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Title: Biomonitoring at Los Alamos National Laboratory

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Biological resources
Reading Room
DOE O 231.1

BIOMONITORING AT LOS ALAMOS NATIONAL LABORATORY

Philip Fresquez, WES-EDA, LA-UR-11-

Biomonitoring Components

- **FOODSTUFFS-Edible biota**
  - Domestic Crops-fruits, vegetables, grains
  - Wild edible plants/herbs/teas
  - Elk/Deer/Livestock
  - Fish/Crayfish
  - Honey
  - Milk
  - Eggs
- **NONFOODSTUFFS- Nonedible biota**
  - Native Vegetation-trees, grasses, forbs
  - Honey bees
  - Birds
  - Benthic macroinvertebrates
  - Small mammals

Objectives:

- **Determine whether LANL operations are impacting human health via the food chain (foodstuffs) and the environment (nonfoodstuffs)**

1. **Determine concentrations and distribution of:**
   - Radionuclides, hazardous metals, and organic compounds from potential impacted areas and compare them to:
     - Regional Background (RSRLs) (world wide fallout and natural sources)
     - Screening Levels (SLs or ESLs)
     - Standards (DOE, NMED, EPA, FDA)
2. **Trends over time**
3. **Dose and Risk**

Regulatory and Other Requirements:

- DOE Order 435.1, “Radioactive Waste Management”
- DOE Order 450.1, “General Environmental Protection Program”
- DOE Order 5400.5, “Radiation Protection of the Public and Environment”
- “DARHT EIS Mitigation Action Plan”
- “Special Environmental Analysis (SEA) Mitigation Action Plan”
- “DOE/Bureau of Indian Affairs/LANL Memorandum of Understanding for Environmental Sampling at San Ildefonso Pueblo”

Methods

As part of the environmental surveillance program at LANL, we evaluate impacts from LANL operations to various biota by the following:

•Analysis of tissues,

•Analysis of Populations and Species Composition,

•Modeling (estimating radionuclide uptake and dose using data from lower trophic levels), and

•Global positioning system (GPS) tracking to determine time spent by big game near impacted sites.

Constituents Analyzed in Tissues

Radionuclides:

- H-3, Cs-137, Sr-90, U-234, 235, 238, Pu-238, 239/240, Am-241

Target Analyte List (TAL):

- Ag, Al, Ar, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, Zn

Organic Compounds:

- VOCs, SVOCs, PEST, PCBs, HE, Dioxin/Furans

CROP SAMPLING

Crop Sampling locations

- **LANL**
- **Los Alamos**
- **White Rock/Pajarito Acres**
- **Pueblos (San Ildefonso, Santa Clara, Cochiti, Jemez)**
- **Downstream irrigated farms (Pena Blanca, Cochiti, Sile)**
- **Northern NM communities (Abiquiu, Espanola, Ojo Sarco, Dixon, Embudo)**

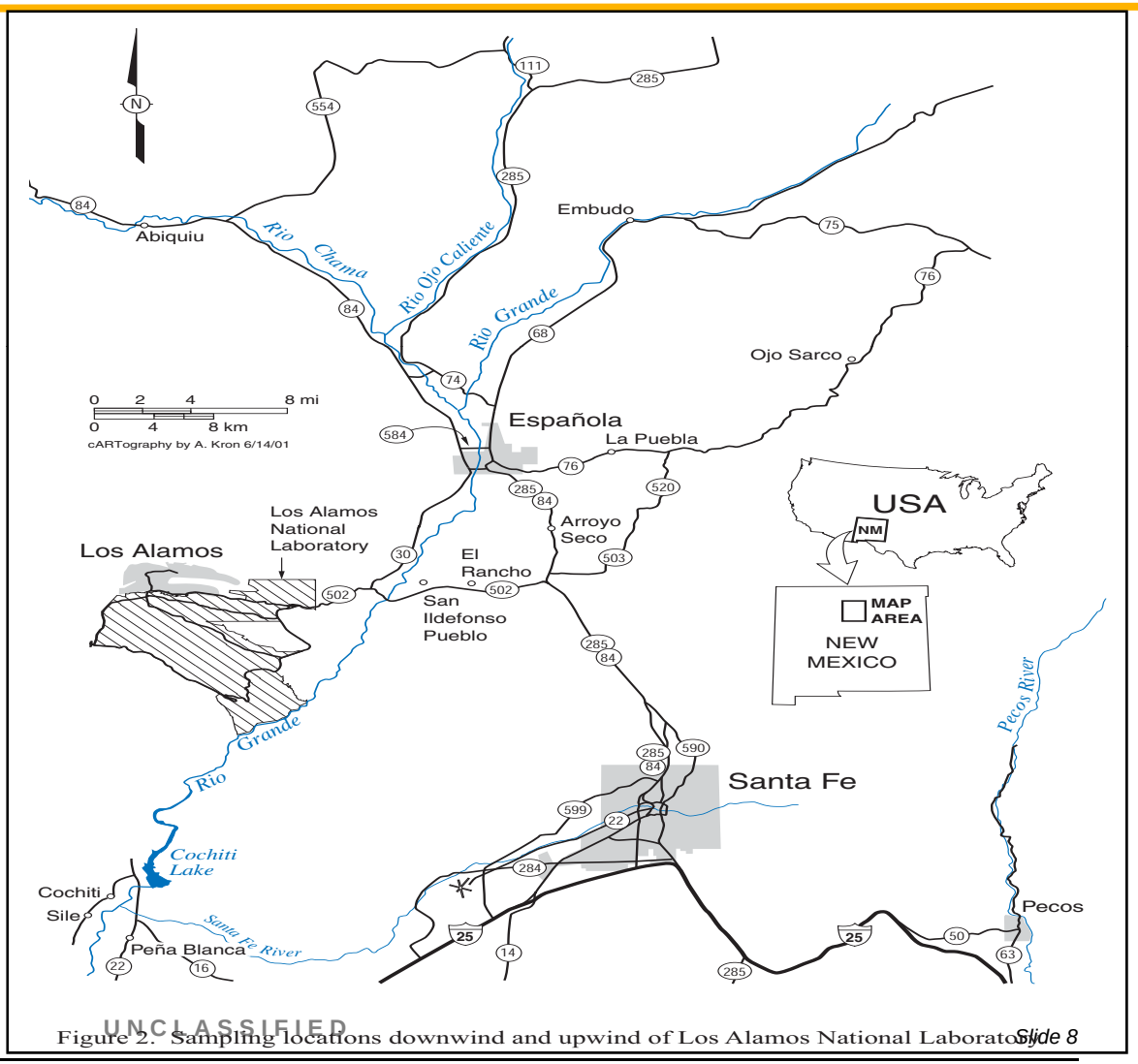
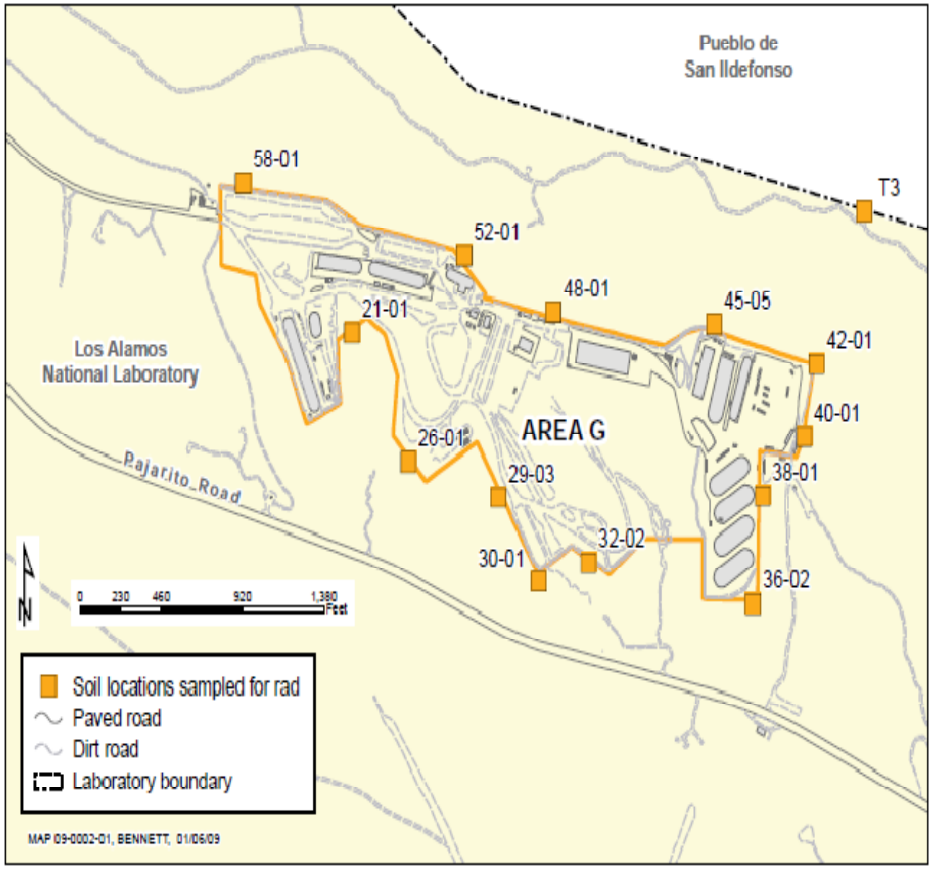


Figure 2. Sampling locations downwind and upwind of Los Alamos National Laboratory

Elk and Deer-Tissue Sampling

- Data Base = 26 deer and 43 elk from LANL, perimeter, and regional
- Collected as road kills
- Meat for radionuclides, metals, and PCBs
- Bone for radionuclides
- All constituents either ND, similar to background and/or below screening levels.

Elk and Deer-Modeling

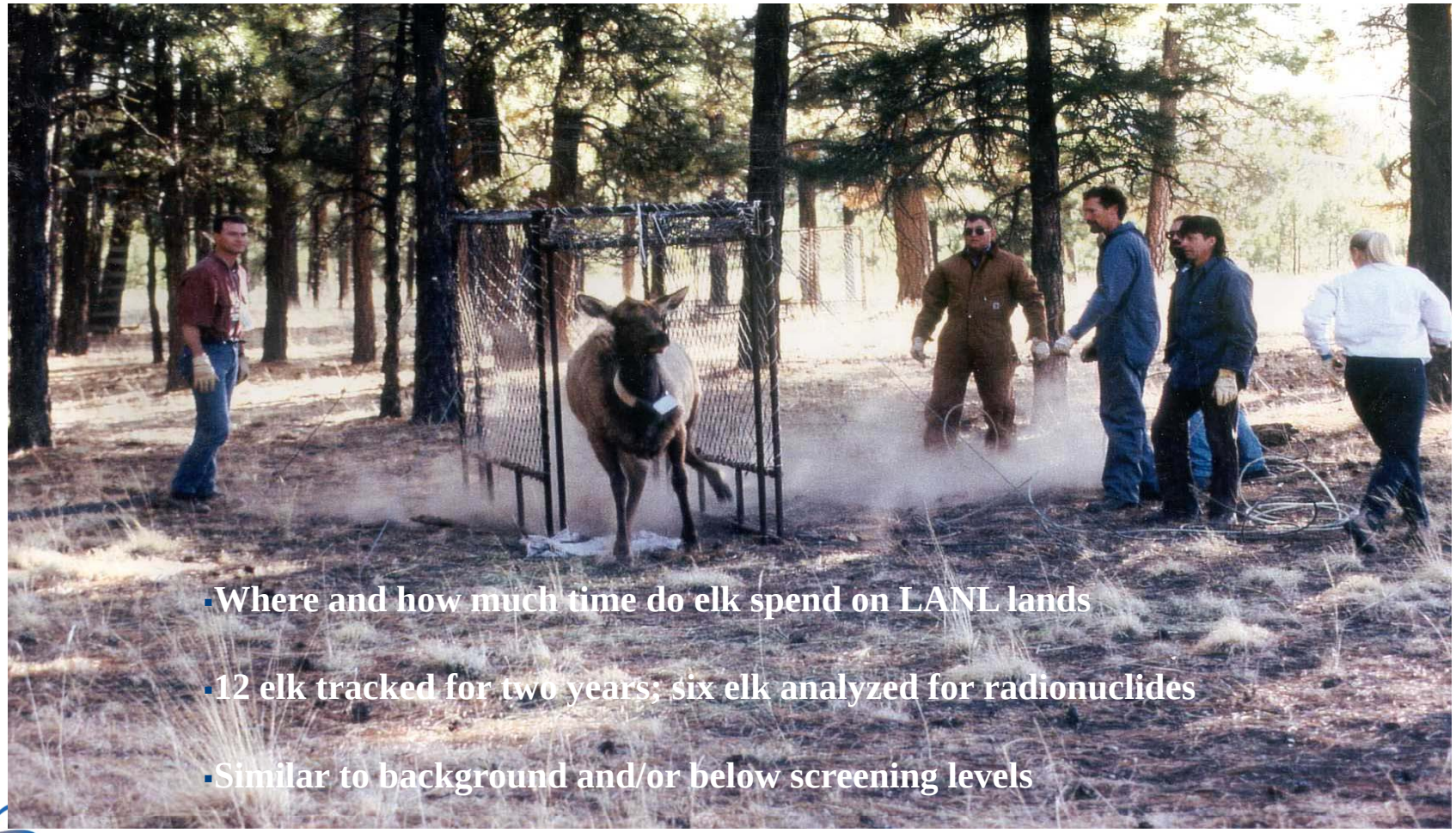


- Uptake and dose to deer were estimated using soil, vegetation, and water data collected over a four year period from around the Area G perimeter

- Compared to tissues of (road killed) deer collected as part of the ESP

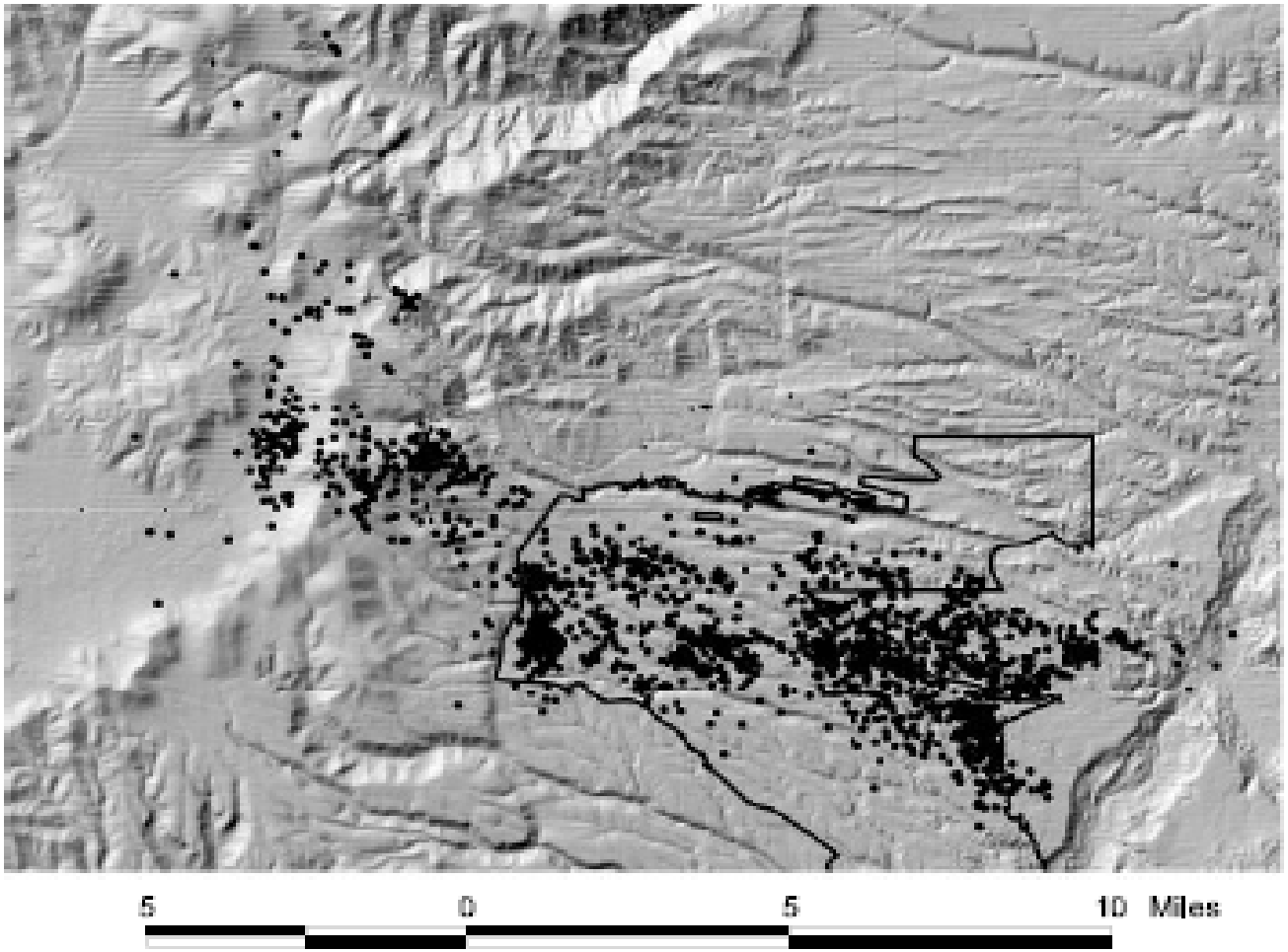
- Ferenbaugh et al. 2002. Environmental Monitoring and Assessment 74:242-254

Elk and Deer-GPS Collaring



- Where and how much time do elk spend on LANL lands
- 12 elk tracked for two years; six elk analyzed for radionuclides
- Similar to background and/or below screening levels

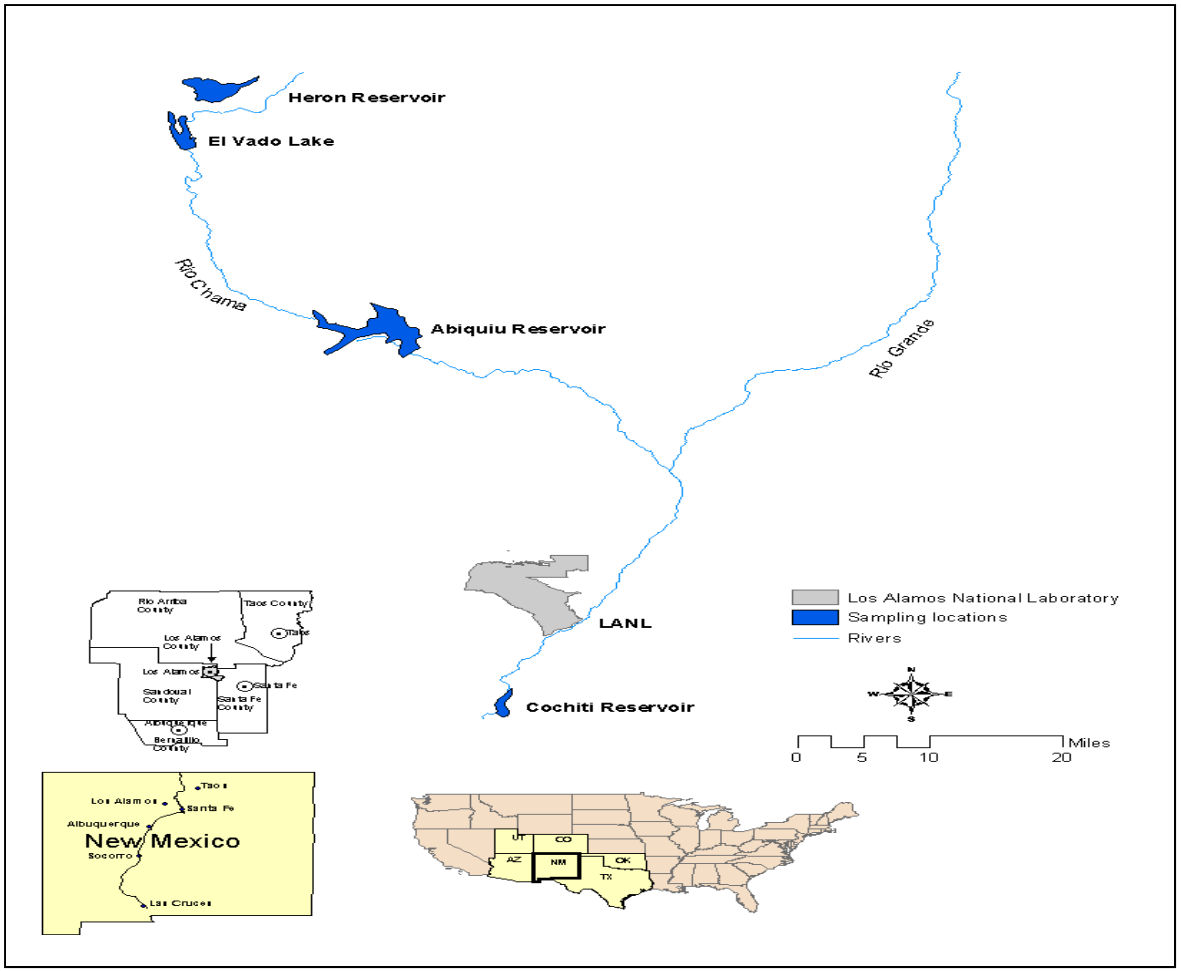
GPS Example



- 12 elk
- 23hr for two yrs

FISH/CRAYFISH SAMPLING

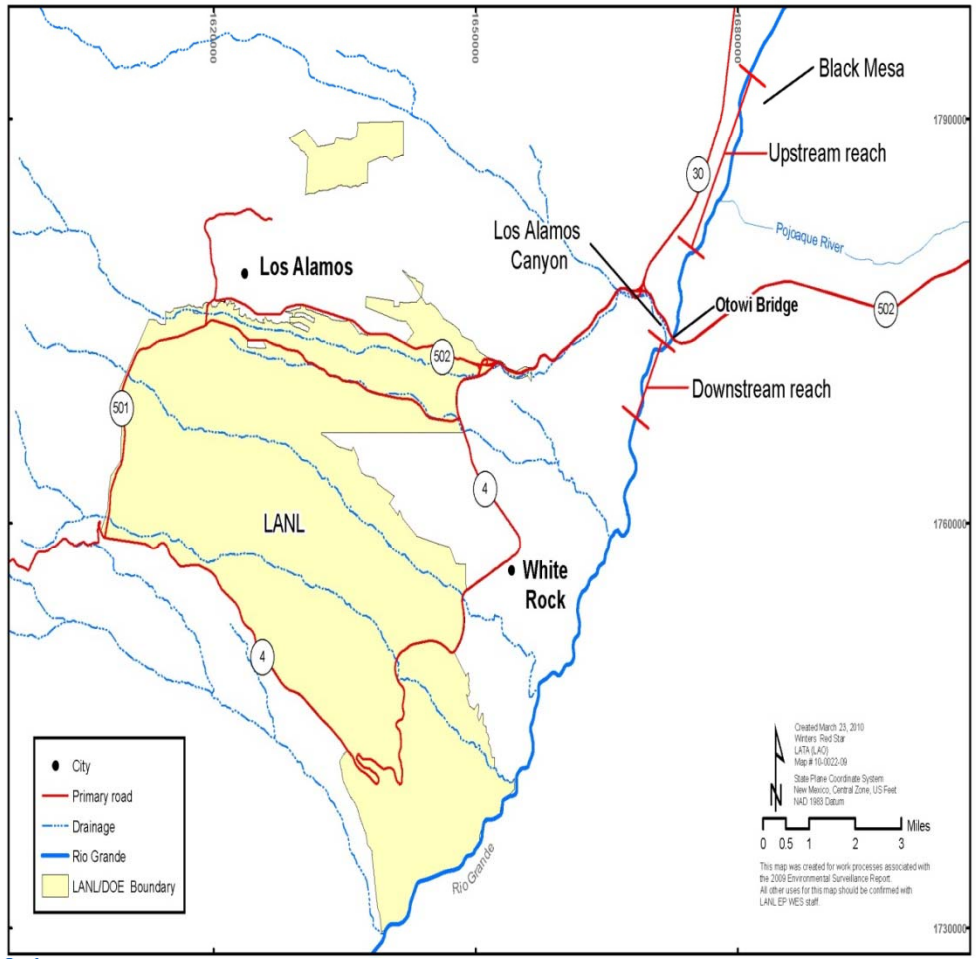
Monitoring Locations



Fish

- Predator and bottom-feeding fish; since the early 1980's
- Meat & bone analyzed for radionuclides
- Meat (fillet) analyzed for metals and PCBs
- All constituents similar in (direct) upstream and downstream fish from LANL; not a significant LANL contribution
- Mercury and PCBs above screening levels; fish advisories for Rio Grande

Crayfish



- Upstream and downstream of LANL in Rio Grande
- Analyzed for radionuclides, heavy metals, and PCBs
- All constituents similar to background and/or below screening levels

Other Foodstuffs Samples

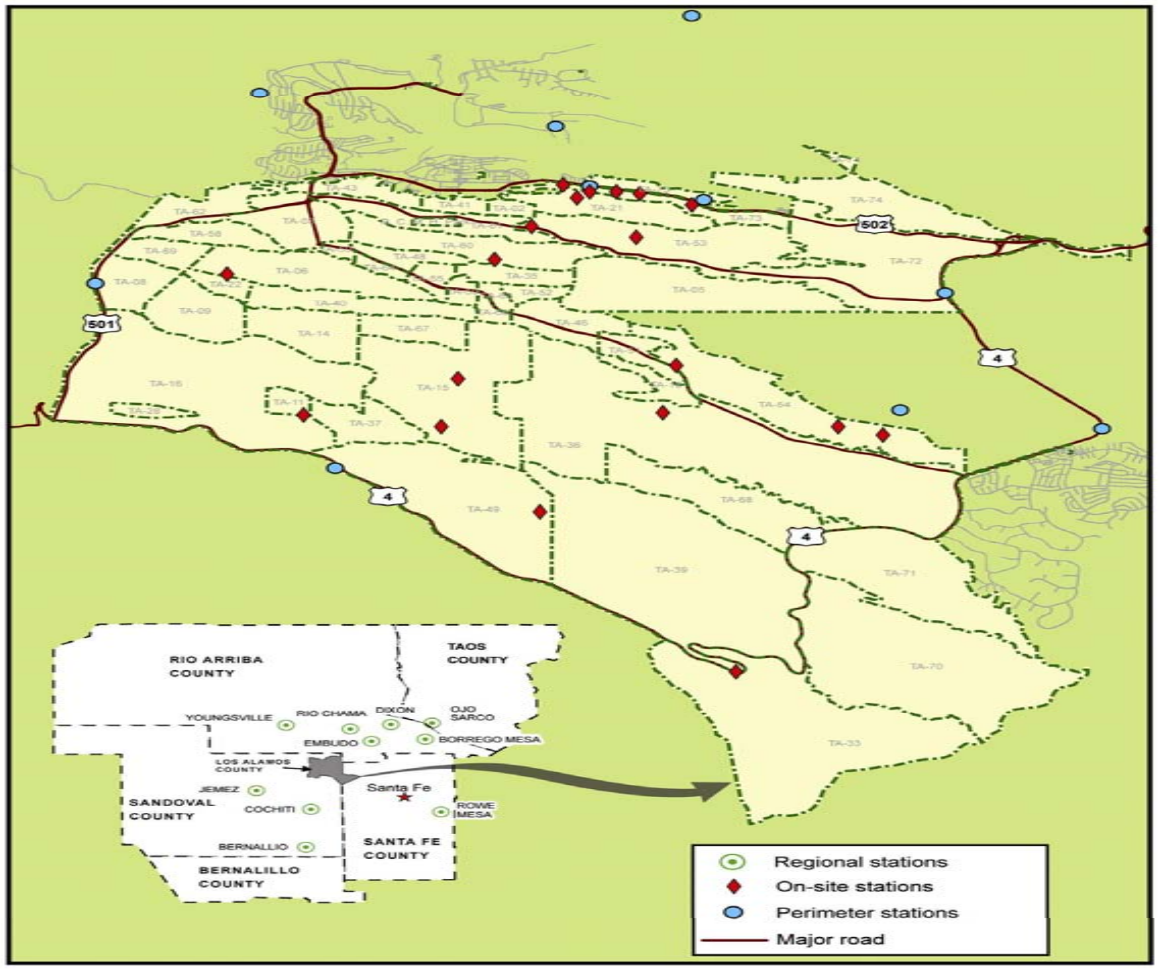
Goat Milk

Honey

Eggs

NATIVE VEGETATION SAMPLING

- **1974-present**
  - Overstory
  - Understory
- **Institutional**
  - 17 onsite
  - 11 perimeter
  - >4 regional
- **Area G**
  - 30 locations
- **DARHT**
  - 9 locations



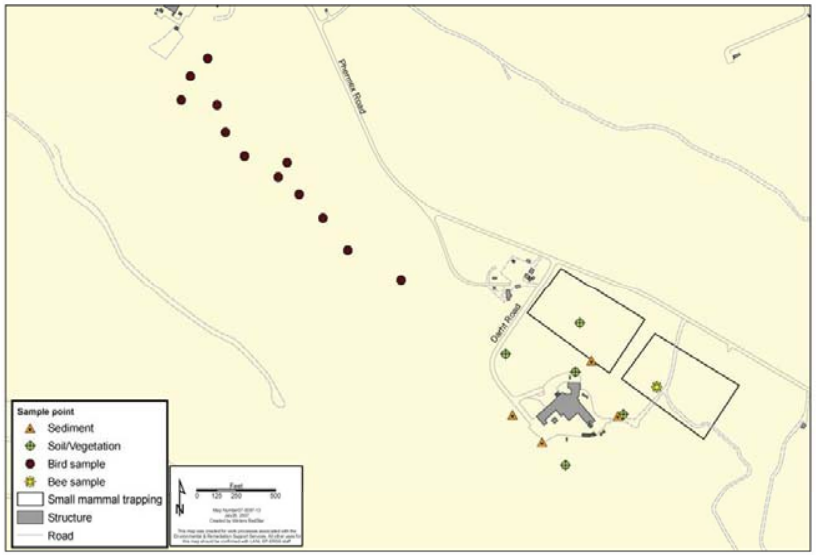
HONEY BEE SAMPLING

- Data Base: since the late 1970's to present
- LANL, Area G, DARHT
- Analyzed for radionuclides
- Tritium in some sites above background but below screening levels

BIRD SAMPLING-Population and Species Composition

- General ecological stress around the vicinity of DARHT that may be associated with noise, disturbance, traffic, etc.

- The # of birds, # of bird species, diversity; similar to preoperational periods; composition slightly different due to Cerro Grande Fire vegetation changes.

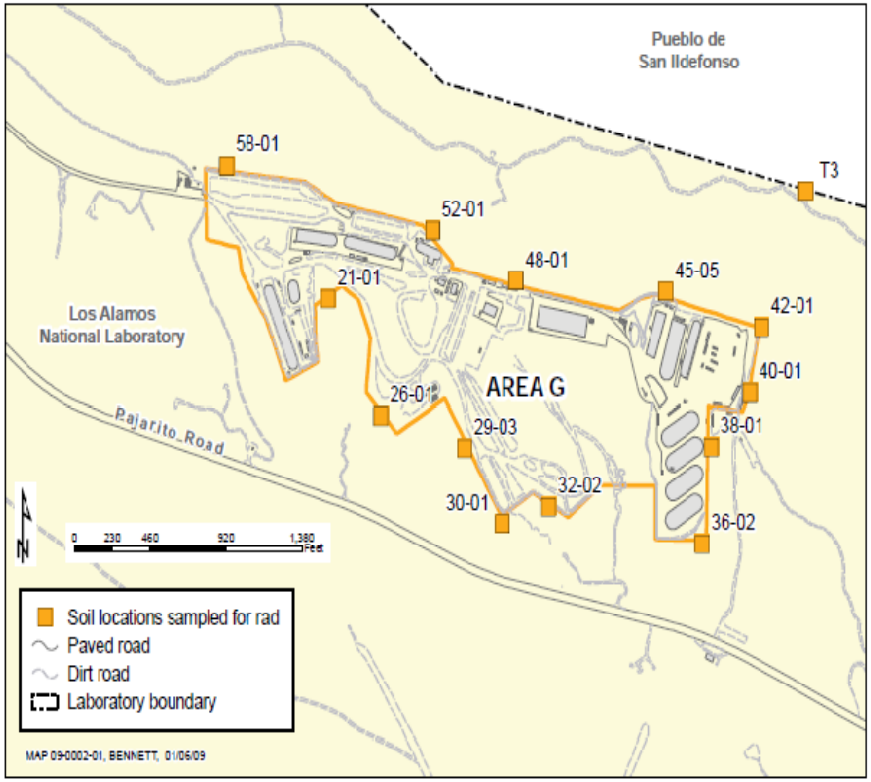


Protected Bird Species-Modeling

In situations where samples of protected bird species (e.g., hawks, falcons, bald eagle, and owls) cannot be collected for radionuclide tissue analysis, impacts were estimated using data from lower trophic level components.

- Uptake and dose to predators estimated using mice data collected from within Area G grounds (Soholt et al. 2003, LANL report LA-13999)

- Risk to the bald eagle from fish in the Rio Grande (Gonzales et al. 1998. LANL report LA-13399)



AQUATIC INSECTS-
Population and Species Composition

- Benthic macroinvertebrates upstream and downstream of LANL in Rio Grande
- Metrics indicates quality of the water
- Rock basket samplers
- Upstream and downstream similar; good water quality

SMALL MAMMAL SAMPLING

- Field mice, rabbits, gophers, rock squirrels
- Field mice are LANLs dose and chemical model—mammal with the smallest home range
- Area G, DARHT, Los Alamos Canyon Weir, Pajarito Flood Retention Structure, Open Detonation Sites, San Ildefonso lands
- Whole body analyzed for radionuclides, heavy metals, PCBs, dioxin/furans, high explosives.

CONCLUSIONS

- All parameters measured in foodstuffs/nonfoodstuffs biota collected within and around LANL were very low and most were either not detectable or similar to background
- The few parameters that were above background were below tissue screening levels or ecological screening levels.
- Constituents are not increasing over time.
- Based on fish, crayfish and benthic macro invertebrates, LANL is not significantly impacting the Rio Grande.

Environmental Surveillance Report