Factors Affecting Radon Levels in Houses: A GIS Study around Castleisland

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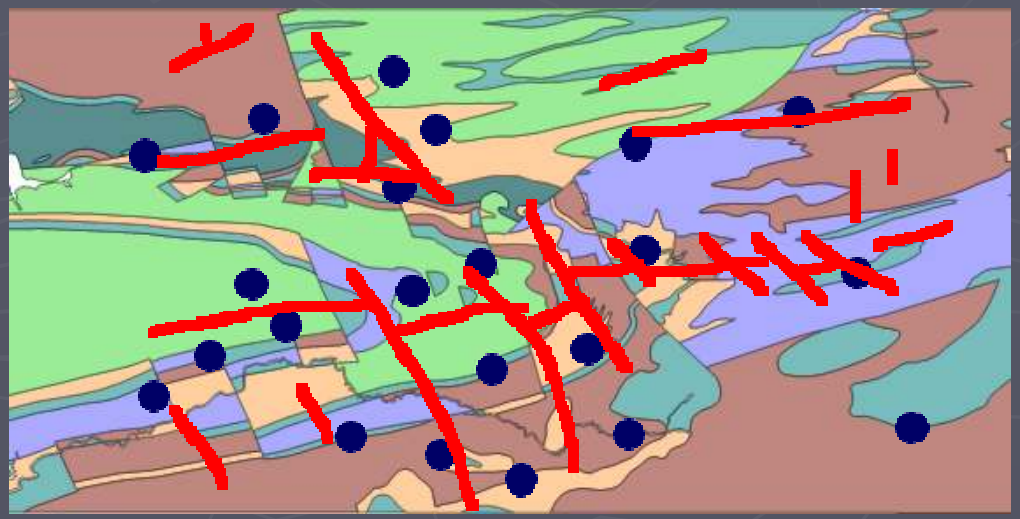
Outline

- What is GIS ?
- What is SDSS ?
- Project Aims
- The Data
- Developing a Model for Radon Potential
- Radon Potential Maps in GIS

What is GIS ?

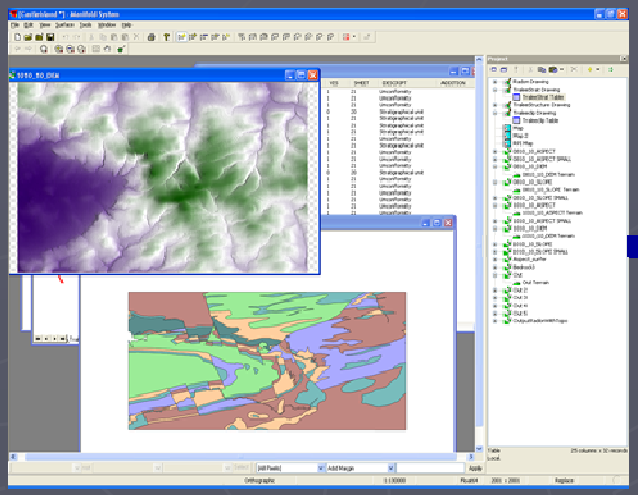
- Geographic Information Systems
  - Management, Display and Analysis of Geographic Information

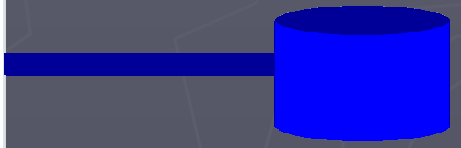


What is SDSS ?

- Spatial Decision Support System
  - SDSS = Bespoke GIS

GIS





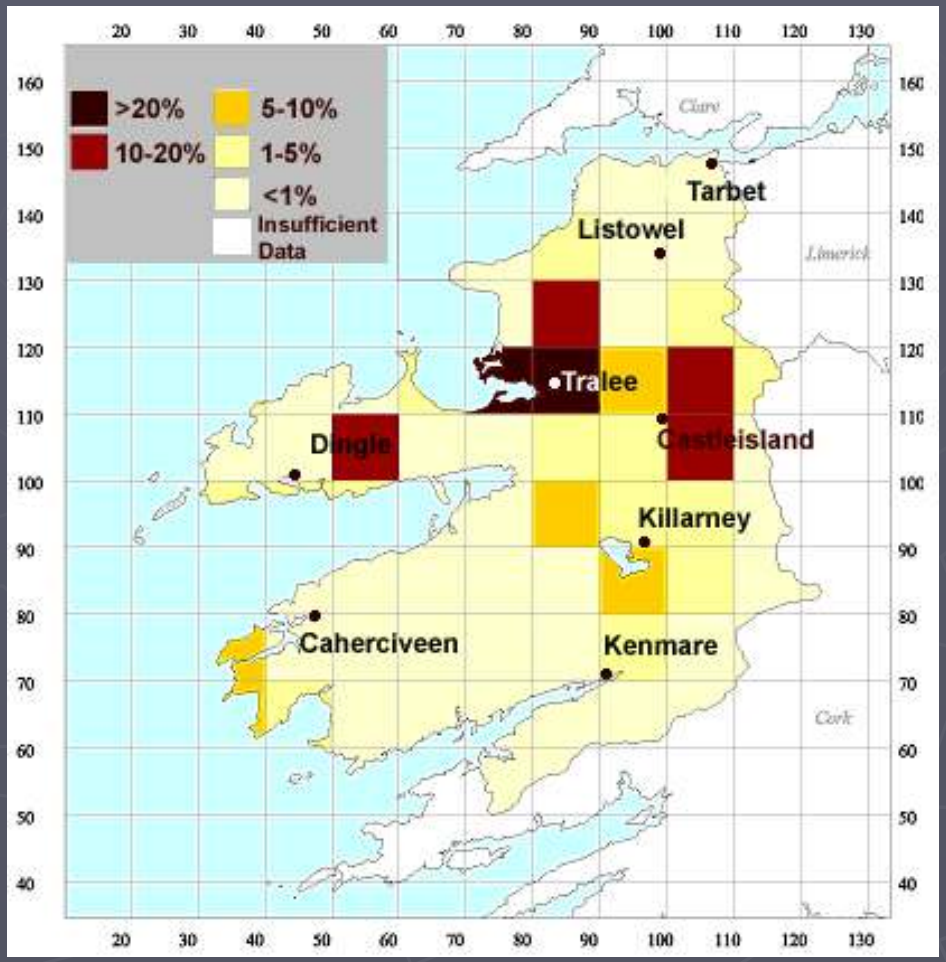
Database

Decision Makers

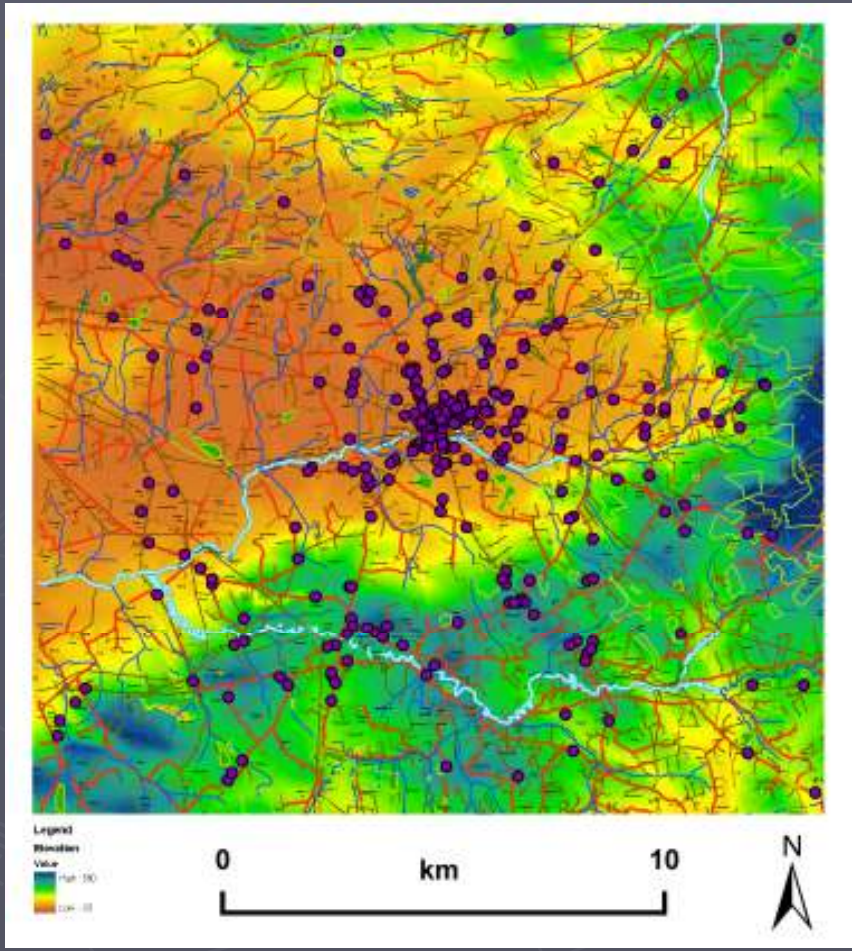
Project Aims

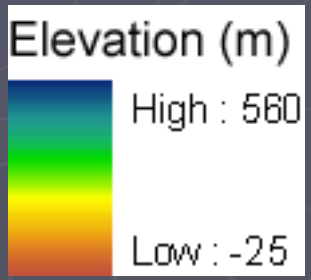
- To investigate spatial distribution of radon levels in houses around Castleisland, Co. Kerry, Ireland
- To look for a predictive model to provide mapping of radon potential
- To assess the extent to which standard GIS are suitable as the basis for a radon Spatial Decision Support System

RPII National Radon Survey 1992-99

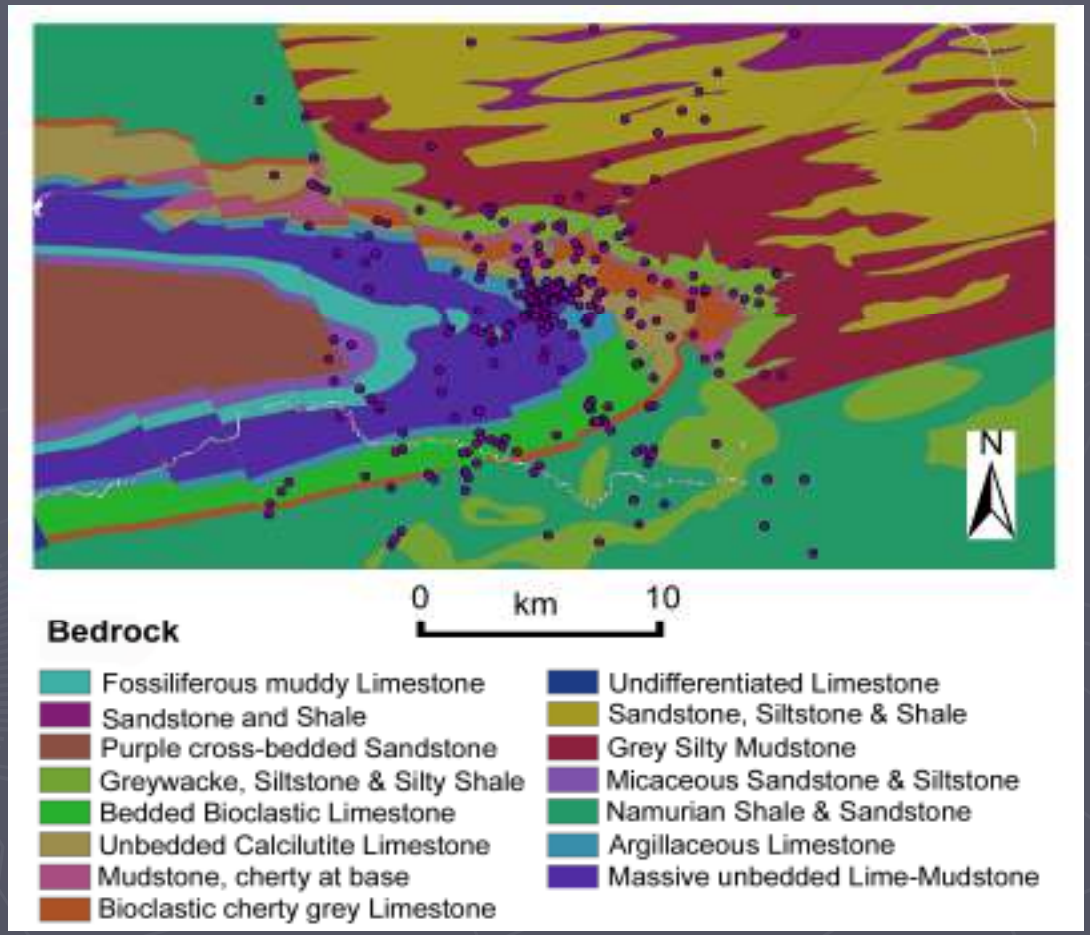


Castleisland Survey Data





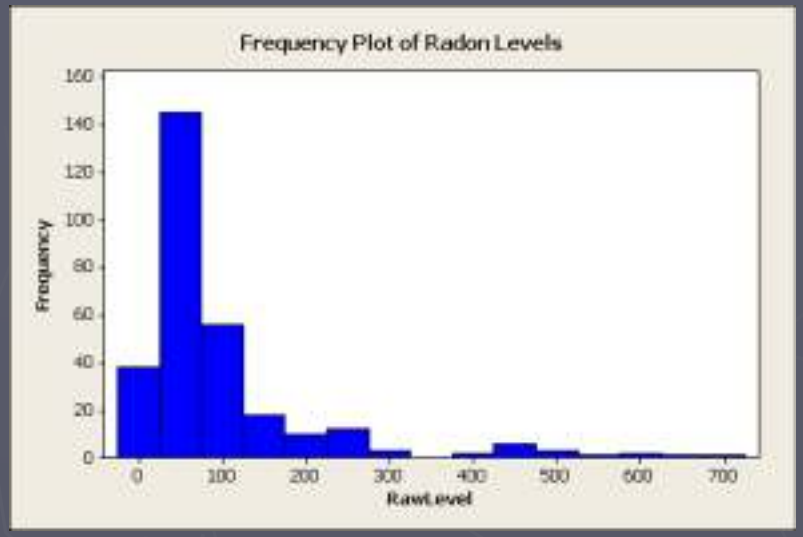
GSI Bedrock & Aquifer Data



Methodology

- Exploratory Data Analysis
- Investigate multiple regression models for radon potential
- Produce radon potential maps

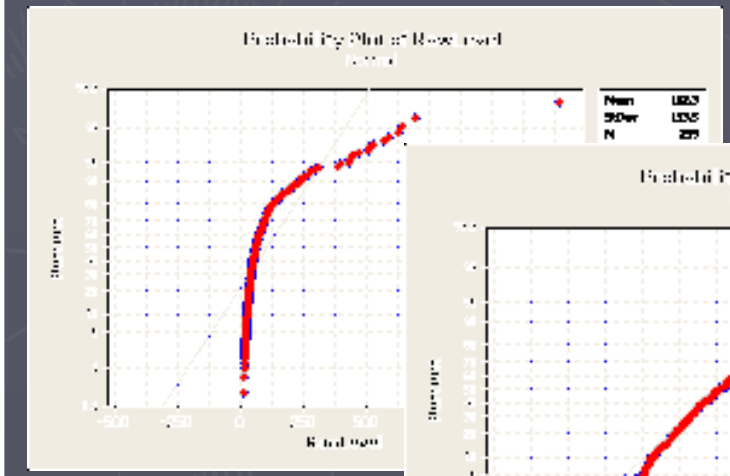
Exploratory Data Analysis

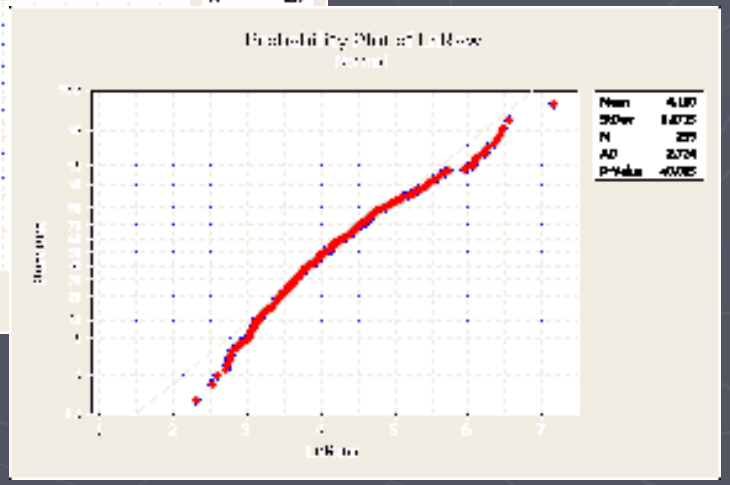


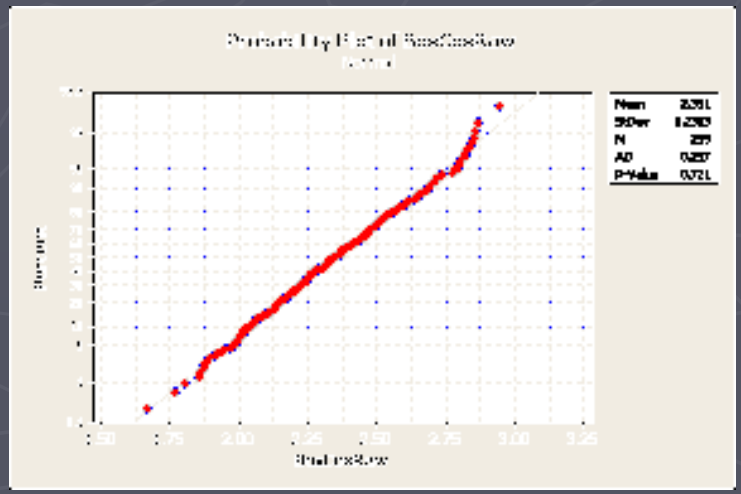
Data are not normally distributed. Gunby *et al*. report UK radon data lognormal after background correcting by 4Bq/m3

$$T(y) = \frac{(y^{\lambda} - 1)}{\lambda}$$

Box-Cox Transform







Regression Modelling

- Linear Regression
  - fit a straight line through data
- Multiple regression
  - Extension of the idea to multiple explanatory variables.
- Use Geological & Topographical data as explanatory variables

Regression Model (data > 200Bq/m^3)

$$BOX\_COX = C_0 + C_1.SLOPE + C_2.LN\_ASPECT + C_3.STRAT\_CL + C_4.ST\_CLcr + C_5.STRAT\_CS + C_6.STRAT\_RF$$

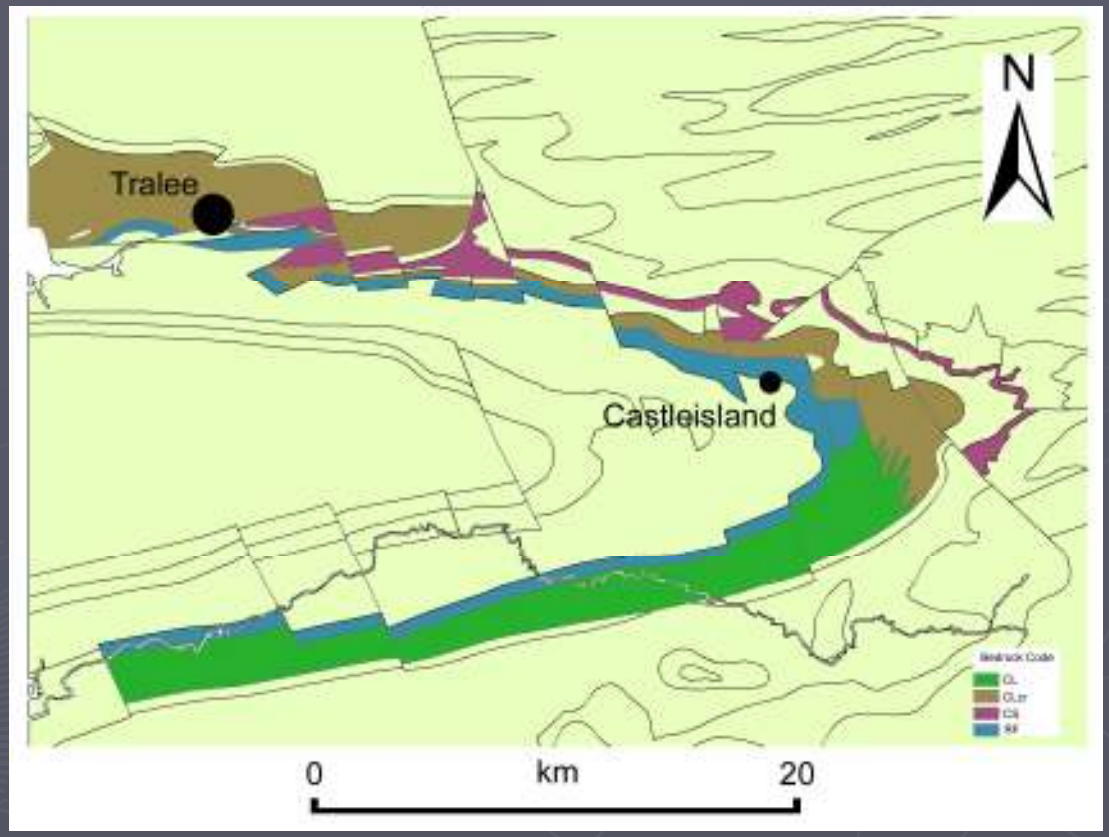
gives $R^2 = 0.6$

This model explained 60% of the variation! ☺

The Culprits I

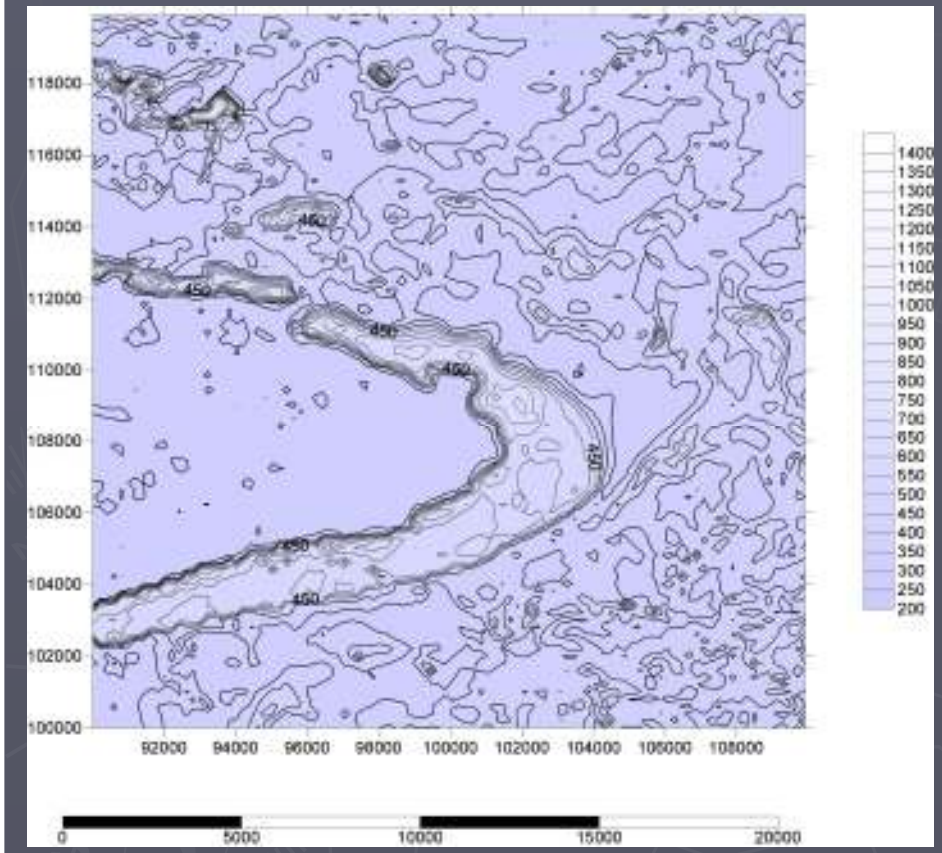
LITHOLOGY CODE	Description
STRAT_CL	Bedded Bioclastic Limestone
STRAT_CLcr	Unbedded Calcilutite Limestone
STRAT_CS	Mudstone
STRAT_RF	Well-Bedded Argillaceous Limestone

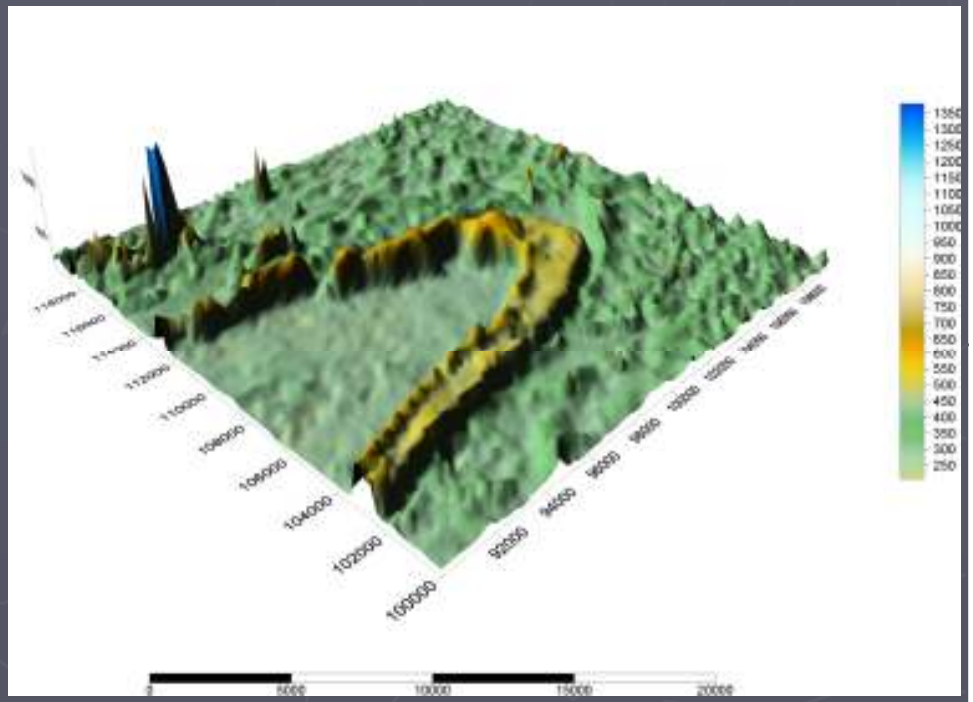
The Culprits II



Geological Map of the Extended Area

Radon Model Prediction





Radon Potential Map

Study Area

Radon Potential Map

Extended Area

Further work ?

- identify target addresses by combining the radon risk map with GeoDirectory in a GIS
- Improve model using soil gas radon and soil permeability measurements
- Develop a bespoke GIS as an SDSS ?

Acknowledgments

- RPII
  - Dr Catherine Organo
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