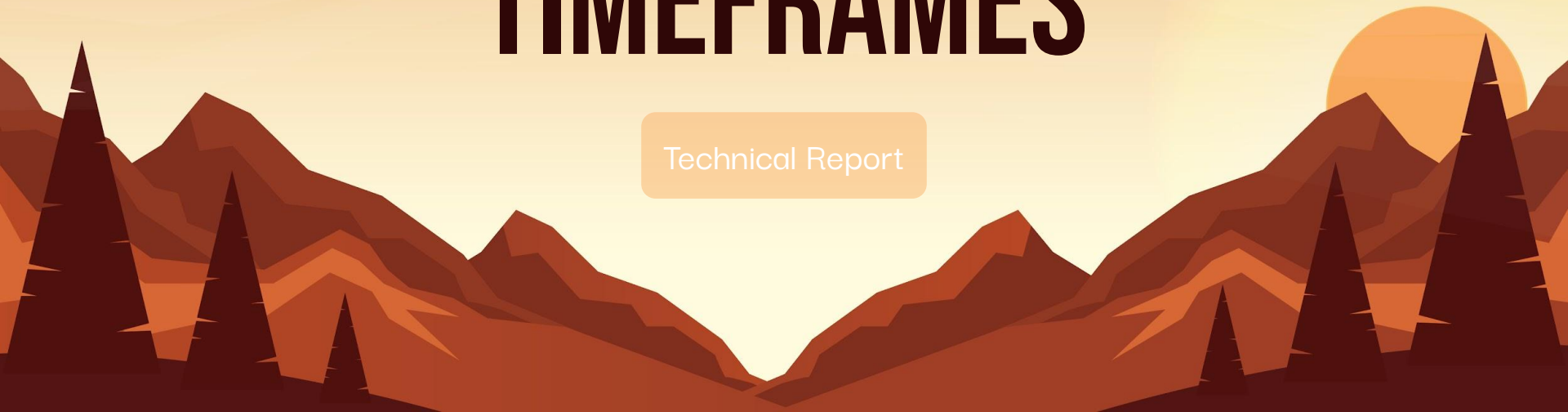
SEARCH AND RESCUE TIMEFRAMES

Technical Report



PROBLEM STATEMENT

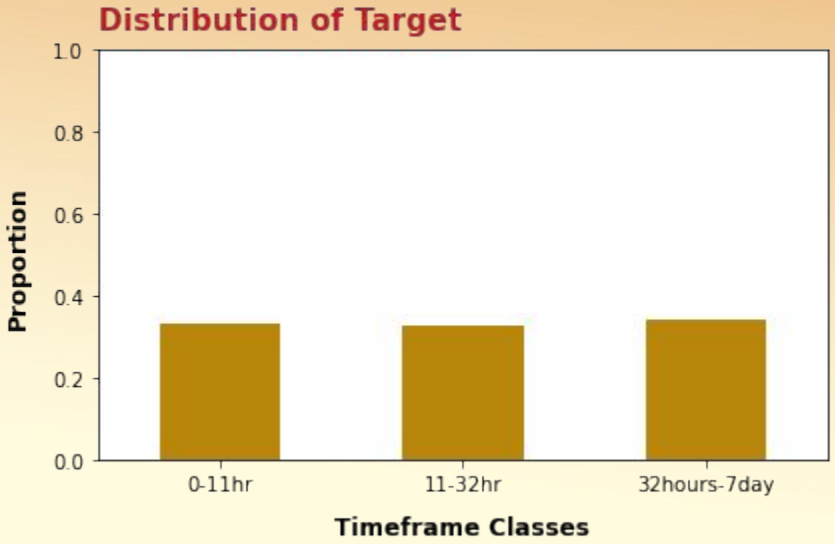
Through analyzing this dataset for Search and Rescue missions, what are the key factors that indicate the timeframe to locate and rescue victims both in wilderness and non-wilderness environments?

TARGET - SAR MISSION TIMEFRAMES

Classes: 0-11 hours | 11-32 hours | 32 hours - 7 days

- Normally distributed classes. Both classification models gained precision.
- Survival rates decrease when victims are in the elements especially overnight

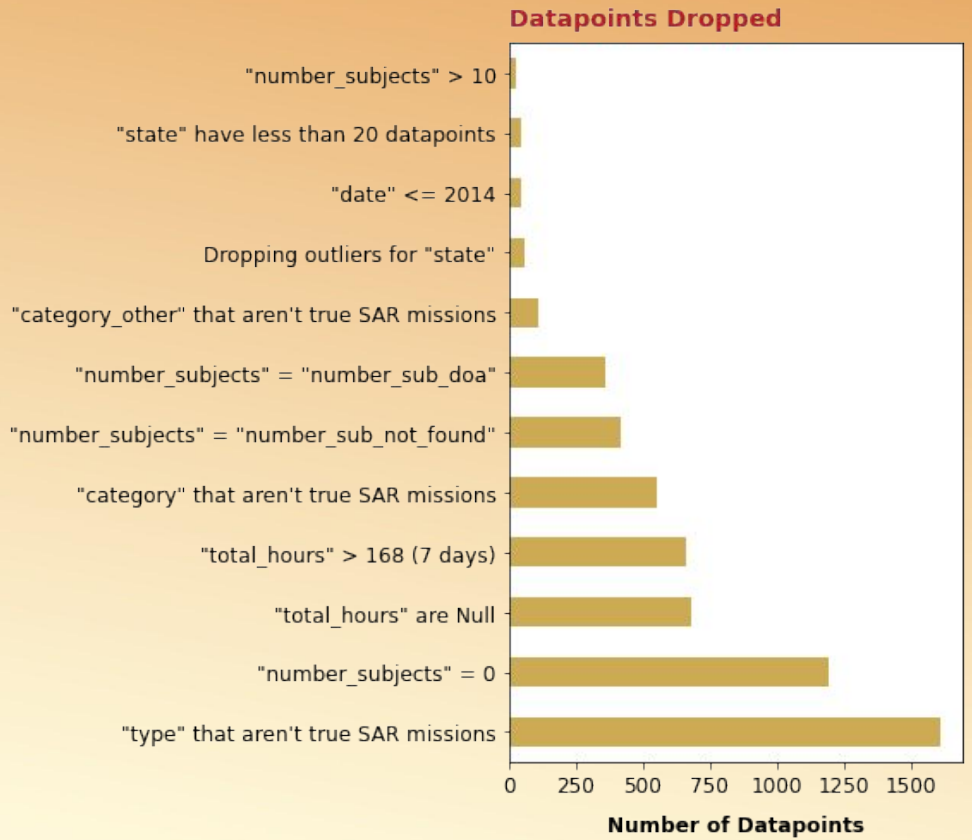
Baseline: 35% for the majority class 32 hours - 7 days



DATA CLEANING

Collected by Mountain Rescue Association
(https://mra.org)

- Live victim was being rescued
- 2014 - 2021
- 0-7 days
- Max 10 victims
- 13 States
- 78 SAR Teams
- 4 Area Types
- 10,000+ datapoints final



FEATURE ENGINEERING & IMPUTATION

State - imputed from Teams where State not null

Area Type - imputed nulls from other related variables

wilderness | urban/rural | water | interface wilderness

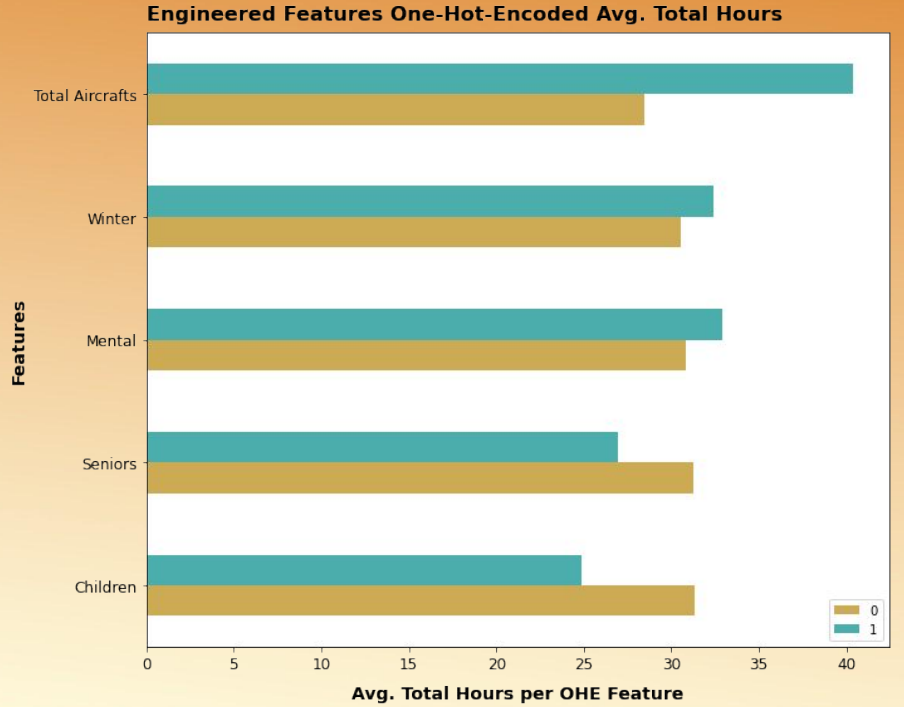
Seniors - True where any subject had dementia

Winter - incident occurring in winter & snow conditions

Number Volunteers - Median

Categorical Features were dummified

Continuous Variables were scaled with Standard Scaler

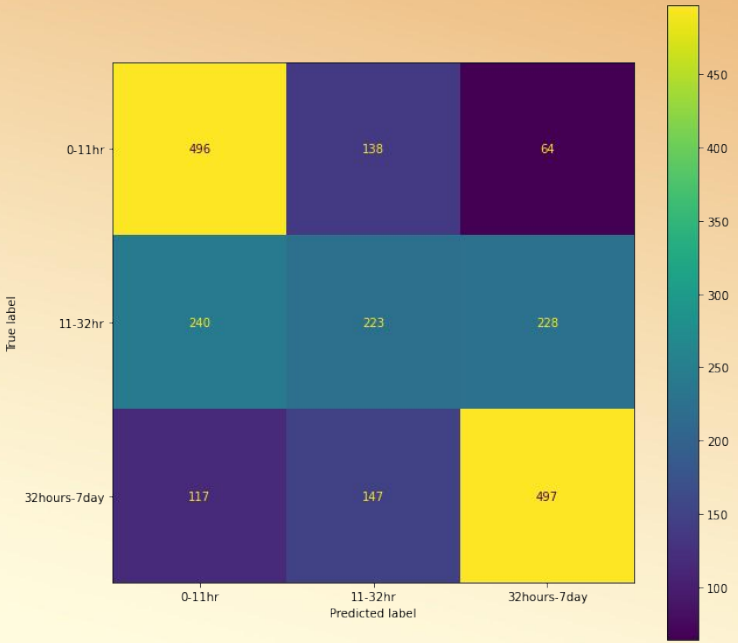


CLASSIFICATION MODELS

LOGISTIC REGRESSION

ACCURACY: 57% - 22% ABOVE BASELINE OF 35%

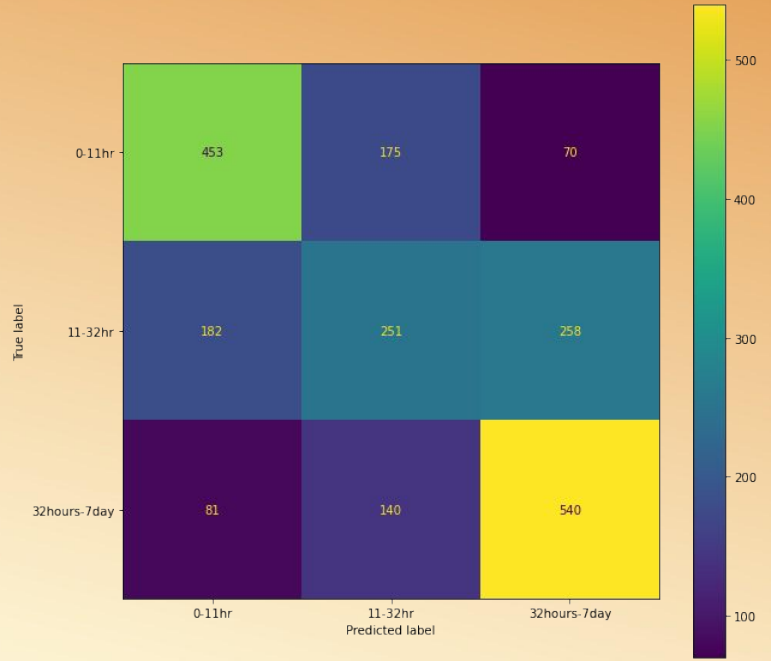
Precision for 2nd class ½ of 1 and 3



RANDOM FOREST

ACCURACY: 58% - 23% ABOVE BASELINE OF 35%

Precision for 2nd class ⅔ of 1 and 3



PRODUCTION MODEL

Logistic Regression with Lasso

- Most useful in understanding factors indicating each class

Random Forest Top Important Feature: Number Volunteers

Coefficients:

0-11 hours		11-32 hours		32 hours - 7 days	
Pennsylvania	29.85	New Jersey	0.49	New Mexico	1.85
Colorado	0.83	Nevada	-0.21	Washington	1.33
Number Volunteers	-0.74	Utah	-0.19	Number Volunteers	1.29

STATES

California & Colorado

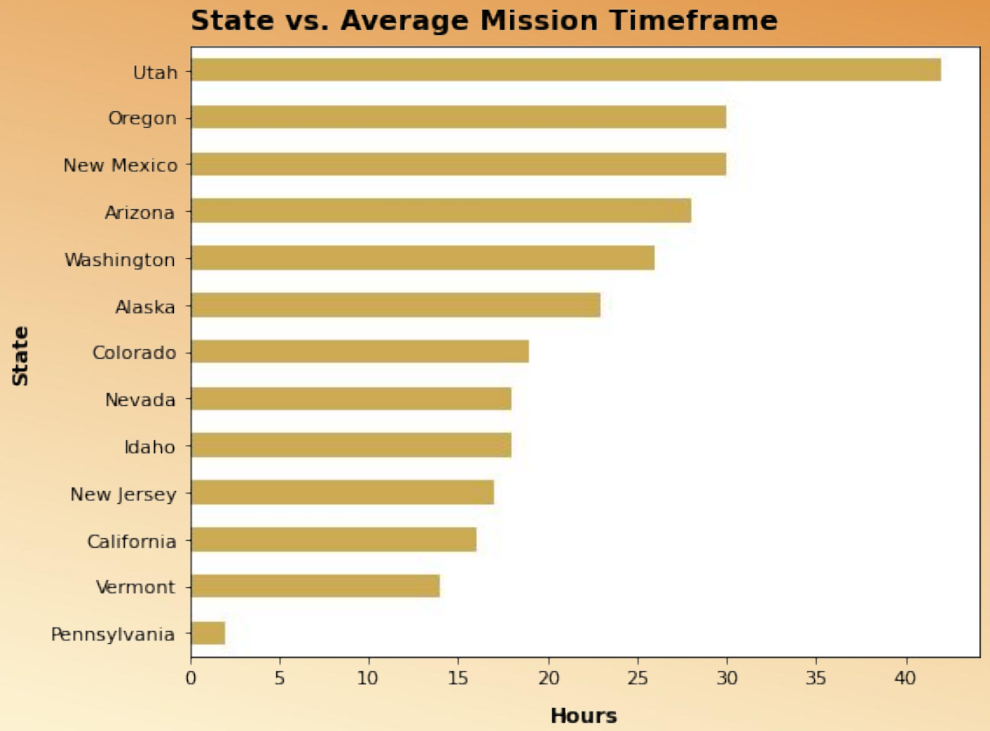
- 60% of dataset
- Avg 16 & 20 hours

Utah, Oregon, New Mexico

- Together 10% dataset
- Highest averages 30+

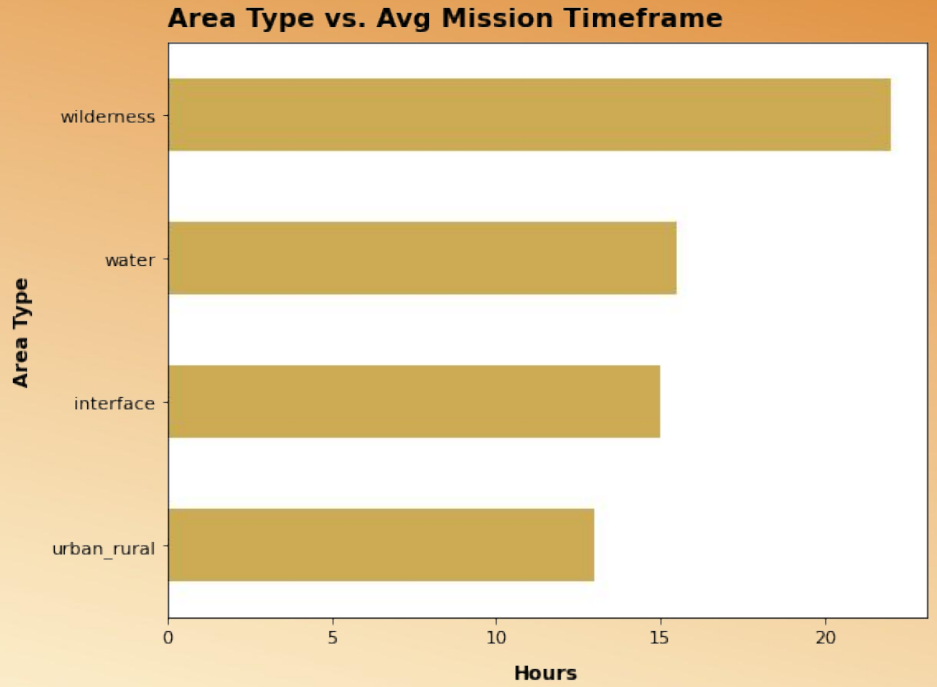
Recommendation

- Study the CA & CO SAR programs
- Do they benefit from more government funding?
- SAR collaboration program to share knowledge



AREA TYPE

- Wilderness 75% of dataset
- On avg. 8 hours longer than other Areas



Recommendation

Implement a public education campaign

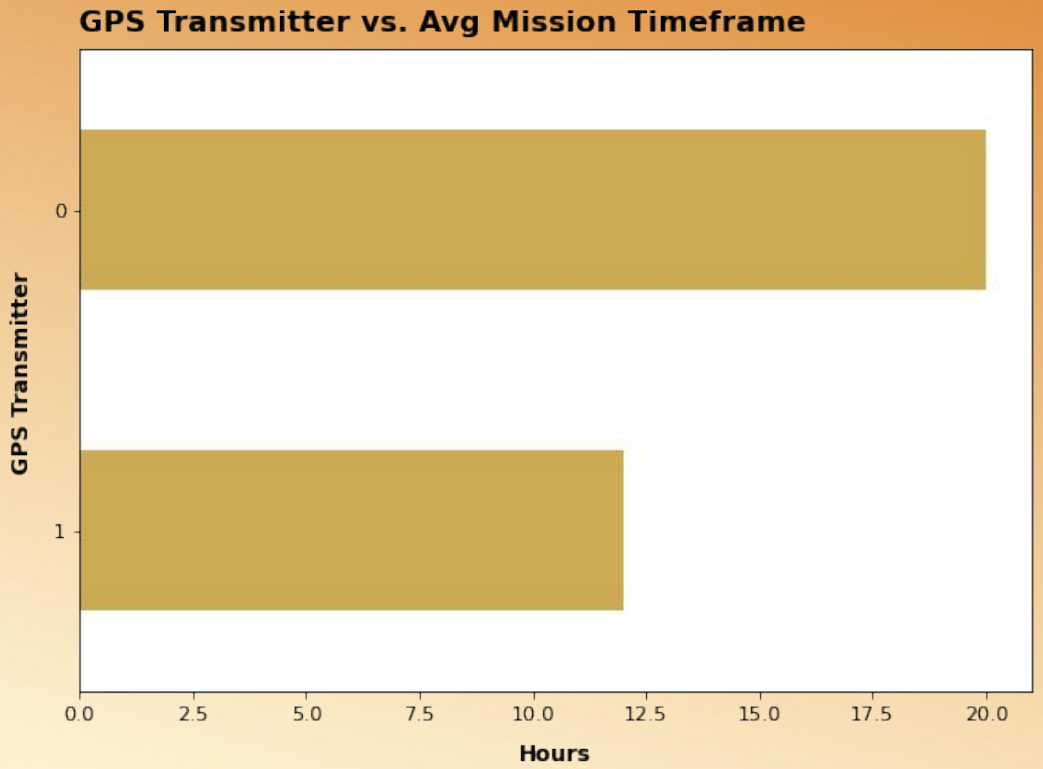
- SAR what-to-do and preparedness pamphlets
- Make pamphlets available at trailheads with maps

GPS TRANSMITTERS

- With GPS on average half the timeframe
- Comprise a small portion of the dataset but have a clear effect on the timeframe

Recommendation

- Educate adventure seekers the value of having a personal locator beacon
- Garmin InReach



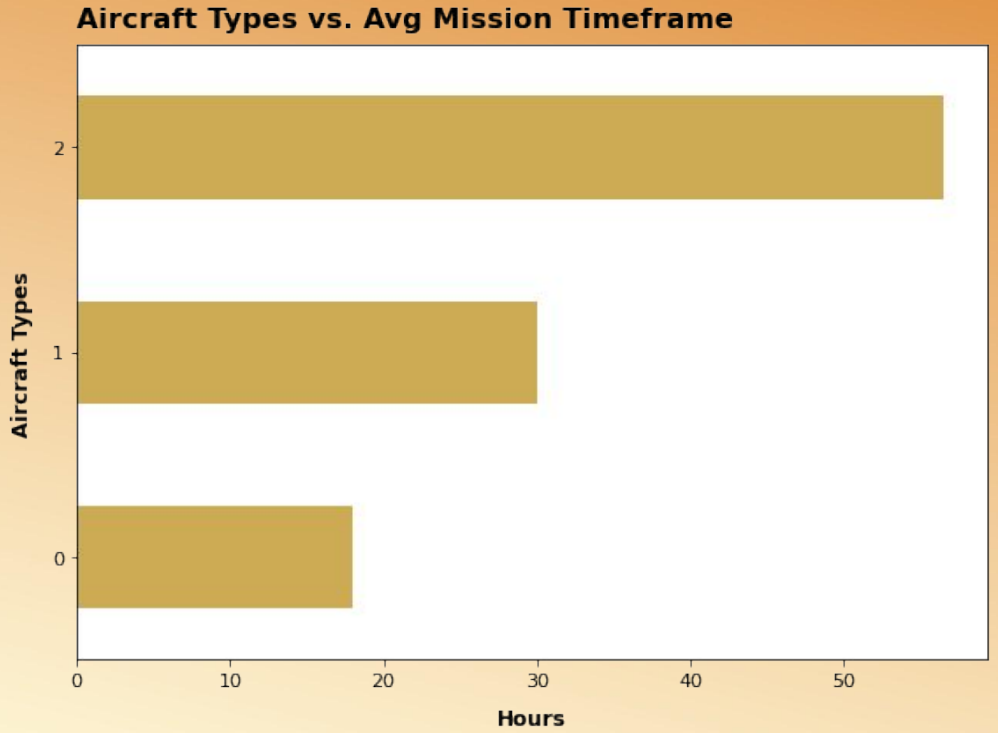
AIRCRAFT TYPES

- Types increase with Timeframe
- Timeframes likely reduced with more aircrafts
- UAVs are surprisingly not often used

Recommendation

Research potential benefits of UAVs

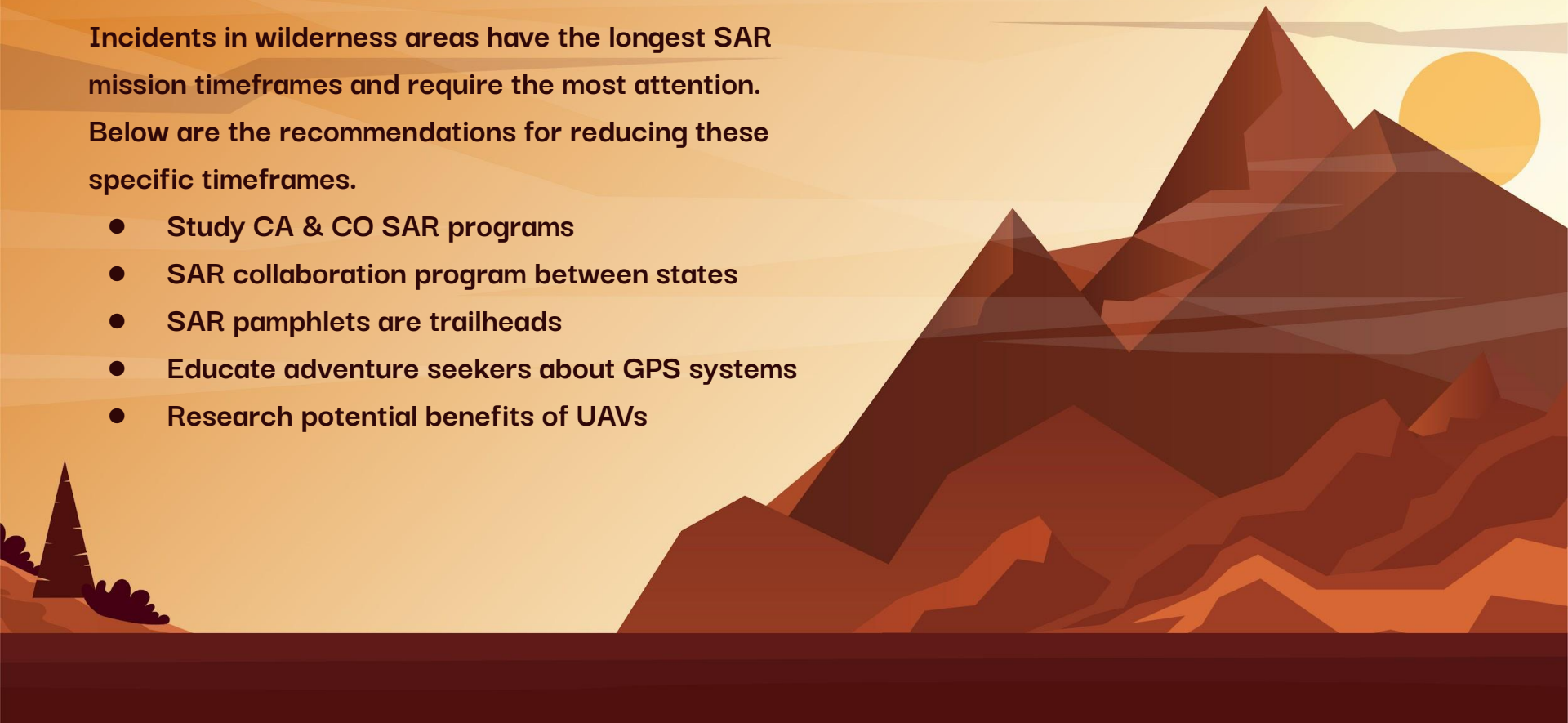
- Low-cost
- Programmable search patterns
- Infrared Cameras for nighttime searches
- Can interact & communicate with victims



CONCLUSIONS & RECOMMENDATIONS

Incidents in wilderness areas have the longest SAR mission timeframes and require the most attention. Below are the recommendations for reducing these specific timeframes.

- Study CA & CO SAR programs
- SAR collaboration program between states
- SAR pamphlets are trailheads
- Educate adventure seekers about GPS systems
- Research potential benefits of UAVs



THANKS!
QUESTIONS

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