



# Radioactivity and the Environment

# TREE



# TRansfer - Exposure – Effects (TREE): integrating the science needed to underpin radioactivity assessments for humans and wildlife

PI: Dr. Brenda Howard (NERC-CEH)

---



UNIVERSITY OF  
STIRLING



University of  
**Salford**  
MANCHESTER



**RESEARCH  
WITH  
PLYMOUTH  
UNIVERSITY**

# WP1: Biogeochemical processes and radionuclide behaviour in soil-plant systems

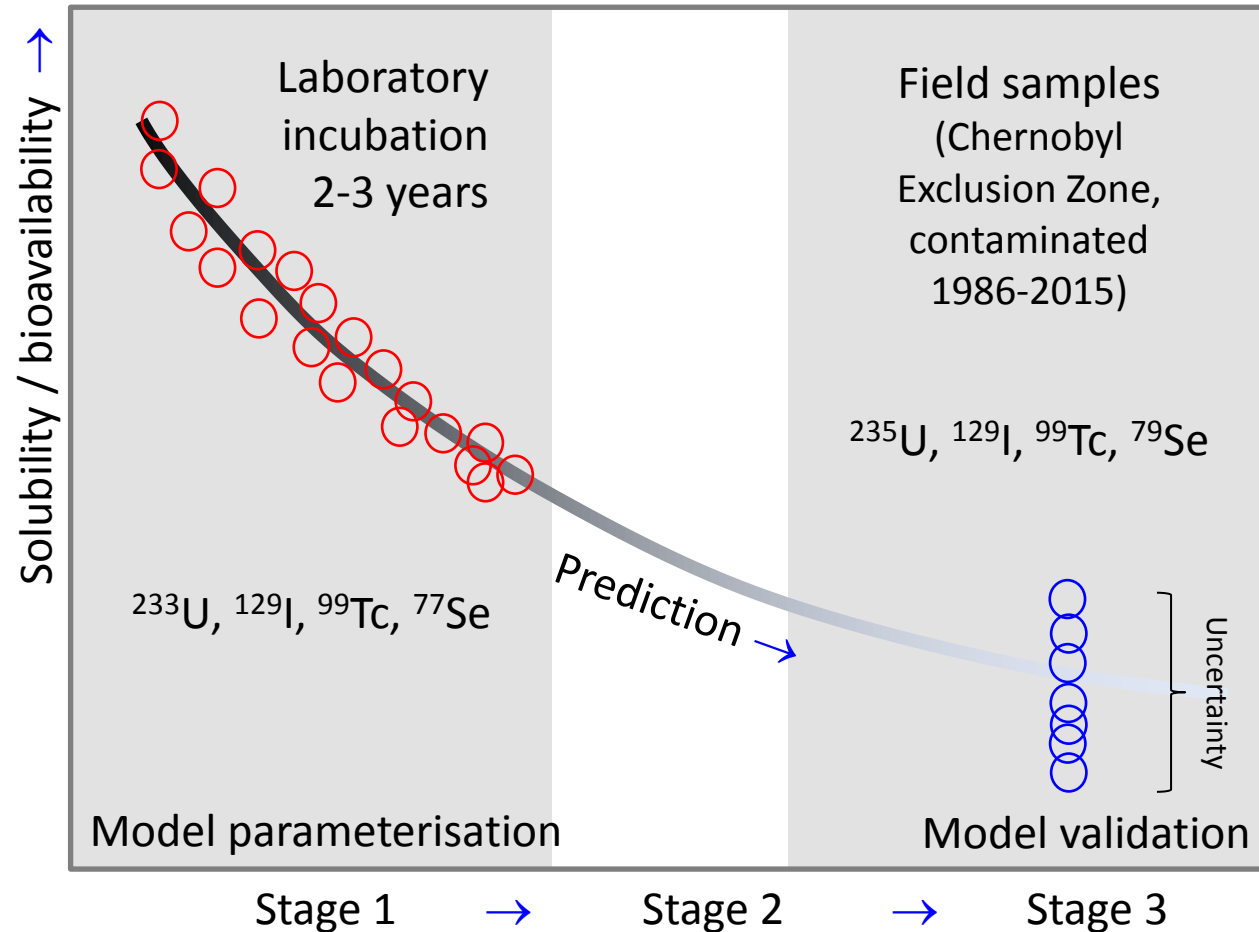
Objectives: Improve understanding of the biogeochemical behaviour  $^{129}\text{I}$ ,  $^{79}\text{Se}$ ,  $^{99}\text{Tc}$ , and  $\text{U}$  isotopes in soils; Critically assess the validity of models parameterised from short-term laboratory experiments.

## Approach:

**Controlled incubation of different soils 'spiked' with radionuclides. Determine solubility and isotopic exchangeability over 2-3 years**

**Develop/parameterise kinetic models describing changes in isotope speciation with time based on incubation experiments**

**Validate models using samples from Chernobyl exclusion zone**



# WP2: Novel approaches to estimate the radionuclide activity concentrations in the human foodchain and terrestrial and aquatic wildlife

**Objective:** to develop a new scientifically robust approach to predicting radionuclide activity concentrations in human foodstuffs and wildlife, which is independent of site variables and generically applicable across species

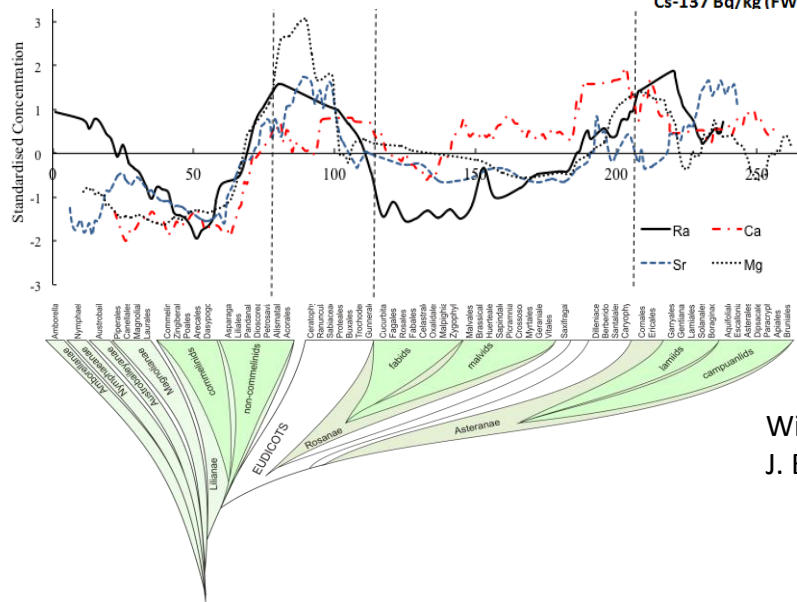
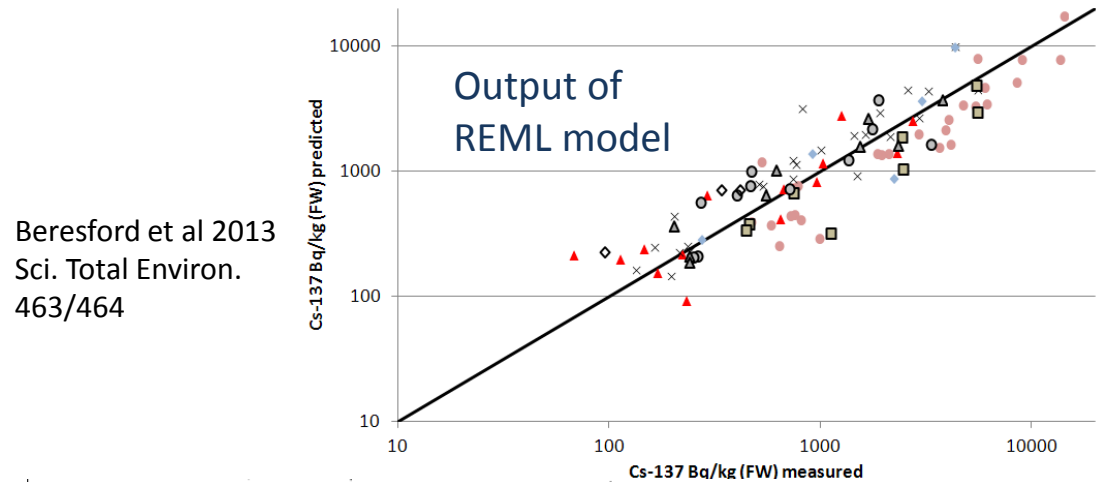
## Approach:

Adapt methodologies (**phylogeny & ionomics**) from plant science to improve models of radionuclide transfer to crop species and wildlife

## Plant uptake studies

Field sampling (wildlife – ICRP Reference Animals & Plants)

Use international databases (held by by TREE consortium and Project Partners)



## WP3: Exposure of wildlife under field conditions

Objective: to evaluate uncertainties in wildlife exposure estimation by assessing how animals utilize contaminated environments.

### Approach:

Evaluate pathways of exposure in the Chernobyl Exclusion Zone

Compare field measurements with predictions using different modelling approaches

**Wildlife cameras - Image-based analysis of habitat utilisation**

**GPS collars linked to base station - Digital tracking of habitat utilisation**

**TLDs - External dose rates**

**Faeces sampling – DNA metabarcoding (to determine diet composition)**

**Live-monitor**



Source: S. Gashchak



# WP4: Mechanisms of biological effect and trans-generational impacts of exposure to ionising radiation

**Objective:** Determine whether low level chronic exposure to radiation has significant effects on exposed populations in contaminated sites.

## Approach:

Compare effects from radiation exposure in laboratory and field studies

Measure exposure and effects in contaminated sites

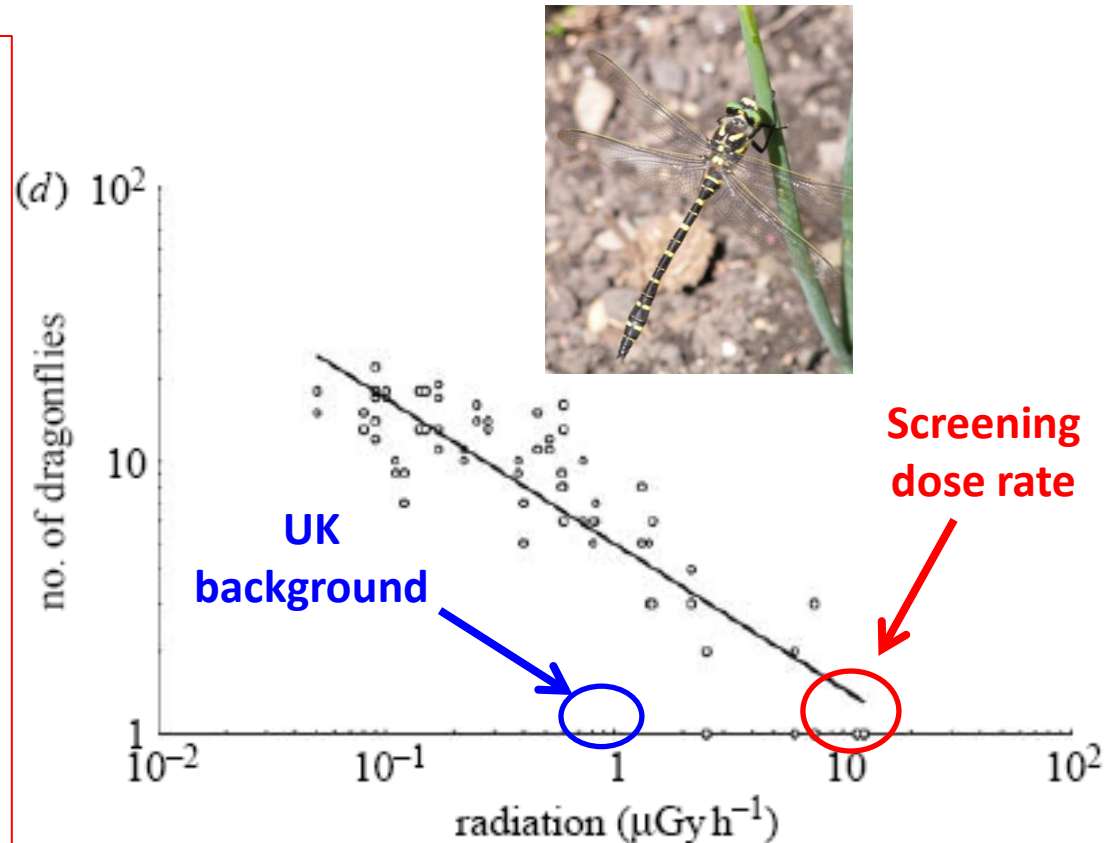
Test whether transgenerational effects are occurring at Chernobyl zone

**Trans-generational studies on worms and bees**

**Develop biomarkers for terrestrial and aquatic spp. in the lab**

**Field studies in aquatic and terrestrial Chernobyl systems taking account of confounding factors**

**Expand to marine systems with Japanese partners**



Moller and Mousseau 2009  
Biology Letters 5, 356-359

# Capacity Building

- Extensive national & international network, including industry & regulators
- key skills development using our diverse expertise – 4 PDRAs, 7 PhDs
- multidisciplinary summer school at Chernobyl
- working with COGER to provide training opportunities
- Interaction with European student cohorts (& access to facilities)
- training for regulators and industry



# Wider Impact



## TREE consortium

Radioecologists  
Soil scientists  
Plant scientists  
Ecotoxicologists  
Environmental chemists  
Modellers  
Specialised analysts

Subcontractors

Project Partners

## Wider networking

International organisations (IAEA, ICRP IUR)  
European networks and platforms (STAR, COMET, ALLIANCE, OPERRA)  
Radioactive waste group (Bioprota)  
Scientific media  
Gov-associated bodies ( UK: SEPA, NE, FSA, Japan: NIRS)

## Annals of the ICRP

ICRP PUBLICATION 114

Environmental Protection: Transfer Parameters  
for Reference Animals and Plants

Editor  
C.H. CLEMENT

Authors on behalf of ICRP  
P. Strand, N. Beresford, D. Copplestone, J. Godoy,

