Soil management requirements

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Land use and land management must be sustainable

That means e.g.

- All ecosystem services have to be considered in a long term perspective

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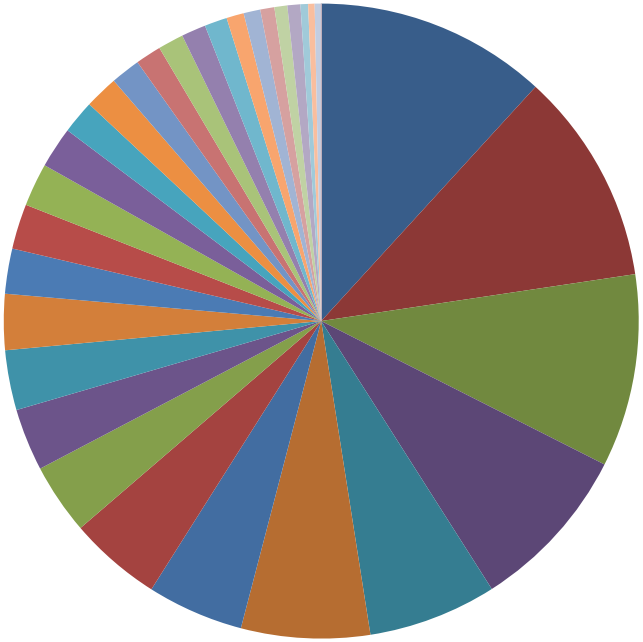
- Use and management must be site adapted

"....and we can save 700 lira by not taking soil tests."

Soil is a diverse concept – and so is soil management



- Cryosols
- Leptosols
- Cambisols
- Arenosols
- Acrisols
- Calcisols
- Ferralsols
- Gleysols
- Luvisols
- Podzols
- Kastanozems
- Lixisols
- Fluvisols
- Histosols
- Vertisols
- Albeluvisols
- Regosols
- Solonchaks
- Chernozems
- Alisols
- Nitisols
- Phaeozems
- Stagnosols
- Solonetz
- Planosols
- Andosols
- Gypsisols
- Umbrisols
- Plinthosols
- Durisols
- Technosols
- Anthrosols

Global: 15 300 Mha

From: World Reference Base for Soil Resources, 2006

Properties are set by:

1. Topography
2. Climate
3. Geology
4. Biota and land use
5. Time

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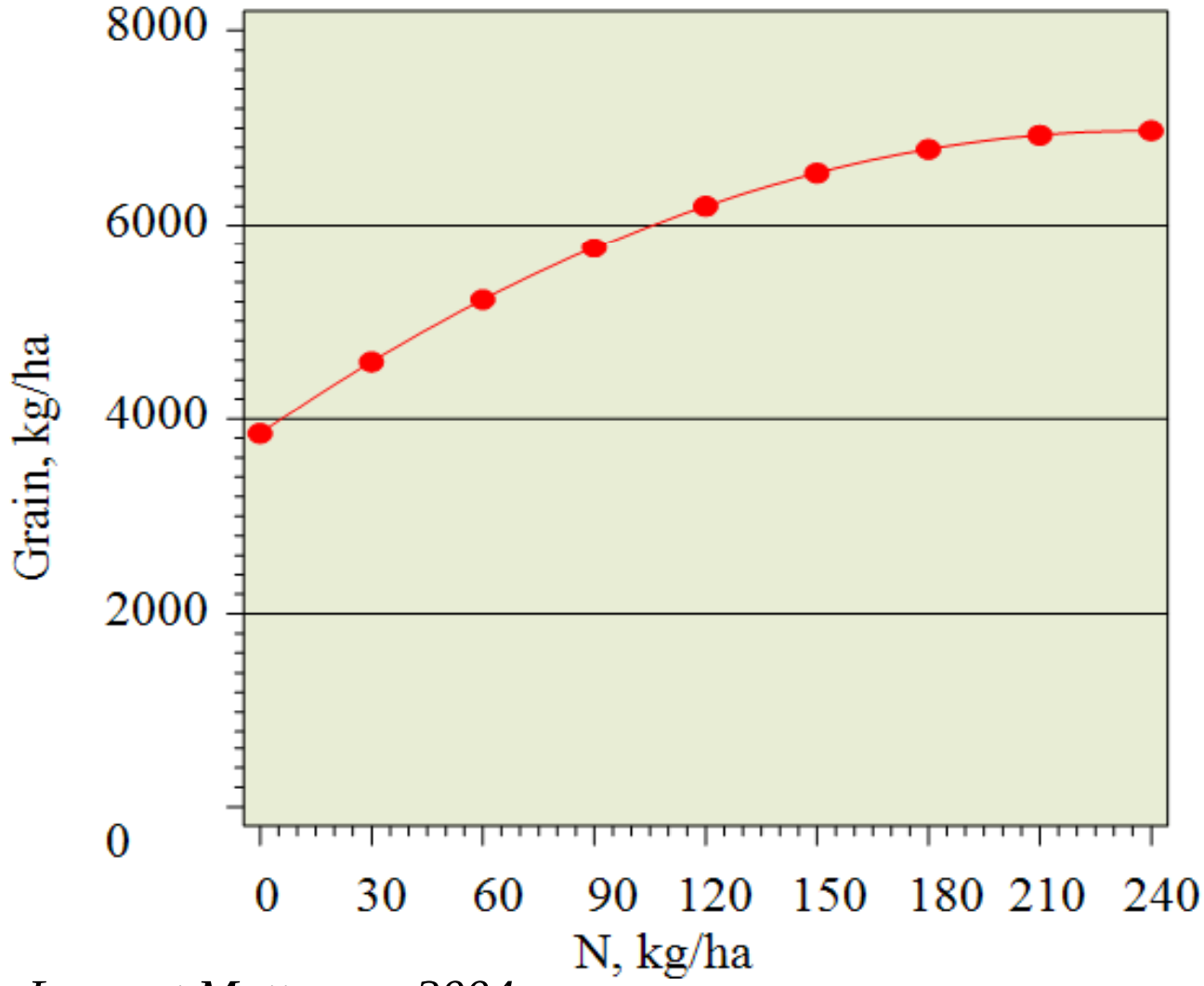
- Use and management must be site adapted
- A system analyses perspective should be applied

Wheat production at different N fertilizing rates, Sweden, kg/ha*yr



From Lennart Mattsson, 2004

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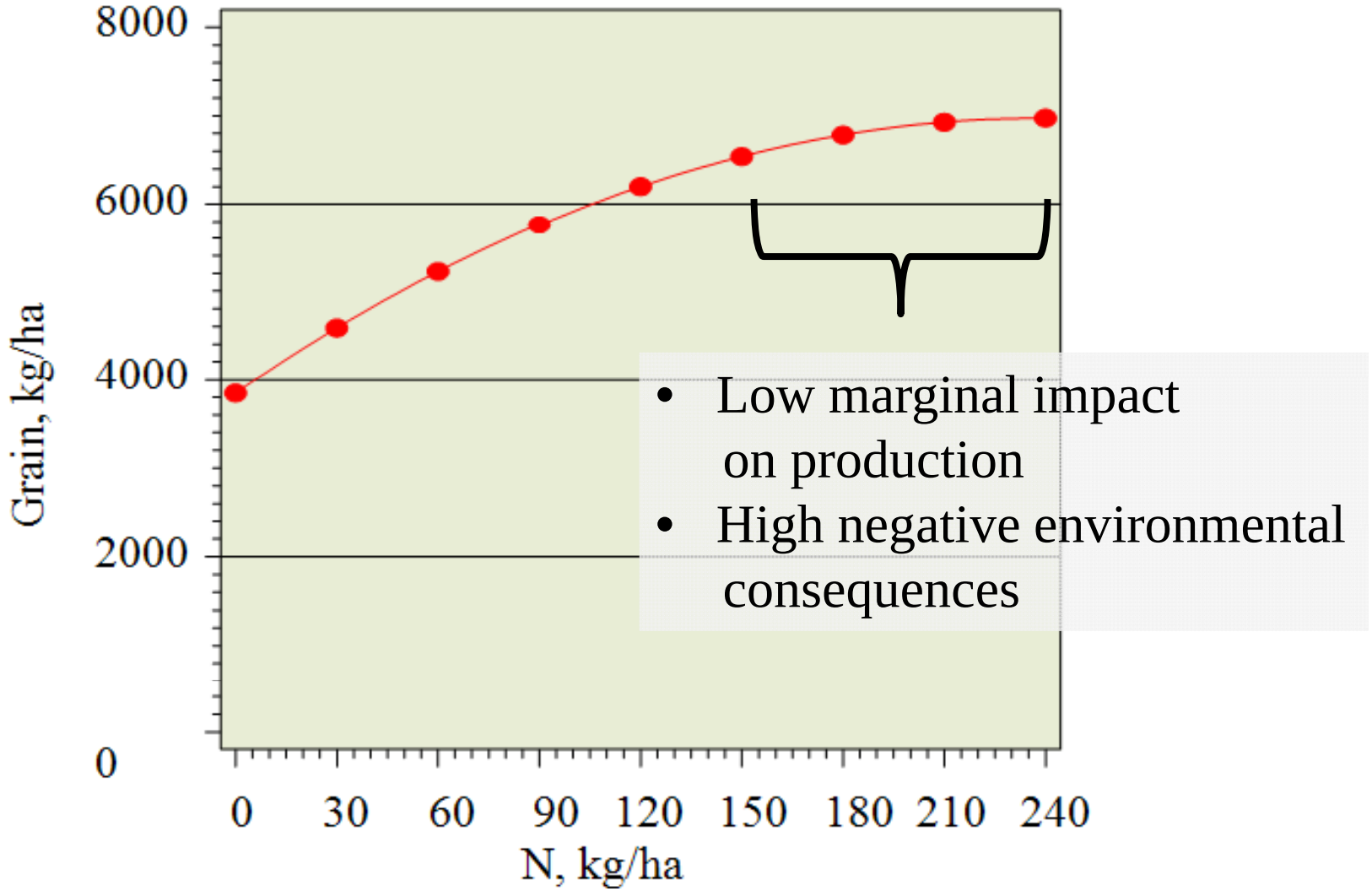
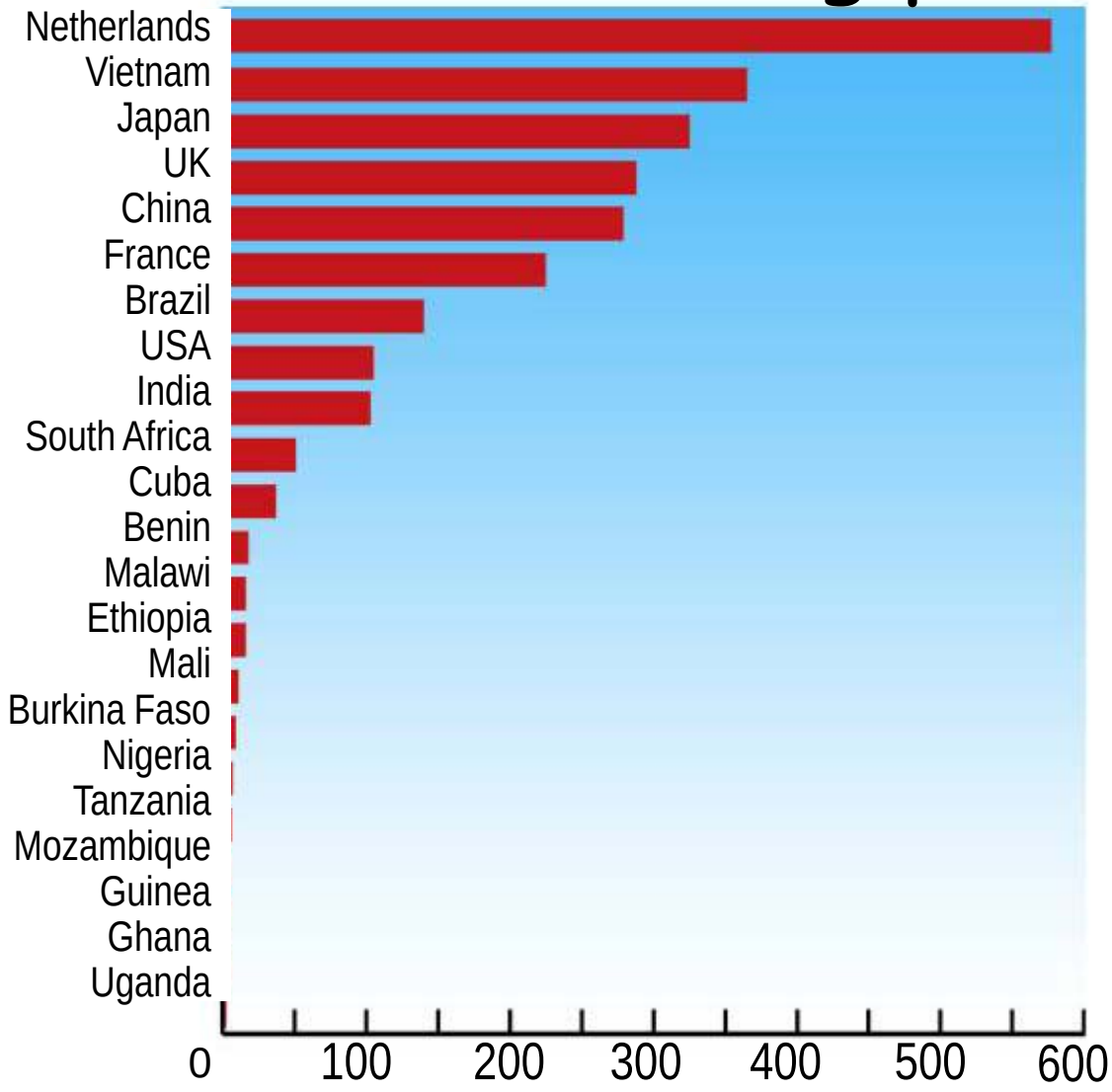


From Lennart Mattsson, 2004

Fertilizer use, kg perha*yr



Source: FAOSTAT, July 2003;
Norman Borlaug, 2004

Managment categories

Soils not suitable for production; cold climate, erosion potential and/or should be protected for other reasons (provision of other ecosystem services)
Soils with too much water; high groundwater table, poor drainage and/or too much precipitation
Soils with too low water availability; drought, low water retention capacity, thin soils
Fertile soils with good nutrient availablity, good structure and good water retention
Poor soils with low nutrient availabilty; caused by climate, mineralogy and/or age

Soils not suitable for production

	% area	
Cryosols	11.8	Too cold (with permafrost) – extensive grazing
Leptosols	10.8	Too thin, and erosion sensitive – extensive forestry, agroforestry
Plinthosols	0.4	Tropical soils with hard subsoil – extensive grazing or forestry
SUM	**> 23**	

Data from World Reference Base for Soil Resources 2006

Too much water – drainage needed

	% area	
Fluvisols	2.3	Flooded soils. Good natural fertility
Gleysols	4.7	High groundwater table
Stagnosols	1.1	(Pseudogley) Dense subsoil prevents drainage. Rather fertile. Drainage/deep ploughing needed.
Planosols	0.9	Dense subsoil prevents natural drainage. Drainage and fertilisation needed
Histosols	2.3	Peat soils (bogs and fens). Fertilisation needed.
SUM	**11.3**	

Data from World Reference Base for Soil Resources 2006

Too low moisture availability - irrigation needed

	% area	
Chernozem	1.5	Fertile. P fertilization recommended
Kastanozem	3.0	Fertile
Calcisols	6.0	Fertilization needed
Solonetz	0.9	Fertilization and liming needed
Solonchak	1.7	Strong irrigation and fertilization needed
Durisols	0.3	Strong irrigation – otherwise grazing
Gypsisol	0.7	
Arenosols	8.5	Strong fertilization – otherwise forestry
SUM	**22.6**	

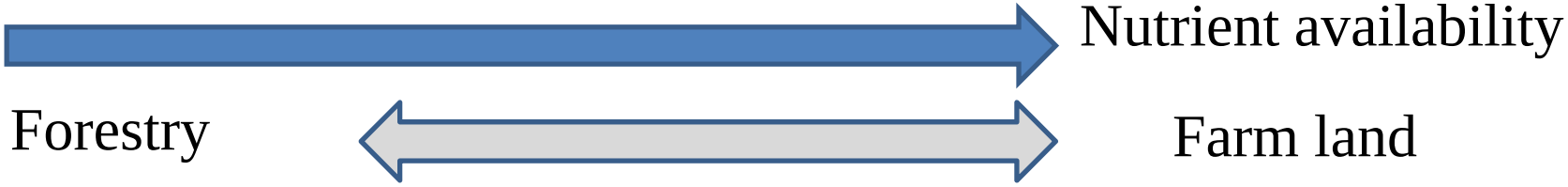
Naturally fertile agricultural soils, inherited high nutrient contents

	% area	
Cambisols	9.8	
Vertisols	2.2	
Phaeozem	1.2	
Luvisols	3.6	
Andosols	0.7	P fertilization may be needed
Nitisols	1.3	P fertilization may be needed
SUM	**19.5**	

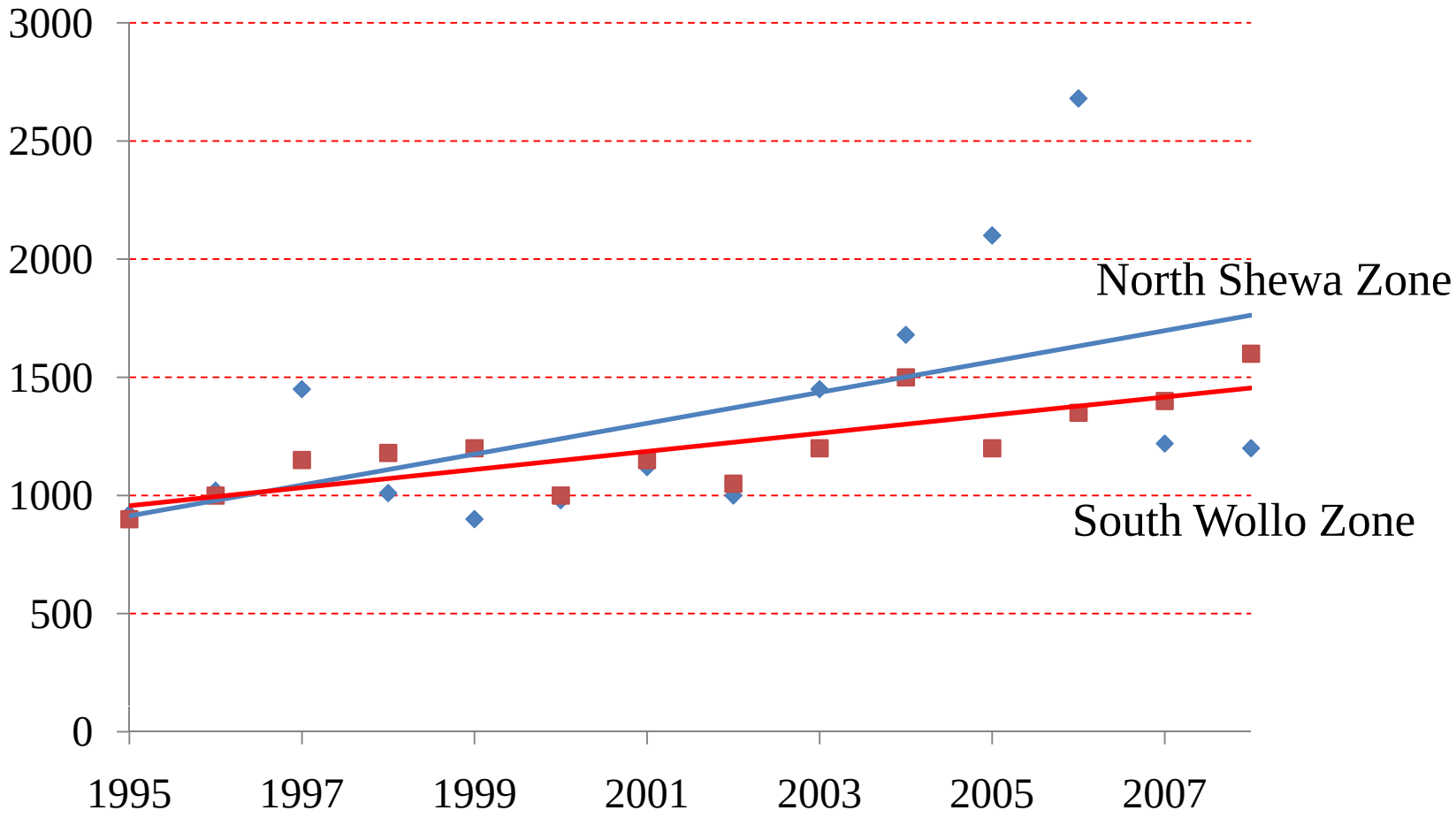
Data from World Reference Base for Soil Resources 2006

Nutrient poor soils, inherited or highly weathered. Suitable for forestry and, if improved, agriculture

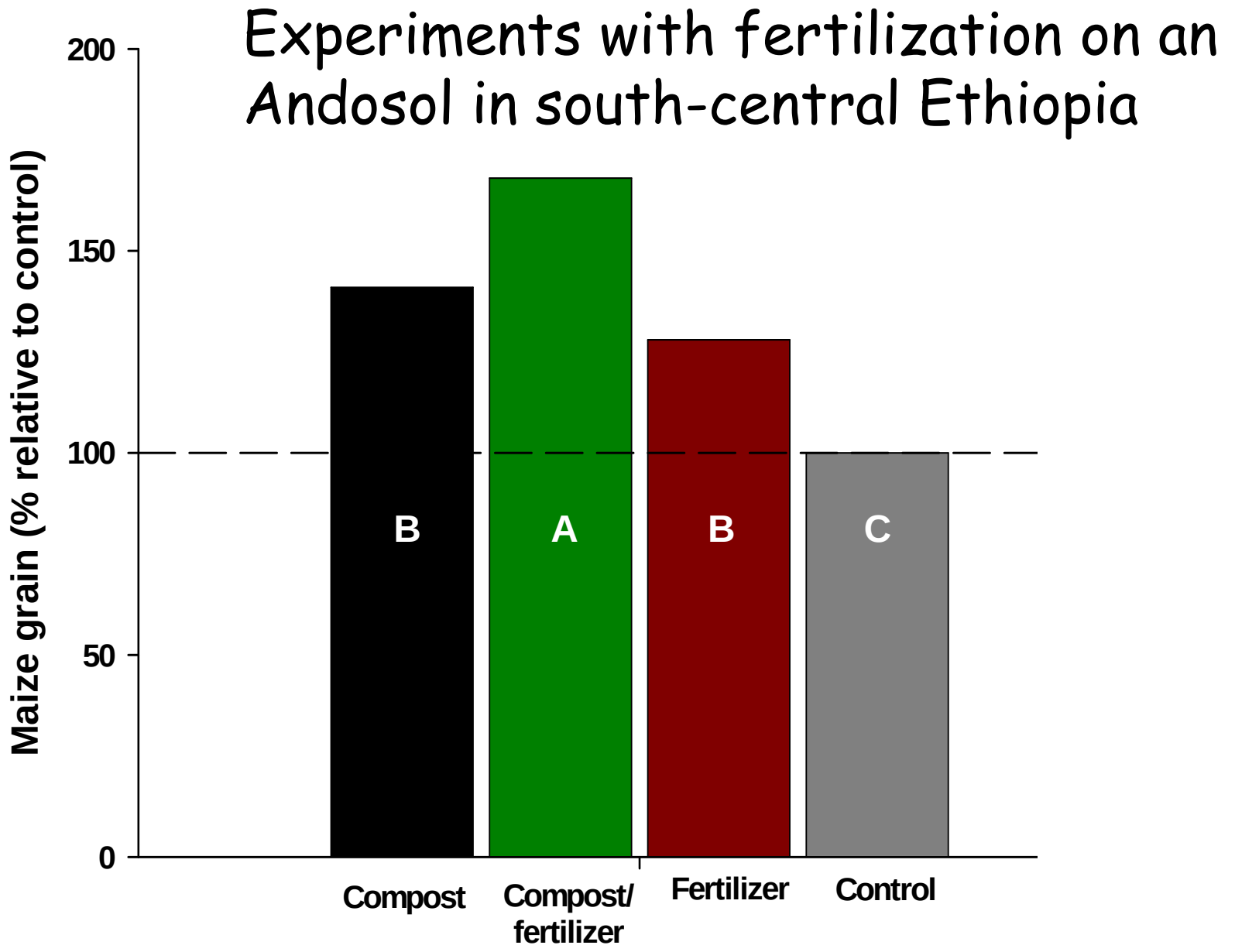
	% area	Needed for agricultural use
Ferralsols	4.9	weathered tropical soils – P and fertilizers needed, OM
Acrisols	6.6	weathered tropical soils – P and fertilizers needed, OM
Alisols	1.3	Tropical soil - Al-toxicity – liming and fertilization
Lixisols	2.8	Tropical soil – fertilization, OM
Albeluvisols	2.1	Liming and fertilizers
Podzols	3.2	Liming and fertilizers
Umbrisols	0.7	Liming and fertilizers
Regosol	1.7	Diverse group – needs fertilizers, OM, irregation
SUM	**23.3**	



Spring wheat production data for two regions in Ethiopia, kg/ha*yr



From Gizaw Mengistu, data from Central Statistic Agency, Ethiopia



From: Workneh Bedada, Mulugeta Leminih, Motuma Tolera & Erik Karltun

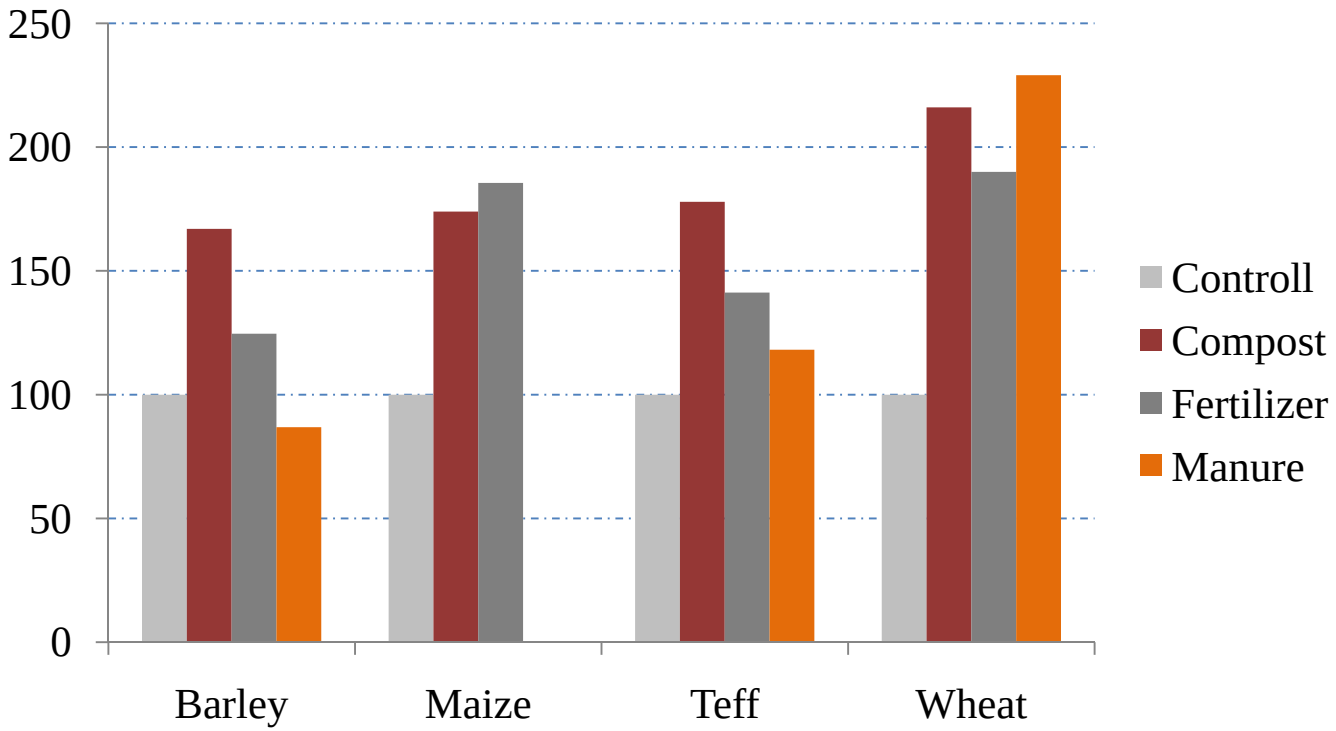
THE TIGRAY PROJECT: A Success Story in Sustainable Agriculture

From: Hailu Araya & Sue Edwards

The main aim of the project is to find out if a community-based approach to rehabilitating the land and improving crop production based on ecological principles can improve the livelihoods of poor smallholder farmers.

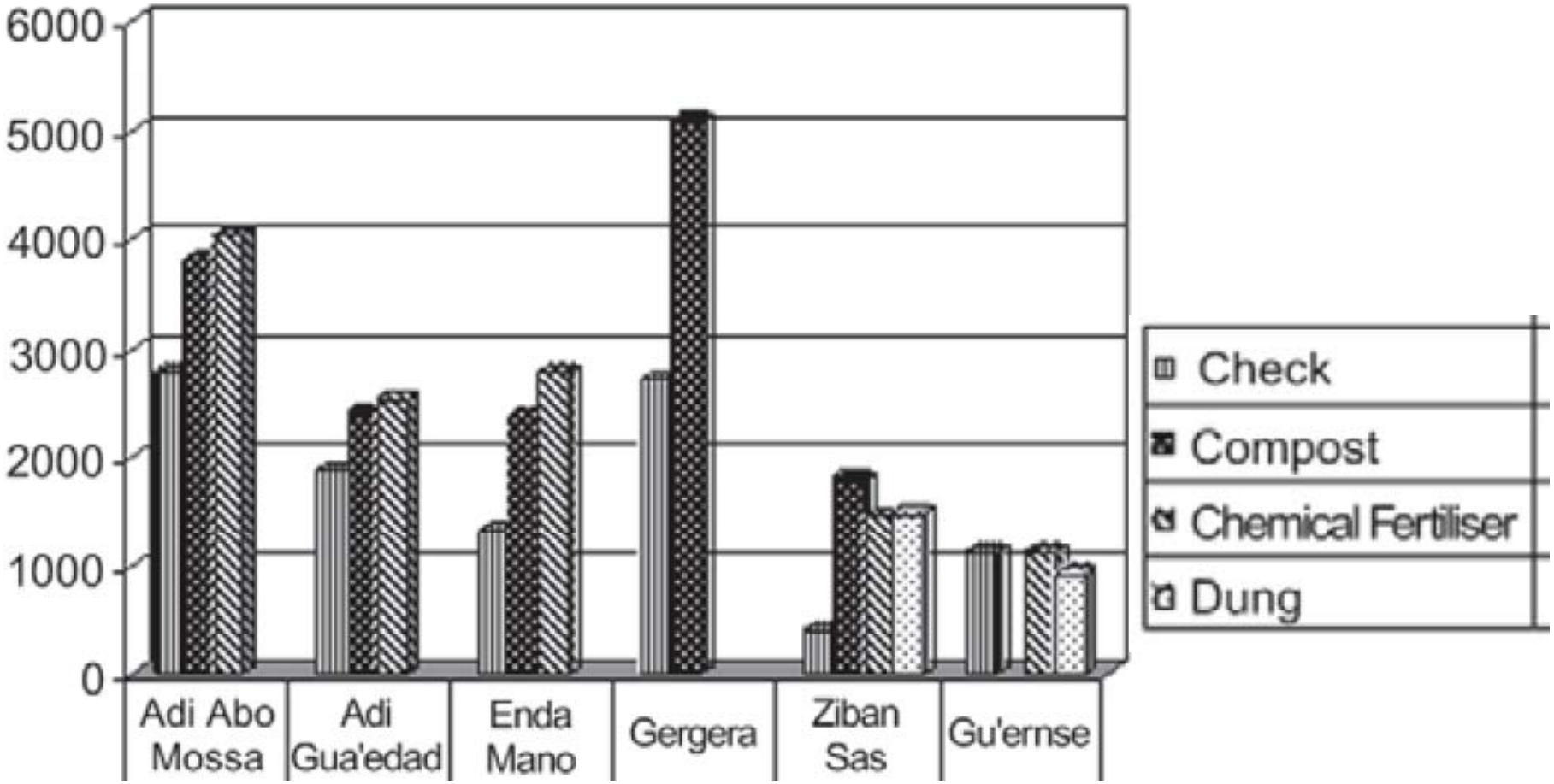
Managed by the Bureau of Agriculture and Natural Resources (BoANR) of Tigray Regional State and the Institute for Sustainable Development (ISD) in collaboration with the woreda administrations and experts, and their local communities.

The Tigray project:
Relative production rate; controll = 100



From: Hailu Araya & Sue Edwards

Variation between villages, wheat kg/ha*yr



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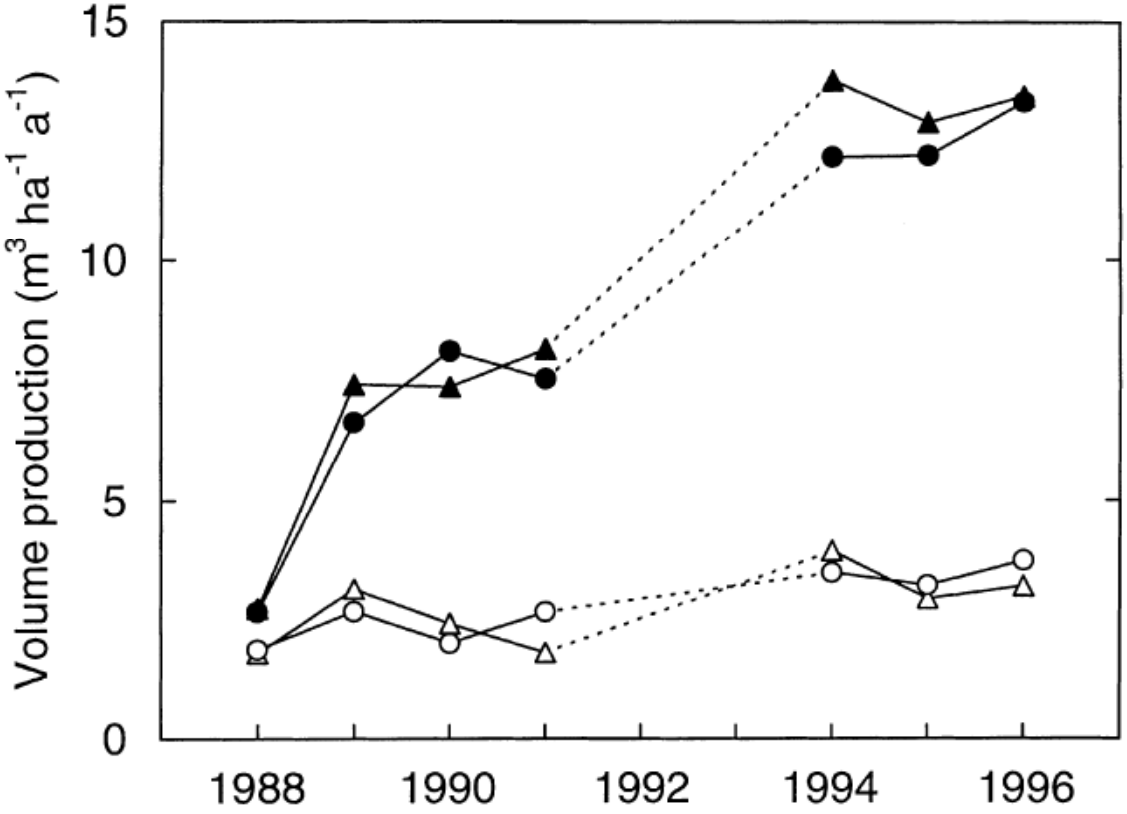
Ex. on soils that may best be used for forestry:

Leptosols
Plinthosols
Acrisols
Alisols
Lixisols
Albeluvisols
Podzols
Regosols
Arenosols

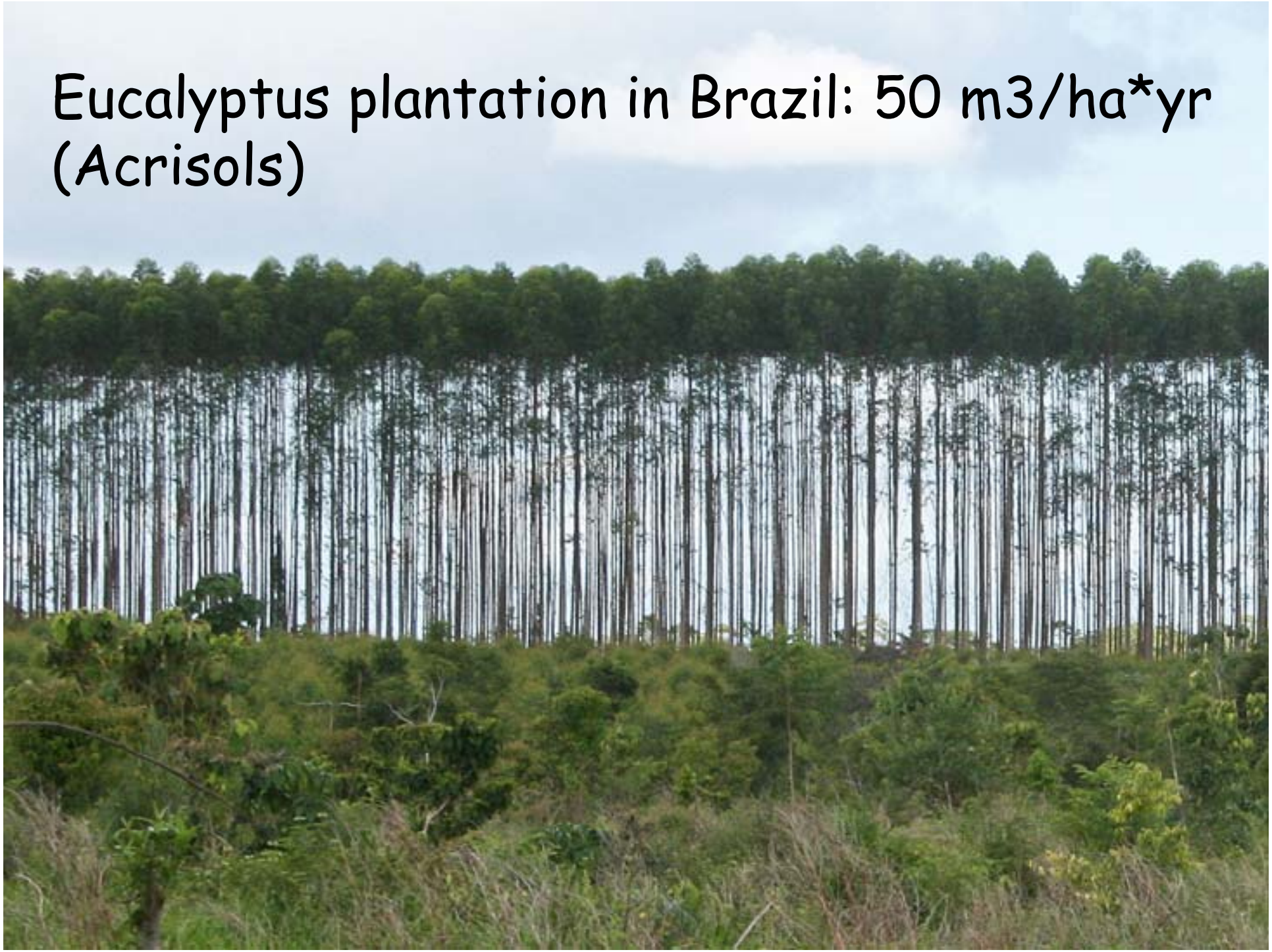
The annual increment of stem volume in stands of young Norway spruce (Flakaliden, N. Sweden).



From Bergh et al 1999

Control (open circle)
Irrigation (open triangle)
Solid fertilisation (filled circle)
Combined irrigation and fertilisation (filled triangle).

Eucalyptus plantation in Brazil: 50 m3/ha*yr (Acrisols)



Soil: Alisols

Site preparation

NPK added
200-600 kg N/ha per rotation (5 years)

Lime

Herbicides

Insecticides

CONCLUSIONS

- Soils are different – different management
- All ecosystem services has to be considered in a long-term perspective
- Use and management must be site adapted
- A system analyses perspective should be applied
- Agricultural yields on many soils in developing countries may get doubled or tripled production rates provided improved soil management
- Higher effiency in using fertilizers in developing countries than in developed countries