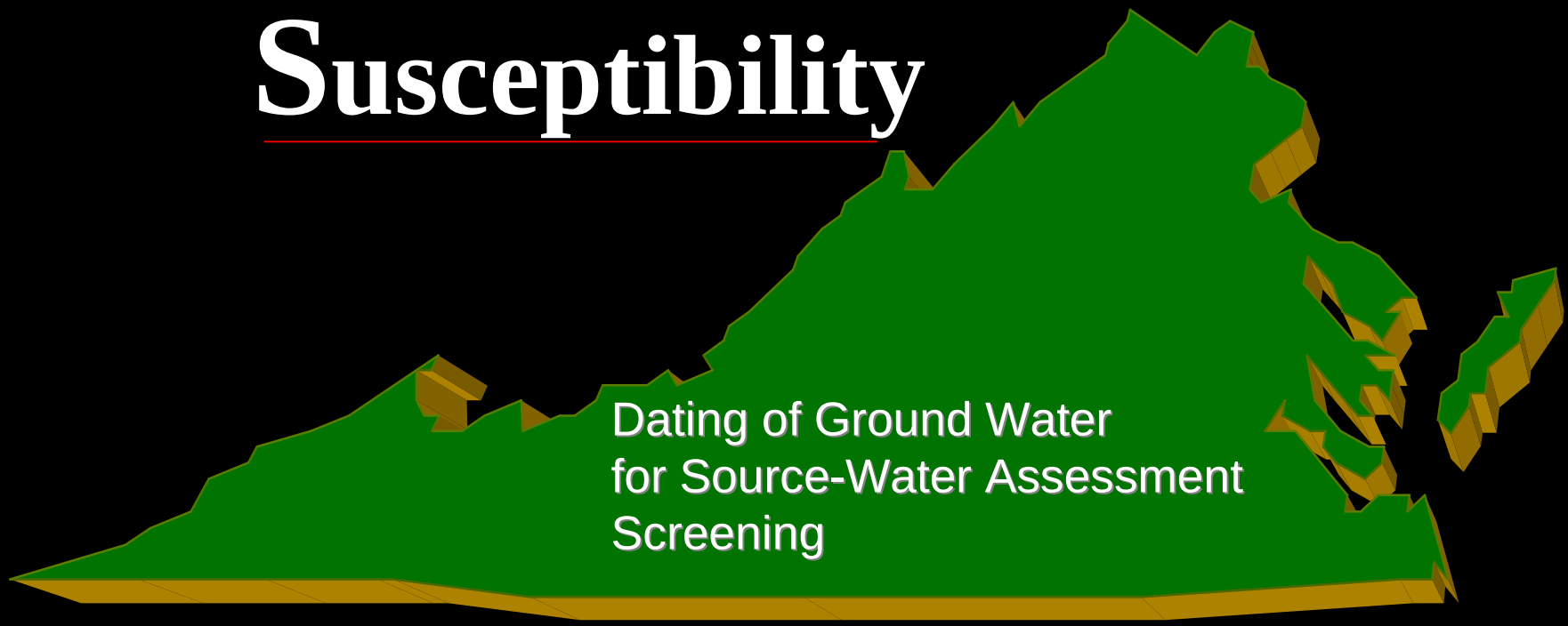
Virginia Aquifer Susceptibility



Dating of Ground Water
for Source-Water Assessment
Screening

Objective

- **Identify the intrinsic natural susceptibility of regional aquifers in Virginia**

- **Apply susceptibility determinations in screening public ground-water supplies and identifying those that require detailed source-water assessments**

USGS

Virginia Source Water Assessment Program

(http://www.vdh.state.va.us/owp/water_supply.htm)

Type of source water	Sensitive source	LUA present in source area	Susceptibility
Ground water	No	No	Very Low
Ground water	No	Yes	Low
Ground water	Yes	No	Moderate
Ground water	Yes	Yes	High

LUA -- Land-use Activity

Sampling Activities - Ground-Water Dating

CHLOROFLUOROCARBONS

- F-11, F-12, and F-113
- Young waters (<50 years)
- Susceptibility determinations

TRITIUM

- Nuclear weapons testing
- Political isotope
- Young waters (<50 years)

TRITIUM/HELIUM

- Radioactive decay of ^{3}H
- Young waters (<30 years)

SULFUR HEXAFLUORIDE

- Experimental
- Young waters (<30 years)

CARBON-14

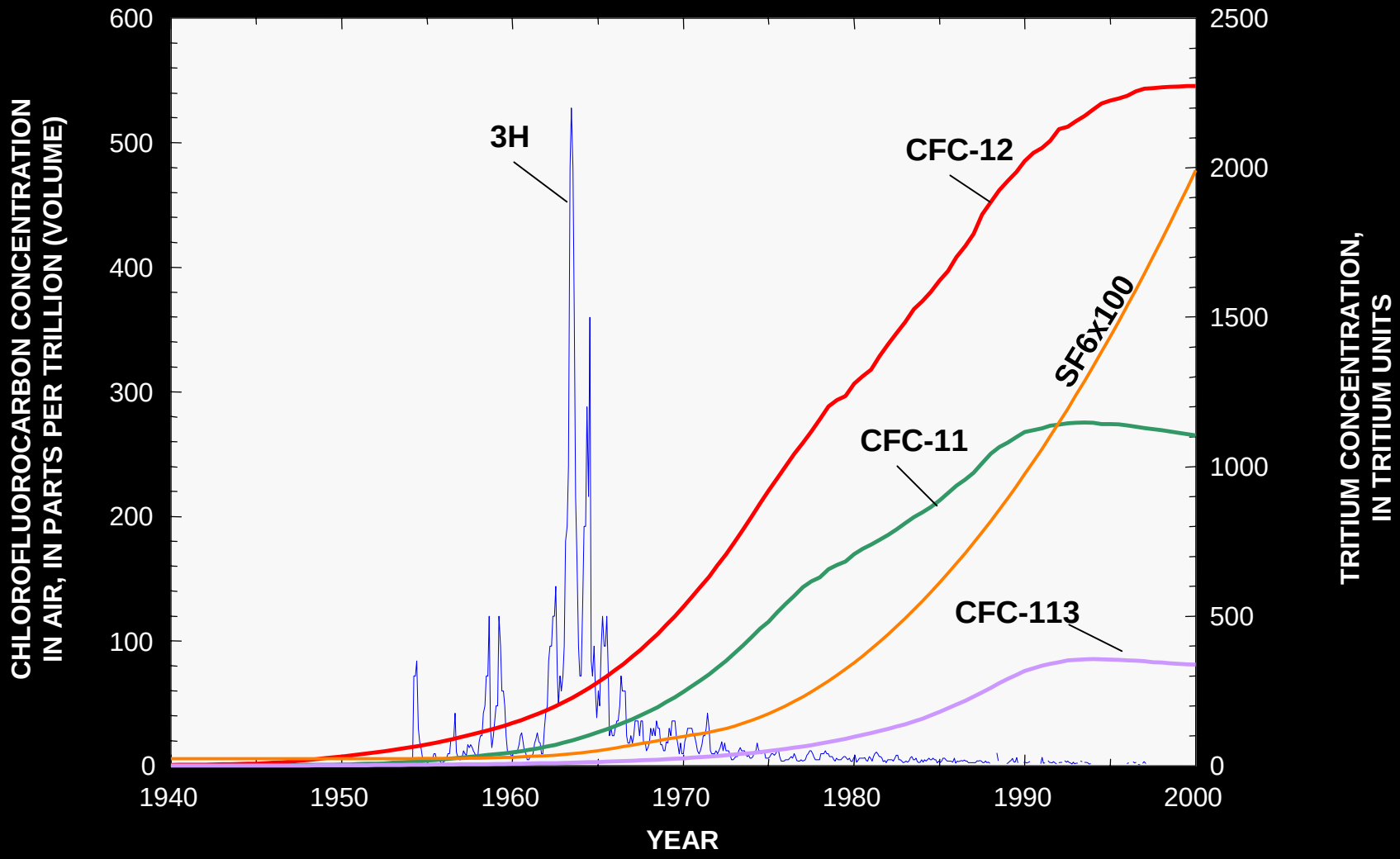
- Dissolved inorganic carbon
- Paleowaters (1,000 - 30,000 years)

HELIUM-4

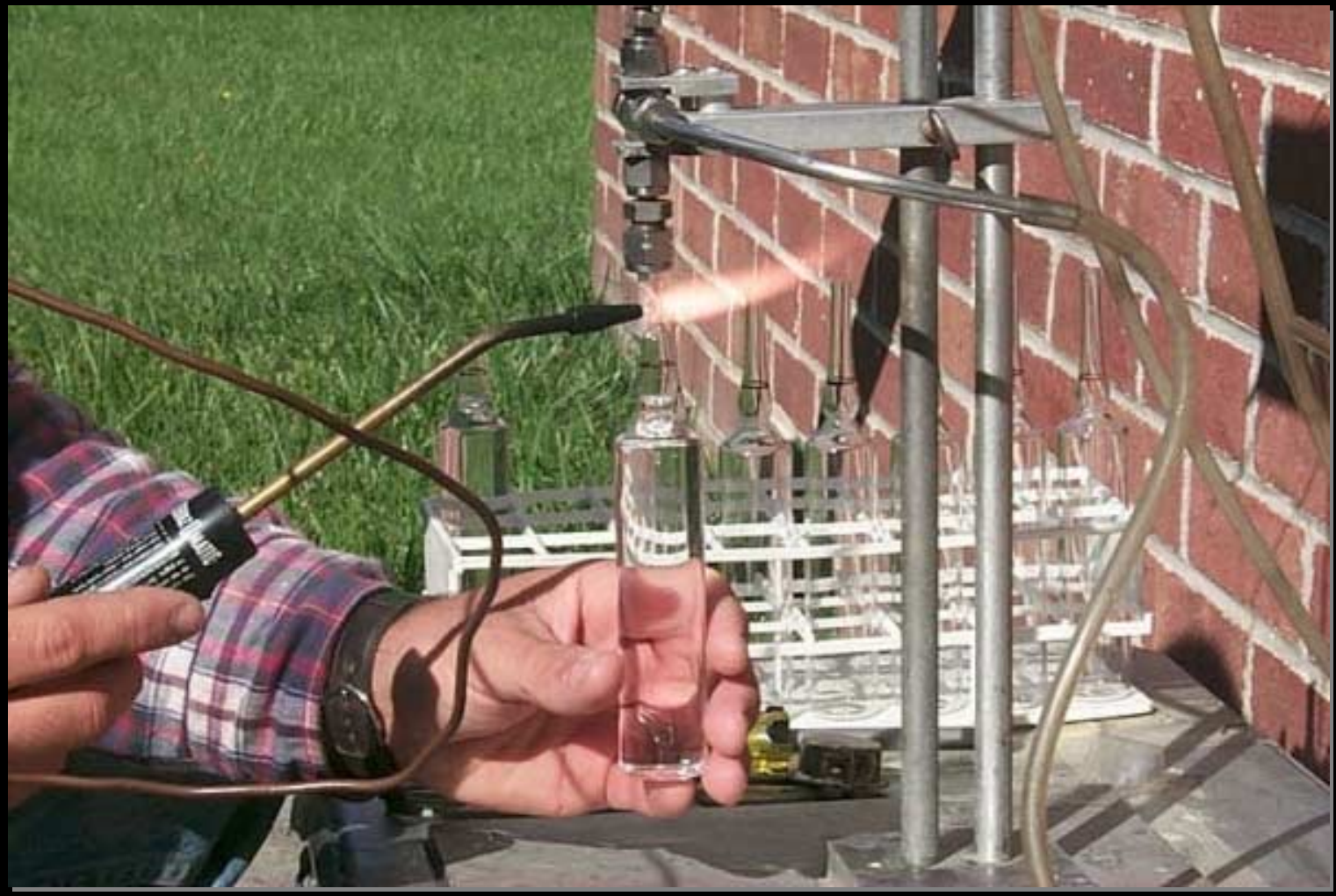
- Paleowaters

USGS

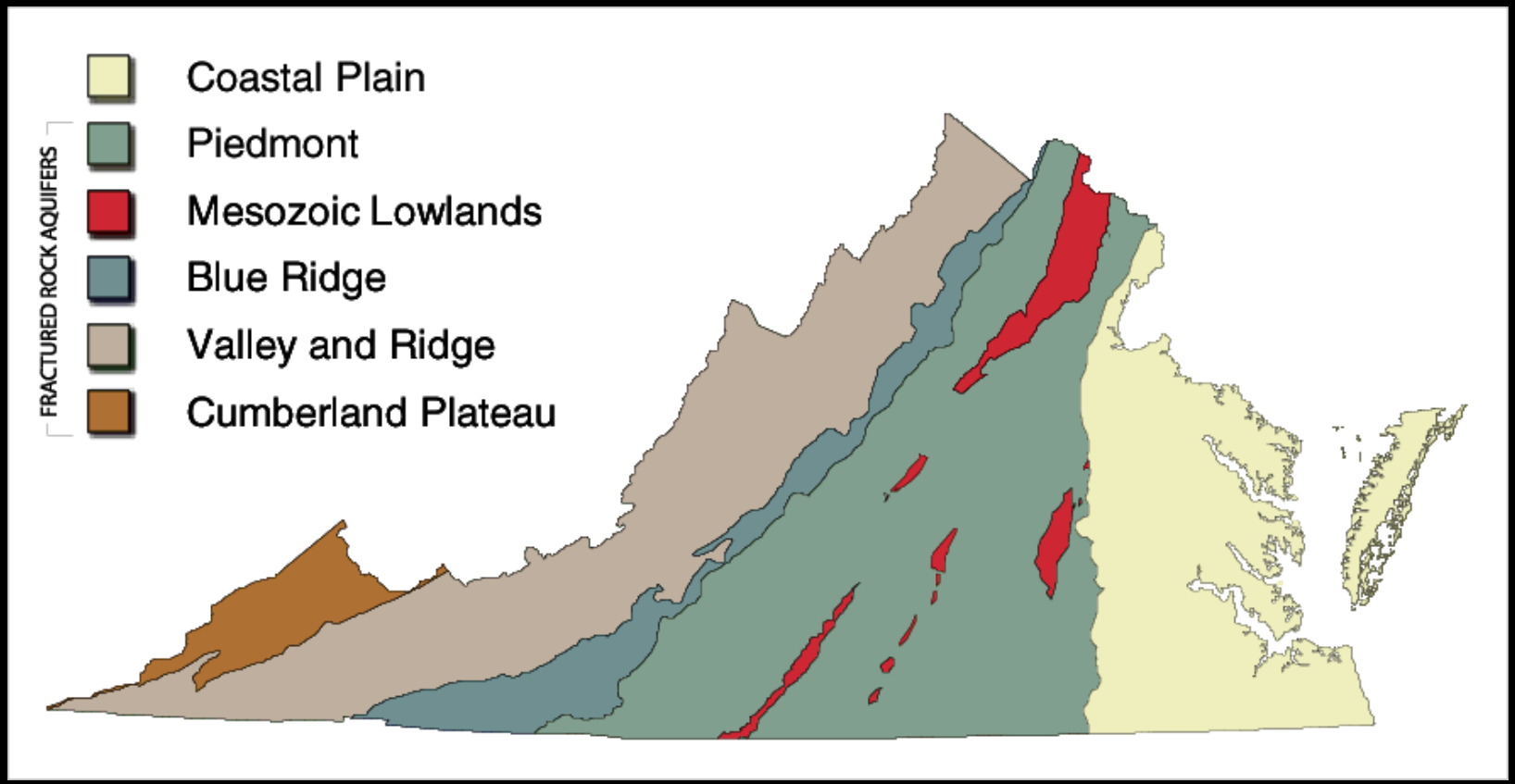
Atmospheric mixing ratios



CFCs Sampling

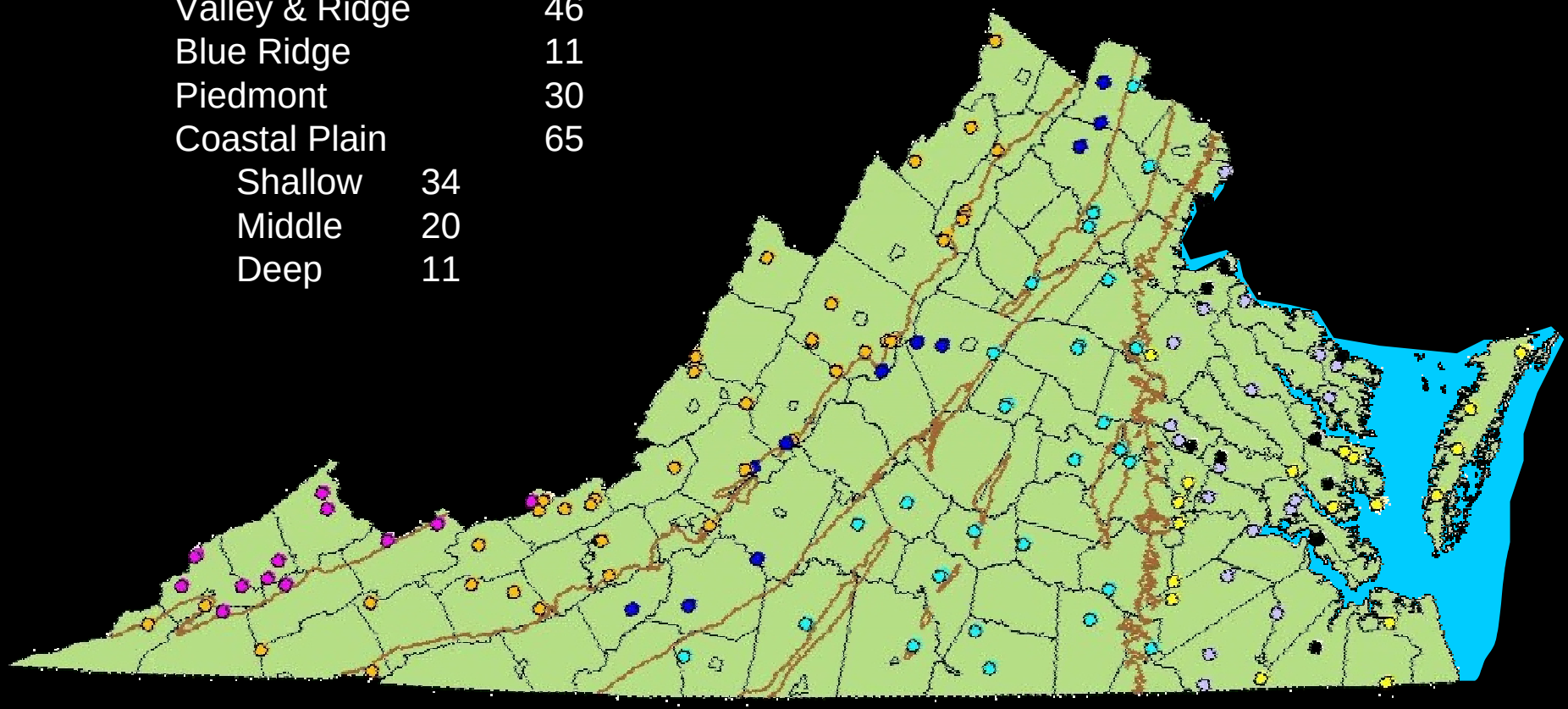


Physiographic Provinces of Virginia

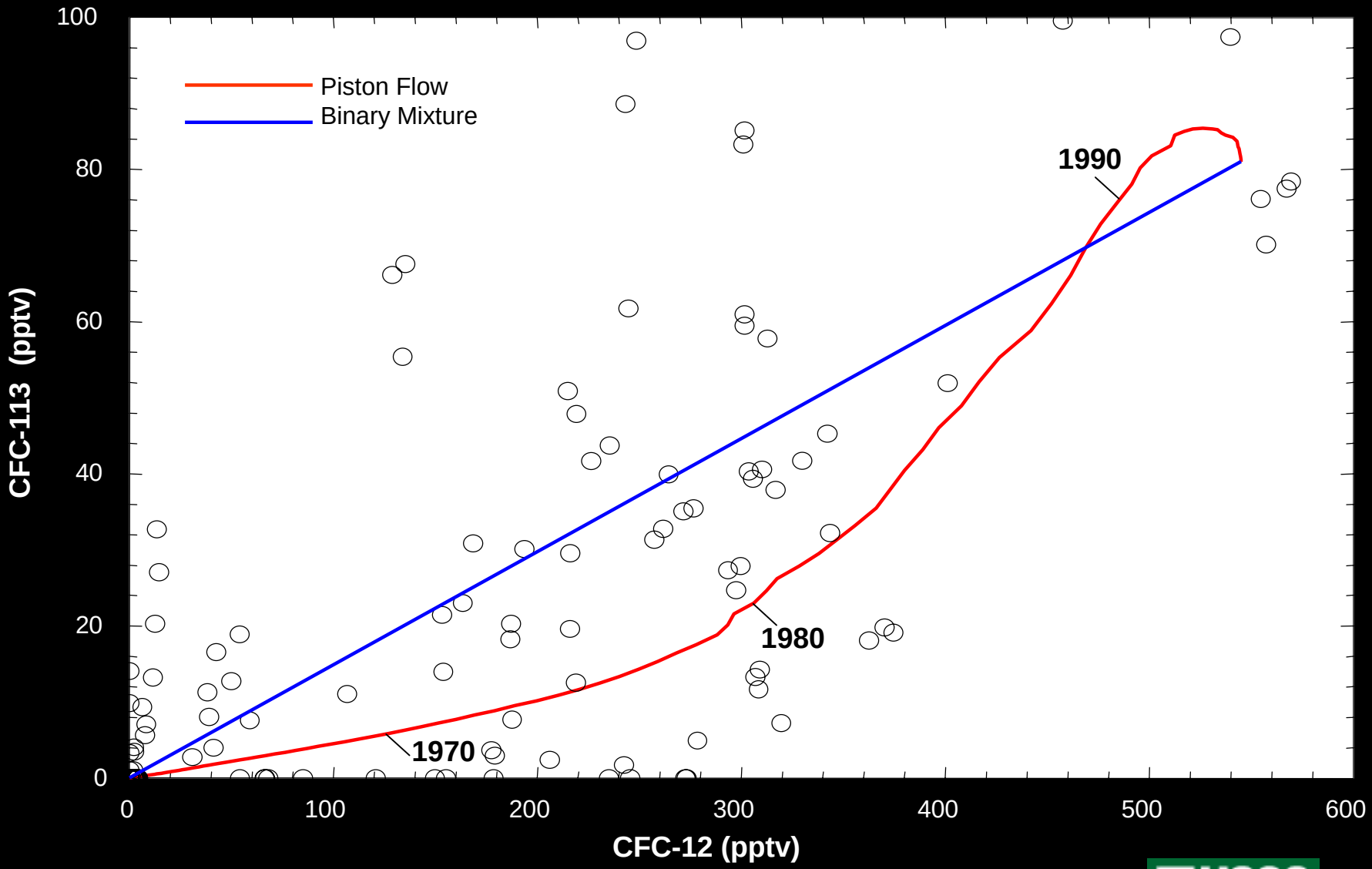


Virginia Aquifer Susceptibility Sampling Sites (n=165)

Appalachian Plateaus		13
Valley & Ridge		46
Blue Ridge		11
Piedmont		30
Coastal Plain		65
	Shallow	34
	Middle	20
	Deep	11

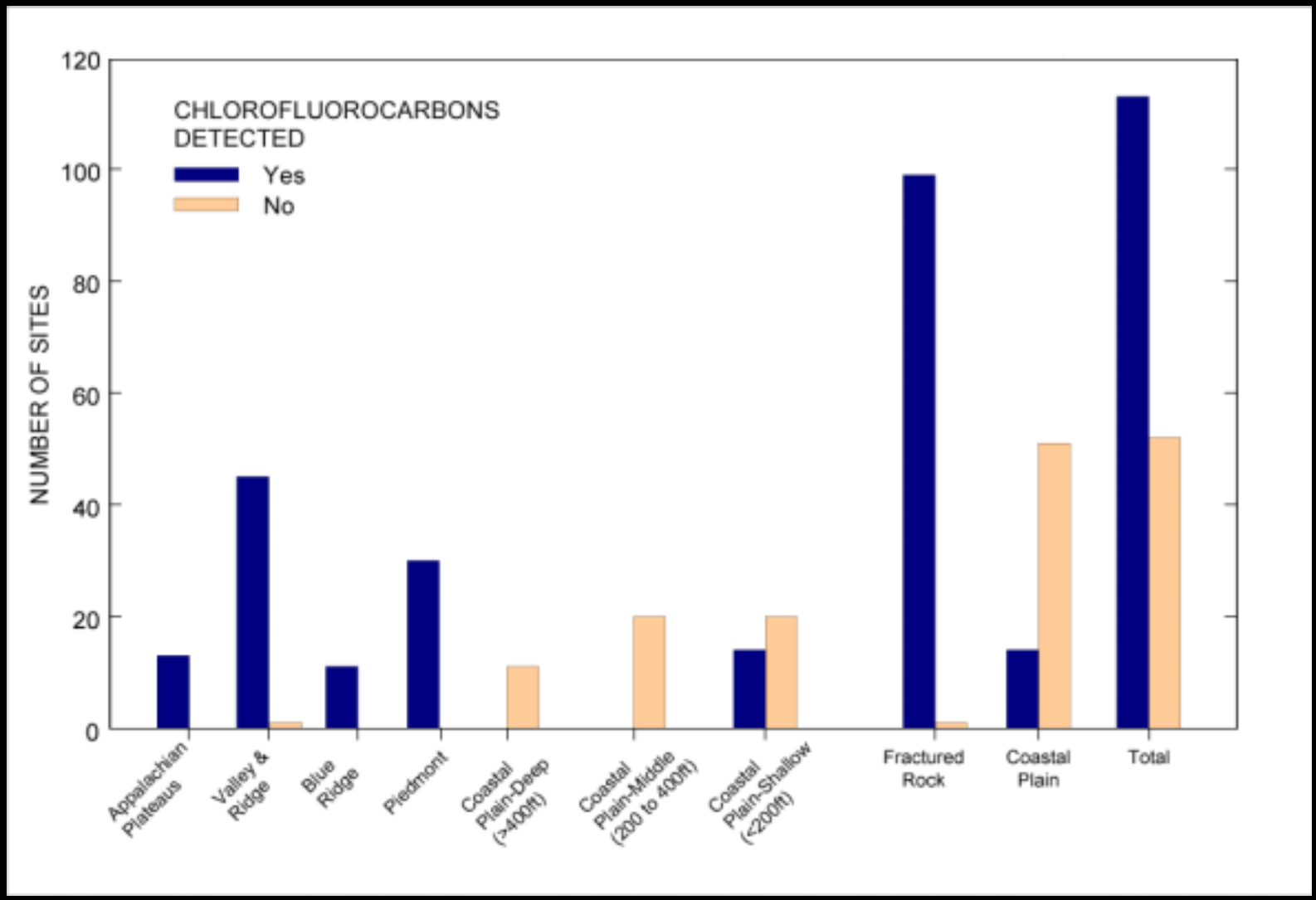


CFC-12 vs. CFC-113 Mixing Models

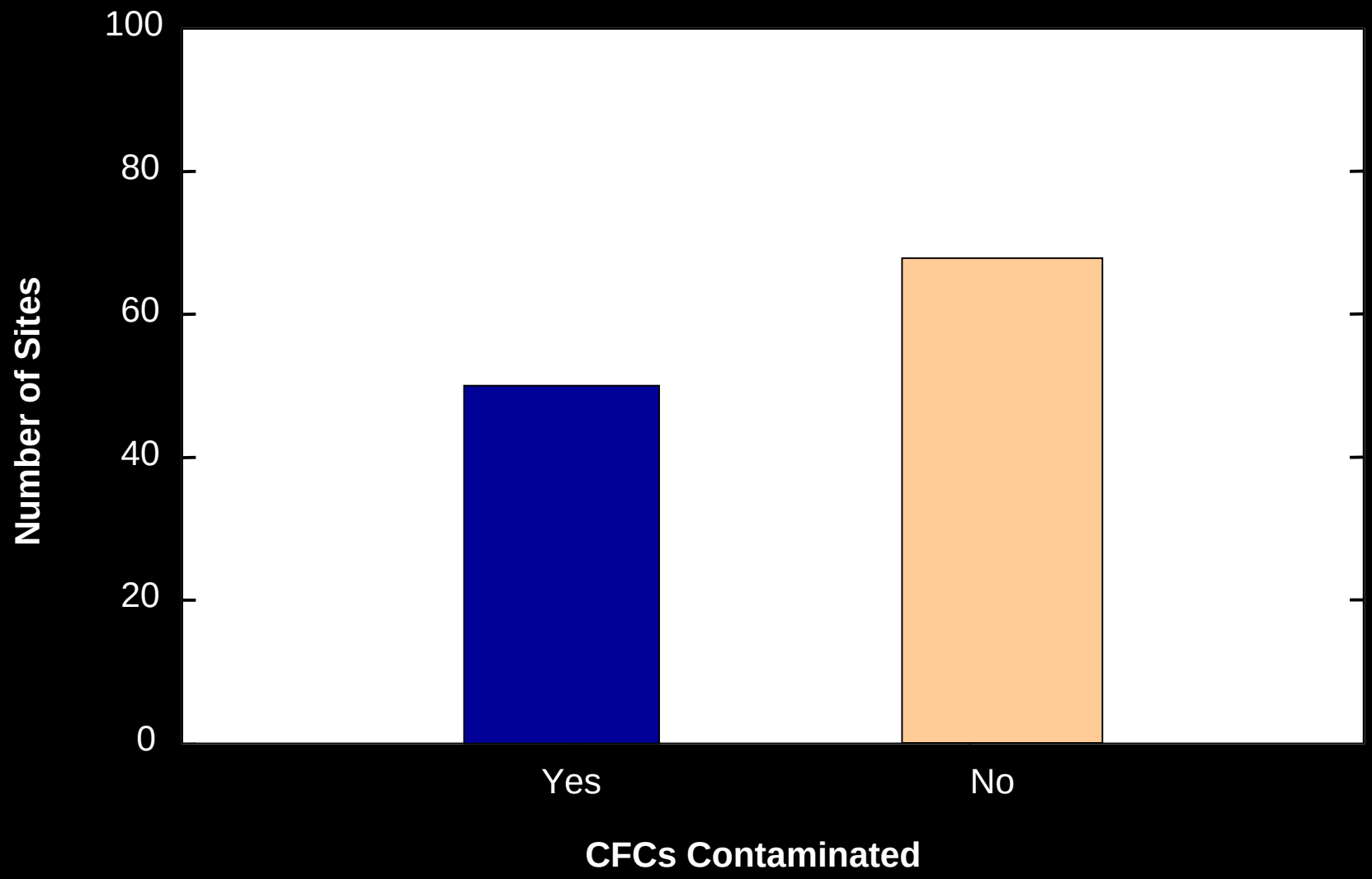


Susceptibility Determinations

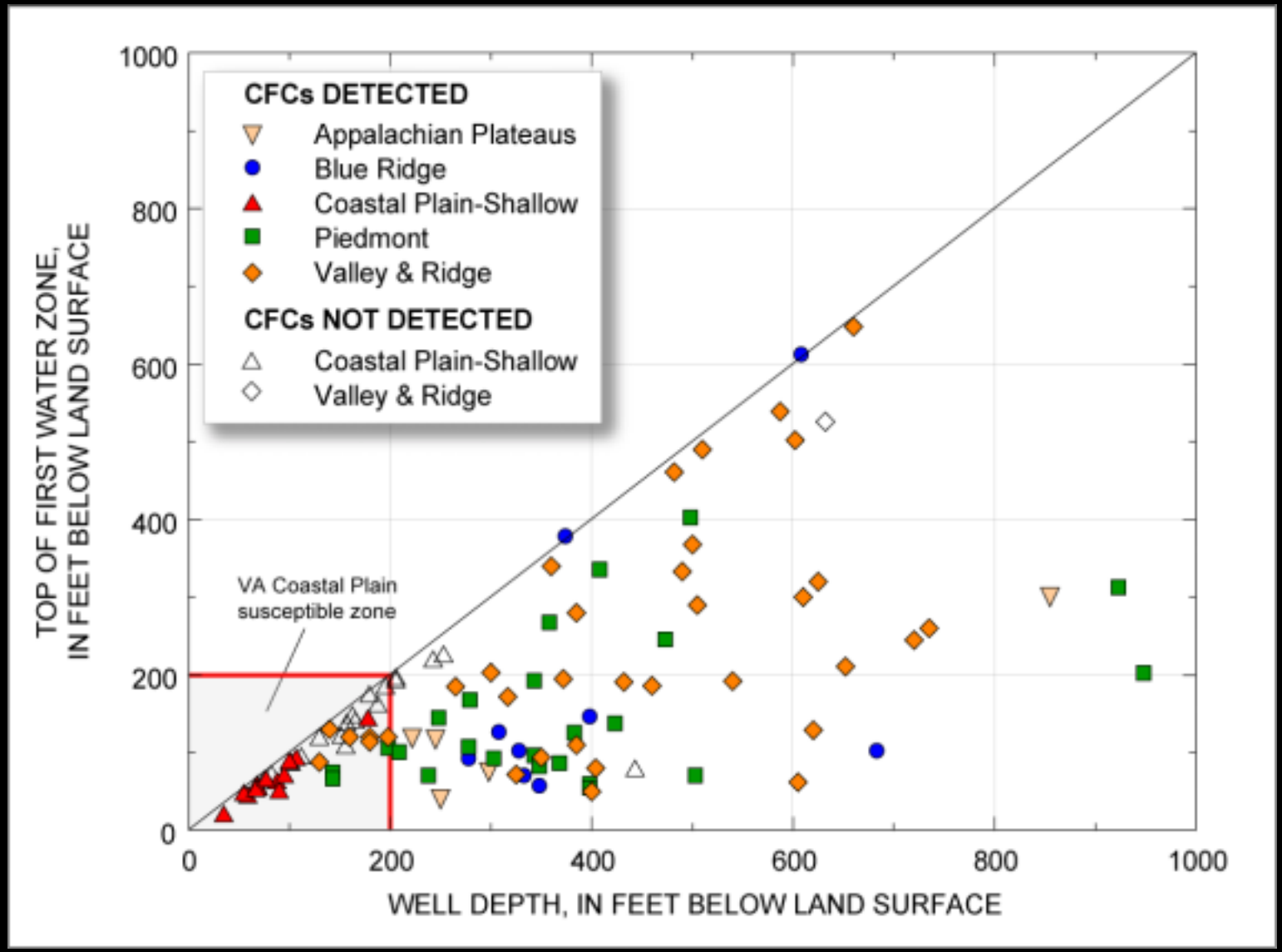
Based on CFC concentration greater than 5 pg/kg

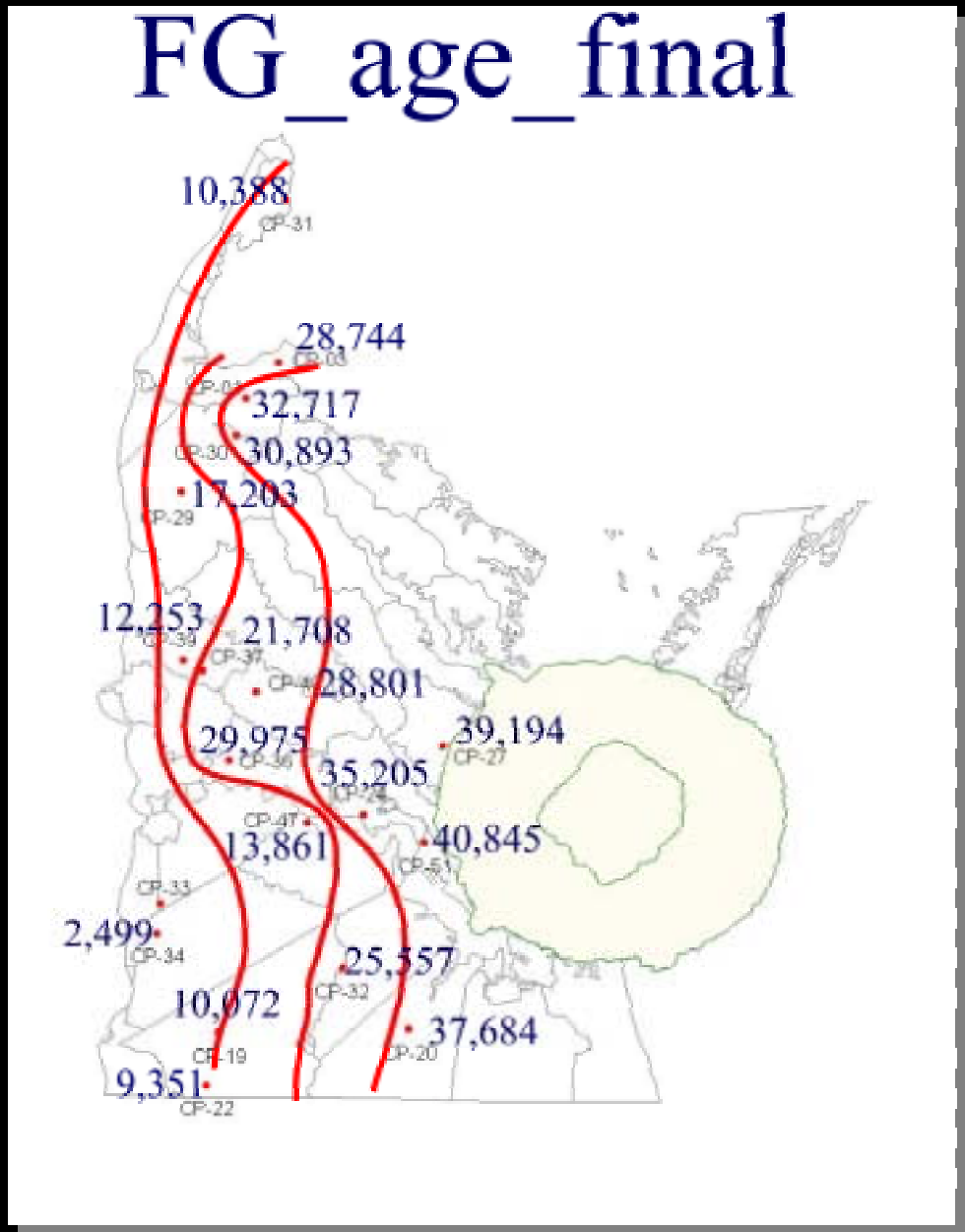


Number of Sites with CFCs Contamination



CFCs Occurrence with Depth



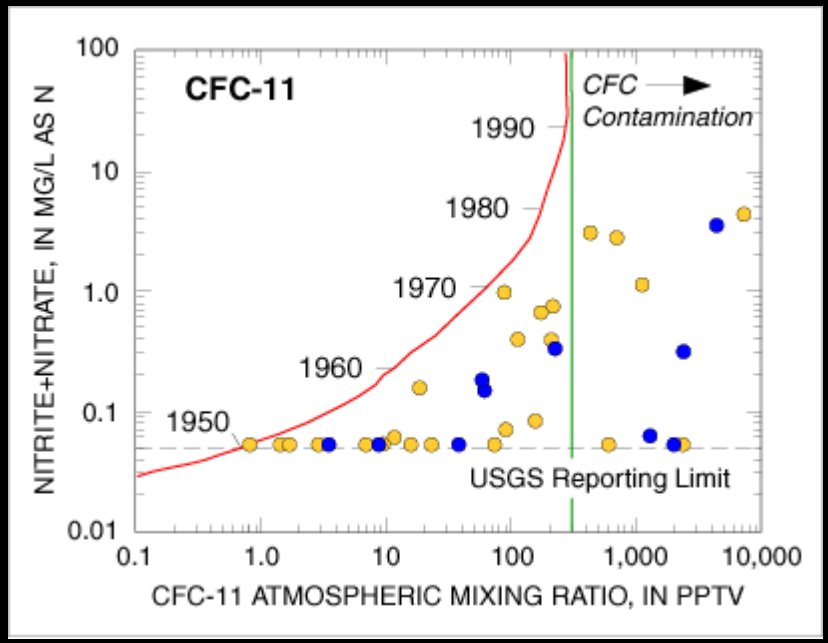


Fontes-Garnier Model ^{14}C Ages

Middle Potomac Aquifer

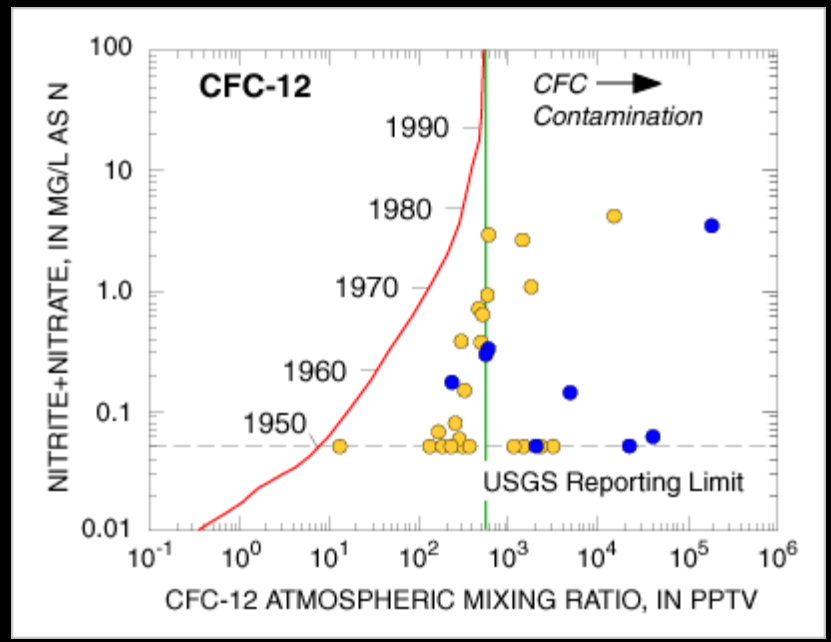
Top of screen intervals range from 62 to 1,020 feet below land surface

Relation between CFCs and Nitrate



EXPLANATION

- Blue Ridge
- Piedmont



USGS

Ideas for Future Investigation

- Temporal changes in ground-water age or binary mixtures
- Vertical distribution of ages
- Relation between helium concentrations and binary mixtures
- Relation between ground-water age and the occurrence of viruses and other emerging contaminants
- Relate ground-water dating results with dye tracer results in karst terranes

Radon in Ground Water