



# REBUILDING A RESILIENT LAND BOUNDARY INFRASTRUCTURE FOLLOWING NATURAL DISASTERS

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# I SPENT THE SUMMER OF 2022 MARKING NATIONAL FOREST BOUNDARIES WITHIN THE DIXIE FIRE

- From Wikipedia, the free encyclopedia
- The **Dixie Fire** was an enormous [wildfire](#) in [Butte](#), [Plumas](#), [Lassen](#), [Shasta](#), and [Tehama](#) Counties, [California](#).<sup>[4]</sup>... The fire began in the [Feather River Canyon](#) near Cresta Dam on July 13, 2021, and burned 963,309 acres (389,837 ha) before being 100% contained on October 25, 2021.<sup>[6]</sup> It was the largest single (i.e. non-complex) wildfire in recorded California history, and the second-largest wildfire overall (after the [August Complex fire](#) of 2020).<sup>[7][8]</sup> The fire damaged or destroyed several small towns or communities, including [Greenville](#) on August 4, [Canyondam](#) on August 5, and [Warner Valley](#) on August 12.<sup>[9]</sup>
- ...Smoke from the Dixie Fire caused unhealthy [air quality](#) across the [Western United States](#),<sup>[14]</sup> including states as far east as [Utah](#) and [Colorado](#).<sup>[15][16][17]</sup> The Dixie Fire was the most expensive wildfire in terms of suppression efforts in United States history, costing \$637.4 million to fight.<sup>[18]</sup>

SOME MONUMENTS SURVIVED THE DIXIE FIRE, MOST BEARING AND LINE TREES DID NOT, MOST SIGNS AND POSTS MELTED



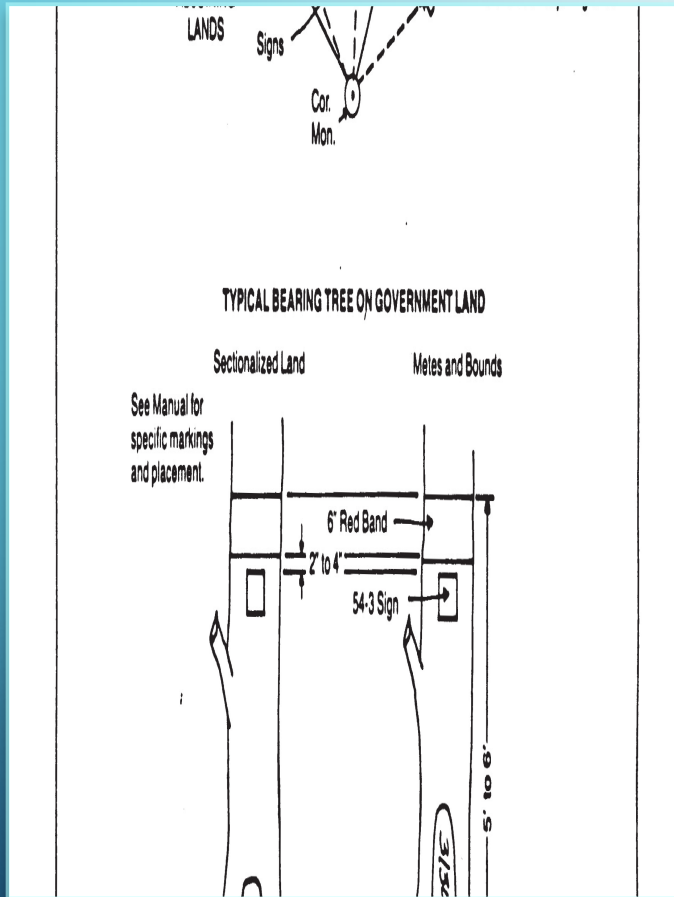
# NEARLY ALL OF THE DEAD AND BURNED TIMBER (INCLUDING WITNESS TREES) WILL BE REMOVED BY SALVAGE LOGGING OPERATIONS



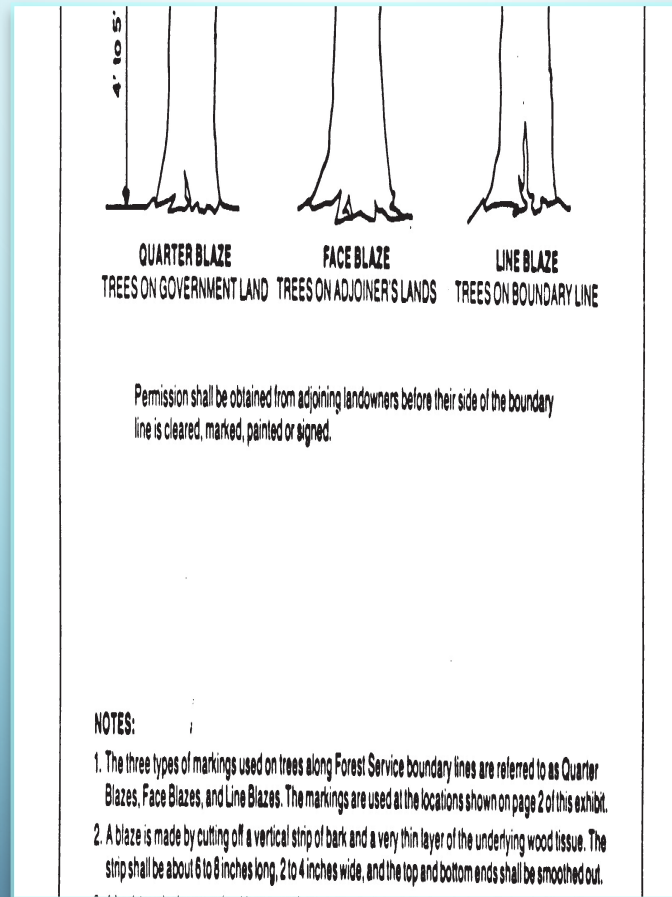
## LOSS OF SURVEY MARKS IS NOT THE MOST TRAGIC ASPECT OF CATASTROPHIC WILDFIRES

- I was in Shasta County when the CAMP FIRE killed 85 people and the CARR FIRE burned right up to the city limits of Redding. I lived in Humboldt County when the AUGUST COMPLEX FIRE burned a million acres. I worked for the Forest Service in California during the 2020 fire season and during the Dixie Fire.
- The truth is that the greatest tragedy of Wildfires, is the loss of life and property.
- Nonetheless- we are surveyors, and we have a duty to mitigate the harm that lies within the realm of our professional practice.
- And remember this- Wildfire is not the only climate driven cause of survey mark destruction. Hurricanes and floods also destroy survey marks.

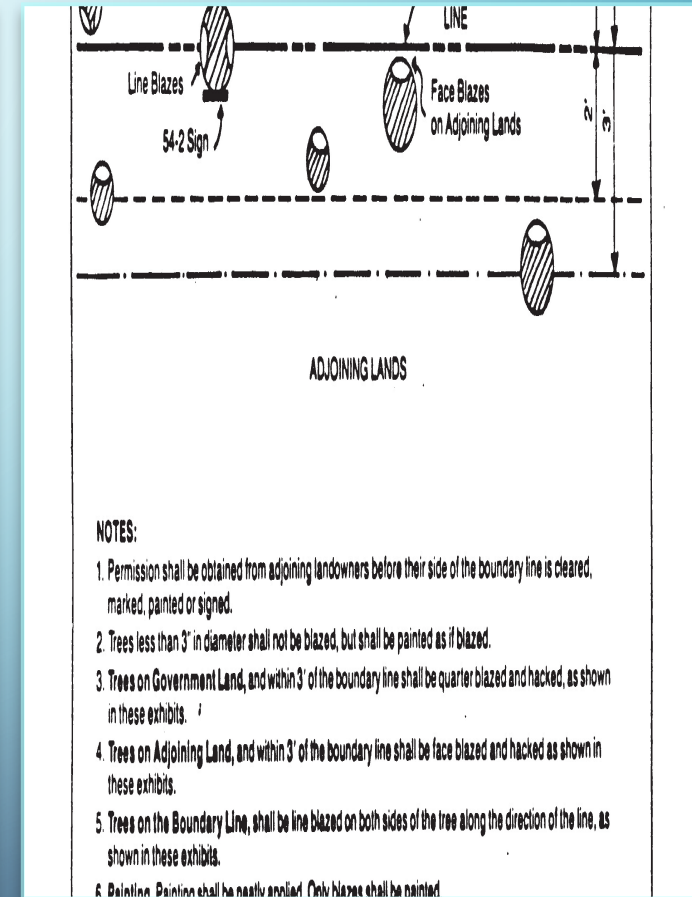
# FORESTRY BOUNDARY MARKS DEPEND ON TREES



BEARING TREES AT CORNERS



LINE TREES MARK SECTION LINES



THESE TREES ALL BURN

# FOR OVER 200 YEARS SURVEYORS HAVE RELIED ON THE ORIGINAL LOCATION OF GLO CORNERS

LAND ACT OF MARCH 1, 1800

Corners regularly set by original government surveyors in the field are to be held as true corners even if later surveys show they had been placed incorrectly,...

BLM

1. Boundaries of the public lands, when approved and accepted are unchangeable.
2. Original townships, section, and  $\frac{1}{4}$  section corners, must stand as true corners... whether in the place shown by the fieldnotes or not.

# AND ACCORDING TO STANDARD TEXTBOOKS ON LAND BOUNDARIES, MONUMENTS RULE SUPREME

- As Curtis M. Brown said in BOUNDARY CONTROL AND LEGAL PRINCIPLES, The order of conflicting elements of a deed description are:
  - MONUMENTS
  - DISTANCE
  - DIRECTION
  - AREA
  - COORDINATES

# THE BLM MANUAL HAS BEEN REVISED IN 2009

- BLM MANUAL OF SURVEY INSTRUCTIONS 2009-
- Section 2-34 ... any point can be re-established once it's coordinates have been determined. However, great care must be exercised to ensure that the original coordinate pairs were produced by a process that is repeatable within a quantifiable accuracy standard. Repeatable coordinates may provide collateral evidence of a corner position, may constitute the best available evidence of a corner position, and in some cases, may constitute substantial evidence of the position of an obliterated corner.

# AND BROWN ALSO SAID THIS-

- Section 4:27 Coordinates
- ...If a monument is found, and the coordinates of the monument are precisely determined by an acceptable method, and then the monument is later lost, the coordinates so established will probably form the best available means of re-establishing the former position.
- **ALWAYS REMEMBER THIS-**
- The original corner was correct in its location and, if the monument is gone, the surveyor must put it back where it was.
- If using coordinates assists you in this goal, then **USE THEM!**

# RELIABLY CREATING ACCURATE COORDINATES REQUIRES SKILL AND DETERMINATION

- 1-Use the latest receivers and all available constellations. Shorten your baselines. Densify control.
- 2-Use rapid or precise ephemeris data. Use fixed ambiguity solutions. Start each real time session with a check to independent control.
- 3-Pay attention to the number of satellites, Positional Dilution of Precision, and Signal to Noise Ratio. Set your elevation mask to 15 degrees or higher.
- 4-All corner positions should be based on at least two independent observations.

# PRESERVE YOUR WORK WHERE FUTURE SURVEYORS CAN FIND IT, IN STANDARD CORNER AND PLAT RECORDS

- We need to leave future surveyors an easy way to find our evidence AND we need to make the evidence persuasive. Put yourself in the shoes of a land surveyor 50 years from now. What information would you need, and what additional information would inspire confidence?
- What coordinate evidence would you trust?

# TO PERSUADE- YOU MUST SHOW YOUR WORK IN DETAIL AND INCLUDE REDUNDANT MEASUREMENTS

MISSOURI DEPARTMENT OF AGRICULTURE  
DIVISION OF WEIGHTS, MEASURES AND CONSUMER PROTECTION  
LAND SURVEY PROGRAM  
CERTIFIED LAND CORNER DOCUMENT

P.O. Box 937  
Rolla, Missouri 65402-0937  
(873) 368-2300

CORNER RESTORATION (Accepted or perpetuated corner)  
 CORNER ESTABLISHMENT (Any PLSS corner created, but not monumented in the original survey; Blank 1/A, Center 1/A, etc.)  
 CORNER REESTABLISHMENT (Lost corner)

Description of original and subsequent surveys referencing this corner position:  
(References shall include date of survey, surveyor of record, location of survey (book and page), monument, accessories and other information relevant to the location of this corner.)

Description of corner evidence found or a concise statement of the method used to establish or reestablish this corner:

Description of monument and accessories established to perpetuate the location of this corner:  
(Provide a sketch of the corner on the back of this form.)

CORNER DESCRIPTION	TOWNSHIP	RANGE	COUNTY

CORNER COORDINATE	MISSOURI COORDINATE SYSTEM (1983 METRIC)	UTM	STATE PLANE

CONTROL STATION(S) DESCRIPTION: MISSOURI COORDINATE SYSTEM (1983 METRIC)  
USDA FILE# \_\_\_\_\_ COORDINATE ORIGIN POINT \_\_\_\_\_ DATE \_\_\_\_\_ ON U.S. GOVERNMENT ZONE \_\_\_\_\_

**SURVEYOR'S CERTIFICATE**  
This is to certify that I, \_\_\_\_\_, D. S. # \_\_\_\_\_, have on this date \_\_\_\_\_  
 Restored  the corner described, and have verified the statements  
 Established  and when considered correct, sign and register the  
 Reestablished  evidence, monuments, and accessories for this corner.

**NOTE** This document does not create an implied warranty by either the surveyor or the Department of Agriculture  
as to the accuracy of the corner location.  
I, the undersigned STATE LAND SURVEYOR, do hereby certify that the foregoing instrument was filed for record with the MISSOURI  
DEPARTMENT OF AGRICULTURE'S DIVISION OF WEIGHTS, MEASURES & CONSUMER PROTECTION LAND SURVEY PROGRAM  
STATE LAND SURVEYOR DATE \_\_\_\_\_ CORNER INDEX NO. \_\_\_\_\_ DOCUMENT NUMBER \_\_\_\_\_

MO 780-1788-0414 SHEET \_\_\_\_\_ OF \_\_\_\_\_

SKETCH OF CORNER

OBSERVATION ONE  
START: 8/2/2022 11:33:12 PM STOP: 8/2/2022 11:59:28 PM  
REF NAME: 14040201010000-2010.0000 REF POINT: 010000-0000.0000 REF POINT: 010000-0000.0000  
REF NAME: 14040201010000-2010.0000 REF POINT: 010000-0000.0000 REF POINT: 010000-0000.0000

POINT	N	E	Z	LAT
1	4256428.171505	0.028800	4256431.520500	0.028800
2	1366897.434100	0.048600	1366897.375500	0.048600
3	1366897.434100	0.048600	1366897.375500	0.048600
4	4256428.171505	0.028800	4256431.520500	0.028800

UTM COORDINATES STATE PLANE COORDINATES UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 18)	SPC (California zone 1)	UTM (Zone 18)	SPC (California zone 1)
Northing (N) [Survey Feet]	14884252.908	124854.424	214854.424
Easting (E) [Survey Feet]	203168.056	665324.179	665324.194
Convergence [Degrees]	0.90483379	0.24331483	0.90483356
Point Scale	0.99978317	0.99989882	0.99978316
Combined Factor	0.99942445	0.99973998	0.99942434

US NATIONAL GRID DESIGNATION: 18N UTM COORDINATE SYSTEM  
BASE DATUM: NAD 83  
PROJECTION: UTM  
UNIT: METERS

PID DESIGNATION	LATITUDE	LONGITUDE	DISTANCE (FT)
NONE P900	N 40° 59' 51.46289" W	127° 24' 53.52837" W	216418.893
NONE P901	N 40° 59' 52.34929" W	127° 30' 24.78540" W	288770.488
NONE P902	N 41° 11' 00.02134" W	127° 36' 54.40770" W	399533.843
NONE P903	N 40° 41' 59.89437" W	127° 42' 03.96747" W	544555.495
NONE P904	N 40° 41' 59.89437" W	127° 37' 09.69947" W	34525.497
NONE P905	N 42° 21' 31.80550" W	127° 46' 41.64687" W	257070.850
NONE P906	N 40° 24' 32.89437" W	127° 21' 41.69687" W	22217.720

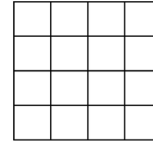
MO 780-1788-0414 SHEET \_\_\_\_\_ OF \_\_\_\_\_

# COMPLETE THE FRONT OF THE CORNER FORM AS USUAL AND INCLUDE STATE PLANE COORDINATES

- On the back of the form include detailed information about two post processed static or rapid static occupations. Include the date and time of both observations, detailed information about EPOCH, and earth model. Include the location and name of the CORS stations used, and the vectors measured from them. This information will both inspire confidence and leave a lasting legacy that will remain useful for many years.

# TWO INDEPENDENTLY MEASURED AND REDUCED STATIC OR RAPID STATIC OBSERVATIONS ARE PERSUASIVE EVIDENCE OF A CORNER LOCATION

SHOW YOUR WORK AND HELP BUILD A BETTER PUBLIC LAND SURVEY SYSTEM. JUST EDIT THE OUTPUT FILES FROM THE POST PROCESSING RESULTS AND INSERT THOSE RESULTS ONTO THE BACK OF THE CORNER FORM.



## OBSERVATION ONE

START: 3/1/2022 11:23:12 PM STOP: 3/1/2022 11:59:28 PM  
 REF FRAME: NAD83(2011)[EPOCH:2010.0000] ITRF2014 (EPOCH:2022.163)  
 X: -8295428.271 (sf) 0.028(sf) -8295431.592(sf) 0.028(sf)  
 Y: -13467718.896 (sf) 0.048(sf) -13467714.570(sf) 0.048(sf)  
 Z: 13658397.424 (sf) 0.048(sf) 13658397.257(sf) 0.048(sf)  
 LAT: N 41° 00' 03.60040" 0.035(sf) N 41° 00' 03.61172" 0.035(sf)  
 E LON: E 238° 22' 08.57335" 0.046(sf) E 238° 22' 08.50692" 0.046(sf)  
 W LON: W 121° 37' 51.42665" 0.046(sf) W 121° 37' 51.49308" 0.046(sf)  
 EL HGT: 2904.610(sf) 0.045(sf) 2903.036(sf) 0.045(sf)  
 ORTHO HGT: 2985.248(sf) 0.045(sf) [NAVD88 (Computed using GEOID18)]

## UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 10)	SPC (California zone 1)
Northing (Y) [ survey feet 14894230.908	2248154.814
Easting (X) [ survey feet 2018168.053	6663524.179
Convergence [degrees] 0.90481379	0.24131480
Point Scale 0.99976317	0.99989882
Combined Factor 0.99962435	0.99975998

## US NATIONAL GRID DESIGNATOR:

### BASE STATIONS USED

PID DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(sf)
NONE P060	N 40° 59' 51.46286" W 122° 24' 53.52823"	216418.877	
NONE P347	N 41° 11' 00.02114" W 120° 56' 54.40776"	199553.843	
NONE P348	N 40° 54' 19.95132" W 121° 49' 40.75607"	64654.409	
NONE P349	N 40° 43' 51.89429" W 122° 19' 09.60941"	214325.497	
NONE P671	N 40° 24' 32.89437" W 121° 25' 41.49484"	222917.710	

## OBSERVATION TWO

START: 8/10/2021 8:16:53 PM STOP: 8/10/2021 8:49:57 PM  
 REF FRAME: NAD83(2011)[EPOCH:2010.0000] ITRF2014 (EPOCH:2021.6068)  
 X: -8295428.327(sf) 0.008(sf) -8295431.615(sf) 0.008(sf)  
 Y: -13467719.014(sf) 0.012(sf) -13467714.700(sf) 0.012(sf)  
 Z: 13658397.493(sf) 0.012(sf) 13658397.334(sf) 0.012(sf)  
 LAT: N 41° 00' 03.60007" 0.009(sf) N 41° 00' 03.61150" 0.009(sf)  
 E LON: E 238° 22' 08.57354" 0.012(sf) E 238° 22' 08.50755" 0.012(sf)  
 W LON: W 121° 37' 51.42646" 0.012(sf) W 121° 37' 51.49245" 0.012(sf)  
 EL HGT: 2904.754(sf) 0.012(sf) 2903.180(sf) 0.012(sf)  
 ORTHO HGT: 2985.391(sf) 0.012(sf) [NAVD88 (Computed using GEOID18)]

## UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 10)	SPC (California zone 1)
Northing (Y) [ survey feet] 14894230.875	2248154.781
Easting (X) [ survey feet] 2018168.068	6663524.194
Convergence [degrees] 0.90481356	0.24131484
Point Scale 0.99976316	0.99989882
Combined Factor 0.99962434	0.99975997

## US NATIONAL GRID DESIGNATOR:

### BASE STATIONS USED

PID DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(sf)
NONE P060	N 40° 59' 51.46285" W 122° 24' 53.52823"	216418.893	
NONE P341	N 40° 39' 02.34929" W 122° 36' 24.78546"	298770.488	
NONE P347	N 41° 11' 00.02116" W 120° 56' 54.40775"	199553.841	
NONE P349	N 40° 43' 51.89429" W 122° 19' 09.60940"	214325.495	
NONE P730	N 41° 21' 33.09550" W 120° 49' 41.64493"	256705.850	

SEAL	
SIGNATURE	DATE
CORNER INDEX NO.	DOCUMENT NUMBER

# THANKS FOR WATCHING

- Brian Dollar PLS
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- Hot Springs, AR 71913
- [dollarlandsurvey@gmail.com](mailto:dollarlandsurvey@gmail.com)