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Fuelcast.net Reporting Interface

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Jeremiah Ormseth, Wyatt Featherly, Brad Deibert, Colton Gerth

Fuelcast Data Reporting



Fuelcast



What it provides

Weekly forecasts of rangeland fuel levels and performance in the Western U.S.



How it's done

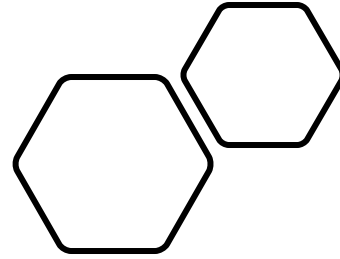
Interactive geospatial map powered by Google Maps API and Earth Engine



Who it's for

Federal government agencies and land permittees monitoring rangelands

Our Project



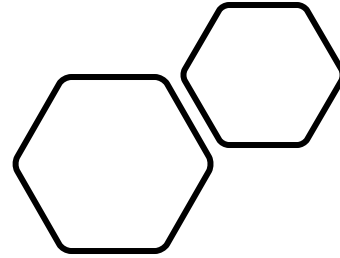
Problem

- Generating reports from Fuelcast data was a manual task – the application could not produce reports on its own

Solution

- Automate the creation of common reports and provide access to them on-demand through the Fuelcast platform.

Our Task



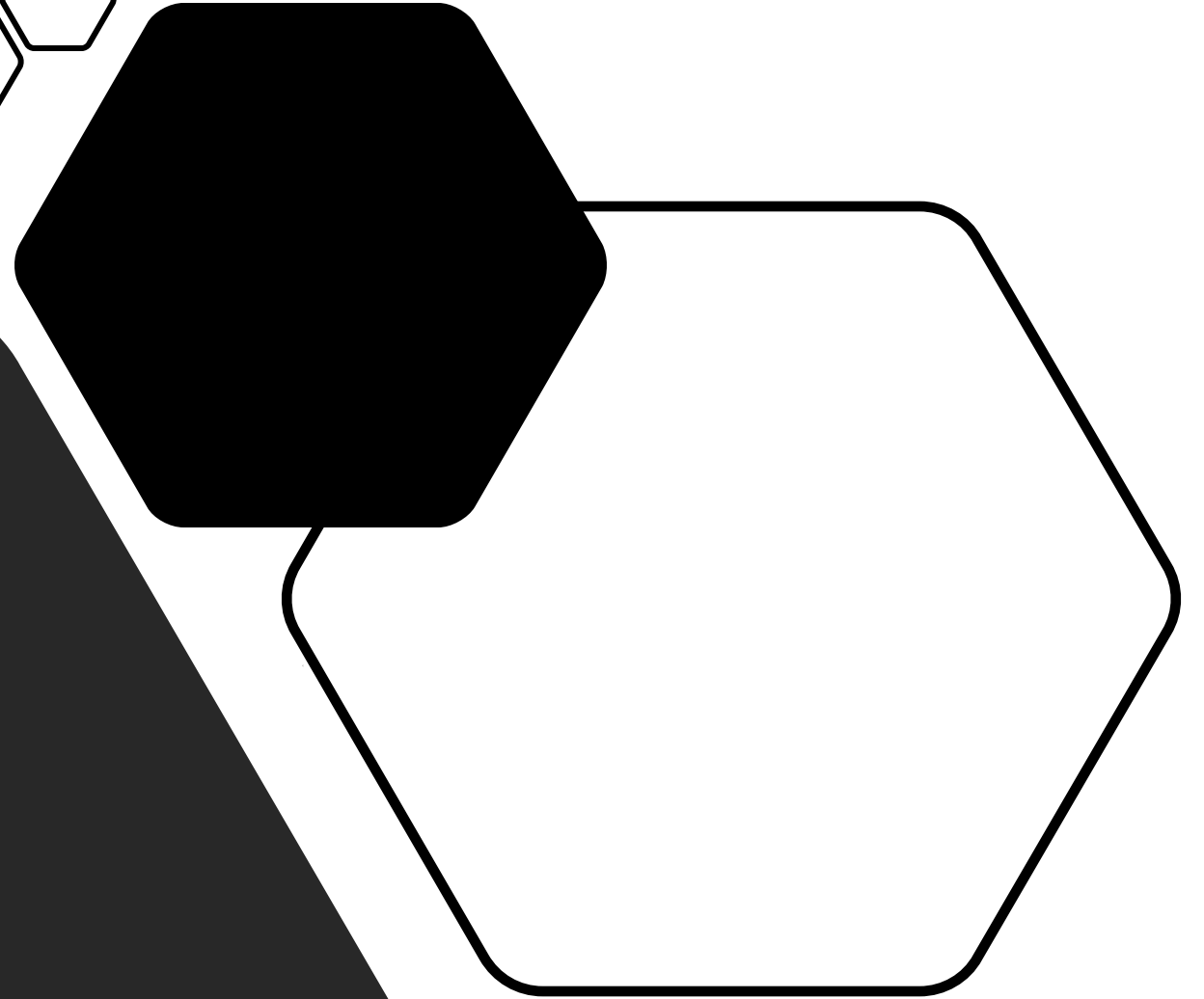
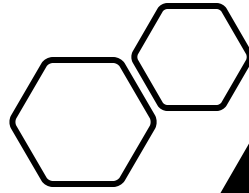
Overview

- Build reporting functionality into Fuelcast to provide access to in-depth insights on rangeland performance across the western U.S.

Priorities

1. General reports from latest Fuelcast projections data
2. Farm Services Agency (FSA) centric reporting capabilities – downloadable "season end" reports
3. Support report generation for different Regions of Interest (ROIs).

Before





fuelcast.net

Weekly fuel and rangeland production forecasts

[Go to the App](#)

[Get the Data](#)

[FSA App](#)

Actionable geospatial intelligence
for rangeland managers, fire specialists, and producers

Fuelcast.net is a fuel and rangeland production forecasting system

MACHINE LEARNING FORECASTS

WEEKLY UPDATES

Rangeland Productivity Monitoring Service (Beta)

Latest data from 2020-09-03

Research: Matt Reeves (matt.c.reeves@usda.gov)

Development: Robb Lankston (www.lankstonconsulting.com)

Satellite

Layers

- Projected Pounds Per Acre (PPA)
- Projected Peak of Season (Julian DOY)
- Projected PPA, Annual Herbaceous Component Only
- PPA Deviation from 15-year mean
- DOY Deviation from 15-year mean
- Annual Herbaceous Deviation from 15-year mean
- Updated FBFM40 Using Latest Projections

Projected Pounds Per Acre

100 lbs/ac 4500 lbs/ac

Downloads Page

[Download Projected Pounds Per Acre \(PPA\)](#)

[Download Projected Day of Year \(DOY\)](#)

[Download Projected Herbaceous](#)

[Download Projected PPA Deviation from 15-year mean](#)

[Download Projected DOY Deviation from 15-year mean](#)

[Download Projected Herbaceous Deviation from 15-year mean](#)

[Download Updated FBFM40 \(Reference: Landfire 1.4\)](#)

FSA Reports

Click the map to get values

PPA Deviation

By County

By Subsection

California Forage

Projected Percent Deviation from Mean

-200%

200%



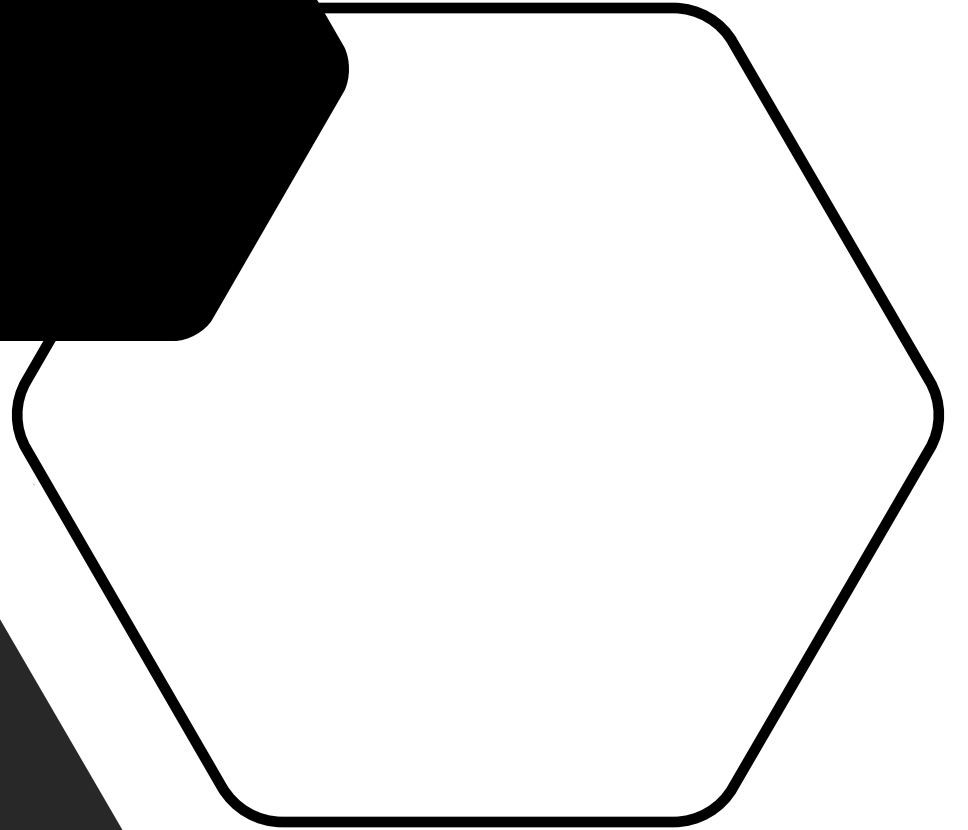
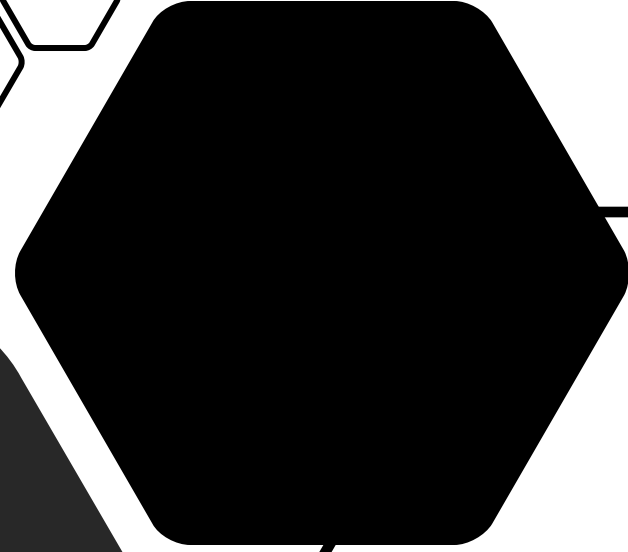
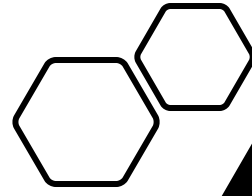
Missoula County

These values represent the projected percent deviation from the 15-year mean annual production

Zone mean: 5.13%

Zone standard deviation: 27.33%

After





Fuelcast.net

Weekly fuel and rangeland production forecasts

[Go to the Map](#)

[Overview](#)

[Downloads](#)

[Details](#)

[Contact](#)

Actionable geospatial intelligence for rangeland managers, fire specialists, and producers

Fuelcast is a fuel and rangeland production forecasting system

Machine Learning Forecasts

Leverages Google Earth Engine and Tensorflow to process near real-time weather and remote sensing data

Weekly Updates

Weekly forecast estimates of magnitude and timing of annual production and fuel across coterminous US rangelands

Detailed Reports

Produces several cutting edge information products with detailed reports in development

Geospatial Intelligence

Provides free, near real-time information to rangeland managers, fire specialists, and producers to act on in a timely manner



Satellite ▾



LAYERS

Region of Interest

Predictive Service Areas

Pastures

U.S. Counties

U.S. States

Data

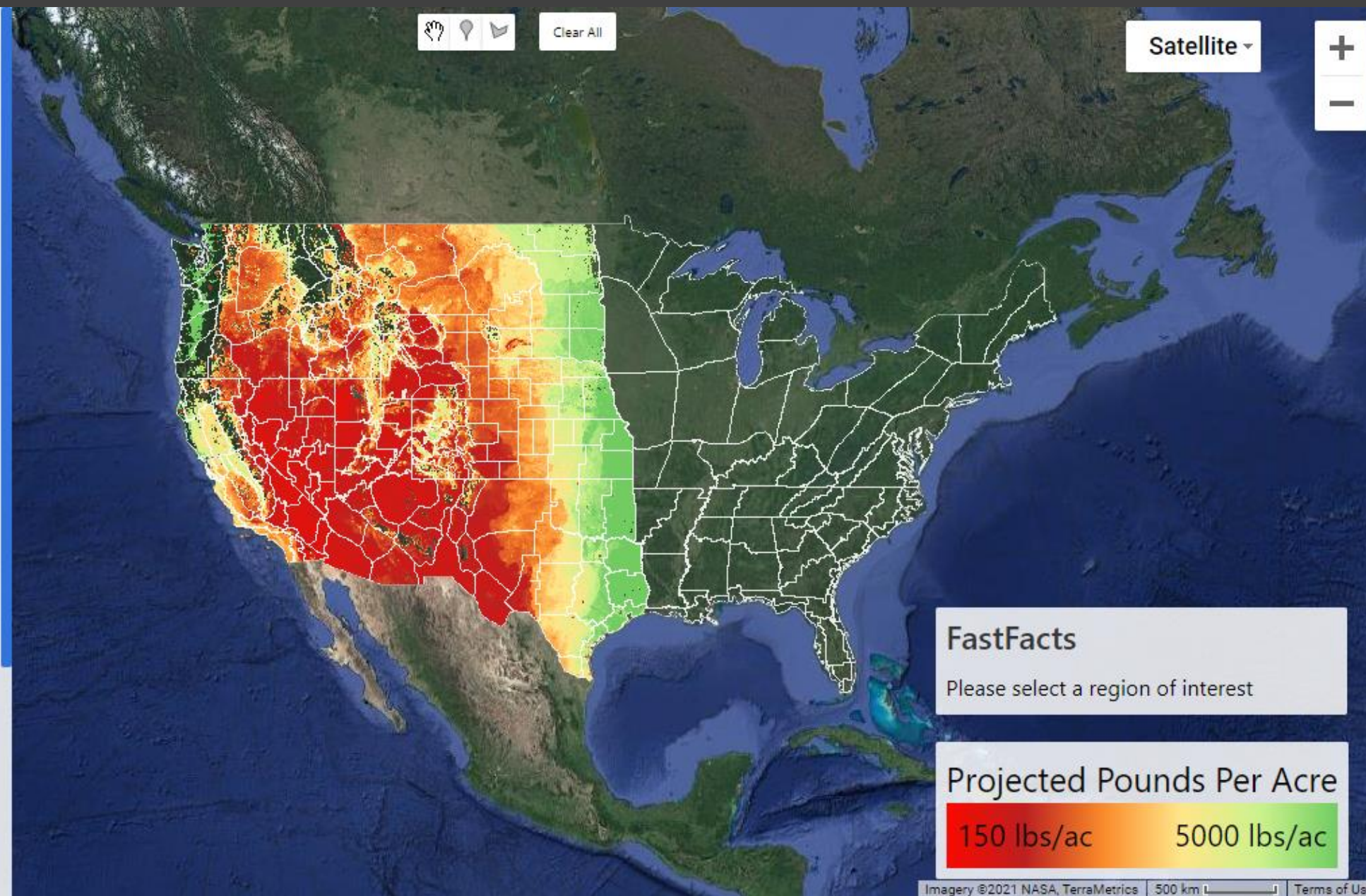
Projected Pounds Per Acre (PPA)

Projected PPA, Annual Herbaceous Component Only

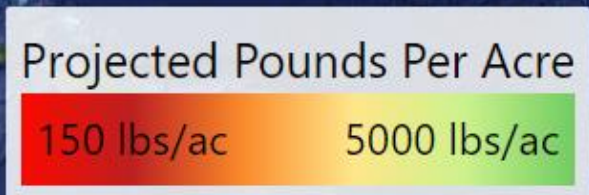
PPA Deviation from 15-year mean

Annual Herbaceous Deviation from 15-Year Mean

Standing Dead



FastFacts
Please select a region of interest





LAYERS

Region of Interest

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Projected Pounds Per Acre (PPA)

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Standing Dead

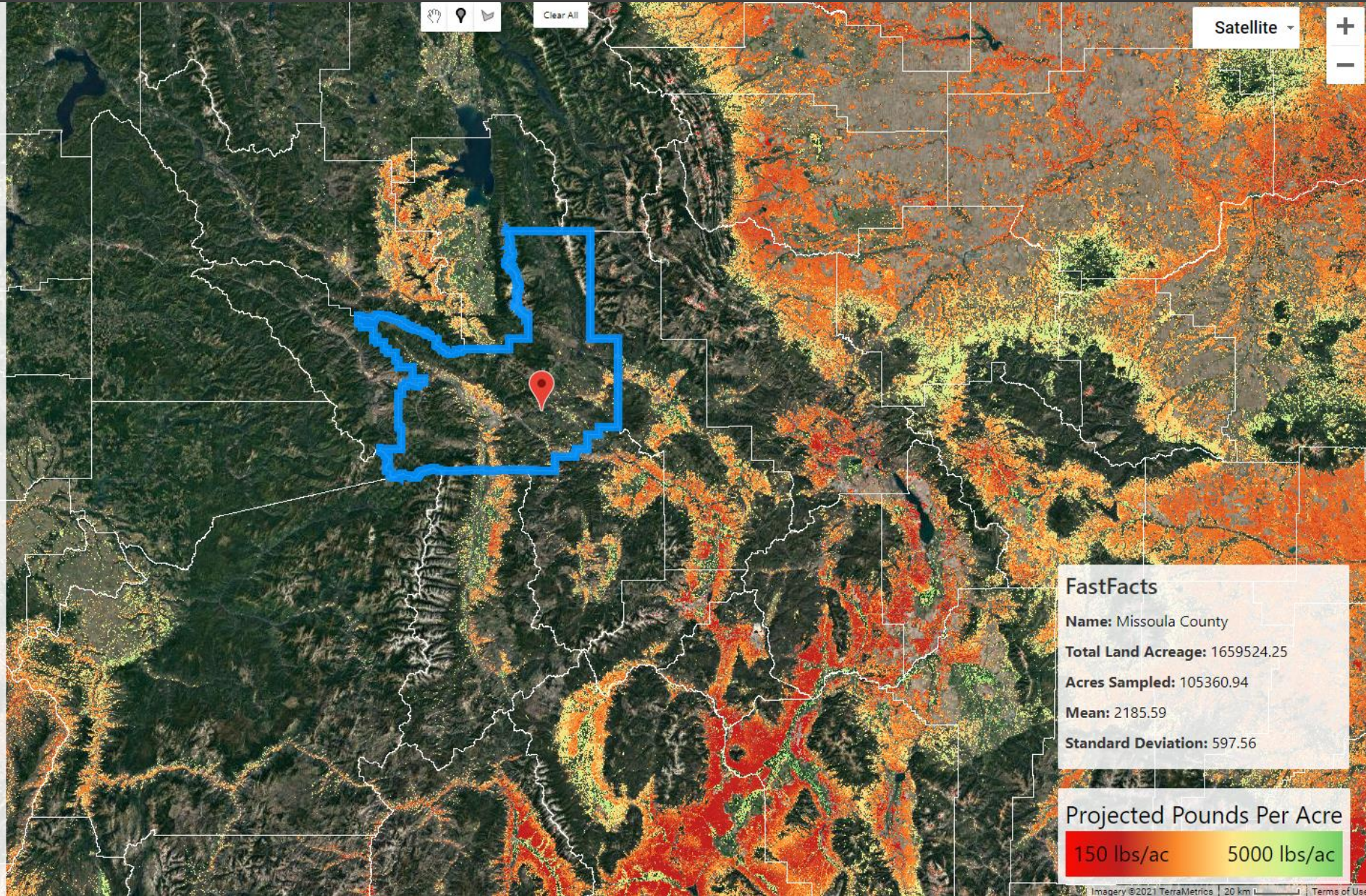
Updated FBFM40 Using Latest Projections

REPORTING

Generate report with latest projections

Generate season-end report

Hide Toolbar



FastFacts

Name: Missoula County
Total Land Acreage: 1659524.25
Acres Sampled: 105360.94
Mean: 2185.59
Standard Deviation: 597.56

Projected Pounds Per Acre

150 lbs/ac 5000 lbs/ac



LAYERS

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U.S. States

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Projected Pounds Per Acre (PPA)

Projected PPA, Annual Herbaceous Component Only

PPA Deviation from 15-year mean

Annual Herbaceous Deviation from 15-Year Mean

Standing Dead

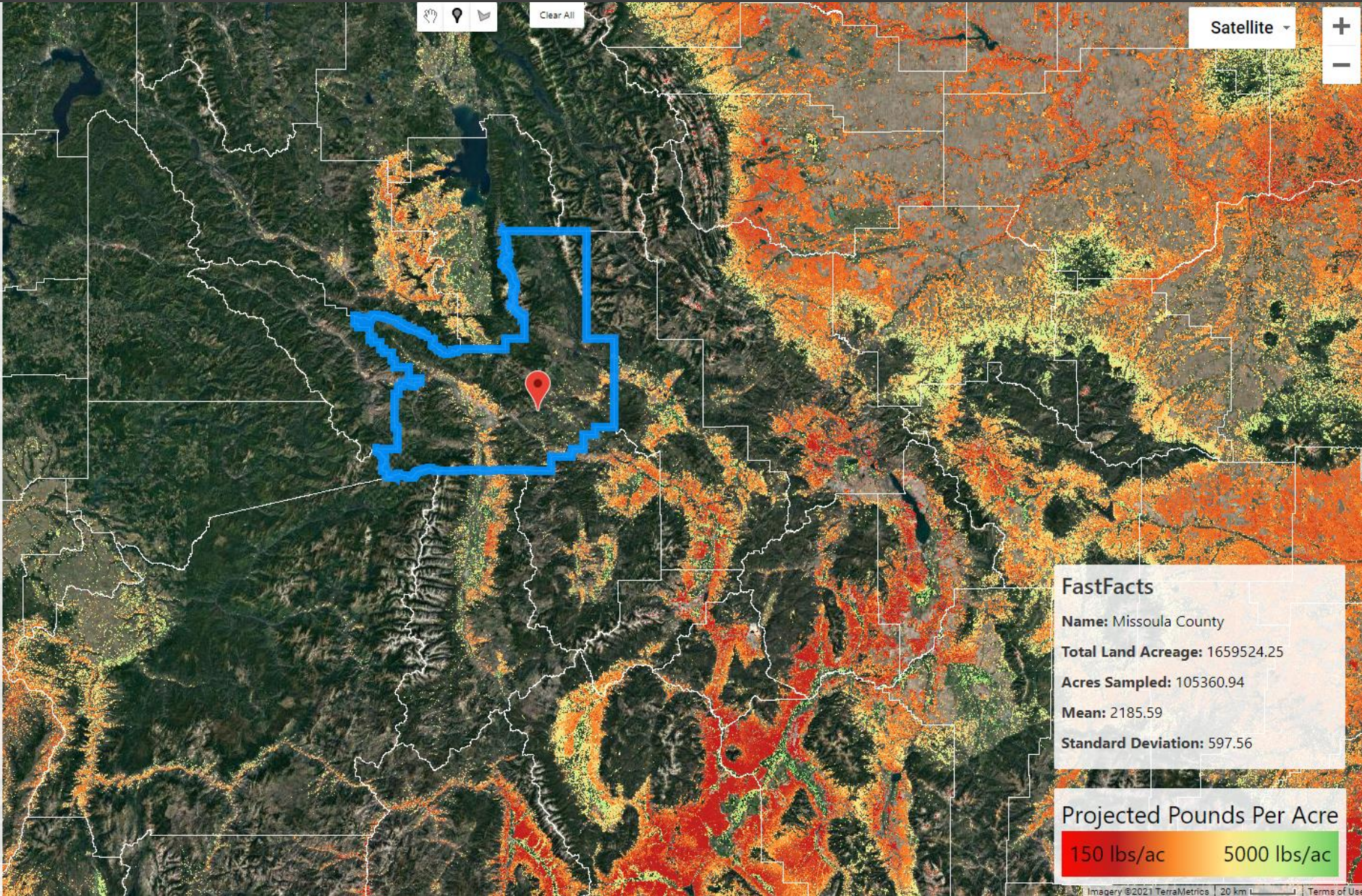
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FastFacts

Name: Missoula County
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Mean: 2185.59
Standard Deviation: 597.56

Projected Pounds Per Acre



Fuelcast Latest Weekly Projections



Latest Projections Report (from 2021-04-15)

Area	Mean Total PPA Yield (lbs)	Mean Total Change in Fuel (%)	Mean Total Herbaceous Yield (lbs)	Mean Total Change in Herbaceous Fuels (%)	Mean Standing Dead (lbs)
Missoula County	2185.59	-7.81	1273.89	-2.44	1242.22

Cancel



Clear All

Satellite ▾



LAYERS

Region of Interest

Predictive Service Areas

Pastures

U.S. Counties

U.S. States

Data

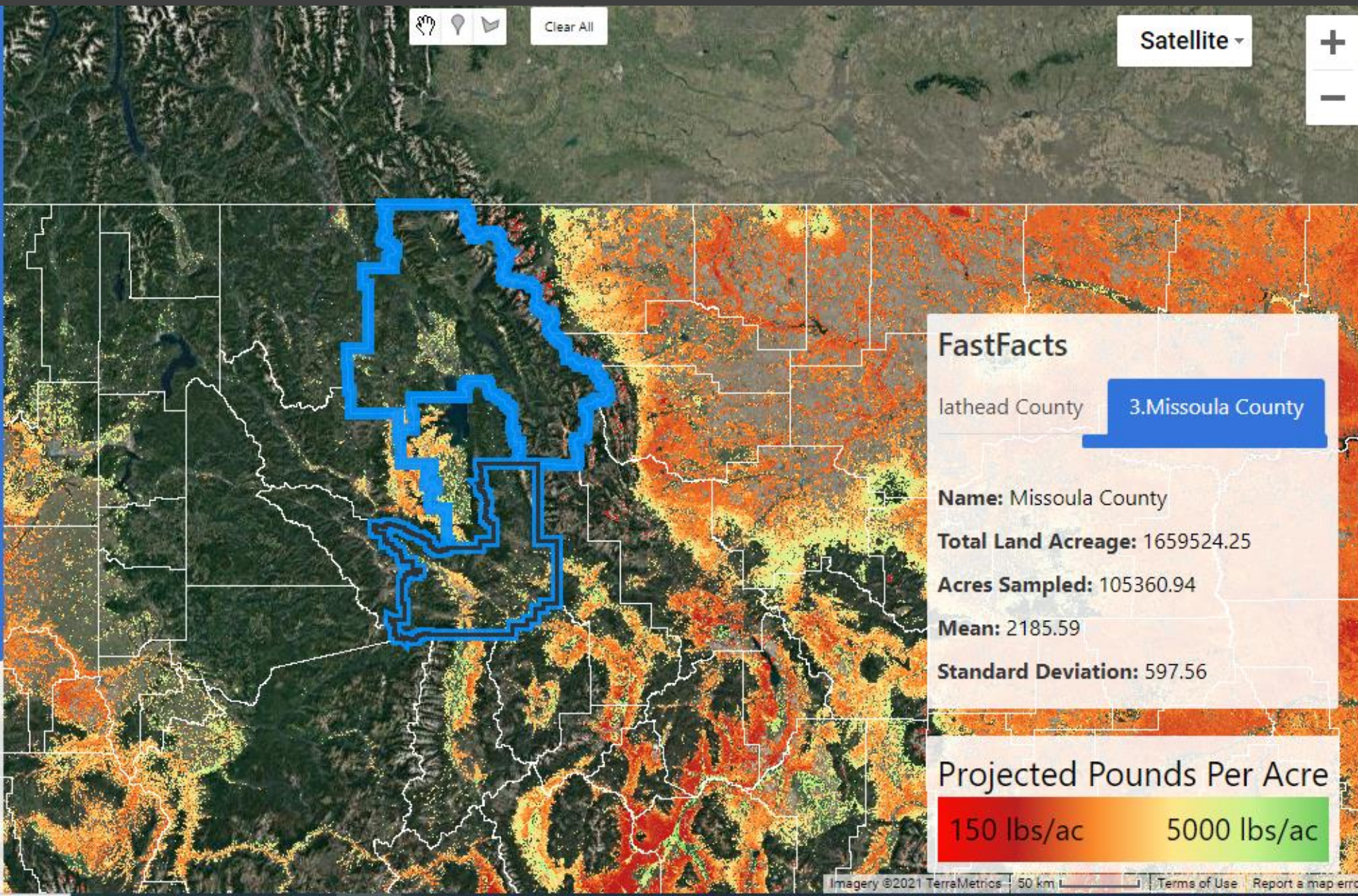
Projected Pounds Per Acre (PPA)

Projected PPA, Annual Herbaceous Component Only

PPA Deviation from 15-year mean

Annual Herbaceous Deviation from 15-Year Mean

Standing Dead



FastFacts

lathead County

3.Missoula County

Name: Missoula County

Total Land Acreage: 1659524.25

Acres Sampled: 105360.94

Mean: 2185.59

Standard Deviation: 597.56

Projected Pounds Per Acre

150 lbs/ac

5000 lbs/ac

Fuelcast Latest Weekly Projections



Latest Projections Report (from 2021-04-15)

Area	Mean Total PPA Yield (lbs)	Mean Total Change in Fuel (%)	Mean Total Herbaceous Yield (lbs)	Mean Total Change in Herbaceous Fuels (%)	Mean Standing Dead (lbs)
Lake County	2176.03	-6.98	1417.71	-0.44	1350.69
Flathead County	2221.00	-8.41	1344.47	-4.14	1050.05
Missoula County	2185.59	-7.81	1273.89	-2.44	1242.22

Cancel



LAYERS

Region of Interest

Predictive Service Areas

Pastures

U.S. Counties

U.S. States

Data

Projected Pounds Per Acre (PPA)

Projected PPA, Annual Herbaceous Component Only

PPA Deviation from 15-year mean

Annual Herbaceous Deviation from 15-Year Mean

Standing Dead

Updated FBFM40 Using Latest Projections

REPORTING

Generate report with latest projections

Generate season-end report

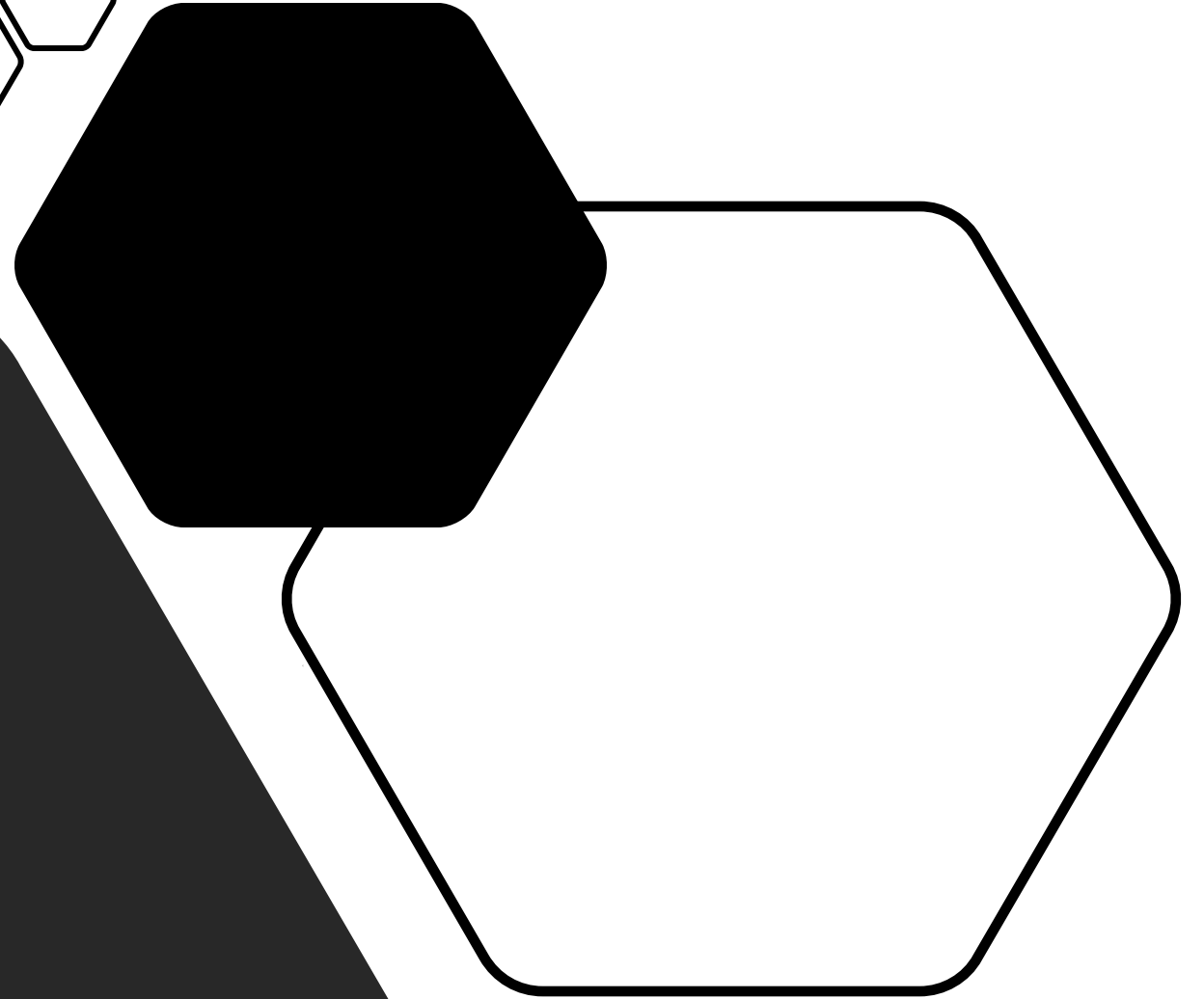
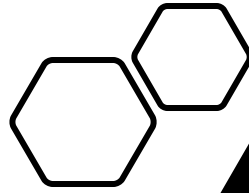
Hide Toolbar



Arizona Season End Report

Area	Rangeland Sampled (in acres)	Rangeland Exceeding -51% Loss (in acres)	Rangeland Exceeding -51% Loss (as %)	Mean Forage Loss Estimate (as %)	Forage Loss Standard Deviation (as %)
Apache County	8823349.44	1080964.62	12.25	-18.78	41.81
Cochise County	4692938.25	541732.75	11.54	-23.64	44.66
Coconino County	14756382.06	1096139.69	7.43	-10.90	45.68
Gila County	3696849.00	177160.75	4.79	25.51	72.27
Graham County	3547383.12	270418.69	7.62	7.21	66.12
Greenlee County	1417332.31	188677.12	13.31	-15.98	51.00
La Paz County	3481310.62	51422.31	1.48	65.33	67.01
Maricopa County	7078942.81	89877.12	1.27	100.99	61.09
Mohave County	10623747.88	251554.06	2.37	61.68	65.02
Navajo County	7841045.88	765329.50	9.76	-12.30	45.71

What we
Learned



Project Charter

Developed a basic understanding of the Fuelcast project and "got our feet wet"

- What it is
- Who it is for
- Why it is valuable

Set our initial goals for the project

- Got a general idea of what we needed to accomplish in the given timeframe

Requirements Specification

Detailed list of desired functionalities

- Gathered from meetings with clients and end-users
- Split into high, medium, low priority groups
- Gave us our "roadmap" for the implementation phase

Communication is key. Mishaps in this phase could lead to:

- Developing features that were not asked for
- Missing key pieces of desired functionality in the final product

UI Prototyping

Low Fidelity

- Rough draft for new application design
- Provided a visual framework to help weave gathered requirements together

High Fidelity

- Finer design elements worked in
- Our high-fidelity prototype mostly wound up being our finished product's design.

Prototypes are not binding.

- Bound to change during development.
- We made several changes from our low fidelity prototype to our final product. (See following slides.)

fuelcast.net

ABOUT

LINKS

to Applications

Webcasts

Data

CONTACT

Matt Reeves

Robb Lankston

Forecast

Layer:

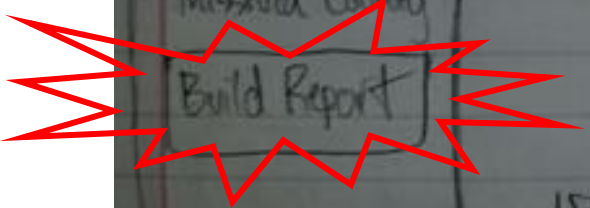
Counties

Data:

Projected PEA

Selected Area:
Missoula County

Build Report



ID

MT

ND

WY

SD

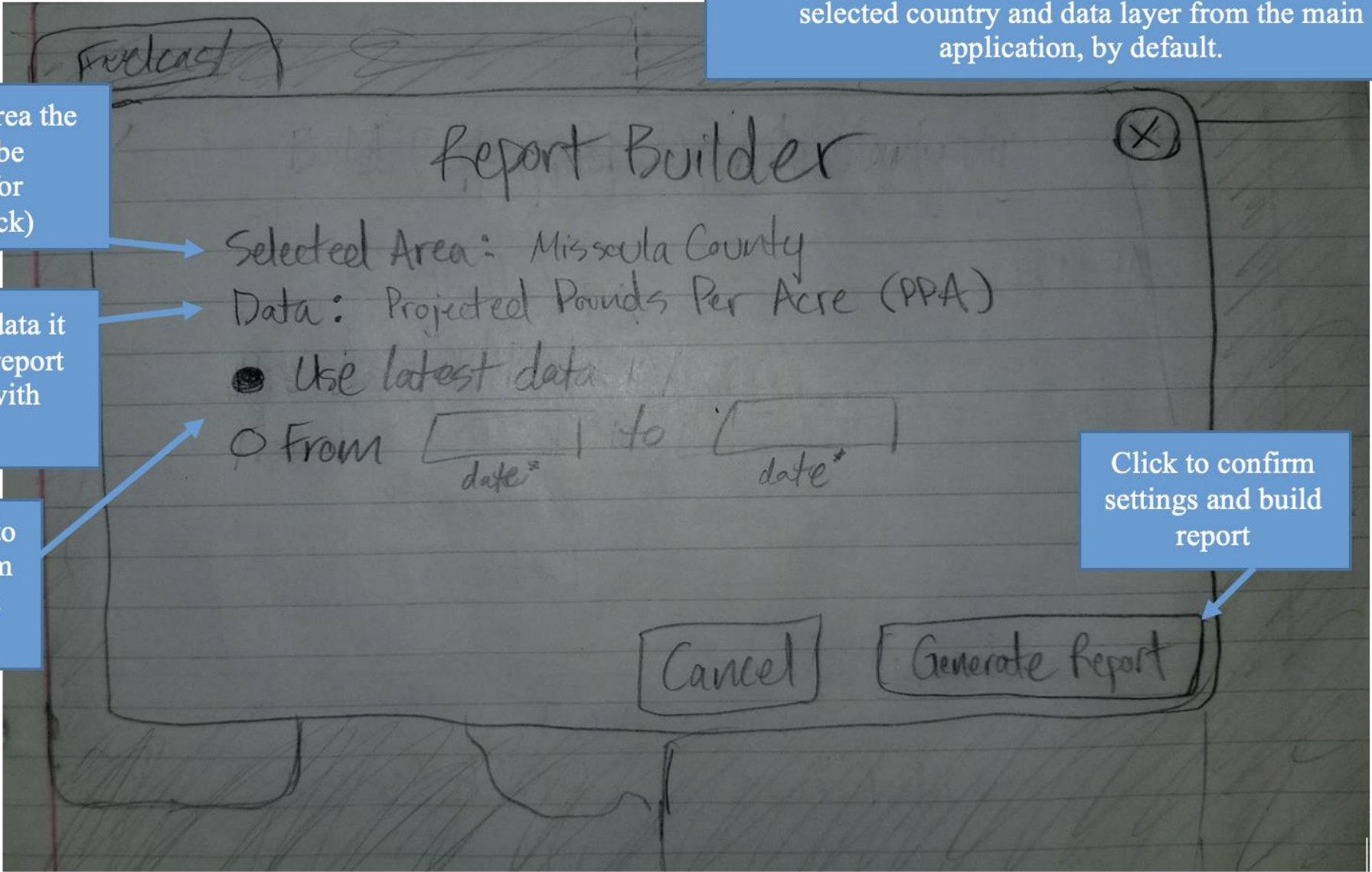
The report modal will pop up above the main application view, allowing users to manipulate more settings for their report. The report is set to be created from the selected country and data layer from the main application, by default.

Field tells the area the report will be generated for (via map click)

Field tells which data it will generate the report from (selected with dropdown)

User can select to build report from latest data, or a time frame

Click to confirm settings and build report



Sketch 3: Report Builder Modal

Forecast

Report Builder



Selected Area: Missoula County

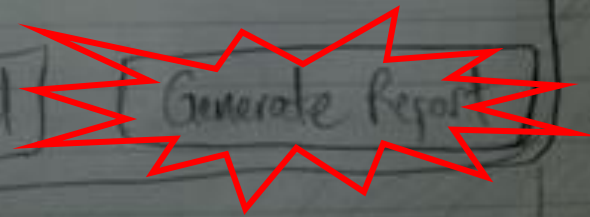
Data: Projected Pounds Per Acre (PPA)

Use latest data

From to

Cancel

Generate Report



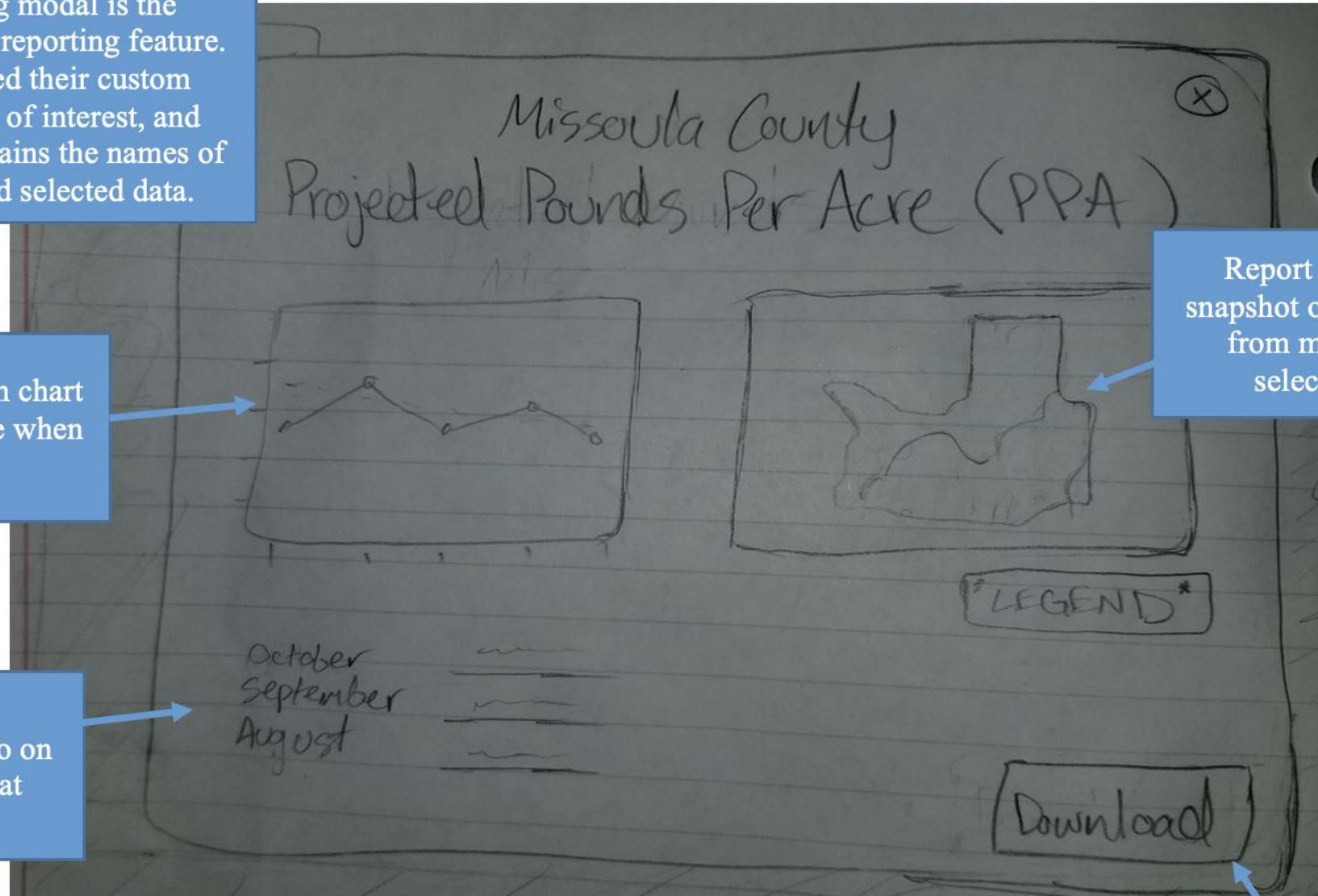
The report viewing modal is the ultimate payoff of the reporting feature. The user is presented their custom report (by area, data of interest, and timeframe). Title contains the names of the selected area and selected data.

Time series data in chart format is available when applicable

Time based data also on report in list format

Report contains a snapshot of spatial data from map for the selected area

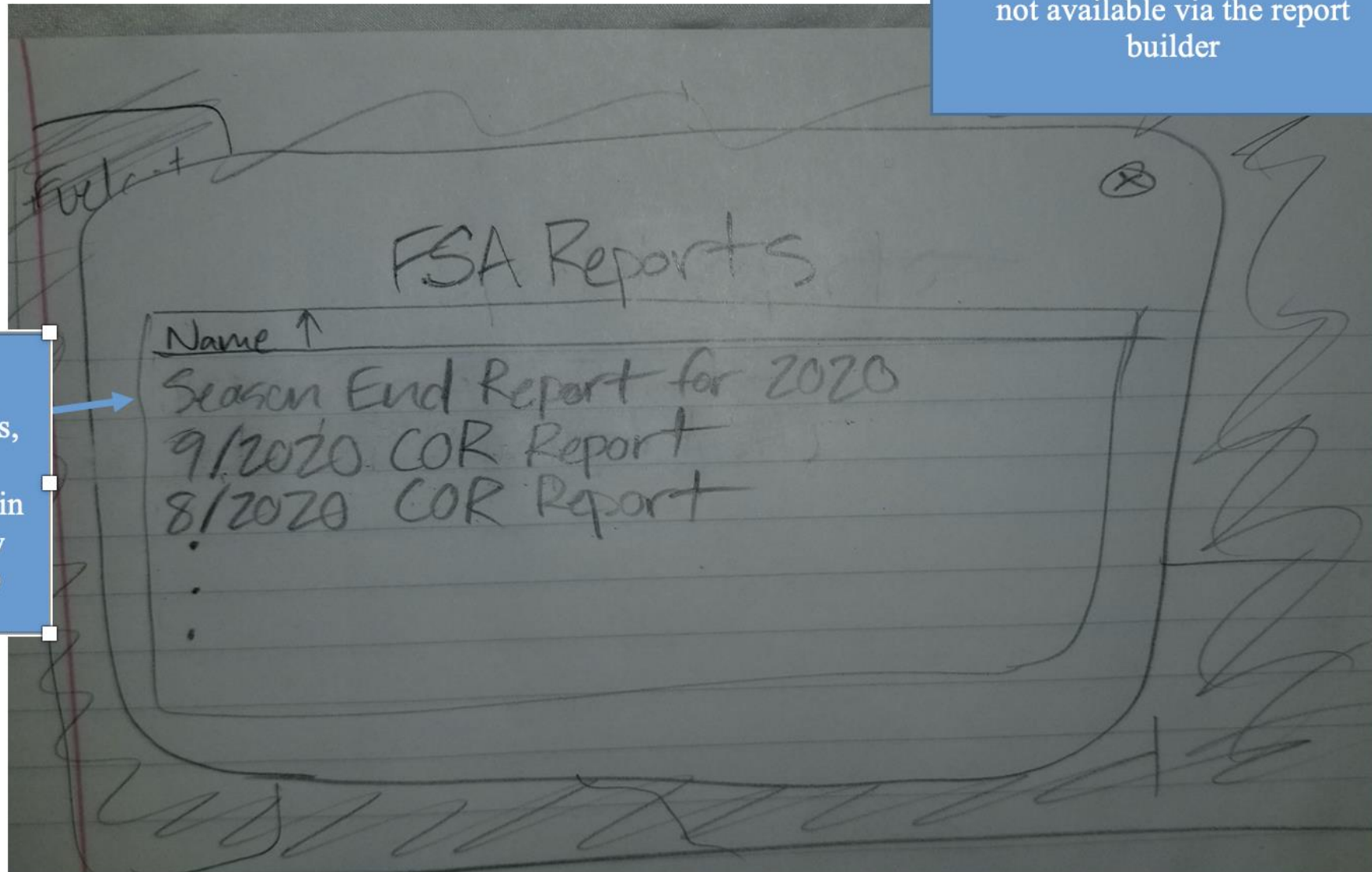
Click to download report in print friendly format



Sketch: Report View Modal (with download)

The FSA report modal provides access to useful reports that are not available via the report builder

Table of available reports, clickable to view/download in the report view modal (above)



Sketch: FSA Reports Modal

Implementation

Requirements appear/disappear in "the thick" of development.

- "Development is never done."

Doing "janitorial" work can end up consuming a lot of time

- Squashing bugs
- Cleaning up code
- Technical difficulties (merge conflicts, code formatting)

Adaptability is a virtue

- Reading code in unfamiliar languages
- Learning new technologies

Breakthroughs via teamwork and collaboration

- Sometimes all you need is a new set of eyes, or better yet...



User Testing

Understood the value in intuitive design for inexperienced users.

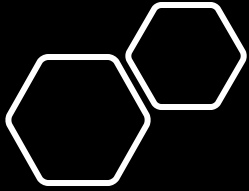
- You can have a piece of software do a million things, but if new users have no clue how to get started, it will never be used.

Learned how to use our testing time efficiently.

- 30 minutes is *not* enough time.

Exposed blind spots to the team in our new features.

- Our team had not thought about the two most apparent issues from our testing sessions:
 - Search functionality for finding ROIs
 - Unintuitive multi-select functionality (polygon drawing tool)



What We Learned

(from a technical perspective)

Tech

- Flask (Python micro web framework)
- Google Maps API
- Google Earth Engine
- Bulma CSS framework
- Javascript (+ jQuery)
- Version Control (git + GitHub)

Other

- How two halves make a whole application (frontend & backend = fullstack)
- Quality assurance of code through peer review and testing



Closing Remarks



The Good

The Bad

The Takeaways

Successes

- The project, as a whole!
- Navigate over to www.fuelcast.net

Some Failures

- Reports are not downloadable in a printer friendly format.
- Data visualizations were not included on reports.
- User testing feedback not addressed in implementation.
- A momentarily hamstrung team.

Takeaways

- **Communication is key.**
- **Always trust your team and believe in their ability to succeed.**