Oregon State University | Extension Service

What is Sustainable Agriculture?

Why is it important?

October, 2009

Nick Andrews
North Willamette Research & Extension Center
(503) 678-1264 x149
nick.andrews@oregonstate.edu

POWERED BY ORANGE

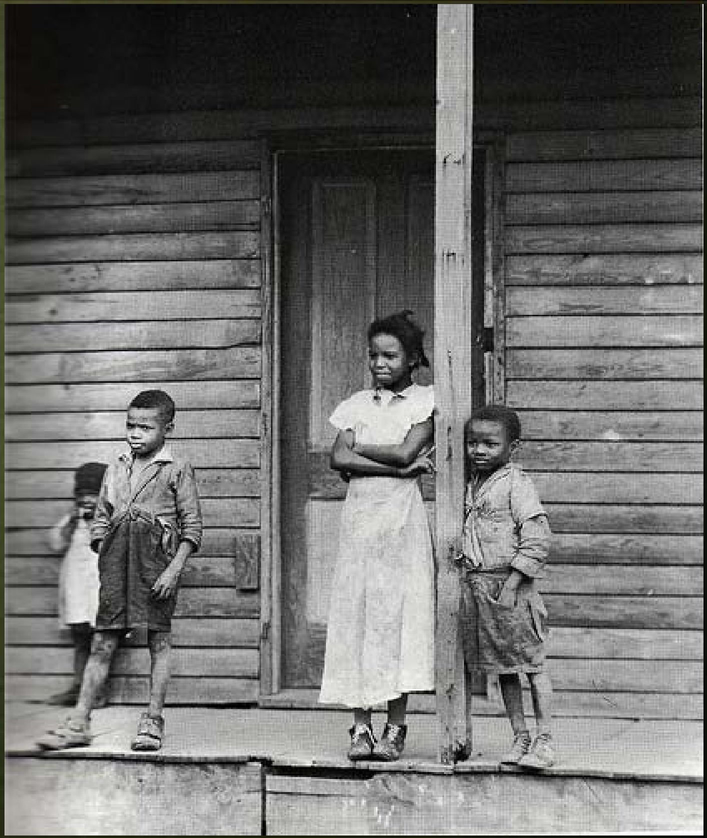
When a process is sustainable, it can be maintained indefinitely

---

Can our food and farming systems be maintained indefinitely?

ECONOMIC SUSTAINABILITY

- Family net assets are stable or increasing over time
- Profits from farm products are fair and stable
- Most farm inputs are available from local sources
- Government payments reward ecosystems services



Adapted from Sullivan (2003). Applying The Principles Of Sustainable Farming

Adapted from Sullivan (2003). Applying The Principles Of Sustainable Farming

SOCIAL SUSTAINABILITY

- The farm supports other businesses and families in the community
- Farms are locally owned and food dollars circulate within the local economy
- The number of rural families is going up or holding steady

Adapted from Sullivan (2003). Applying The Principles Of Sustainable Farming

SOCIAL SUSTAINABILITY

- Young people take over their parents' farms and continue farming
- College graduates return to the community after graduation
- Local people have access to affordable food
- Farmers are generally happy

Adapted from Sullivan (2003). Applying The Principles Of Sustainable Farming

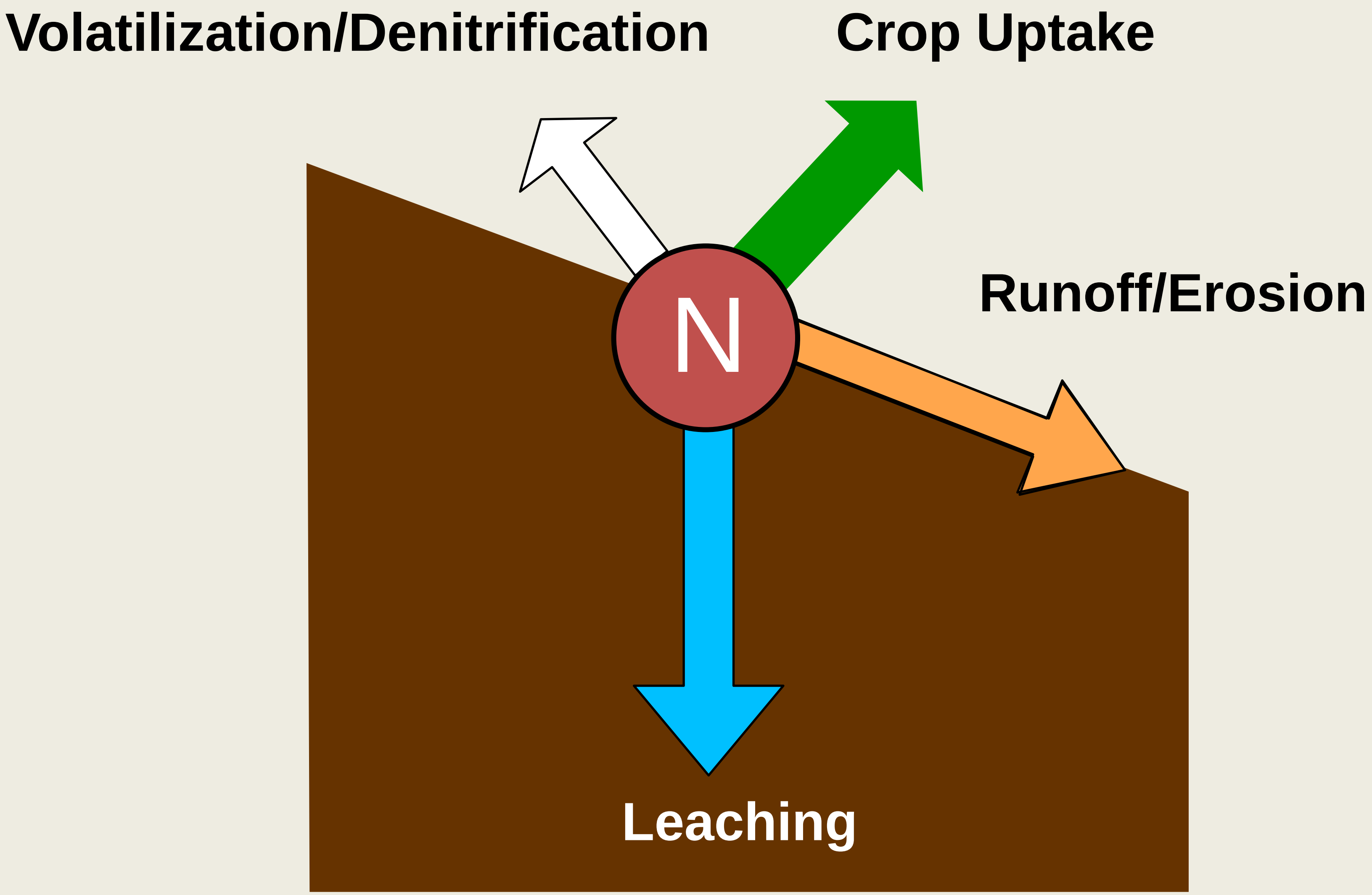
ENVIRONMENTAL SUSTAINABILITY

- Erosion is minimal and soil quality is being maintained or improved
- Farms can maintain or improve the quality of water flowing through their farm
- Wildlife habitat is protected and being improved
- Water temperatures are cool and stable
- Regional landscapes are diverse

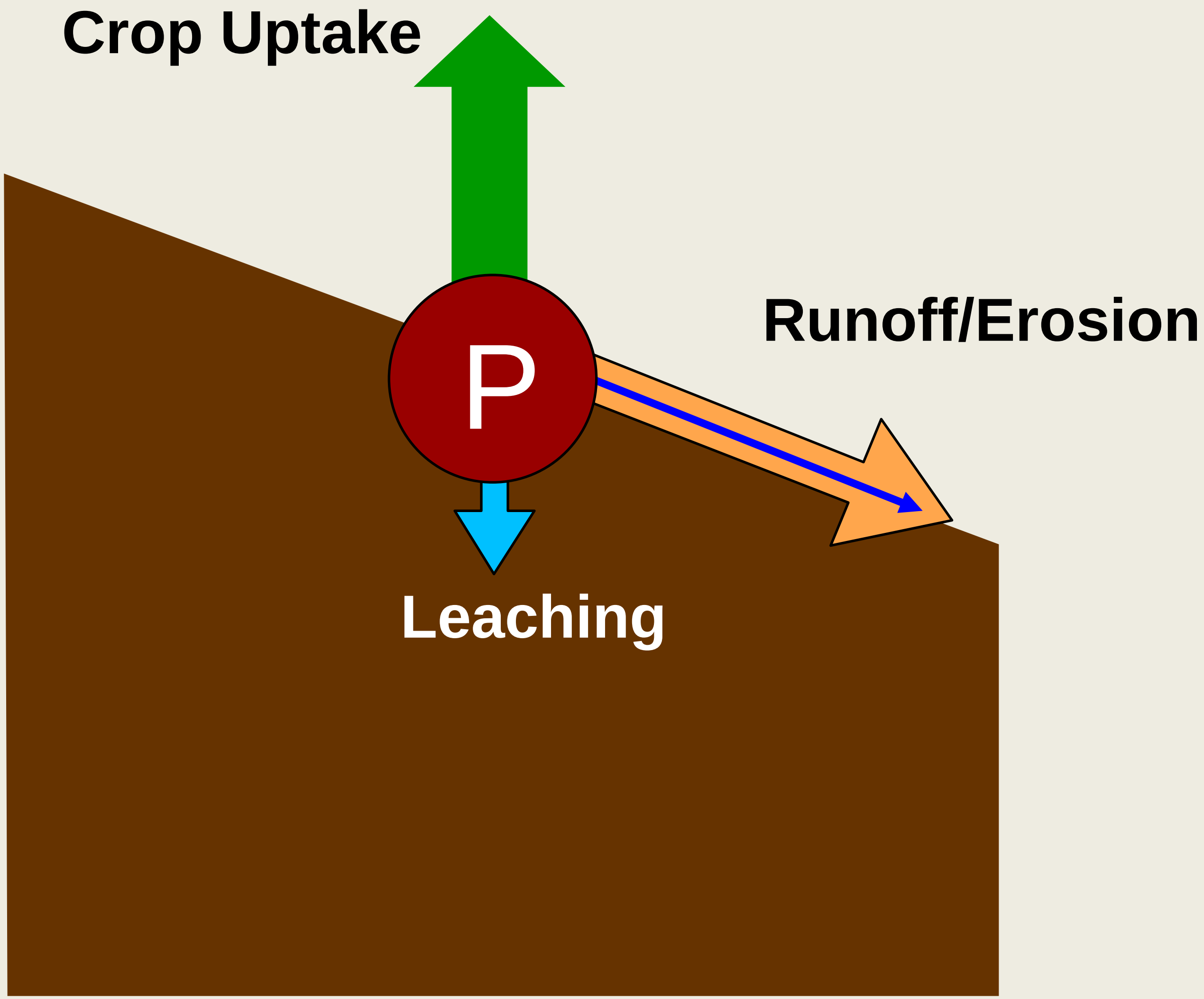
IS AGRICULTURE PART OF THE ENVIRONMENTAL PROBLEM OR PART OF THE SOLUTION?

- Biodiversity
- Water pollution
- Soil depletion
- Climate change

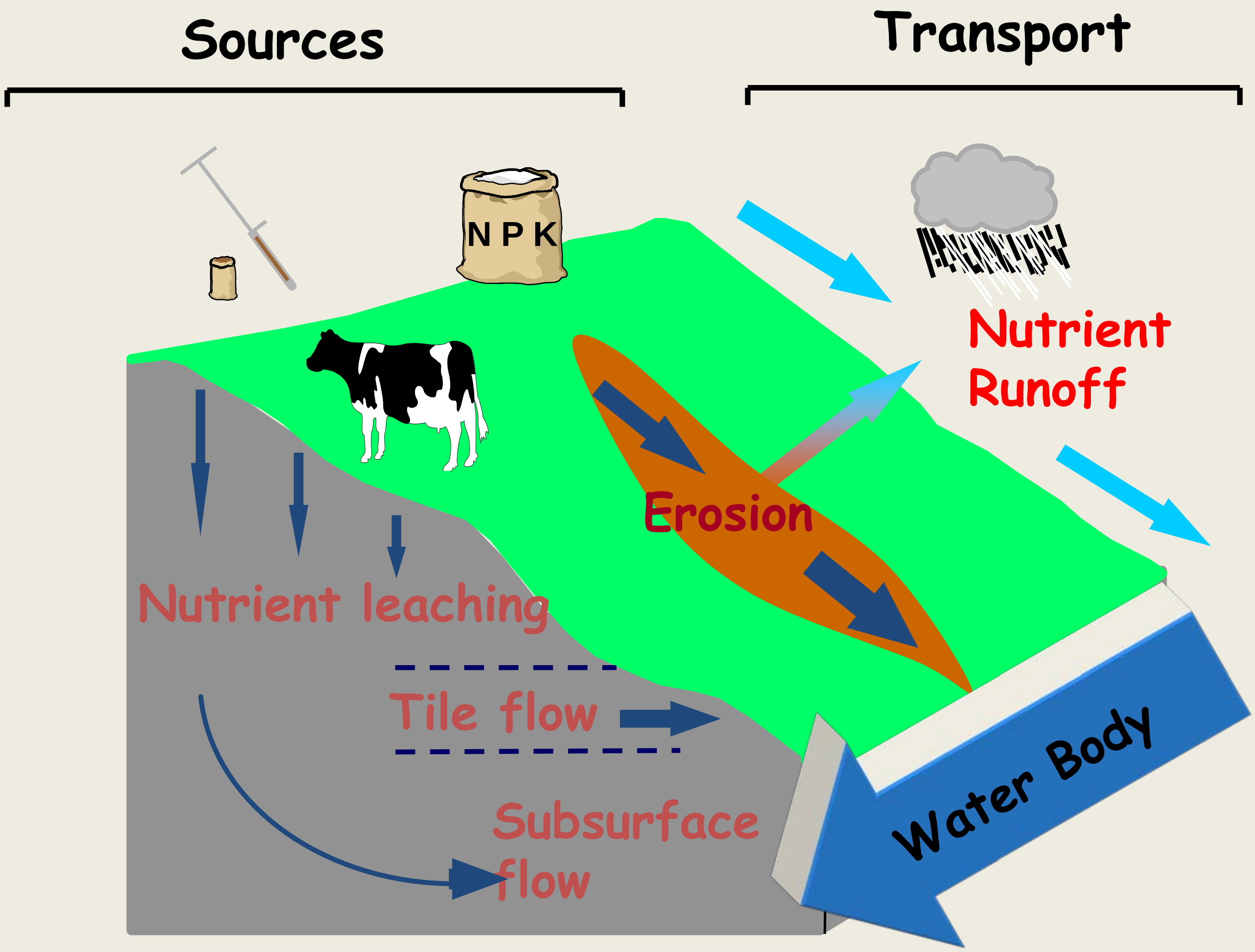
Nitrogen Transport



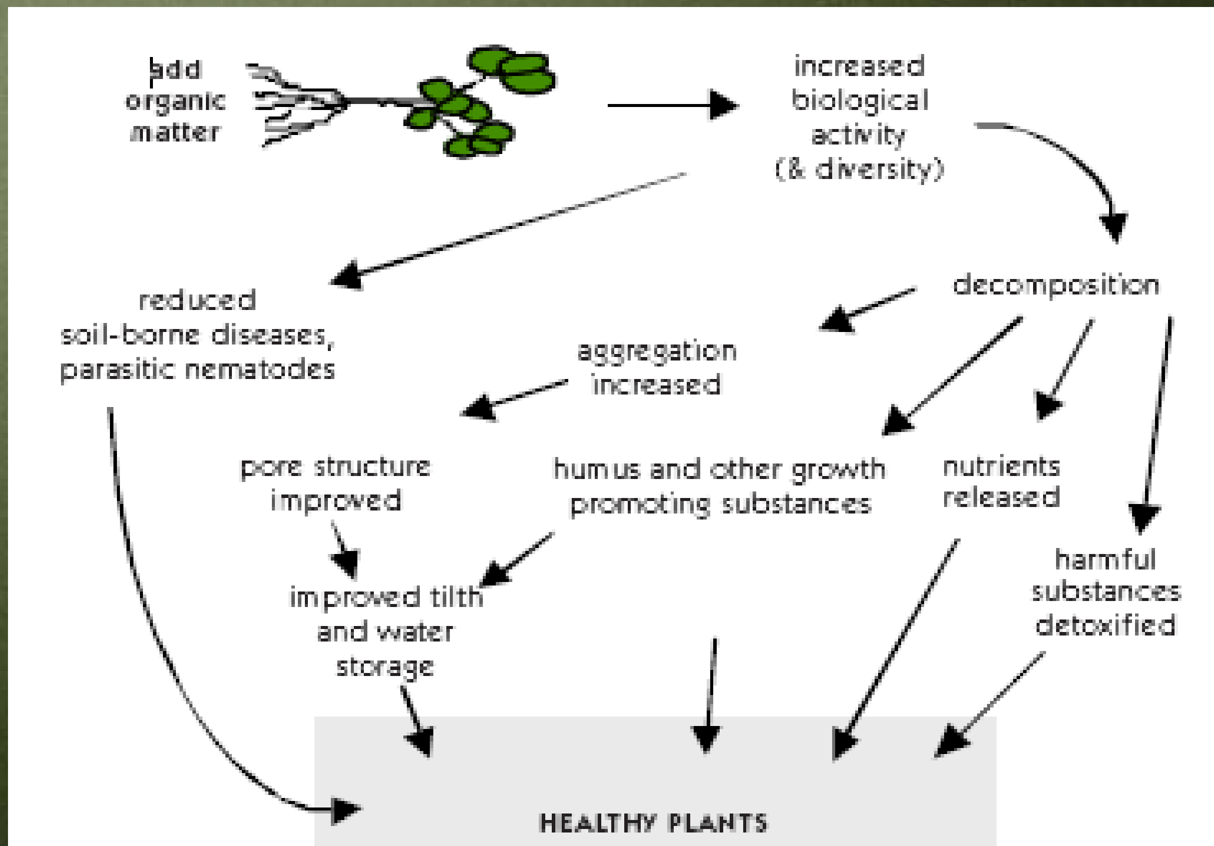
Phosphorus Transport



Nutrient Pollution: Source and Transport



Soil organic matter is key



SOM also protects water quality

Building Soils for Better Crops. Chapter 4. Why is organic matter so important?
http://www.sare.org/publications/soils.htm

Soil aggregation is important for preventing erosion

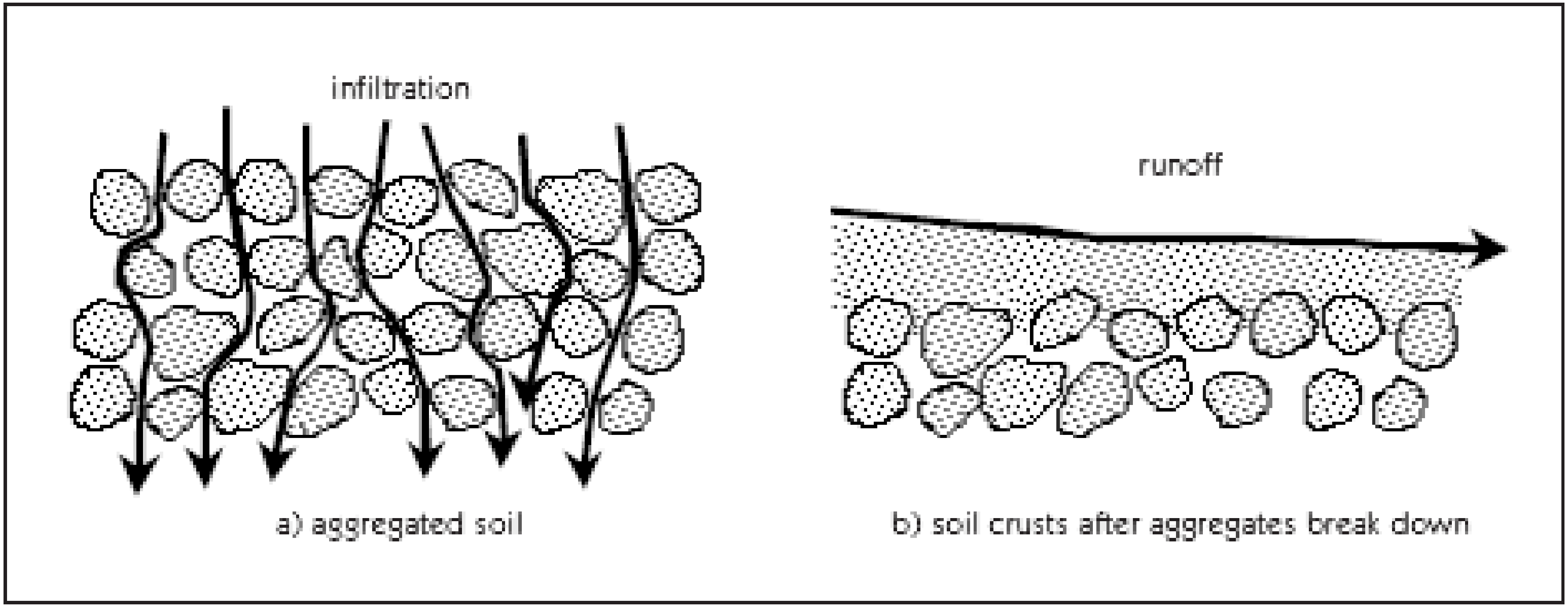


Figure 4.4 Changes in soil surface and water-flow pattern due to soil crusting.

Building Soils for Better Crops. Chapter 4.

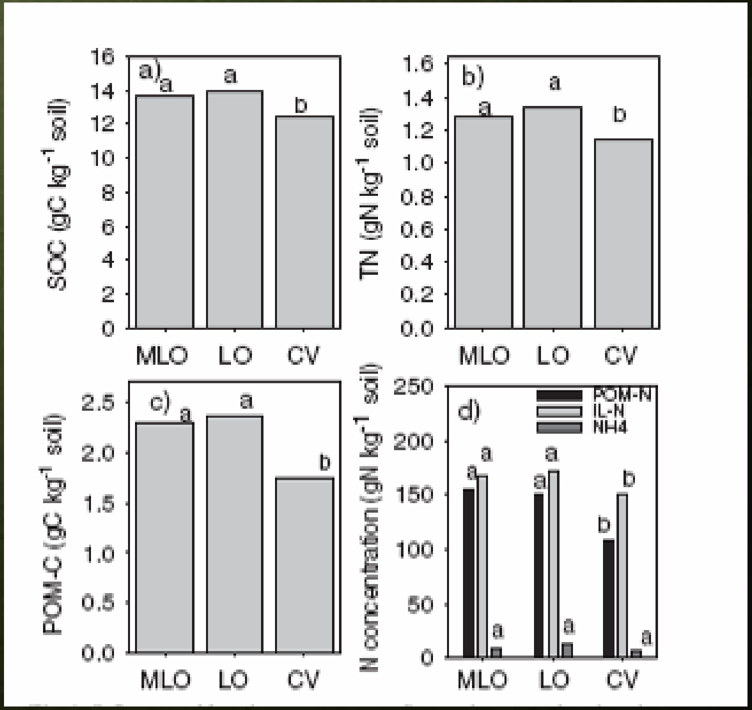
9-year annual system trials:

Comparing legume-based, manure-based and synthetic fertilizer systems in 6 States

Organic management led to:

POM, C & N ↑ 30-40%

SOC (ave 10yr) ↑ 14%



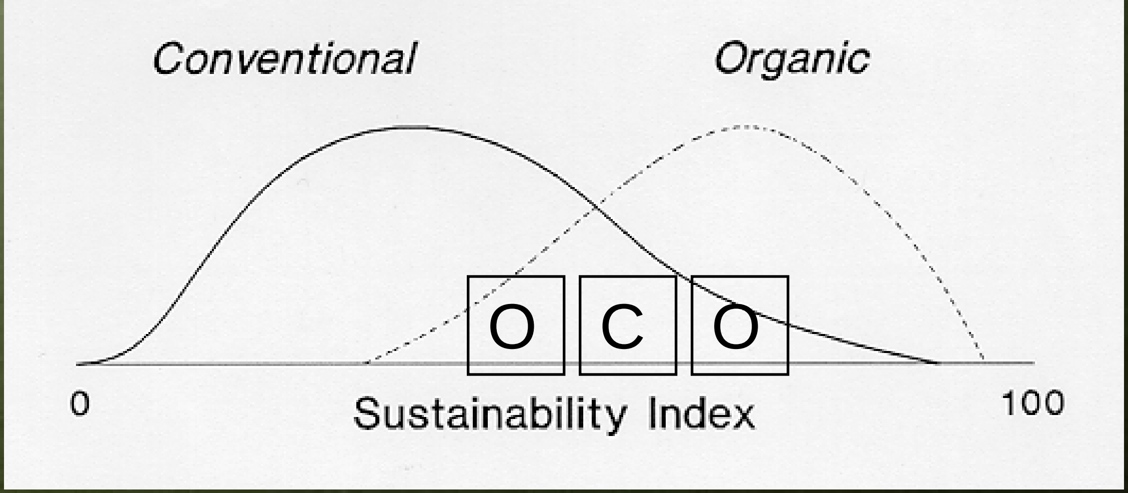
(Marriott & Wander, 2006)

Legume system ≈ manure system

MLO=manure org, LO=legume org, CV=conventional

Slide courtesy of David Granatstein (WSU)

Organic farms can be more or less sustainable than a conventional farm



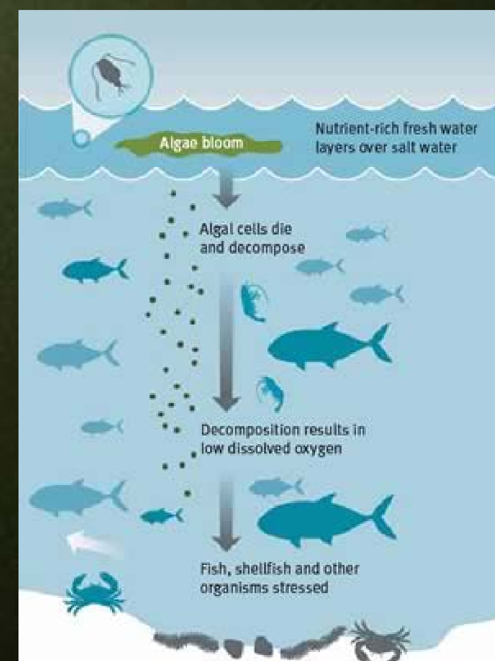
Slide courtesy of David Granatstein (WSU)

Sustainability is more important than "organic"

Many successful organic and conventional farmers are key innovators in efforts to develop a sustainable economy

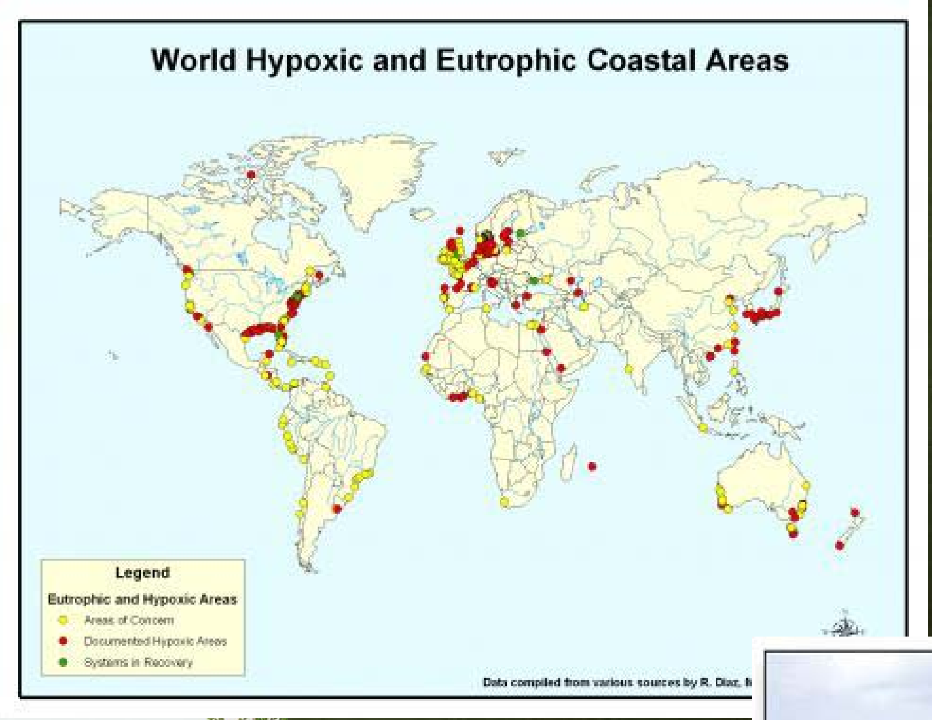
WATER POLLUTION

Poor nutrient mgt → eutrophication → hypoxia



Too much of a good thing

WATER POLLUTION



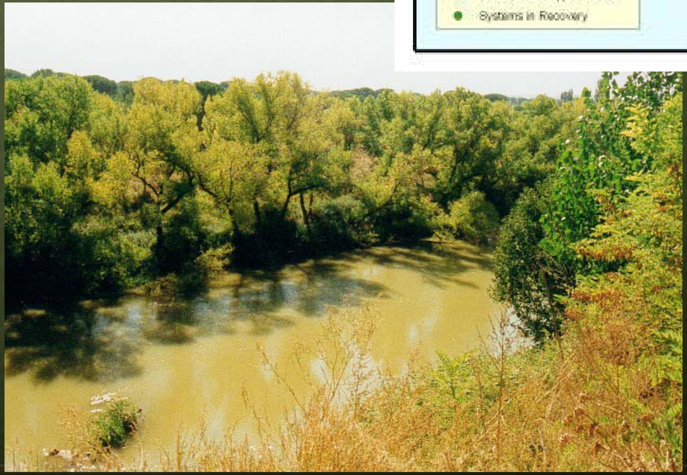


Photo: Nancy Rabalais, Louisiana Universities Marine Consortium

WATER POLLUTION

400 dead zones around the world

Doubles every decade

Most caused by fertilizer and/or sewage pollution

Climate change is causing PNW dead zone, not agriculture

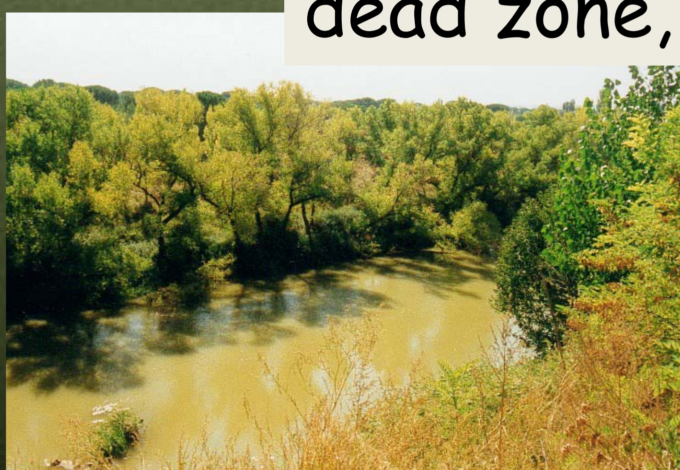


Photo: Nancy Rabalais, Louisiana Universities Marine Consortium

Journal of
Environmental Quality

VOLUME 30 • MARCH–APRIL 2001 • NUMBER 2

SYMPOSIUM PAPERS

Overview of Hypoxia around the World

Robert J. Diaz*

EFFECTS ON OCEANS

No
estuar
chang
oxygen. While hypoxic and anoxic environments have existed through geological time, their occurrence in shallow coastal and estuarine areas appears to be increasing, most likely accelerated by human activities. Several large systems, with historical data, that never re-

riatic
). In
s less
land–
Virginia; Saanich Inlet, British Columbia; Port Hacking, Australia).

The northern Gulf of Mexico may be typical of these

Journal of
Environmental Quality

"No other environmental variable of such ecological importance to estuarine and coastal marine ecosystems around the world has changed so drastically, in such a short period of time.

It appears that many ecosystems that are now severely stressed by hypoxia may be near or at a threshold of change or collapse (loss of fisheries, loss of biodiversity, alteration of food webs)."

areas appears to be increasing; most likely accelerated by human activities. Several large systems with historical data that never re-

The northern Gulf of Mexico may be typical of these

WATER POLLUTION

Mid Willamette Water Quality (DEQ)

Table 1. Seasonal Average OWQI Results for the Middle Willamette Basin (WY 1986 -1995)

1986-1995

Site	STORET Number	River Mile	Summer Average	FWS Average	Minimum Seasonal Average
S. Santiam R. @ HWY 226 (Crabtree)	40[illegible]	[illegible]	[illegible]	88	88
N. Santiam R. @ Greens Br.	40[illegible]	[illegible]	[illegible]	91	91
Willamette R. @ Salem	40[illegible]	[illegible]	[illegible]	80	80
Willamette R. @ Wheatland Ferry	402012	71.9	84	82	82
Salt Ck. @ Whiteson	404184	1.8	38	40	38
S. Yamhill R. @ HWY 99W	402625	16.5	83	74	74
N. Yamhill R. @ Poverty Bend Rd.	402606	4.5	77	70	70
Yamhill R. @ Dayton	402031	5.0	58	63	58
Willamette R. @ Newberg Br.	402010	48.6	83	78	78
Pudding R. @ HWY 214 (u/s Cannery)	402319	26.9	65	57	57
Pudding R. @ HWY 211 (Woodburn)	402317	22.4	52	46	46
Pudding R. @ Bernard Rd. (Whiskey Hill)	404207	17.5	58	54	54
Pudding R. @ HWY 99E (Aurora)	402594	8.1	60	54	54
Molalla R. @ Canby	402314	3	86	86	86
Willamette R. @ Canby Ferry	402007	34.4	81	79	79

Summer: June - September; FWS (Fall, Winter, & Spring): October - May
Scores - Very Poor: 0-59, Poor: 60-79, Fair: 80-84, Good: 85-89, Excellent: 90-100

http://www.deq.state.or.us/lab/WQM/wqimain.htm

WATER POLLUTION

PUDDING RIVER

Historically impacted by point sources and non-point sources of pollution.

Point sources include sewage trtmt plants, food processing plants and other municipal activities.

Non-point sources include sediment from erosion, and poorly managed fertilizers and pesticides.

Lower Willamette Water Quality (DEQ)

Table 1. Seasonal Average OWQI Results for the Lower Willamette Basin (WY 1986 - 1995)

Site	STORET Number	River Mile	Summer Average	FWS Average	Minimum Seasonal Average
Tualatin R. @ Rood Br.	402131	39.0	78	66	66
Beaverton Ck. @ 216th Ave. (Orenco)	402150	0.3	36	59	36
Tualatin R. @ HWY 210 (Scholls)	402129	26.9	50	48	48
Tualatin R. @ Elsner Rd.	402128	16.2	53	57	53
Fanno Ck. @ Bonita Rd.(Tigard)	402139	2.3	55	55	55
Tualatin R. @ Boones Ferry Rd.	402126	8.6	37	40	37
Clackamas R. @ High Rocks	402913	1.2	87	88	87
Johnson Ck. @ SE 17th Ave. (Portland)	404000	0.2	26	30	26
Willamette R. @ Hawthorne Br.	402288	13.2	79	74	74
Swan Island Channel (Willamette R.)	402478	0.5	63	77	63
Willamette R. @ SP&S RR Br. (Portland)	402000	7.0	74	75	74
Columbia Slough @ Landfill Rd.	402881	2.6	30	22	22

Summer: June - September; FWS (Fall, Winter, & Spring): October - May
Scores - Very Poor: 0-59, Poor: 60-79, Fair: 80-84, Good: 85-89, Excellent: 90-100

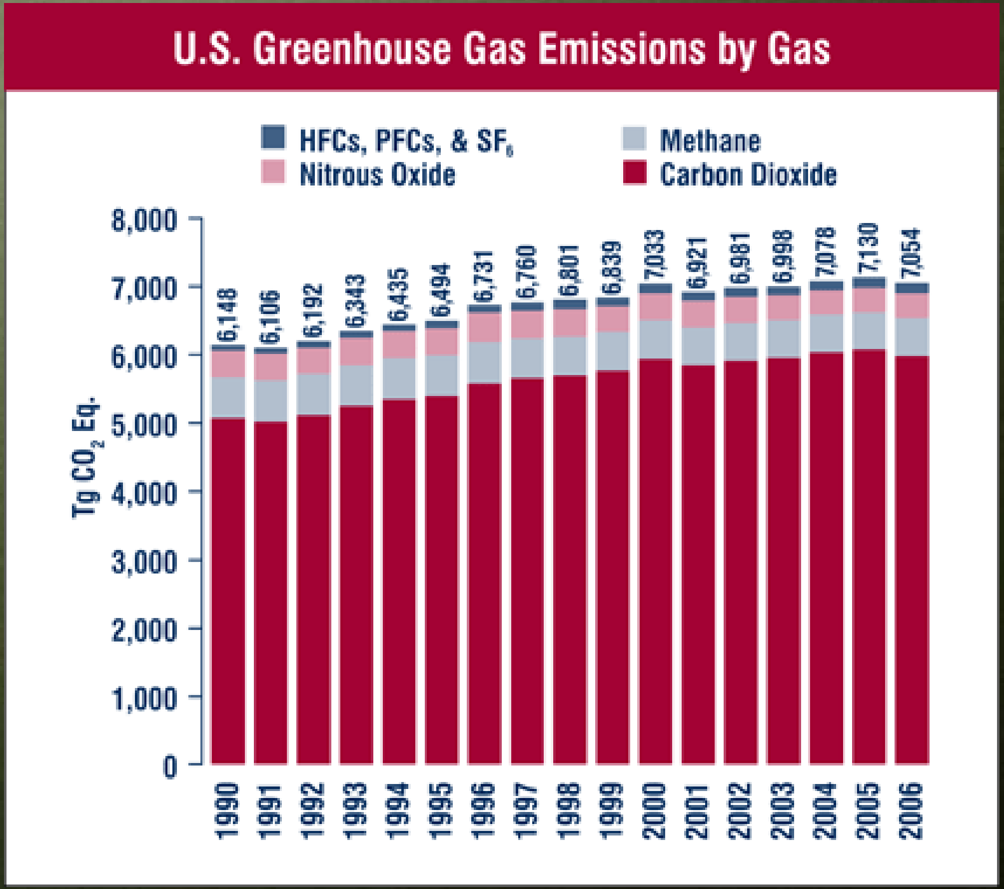
http://www.deq.state.or.us/lab/WQM/wqimain.htm

WATER POLLUTION

Agriculture

Part of problem	Part of solution
Poor manure management	Composting and good manure mgt
Erosion	soil building i.e. cover crops
Over fertilization	Good nutrient mgt
	Soil building → filtration

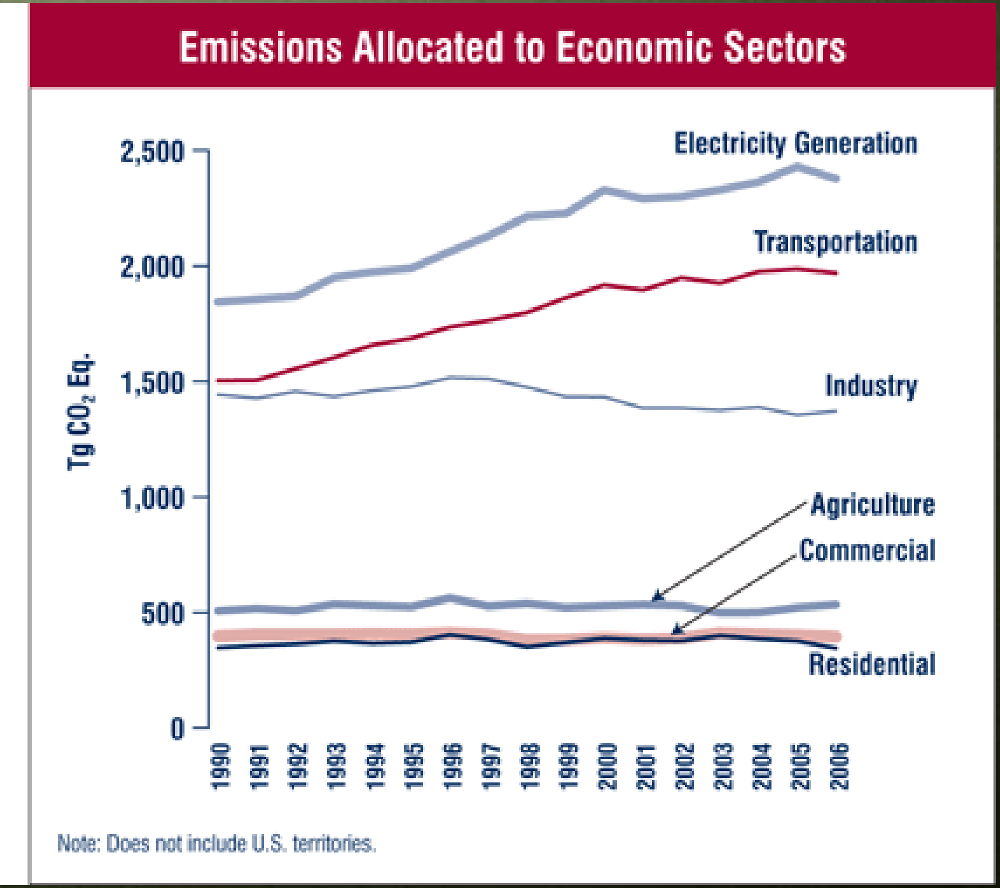
Climate Change



Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, USEPA #430-R-08-005

Oregon State UNIVERSITY | Extension Service

Climate Change

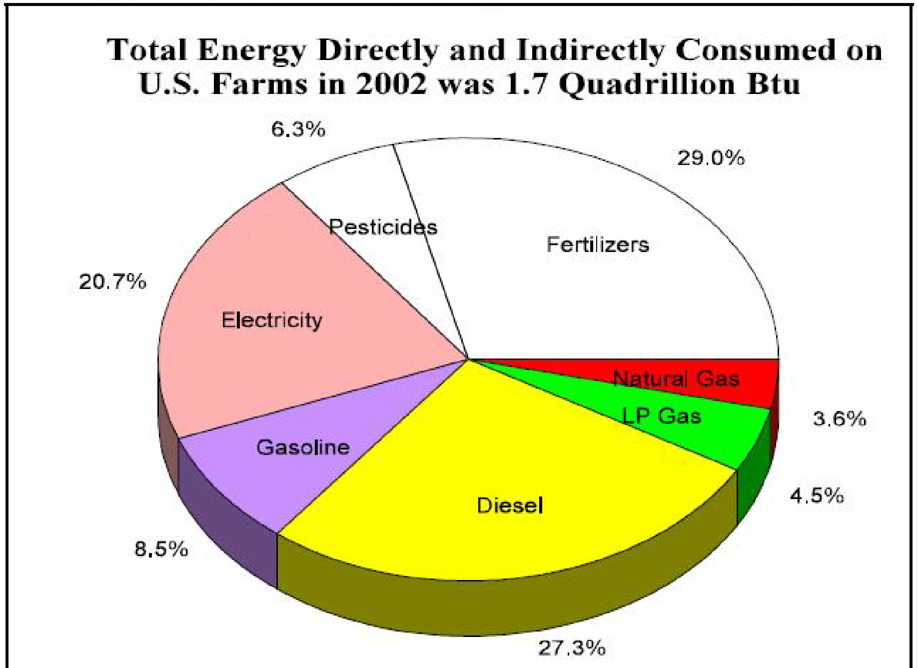


POWERED BY ORANGE

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, USEPA #430-R-08-005

Climate Change

Figure 2. U.S. Farm Energy Use by Source, 2002



Source: Miranowski (2004).

Ag ~1.73% of US direct energy consumption

Oregon State University Extension Service

Target Atmospheric CO2: Where Should Humanity Aim?

J. Hansen, (Director, NASA Goddard Inst.) et al.

"If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted… CO^2 will need to be reduced from its current 385 ppm to at most 350 ppm, but likely less than that. An initial 350 ppm CO^2 target may be achievable by phasing out coal use (mainly for electricity generation)…and adopting agricultural and forestry practices that sequester carbon. If the present overshoot of this target CO^2 is not brief, there is a possibility of seeding irreversible catastrophic effects."

Open Atmos. Sci. J. (2008), vol. 2, pp. 217-231

Target Atmospheric CO2: Where Should Humanity Aim?

J. Hansen, (Director, NASA Goddard Inst.) et al.

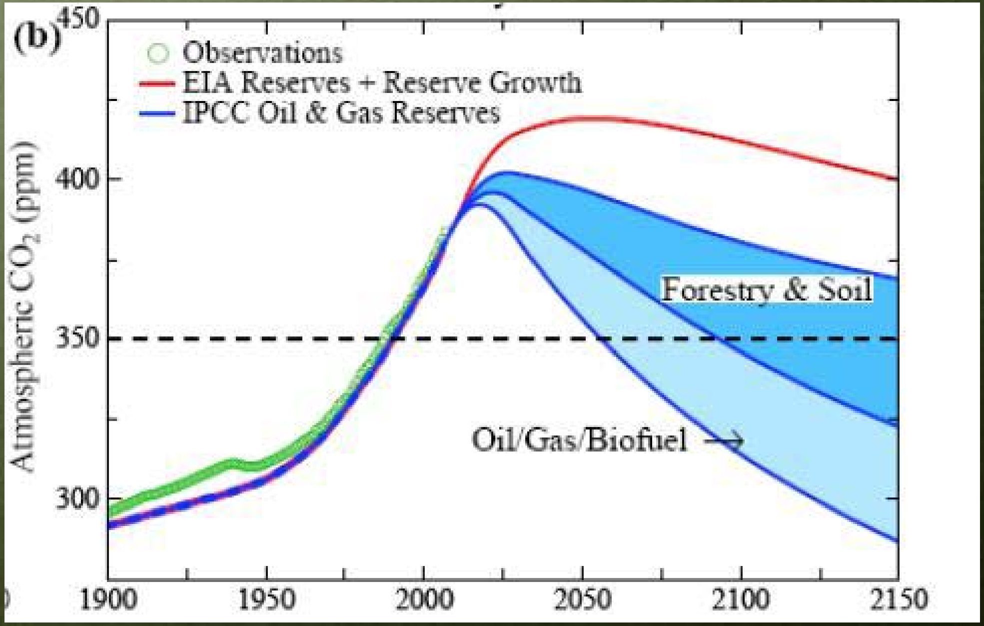
Demonstration in Micronesia

www.350.org

Open Atmos. Sci. J. (2008), vol. 2, pp. 217-231

Target Atmospheric CO2: Where Should Humanity Aim?

J. Hansen, (Director, NASA Goddard Inst.) et al.



Ag and forestry could reduce atm. CO^2 by 50ppm through carbon sequestration using biochar

Open Atmos. Sci. J. (2008), vol. 2, pp. 217-231

Oregon State University Extension Service

Energy used for N-fertilizer

Leach (1976)

• NH_4NO_3	76 MJ/kg
• Urea	83.5 MJ/kg
• Anhydrous	62.5 MJ/kg

100lbs N/ac =2,812-3757 MJ

=19-26 gallons gasoline

Courtesy of David Granatstein (WSU)

Rye, vetch & peas
~20" canopy

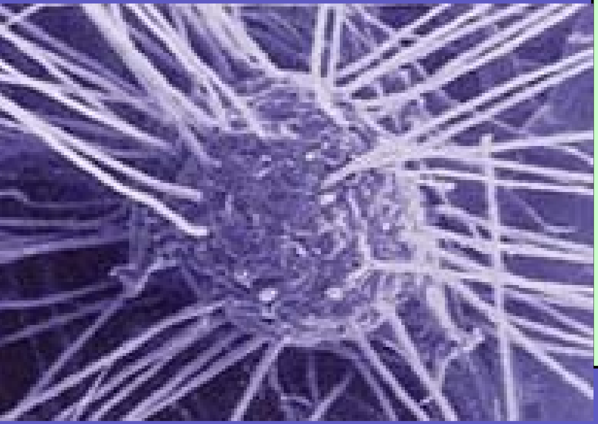
~ 155lbs total N & ~60lbs PAN

Oats & vetch
~26" canopy

~110 lbs total N & ~10lbs PAN

Western Region
Sustainable Agriculture Research and Education

High biomass crops for vegetable rotations: Sudhan grass



www.myco-labs.com/

Cover Crop Benefits

- Reduce erosion and improve soil structure
- Fix N and reduce nitrate leaching
- Supply N without increasing soil P or introducing human pathogens
- Increase soil organic matter
- Improve mycorrhizal winter survival
- Provide nectar & pollen for beneficial insects
- Reduce weed pressure

Oregon State University Extension Service

CLIMATE CHANGE

Agriculture

Part of problem	Part of solution
Unrestrained use of fossil fuels	Increased efficiency and switch to renewable energy
Long distance transport of ag inputs and products	Inputs are sourced locally and local food systems are restored
Soil organic matter depletion	soil building i.e. cover crops and compost
De-forestation	Reforestation and increased use of perennial crops

Oregon State University | Extension Service

Is Sustainable Agriculture Important?

Nick Andrews
North Willamette Research & Extension Center
(503) 678-1264 x149
nick.andrews@oregonstate.edu