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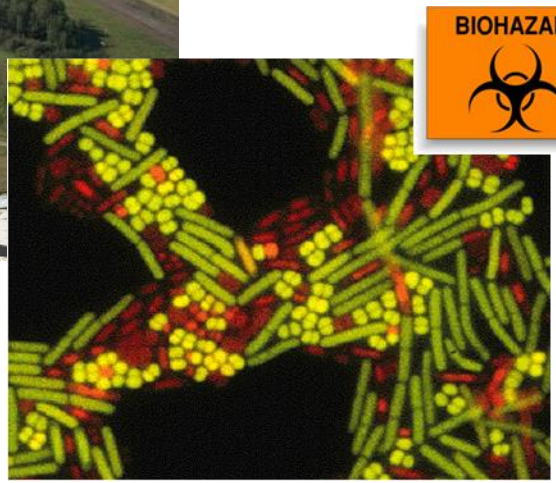
# Animal Production and the Environment

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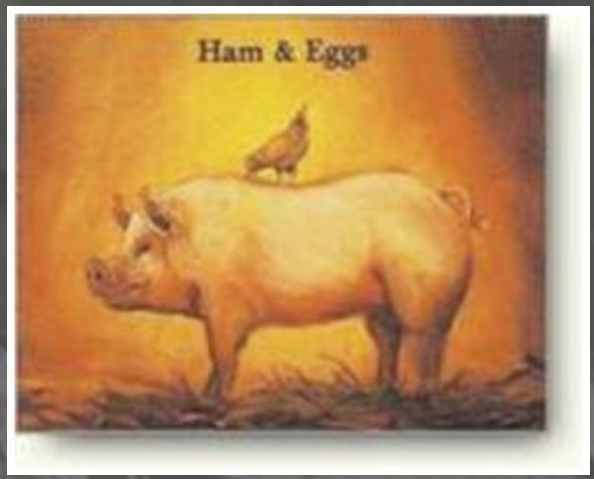
# Recycling of nutrients between animal production systems and crop production systems

**Appropriate use of manures:**

- Recycles and conserves nutrients
- Improves soil structure
- Improves crop yields

# But, manures can contain:

-Microorganisms. Pathogenic, antimicrobial resistant.

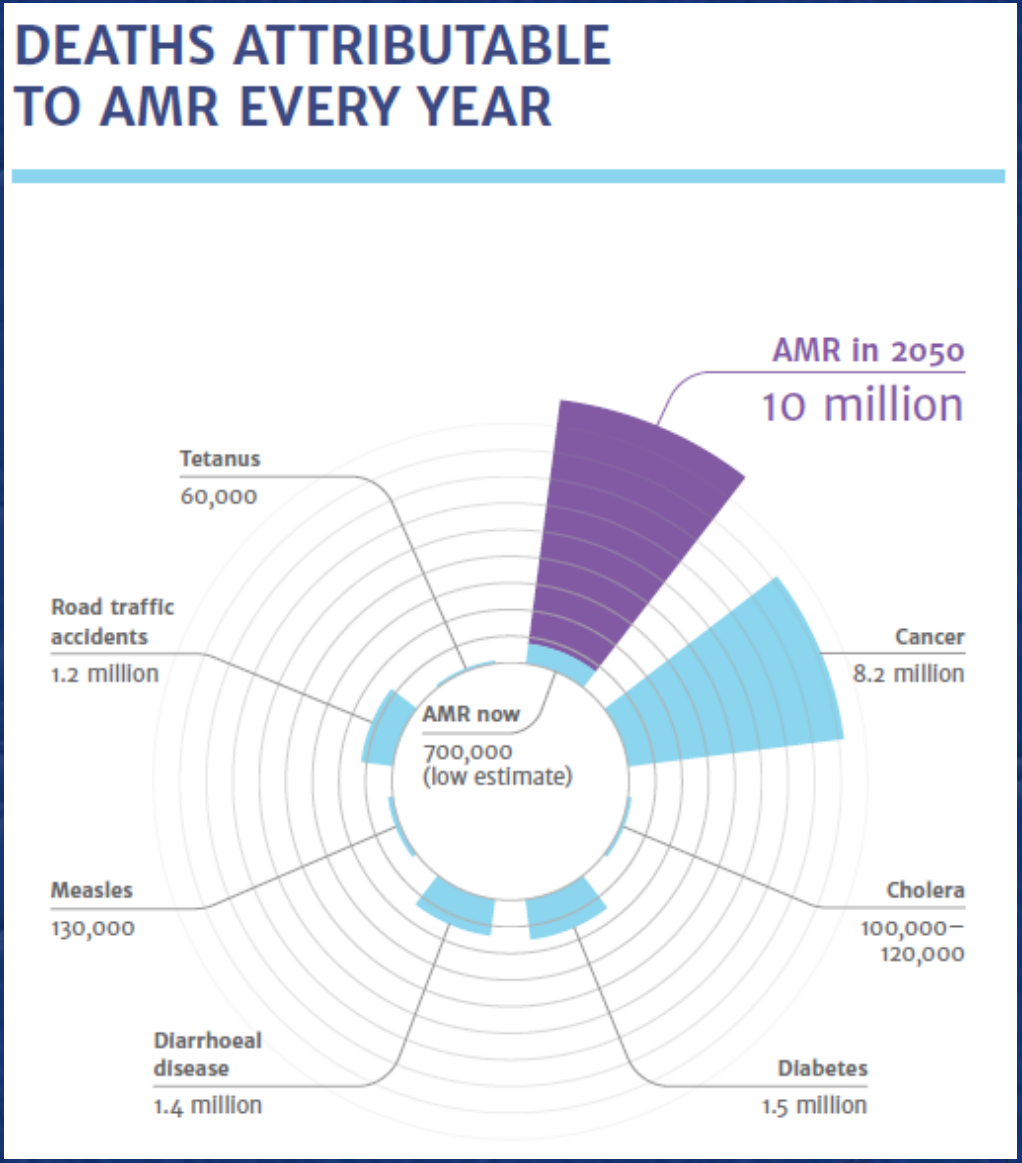
-Antimicrobial chemical residues.

-Nutrients [N,P]

The amount and types of these agents can vary with the production system

# The Review on Antimicrobial Resistance

**"The O'Neill report"**
**2016 100 trillion USD decline in global productivity attributable to 10 million deaths.**



# Understanding risk: Potential concerns

Fecal material is enriched for ARB.
Soils fertilized with these materials become enriched with ARG.

## Diverse and abundant antibiotic resistance genes in Chinese swine farms

Yong-Guan Zhu[a,b,1,2], Timothy A. Johnson[c,d,1], Jian-Qiang Su[a], Min Qiao[b], Guang-Xia Guo[b], Robert D. Stedtfeld[c,e], Syed A. Hashsham[c,e], and James M. Tiedje[c,d,2]

PNAS | February 26, 2013 | vol. 110 | no. 9 | 3435–3440

Applied and Environmental Microbiology

## Impact of Manure Fertilization on the Abundance of Antibiotic-Resistant Bacteria and Frequency of Detection of Antibiotic Resistance Genes in Soil and on Vegetables at Harvest

Romain Marti, Andrew Scott, Yuan-Ching Tien, Roger Murray, Lyne Sabourin, Yun Zhang and Edward Topp
*Appl. Environ. Microbiol.* 2013, 79(18):5701. DOI: 10.1128/AEM.01682-13.
Published Ahead of Print 12 July 2013.

# Evidence that reducing the carriage of STEC would reduce human exposure via the environment

Shiga toxigenic *Escherichia coli* incidence is related to small area variation in cattle density in a region in Ireland

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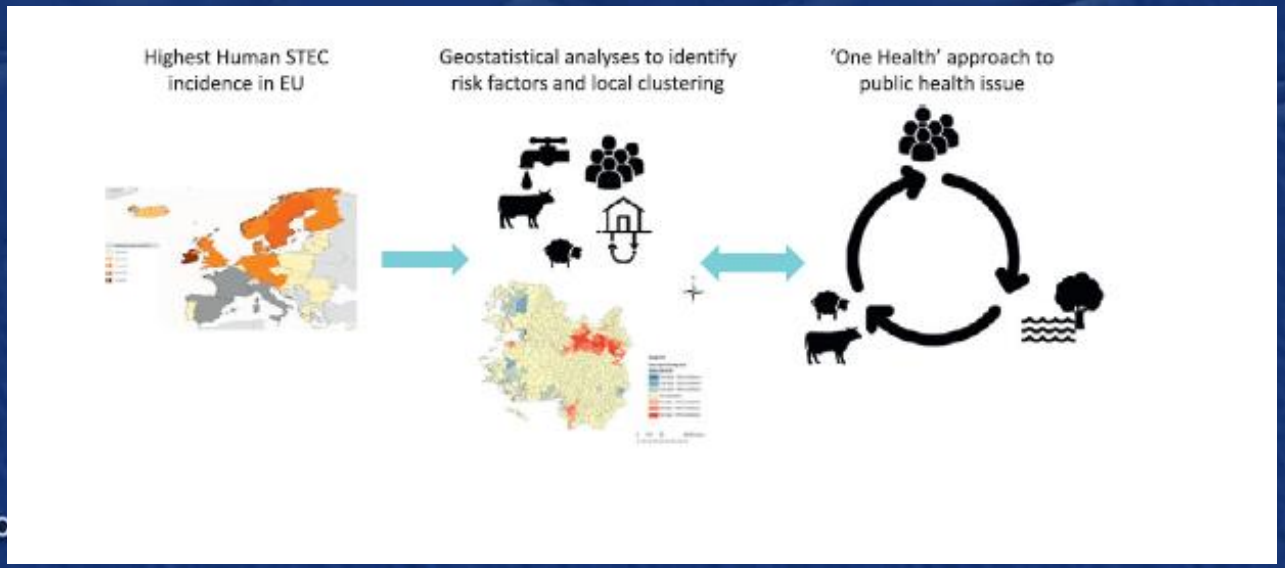
Sci. Total Environ. 2018 637-638:865-870.



# More antibiotic-resistant *E. coli* in wells proximal to livestock

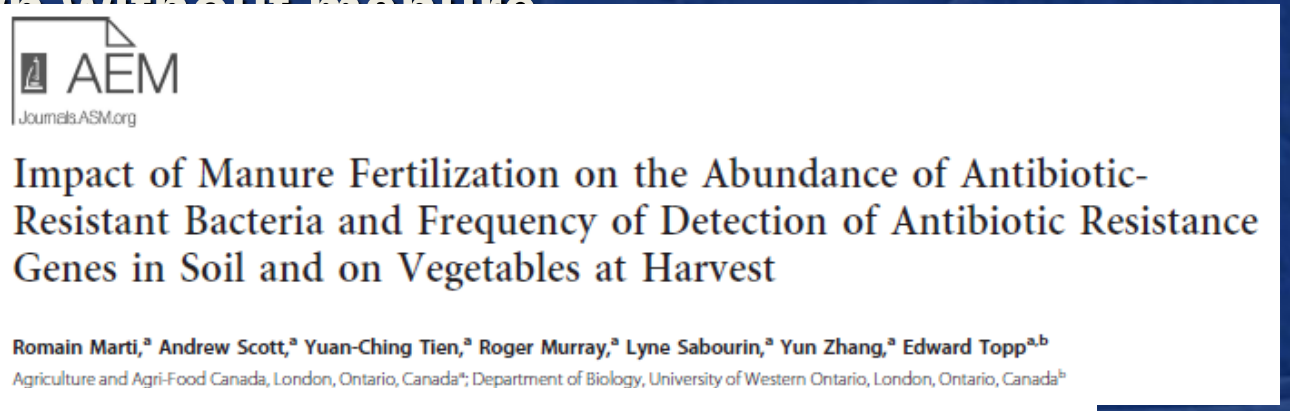
**Table 4 – Results of testing for antibiotic resistance using NARMS test panels for households participating in study-with *E. coli* contaminated drinking water sources-Ontario and Alberta, Canada-2005–2006.**

| Antibiotic class | Number and proportion of *E. coli*-positive tests | | |
|---|---|---|---|
| | No livestock ($N = 443$) | Livestock[a] ($N = 214$) | P value |
| Resistant (any) | 133 (30%) | 100 (46%) | <0.001 |
| Tetracycline | 94 (21%) | 90 (42%) | <0.001 |
| Sulphonamides | 61 (14%) | 54 (25%) | <0.001 |
| Aminoglycosides | 48 (11%) | 45 (21%) | 0.001 |
| Beta-lactams | 63 (14%) | 30 (14%) | 0.94 |
| Chloramphenicol | 15 (3%) | 11 (5%) | 0.28 |
| Quinolones | 6 (1%) | 2 (1%) | 1.00 |
| *Sul-Tet* | 42 (9%) | 52 (24%) | <0.001 |
| *Ami-Tet* | 32 (7%) | 43 (20%) | <0.001 |
| *Blac-Tet* | 35 (8%) | 25 (12%) | 0.12 |
| Multi-class[b] | 44 (10%) | 46 (21%) | <0.001 |
| *Sul-Ami-Tet* | 26 (6%) | 39 (18%) | <0.001 |
| *Blac-Sul-Ami* | 27 (6%) | 13 (6%) | 0.99 |
| *Blac-Sul-Ami-Tet* | 18 (4%) | 13 (6%) | 0.25 |

Ami: Aminoglycosides; Blac: Beta-lactams; Sul: Sulphonamides; Tet: Tetracycline.

**Genes associated with antibiotic resistance can persist in soil for multiple seasons following manure application**

**Vegetables harvested in the year of manure application will carry a larger burden of antibiotic resistance than vegetables grown without manure**



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Impact of Manure Fertilization on the Abundance of Antibiotic-Resistant Bacteria and Frequency of Detection of Antibiotic Resistance Genes in Soil and on Vegetables at Harvest

Romain Marti,[a] Andrew Scott,[a] Yuan-Ching Tien,[a] Roger Murray,[a] Lyne Sabourin,[a] Yun Zhang,[a] Edward Topp[a,b]

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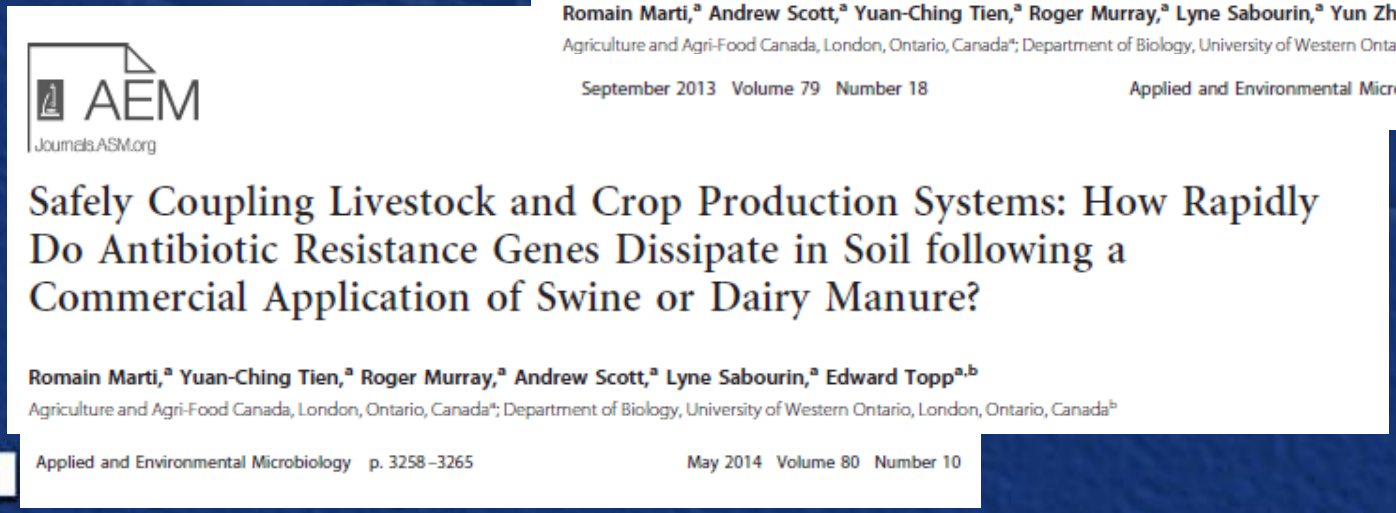
September 2013 Volume 79 Number 18 Applied and Environmental Microbiology p. 5701–5709



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Safely Coupling Livestock and Crop Production Systems: How Rapidly Do Antibiotic Resistance Genes Dissipate in Soil following a Commercial Application of Swine or Dairy Manure?

Romain Marti,[a] Yuan-Ching Tien,[a] Roger Murray,[a] Andrew Scott,[a] Lyne Sabourin,[a] Edward Topp[a,b]

Agriculture and Agri-Food Canada, London, Ontario, Canada[a]; Department of Biology, University of Western Ontario, London, Ontario, Canada[b]

Applied and Environmental Microbiology p. 3258–3265 May 2014 Volume 80 Number 10

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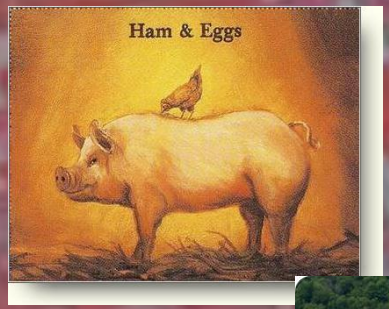
# Bugs and Drugs
# Critical control points




BIOHAZARD

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# Consultation with livestock and poultry sectors

**What are the key 2-3 health challenges that, if controlled by vaccination [or other means], would lead to the most significant reduction in antimicrobial use?**

# Key drivers of antimicrobial use in livestock and poultry

**Beef**

- Liver abscesses
- Bovine respiratory diseases (BRD)

**Dairy**

- Mastitis
- Metritis

**Beef/Dairy**

- Lameness
- Respiratory disease and diarrhea in calves

**Swine**

- Post-weaning diarrhea
- Respiratory diseases

**Poultry**

- Colibacillosis
- Necrotic enteritis

# Key take home message

- Need to keep animals healthy using means other than antimicrobials, so that the need for antimicrobials is reduced.
  - Reduce selection pressure, transmission.

- Vaccination is a key tool to meet this objective.


Thank you/merci