

California Bovine Tuberculosis USAHA October 2014



California Department of Food and Agriculture
Animal Health Branch

California Bovine TB: 1999-2014

- 1999: Gain Bovine TB “Free Status”
- April 2003: Downgraded to “Mod. Accredited Advanced” (MAA) - bovine TB in 3 dairy herds
- April 2005: Regained “Free Status”
- Sept 2008: Downgraded to MAA - bovine TB in 3 dairy herds
- Jan 2009: 4th affected dairy herd
- Eligible for “Free” in 2012 but ...
- 2011-12: 3 affected dairy herds
- Feb 2013: 1 affected dairy herd
- Eligible for “Free” July 2016



11 affected dairy herds in 11 years

Location of the 11 Affected Dairy Herds in California

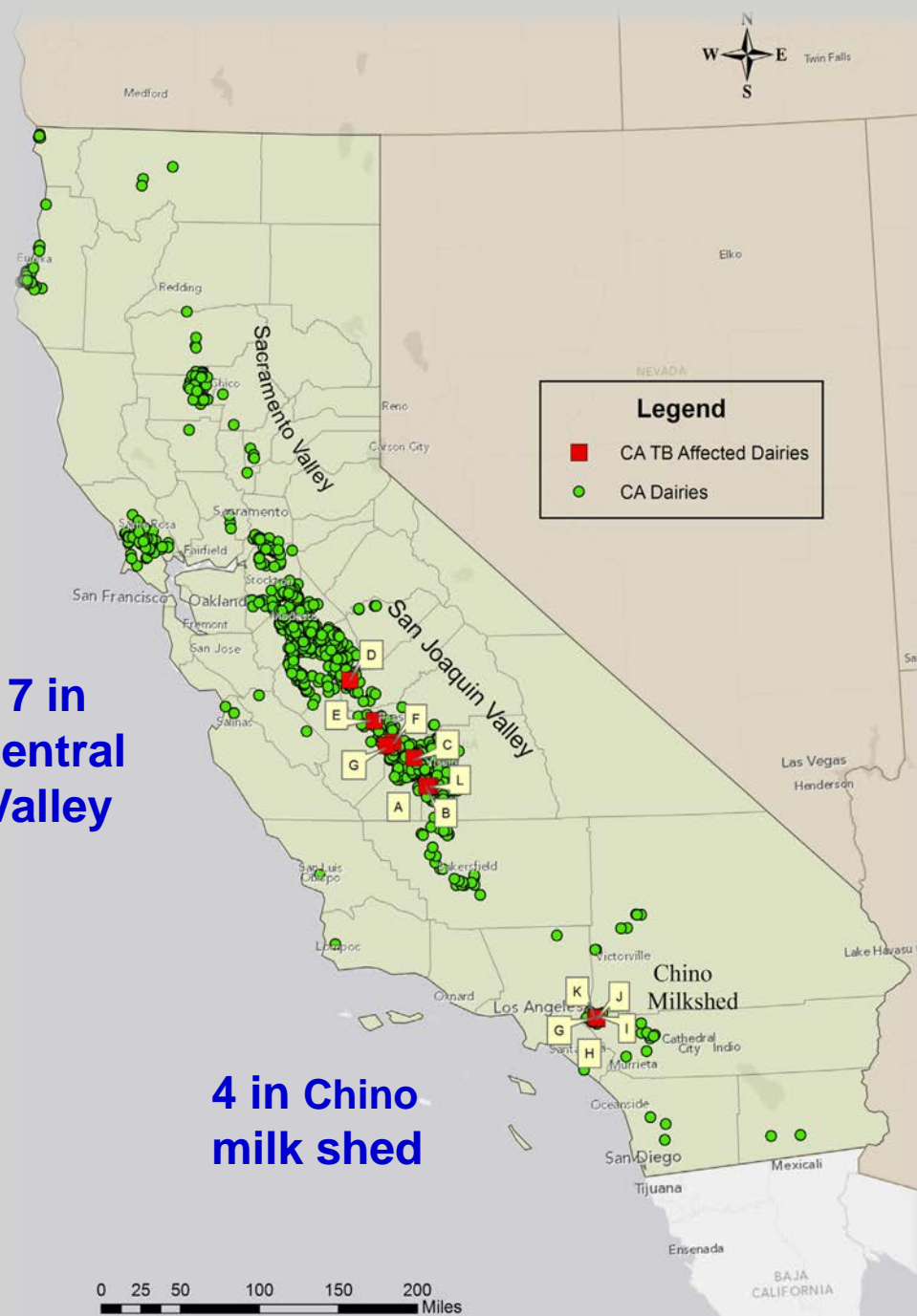
7 in Central Valley

4 in Chino milk shed

Mycobacterium bovis in California dairies: A case series of 2002–2013 outbreaks

B. McCluskey et al

J Pre Vet Med April 2014



Source: USDA-APHIS-VS, CDFA-Animal Health
Date: June 7, 2013

Eleven Bovine Tuberculosis Affected Herds Detected in California in Eleven Years

~35,000 Dairy Cows in TB-Affected Herds

Premises	Date Herd Detected	How Detected	Approximate Herd Size	# Infected Animals	Resolution	Epidemiology	Strain
Dairy A Tulare Co.	May 2002	Slaughter trace	3,600 adults	53	Depopulated ~6,500 in November 2002; restocked	Unknown source; bulls from local breeders; replacements from out of state	New strain type
Dairy B Tulare Co.	October 2002	Traces into and out of Dairy A (owner also a dealer)	2,000 adults	1	Depopulated ~5,000 in March 2003; restocked	Exposed to Dairy A	Genotype matched Dairy A
Dairy C Kings Co.	December 2002	Slaughter trace	400 adults	35	Depopulated ~600 in April 2003; restocked	Unknown source; purebred herd, imported ~60% of cattle from "TB Free" states	New strain type
Dairy D Fresno Co.	December 2007	Slaughter trace	2,600 adults	5	Depopulated ~5,000 in August 2008; restocked	Unknown source; purebred herd, few trace-ins	New strain type
Dairy E Fresno Co.	May 2008	Trace out of Dairy D	400 adults	1	Depopulated ~1,000 in August 2008; restocked on different premises	Infected cow moved from Dairy D (infected animal was CFT negative)	Genotype matched Dairy D
Dairy F Fresno Co.	May 2008	Trace into Dairy D	2,500 on one premises and 9,500 at another	1	Test and removal program; released from quarantine December 2009	Unknown source; purebred herd, very few trace-ins	New strain type
Dairy G San Bernardino Co.	January 2009	Trace out of Dairy F	1,300 adults	1	Test and removal program; released from quarantine June 2010	Unknown source	New strain type
Dairy H San Bernardino Co.	April 2011	Slaughter trace	6,000 (total)	9	Test and removal program; released from quarantine February 2013	Unknown source	New strain type
Dairy I San Bernardino Co.	October 2011	Slaughter trace	1,500 adults	65	Depopulated ~3,300 in June 2012; not restocked	Unknown source; shared equipment with M-branded cattle in the past	New strain type
Dairy J San Bernardino Co.	December 2011	Contact with Dairy I	2,000 (total)	1	Test and removal program; released from quarantine November 2012	Exposed to Dairy I	Genotype matched Dairy I
Dairy K Tulare Co.	February 2013	Slaughter trace	2,200 adults	14	Test and removal program; released from quarantine July 2014	Potentially exposed to Dairy A	Genotype matched Dairy A

11 Affected Dairy Herds in 11 years

- 6 detected by slaughter surveillance
- 5 detected by trace testing: 2 were new strains – why?

7 different *M. bovis* strain types =

7 introductions of bovine TB in California's dairies

- Never found source of the 7 introductions
- Minimal spread from herds (4 w/same strain-type)
- CA is only MAA State in nation

How is *M. bovis* entering CA dairies?

Direct: Cattle (legal/illegal), wildlife, people, etc?

Fomite: Foodborne, airborne, environment, etc?

How can we mitigate these introductions?

Bovine TB Surveillance in California


A. Slaughter Surveillance

- Had four of top 40 US adult packing plants (95% of adults)
- Submit granulomas to CA lab (FY13-14) = 1,070 total
 - Now all split samples to NVLS for PCR
- Adults slaughtered in CA (FY13-14) = 777,468
 - Rate = 2.75 submissions per 2,000 adults
- “Fat” cattle slaughtered in CA (FY13-14) = 702,273

B. Live Cattle TB Surveillance FY 13-14

- Private Veterinarians: 120,491 CFTs (1,264 accessions)
 - Suspects = 1,420 Response Rate 1.18%
- Regulatory Veterinarians: 75,351 CFTs (58 herds)
 - Suspects = 1,302 Response Rate 1.73%

February 2013 TB-Affected Herd

- Granuloma at AZ packing plant September 2012
- NVSL “not compatible”: *M. bovis* cultured October 2012
- Trace: No individual ID collected, 1 of 151 rebranded cattle, 117 from CA (72 CA herds) 34 from other states
 - Breed DNA = Holstein, female (62 CA herds), sire?
 - *M. bovis* genotype matched strain from 2002 CA herd
- Focus “trace & 2002 related”  affected herd
 - 2,200 cow dairy: Test & removal plan (USDA model)
 - 14 TB-infected cattle removed (on first two tests)
 - Released July 2014 (after 5 whole herd tests)
 - Annual tests for 5 years after release quarantine

Investigation of 2013 Affected Herd

5 years of records: brand + sale-yard + private sales

- 11 dairy herds assoc. at calf ranch
- Trace ~4,400 cattle sold 2008-2013
- Epi investigated 99 herds
- Examined 36 herds for brands from affected herd
- Tested 65 trace herds (approx 106,000 cows)
- No spread of bovine TB detected
- Wildlife surveillance: Negative
- Two USDA/APHIS/VS IMT assisted investigation
- Public Health and OSHA oversight of dairy personnel



Infection “hidden” from surveillance for 10 yrs

April 2013: Slaughter Trace

- Granuloma at California plant
- PCR positive; *M. bovis* cultured
 - Inadequate ID to confidently trace
- Breed DNA: Jersey female
 - Most likely: 3 yr old cow

From dispersed 500 cow San Diego Co dairy
To California Jan 2012 from Pennsylvania
dealer (origin untraceable)

- *M. bovis* genotype: Unique strain (8th)
- Most closely resembles Mexican steer in TX in 2001 (26 SNPs difference)
- Investigations complete



September 2013: Slaughter Trace

- Granuloma at California plant (during TB-review)
- PCR positive; *M. bovis* cultured
- *M. bovis* genotype: **Same strain as April 2013 cow**
- Trace (backtag not sub): 12 year-old home raised **beef** cow
- Granuloma **DNA matched to ½ sibling** in herd
- Herd ~150 pairs quarantined: TB tested neg. twice - released
- Retest herd in 12 months
- Contacts & wildlife tested neg
- Herd was **exposed to dairy**
(source of April 2013 sample)
- Irrigate with reclaimed water

Which infected first – dairy or beef?



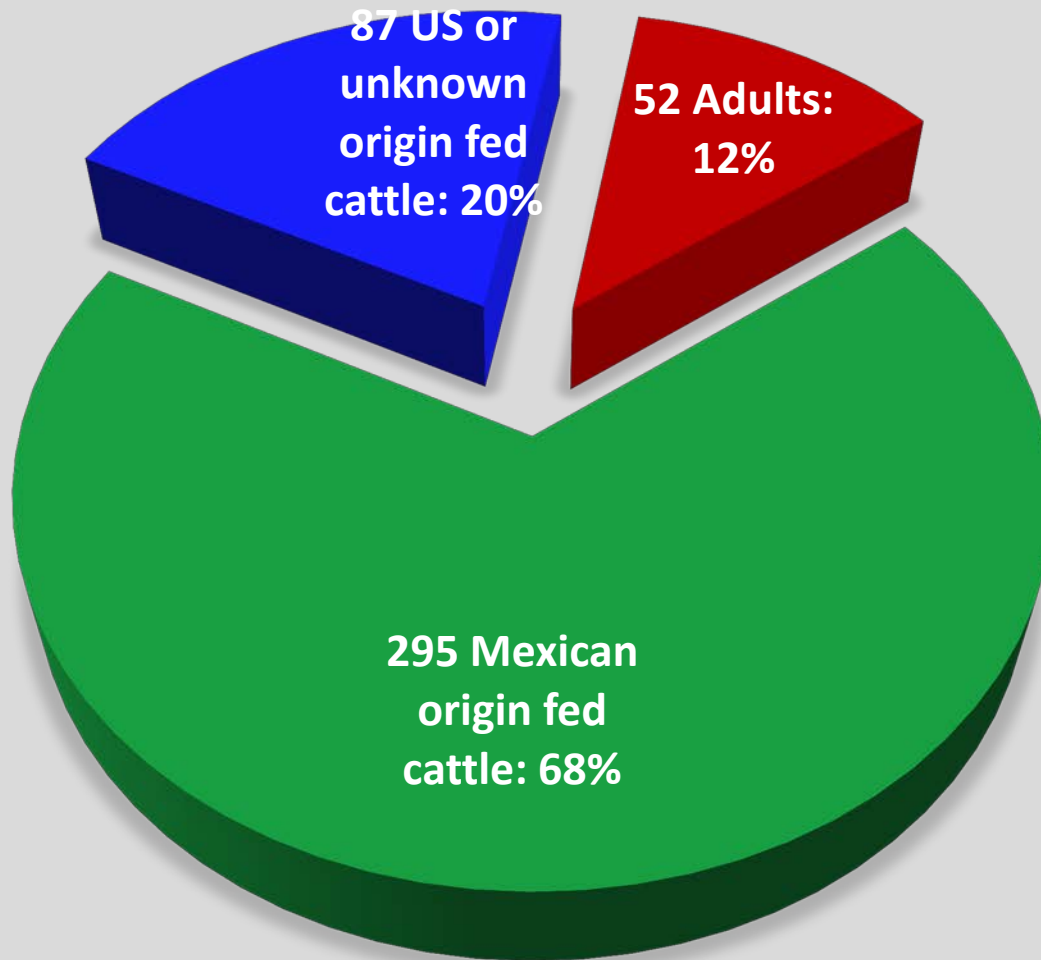
November 2013: Slaughter Trace

- *M. bovis* cultured Dec 26, 2013
- Granuloma collected at California plant Nov 2013
- Trace: Utah backtag, but **hair DNA not match TB-tissue DNA**
- Female, Holstein
- *M. bovis* genotype: **Unique strain (9th)**
- Test: Herds of origin of index and cattle on either side on packing-plant rail
- Utah tested 3 “most likely” herds: Neg
- California tested 4 herds: Neg
- Additional herd scheduled: AZ next



Is There an *M. bovis* Reservoir in California? Mexican Origin Cattle?

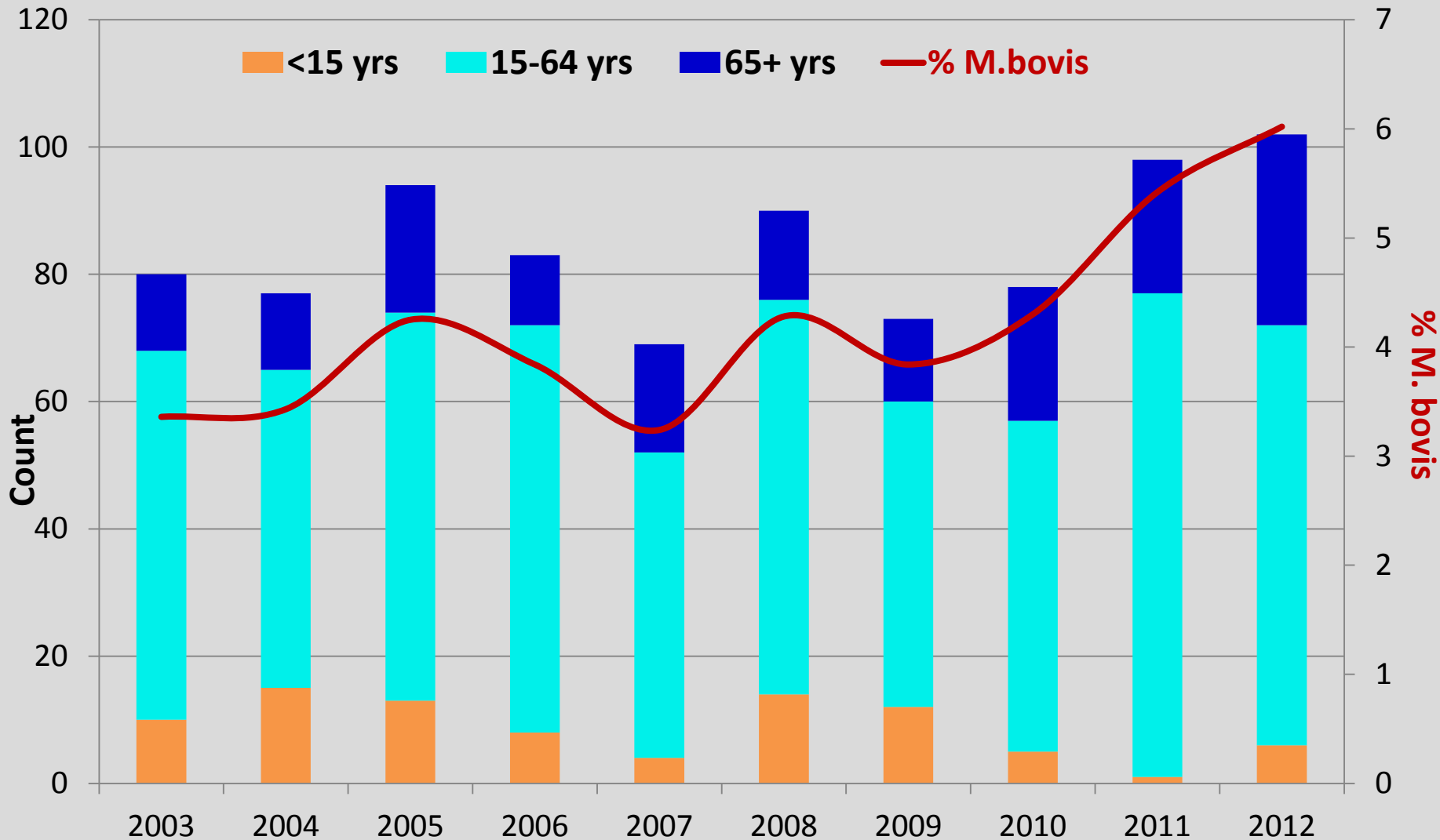
435 *M. bovis* infected cattle in US from slaughter surveillance
FY 2001–June 30, 2014



Genotyping indicates that these Mexican cattle were not the source of infection for California's recent dairy cases

Human TB Cases Attributable to *M. bovis* by Age Group California, 2003-2012

70-100 cases each year, ~50% of total US cases!



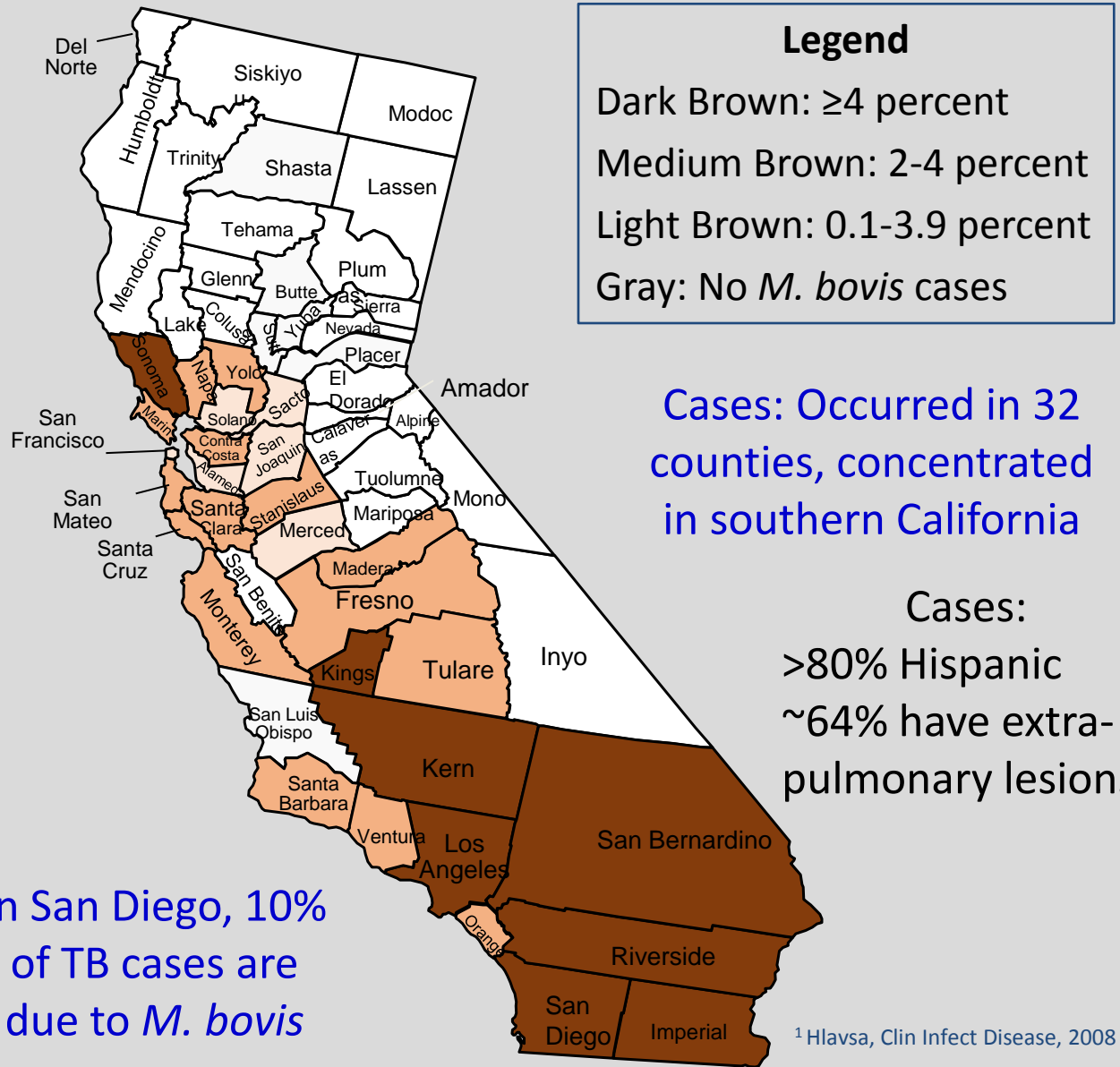
Percentage of Human TB Cases Attributable to *M. bovis*, California, 2003-2011

M. tuberculosis and *M. bovis* disease in people: Clinically, radiographically, and pathologically indistinguishable

M. bovis accounts for ~4.5% of all culture-positive TB cases in CA, compared to 1-2% nationally¹

About 25% of childhood TB in US is due to *M. bovis*

In San Diego, 10% of TB cases are due to *M. bovis*



Spoligotype and 24 MIRU-VNTR Genotyping Results

Year	Cattle <i>M. bovis</i> Case	# Cattle Isolates Genotyped	# CA People with Same Genotype	Any Epi Links?
2007	Dairy D: Fresno	6	5	0 reside in affected counties, 2 recent US arrivals, 2/3 interviewed/no link accurint search neg
2007	Dairy F: Fresno	1	3	0 reside in county, 2 interviewed, no epi link accurint search neg
2009	Dairy G: San Bernardino	1	4	Accurint search neg
2011	Dairy H: San Bernardino	4	2	0 reside in county, accurint and DMV searches, no links
2011	Dairy H: San Bernardino	1*	0	NA
2011	Dairy I: San Bernardino	23	0	NA
2011	Dairy I: San Bernardino	1*	2	0 reside in county, accurint and DMV searches, no links

* 1-off MIRU-VNTR

16 people infected with strains that match 5 herd strains

Whole Genome Sequencing Project Plan

M. bovis Isolates from People in California

□ Goals

- Better characterize *M. bovis* isolates in North America
- Build database to guide US cattle disease control policies
- Determine if US sporadic cattle TB strains also infect people
- Assist Mexico's cattle TB program
- Identify source herds infecting people
- Reduced *M. bovis* in people

□ Comments

- CA Dept Public Health (CDPH) hold patient information
- Project will not interfere with CDPH genotyping (spoligo/MIRU)
- NVSL will report results to CDPH
- CDFA hold cattle herd information
- If isolates from cattle and people match - CDFA and CDPH discuss

Potential Sources and Mitigation of Risk of Bovine Tuberculosis to California's Cattle

Potential TB Source	Mitigate Risk
Mexican Origin Cattle	Support Mexico control programs, entry requirements, surveillance, traceability
	Keep separate from replacement stock
	Prevent illegal entry (dairy calves/cheese/etc)
Domestic Cattle	Surveillance, traceability, and diagnostic tests
	Pasteurize waste milk/colostrum
	Biosecurity/management practices
People	Educate workers to reduce risk: prevention, testing, treatment, sanitation
	Support TB-control/education programs for Mexicans
	Determine if herds with human sanitation problems should be TB-tested
	Ensure biosolids/reclaimed water adequately treated before use
	Prevent cattle from contact with sewage wastewater (wildlife component?)
Wildlife	Surveillance; biosecurity to control contact
Cattle Feed/water	Waste water management; feed source biosecurity, imported feeds?
Non-traditional species	Surveillance, prevent contact

Take-home Messages

1. New *M. bovis* strains continue in US cattle with no definitive source: 32 unexplained US herds since 2000 (>5 SNP to fed case) {Suelee}
2. Need active surveillance of adult and fed cattle
3. Lack of individual cattle identification hinders tracing
4. Need rapid accurate tests to detect infection
5. Over 50% of US *M. bovis* cases in people occur in California
6. Genotyping is helping to determine disease relationships
7. Determine what makes a herd high risk for disease
8. Mitigate the risk of introducing disease from many potential sources

