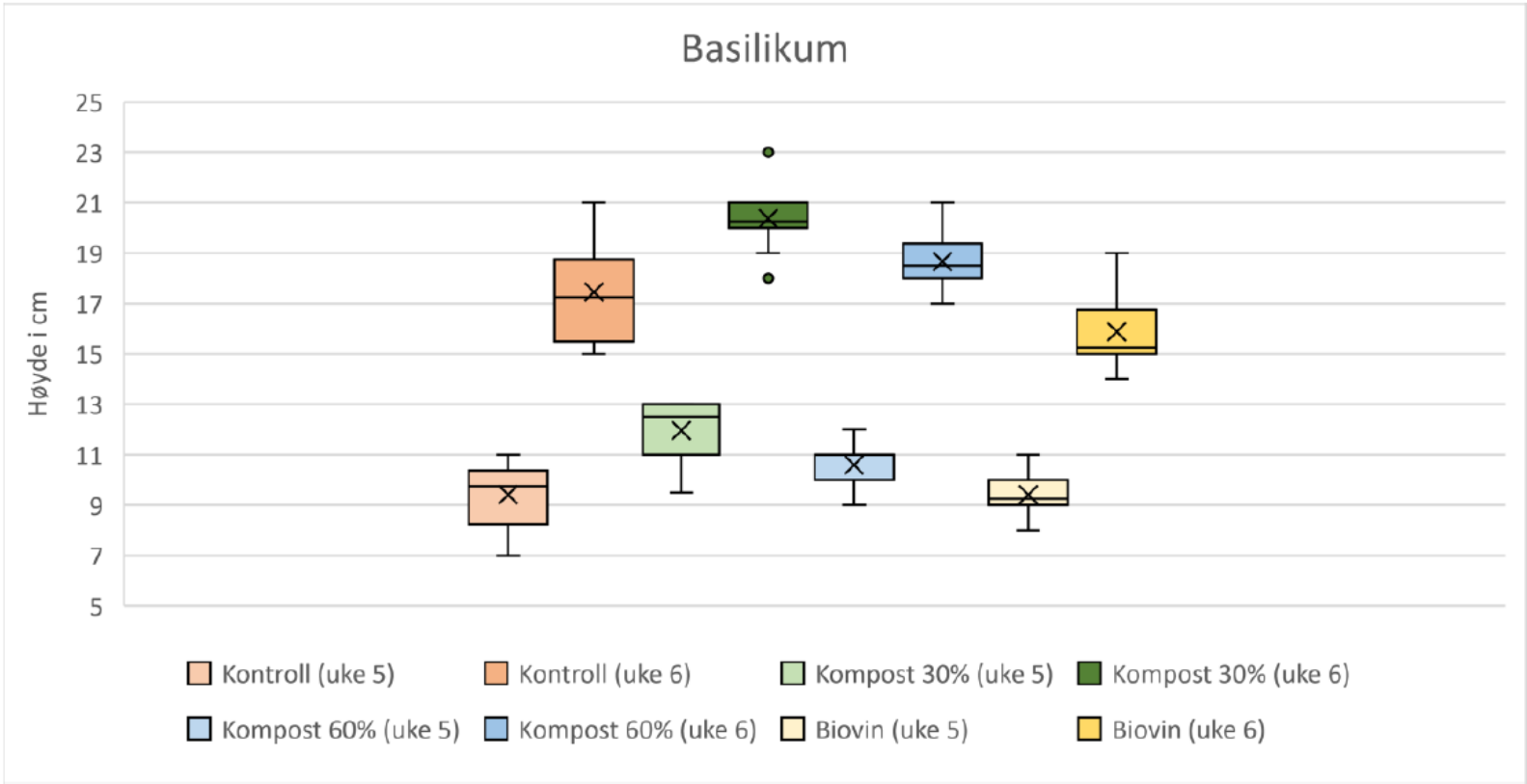
Det ble testet ut 3 forskjellige dyrkingsmedier, mod vanlig brukt torv som kontroll (T). Disse var:

1) Ugødslet og ukalka torv med 30 % vermikompost (K30)
2) Ugødslet og ukalka torv med 60 % vermikompost (K60)
3) Ugødslet og ukalka torv med Biovin (B)

Observasjon av spiring 2 uker etter såing

Da frøene ble sått for hånd varierer antallet av frø per potte, i stedet for å telle spiring ble det vurdert om der var jevn spiring. Dette var tilfellet for alle potter på nær enkelt. Det har altså ikke hatt innflytelse på spiringen hvilken torvblanding man har brukt.




Basilikum
Høyde i cm
25
23
21
19
17
15
13
11
9
7
5
Kontroll (uke 5)
Kontroll (uke 6)
Kompost 30% (uke 5)
Kompost 30% (uke 6)
Kompost 60% (uke 5)
Kompost 60% (uke 6)
Biovin (uke 5)
Biovin (uke 6)

Kvalitativ vurdering 7 uker etter såing

Basilikum: Etter 7 uker står plantene stadig fint og har fine røtter. De eneste som skilte seg ut var de som var sått i Biovin, de var stadig lidt lave men ellers fine

Timian: Etter 7 uker var de fleste planter stadig fine, noen hadde fått sopp. Det så ut til at det var kontrollen som hadde mest problemer med sopp. Plantene sått i Biovin var stadig lidt små, og røttene lå fortsatt i toppen av potten.

Målinger og kvalitetsvurderingen foretatt av Anders Hafskjold og Astrid S. Andersen, rapport er laget for Den Lille Krydderhaven av Norsk Lanbruksrådgivning Viken

Alle foto er tatt av Astrid S. Andersen

Norsk Landbruksrådgiving Viken

Lindum – for miljøets skyld

Effekt av kompost

Storskalaforsøk i knollselleri (Prinz) på Linnesvollen i Lier

Rettet utgave av rapport sendt 16.des 2013, v/NLR Viken

Resultater

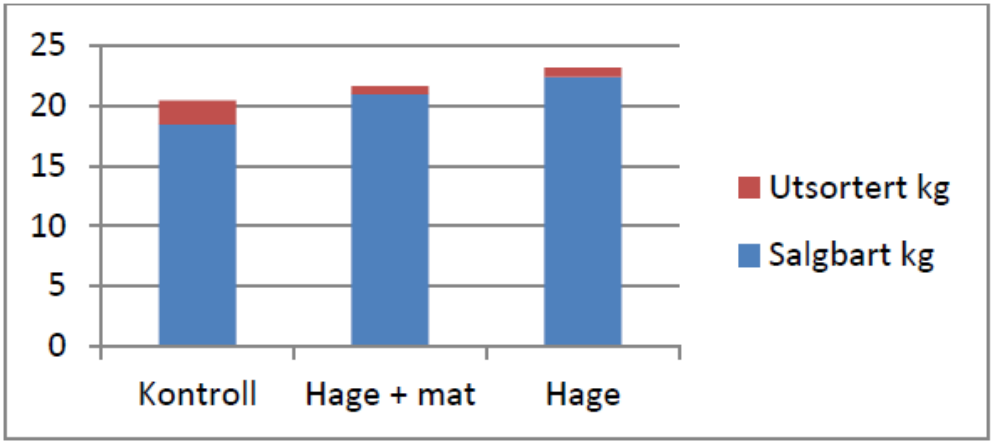


Diagram 1: Diagrammet viser gjennomsnittlig kg avling i høsterutene (salgbart og utsortert), p = 0,10. Salgbar avling =over 300 g per knoll.

Behandling	Utsortert	Årsak
Kontroll	47,5 kg	Mye gråskimmel og mer storknolla råtesopp enn i kompostbehandlingene.
Hage-/matkompost (miks)	28,8 kg	Mest gråskimmel
Hagekompost	34,7 kg	Mest gråskimmel

Å lage et helvete….

Focus Group SOIL-BORNE DISEASES

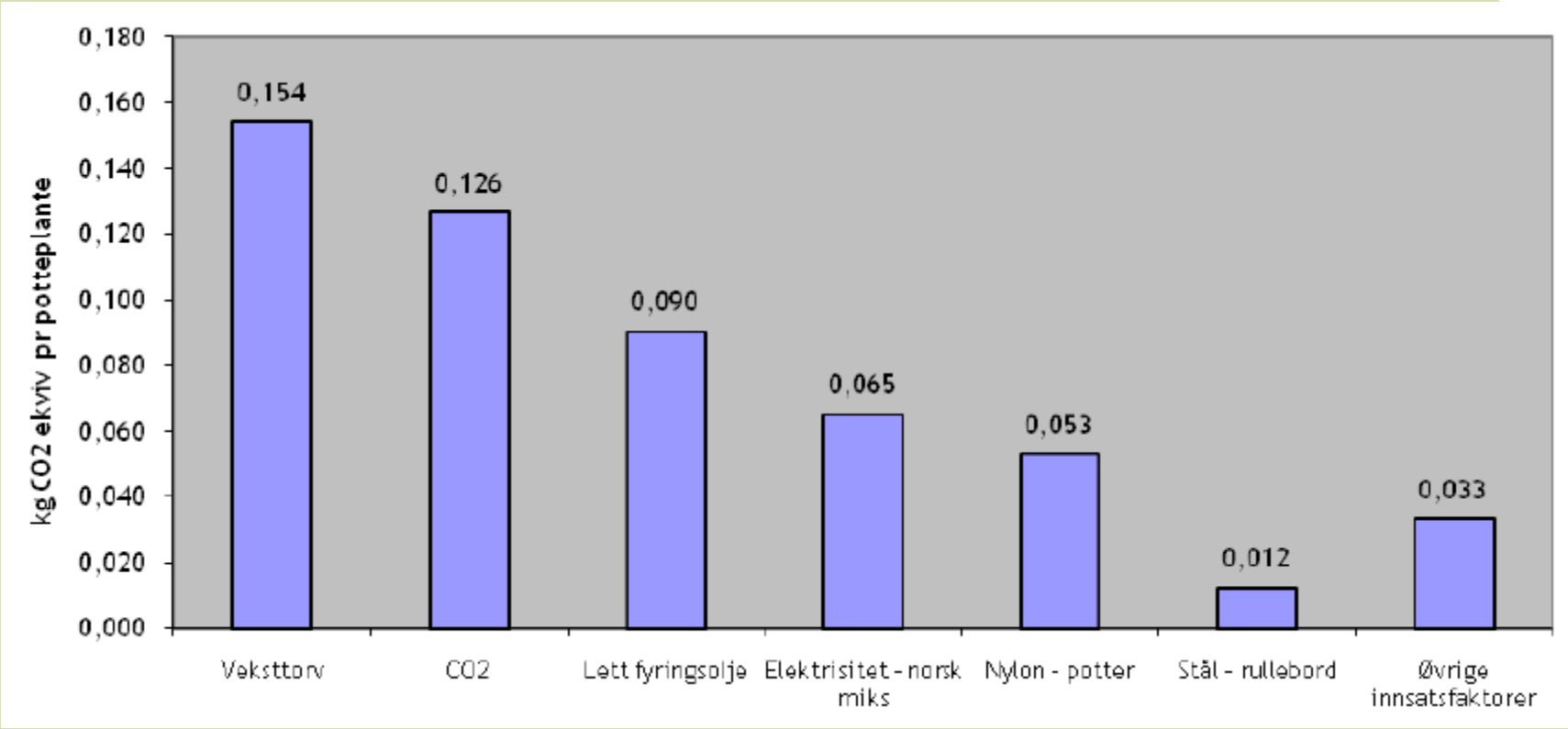
Mini-paper – *Anaerobic Soil Disinfestation and other techniques of 'non chemical' soil disinfestation techniques*

Miguel de Cara

Lindum – for miljøets skyld

Lindum – for miljøets skyld

CO2-regnskap potterose produksjon i veksthus

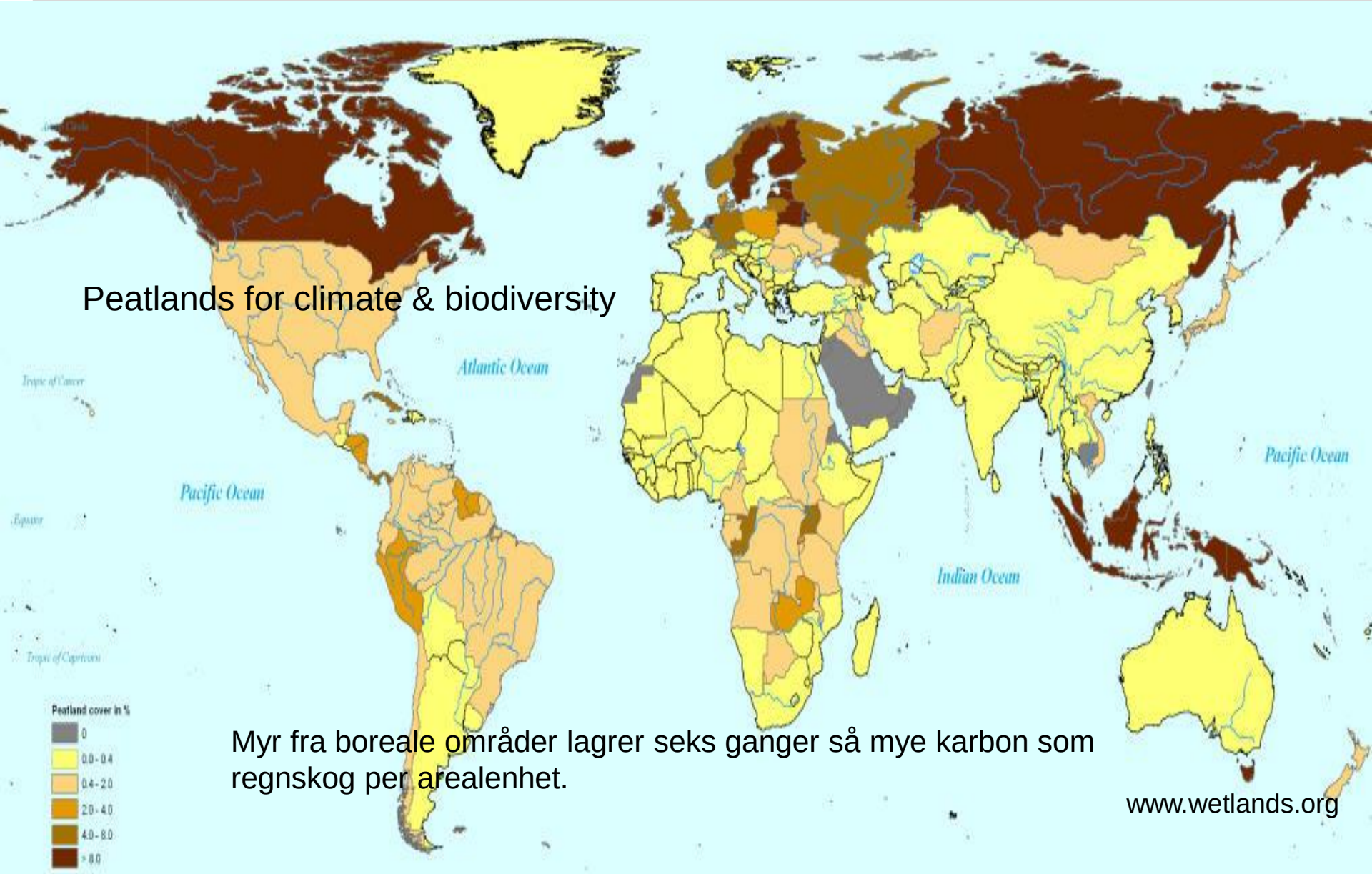


Bioforsk Rapport
Bioforsk Report
Vol. 5 Nr. 135, 2010

Klimagassregnskap for norske veksthusprodukter

Lindum – for miljøets skyld

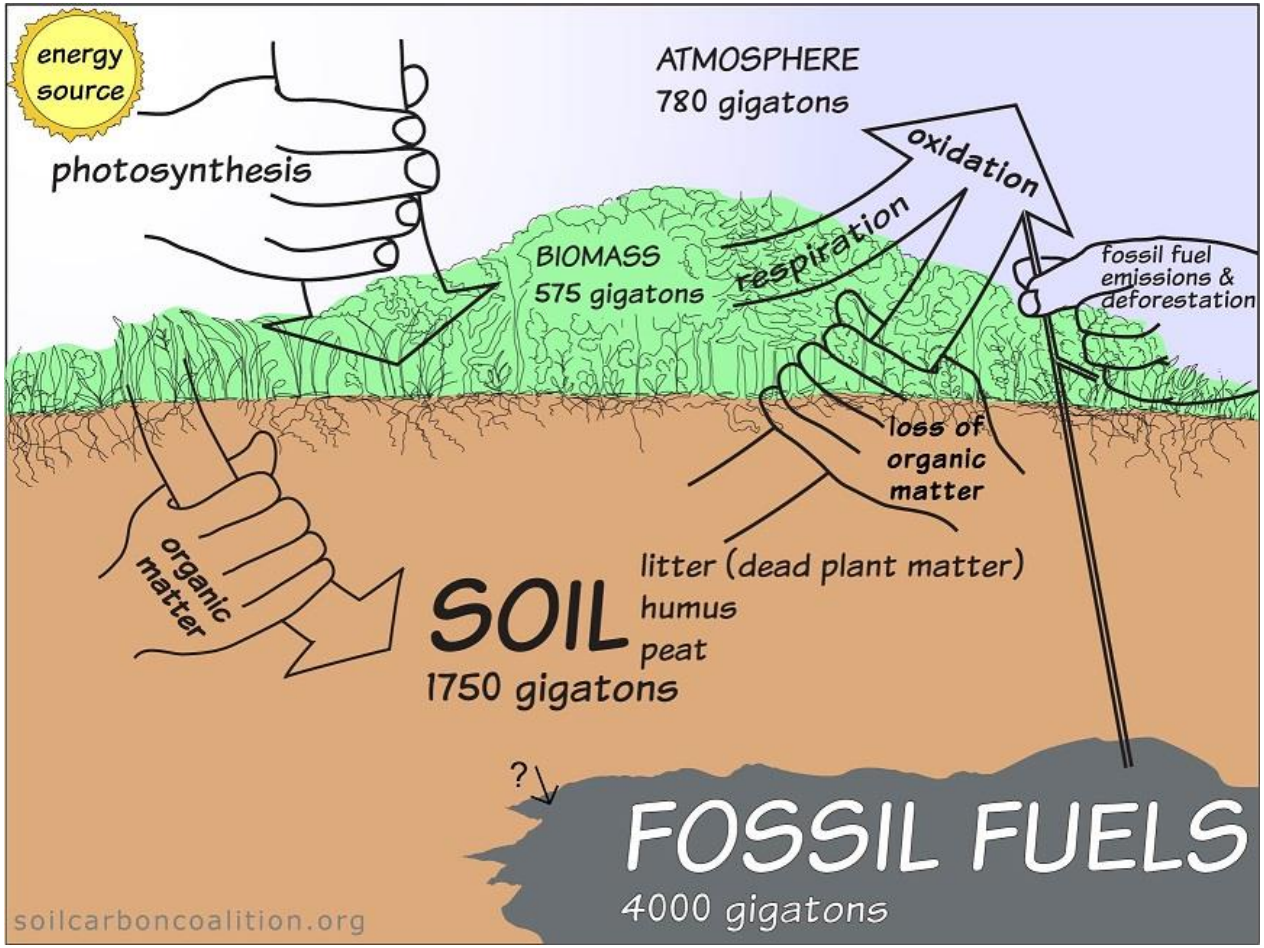
Peatlands for climate & biodiversity



Myr fra boreale områder lagrer seks ganger så mye karbon som regnskog per arealenhet.

www.wetlands.org

Menneskets hånd på karbonfluks og klima og jord…..James Lovelock: Snu til *løsninga* på klimakrisen!



http://soilcarboncoalition.org/manifesto

Lindum – for miljøets skyld

Vekstforsøk i England med kompostblanding fra Lindum ->best avling (15% torv)

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Kommersiell øko (torv>80%)

Kommersiell torv kunstgj.

Lindum miks (torv< 50%)

Lindum – for miljøets skyld

Kommersiell øko (torv>80%) Kommersiell torv kunstgj. Lindum miks (torv< 50%)

Lindum – for miljøets skyld

Fuglerud Øko

Lindum ren kompostmiks (bare HA og vermikompost)

Fuglerud Konv

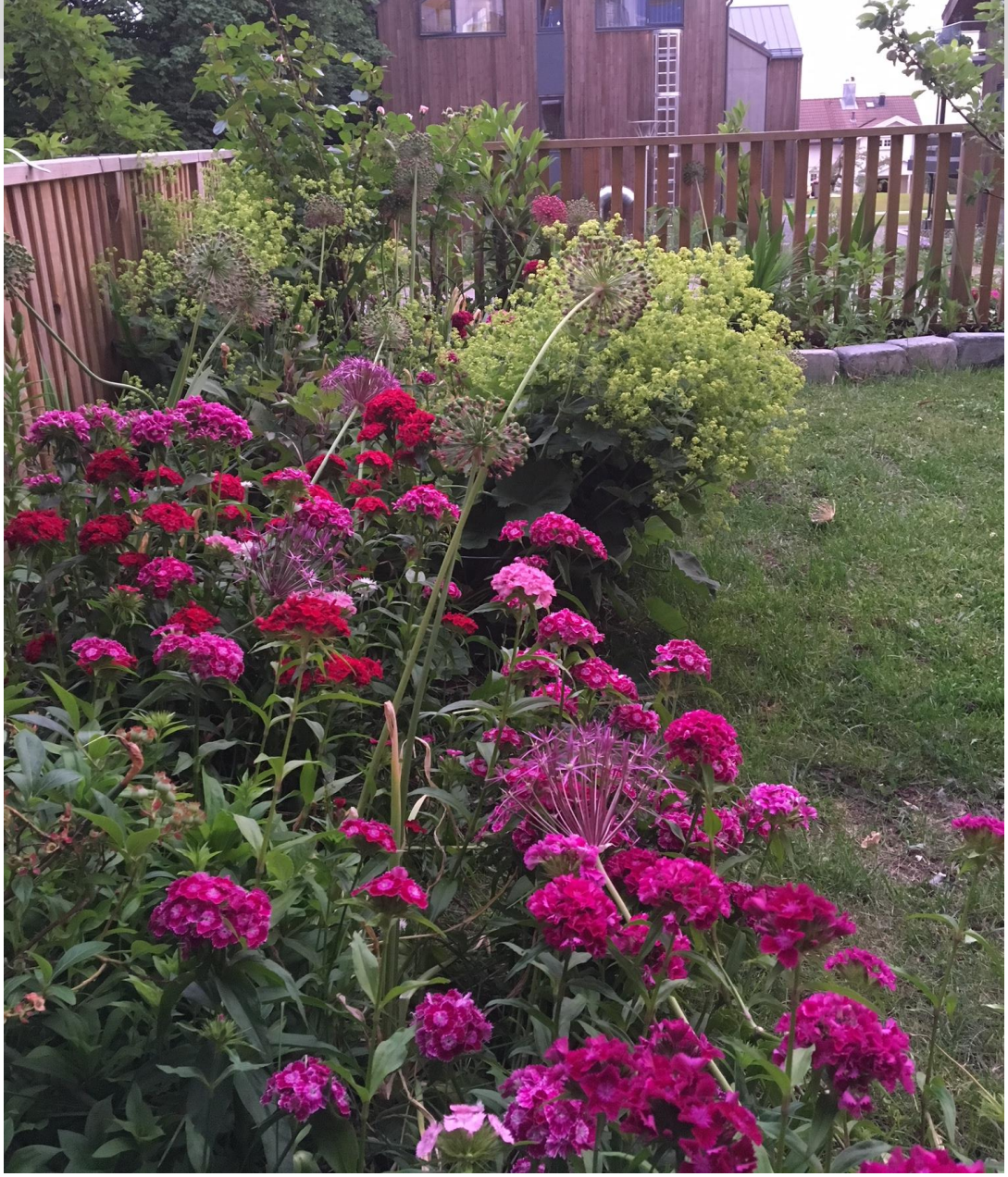
God spiring med ren kompost, men vannholde-egenskapene var for ulik, slik at standard vanningsregime hos Fuglerud ga for våte potter med kompost

Torvfri jordutvikling Alene Tesfamichael (Tomat og Brokkoli), Lindum 2016

Fra venstre til høyre

- Kommersiell torvbasert, med kunstgjødsel
- Lindum miks (40% torv, uten kunstgjødsel, med vermikompost)
- Lindum torvfri (kun kompost, inklusive en spesiell næringssvak kompost

Lindum – for miljøets skyld



Løren våren 2017.
Man blander sammen sand og torv og tror det blir jord…..

Specifying Blended Soils

Components

Blended Soil

Teardrop Park
Specifications

High Use Turf

Soil Requirements

- Withstand heavy use
- High infiltration rate

Specifications

Mix Ratio *	3S : 1.5L : 1C
% passing 270 sieve	11 -14%
Uniformity ratio D_{70}/D_{20}	< 4.5
Organic content	4 - 5%
Compaction	86 - 88%
Hydraulic conductivity	> 4 inches/hr

* S = Sand L = Base Loam C = Compost

Teardrop Park
Specifications

Trees with understory no ground cover

Soil Requirements:
- recreate natural forest soil profile
- encouraging shallow feeder roots
- deep rooting in horticultural subsoil

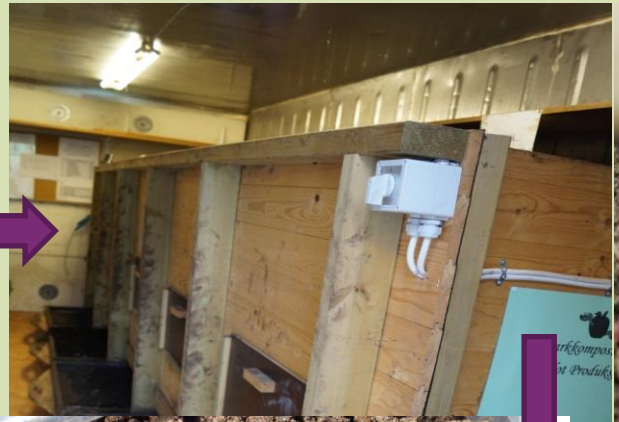
Specifications

Mix Ratio *	2S : 1L : 3C
% passing 270 sieve	11 - 16%
Uniformity ratio D_{70}/D_{20}	< 6.0
Organic content	9 - 11%
Compaction	84 - 86%
Hydraulic conductivity	> 3 inches/hr

* S = Sand L = Base Loam C = Compost

Vermikompost fra biorest

Avvannet biorest



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Lindums vermikomposteringsanlegg

Lindum – for miljøets skyld

Lindum - for miljøets skyld

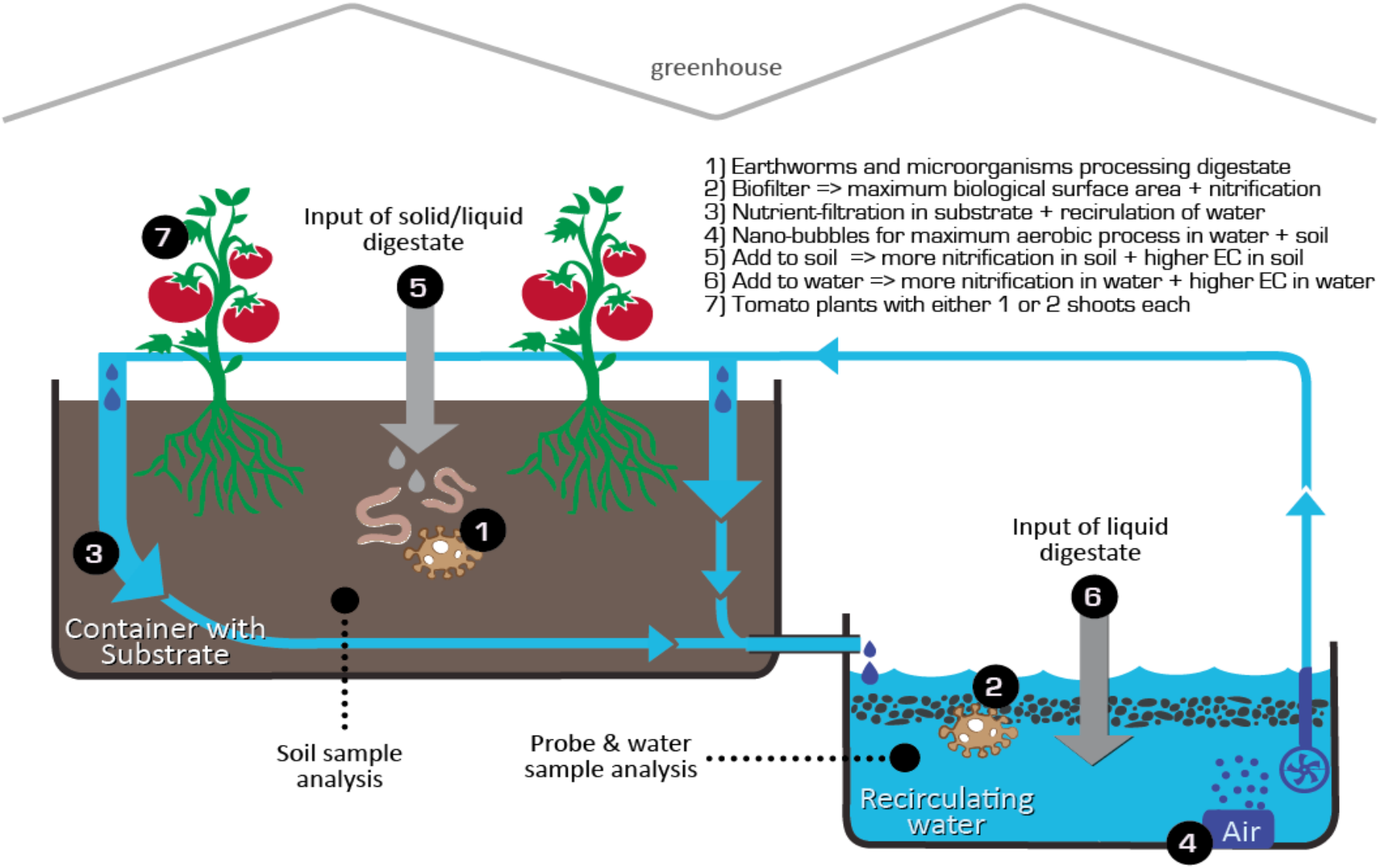
Lindum - for miljøets skyld

Industriell dyrking krever aktiv gjødsling –med biorest

Food2Waste2Food

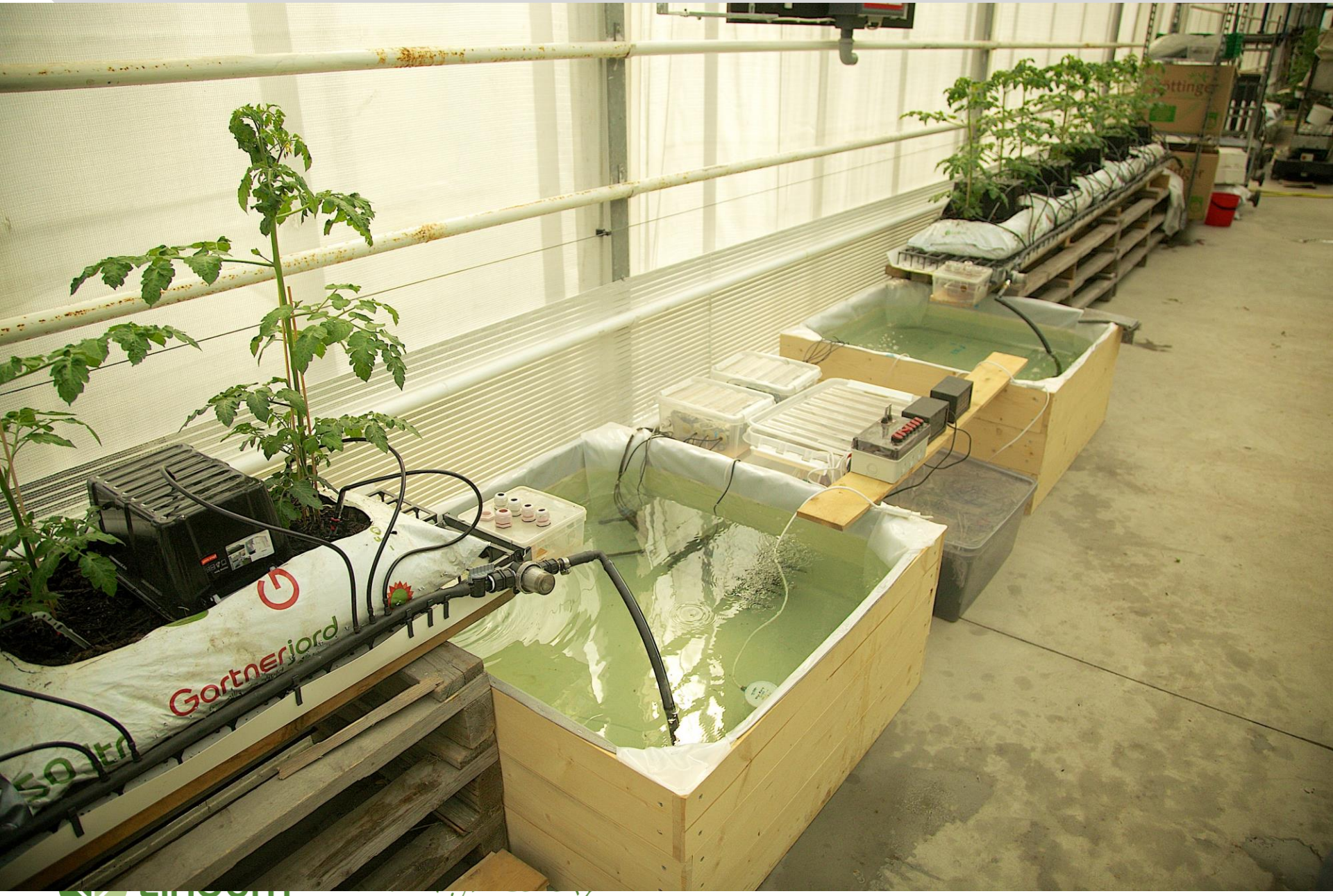
Lindum – for miljøets skyld

Principle of Digeponics



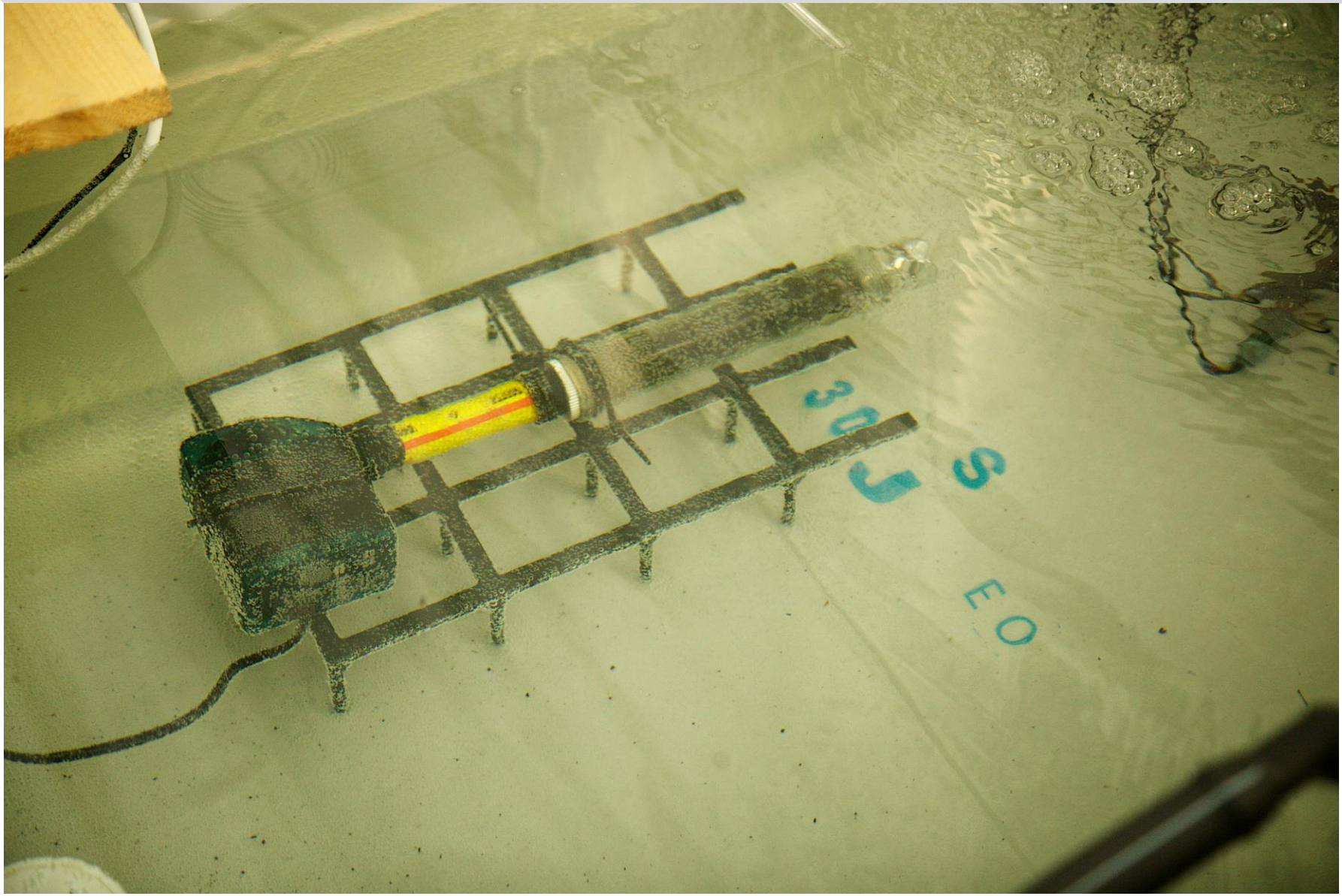
Lindum - for miljøets skyld

Ketil Stoknes


Gartnerjord

Lindum - for miljøets skyld

Lindum - for miljøets skyld


3 0 E
S
E O

pH

Ettårighet (grønnmasse, grønnsaker)

Flerårighet, forvedet vekst

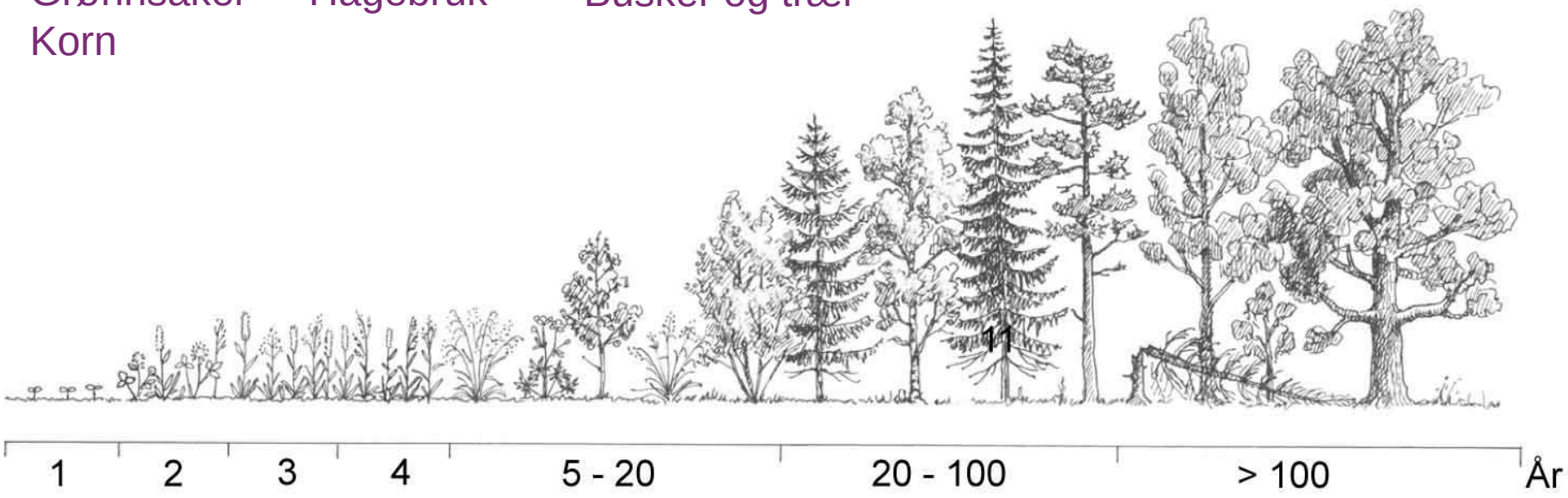
Nitrifikasjon (NO3<-NH4)

Sopp

Bakterier

C/N-forhold

Grønnsaker Hagebruk Busker og trær
Korn



Naturlig suksesjon

(fra Plantevernleksikonet, Nibio)

Lindum – for miljøets skyld