Carbon Farming – the Future.

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Chairman, Carbon Link Limited

October, 2011

Issues to cover

- Why bother
- The Carbon cycle
- What is Soil Carbon?
- How does it get there?
- Measuring Soil Carbon
- Selling Soil Carbon
- Implications for rural industry

Wealth Transfer (or Mining?)

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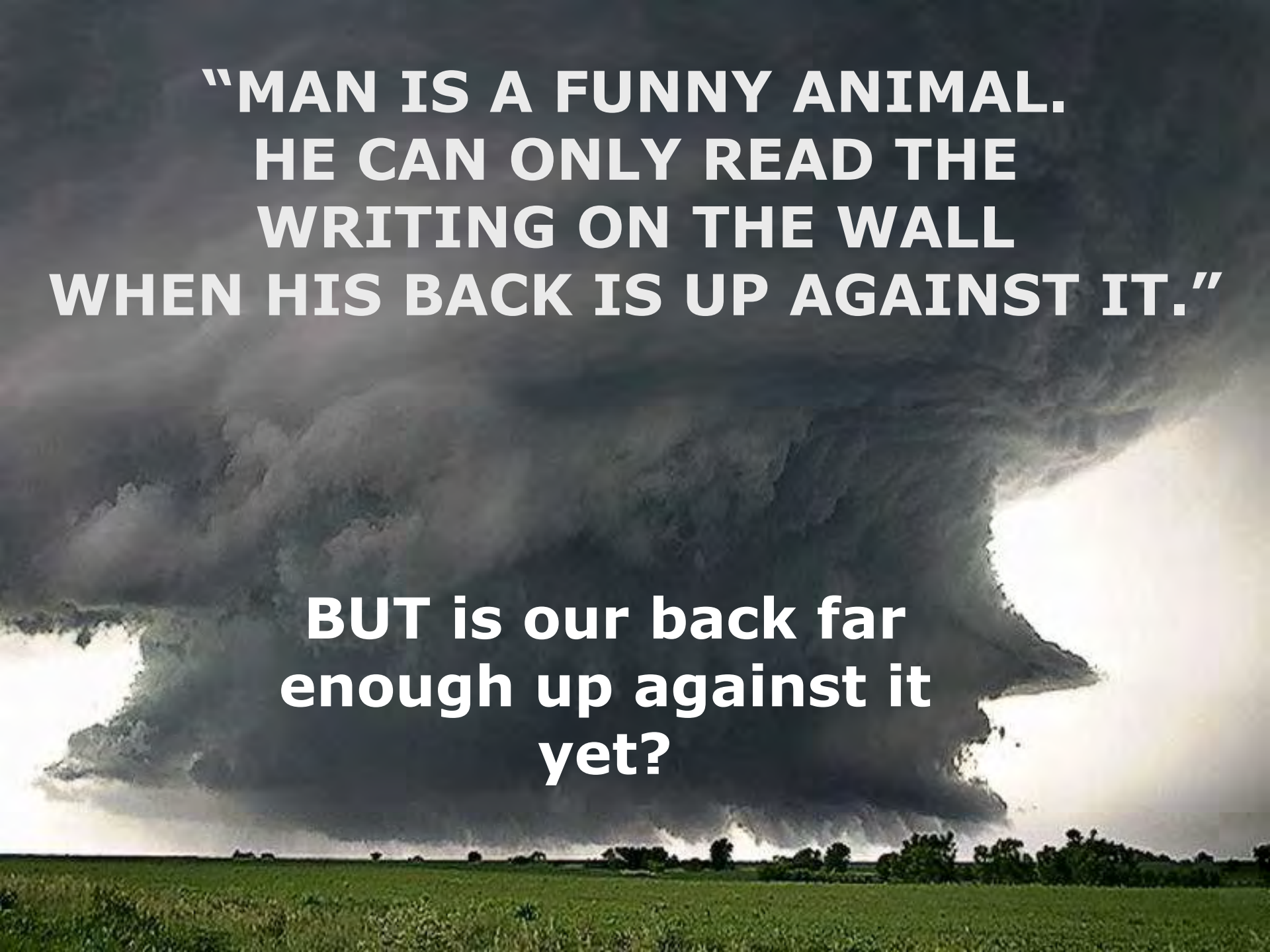
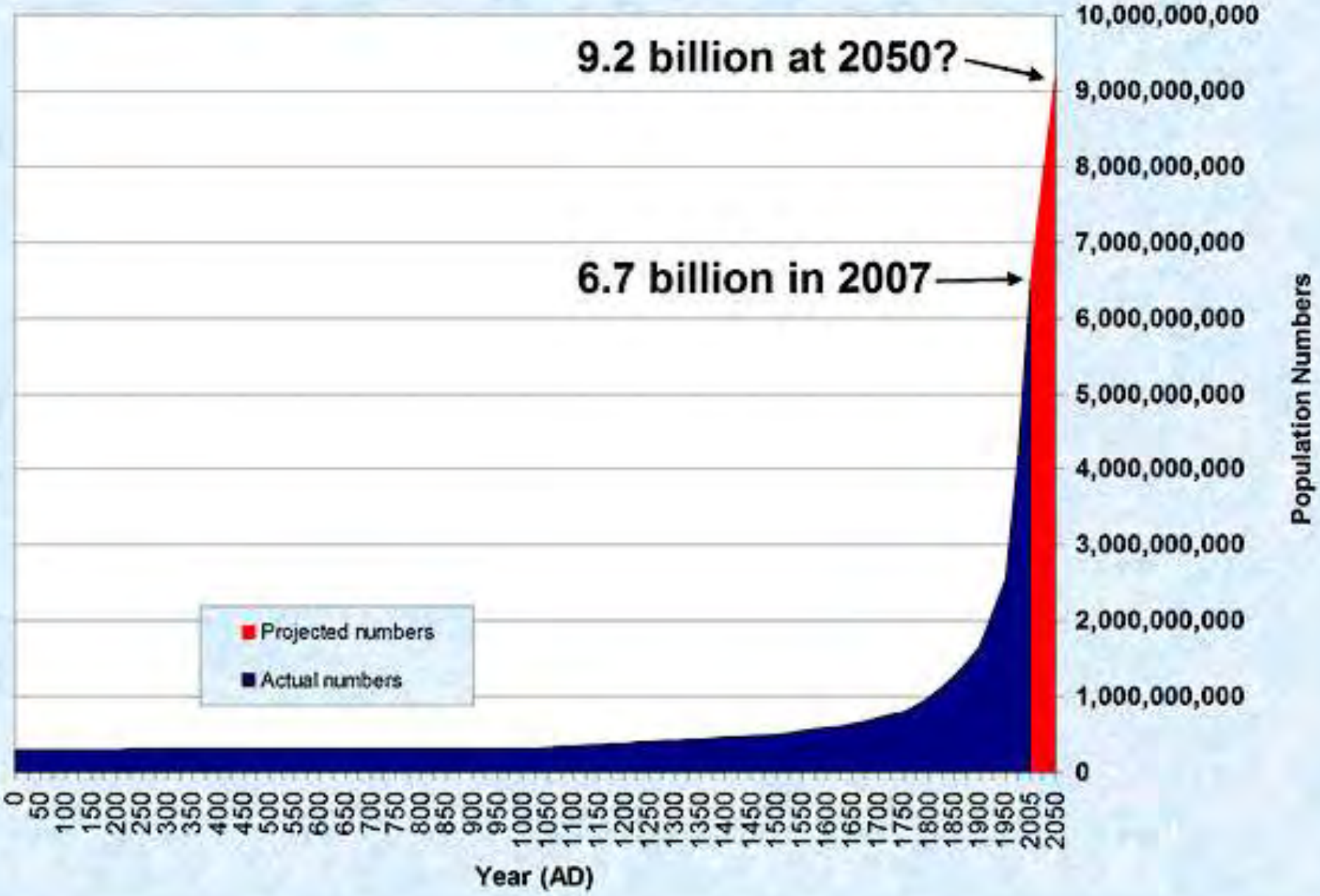
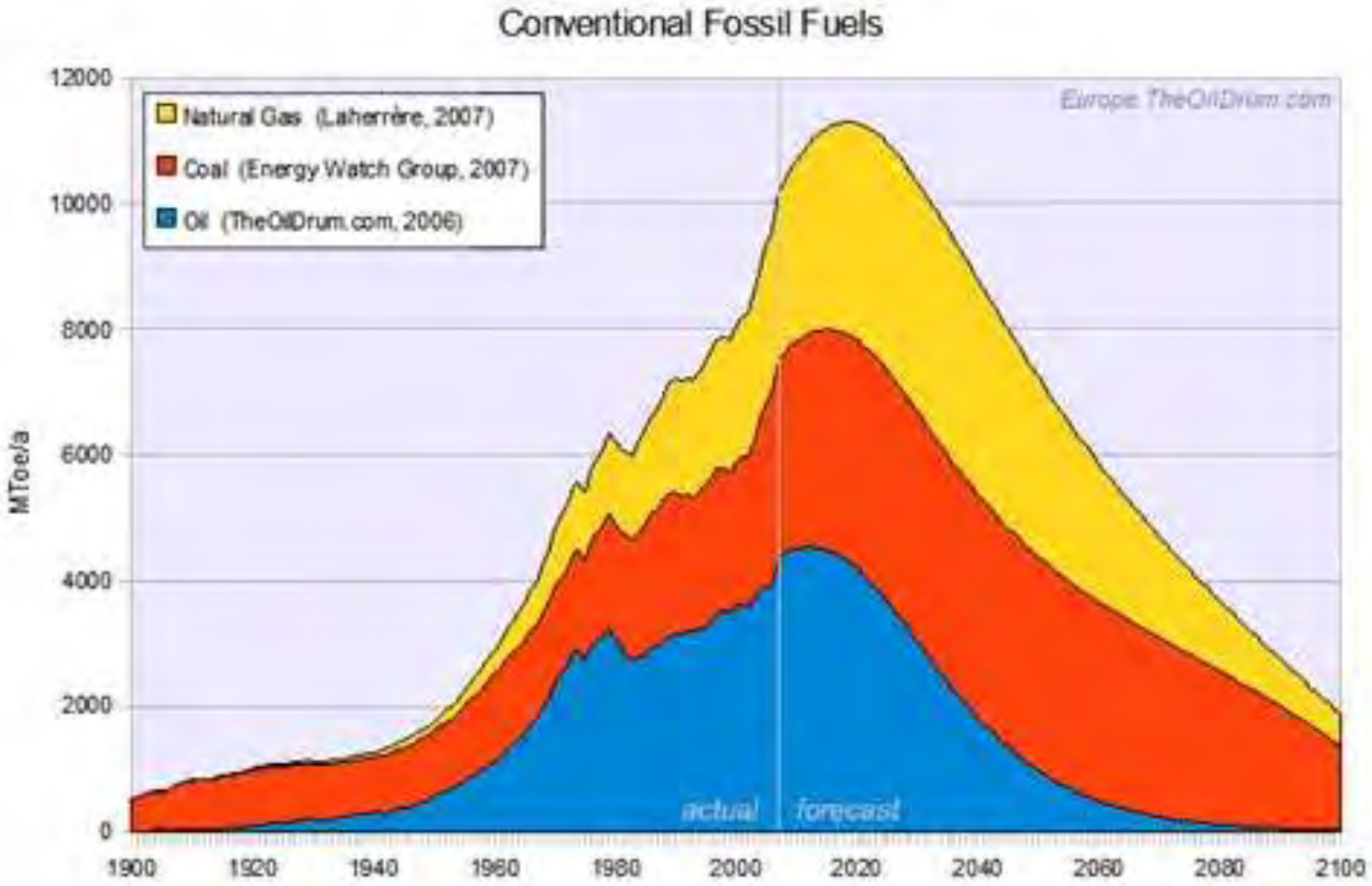

"MAN IS A FUNNY ANIMAL.
HE CAN ONLY READ THE
WRITING ON THE WALL
WHEN HIS BACK IS UP AGAINST IT."
BUT is our back far
enough up against it
yet?


THE LOCUST
GENERATION

World population growth

Optimum Population Trust
Source: United Nations figures





15,394 Days
to the end of oil

PEAK OIL

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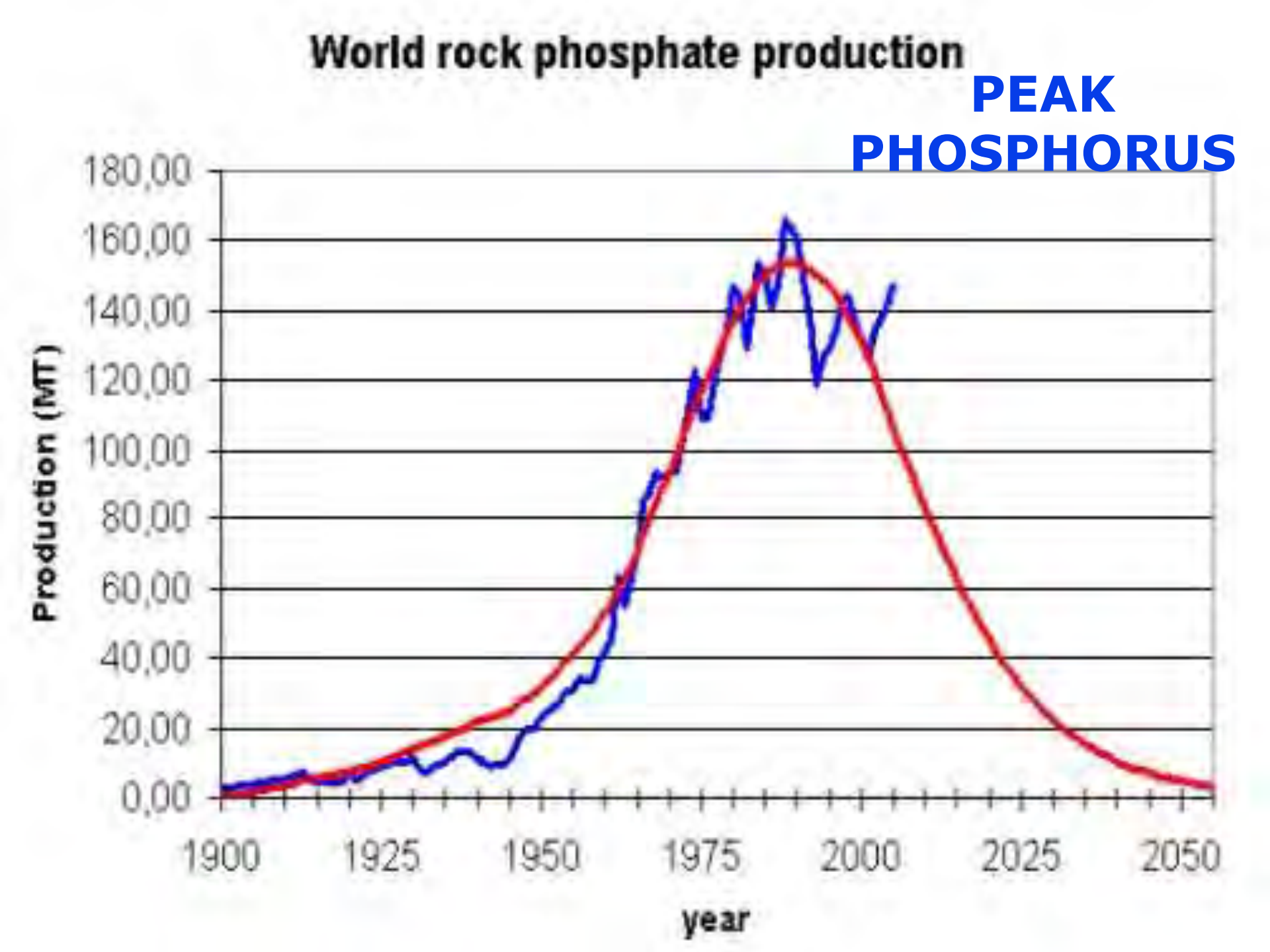
World rock phosphate production
PEAK PHOSPHORUS
Production (MT)
180,00
160,00
140,00
120,00
100,00
80,00
60,00
40,00
20,00
0,00
1900
1925
1950
1975
2000
2025
2050
year

PEAK ECOLOGICAL WATER?

Exceeding the point of water use where serious ecological damage occurs.

FRESH WATER as % of TOTAL = 2.53%

PERCENT of FRESH WATER in GLACIERS = 68.5%

PERCENT of FRESH WATER UNDERGROUND = 30%

Meena Palaniappan and Peter H. Gleick (2009)

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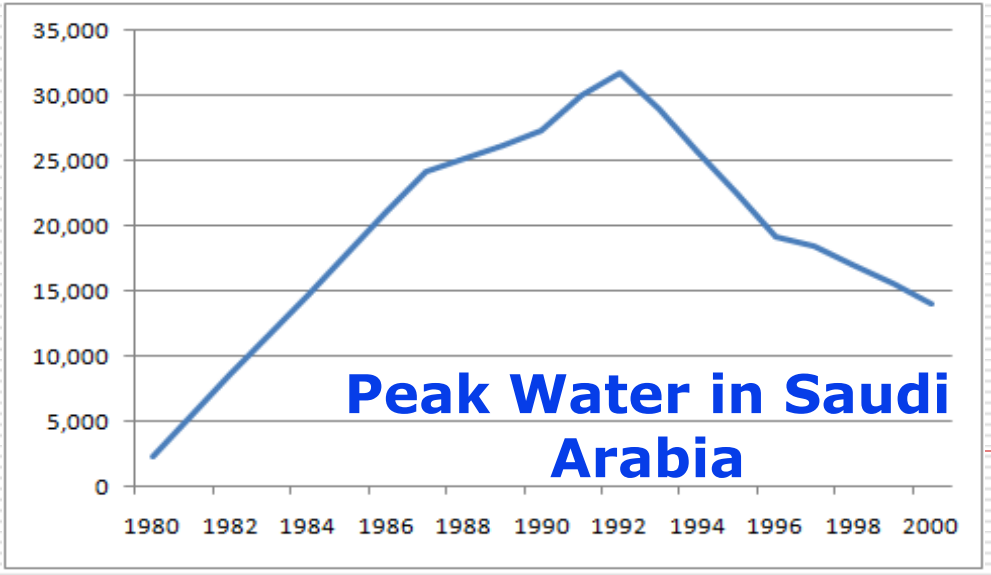
"Fossil" Water decline

Depleting Fossil Aquifers

- Ogallala Aquifer in US
- Saudi Aquifer
- North China Plain



India

- 15% of India's food supply is produced by mining ground water.
- 175 million Indians consume grain watered from irrigation wells that will soon be exhausted

IS THERE PEAK HUMAN HEALTH?

ESTIMATES for 2011

- **USA spend per DAY on Obesity related diseases**
  $347,000,000
- **USA spend per DAY on weight loss programs**
  $138,000,000
- **World spending on illegal drugs this year to date:**
  $398,434,000,000
- **Public spending per DAY on US health care:**
  $745,900,000

Worldometers - real time world statistics. 12 Oct 2011.)
<http://www.worldometers.info>.

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IS THERE PEAK AGRICULTURAL LAND?

Estimated losses (for 2011)

• **Arable land lost to Erosion**	**6,242,000ha**
• **Desertification**	**10,698,000ha**
	16,940,000ha

In addition, agricultural land is lost to:

- National parks
- Urban development
- Mining

Worldometers - real time world statistics. 20 May 2010.)
http://www.worldometers.info.

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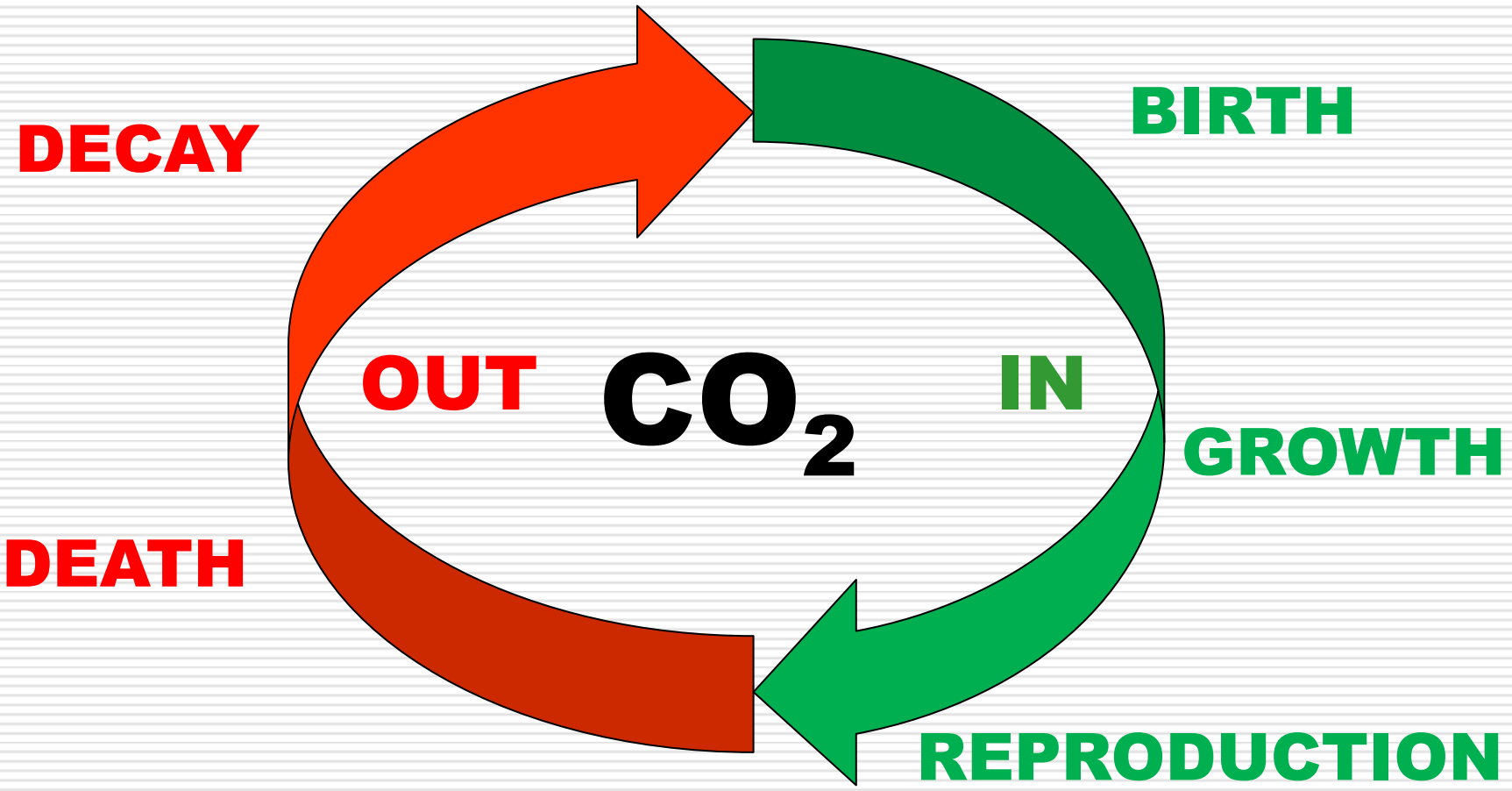
"A Nation that destroys its SOIL, Destroys Itself."
Franklin Roosevelt

Farmers will need to grow as much food in the next 50 years as we have produced in the last 10,000 years.

(Recent UN Report quoted on http://www.futurefoodqld.com.au/facts.php)

The Carbon and Life Cycle



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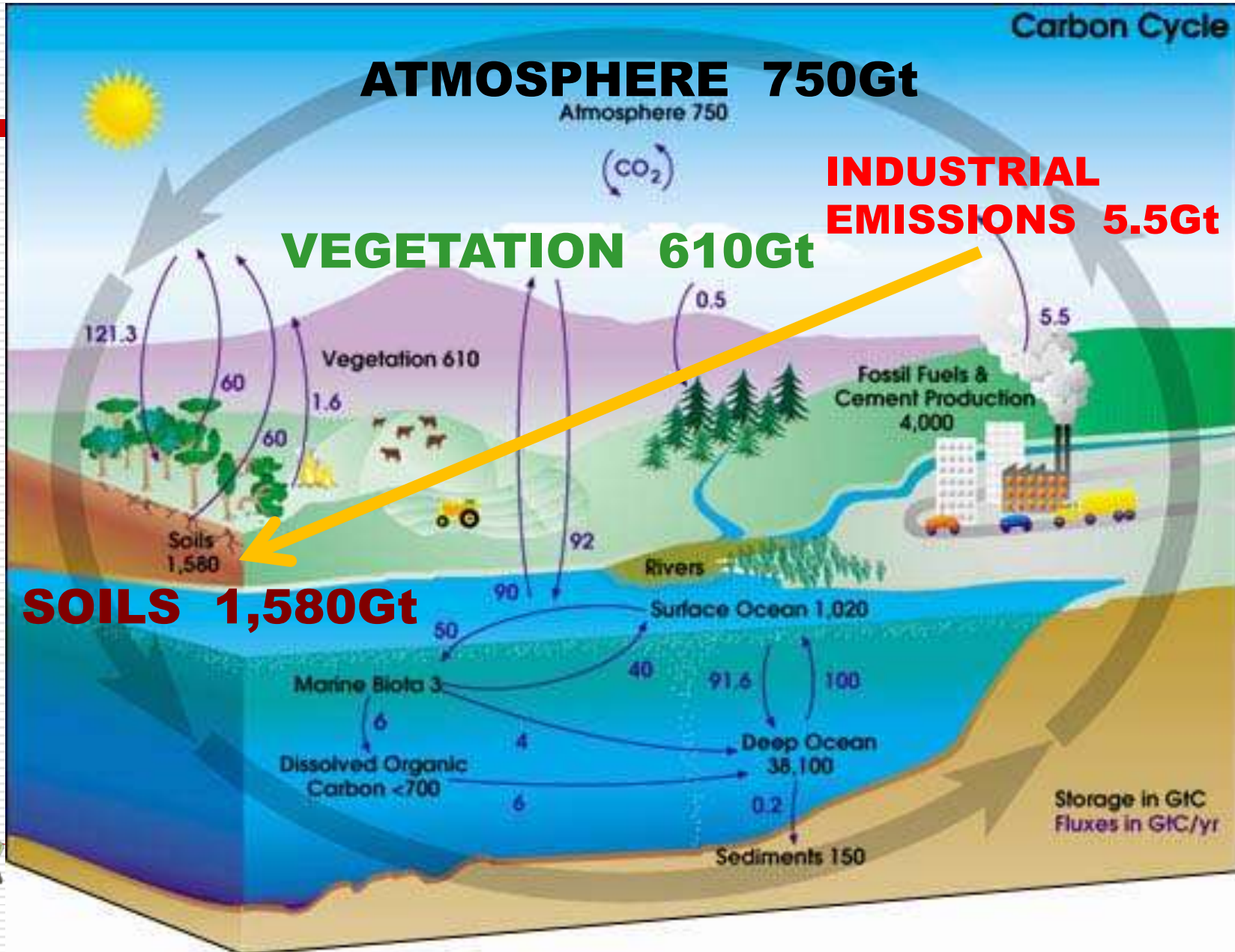
SOIL CARBON in PERSPECTIVE



Kyoto – Industrial v Biological Systems

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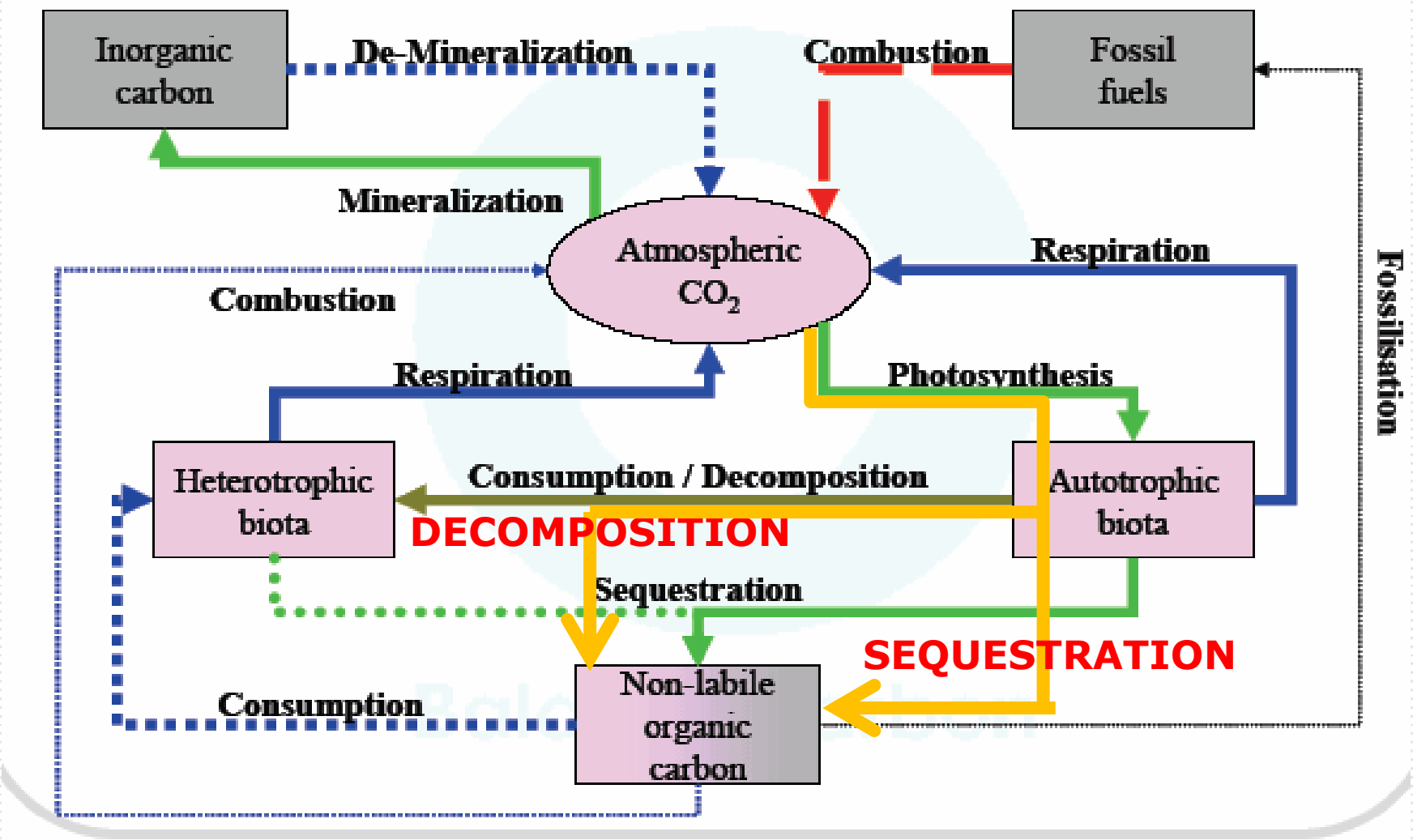
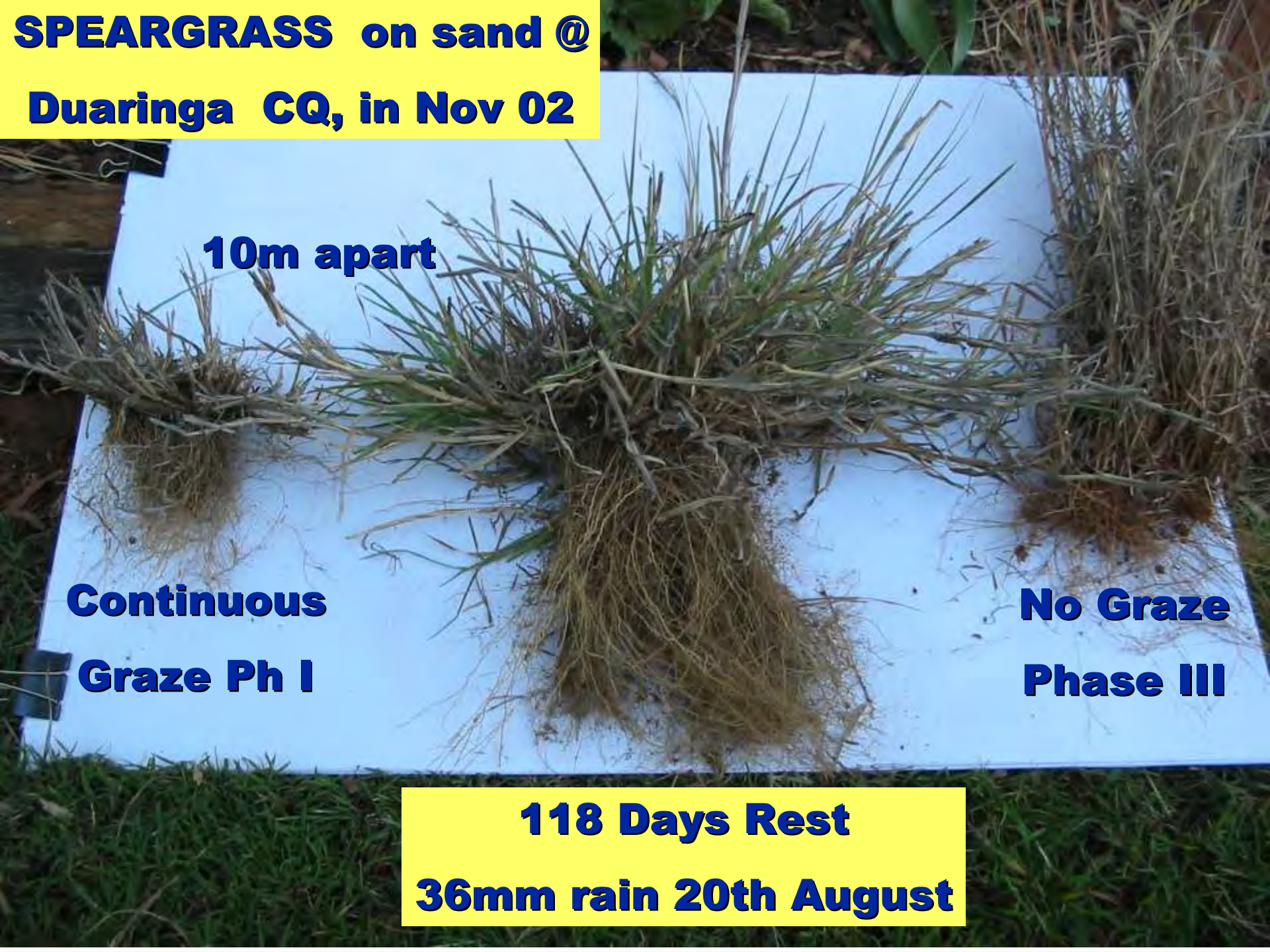
Soil Carbon – An Example.

Soil Carbon – the Pathways.




SPEARGRASS on sand @
Duaringa CQ, in Nov 02
10m apart
Continuous
Graze Ph I
No Graze
Phase III
118 Days Rest
36mm rain 20th August

Mycorrhizal Fungi

Source: Elaine Ingham, SoilFoodWeb Inst..

What will determine the value of Carbon?

- Govt will set a price (eg \$23/t CO_2e).
- Carbon is sold as Tonnes of CO_2 equivalents.
- Carbon tax (July 2012) leading to CPRS (2015)
- Market perception of its QUALITY
- Supply & DEMAND

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Immediate Implications of a Carbon Tax.

- Higher fuel & tyre prices
- Higher Electricity prices
- Higher fertilizer prices
- Higher transport costs (which will flow on to most other things!!)
- Higher Poly prices (pipe & troughs)
- High Compliance costs
- **Provides volume and sets price for CFI.**

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Offset or Sequester?

- A carbon offset. Leaves CO_2 in the air. eg a wind farm supplies electricity which reduces the coal burnt in a power station.
- Sequestration. Removes CO_2 from the atmosphere. Eg photosynthesis storing carbon in plants and soil.
- Sold in Vintages

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Agriculture and Carbon Trading

- Agriculture has the ability to sequester.
- However, **NOT under most conventional farming systems, which are nett emitters.**
- eg Methane = CO_2 **X 23** and N_2O = CO_2 **x 310**

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Carbon Farming Initiative

- Passed House of Reps 16th June, Senate 23rd August.
- Allows a wide range of offsets from Agriculture on "Opt-In" basis.
- Methodologies to be submitted to DOIC for approval. – Only five approved so far.
- Permanence Period = 100 years
- Cells will pass additionality test.
- Allows offsets or Sequestration

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Carbon Farming Initiative (CFI)

- Voluntary Market but can link to Carbon Tax ($250 million).
- Possibly a A$1.1B market in Carbon Tax arena.
- Will cover soil carbon, forestry, methane reduction, fertilizer reduction, avoided deforestation, woodlots
- Credits sold as ACCU's (Australian Carbon Credit Units), which = 1t CO_2

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What do buyers require?

- Verification by an independent accredited organization
- Verified against an acceptable Standard e.g. CFI, VCS, Gold
- Carbon should be recent vintage
- Carbon must be maintained for the permanence period
- Science behind the measuring & monitoring protocols must be able to withstand highest level of scrutiny (DOIC).
- Registry/traceable

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REQUIREMENTS of STANDARDS

- Additionality – The carbon credits generated must be additional to "business as usual". CFI unclear on this.
- Permanence – Carbon Credits must be permanent removal or reduction of CO_2. Permanence period is 100 years in the CFI.
- No Leakage – Cannot transfer emissions from one area to another. No problem.
- Verification – Independent stamp of approval. Says it is real. Costs

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Opportunities

- Change farming and grazing systems to renewable practices.
- Regrowth (which has a right to clear)
- Soil Carbon
- Production benefits of increasing soil carbon
- Fuel and fertilizer reduction
- Methane reduction

Threats

- Methane in the Livestock industries
- Leasehold v's Freehold
- Lower rainfall
- Higher Temperatures
- Difficulties off-setting soil carbon in North Australia and on native pasture.
- Permanence periods

ISSUES for SOIL CARBON

- Permanence. The permanence period for Australian soils is likely to be at 100 years under CFI. **This is unworkable.**
- Additionality. *"The Government's intention with this test will enable crediting of activities that improve agricultural productivity or have environmental co-benefits, but which have not been widely adopted"*. CFI Explanatory Memo.
- Accurate Measurement

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The CFI

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The “old” Agricultural Paradigm

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New Paradigms

10m in 10 min

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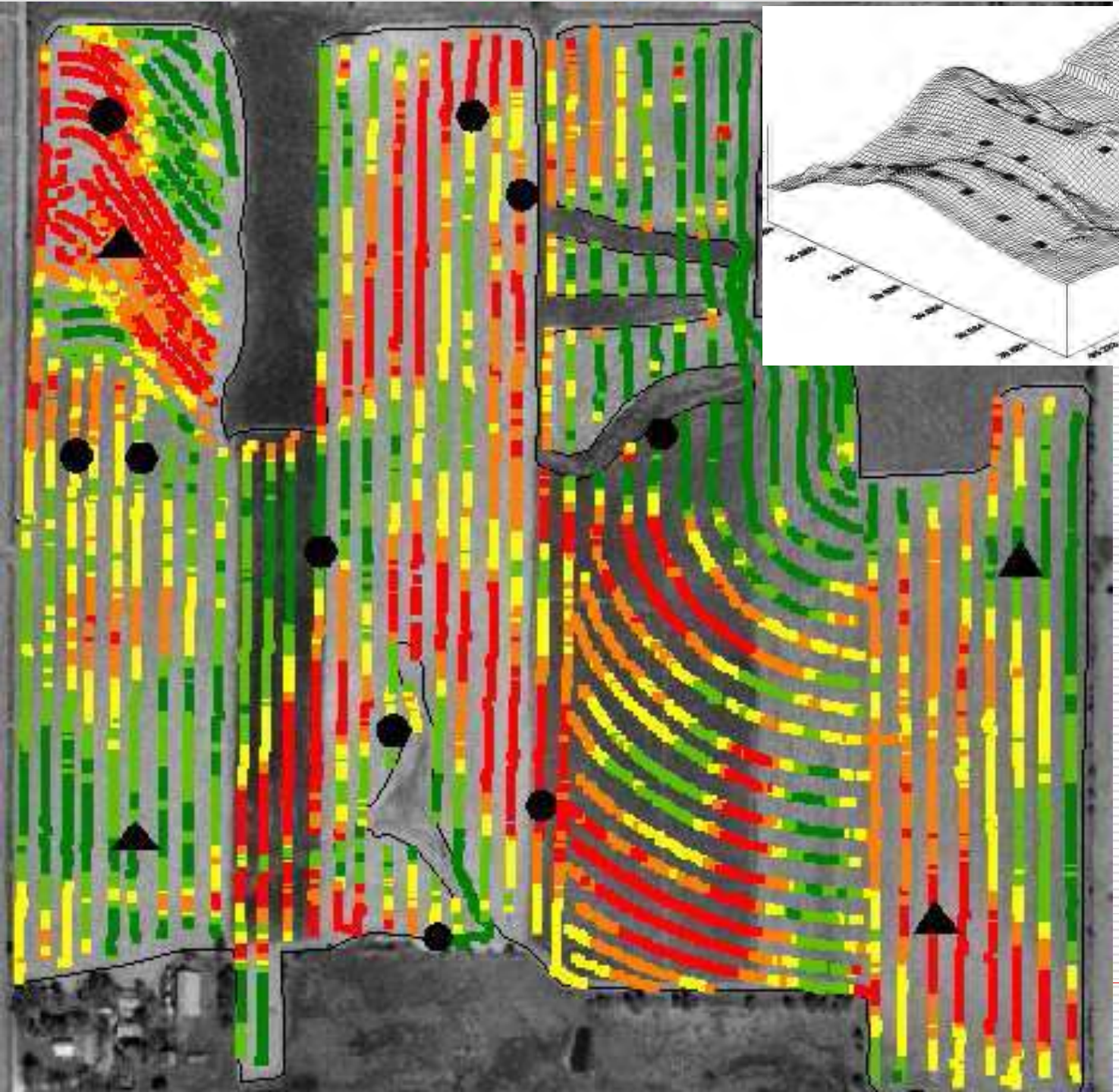
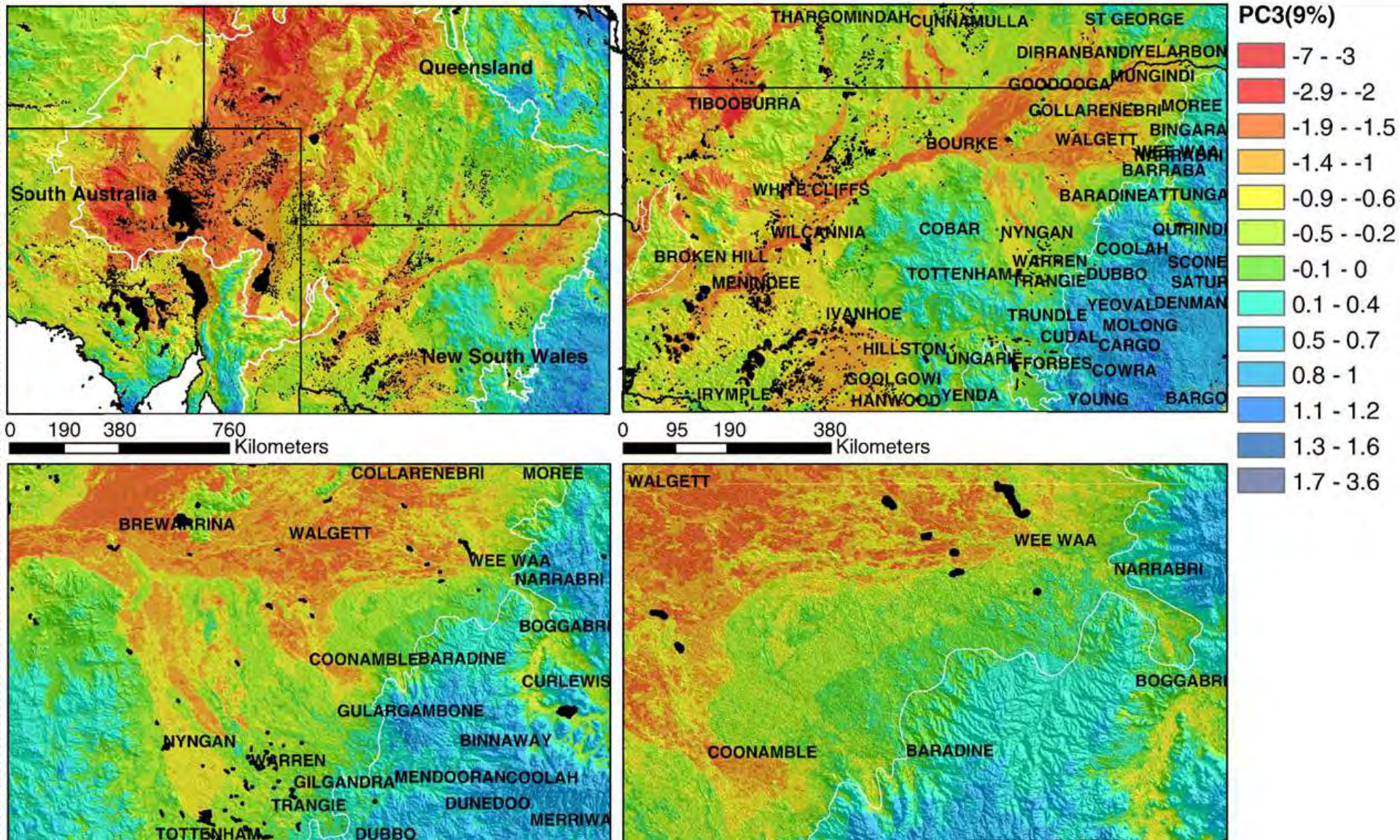
VERIS Vis-NIR Spectrophotometer



Stratification via Satellite

Viscarra Rossel and Chen (2011)



Portable Spectrograph & NIR

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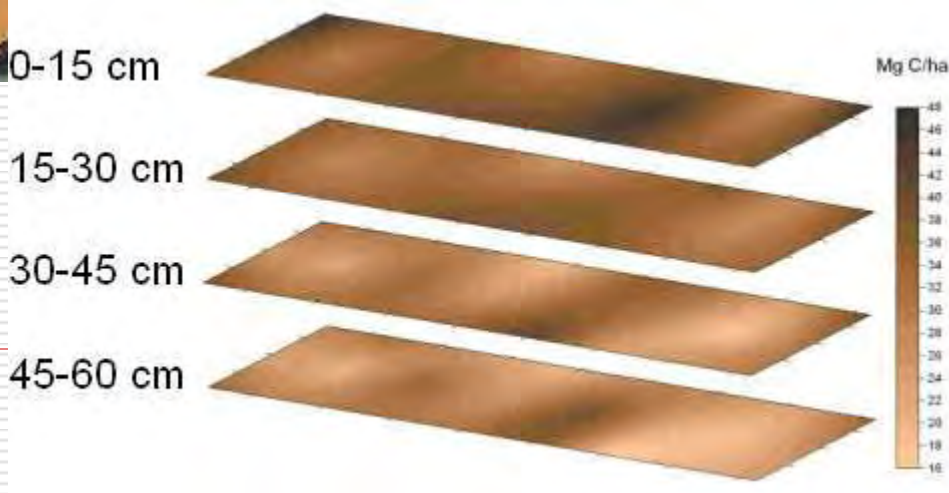
Legend
49.172 - 62.435
47.083 - 49.171
44.841 - 47.082
41.036 - 44.840
0.000 - 41.035


0-15 cm
15-30 cm
30-45 cm
45-60 cm
Mg C/ha

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New Concepts

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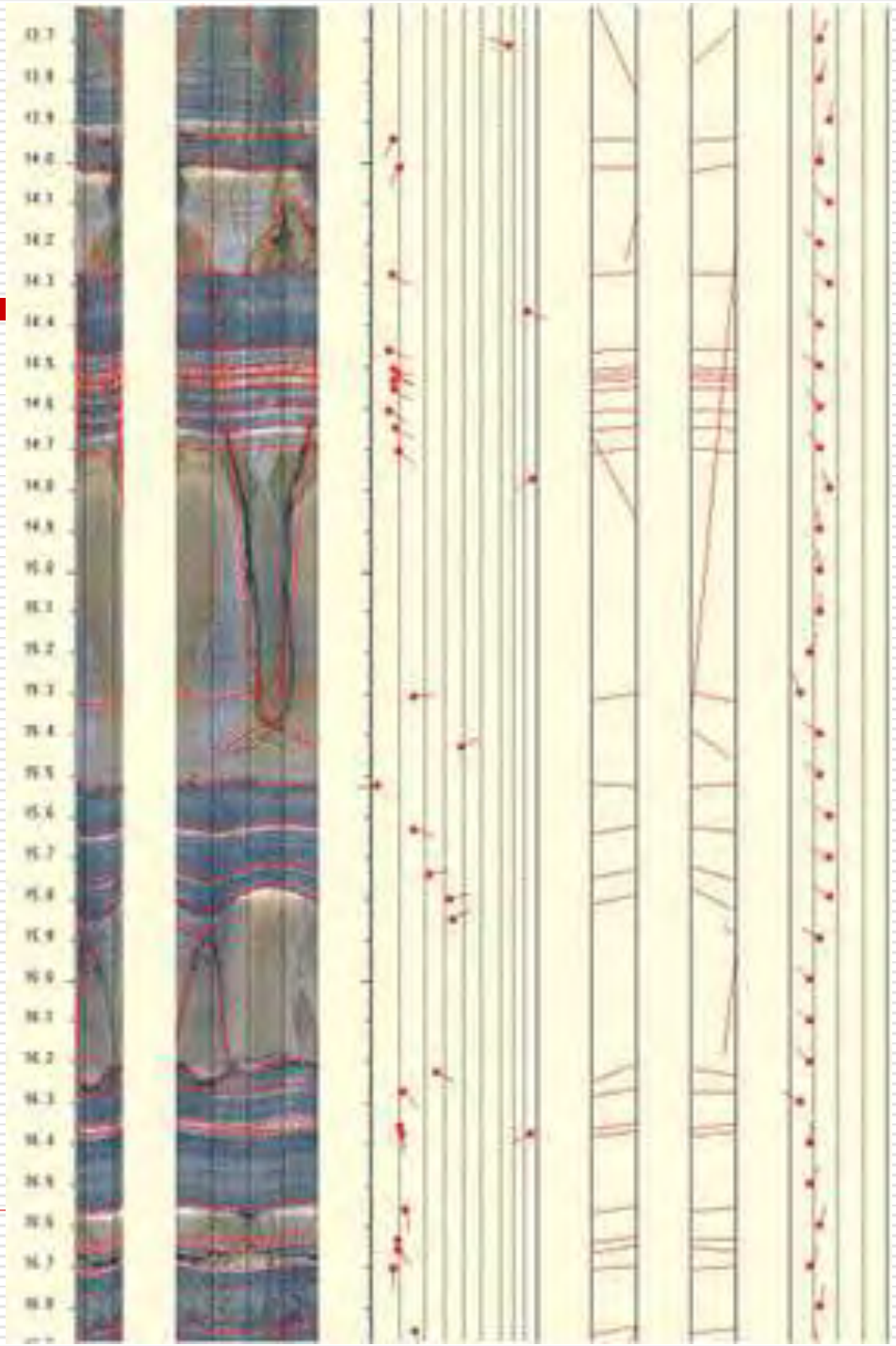

New Concepts – The Earth Rover

A core sampling rig linked to a set of four proximal sensors. The 4 sensors are:

- a line-scan camera.

- DRIFTS sensor – (diffuse near infra-red reflectance spectrum) to measure soil carbon content.

- LIBS sensor – (laser-induced breakdown spectroscopy) to measure the amount of nominated elements (including carbon).

NASA Spirit Rover Completes Mission on Mars

- DAX sensor - measures the bulk density and water content profile of the core sample.

New Concepts – Methane
1. Bolus

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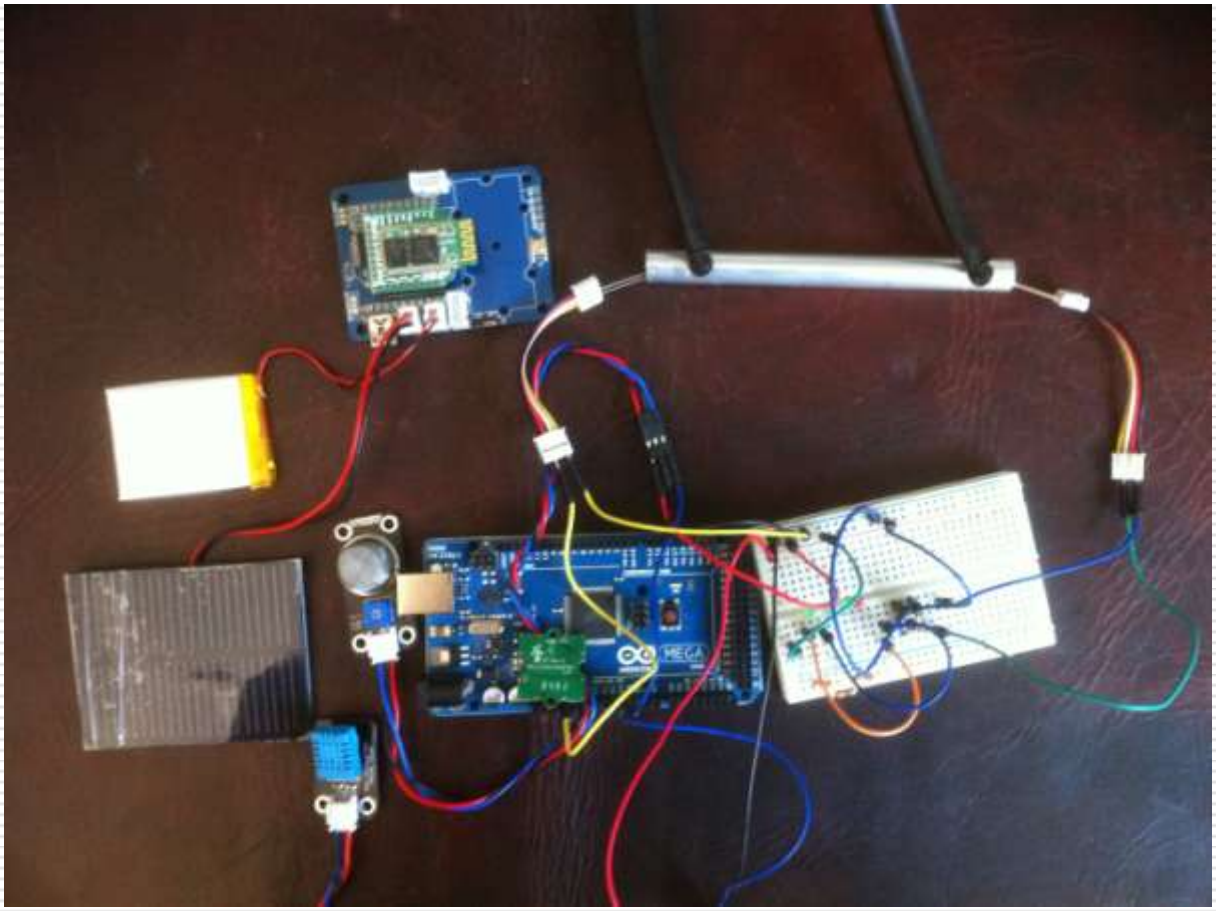
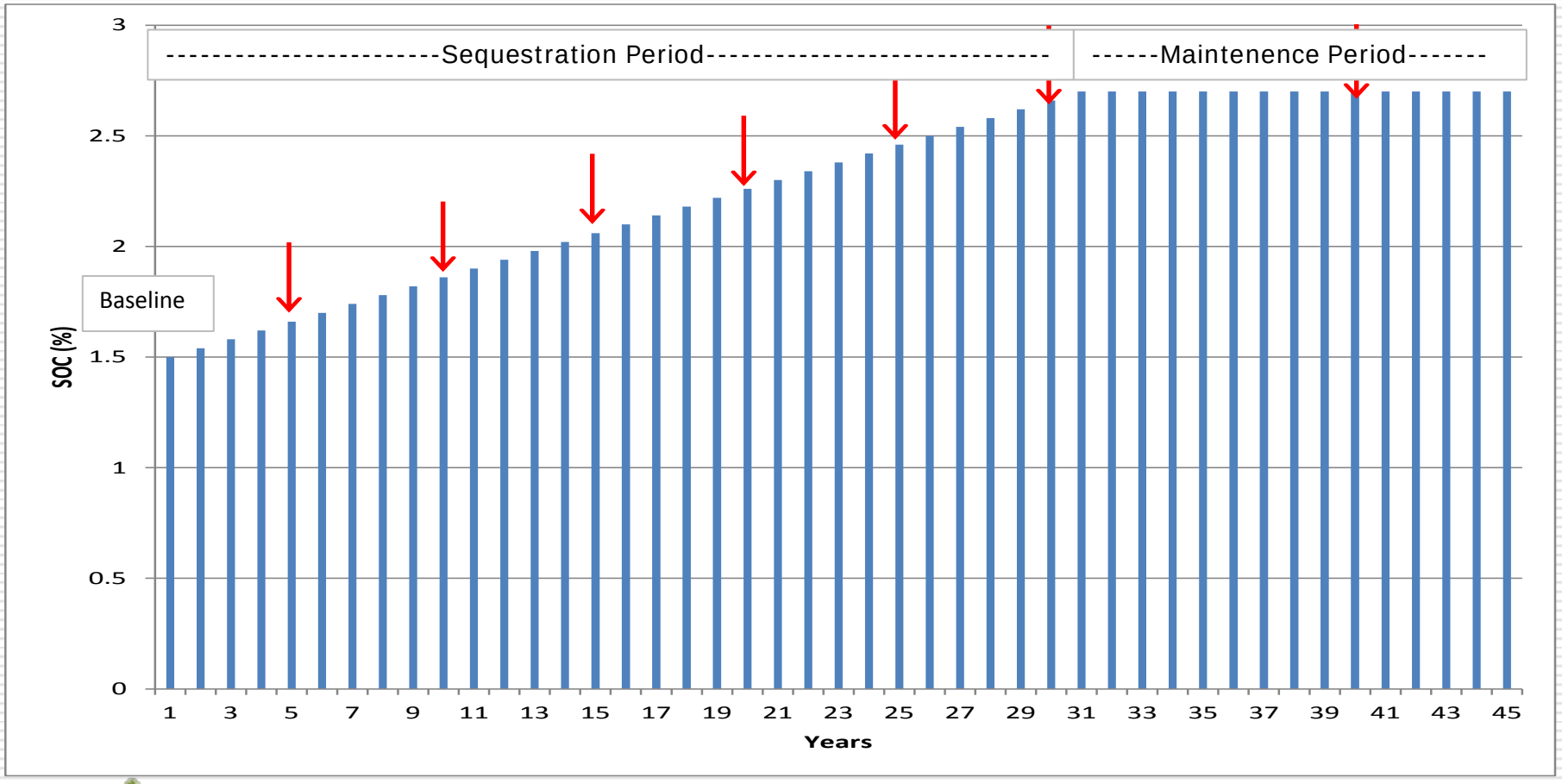
Industry Capability Network (Victoria) & Finney Whelan International.

New Concepts – Methane
1. Home made device ($200)



Sequestration and Maintenance Cycles



Estimating SOC available for sale

- By physical sampling every 5 to 10 years for the Sequestration period; may be extended to every 10 to 20 years after sequestration has reached the equilibrium level for the region.
- Monitored by remote sensing
- By modeling between physical samplings e.g. year 1, 2, 3 & 4

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What does the sampling/monitoring cost?

- Baselining
  - $25 per ha (latest estimate on a large area)
- Monitoring
  - $12 per ha each 5 to 10 years

All subject to validation; will vary with area.

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Is it worth it?

Nett Projected Annual Income on 4,000ha

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
$181K	$181K	$181K	$181K	$732K	$226K	$226K	$226K	$226K	$753K
Yr 11	**Yr 12**	**Yr 13**	**Yr 14**	**Yr 15**	**Yr 16**	**Yr 17**	**Yr 18**	**Yr 19**	**Yr 20**
$236K	$236K	$236K	$236K	$762K	$236K	$236K	$236K	$236K	$762K

The average annual GROSS MARGIN from CARBON is $78 per ha in this example

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HOW can the RISKS be mitigated?

- Permanence
  - Buffer Pools
  - Not counting Labile Carbon
  - Modelling
  - Monitoring (Satellite)
- Management Ability
  - Buffer Pools
  - Monitoring
- Fire, Drought
  - Buffer Pools
  - Not counting labile carbon

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Can the CFI be By-passed?

What are the Implications For Graziers?

- Permanence Period
- Contracts over the carbon
- Are there liabilities or assets associated with any carbon contract?
- Are there liabilities with Nitrous Oxide or Methane?
- Is there potential for sequestration?
- Leasehold v Freehold

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What should you do now?

1. Separate Carbon farming from the carbon tax in your mind.
2. Establish if you have opportunity eg woodlots, soil C, Methane, Fertilizer reduction.
3. Develop your awareness of opportunities
4. Budget for baselining
5. Stay abreast of progress

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