

# Nick Beresford & Cath Barnett

# Centre for Ecology & Hydrology

Lancaster



Edinburgh



Bangor



Wallingford (Headquarters)

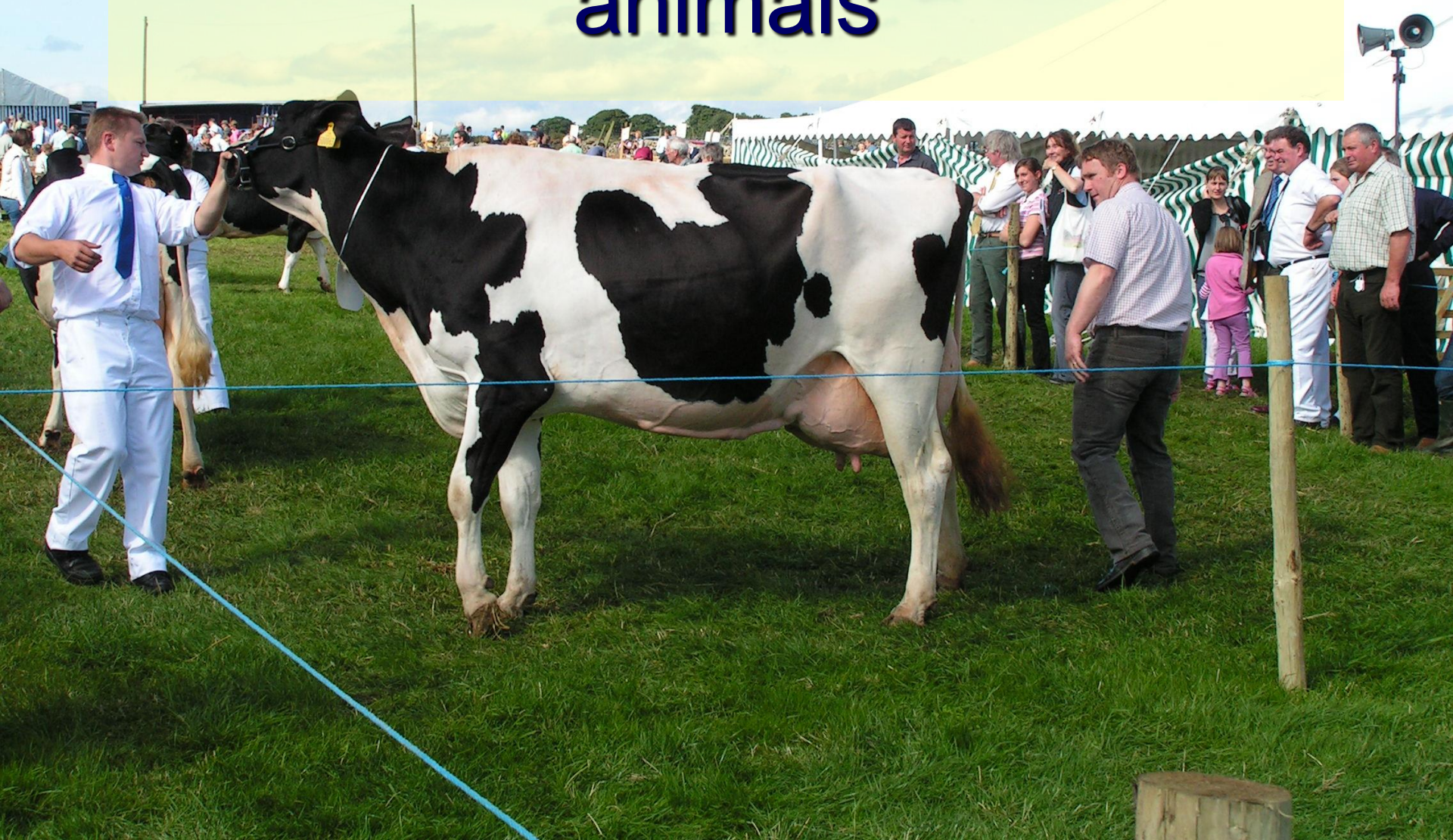


# CEH Science Areas CEH

- Biosphere – Atmosphere Interactions
- Ecological Processes and Resilience
- Environmental Informatics
- Monitoring and Observing Systems
- Natural Capital
- Natural Hazards
- Pollution and Environmental Risk
  - Environmental Contaminants [Group Leader]
- Soil
- Sustainable Land Management
- Water Resources



# Radionuclide transfer to animals



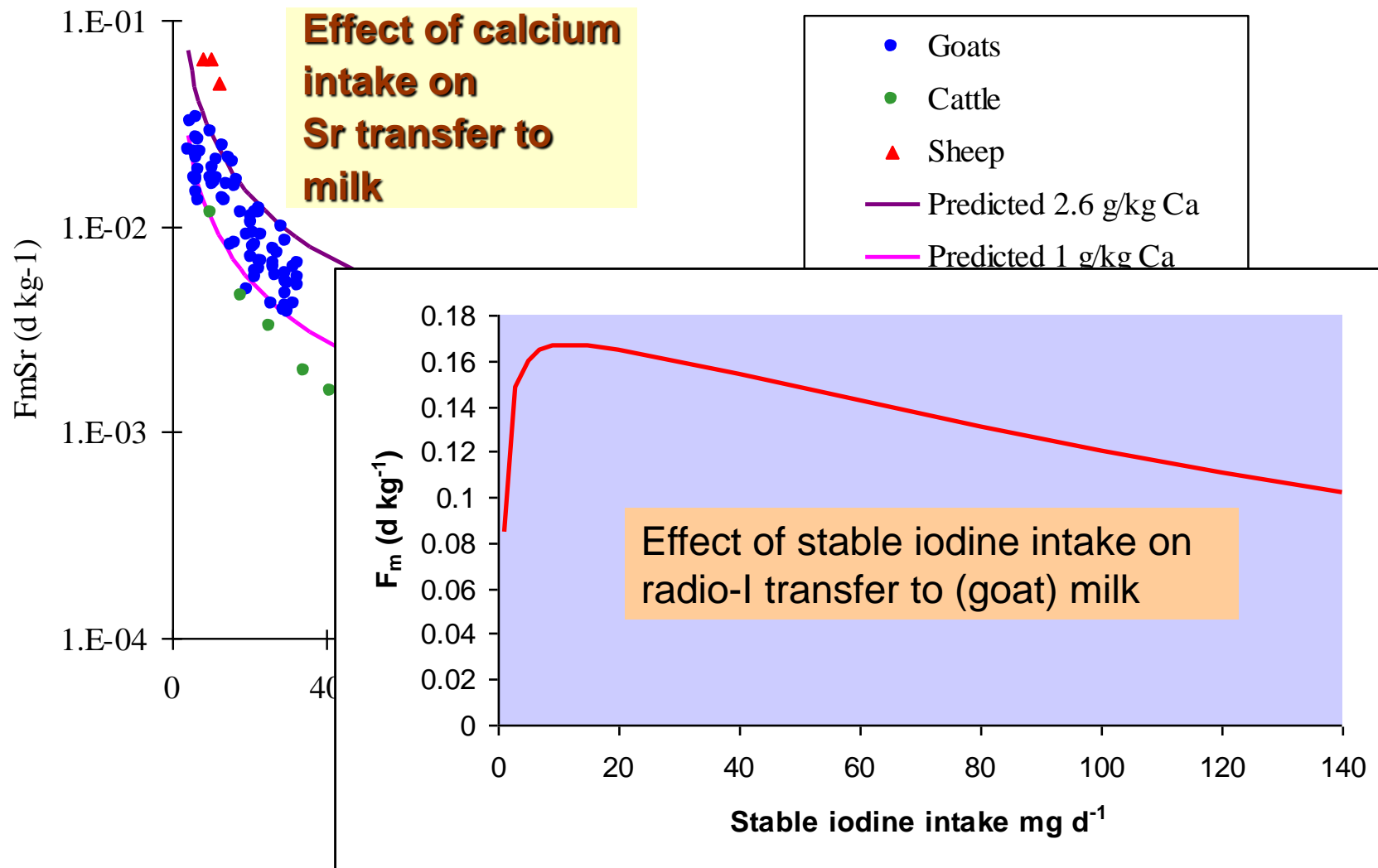


# Why important?

- Often major dose contributor routine & accidental release, e.g. following 1986 Chernobyl accident:
  - Primary health effect in FSU was due to ingestion of radioiodine in milk
  - Long-term privately produced milk is a major contributor to dose in Ukraine/Russia/Belarus
  - Elsewhere in Europe only animal products required long-term countermeasures
    - UK, Scandinavia

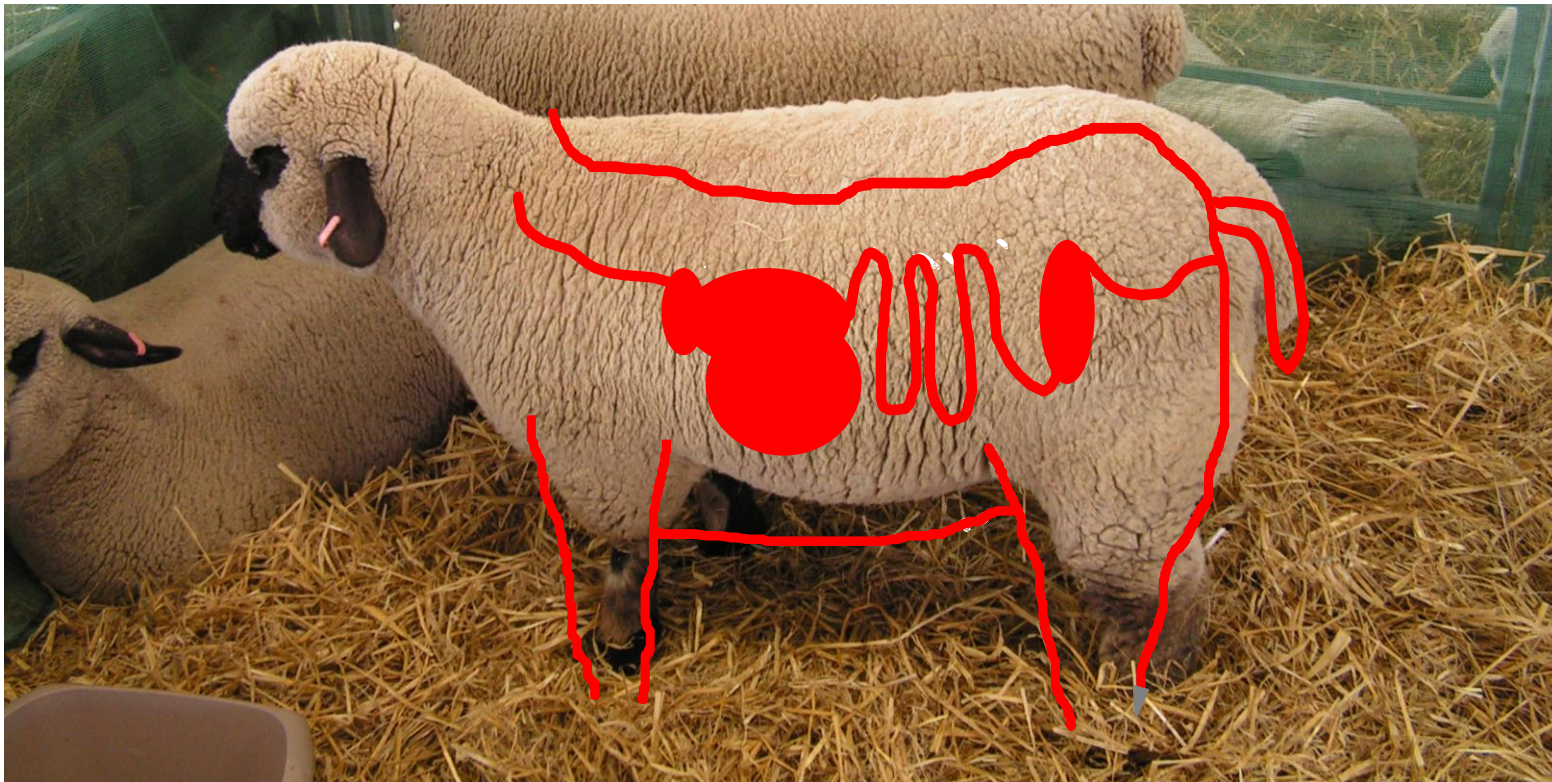


# Stable element status

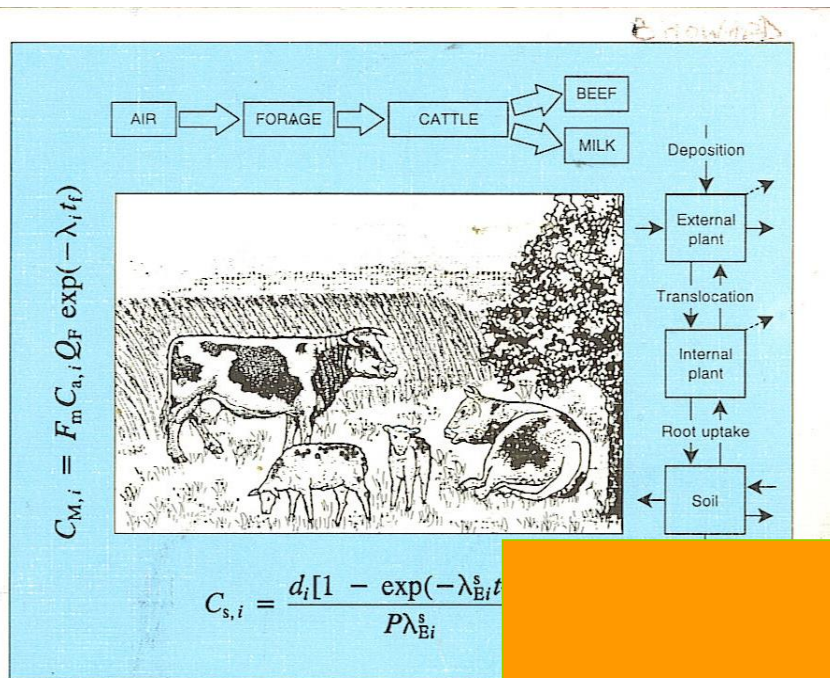


# Bioavailability

- Define as gut absorption (transfer from diet to blood)







TECHNICAL RE

# Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environments



Produced in collaboration with the  
International Union of Radioecologists



INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1994

TECHNICAL REPORTS SERIES NO. 472

# Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Terrestrial and Freshwater Environments



IAEA  
International Atomic Energy Agency



# H-3 & C-14

- Few experimental data

**BUT:**

- H & C macroelements – major constituents of animal feed, tissues & products, **water** (H-3)
  - Transfer coefficients inappropriate (e.g. the dry matter food intake of dairy cattle changes considerably during lactation .... the C and H concentrations of milk (meat) do not.
- Specific activity approaches recommended



ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



ScienceDirect

Journal of Environmental Radioactivity 98 (2007) 205–217



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INCL

JOURNAL OF  
ENVIRONMENTAL  
RADIOACTIVITY

[www.elsevier.com/locate/jenvrad](http://www.elsevier.com/locate/jenvrad)

# Modelling $^3\text{H}$ and $^{14}\text{C}$ transfer to farm animals and their products under steady state conditions

D. Galeriu<sup>a,\*</sup>, A. Melintescu<sup>a</sup>, N.A. Beresford<sup>b</sup>, N.M.J. Crout<sup>c</sup>,  
R. Peterson<sup>d</sup>, H. Takeda<sup>e</sup>

Radiat Environ Biophys (2001) 40:325–334

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ORIGINAL PAPER

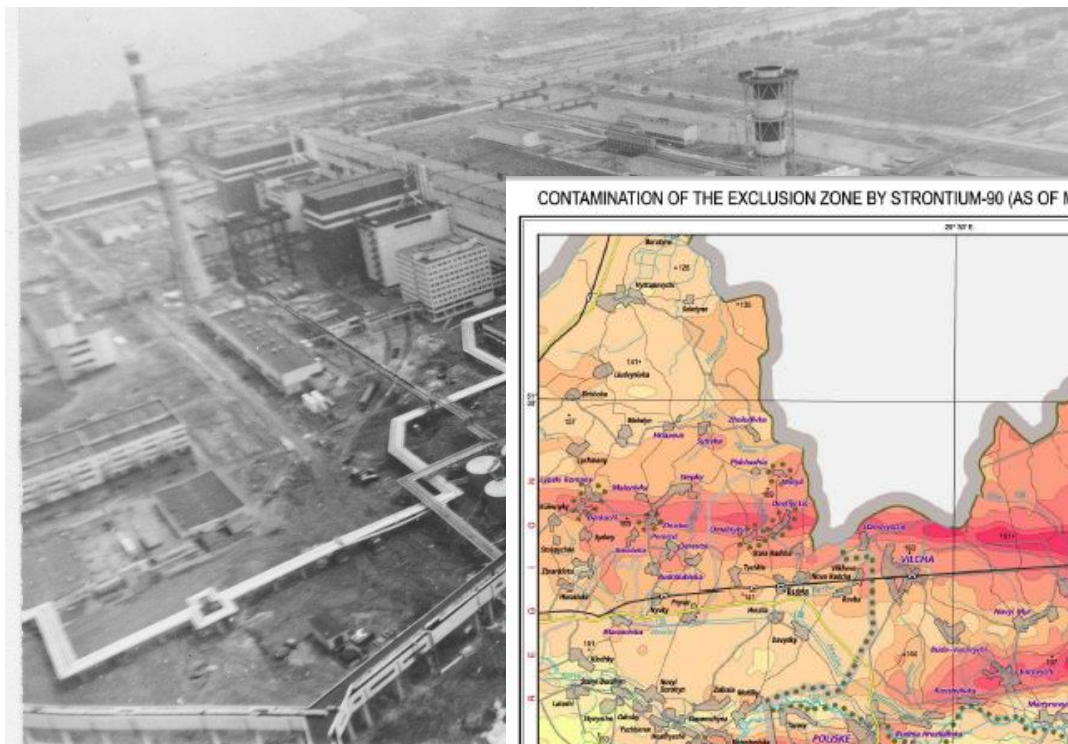
D. Galeriu · N.M.J. Crout · A. Melintescu  
N.A. Beresford · S.R. Peterson · M. Van Hees

**A metabolic derivation of tritium transfer coefficients  
in animal products**

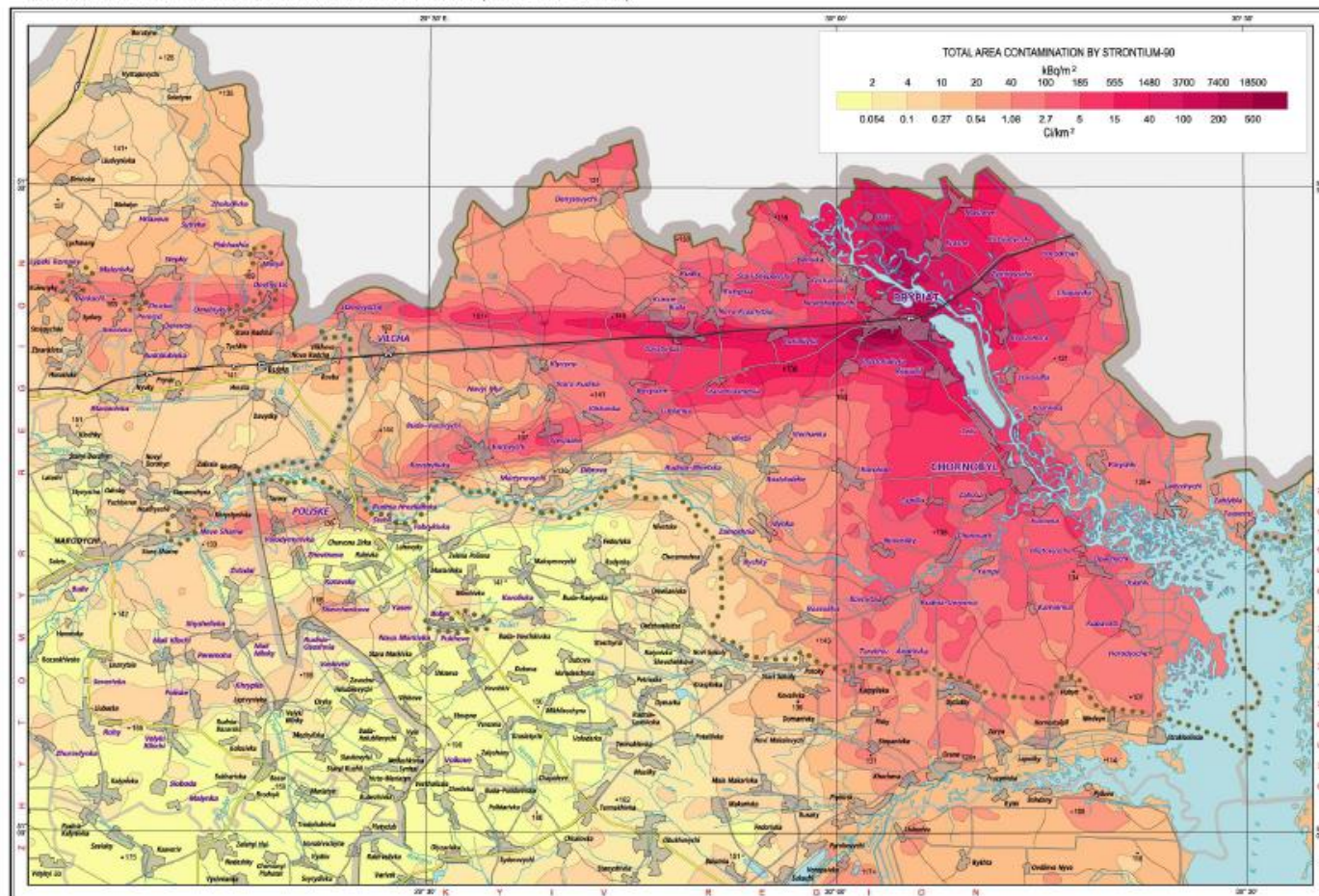


# Chernobyl 1986



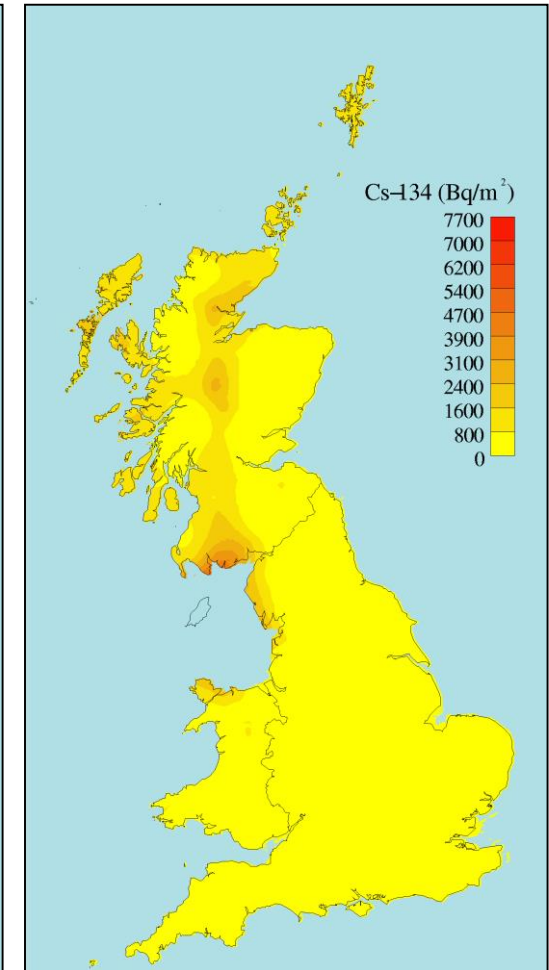
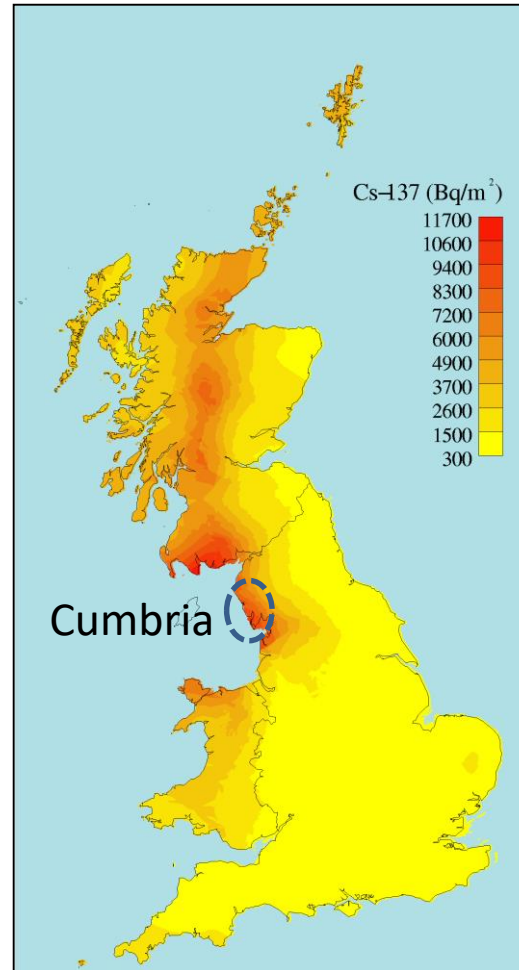
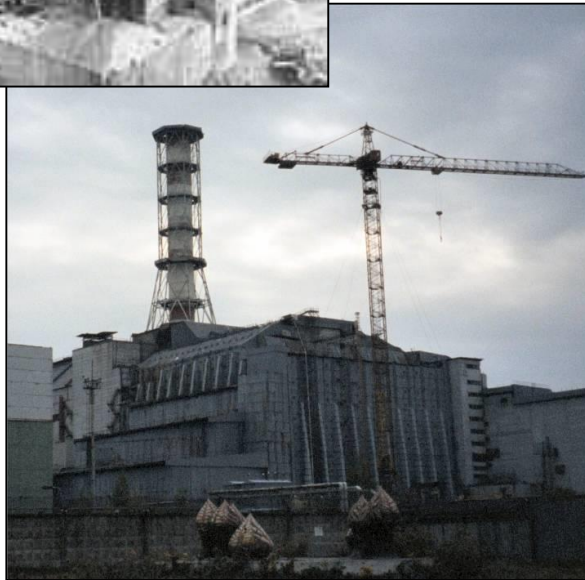


CONTAMINATION OF THE EXCLUSION ZONE BY STRONTIUM-90 (AS OF MAY 10, 2006)





# Cs in Great Britain after Chernobyl



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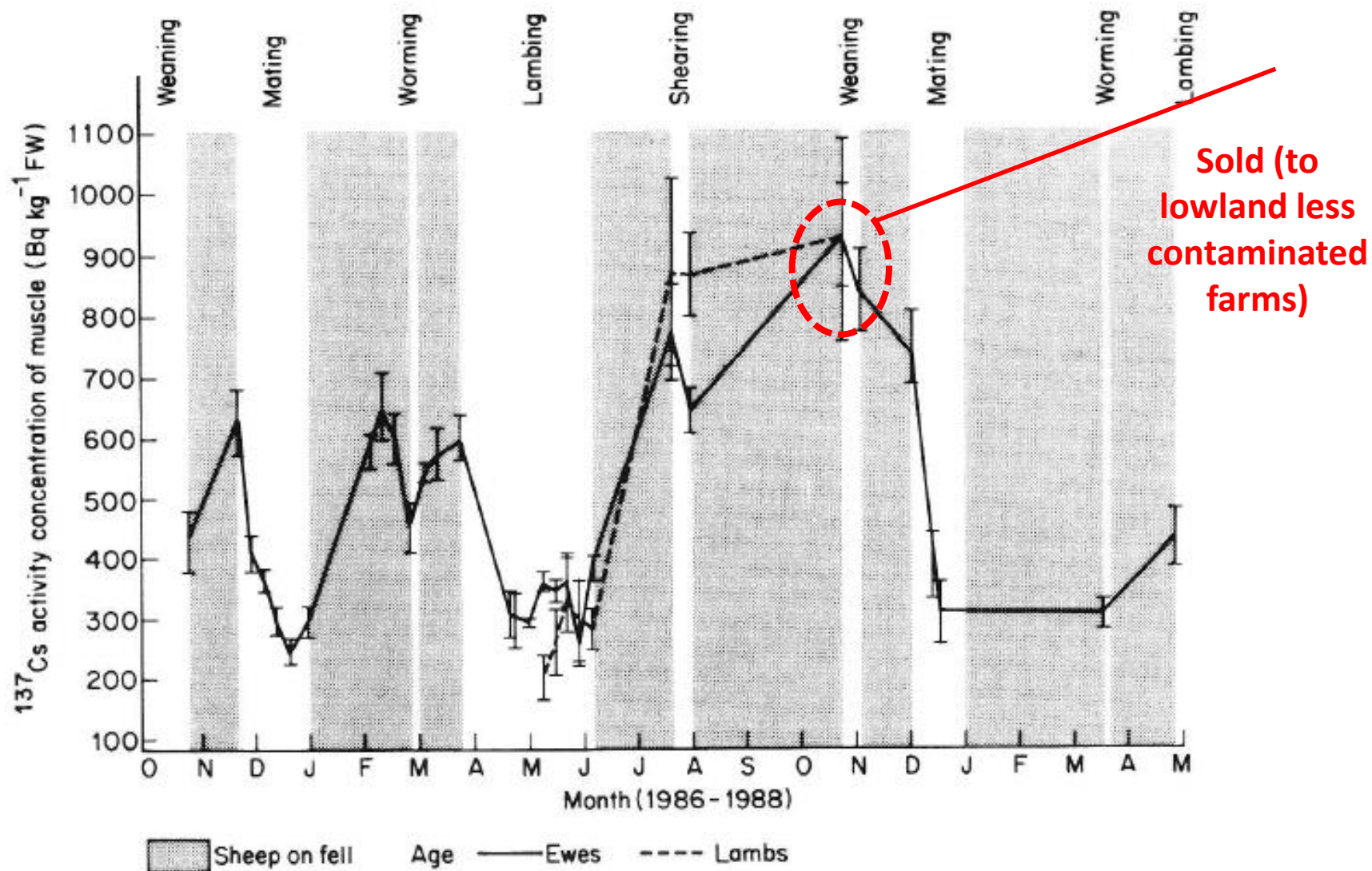


# Cumbria



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# Variation through year





# Restrictions (Mark & Release scheme)

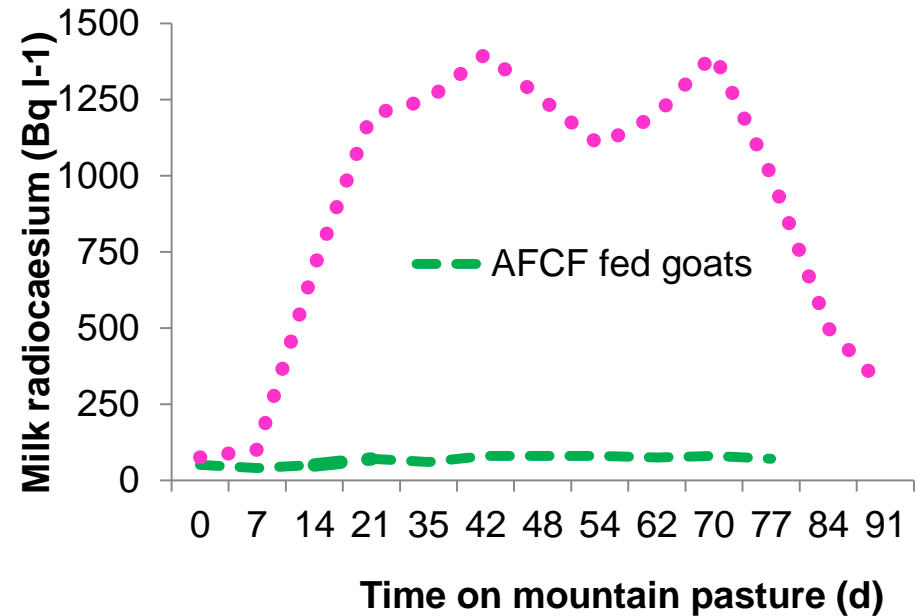


- ***Intervention limit*** – limit above which sheep cannot enter the human food chain is  $1000 \text{ Bq radiocaesium kg}^{-1}$
- ***Working action level*** – activity concentration at which 97.5 % confidence limit equals  $1000 \text{ Bq kg}^{-1}$  ( $733 \text{ Bq kg}^{-1}$ )
- ***Farm is restricted if an sheep 'fails' (& so are neighbouring farms if share grazing)***



# Countermeasures

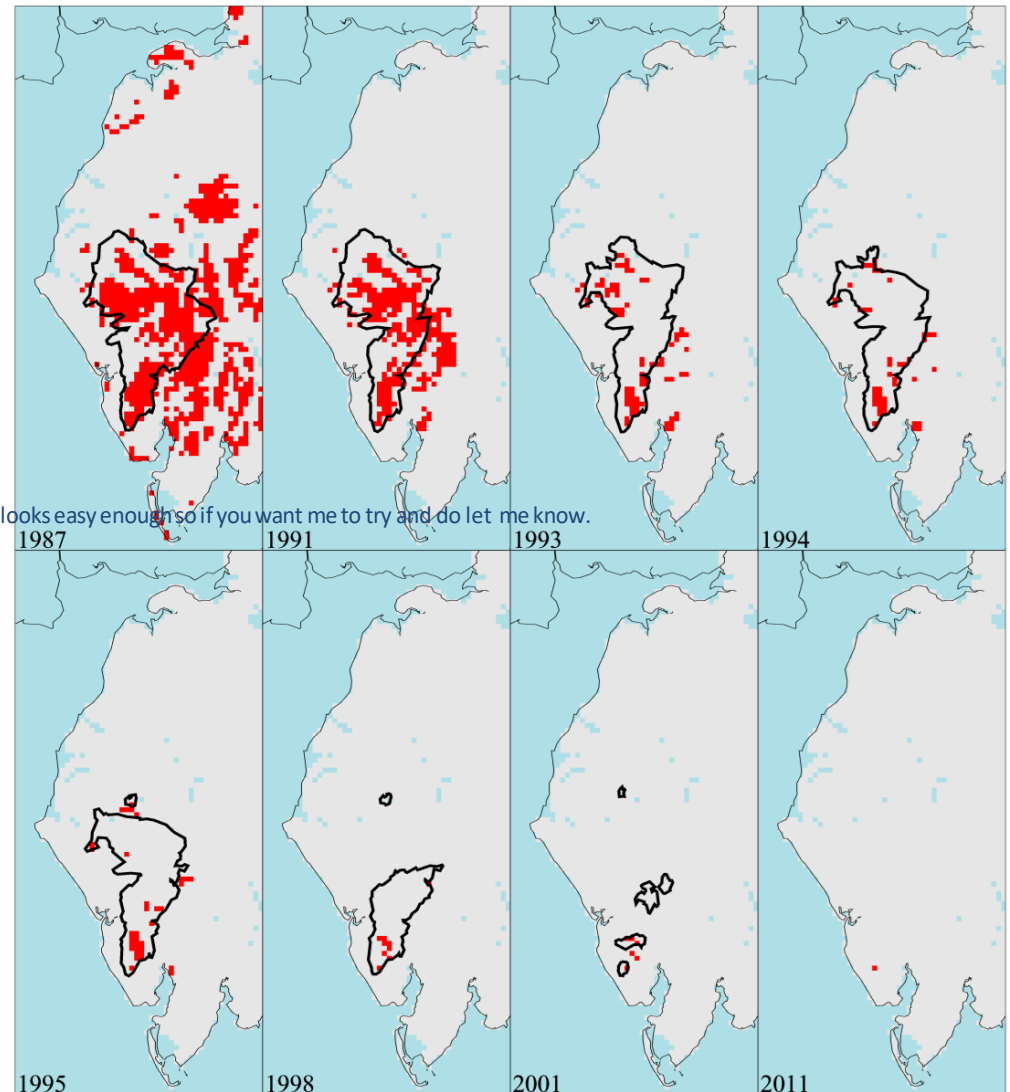
- AFCF (Prussian Blue)
- Effectiveness: v high
- Feasibility
  - size, delivery routes for free ranging animals
- Boli developed in Norway
- Too big UK lambs
  - Smaller boli developed



# Predicted restricted areas

Used to predict changes in the Post-Chernobyl restricted area of Cumbria

Concentrations in sheep being derived from predicted vegetation activities and grass-sheep transfer studies conducted in Cumbria



Cs- 137 activity concentration ( $\text{Bq kg}^{-1} \text{FW}$ )

No Data 0 733

# Environmental protection

- Since 2000 our research has had a focus on developing and testing models to estimate exposure and risk to wildlife
  - Transfer
  - Effects





# Any questions?



@Radioecology  
@RadioXchange

# Today

- Background on environmental protection
- The 'Chernobyl question'
- Making data available
- Interactive demonstration of assessment model

Lunch 12:00-13:30