

A Novel Outbreak of Skunks Infected with a Bat Variant of Rabies Virus

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Rabies Reservoirs in Arizona

Animals



Flagstaff

Biome: Ponderosa Pine
Elevation: 7000 ft.
Population 60,000



Flagstaff, January 2001

- **January 7:**
Resident reports dead skunk
- **Animal control**
submits skunk for surveillance
- **Jan 9: Rabies test**
= **Positive**



Unusual Location: What Variant?

- Tissue sent to regional rabies lab in Texas for antigenic and genetic rabies tests
- Result= Bat virus variant



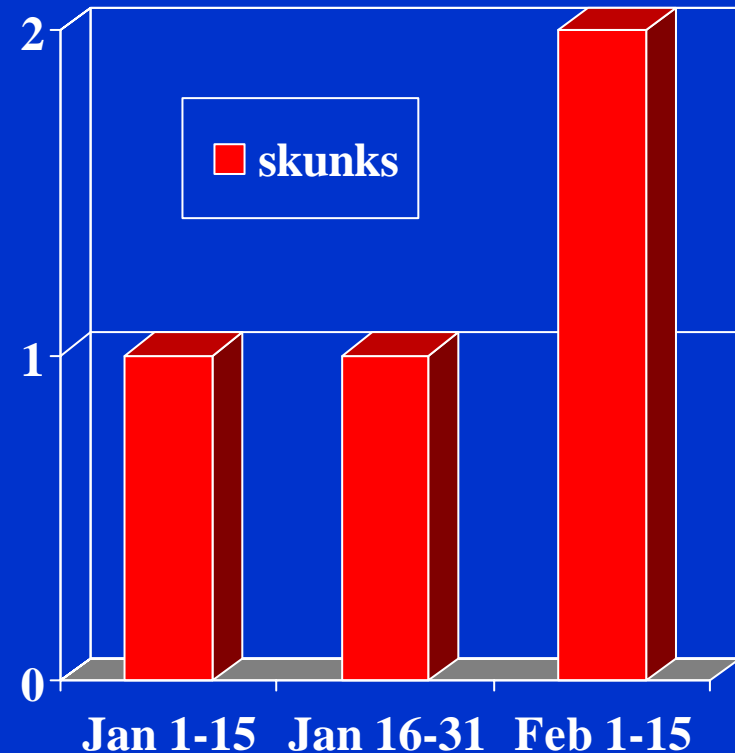
Prediction: Self- limiting Event



- **Bat variants of rabies have infected horses, dogs, cats, humans, foxes and other terrestrial mammals, however interspecies transmission has rarely lead to successful secondary transmission.**

January 9- February 15

- **Three additional skunks test positive- all with bat variant. N=4**
- **Consider common source exposure? Common den?**



Site Visit, Late February



- **No common den/ source identified**
- **Excellent habitat with numerous den sites, wildlife corridors, water, food sources.**
- **County/city meeting- rabies update**

Jan. 9- March 31, 2001

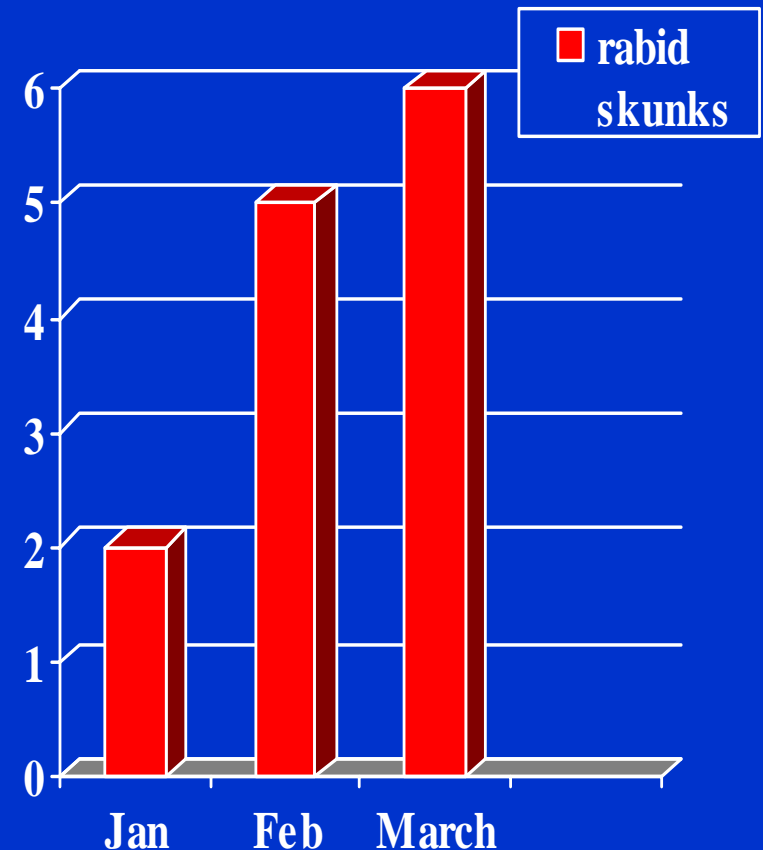
13/63 skunks test positive

- **Emphasize surveillance and prevention**

- Notify wildlife agencies, veterinarians, pest control
- Prohibit translocation- test trapped skunks & road kill

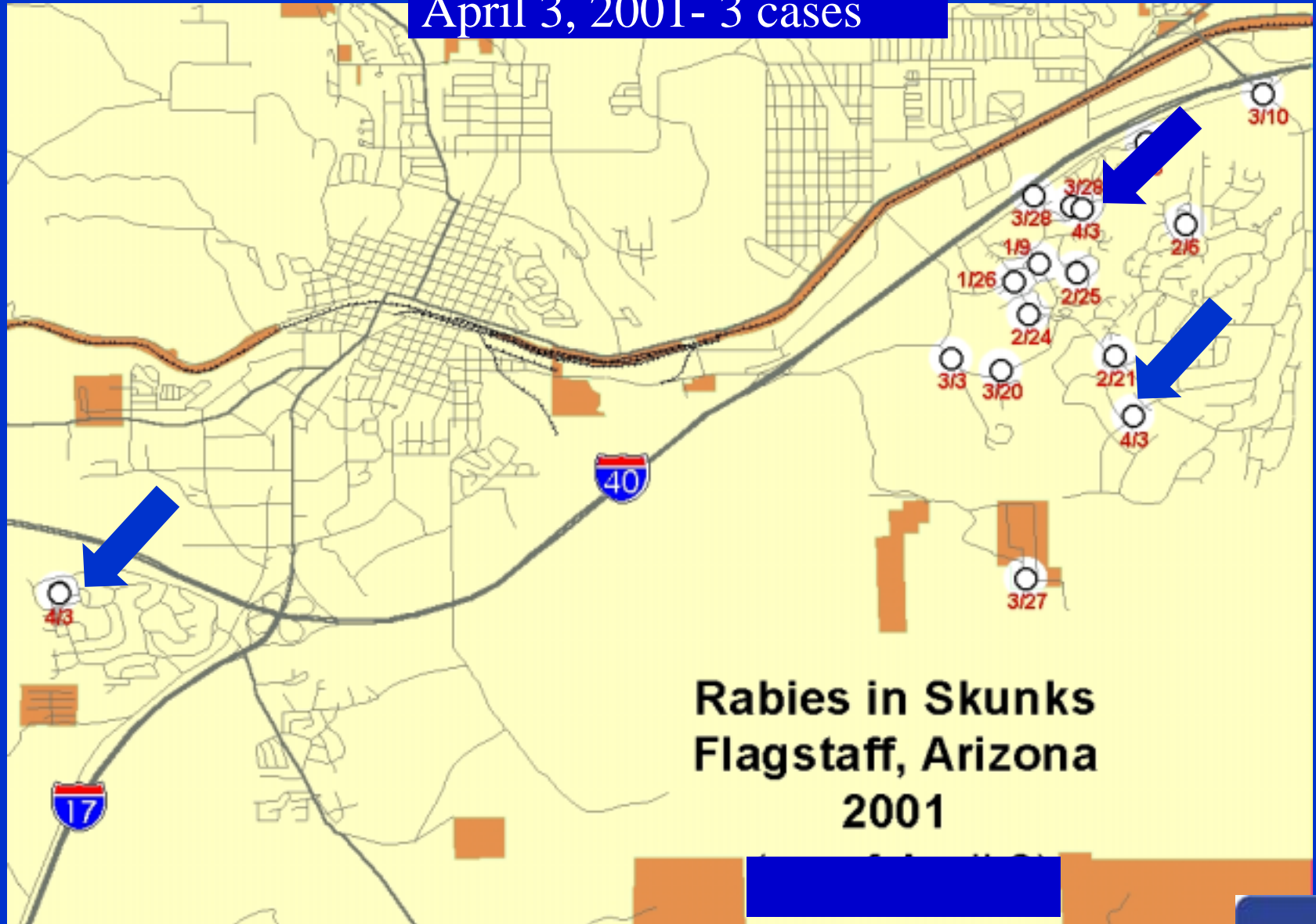
- **Public awareness:**

- Door to door, mailout, media
- Pet vaccine clinics



Rabid Skunks by Date

April 3, 2001- 3 cases



**Rabies in Skunks
Flagstaff, Arizona
2001**

Wildlife Rabies: Control Options



- **Trap-Vaccinate-Release**
- **Depopulation**
- **Combination**

• **Oral recombinant vaccine baits are not effective in skunks.**

Intervention: Factors to Consider

- **Ecology:**
 - Urban area surrounded by forest
 - **Community safety and acceptance**
 - **Abundant wildlife including fox, raccoon, skunk, squirrel, prairie dog...**
 - **No baseline density data**
- **Epidemiology:**
 - **Temporal and spatial distribution- movement**
- **Logistics:**
 - **Vaccine efficacy?**
 - **Funding for equipment and staff**
- **Goals and objectives**



Trap, Vaccinate, Release Program

- **Objective:** To protect human and animal health by reducing or eliminating rabies virus transmission among skunks in Flagstaff.



Live Traps



Bait

- Sardines
- Peanut butter and molasses
- Eggs



Approach with plastic!



Vaccinate



Off label use of a commercially licensed, parenterally administered rabies vaccine.

Ear-tag



Weight and GPS location



Release

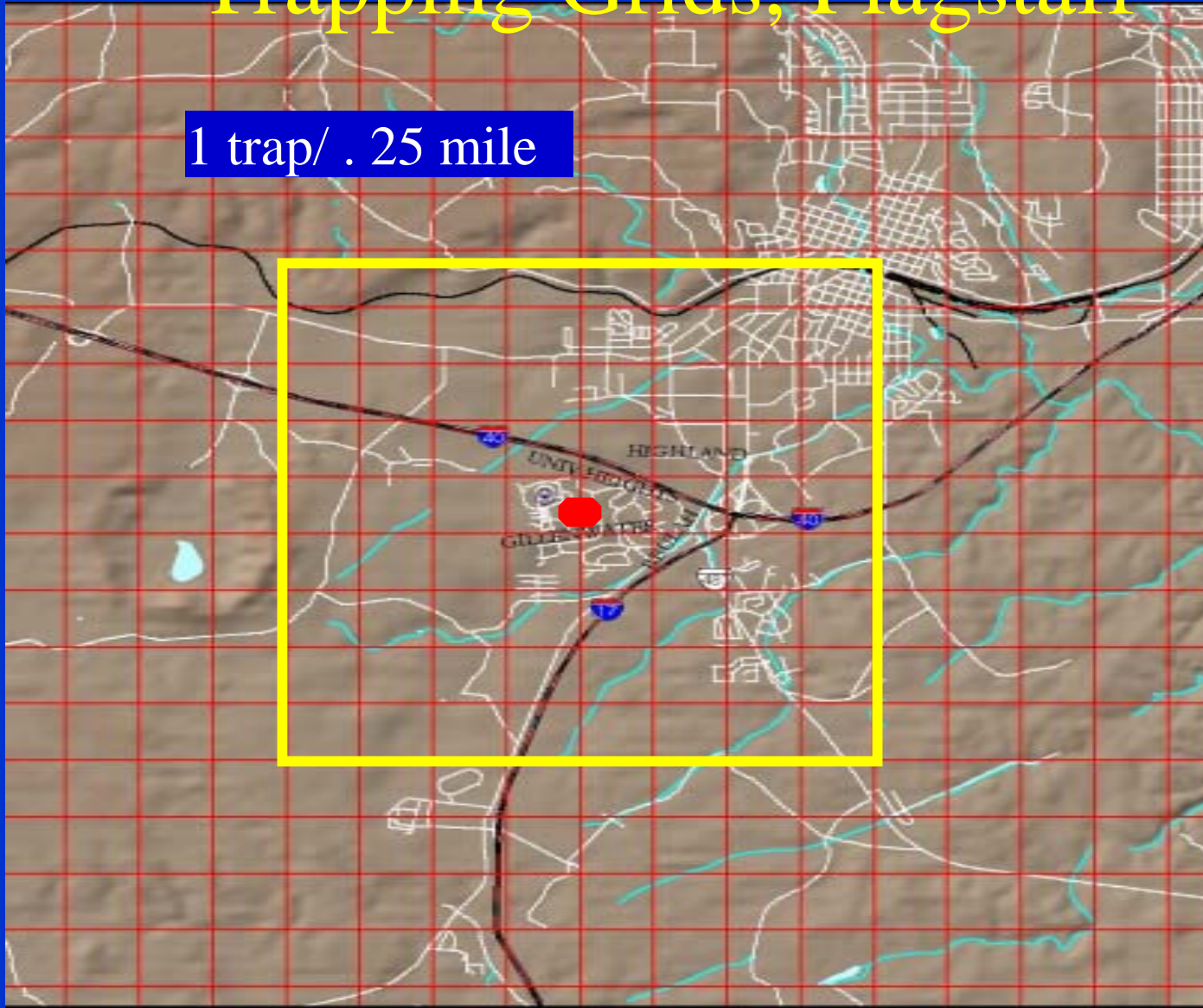


Media Day

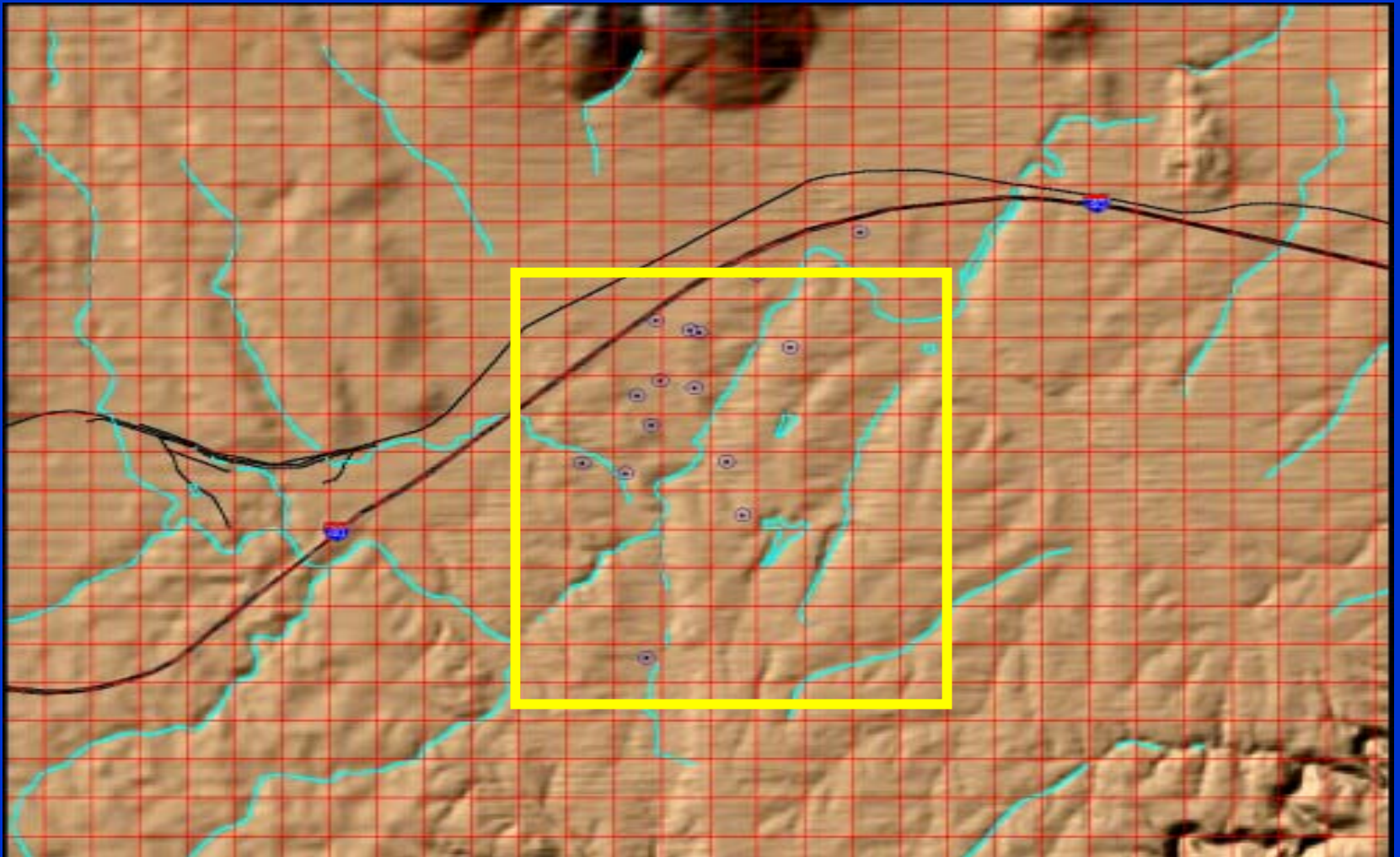


Phase 1- May: Trapping Grids, Flagstaff

1 trap/ .25 mile



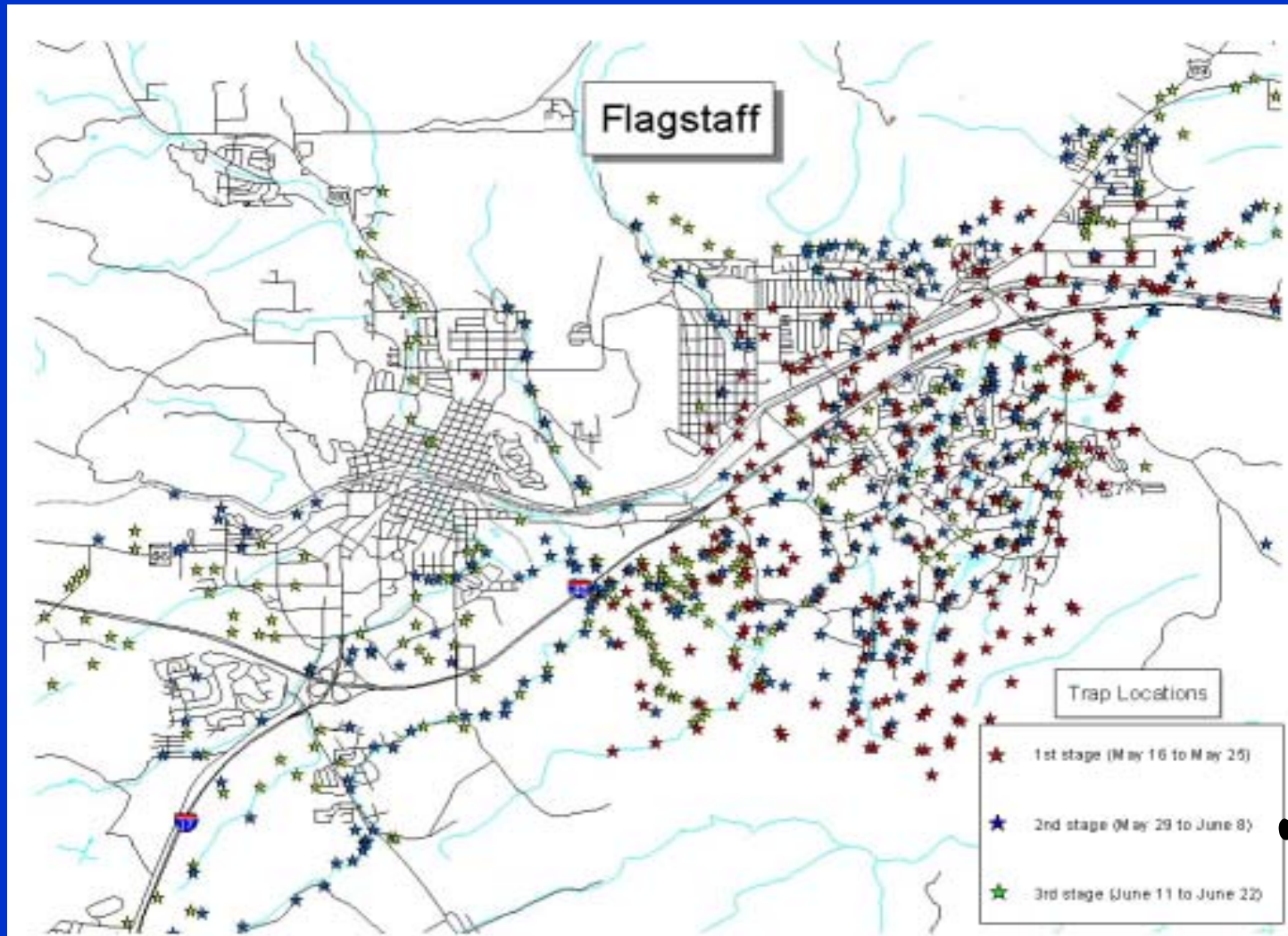
Phase 1 June: Grids + Wildlife Corridors



Phase 2 and 3: Peridomestic Trapping/ Off site Release



Trap Locations



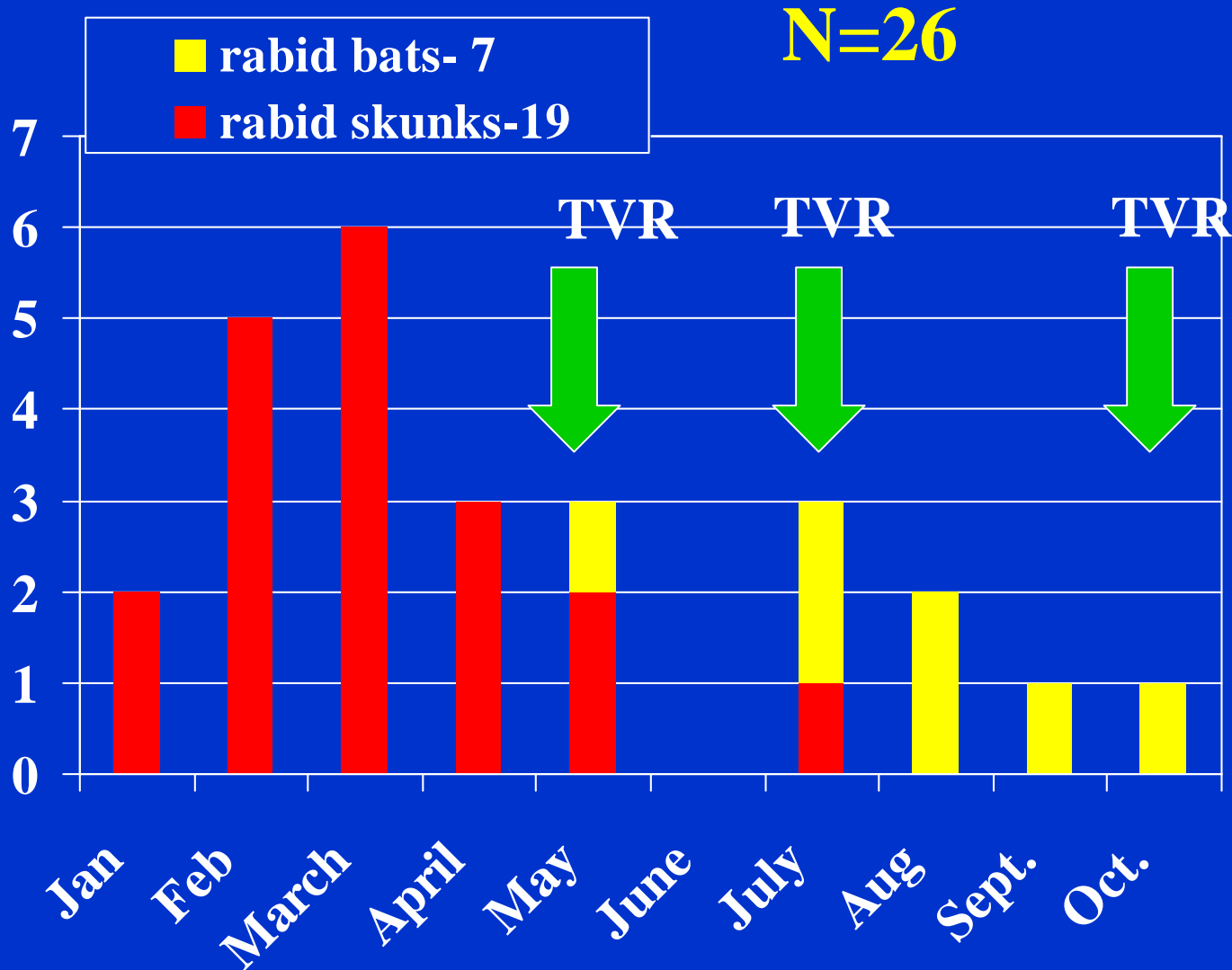
TVR Project



- **May 16- Nov. 15, 2001 (3 phases)**
- **> 7000 trap nights**
 - 1-18% trap success
- **218 skunks vaccinated, ear tagged and released**
- **54 skunks captured > once**
- **27 skunks euthanized**
- **74 cats, 16 squirrels, 2 raccoons, 2 foxes**
- **Trapping was most effective:**
 - peridomestically
 - during July when the young were dispersing
- **Various baits were equally effective**

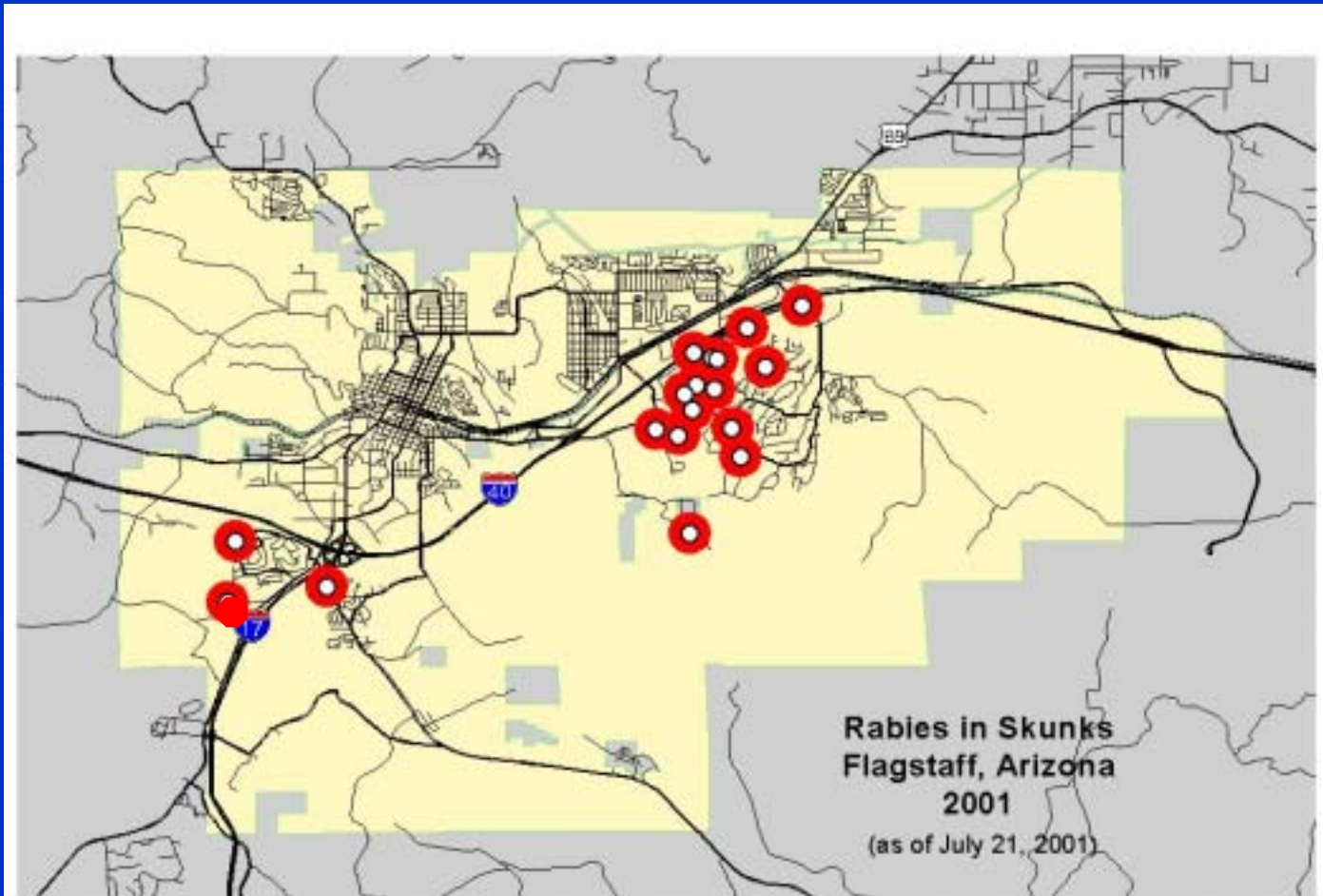


Rabies in Flagstaff, 2001



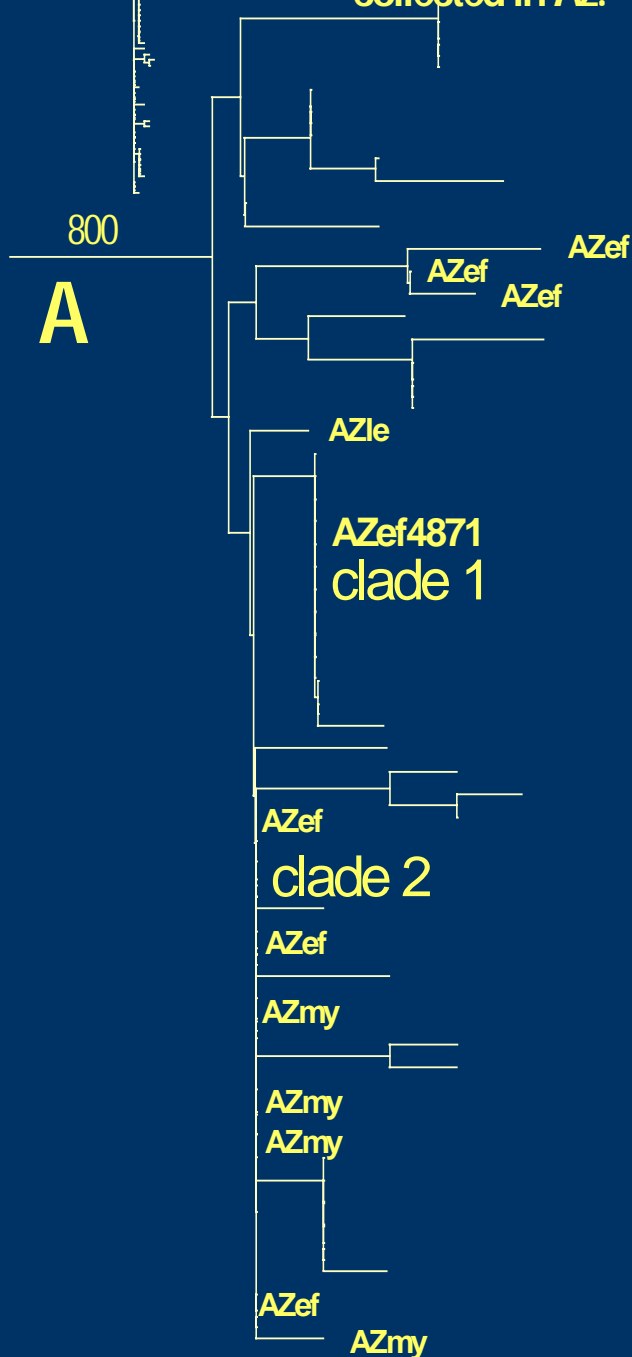
Rabies in Flagstaff, 2000= 1 bat in June

Flagstaff: 19 Rabid skunks Jan- July,30 2001



Laboratory Results

- The 19 rabies virus samples shared a monoclonal antibody pattern associated with Western *E. fuscus* bats.
- PCR amplicons produced a single restriction digest pattern which did not match patterns seen in terrestrial mammals in the U.S.



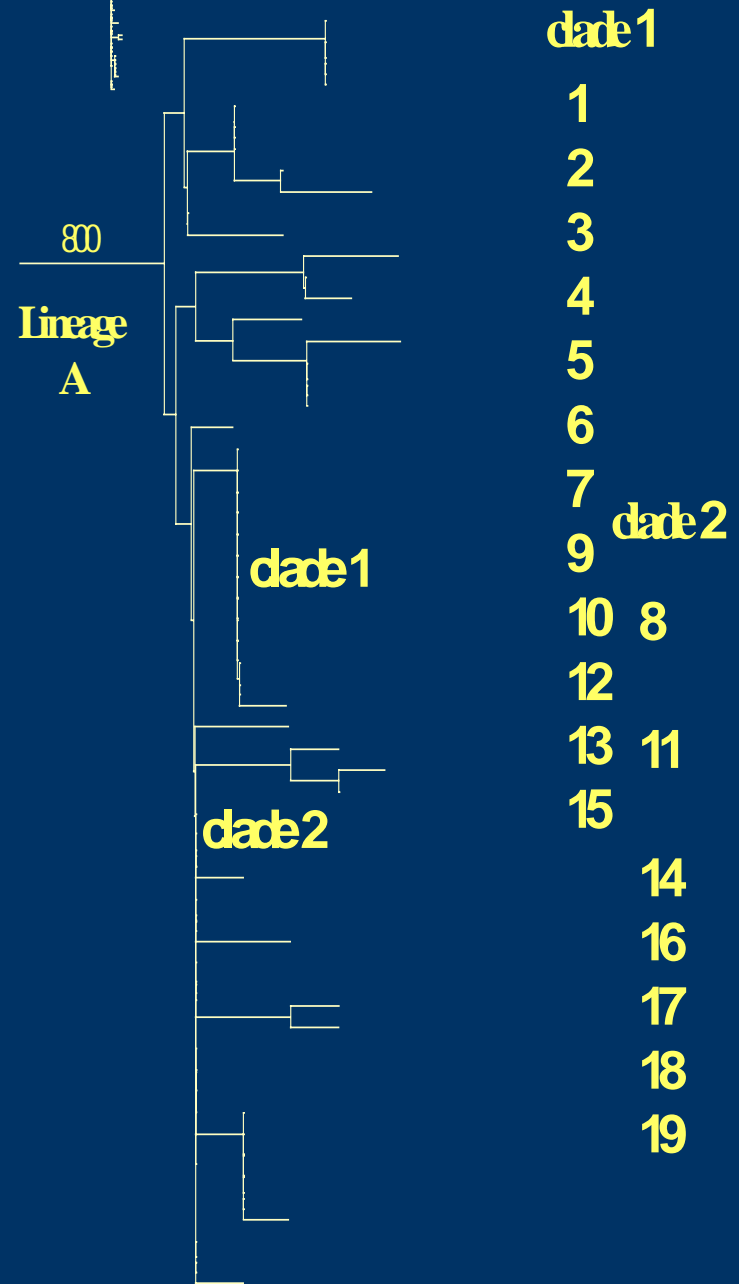
- The Flagstaff skunk samples shared $\geq 97\%$ homology with 7/8 *E. fuscus* (ef), 4/15 *Myotis* (my), 1/6 *L. ega* (le) from Arizona.

Laboratory Results

- **Compared to terrestrial animals from Western states that had been infected with bat virus variants, the Flagstaff skunk samples shared lineage with 15/119 samples including:**
 - 1 skunk/ CO; 1 cat /CA;
 - 1 cat and 1 bovine/ OR;
 - 1 raccoon, 1 skunk, 1 cat, 1 fox/ NM;
 - 1 horse, 1 skunk and 5 foxes/NV.

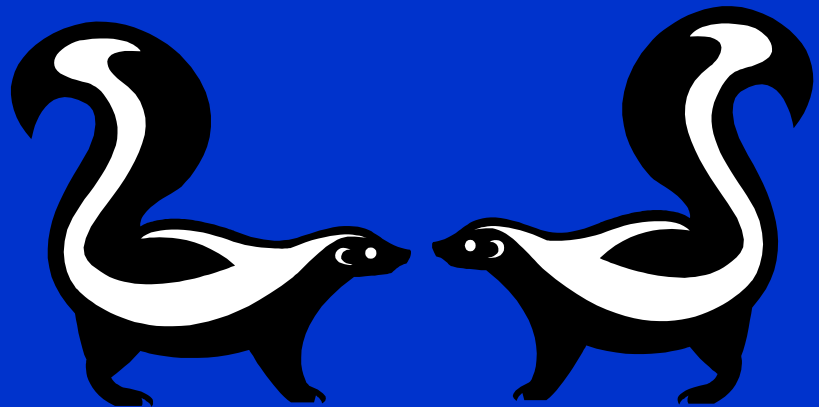
The Flagstaff skunk samples were $\geq 99\%$ homologous (over a 300 bp region of the nucleoprotein gene) and shared $<78\%$ homology with other terrestrial mammal rabies viruses in AZ.

Two phylogenetic clades formed.



Laboratory Results

- **Bat variant rabies virus was identified in the salivary glands of skunks, adding to the epidemiologic evidence that skunk to skunk transmission was occurring.**



Results



- **There were no human or pet exposures to the 19 rabid skunks in Flagstaff.**
- **The observed behavior of the Flagstaff rabid skunks was not similar to that in rabid skunks in southern AZ.**
- **There have not been any new rabid skunk cases in Flagstaff or the surrounding area since July 27, 2001**

Conclusions



- Rabies epizootics may be associated with fluctuations in wildlife populations, translocation, changing ecologic conditions.
- Recognition of this epizootic was facilitated by the location--- urban, non enzootic area.
- The apparent movement from the east to west side of town may have been due to human translocation or natural disease spread.

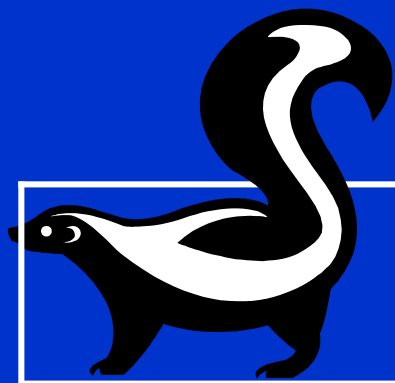
Conclusions

- **This epizootic may not have been recognized if we excluded the testing of animals without human or pet exposure. Surveillance testing of sick and dead wildlife is routine in AZ.**
- **Lower threshold for variant testing even in enzootic hosts.**
- **There is a need to develop more efficient rabies control methods for skunks.**
- **The TVR program will be very difficult to evaluate.**

- **What factors allowed this virus to adapt in skunks?**
- **Was this the initial event? ... or had this been smoldering undetected?**
 - **The divergence into two phylogenetic clades may indicate two introductions or a more longstanding adaptation.**
- **Is this type of event more common than is recognized?**







Three phase TVR project

	May/June 6 weeks	July 3.5 weeks	Oct/Nov 6 weeks
Staff	4-USDA/WS	1-CDC/ADHS	2-NAU/ADHS
Trap nights	6475	511	+/- 60
Trap success	2.6%	18%	N/A
TVR skunks N=218	115	72	31
Recaptures N=53	36	13	4
Euth (28)	19	8	1
Method	Grid/corridor	Residential	On-call

Task Force(s)

- State:

- Arizona Dept. Health - Lab and Epi
- Arizona Game and Fish
- Northern Arizona University

- Local:

- Flagstaff City-Police/Animal Control
- Coconino County Health Dept. and Community Services
- Coconino Humane Society
- Veterinary Community
- Animal Defense League
- Coconino Pest Control

- Federal:

- Centers for Disease Control
- USDA/Wildlife Services

Consultants: Ontario Ministry of Natural Resources, U New Mexico