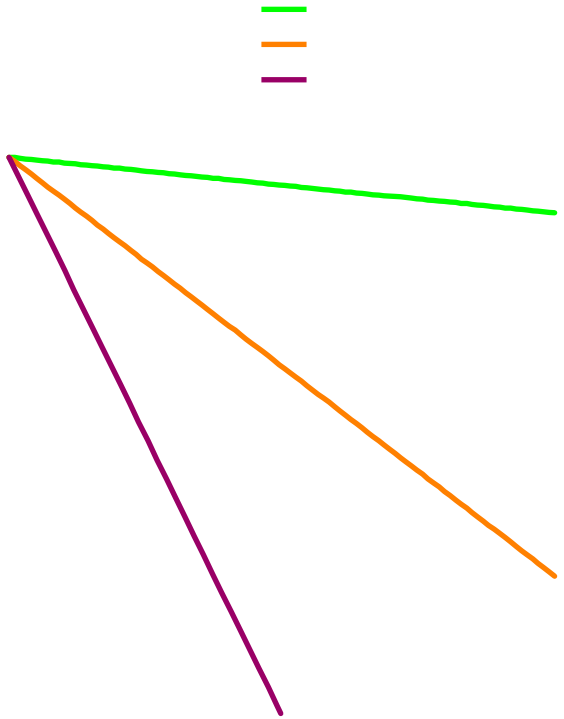
Vulnerable ecosystems

- vulnerability to radioactive contamination can be considered in terms of the extent of radiation dose to man or biota
- regions, pathways or communities can all be considered to be vulnerable to radioactive contamination if they give rise to, or receive relatively high radiation doses

Vulnerability

-changes with time

- long effective ecological half-lives for ^{137}Cs
  - **terrestrial animals inhabiting areas with organic soils**
  - **mushrooms**



Vulnerability
- quantification

- **SPECIFIC**
  - **specific activity (Bq/kg) in a product**
    - **predicted using deposition, transfer coefficients and effective ecological half-lives**
- **FLUX**
  - **total Bq output in a product (Bq)**
    - **needs estimates of production or rates of harvesting**

Vulnerability

-Spatial analysis

- compiling variation in food production and harvesting rates
- mapping the distribution of food products, especially wild foods
- quantification of transfer, relevant to soil type and species
- incorporating changes with time in contamination of important foodstuffs

Vulnerable areas or groups

- **proximity to potential sources**
- **high precipitation rate**
- **high milk production rate dominance of “small” animals**
- **presence of semi-natural ecosystems**
  - **organic soils, forests**
- **special groups, with high consumption rates of contaminated products**
  - **mushroom foragers, game consumers**

Vulnerability

Generalizations can mask high individual exposure

Consideration of vulnerability at a small spatial scale can improve estimates of:

- collective dose
- individual dose
- provide guidance on uncertainities

Vulnerability
- emergency response

- prior studies of vulnerability and its spatial and temporal variation can identify areas, and types of foods which would be contaminated above intervention limits
- Identification of vulnerable areas, combined with contamination maps can guide monitoring and implementation of countermeasures

Exposed groups

- **General public**
  - **collective and individual doses**
- **Special groups**
  - **individual doses**
    - **users of semi-natural ecosystems, eg hunters, mushroom foragers, upland dairy goat smallholders**
    - **people who eat/drink large quantities of home-grown produce, including milk (eg smallholders)**

Vulnerable areas

- Vulnerability can be considered in a variety of ways, including:
  - high activity concentrations in different food products
  - high total fluxes of radiocaesium
  - special population groups with high radiocaesium intake rates
- Conversely, resilient areas are those where the impacts of radiocaesium deposition are low

The identification of areas producing

Ecosystem variation

- Agricultural ecosystem
  - potentially important for all mobile radionuclides
  - short ecological half-lives
- Semi-natural ecosystems
  - important mainly for radiocaesium
  - inherently more variable than agricultural systems
  - long ecological half-lives

Vulnerability
-Spatial analysis

- compiling variation in food production and harvesting rates
- mapping the distribution of food products, especially wild foods
- quantification of transfer, relevant to soil type and species
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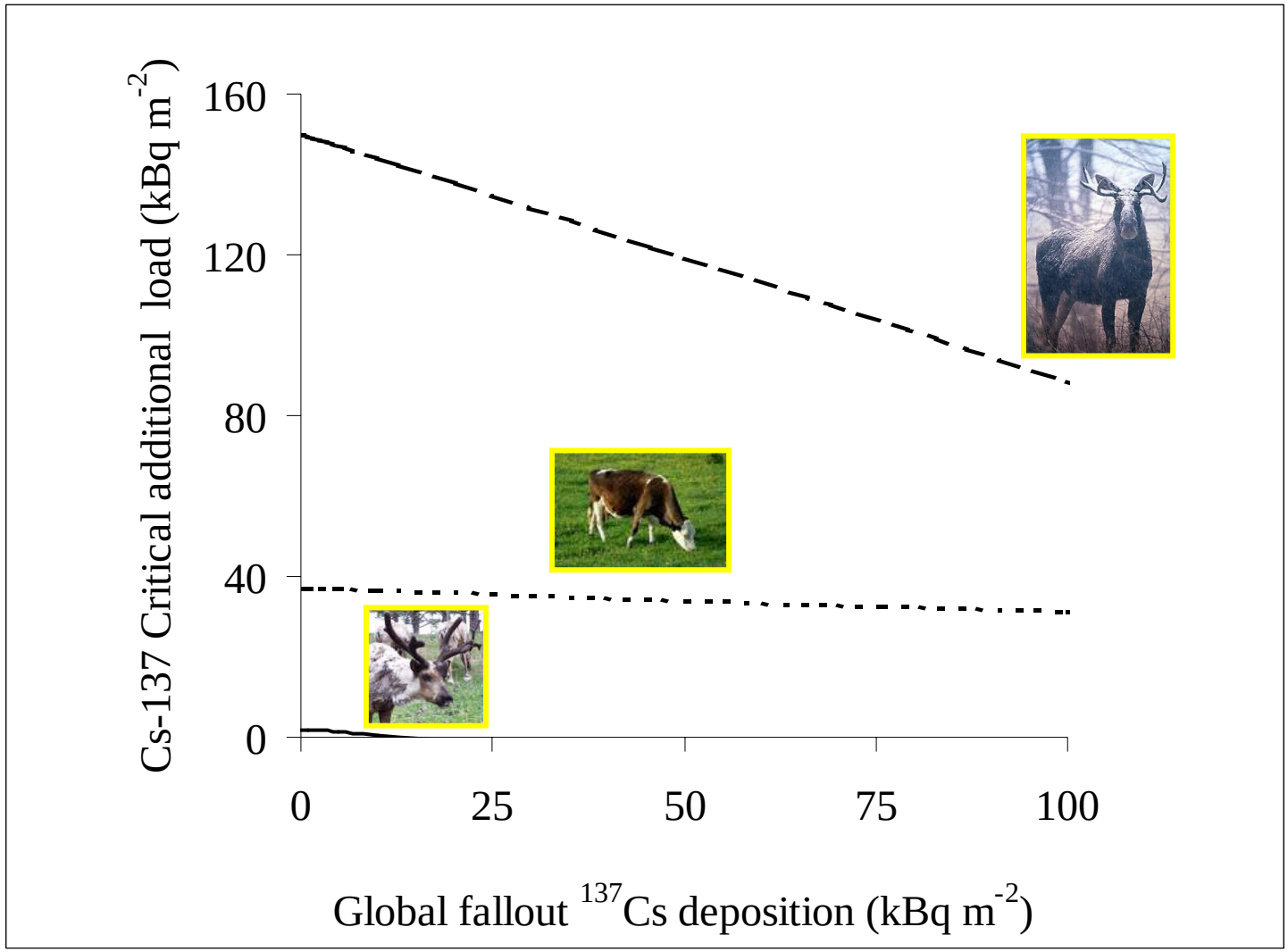
Action or Critical loads

- The amount of radionuclide deposition necessary to produce radionuclide concentrations in food products exceeding intervention limits for areas used in the production or harvesting of foodstuffs

- Action load– short term (surface)
- Critical load – mid-long term

Additional critical loads for ^{137}Cs in arctic systems



Vulnerable areas or groups

- proximity to potential sources
- high precipitation rate
- high milk production rate & dominance of “small” animals
- use of semi-natural ecosystems
  - organic soils, forests
- special groups, with high consumption rates of contaminated products
  - mushroom foragers, game consumers

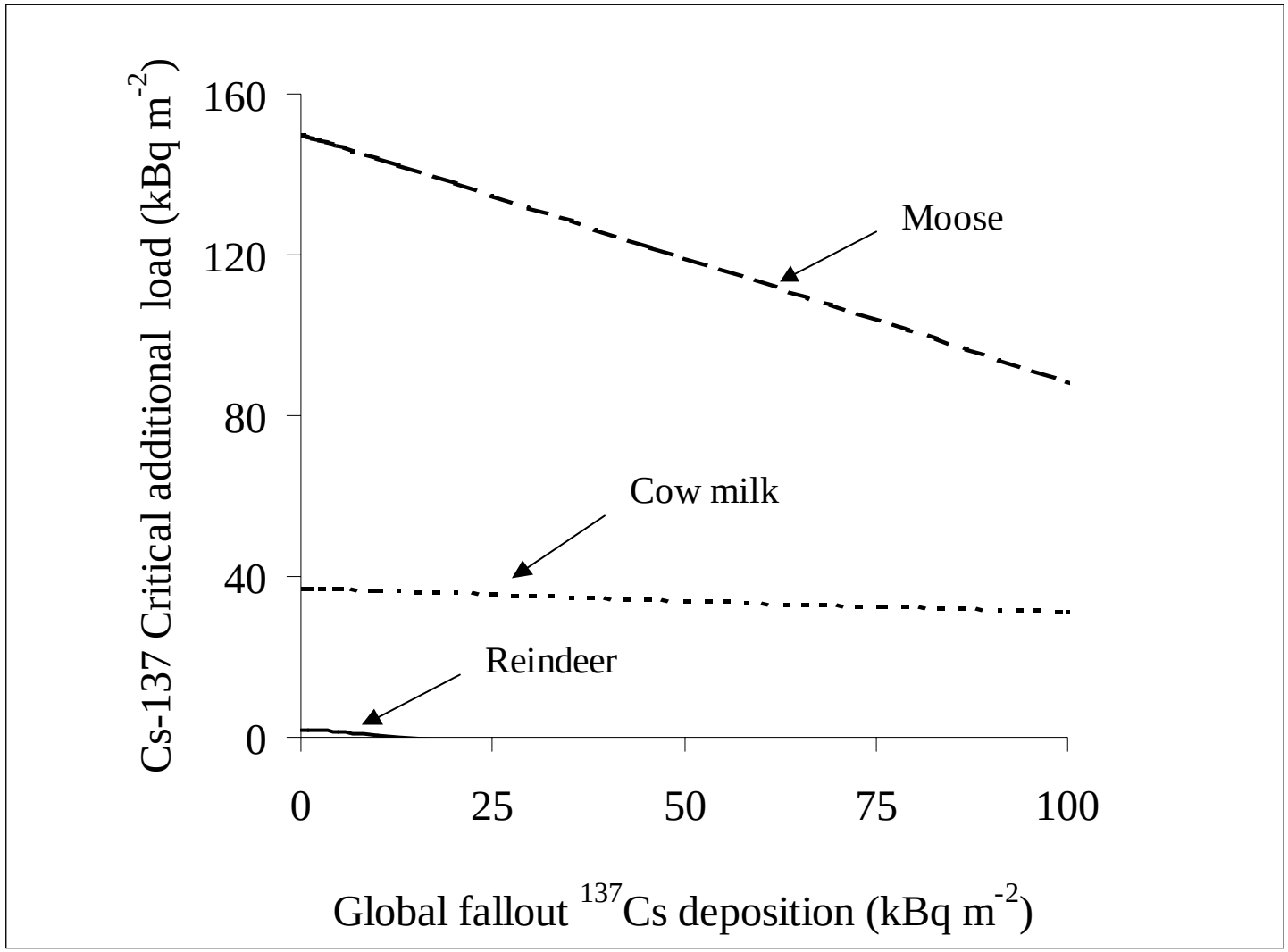
Vulnerability
- emergency response

- prior studies of vulnerability and its spatial and temporal variation can identify areas, and types of foods which would be contaminated above intervention limits
- Identification of vulnerable areas, combined with contamination maps can guide monitoring and implementation of countermeasures

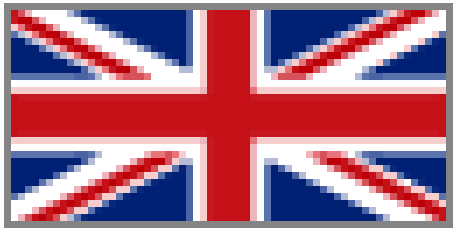
Action or Critical loads

- Potential method of addressing issues of vulnerability to radionuclide contamination
- Can be defined as the amount of radionuclide deposition necessary to produce radionuclide concentrations in food products exceeding intervention limits for areas used in the production or harvesting of foodstuffs

Additional critical loads



UK aspects



- Identification of vulnerable areas
- Injection of realism
- Importance of public reassurance
- Setting up of working groups involving stakeholders
- extension of emergency exercises for longer times

Vulnerability assessment