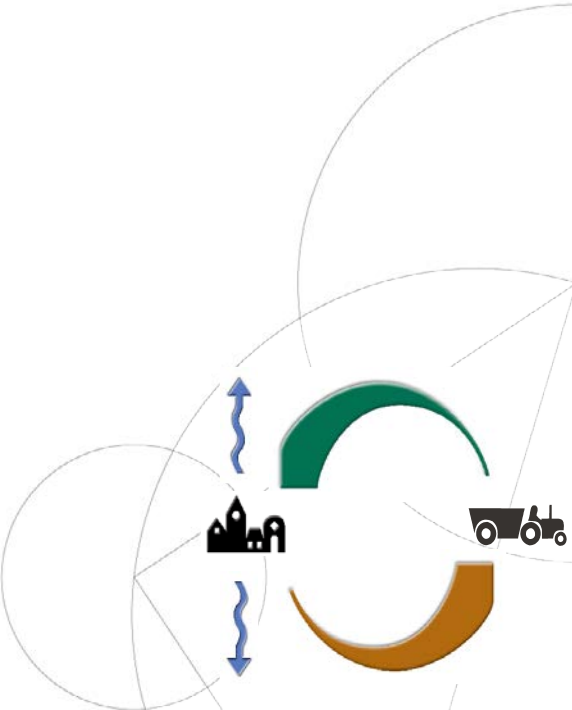
Urban organic waste – problem or resource?

100 years' application of sewage biosolids and urban waste compost - data on heavy metals, soil biology, antibiotic resistance – potential for study of pharmaceuticals and organic contaminants

Jakob Magid




N
Image © 2007 COWI A/S, DDO
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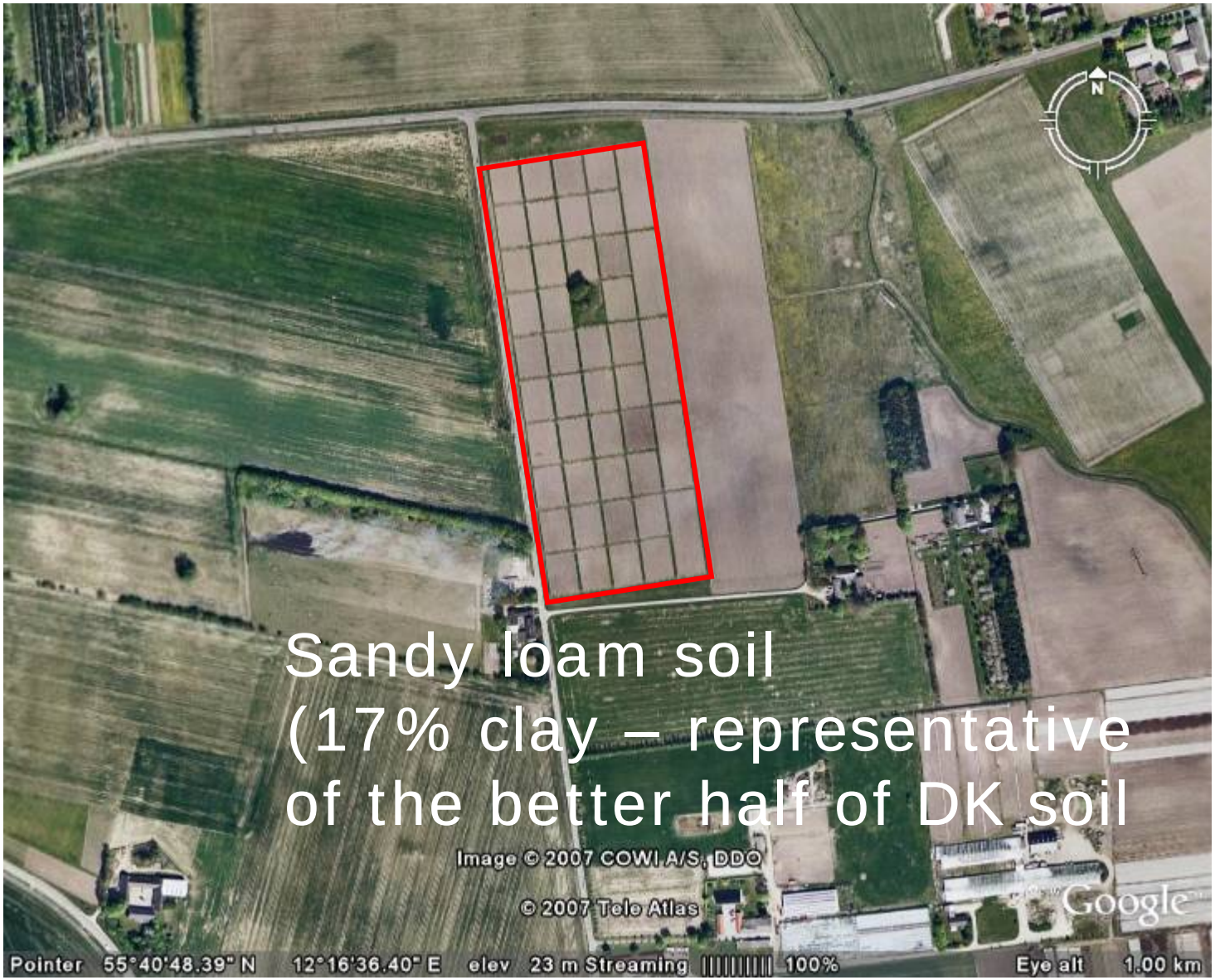
Google
Taastrup, Denmark
Pointer 55°40'14.48" N 12°16'54.70" E elev 22 m Streaming 100%
Eye alt 4.92 km


N
Sandy loam soil
(17% clay – representative
of the better half of DK soil
Image © 2007 COWI A/S, DDO
© 2007 Tele Atlas
Google
Pointer 55°40'48.39" N 12°16'36.40" E elev 23 m Streaming 100%
Eye alt 1.00 km

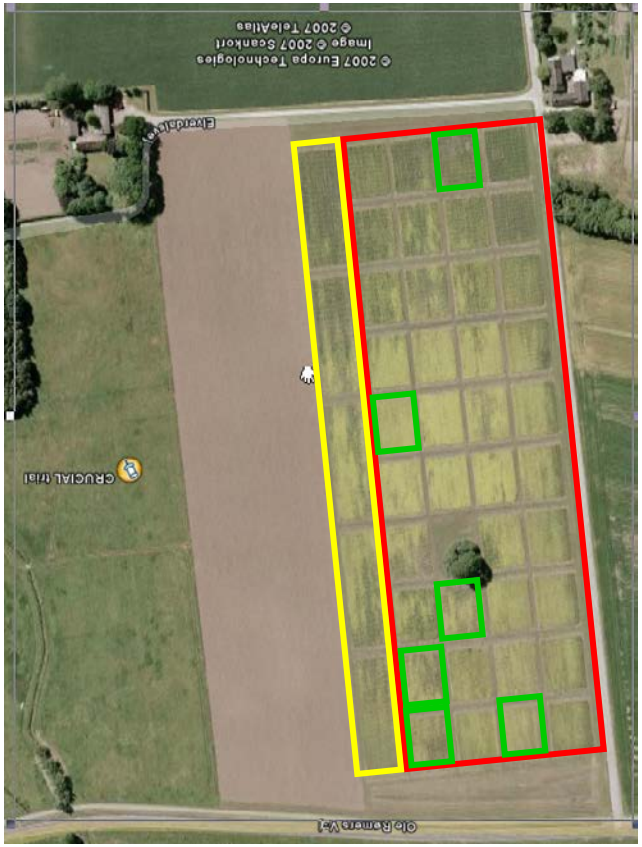
CRUCIAL - long-term field trial

Treatments are:

- Composted household waste (normal and accelerated level)
- Sewage sludge (normal and accelerated level)
- Human urine

- Cattle manure (accelerated level)
- Deep litter
- Cattle slurry
- NPK fertilizer
- Green manure
- Unfertilized

- One/two spare treatment available
- One extra block on side of exp. available



The Frankenstein effect

How bad can it get?

⇨ Accelerated treatments
Presently > 100 yr dose

Rationale

The CRUCIAL facility was developed with the view to establish a ‘historical site’ that can contribute to our knowledge on cycling of matter, and plant and soil quality , and

the impact on the environment and the integrity of agricultural production systems

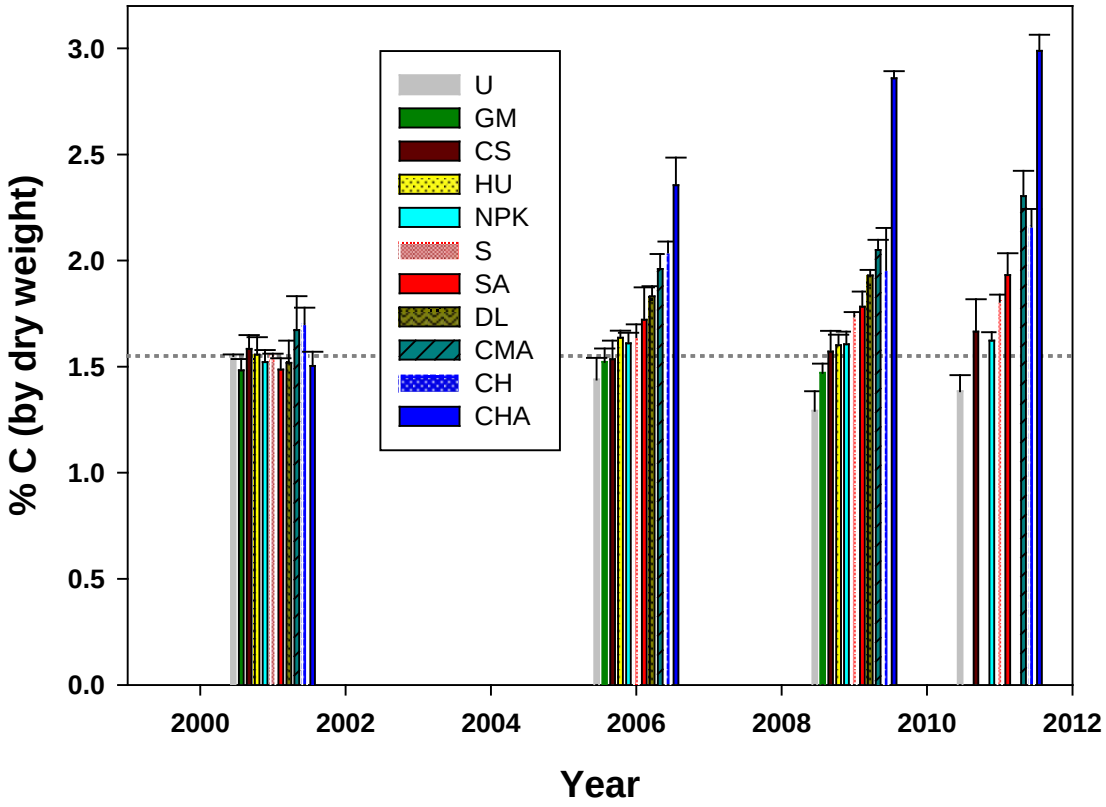
The cycling of matter is broadly defined and includes e.g. nutrients, heavy metals, and xenobiotics (i.e. medicinal residues), pathogens and other micro-organisms as well as genes

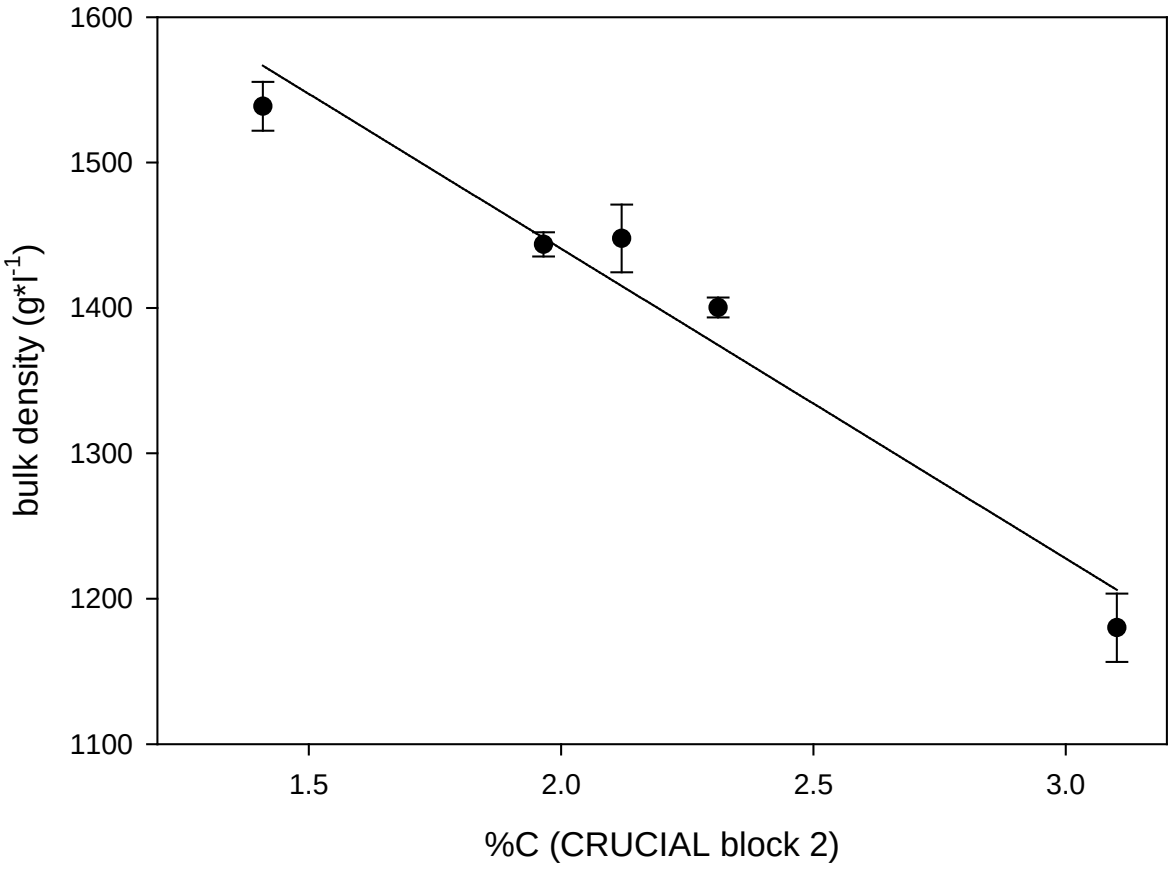
Null hypothesis

When ecotoxicological limits for heavy metals have been approached realistically

there will be no (unexpected) adverse effects on soil quality, environment and production system integrity

Total Carbon in soil (2001 -2011)




1600
1500
1400
1300
1200
1100
bulk density (g*l-1)
1.5
2.0
2.5
3.0
%C (CRUCIAL block 2)

Retention curves for selected amendments in the CRUCIAL soil.

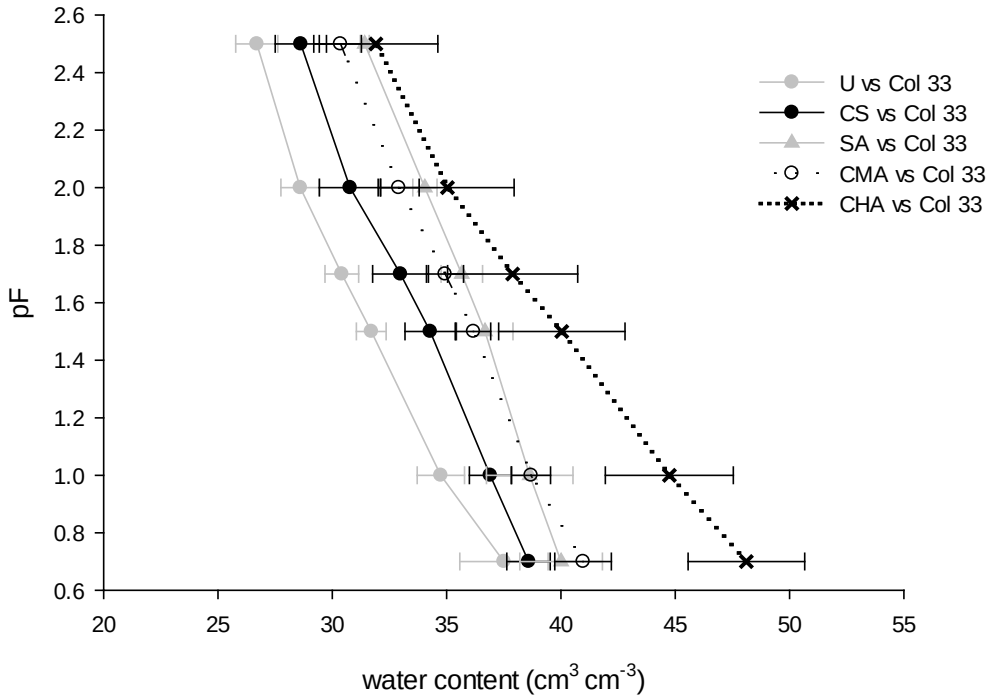


Fig. 1: Retention curves for 100 cm³ samples. Each point is a mean of six replicate samples (+/- sd). Amendments: U) unfertilized (since 2002); CS) Cattle Slurry; SA) Accelerated Sludge; CMA) Cattle Manure Accelerated; CHA) Composted Householdwaste Accelerated

Summary of main results

Soil Biology & Biochemistry 57 (2013) 794–802

Contents lists available at SciVerse ScienceDirect

Soil Biology & Biochemistry

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

Effects of fertilization with urban and agricultural organic wastes in a field trial – Waste imprint on soil microbial activity

Pernille Hasse Busk Poulsen*, Jakob Magid, Jesper Luxhøi, Andreas de Neergaard

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Microbial activity is closely related to input levels, microbial function unaffected

Soil Biology & Biochemistry 57 (2013) 784–793

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Soil Biology & Biochemistry

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

Effects of fertilization with urban and agricultural organic wastes in a field trial – Prokaryotic diversity investigated by pyrosequencing

Pernille H.B. Poulsen [a,b,*], Waleed Abu Al-Soud [b], Lasse Bergmark [b], Jakob Magid [a], Lars H. Hansen [b], Søren J. Sørensen [b]

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Highly robust system – when measuring procariotic diversity

RESEARCH ARTICLE

Exploring the immediate and long-term impact on bacterial communities in soil amended with animal and urban organic waste fertilizers using pyrosequencing and screening for horizontal transfer of antibiotic resistance

Leise Riber[1], Pernille H.B. Poulsen[1,2], Waleed A. Al-Soud[1], Lea B. Skov Hansen[1], Lasse Bergmark[1,3], Asker Brejnrod[1], Anders Norman[1,4], Lars H. Hansen[1,5], Jakob Magid[6] & Søren J. Sørensen[1]

[1]Section of Microbiology, Department of Biology, University of Copenhagen, Copenhagen, Denmark; [2]Danish Standards Foundation, Charlottenlund, Denmark; [3]National Food Institute, Technical University of Denmark, Lyngby, Denmark; [4]Department of Earth and Planetary Science, University of California Berkeley, Berkeley, CA, USA; [5]Department of Environmental Science, Aarhus University, Roskilde, Denmark; and [6]Department of Plant and Environmental Science, University of Copenhagen, Frederiksberg C, Denmark

Agriculture, Ecosystems and Environment 231 (2016) 44–53

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

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

Long-term amendment of urban and animal wastes equivalent to more than 100 years of application had minimal effect on plant uptake of potentially toxic elements

Sandra López-Rayo, Kristian H. Laursen, Jonas D.S. Lekfeldt, Fabio Delle Grazie, Jakob Magid*

Plant and Soil Science, Department of Plant and Environmental Sciences, Faculty of Science, University of Copenhagen, Thorvaldsensvej 40, Frederiksberg DK-1871, Denmark

Antibiotic resistance of pseudomonads was only affected in the very short term (3 weeks) by waste application treatments

Agriculture, Ecosystems and Environment 211 (2015) 94–101

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

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

Repeated soil application of organic waste amendments reduces draught force and fuel consumption for soil tillage

Clément Peltre[a,*], Tavs Nyord[b], Sander Bruun[a], Lars S. Jensen[a], Jakob Magid[a]

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A REDUCTION IN FUEL CONSUMPTION OF 14% AT THE 'NORMAL' COMPOST AMMENDMENT RATE

Reflections

So far we have not found alarming results of waste recycling

The soil system is highly robust and resilient

Potential for study of pharmaceuticals and organic contaminants ….

Table 1
Cumulated input of Cu, Zn, total nitrogen and phosphorous during the years 2003–2013, in the treatments, followed by an estimate of the equivalent number of years of input, based on P application, and the mineral fertilizer equivalent (MFE) factor used for correction of N application rates.

Treatment	Treatment abbreviations	Cumulated input 2003–2013 (kg ha^{-1})				Equivalent number of years[a]	MFE
		Cu	Zn	N	P		
Unfertilized	U	0	0	0	0	0	NA
Unfertilized + clover undersown	UC	0	0	NA	0	0	NA
Mineral fertilizer	NPK	0	0	1188	149	5	100
Human urine	HU	0.16	0.38	1859	135	4.5	65
Cattle slurry	CS	1.7	10.4	1620	389	13.0	70
Deep litter	DL	3.8	25.9	2588	933	31,1	45
Cattle manure, accelerated (acc.)	CMA	6.6	33.2	5258	1642	54.7	65
Sewage sludge	S	17.9	44.9	3245	2295	76.5	45
Sewage sludge, acc.	SA	50.0	125.3	9074	6414	213.8	45
Organic household waste compost	CH	30.5	63.3	3657	1400	46.7	40
Organic household waste compost, acc.	CHA	92.7	191.6	11039	4231	141.0	40

[a] This value is calculated on the basis of the current maximum permissible application of total P with organic waste fertilizers (30 kg ha^{-1} y^{-1}) following current Danish legislation (Danish Ministry of the Environment, 2006). This legislation regulates the use of sewage sludge and composted household waste used in the following treatments: S, SA, CH and CHA.

An invitation for further collaboration

We need more knowledge on ’the good and the bad’ in recycling of organic waste products

We invite the international community to utilize the facility

- To research ’new’ issues
- To assess risks and opportunities in recycling organic waste through the terrestrial production system

Questions and comments!!