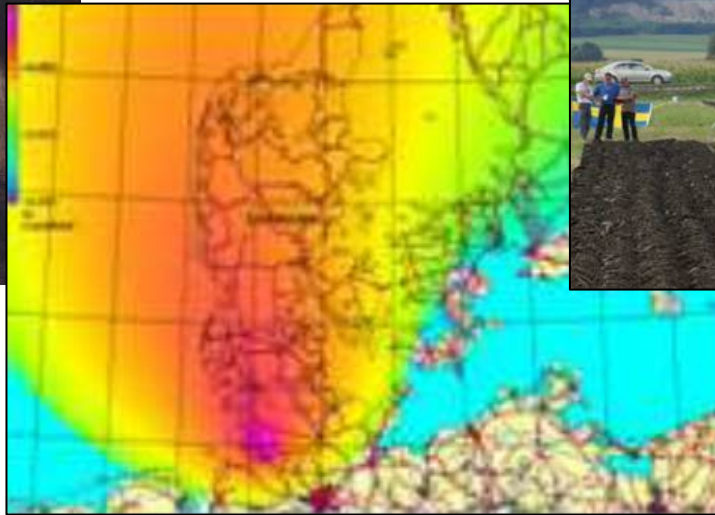
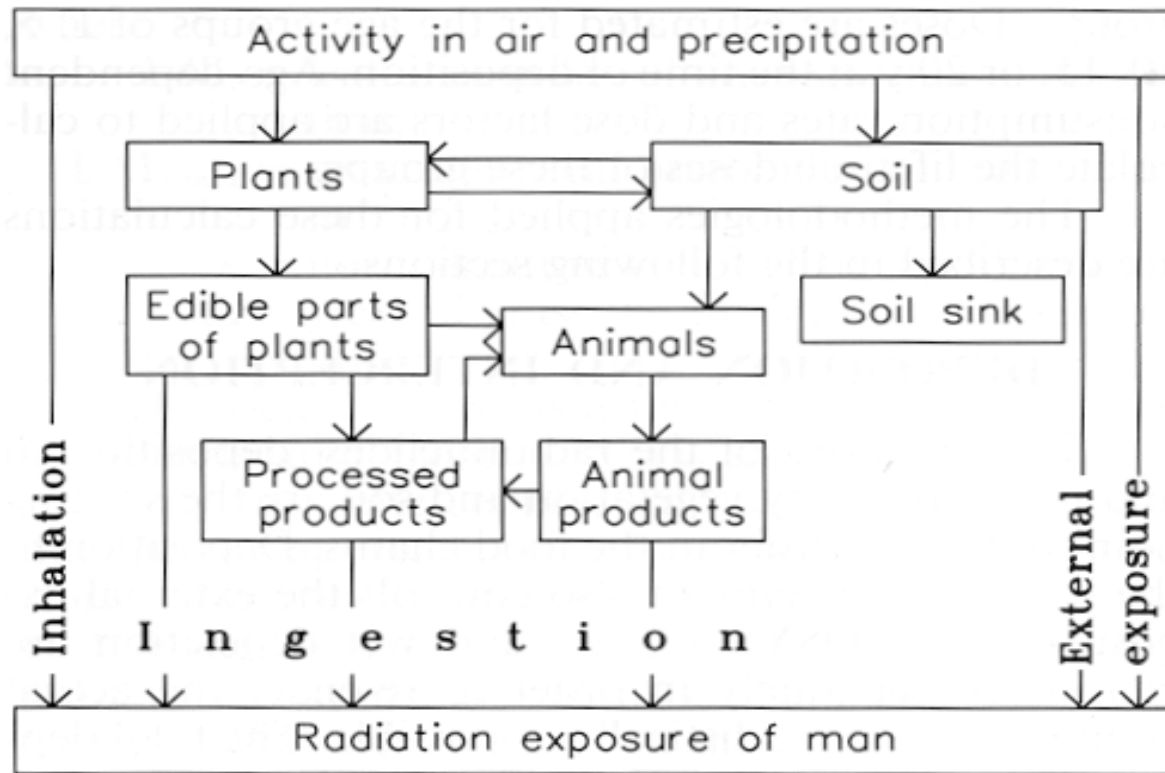


Nordic improvements of the ECOSYS model for ingestion dose estimation



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ECOSYS model



Müller, H. & Pröhl, G. (1993). ECOSYS-87: a dynamic model for assessing radiological consequences of nuclear accidents, *Health Physics* 64(3), pp. 232-252.

NKS PardNor activity

PardNor

PARameters for ingestion Dose models for NORdic areas

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NKS PardNor activity

- i) To update ECOSYS, which was developed in the 1980's, and thus includes very little of the host of data generated since Chernobyl. Current default data (e.g., for deposition, post-deposition migration and uptake) do not adequately reflect the knowledge of today.

- ii) To target ECOSYS for use in Nordic areas. It was parameterised for South German conditions. Its originators have always recommended revision of site-specific parameters before use in any other area. However, the model is still used in ARGOS and RODOS with defaults.

NKS PardNor work tasks

Analyses of typical diets in different Nordic countries

Analyses of Nordic import fractions of food products

Animal feeding regimes in the Nordic countries

Improved deposition velocity estimates according to particle size

Seasonal leaf area development in the Nordic countries

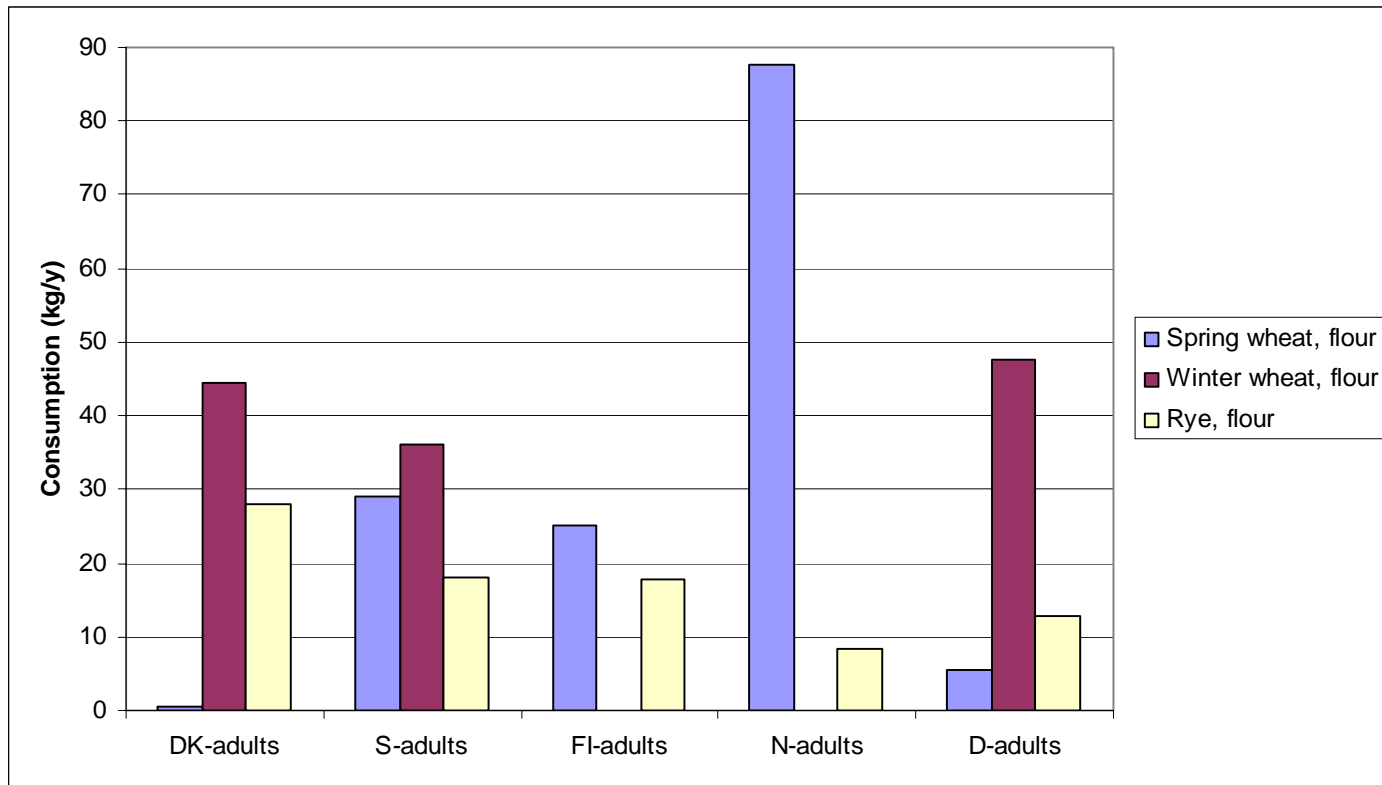
Better leaching rates, fixation rates, desorption rates, resusp. enrich. factor

Transfer factors in relation to soil classification

Improved animal metabolism parameters (transfer factors, biolog. half-lives)

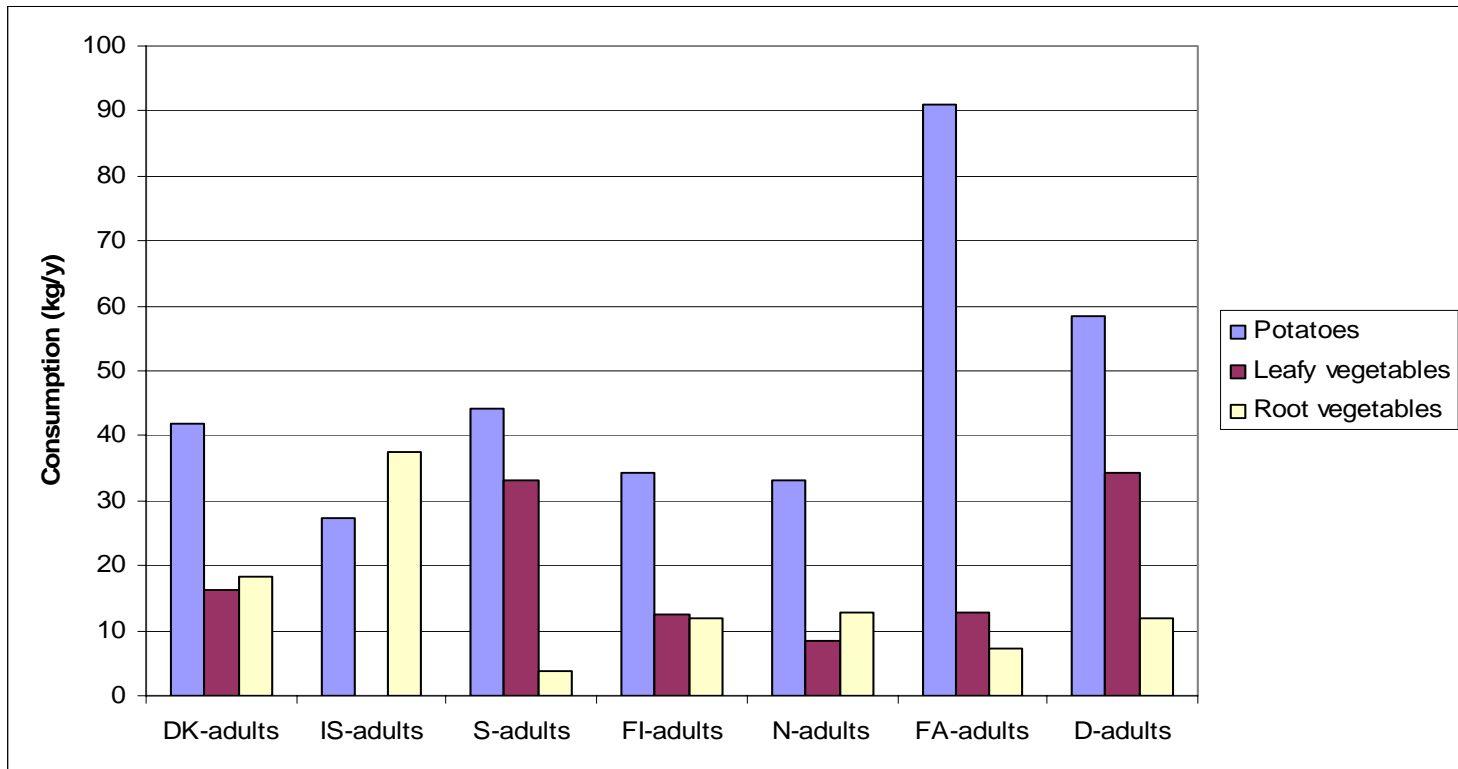
Improved natural weathering rates (e.g., precipitation, time dependent)

Analyses of typical diets in different Nordic countries



Consumption of wheat and rye flour in the Nordic countries, compared with the German ECOSYS defaults (average figures for adults - ca. 30 y).

Analyses of typical diets in different Nordic countries

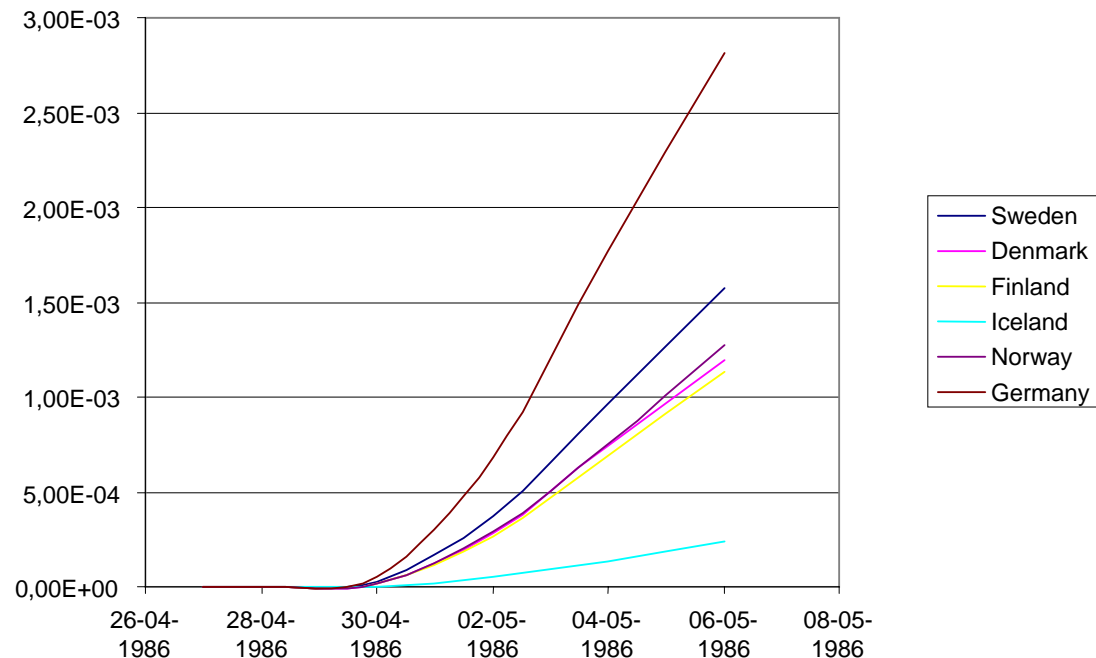


Consumption of potatoes, leafy vegetables and root vegetables in the Nordic countries, compared with the German ECOSYS defaults (average figures for adults - ca. 30 y).

Percentage of consumed foods produced in the country

Food item:	S	FA	N	DK	FI	IS
Wheat	98	~0	67	60	50	~0
Rye	99	~0	40	86	15	~0
Potatoes	91	~10	100	86	96	59
Leafy vegetables	42	~0	55	75	77	33
Berries	29	~0	6	10	69	~0
Milk	98	97	100	90	99	100
Butter	66	n	98	69	97	99
Cheese	60	~0	93	63	66	99
Beef	68	~10	95	88	86	98
Pork	80	~0	95	94	91	96
Lamb	33	~65	95	20	30	100

Analyses of typical diets in different Nordic countries



Example of estimates of accumulated individual ingestion dose for the average population in each of the Nordic countries (mSv), using location-specific dietary information and import fractions: 'close-up' diagram for the first week after deposition. ECOSYS runs based on the ^{137}Cs air concentrations, rainfall and only dry deposition recorded at Tranvik (Sweden) in the first month after the Chernobyl accident (adults - ca. 30 y).

Animal feeding regimes



Norwegian lactating cattle begin their grazing season nearly a month later than assumed in the Bavarian ECOSYS defaults, and end it nearly two months earlier.

Example of ECOSYS run (^{137}Cs dry deposition on 1st of May):

Product	Bq/kg after 6 months (D)	Bq/kg after 6 months (DK)
Cream	$1.8 \cdot 10^0$	$5.4 \cdot 10^{-3}$
Butter	$5.2 \cdot 10^{-1}$	$1.5 \cdot 10^{-3}$
Beef (cow)	$8.6 \cdot 10^0$	$2.3 \cdot 10^{-2}$

Transfer factors in relation to soil classification

For all Nordic countries (except the Faroes) soil type data exists on grids (typically 10-100 points per 1000 hectares) that could be used to select location specific transfer factors for crop uptake.

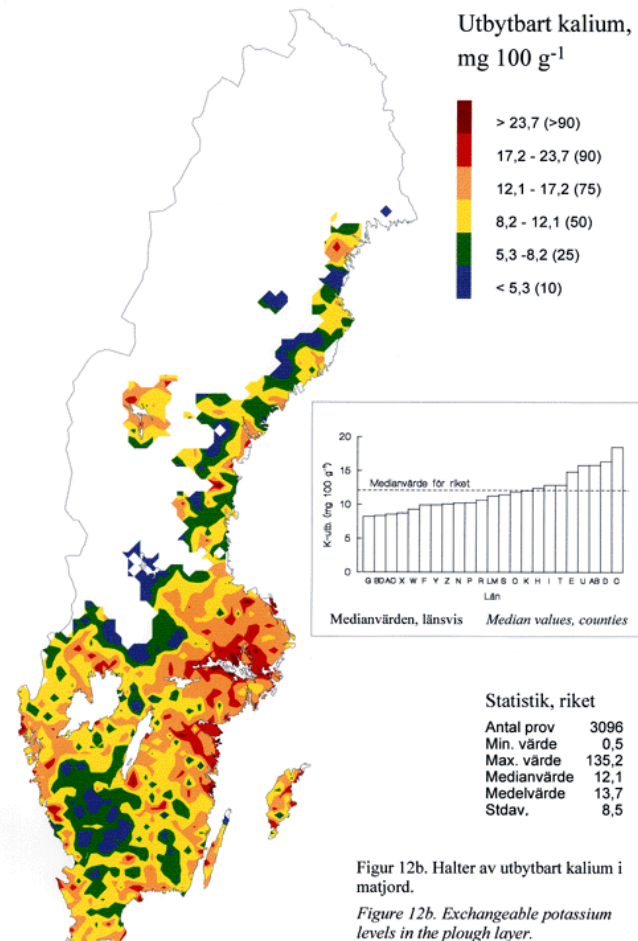
For the Faroes, such data is available for selected localities.

An assessment was made in PardNor of:

- Availability of gridded soil classification data (primarily texture classes)
- Resolution of grid (e.g., # locations sampled per 100 ha, or grid mesh size)
- The owner of the data
- The age of the data

Transfer factors in relation to soil classification

	ECOSYS default		New review value
Plant group	Bq kg ⁻¹ fw/ Bq kg ⁻¹ dw	Soil type	Bq kg ⁻¹ fw/ Bq kg ⁻¹ dw
Grass pasture	1	Sand	0.058
		Loam	0.038
		Clay	0.036
		Organic	0.15
Maize (grain)	0.01	Sand	0.042
		Loam	0.014
		Clay	0.010
		Organic	0.012
Potatoes	0.01	Sand	0.020
		Loam	0.0074
		Clay	0.0053
		Organic	0.012



Conclusions

The findings of the NKS-B PardNor activity show that considerable dose estimation errors that could lead to wrong decision support may occur if ECOSYS is used with current default parameters.

The work should attract European interest (all RODOS and ARGOS users) and derivation of European location specific parameters and final generation and implementation of generic as well as location specific model data libraries should be a European task (EURATOM).