CARBON SEQUESTRATION IN WORLD SOILS

R. Lal
Carbon Management and Sequestration Center
The Ohio State University
Columbus, OH 43210 USA

STRATEGIES OF MANAGING GASEOUS EMISSIONS AND CLIMATE CHANGE

1. Mitigation: Limiting of GHGs by:

- Reducing emission, and
- Carbon capture and storage

2. Adaptation: Limiting the negative impacts

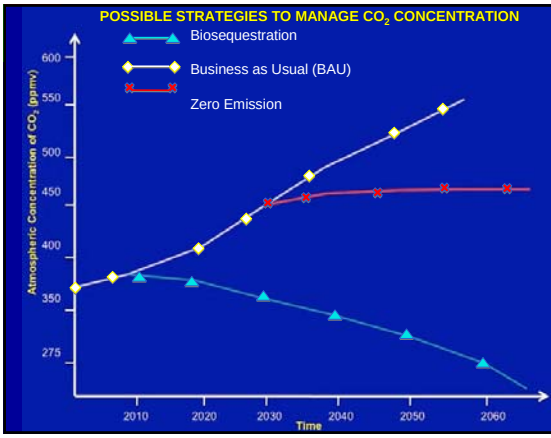
SYNERGISM BETWEEN MITIGATION AND ADAPTATION STRATEGIES

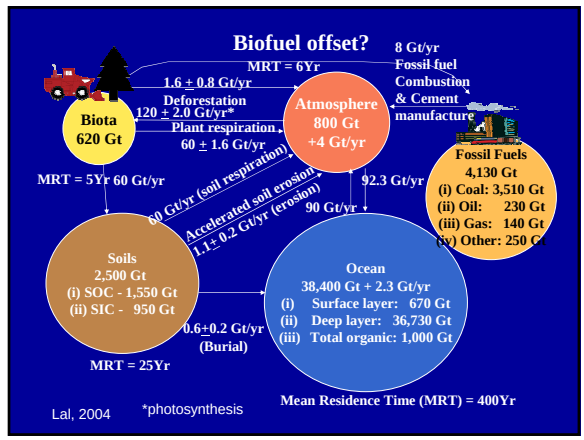
A separate treatment of mitigation (CCS) and adaptation (soil C sinks), in both science and policy arenas has hindered the progress.

ADAPTATION AND SUSTAINABLE DEVELOPMENT

- Adaptation strategies are synonymous with sustainable development objectives.
- Rather than viewing it as mitigation's "poor cousin" in the climate science and policy arena, adaptation through soil C sequestration must be given the prominence that it deserves.
- The SCS technologies enhance synergistic effects.

POSSIBLE STRATEGIES TO MANAGE CO_2 CONCENTRATION





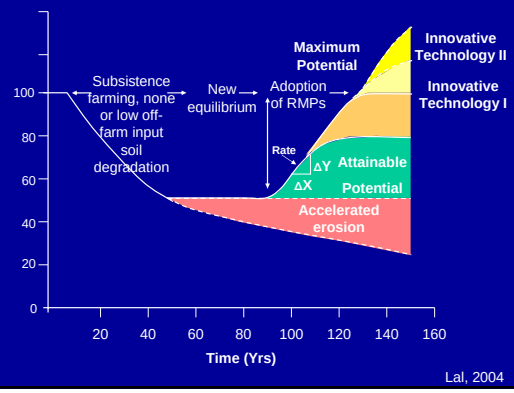
TOTAL C POOL IN GRASSLANDS AND SAVANNAS (JANZEN, 2005)

Ecosystem	Organic C Pool (Pg C to 1-m depth)				
	Range	Mean	% of Total	Flux (Pg C/yr)	
Total in world soils	1395-2011	1580	100	60	
Cropland soils	128-168	152	9.6	3	57%
Grassland/Savannas	279-559	425	26.9	26	
Plantations	-	90	5.7	5	
Forests	-	704	44.5	17	

FARMERS AND THE ENVIRONMENT

Farmers have custody of more environment than does any other group.

. . . . Paarlberg (1980)



Lal, 2004

CAPACITY OF TERRESTRIAL CARBON SINK

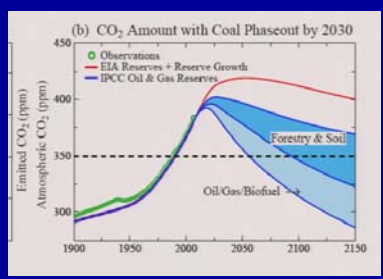
Historic Loss from Terrestrial Biosphere = 456 Gt with 4 Gt of C emission = 1 ppm of CO_2

The Potential Sink of Terrestrial Biospheres = 114 ppm

Assuming that up to 50% can be resequestered = 45 – 55 ppm

Cropland Soils: 1 Gt/yr
Rangeland Soils: 1 Gt/yr
Restoration of Degraded/Desertified: 1 Gt/yr
Drawdown: 50 ppm of CO_2 over 50 years

POTENTIAL OF MITIGATING ATMOSPHERIC CO_2



(Hansen, 2008)

CARBON SEQUESTRATION IN SOILS AND TERRESTRIAL ECOSYSTEMS

C Sequestration = $C_{input} > C_{output}$
C Depletion = $C_{input} < C_{output}$
C_{output} = Erosion, Decomposition, leaching, Harvest
C_{input} = Residues, Mulch, Compost, Amendment, Deposition

TECHNOLOGICAL NITCHES

Technology	Temperate			Tropics			Highlands		
	Humid	Sub-Humid	Arid	Humid	Sub-Humid	Arid	Humid	Sub-Humid	Arid
No-Till									
Cover Cropping									
Manuring									
Biochar									
Agroforestry									
Irrigation									
INM									
Improved Pasture									

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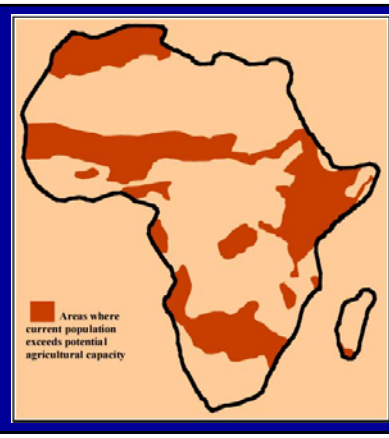

ESTIMATED INCREASE IN FOOD PRODUCTION IN AFRICA BY INCREASE IN SOC POOL BY 1 Mg/ha/yr (Lal, 2006)

Type	Total Annual Increase (10^6 Mg/yr)
Grains	3.3-5.4
Roots and Tubers	3.0-6.2
Total	6.3-11.6

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SUGGESTIONS FOR POLICY MAKERS (SHORT-TERM 30 YRS)

If the objective to mitigate CO_2 and global warming policy makers may be better advised to focus on the following:

(i) Increase the efficiency of fossil fuel use,

(ii) Conserve the existing forest and savannahs,

(iii) Restore natural forests and grasslands or croplands that is not needed,

(iv)Restore soil C pool, and

(v)Trade C credits.

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SUGGESTIONS FOR POLICY MAKERS (LONG-TERM >50 YRS)

Non-C Fuel Technology

(H_2)

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CONCLUSION

- Soil C sequestration is a readily implementable option.
- The technical potential of soil C sequestration is about 3-4 Gt C/yr for next 25-50 years.
- In addition to benefits of adaptation, soil C sequestration also provides mitigation in a cost-effective manner comparable to current abatement options in other industries.

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