



Tutorial C

How to Use IFTDSS to Prepare a Prescribed Burn Plan

Using the Red Bull Prescribed Burn Plan as an example

Overview

This tutorial covers the following topics:

- Setting up a project in IFTDSS.
- Creating and filling in the burn plan template.
- Establishing burn objectives and environmental thresholds.
- Using the Prescribed Burn Planning workflow to perform the following tasks:
 - Describe what modules can be used for specific burn plan elements.
 - Model minimum and maximum fire behavior and effects inside the burn unit.
 - Model worst-case fire behavior and effects outside the burn unit.
 - Download the inputs and output variables needed for the burn plan document.
- Generating the burn plan as a Microsoft Word document and customizing the plan.
 - Filling in the appendices with maps and modeling data.

Note: Before continuing with this tutorial, we recommend that you review [Tutorial B: How to use hazard analysis tools in the IFTDSS for prescribed fire planning](#).

Introduction

The Prescribed Burn Plan

- is a site-specific implementation document
- is a legal document that provides the Agency Administration the information needed to approve the plan
- provides the Prescribed Fire Burn Boss with all the information needed to implement the prescribed fire

Prescribed fire projects must be implemented in compliance with the written plan

(U.S. Department of Agriculture and U.S. Department of the Interior [2008] [Interagency Prescribed Fire Planning and Implementation Procedures Guide](#), p. 19. Citations for this guide will be in this form: USDA and U.S. DOI, 2008.)

Interagency Prescribed Fire
Planning and Implementation Procedures Guide

PRESCRIBED FIRE PLAN

ADMINISTRATIVE UNIT(S): _____

PRESCRIBED FIRE NAME: _____

PREPARED BY: _____ DATE: _____
(Name & Qualification Category)

TECHNICAL REVIEW BY: _____ DATE: _____
(Name & Qualification Category)

COMPETENCY RATING: _____

MINIMUMS REQUIREMENT: _____

APPROVED BY: _____ DATE: _____
(Signature)

July 2008

Note: The main reference glossary for the *Interagency Prescribed Fire Planning and Implementation Procedures Guide* (IPFRG) is the [National Wildfire Coordinating Group \(NWCG\) Glossary](#).

Introduction

The tools provided under the IFTDSS **prescribed burn planning workflow** aid fuels treatment planners and prescribed fire planners in assessing fire behavior and effects for varying fuel and environmental conditions.

IFTDSS also contains tools for preparing and generating a burn plan document that is based on the guidelines in the

- Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide (USDA and U.S. DOI, 2008)
- RX-341 Prescribed Fire Plan Preparation course. In this tutorial, we follow along with the Red Bull Prescribed Burn Plan example given in that course.

Using the tools in IFTDSS, you can

- Model fire behavior and fire effects for different fuel models and environmental scenarios.
- Create a prescribed burn plan; as part of your planning process, you can save a Word file from IFTDSS that has a number of elements filled in from your model runs.

Important: Microsoft Word 2007 or later, or Word 2003 with the Microsoft Office Compatibility Pack, is required to open the burn plan document. You can [download the compatibility pack](#) at Microsoft.com.

Tutorial Objectives

This tutorial

- provides users with the skills and tools needed to prepare a **prescribed burn plan** in accordance with agency policy and guidelines.
- is based on the 21 required elements of a prescribed burn plan identified in the ***Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide*** (USDA and U.S. DOI, 2008) .
- describes what is **minimally** acceptable for prescribed fire planning and implementation.
- uses the example burn plan in the RX-341 Prescribed Fire Plan Preparation course (Red Bull Prescribed Burn Plan).

Note: Agencies may choose to provide more restrictive standards and policy direction, but must adhere to the **minimums** described in the *IPFRG* (USDA and U.S. DOI, 2008, p. 7).

[Element 1: Signature Page](#)
[Element 2, Part 1: Agency Administrator Go/No-Go Pre-Ignition Approval Checklist](#)
[Element 2, Part 2: Prescribed Fire GO/NO-GO Checklist](#)
[Element 3: Complexity Analysis Summary](#)
[Element 4: Description of Prescribed Fire Area](#)
[Element 5: Objectives](#)
[Element 6: Funding](#)
[Element 7: Prescription](#)
[Element 8: Scheduling](#)
[Element 9: Pre-Burn Consideration and Weather](#)
[Element 10: Briefing Checklist](#)
[Element 11: Organization and Equipment](#)
[Element 12: Communication](#)
[Element 13: Public and Personnel Safety, Medical](#)
[Element 14: Test Fire](#)
[Element 15: Ignition Plan](#)
[Element 16: Holding Plan](#)
[Element 17: Contingency Plan](#)
[Element 18: Wildfire Conversion](#)
[Element 19: Smoke Management and Air Quality](#)
[Element 20: Monitoring](#)
[Element 21: Post-Burn Activities](#)
[Appendices](#)

Getting Started

Begin by creating a new **project**.

- After creating a new project, you will see the **Create new run** page.
- The next step is to acquire LANDFIRE data, so we are going to navigate away from this page.

Access the **Data** tab.

Create New Project

Project Name

Description

Next

The screenshot shows the IFTDSS 1.0 beta web interface. The navigation bar includes Home, Collaborate, Projects, and Data (highlighted with a pink box). The user is logged in as Tecu. A green notification bar at the top states "Created project 'Red Bull'". Below this, the user is prompted to "Choose the type of run you would like to create:" with a "Start" dropdown menu and a "Back" button. Three options are listed: "By IFTDSS Workflows", "By Model Developer(s)", and "All Available Models in IFTDSS". A text box on the right explains the software modeling tools available in IFTDSS, grouped by workflow, model developer, or model type.

Getting Started

Now, we will acquire data from LANDFIRE.

Choose **Acquire Data from LANDFIRE**.

The screenshot shows the IFTDSS 1.0 beta web interface. The top navigation bar includes links for Home, Collaborate, Projects, and Data. The user is logged in as Tecuya. The main content area is titled 'Saved Data Sets' and features a 'Help' link. Two buttons are visible: 'Upload New Data Set' and 'Acquire Data from LANDFIRE', with the latter being highlighted by a pink box. Below these buttons is a table with columns for Name, Project, Creation Date, Status, and Actions. The table is currently empty, displaying 'No data available in table'. A search bar and a filter dropdown (set to '(all)') are also present. At the bottom, it shows 'Showing 0 to 0 of 0 entries' and navigation buttons for First, Previous, Next, and Last.

IFTDSS 1.0 beta

Home Collaborate Projects Data

About Help Feedback Log Out

Logged in as Tecuya

Saved Data Sets

Help

Upload New Data Set

Acquire Data from LANDFIRE

Show 10 entries Search:

Name	Project	Creation Date	Status	Actions
No data available in table				

Filters: (all)

Showing 0 to 0 of 0 entries

First Previous Next Last

Selecting a Data Set Area

Navigate to your desired location by using one of these three options:

- A** Using the navigation tools located in the top left portion of the map.
- B** Using the mouse. Click and drag to move; double-click to zoom in.
- C** Entering coordinates.

Tip: For this example, the coordinates are

- **North:** 44.0575942
- **East:** -99.4283515
- **South:** 44.0528583
- **West:** -99.4345037

IFTDSS 1.0 beta About Help Feedback Log Out
Home Collaborate Projects Data Logged in as Tecuya

Select Data Set Area

Name of data set

North

West East

South

Define the area for your LANDFIRE data set by using the latitude and longitude coordinate boxes to the left or by selecting an area on the map below. Please limit your download to an area of 30km x 30km (approximately one million 30-meter grid cells).

Navigate Map Draw Box

A **B** **C**

1000 km
1000 mi

Note: your region may have shifted due to a coordinate system transformation.

Back Acquire

Selecting a Data Set Area

Choose **Acquire** to import LANDFIRE data.

Tip: Select a large project area. By creating a large project area, you can view landscape data and model fire behavior and effects inside and outside the burn unit.

Maximum area: Acquisition of LANDFIRE data is limited to 250,000 acres.

Select Data Set Area

Name of data set
Red Bull Unit

North
44.0575942

West East
-99.4345037 -99.4283515

South
44.0528583

Define the area for your LANDFIRE data set by using the latitude and longitude coordinate boxes to the left or by selecting an area on the map below. Please limit your download to an area of 30km x 30km (approximately one million 30-meter grid cells).

Selected area: 76.06 acres

Navigate Map Draw Box



Note: your region may have shifted due to a coordinate system transformation.

Defining the Project Area of Interest

After acquiring the LANDFIRE data, click the **Projects** tab.

Choose the **Project** you are working in.

In this example, we are working in the **Red Bull** project that we previously set up.

Next, **acquire data for use in this project.**

IFTDSS 1.0 beta

Home Collaborate **Projects** Data

Logged in as Tecuya

• Data successfully acquired from LANDFIRE.

Active Projects

Active Archived

Show 10 entries Search:

Project Name	# Runs	Author	Date Created	Actions
Red Bull	0	Tecuya	01/10/2012	Edit Archive Delete

Filters: (all) (all)

Showing 1 to 1 of 1 entries

First Previous 1 Next Last

Project Summary

Description [Edit](#)

BIA Crow Creek Agency Buffalo County, South Dakota -Burn Plan -Fire Behavior and Effects modeling
Created: 01/13/2012

Project Data and Area of Interest

Your project area of interest has not been defined.
Acquire Data for use in this Project
or
Manually define the area of interest

Runs

Run Name	Run Group	Pathway	Date Created	Actions
No data available in table				

Filters: (all) (all) (all)

[Create New Run](#)

Project Data Sets

Name	Creation Date	Status	Actions
No data available in table			

Defining the Project Area of Interest

There are three ways to define the project area of interest. In this example, we use the **Copy an existing data set** method.

Select the **Red Bull Unit** data set.

Choose **Next**.

Select a Data Set and an Area of Interest for your Project

Note that the data set you select will define the area of interest for your project.

Acquire data from LANDFIRE

Copy an existing data set: Red Bull Unit

Upload a new data set

Note: Once you select a data set, the Project Area cannot be changed.

To change the Project Area, you must create a new project.

Reviewing Spatial Landscape Data

Now that the project area is defined, review the landscape data for the project area.

At the bottom of the **Project Summary** page, under the **Project Data** section, select **Edit**.

The Data Studio window appears.

Note: Pop-up blockers must be disabled in order to open Data Studio. See [Known Issues](#) in the help for other notes on Data Studio.

Project Summary Help

Description Edit

BIA Crow Creek Agency Buffalo County, South Dakota -Burn Plan
-Fire Behavior and Effects Monitoring
Created: 01/10/2012

Project Area



Southwest corner:
Latitude: 44.0525601°
Longitude: -99.4346766°

Northeast corner:
Latitude: 44.0578435°
Longitude: -99.4281761°

Total Area:
68.05 Acres
275,400 m²

Coordinate System: Albers USGS
Resolution: X: 30.0 meters; Y: 30.0 meters;

[Import data from LANDFIRE](#)

Runs

Run Name	Run Group	Pathway	Date Created	Actions
No data available in table				
Filters: (all) (all) (all)				
Create New Run				

Project Data

Name	Creation Date	Status	Actions
Red Bull Unit (copy)	01/10/2012	Ready	Edit Delete Rename Copy
(all)			

Reviewing Spatial Landscape Data

Now you can review your spatial landscape data using the map in Data Studio. In this example, you can see the project area classified by fuel model.

The screenshot displays the Data Studio interface for the 'Red Bull Unit (copy)'. The central map shows an aerial view with a semi-transparent overlay of fuel model classifications. The 'Fuel Model' layer is selected and highlighted in the 'Layers' panel on the left. The 'Legend' panel on the right provides a key for the fuel models:

- FM2: Timber grass and understory (Cyan)
- FM3: Tall grass (Yellow)
- FM4: Chaparral (Red)
- FM8: Compact timber litter (Blue)
- FM9: Hardwood litter (Teal)
- NB1: Urban/Developed (Light Gray)
- NB3: Agricultural (Dark Gray)

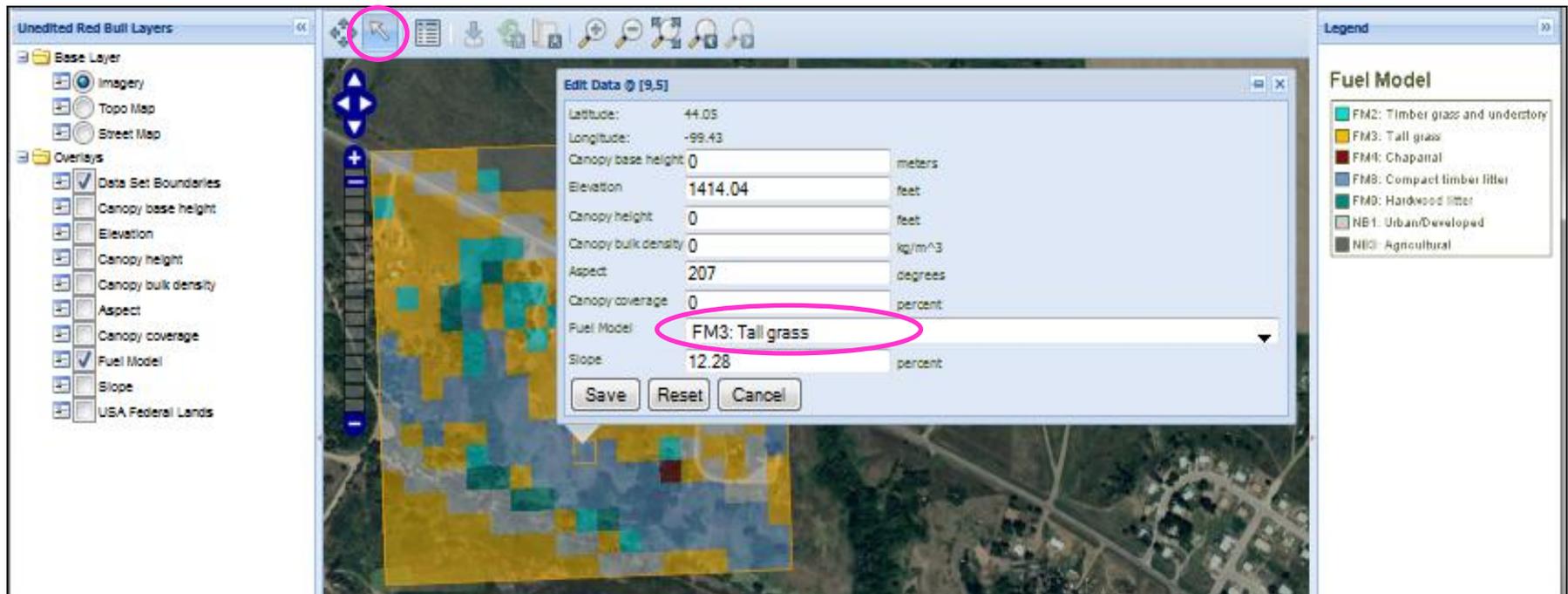
The map interface includes a toolbar with navigation and tool icons, a vertical scale bar on the left, and a 'Layers' panel on the left side. The 'Fuel Model' layer is checked and highlighted with a pink box in the 'Layers' panel.

Editing Spatial Landscape Data

After reviewing the data, several of the grid cells are labeled as FM8: Compact Timber Litter. These cells should be changed to FM3: Tall Grass.

On the upper toolbar, click the **Edit** tool  and select the desired grid cell.

An **Edit Data** toolbox appears. From here, you can edit all input values. In this example, FM3: Tall Grass is selected from the Fuel Model drop-down list.

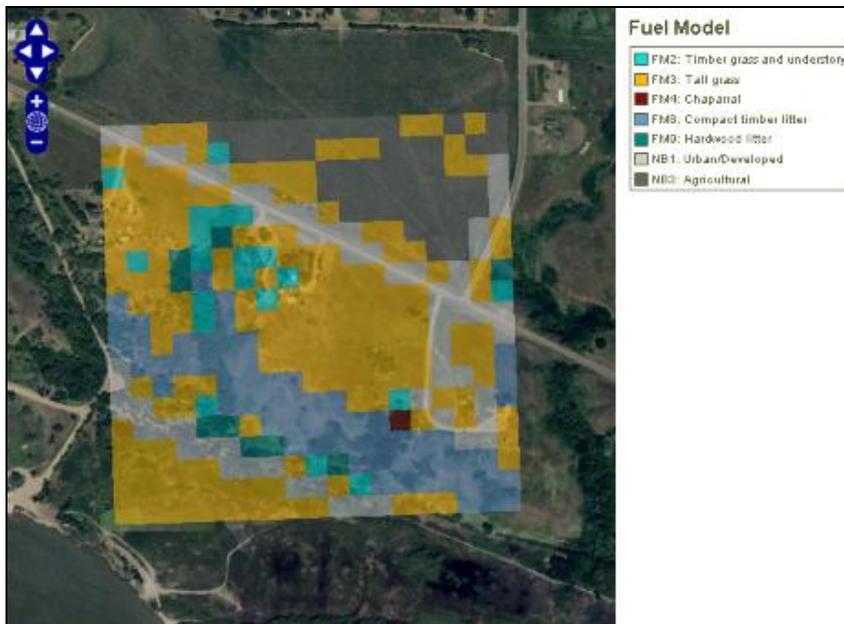


Editing Spatial Landscape Data

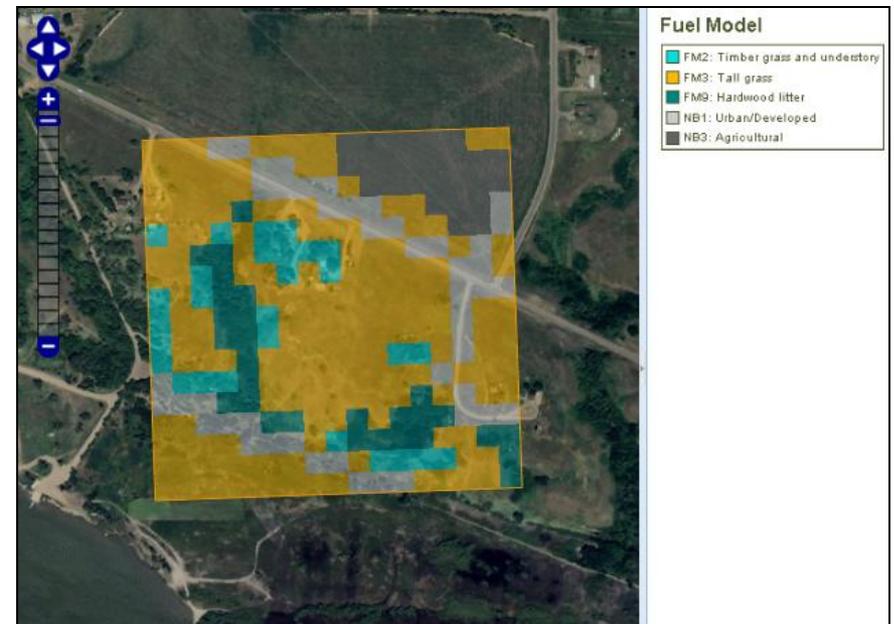
There are also cells labeled as FM8: Compact Timber Litter, which should be labeled as FM2: Timber Grass and Understory or FM9: Hardwood Litter. These cells are edited one at a time.

You can also edit the following landscape layers: canopy base height, canopy height, canopy bulk density, canopy coverage, elevation, aspect, and slope.

BEFORE

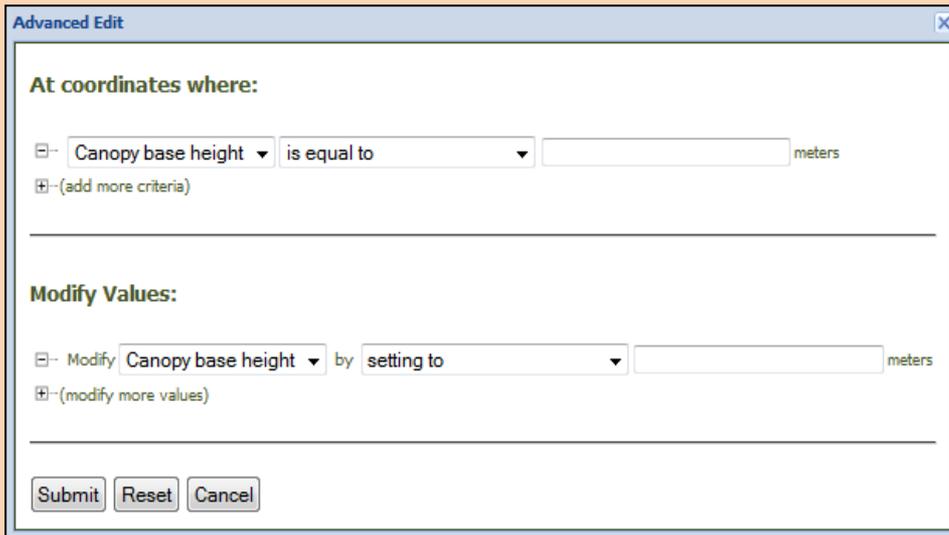


AFTER



Editing Spatial Landscape Data

In the example, we showed how grid cells can be edited one by one. There is also an Advanced Editing  tool that you can use to edit in query format so you can change multiple cells at once.

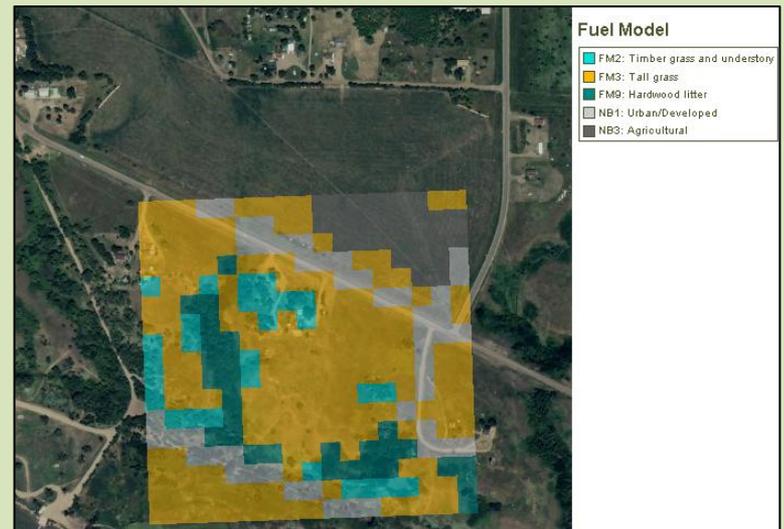
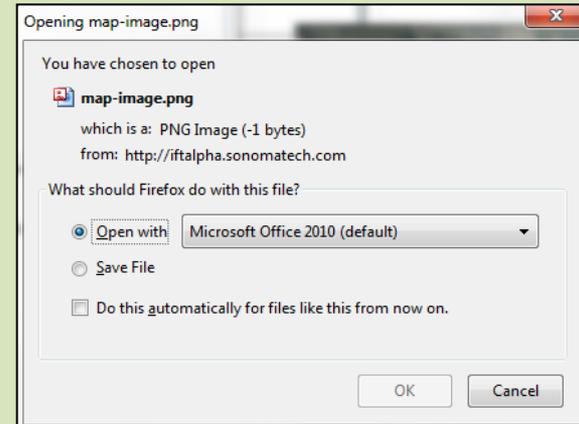


The screenshot shows the 'Advanced Edit' window with the following sections:

- At coordinates where:**
 - Criteria: Canopy base height is equal to meters
 -
- Modify Values:**
 - Criteria: Modify Canopy base height by setting to meters
 -
- Buttons:

Note: When you are done editing, choose **Save**  and close the Data Studio window.

With Data Studio, you can also save the map as an image .



Creating a New Run

Now that we have defined, reviewed, and edited our area of interest, we will create a new run.

Choose **Create New Run**.

The screenshot shows the IFTDSS 1.0 beta web application interface. The top navigation bar includes 'Home', 'Collaborate', 'Projects', and 'Data'. The user is logged in as 'Tecuya'. The main heading is 'Red Bull'. In the top right corner, there are two buttons: 'Create New Run' (highlighted with a pink box) and 'Upload New Data Set'. Below this is the 'Project Summary' section, which includes a 'Description' box with the text 'BIA Crow Creek Agency Buffalo County, South Dakota -Burn Plan -Fire Behavior and Effects Monitoring' and a 'Project Area' section. The 'Project Area' section features a satellite map with a yellow rectangular overlay, a scale bar (200 m / 1000 ft), and corner coordinates: Southwest corner (Latitude: 44.0525601°, Longitude: -99.4346766°) and Northeast corner (Latitude: 44.0578435°, Longitude: -99.4281761°). The total area is listed as 68.05 Acres (275,400 m²). Below the map, the coordinate system is specified as 'Albers USGS' with a resolution of 30.0 meters in both X and Y. A link 'Import data from LANDFIRE' is also present. The 'Runs' section is a table with columns for 'Run Name', 'Run Group', 'Pathway', 'Date Created', and 'Actions'. It currently shows 'No data available in table' and has filter dropdowns for each column, all set to '(all)'. Below the table is a 'Create New Run' button (highlighted with a pink box). The 'Project Data' section at the bottom shows a table with columns for 'Name', 'Creation Date', 'Status', and 'Actions'. It lists 'Red Bull Unit (copy)' with a creation date of '01/10/2012' and a status of 'Ready'. The actions for this entry include 'Edit', 'Delete', 'Rename', and 'Copy'. A filter dropdown for the 'Name' column is set to '(all)'.

Creating a Burn Plan

The next step in creating a run is to choose the type of run you would like to create. In this tutorial, we are creating a burn plan, so that is the type we will choose.

To choose the type of run you would like to create, **click the following links:**

By IFTDSS Workflows

↳ Prescribed Burn Planning

↳ Create a burn plan document

Tip: Open two windows (or tabs) in the browser. This way you can view and fill out the burn plan template in one window while conducting modeling in another window.

Window (or tab) 1: Burn plan template

Window (or tab) 2: Fire behavior and effects modeling

Choose the type of run you would like to create:

Start ▶

- By IFTDSS Workflows
- By Model Developer(s)
- All Available Models in IFTDSS

Choose the type of run you would like to create:

Start ▶ By IFTDSS Workflows ▶

- Prescribed Burn Planning
- Hazard Analysis

Choose the type of run you would like to create:

Start ▶ By IFTDSS Workflows ▶ Prescribed Burn Planning ▶

- Probability of Ignition
- Fire Behavior
- Fire Containment
- Fire Effects
- Create a burn plan document

Create New Run: Create a burn plan document

Run Name

Run Group

Next

Table of Contents and Navigation

This is the Table of Contents for the burn plan.

You can navigate from element to element by using any of the following:

A The **bar** at the top of the page.

B The **links** located in the Table of Contents.

C The **Next** button.

The screenshot displays the 'Red Bull Burn Plan - Create a burn plan document' interface. At the top, a navigation bar (A) contains three buttons: 'Table of Contents', 'Element 1: Signature Page', and 'Element 2, Part 1: Agency Administrator Go/No-Go Pre-Ignition Approval Check'. Below this is a 'Model Information' section with a green header and a paragraph of text. A large list of links (B) follows, including 'Element 1: Signature Page', 'Element 2, Part 1: Agency Administrator Go/No-Go Pre-Ignition Approval Checklist', 'Element 2, Part 2: Prescribed Fire GO/NO-GO Checklist', 'Element 3: Complexity Analysis Summary', 'Element 4: Description of Prescribed Fire Area', 'Element 5: Objectives', 'Element 6: Funding', 'Element 7: Prescription', 'Element 8: Scheduling', 'Element 9: Pre-Burn Consideration and Weather', 'Element 10: Briefing Checklist', 'Element 11: Organization and Equipment', 'Element 12: Communication', 'Element 13: Public and Personnel Safety, Medical', 'Element 14: Test Fire', 'Element 15: Ignition Plan', 'Element 16: Holding Plan', 'Element 17: Contingency Plan', 'Element 18: Wildfire Conversion', 'Element 19: Smoke Management and Air Quality', 'Element 20: Monitoring', 'Element 21: Post-Burn Activities', and 'Appendices'. At the bottom, a 'Next >' button (C) is visible.

Elements Overview

The 21 Elements in a burn plan range in complexity (see the Element Complexity table).

Element Complexity

Element Ranking	Burn Plan Element
Easy complexity	1, 2, 10, 12, 21
Low complexity	4, 6, 8, 14, 19, 20
Medium complexity	5, 9, 11, 13, 18
High complexity	2, 7, 15, 16, 17

Recreated from the RX-341 Prescribed Fire Plan
Preparation course, page 0.9.

Some Elements cannot be completed until after the burn plan is finished (Elements 1, 2, 3, and 10).

IFTDSS contains tools for modeling fire behavior and fire effects; these tools are useful in obtaining information needed to address Elements 3, 4, 5, 7, 15, 16, 17, and 19.

The following pages step through each Element.

Modules and Burn Plan Elements

The matrix on this page shows which modules can be used for specific burn plan elements. Most of the modules can be used for multiple elements. Refer back to this matrix when you are using the prescribed burn planning tools and when you are making a burn plan.

		CATEGORIES																
		Fire Behavior					Fire Effects				Fire Containment			Probability of Ignition		Data and Mapping Tools		
ELEMENTS		Surface fire behavior ^a	Surface fire behavior for FCCS fuelbeds ^b	Crown fire behavior ^a	Fire behavior for individual stands ^c	Fire behavior across a landscape ^c	Consumption and Emissions ^d	Tree Mortality ^d	Crown scorch height ^a	Natural fuels consumption ^e	Spotting distance ^a	Containment resources ^a	Safety zone size ^a	Fire size and spread ^a	Probability of ignition from a firebrand ^a	Probability of ignition from lightning ^a	Data Studio (project area of interest maps)	LANDFIRE Data (Fuel Model & Topography)
Element 3: Complexity Analysis Summary		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Element 4: Description of Prescribed Fire Area						●											●	●
Element 5: Objectives		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Element 7: Prescription		●	●	○	●	●	○	○	●	○	●				●			
Element 15: Ignition Plan		○																
Element 16: Holding Plan		○	○	○	○	○					○	○			○		○	
Element 17: Contingency Plan		○	○	○	○	○	○		○		○	○	○	○	○			
Element 19: Smoke Management and Air Quality							●			●								
Appendices: Appendix A. Maps (Vicinity and Project)						●												●

Signature Page (Element 1)

Navigate to Element 1: Signature Page.

The following information must be included on the signature page:

1. Administrative unit name.
2. Prescribed fire name.
3. At a minimum, three dated signatures are required:
 - Prescribed Burn Plan Preparer
 - Technical Reviewer
 - Agency Administrator
4. Final determined complexity rating.

(USDA and U.S. DOI, 2008, p. 19)

Important: You can only save your work by choosing **Next** – this will save your progress.

The screenshot shows a web-based form titled 'Red Bull Burn Plan. - Create a burn plan document'. At the top, there are navigation buttons for 'Table of Contents' and 'Element 1: Signature Page'. Below this is a 'Model Information' section. The form contains several input fields: 'Administrative Unit(s)' (BIA Crow Creek Agency), 'Project Name' (Crow Creek), 'Burn Unit Name' (Red Bull), 'Complexity Rating', 'Minimum Rx Burn Requirement', 'Prepared by', 'Prepared by Date', 'Technical Review by', 'Technical Review by Date', 'Concurrence', 'Concurrence Date', 'Concurrence', 'Concurrence Date', 'Approved by', and 'Approved by Date'. At the bottom right, there is a 'Generate Burn Plan' button with a document icon and a 'Next >' button highlighted with a pink box. A yellow arrow points from the 'Next >' button in the pink box to the 'Next >' button in the form.

Go/No-Go Checklists

(Element 2, Part 1 and Part 2)

Part 1 – Agency Administration

This checklist evaluates whether compliance requirements, prescribed fire plan elements, and internal and external notification(s) have been completed.

Expresses the Agency Administrator's intent to implement the Prescribed Fire Plan.

(USDA and U.S. DOI, 2008, p. 19)

Part 2 – Prescribed Fire

Prior to all ignition operations, the Prescribed Fire Burn Boss will complete and sign this checklist.

For each day of active ignition on a prescribed fire, a separate daily Go/No-Go Checklist is required.

Note: The online burn plan template Go/No-Go checkbox lists cannot be used until after the burn plan is completed. Once the burn plan is generated, a Yes/No table replaces the checkbox list.

Complexity Analysis Summary (Element 3 and Appendix C)

The purpose of the complexity rating process is to provide

- assignment of a complexity rating of high, moderate, or low to the prescribed fire
- a relative ranking as to the overall complexity of a specific prescribed fire project for management and implementation personnel
- a process that can be used to identify Prescribed Fire Plan elements or characteristics that may pose special problems or concerns

The [Prescribed Fire Complexity Rating Guide](#) was developed to assist personnel in determining a relative complexity of any single prescribed fire project

The Summary Complexity Rating Rationale

- will clearly justify the summary rating for prescribed fire organization and Prescribed Fire Burn Boss level
- must identify those risks from the Complexity Analysis ([Appendix C](#)) that are rated high and cannot be mitigated and will provide a discussion of the risks associated

Element	Risk	Potential Consequences	Technical Difficulty
1. Potential for escape	Low	Moderate	Low
2. Number and dependence of activities	Moderate	Moderate	Moderate
3. Offsite values	Moderate	Moderate	Moderate
4. Onsite values	Moderate	Moderate	Moderate
5. Fire behavior	Moderate	Moderate	Low
6. Management organization	Moderate	Low	Moderate
7. Public and political interest	Moderate	Moderate	Low
8. Fire treatment objectives	Low	Moderate	Moderate
9. Constraints	Low	Low	Low
10. Safety	Moderate	Moderate	Moderate
11. Ignition procedures/methods	Moderate	Moderate	Low
12. Interagency coordination	Low	Low	Low
13. Project logistics	Moderate	Moderate	Low
14. Smoke management	Low	Low	Low

Description of the Prescribed Fire Area (Element 4)

Physical Description

The physical description provides information on the various physical aspects of the area where the prescribed burn is to be made.

Location

Narrative description of the location of the prescribed fire project, including a legal description, UTM and/or latitude/longitude, county, and state.

Size

Area, in acres, of the prescribed fire project, with a breakdown by prescribed fire unit and/or ownership if applicable.

Topography

Identifies the upper and lower range of elevation, slopes (max/min/avg), and aspect(s).

Project Boundary

Defines the area where fire will be ignited and may be allowed to burn.

Describes the physical, natural, and/or human made boundaries .

Defines through maps; may include narratives .

(USDA and U.S. DOI, 2008, pp. 20 and 21)

Location

Buffalo County, South Dakota T107N, R72W, Sect

Location Size

Project size: 37 acres. Acres to be burned: 28

Topography

Elevation: Top: 1465 ft, Bottom: 1375 ft

Aspect: South

Slope % (Average): 5% - upper (north side) flats, 40% - south third, flat bottom - 50 ft average north of the south project boundary

Project Boundary

The project boundary is 37 acres located north of the Missouri River, approximately .3 miles east of Gingway housing, and approximately .2 miles west of East housing (see attached map). Some portions of the unit are adjacent to resident properties and three structures are within the burn unit, with one being an abandoned, dilapidated house. The unit is bordered by predominantly U.S. Corps of Engineers land to the south, with the Missouri River to the south of that, private property to the east, tribal lands to the northeast, private property (cropland) to the north and northwest, with a 2.5 acre home-site in the northwest corner of the project area and predominately U.S. Corps of Engineers land on the west border of the burn unit. The entire project area is within the boundaries of the Crow Creek Reservation on Tribal lands.

Description of the Prescribed Fire Area (Element 4)

Vegetation/Fuels Description

- Describe the structure and composition of the vegetation type(s) and fuel characteristics.
- Describe the percent of the unit composed of each vegetation type and the corresponding fuel model(s).
- Identify conditions (fuels, slope, aspect) in and adjacent to boundaries that may be a potential threat for escaped fire.

Description of Unique Features

- List and discuss special features, hazards, regulations, issues, constraints, etc.

(USDA and U.S. DOI, 2008, p. 21)

Onsite Fuels

Onsite fuels data: Fuel model 3 (over 75%) and 1, with grass as the primary carrier, and small inclusions of hardwoods, characterized as a fuel model 9. Fuel model 3 best represents fire behavior inside of the burn unit. The burn site is dominated by smooth brome, big bluestem, and other native grasses. Coverage is continuous with only minor breaks.
0-1/4 in. 1-hour fuels: ~3 tons/acre
Fuel height: 3 ft.
Duff depth: ¼ in.

Adjacent Fuels

Adjacent fuels data: Fuel models 1, 3 and 9, scattered along all the boundaries. On the lower edge are scattered stands of hardwood tree species and narrow wooded draws to the east and west, best described by fuel model 9. Fuel model 3 best represents fire behavior outside of the burn unit.

Unique Features

The burn unit has structures within it that will need to be protected prior to burning. A dirt road accesses the structures from the middle of the north side of the unit. A fence line runs in an east west direction thru the middle of the prescribed fire unit. Power poles, wooden fence poles, and old dump sites are areas that will be protected or excluded from the burn. Two archaeology sites are located along the east boundary and north, middle flat that do not require any special protection, other than to make sure that no equipment drives over these sites.

Special Considerations: The only smoke receptors of concern are the homes within and adjacent to the burn unit, adjacent communities and disbursed housing along nearby roads. According to Fire Management, local authorities and residents, smoke is not a concern with community members. Water sources are numerous and close by; hydrants, water at home-sites and the Missouri River.

Resource and Prescribed Fire Objectives (Element 5)

It is important to establish burn objectives prior to fire behavior and effects modeling.

Describe in clear, concise statements the specific measurable resource and fire objectives for your prescribed fire.

Objectives must be measurable and quantifiable so prescription elements can be developed to meet those objectives and the success of the project can be determined following implementation.

(USDA and U.S. DOI, 2008, p. 21)

Red Bull Objectives

In the Red Bull example, the objectives fall under two categories:

- **Resource Objectives**

Reduce the risk of future wildland urban interface fire from destroying homes/structures or other special features.

- **Prescribed Fire Objectives**

Burn at least 90% of the target area.

Reduce the fine dead herbaceous fuel loading by 90% or more immediately following the completion of ignition.

Resource and Prescribed Fire Objectives (Element 5)

Here, the objectives from the Red Bull example have been entered in IFTDSS.

← -- Element 5: Objectives -- Element 6: Funding -- Element 7: Prescription -- Element 8: Scheduling -- Element 9: Pre -->

Model Information

Red Bull Burn Plan. - Create a burn plan document Help Tools

Describe in clear, concise statements the specific measurable resource and fire objectives for this prescribed fire. Objectives will be measurable and quantifiable so prescription elements can be developed to meet those objectives and the success of the project can be determined following implementation (IPFRG, 2008, p. 21).

Resource Objectives

Reduce the risk of future wildland urban interface fire from destroying homes/structures or other special features

Prescribed Fire Objectives

Burn at least 90% of the target area
Reduce the fine dead herbaceous fuel loading by 90% or more immediately following the completion of ignition

[Generate Burn Plan](#)

< Back Next >

Tip: Click and drag the corner of the text box to modify the size of the text box.

Funding (Element 6)

Identify the funding source(s) and estimated cost(s) of the prescribed fire.

As shown here, some prescribed burns are conducted in phases; Element 6 can be itemized by phase if desired.

(USDA and U.S. DOI, 2008, p. 21)

Prescribed Fire Phase	Cost	Funding Source
Administration	\$240.00	WUI Program
Planning	\$840.00	WUI Program
Implementation (Personnel)	\$2150.00	WUI Program
Implementation (Equipment)	\$225.00	WUI Program

Total of all estimated costs:
\$3,455.00

 [Generate Burn Plan](#)

< Back Next >

Environmental Prescription (Element 7)

Prescription is defined as “the measurable criteria that define a range of conditions during which a prescribed fire may be ignited and held as a prescribed fire.”

The burn plan environmental prescription will describe

- a range of low to high limits for the environmental (weather, topography, fuels, etc.) parameters
- a set of “worst-case” parameters in case of escape
 - Hottest, driest, windiest prescription limits
 - Most extreme environmental conditions (slope, aspect)

(USDA and U.S. DOI, 2008, p. 21 and 22)

Now that the burn objectives are established, we can create a range of environmental parameters that will be used when modeling potential fire behavior and effects.

Each module has its own set of unique environmental input parameters.

The next step is to navigate to **Element 7: Prescription**, in the “Create a burn plan document” template.

Environmental Prescription (Element 7)

Once you navigate to **Element 7: Prescription**, fill in the Environmental Prescription.

Now that the objectives (Element 5) and Environmental Prescription are established, we can use the **Prescribed Burn Planning Workflow** to model potential fire behavior and effects.

Note: Burning when all environmental prescription variables are at or near the prescription extremes will likely exceed desired prescribed fire behavior characteristics, and should be considered out of the range of conditions that meet the prescription (USDA and U.S. DOI, 2008, p. 22).

Prescription - Environmental			
	Minimum Fire Behavior (Within Unit)	Maximum Fire Behavior (Within Unit)	Worst-Case Fire Behavior (Outside Unit)
Temperature	<input type="text" value="50"/>	<input type="text" value="80"/>	<input type="text" value="80"/>
Relative Humidity	<input type="text" value="70"/>	<input type="text" value="25"/>	<input type="text" value="25"/>
Mid-flame wind speed	<input type="text" value="3"/>	<input type="text" value="11"/>	<input type="text" value="15"/>
Mid-flame wind direction	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>
20-ft wind speed	<input type="text" value="7.5"/>	<input type="text" value="27.5"/>	<input type="text" value="37.5"/>
20-ft wind direction	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>
Cloud cover	<input type="text" value="100"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Fuel shading	<input type="text" value="100"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Aspect	<input type="text" value="South (180 degrees)"/>	<input type="text" value="South (180 degrees)"/>	<input type="text" value="South (180 degrees)"/>
Slope	<input type="text" value="5"/>	<input type="text" value="5"/>	<input type="text" value="40"/>
1-hr fuel moisture	<input type="text" value="14"/>	<input type="text" value="6"/>	<input type="text" value="4"/>
10-hr fuel moisture	<input type="text" value="16"/>	<input type="text" value="8"/>	<input type="text" value="6"/>
100-hr fuel moisture	<input type="text" value="20"/>	<input type="text" value="12"/>	<input type="text" value="8"/>
1000-hr sound fuel moisture	<input type="text" value="n/a"/>	<input type="text" value="n/a"/>	<input type="text" value="n/a"/>
Live woody fuel moisture	<input type="text" value="180"/>	<input type="text" value="170"/>	<input type="text" value="160"/>
Live herbaceous fuel moisture	<input type="text" value="100"/>	<input type="text" value="90"/>	<input type="text" value="80"/>
Duff moisture	<input type="text" value="n/a"/>	<input type="text" value="n/a"/>	<input type="text" value="n/a"/>
Soil moisture	<input type="text" value="n/a"/>	<input type="text" value="n/a"/>	<input type="text" value="n/a"/>
KBDI (0 - 800)	<input type="text" value="0"/>	<input type="text" value="500"/>	<input type="text" value="500"/>

Fire Behavior Prescription (Element 7)

There are several tools to choose from for fire behavior and effects modeling.

In this example, we use Surface fire behavior^a and Crown scorch height^a for our Fire Behavior Prescription (Element 7).

	Fire Behavior					Fire Effects				Fire Containment				Probability of Ignition		Data and Mapping Tools	
	Surface fire behavior ^a	Surface fire behavior for FCCS fuelbeds ^b	Crown fire behavior ^a	Fire behavior for individual stands ^c	Fire behavior across a landscape ^c	Consumption and Emissions ^d	Tree Mortality ^d	Crown scorch height ^a	Natural fuels consumption ^e	Spotting distance ^a	Containment resources ^a	Safety zone size ^a	Fire size and spread ^a	Probability of ignition from a firebrand ^a	Probability of ignition from lightning ^a	Data Studio (project area of interest maps)	LANDFIRE Data (Fuel Model & Topography)
^a As implemented in BehavePlus																	
^b As implemented in FCCS																	
^c As implemented in FlamMap																	
^d As implemented in FOFEM																	
^e As implemented in Consume																	
○ = facilitate in decision making																	
● = outputs needed for burn plan																	
Element 3: Complexity Analysis Summary	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Element 4: Description of Prescribed Fire Area						●									●	●	
Element 5: Objectives	○	○	○	○	○	○	○	○	○								
Element 7: Prescription	●	●	○	●	●	○	○	●	○	●				●			
Element 15: Ignition Plan	○																
Element 16: Holding Plan	○	○	○	○	○				○	○					○		
Element 17: Contingency Plan	○	○	○	○	○	○		○	○	○	○	○	○	○			
Element 19: Smoke Management and Air Quality						●		●									
Appendices: Appendix A. Maps (Vicinity and Project)					●												●

Modeling Potential Fire Behavior and Effects

To start modeling potential fire behavior and effects, right-click on your Project link, **Red Bull**, and select **Open a New Tab**.

IFTDSS 1.0 beta

Home Collaborate Projects Data Logged in as

Red Bull Red Bull Burn Plan - Create a burn plan document

Element 7: Prescription Element 8: Scheduling Element 9: Pre-Burn Consideration and Weather

Model Information

Red Bull Burn Plan - Create a burn plan document Help

Prescription is defined as the measurable criteria that define a range of conditions during which a prescribed fire may be ignited and held as prescribed fire. Parameters are quantitative variables expressed as a range that result in acceptable fire behavior and smoke management. Several prescriptions may be needed for multiple fuel model conditions to address seasonal differences and/or types of ignition (IPFRG, 2008, pp. 27-28).

Prescription - Environmental

	Minimum Fire Behavior (Within Unit)	Maximum Fire Behavior (Within Unit)	Worst-Case Fire Behavior (Within Unit)
Temperature	<input type="text" value="50"/>	<input type="text" value="80"/>	<input type="text" value="80"/>
Relative Humidity	<input type="text" value="70"/>	<input type="text" value="25"/>	<input type="text" value="25"/>
Mid-flame wind speed	<input type="text" value="3"/>	<input type="text" value="11"/>	<input type="text" value="15"/>
Mid-flame wind direction	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>
20-ft wind speed	<input type="text" value="7.5"/>	<input type="text" value="27.5"/>	<input type="text" value="37.5"/>
20-ft wind direction	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>	<input type="text" value="Northerly, NE - NW"/>
Cloud cover	<input type="text" value="100"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Fuel shading	<input type="text" value="100"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Create a New Run

Now we are on the Project Summary page.

Choose **Create New Run**.

The screenshot shows the IFTDSS 1.0 beta web application interface. The top navigation bar includes links for Home, Collaborate, Projects, and Data, along with user information (Logged in as Tecuya) and utility links (About, Help, Feedback, Log Out). The main content area is titled 'Red Bull' and contains a 'Project Summary' section. This section is divided into two panels: 'Description' and 'Project Area'. The 'Description' panel shows the project name 'BIA Crow Creek Agency Buffalo County, South Dakota -Burn Plan -Fire Behavior and Effects Monitoring' and the creation date '01/10/2012'. The 'Project Area' panel features a satellite map with a yellow boundary, a scale bar (200m/1000ft), and corner coordinates: Southwest (44.0525601° Lat, -99.4346766° Lon) and Northeast (44.0578435° Lat, -99.4281761° Lon). It also lists a total area of 68.05 Acres (275,400 m²) and the coordinate system 'Albers USGS'. Below the project area is a 'Runs' table with columns for Run Name, Run Group, Pathway, Date Created, and Actions. The table is currently empty, displaying 'No data available in table'. Below the table are filter dropdowns for Run Name, Run Group, and Pathway, all set to '(all)'. A 'Create New Run' button is highlighted with a pink box. At the bottom, the 'Project Data' table shows one entry: 'Red Bull Unit (copy)' created on '01/10/2012' with a status of 'Ready'. The table includes action links for Edit, Delete, Rename, and Copy.

IFTDSS 1.0 beta

Home Collaborate Projects Data Logged in as Tecuya

About Help Feedback Log Out

Red Bull

Create New Run
Upload New Data Set

Project Summary

Help

Description

BIA Crow Creek Agency Buffalo County, South Dakota -Burn Plan
-Fire Behavior and Effects Monitoring
Created: 01/10/2012

Project Area

Southwest corner:
Latitude: 44.0525601°
Longitude: -99.4346766°

Northeast corner:
Latitude: 44.0578435°
Longitude: -99.4281761°

Total Area:
68.05 Acres
275,400 m²

Coordinate System: Albers USGS
Resolution: X: 30.0 meters; Y: 30.0 meters;

[Import data from LANDFIRE](#)

Run Name	Run Group	Pathway	Date Created	Actions
No data available in table				

Filters: (all) (all) (all)

Create New Run

Project Data

Name	Creation Date	Status	Actions
Red Bull Unit (copy)	01/10/2012	Ready	Edit Delete Rename Copy

(all)

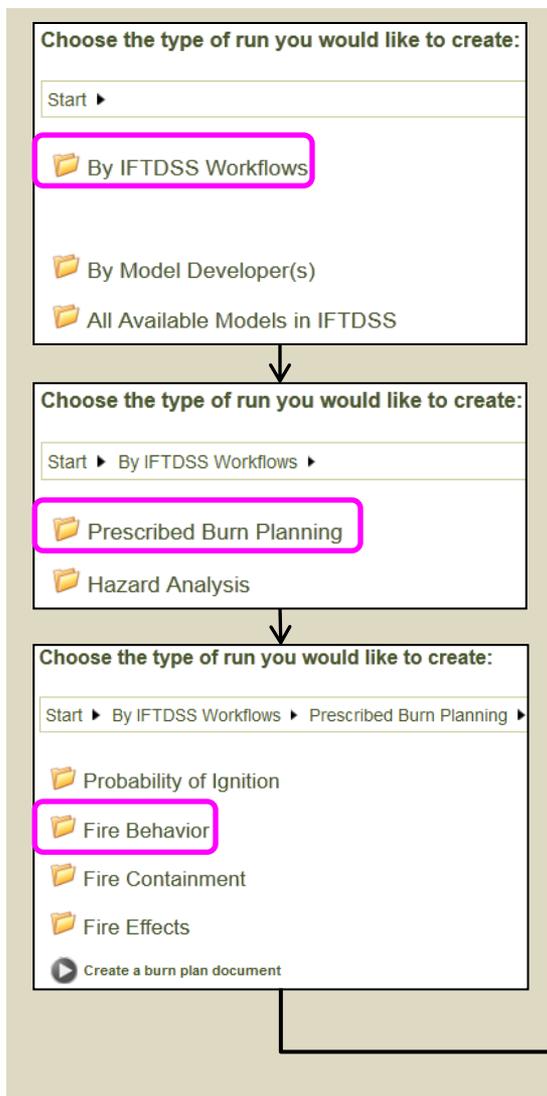
Prescribed Burn Planning Workflow

Workflows: Prescribed Burn Planning

This workflow contains tools needed to model potential fire behavior and effects for the burn plan document.

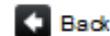
These tools also facilitate in the decision making for ignition, holding, and contingency plans, as well as smoke management and air quality.

Follow the steps shown in the images, and choose **Calculate surface fire behavior (as implemented in BehavePlus)**.



Choose the type of run you would like to create:

Start ▶ By IFTDSS Workflows ▶ Prescribed Burn Planning ▶ Fire Behavior ▶



- Calculate crown fire behavior (as implemented in BehavePlus)
- Calculate fire behavior across a landscape (as implemented in FlamMap)
- Calculate fire behavior for individual stands (as implemented in FlamMap)
- Calculate surface fire behavior (as implemented in BehavePlus)
- Calculate surface fire behavior for FCCS fuelbeds (as implemented in FCCS)
- Calculate surface fire behavior potentials for FCCS fuelbeds (as implemented in FCCS)
- Predict surface fire behavior, size, and spread (as implemented in BehavePlus)

The tools available for modeling crown and surface fire behavior can be used to complete Elements 7, 16, and 17 of the burn plan and can be run for an individual stand or spatially using LANDFIRE (.lcp) data. The surface fire behavior model for FCCS fuelbeds requires FCCS fuelbed data as input.

Modeling Surface Fire Behavior (Element 7)

Create New Run: Calculate surface fire behavior (as implemented in BehavePlus)

Run Name

Run Group

Tip: Give runs descriptive names so you can more readily identify them later.

Number of stands or simulations

Tip: By choosing three simulations, you can model the minimum, maximum, and worst-case fire behavior in one run. IFTDSS supports a maximum of 25 simulations.

Modeling Surface Fire Behavior (Element 7)

Insert data from your Environmental Prescription (Element 7) into the surface fire behavior inputs.

Tip: Run surface fire behavior or surface fire behavior for FCCS fuelbeds before running the other modules.

Some of the **inputs** for other modules are **outputs** from Surface fire behavior (e.g., the output flame length from surface fire behavior is needed as an input for crown scorch height).

Surface fire (min, max, worst-case) - Calculate surface fire behavior (as implemented...)

Help ▾ Tools ▾

Inputs

Parameter	Unit	Simulation #1	Simulation #2	Simulation #3
Fire Behavior Fuel Model		FM3: Tall grass ▾	FM3: Tall grass ▾	FM3: Tall grass ▾
1-hr fuel moisture	percent	14	6	4
10-hr fuel moisture	percent	16	8	6
100-hr fuel moisture	percent	20	10	8
Live herbaceous fuel moisture	percent	100	90	80
Live woody fuel moisture	percent	180	170	160
Midflame Wind Speed	miles/hour	3	11	15
Wind Direction (from North)	degrees	290	290	290
Slope	percent	5	5	40
Aspect	degrees	0	0	0
Flanking Fire Direction		90 degrees ▾	90 degrees ▾	90 degrees ▾
Elapsed Time	hours	1.00	1.00	1.00

< Back Next >

US Customary Units ▾ Change Units

Modeling Surface Fire Behavior (Element 7)

Surface fire behavior reports head, backing, and flanking fire parameters.

Using the **Export to Table** link, you can modify the outputs table into Microsoft Excel format.

When you generate the burn plan (see [page 67](#)), IFTDSS creates the burn plan as a Microsoft Word document. You can paste the modified table into the appendices of the Word document.

min, max, worst-case - Calculate surface fire behavior (as implemented in BehavePlus) Help Tools

Views	Outputs				
Table	Parameter	Unit	Simulation #1	Simulation #2	Simulation #3
Graph	Head Fire Spread Rate	chains/hour	41.81	322.85	595.36
	Backing Fire Spread Rate	chains/hour	4.11	5.95	6.59
	Flanking Fire Spread Rate	chains/hour	7.49	11.69	13.03
	Surface heat per unit area	Btu/ft ²	635.18	742.42	835.12
	Head Fire Fireline Intensity	Btu/ft/s	486.89	4394.29	9115.31
	Backing Fire Fireline Intensity	Btu/ft/s	47.87	81.05	100.86
	Flanking Fire Fireline Intensity	Btu/ft/s	87.17	159.16	199.51
	Head Fire Flame Length	ft	7.75	21.33	29.83
	Backing Fire Flame Length	ft	2.67	3.40	3.76
	Flanking Fire Flame Length	ft	3.51	4.64	5.14
	Reaction Intensity	Btu/ft ² /min	2481.15	2900.07	3282.17
	Head Fire Spread Direction	degrees	110	110	113
	Backing Fire Spread Direction	degrees	290	290	293
	Flanking Fire Spread Direction	degrees	200	200	203
	Head Fire Spread Distance	chains	41.81	322.85	595.36
	Backing Fire Spread Distance	chains	4.11	5.95	6.59
	Flanking Fire Spread Distance	chains	7.49	11.69	13.03
	Residence Time	min	0.26	0.26	0.26
	Effective Wind Speed	miles/hour	3.01	11.00	15.22

[Export Table \(CSV\)](#)

< Back Finish >>

US Customary Units

The output flame length from surface fire behavior is needed as an input for crown scorch height.

Creating a New Run

Next, we want to predict crown scorch height.

Choose the **Red Bull** Project link to return to the Project Summary page.

IFTDSS 1.0 beta

Home Collaborate Projects Data

Red Bull » min, max, worst-case - Calculate surface fire behavior (as implemented in BehavePlus)

Configure Inputs Outputs Run Summary

Model Information

min, max, worst-case - Calculate surface fire behavior (as implemented in BehavePlus)

Views	Outputs	Parameter	Unit	Simulation #1	Simulation #2	Simulation #3
Table		Head Fire Spread Rate	chains/hour	41.81	323.05	595
Graph		Backing Fire Spread Rate	chains/hour	4.11	5.95	6.59
		Flanking Fire Spread Rate	chains/hour	7.49	11.69	13.0
		Surface heat per unit area	Btu/ft ²	635.18	742.42	835

Then choose **Create New Run**.

Red Bull

Create New Run Upload New Data Set

Project Summary

Description: Created: 01/10/2012

Project Area

Southwest corner: Latitude: 44.0526994° Longitude: -99.4344957°

Northeast corner: Latitude: 44.0579827° Longitude: -99.4279951°

Total Area: 68.05 Acres 275,400 m²

Coordinate System: Albers USGS Resolution: X: 30.0 meters; Y: 30.0 meters; Import data from LANDFIRE

Runs

Run Name	Run Group	Pathway	Date Created	Actions
min_max_worst-case	Surface Fire Behavior	Calculate surface fire behavior (as implemented in...	01/10/2012	Copy Delete
Red Bull Burn Plan		Create a burn plan document	01/10/2012	Copy Delete Continue

Filters: (all) (all) (all)

Create New Run

Prescribed Burn Planning Workflow

For this step, make the choices shown to the left.

Then choose **Predict crown scorch height (as implemented in BehavePlus)**.

Choose the type of run you would like to create:

Start ▶

By IFTDSS Workflows

By Model Developer(s)

All Available Models in IFTDSS

Choose the type of run you would like to create:

Start ▶ By IFTDSS Workflows ▶

Prescribed Burn Planning

Hazard Analysis

Choose the type of run you would like to create:

Start ▶ By IFTDSS Workflows ▶ Prescribed Burn Planning ▶

Probability of Ignition

Fire Behavior

Fire Containment

Fire Effects

Create a burn plan document

Choose the type of run you would like to create:

Start ▶ By IFTDSS Workflows ▶ Prescribed Burn Planning ▶ Fire Effects ▶

◀ Back

▶ Calculate consumption and emissions (as implemented in FOFEM)

▶ Calculate natural fuels consumption (as implemented in Consume)

▶ Calculate natural fuels consumption, emissions, and heat release (as implemented in Consume)

▶ Calculate tree mortality (as implemented in FOFEM)

▶ Predict crown scorch height (as implemented in BehavePlus)

The fire effects tools can be used to calculate consumption, emissions, tree mortality, and crown scorch height.

Modeling Crown Scorch Height

Create New Run: Predict crown scorch height (as implemented in BehavePlus)

Run Name
Scorch Height (min, max, worst-c)

Run Group
Element 7

Next

Tip: Give runs descriptive names so you can more readily identify them later.

Number of stands or simulations

9

Next >

Tip: By choosing nine simulations, you can model the minimum, maximum, and worst-case fire behavior for head, flanking, and backing fires in one run.

Modeling Crown Scorch Height (Element 7)

Tip: In this example, we used the flame length **outputs** from the **surface fire behavior (as implemented in BehavePlus)** run as the **inputs** of the crown scorch height (as implemented in BehavePlus) run.

Export the crown scorch height results to Microsoft Excel format by using the **Export Table (CSV)** link.

Navigate to the **Red Bull Burn Plan** tab and fill in the Fire Behavior prescription for Element 7.

Continue modeling fire behavior and effects using the previous steps.

Scorch Inputs

Parameter	Unit	Simulation #1	Simulation #2	Simulation #3	Simulation #4	Simulation #5
Midflame Wind Speed	miles/hour	3.00	3.00	3.00	11.00	11.00
Air Temperature	fahrenheit	50.00	50.00	50.00	80.00	80.00
Flame Length	ft	7.75	2.67	3.51	21.33	3.40

< Back Edit Next >

US Customary Units

Scorch Height (min, max, worst-case) - Predict crown scorch height (as implemented in...) Help

Views	Parameter	Unit	Simulation #1	Simulation #2	Simulation #3	Simulation #4	Simulation #5	Simulation #6
Table	Scorch Height	ft	42.15	7.39	12.00	246.84	4.72	10.10

Graph

 [Export Table \(CSV\)](#)

Fire Behavior Prescription (Element 7)

1. Navigate to **Element 7: Prescription.**

2. Fill in the Fire Behavior Prescription.

If the burn unit is dominated by more than one fuel model, create multiple runs with descriptive names.

There are multiple Fire Behavior Prescriptions in the burn plan for extra fuel models.

3. **Important:** Choose **Next** (at the bottom of the page) to save your progress.

Prescription #1 - Fire Behavior Outputs

	Minimum Fire Behavior (Within Unit)		Maximum Fire Behavior (Within Unit)		Worst-Case Fire Behavior (Outside Unit)	
Fuel model	Tall Grass - 3		Tall Grass - 3		Tall Grass - 3	
	Minimum Fire Behavior (Head)	Minimum Fire Behavior (Backing)	Minimum Fire Behavior (Flanking)	Maximum Fire Behavior (Head)	Maximum Fire Behavior (Backing)	Maximum Fire Behavior (Flanking)
Flame length	7.74	2.67	2.85	21.33	3.4	3.65
Rate of spread	41.72	4.11	4.73	322.92	5.95	6.95
Fireline intensity	485.82	47.85	55.14	4395.24	81.05	94.65
Spotting distance	0.2	0.09	0.1	0.97	0.27	0.28
Scorch height	42.07	7.39	8.33	246.84	4.72	5.62
	Minimum Fire Behavior (Within Unit)		Maximum Fire Behavior (Within Unit)		Worst-Case Fire Behavior (Outside Unit)	
Probability of ignition	12.56		57.09		75.28	
Reaction intensity	2481.15		2900.07		3262.18	
Heat per unit area	635.18		742.42		835.12	

(Shown above is just the top section of this page.)

Modeling Considerations

Models are based on simplified assumptions, such as uniform fuel and steady-state fire spread.

Rather than basing your burn plan prescription solely on modeling, the USDA and U.S. DOI (2008) allows for the use of empirical evidence (historical evidence or researched data) and judgment. These can be used to identify or corroborate prescriptions.

Weaknesses in modeling can be overridden, but must be justified with empirical evidence and/or verified actual fire behavior.

(USDA and U.S. DOI, 2008, p. 22)

Scheduling; Pre-burn Considerations and Weather; Briefing (Elements 8, 9, and 10)

Scheduling

Identify the general ignition time frame(s) (i.e., time of day, duration of ignition) or season(s) and note any dates on which the project may not be conducted.

Pre-burn Considerations and Weather

Describe the onsite and offsite actions to be conducted and considerations to be addressed prior to implementation. Describe any fuel sampling and weather data that may need to be obtained.

The plan will include a list of organizations and individuals that are notified prior to ignition, with contact information for each organization and individual.

Briefing

All assigned personnel must be briefed at the beginning of each operational period to ensure personnel safety.

Prescribed fire objectives and operations must be clearly defined and understood.

The briefing checklist should list briefing topics only, not re-state what is listed in the Prescribed Fire Plan for that element.

The Prescribed Fire Burn Boss is to ensure that any new personnel arriving at the prescribed fire site receives a briefing prior to assignment.

(USDA and U.S. DOI, 2008, pp. 22-23)

Organization and Equipment; Communication; Safety and Medical (Elements 11, 12, and 13)

Organization and Equipment

Specify the minimum required implementation organization needed to meet the capabilities (line production rates, etc.) by position, equipment, and the supplies needed for all phases of the prescribed fire until the fire is declared out.

Communication

Develop a communications plan specific to the project's implementation to address safety and tactical resource management needs.

Public and Personnel Safety, Medical

Describe provisions to be made for public and personnel safety. Identify and analyze the safety hazards unique to the individual prescribed fire project and specify personnel safety and emergency procedures.

Identify and analyze the safety hazards unique to the individual prescribed fire project and specify personnel safety and emergency procedures.

(USDA and U.S. DOI, 2008, pp. 23-24)

Test Fire and Ignition Plan (Elements 14 and 15)

Test Fire

Provisions for a test fire are required and results must be recorded. The test fire must be ignited in a representative location and in an area that can be easily controlled.

The purpose of the test fire is to verify that the prescribed fire behavior characteristics will meet management objectives, and to verify predicted smoke dispersion.

Ignition Plan

Describe planned ignition operations.

Maps showing proposed firing patterns may be included.

Multiple prescriptions and ignition operations may require identifying and developing multiple ignition organizations.

Firing Methods (including techniques, sequences, and patterns)

A combination of flanking, backing and strip head fires, as directed by the Burn Boss and/or Firing Boss.
Techniques: On the flat areas of the burn, and depending on fire behavior of the backing fires, multiple strips may be lit, across slope and uphill, with spacing to be determined by the Burn/Firing Boss, in order to ensure a wide black line on the leeward side of the phased units. If multiple strip head/backing strips are to be lit on the south end of these units, then it is critical to hold up the ~~uplope~~ flanking fire strips until the multiple strips have been completed.

Sequences: Phases of ignition will be primarily dependent on wind conditions. The order of implementation will be specified by the Burn Boss. If weather and fuel conditions are within prescription, all five phases may be ignited in one day. Otherwise, they will be spread out until completed. Below is an example description of ignition sequences and patterns by phase, assuming a north to northwesterly wind. (These may be altered at any time, in consultation between the Burn Boss and Firing Boss): Other ignition sequences and patterns by phase may be identified on the implementation day dependent on wind conditions.

Devices

Handheld drip torches.

Ignition Staffing

Three ~~igniters~~ under the direct supervision of the Firing Boss, unless otherwise directed by the Burn/Firing Boss. Most phases only require two ~~igniters~~, so ~~igniters~~ will rotate as directed by the Firing Boss.

Holding and Contingency Plans (Elements 16 and 17)

Holding and **contingency** plans must be developed with the consideration of the predicted fire behavior outside the project boundary(s).

Holding Plan: describes general procedures to be used for operations to maintain the fire within the project area and meet the project objectives until the fire is declared out (USDA and U.S. DOI, 2008, p. 24).

Contingency Plan: considers the possible but unlikely events and the actions needed to mitigate those events (USDA and U.S. DOI, 2008, p. 25).

Fire behavior characteristics for fuel models within the maximum spotting distance and/or adjacent to the project boundaries must be considered and modeled.

These predictions must be modeled using the

- Hottest, driest, windiest prescription limits
- Most extreme environmental conditions (slope, aspect)

(USDA and U.S. DOI, 2008, p. 22)

Wildfire Conversion and Smoke Management and Air Quality (Elements 18 and 19)

Wildfire Conversion

A prescribed fire must be declared a wildfire by those identified in the burn plan when that person(s) determines that the contingency actions have failed or are likely to fail and cannot be mitigated by the end of the next burning period.

Describe the actions to be taken when a prescribed fire is declared a wildfire. This description is to include

- Wildfire declaration
- IC assignment
- Notifications

Smoke Management and Air Quality

Describe how the project will comply with local community, county, state, tribal, and federal air quality regulations.

Identify what permits, if any, need to be obtained.

Identify smoke-sensitive sensors (population centers, recreation areas, hospitals, airports, schools, etc.).

Include modeling outputs and mitigation strategies and techniques to reduce the impacts of smoke production.

Tip: For more information on smoke management, visit the [National Interagency Fire Center website](#).

Monitoring and Post-burn Activity (Elements 20 and 21)

Monitoring

Describe the monitoring that will be required to ensure that Prescribed Fire Plan objectives are met.

For the prescribed fire, at a minimum, specify the weather (forecast and observed), fire behavior and fuels information, and smoke dispersal monitoring required during all phases of the project and the procedures for acquiring this information (including who and when).

Post-burn Activity

Describe the post-burn activities that must be completed.

These activities include

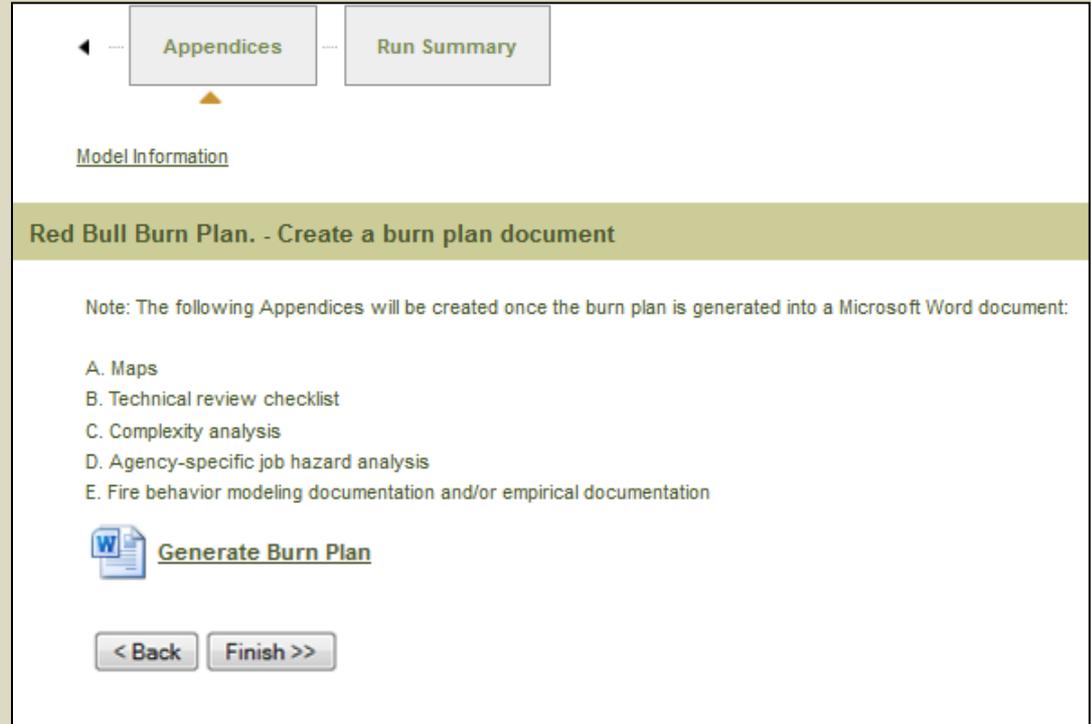
- The post-burn report
- Safety mitigation measures
- Rehabilitation needs

(USDA and U.S. DOI, 2008, pp. 25-26)

Appendices

The following **Appendices** are created once the Burn Plan is generated and exported into a Microsoft Word document:

- A. Maps
- B. Technical review checklist
- C. Complexity analysis
- D. Agency-specific job hazard analysis
- E. Fire behavior modeling documentation and/or empirical documentation



(USDA and U.S. DOI, 2008, p. 27)

Generating the Burn Plan

At the bottom of **any** Burn Plan page, choose **Generate Burn Plan**, then open the document with Microsoft Word.

The screenshot shows the 'Red Bull Burn Plan - Create a burn plan document' interface. At the top, there is a navigation bar with 'Table of Contents', 'Element 1: Signature Page', and 'Element 2, Part 1: Agency Administrator Go/No-Go Pre-Ignition Approval Check'. Below this is a 'Model Information' section. The main content area contains a paragraph explaining the document pathway and a list of 21 elements, each with a checkmark icon. The elements are: Element 1: Signature Page, Element 2, Part 1: Agency Administrator Go/No-Go Pre-Ignition Approval Checklist, Element 2, Part 2: Prescribed Fire GO/NO-GO Checklist, Element 3: Complexity Analysis Summary, Element 4: Description of Prescribed Fire Area, Element 5: Objectives, Element 6: Funding, Element 7: Prescription, Element 8: Scheduling, Element 9: Pre-Burn Consideration and Weather, Element 10: Briefing Checklist, Element 11: Organization and Equipment, Element 12: Communication, Element 13: Public and Personnel Safety, Medical, Element 14: Test Fire, Element 15: Ignition Plan, Element 16: Holding Plan, Element 17: Contingency Plan, Element 18: Wildfire Conversion, Element 19: Smoke Management and Air Quality, Element 20: Monitoring, Element 21: Post-Burn Activities, and Appendices. At the bottom left, there is a 'Generate Burn Plan' button with a Word icon, highlighted by a pink box and an arrow. A 'Next >' button is also visible. A dialog box titled 'Opening rxburn_plan.docx' is open in the foreground, showing the file name and type (Microsoft Word Document) and asking 'What should Firefox do with this file?'. The options are 'Open with Microsoft Word (default)', 'Save File', and 'Do this automatically for files like this from now on.' The 'Open with' option is selected, and the 'OK' button is highlighted.

Customizing the Burn Plan

After downloading the burn plan into a Microsoft Word document, you can easily customize the burn plan.

You can fill out Elements in the online burn plan template located within the IFTDSS website, and/or after generating the burn plan into a Word document.

[Click here for an example of a generated and customized Red Bull burn plan.](#)

Note: The online burn plan template has a 6,000-character limit per text box. If you need more characters, generate the burn plan into a Word document (which has no character limit), and continue editing.

Burn Plan Template in IFTDSS

Element 5: Objectives | Element 6: Funding | Element 7: Prescription | Element 8: Scheduling | Element 9: Pre

Model Information

Red Bull Burn Plan. - Create a burn plan document | Help | Tools

Describe in clear, concise statements the specific measurable resource and fire objectives for this prescribed fire. Objectives will be measurable and quantifiable so prescription elements can be developed to meet those objectives and the success of the project can be determined following implementation (IPFRG, 2008, p. 21).

Resource Objectives

Reduce the risk of future wildland urban interface fire from destroying homes/structures or other special features

Prescribed Fire Objectives

Burn at least 90% of the target area
Reduce the fine dead herbaceous fuel loading by 90% or more immediately following the completion of ignition

Generate Burn Plan

< Back | Next >

Generated Word Document

Element 5: Objectives	
Element 5: Objectives	Project Name: Crow Creek
	Burn Unit Name: Red Bull
Specific, Measurable, and Attainable Resource and Fire Objectives	
Resource Objectives	
Reduce the risk of future wildland urban interface fire from destroying homes/structures or other special features.	
Fire Objectives	
a. Burn at least 90% of the target area. b. Reduce the fine dead herbaceous fuel loading by 90% or more immediately following the completion of ignition.	

Maps

(Appendix A – Maps)

Map Requirements

At a minimum, the plan will include a **vicinity** and **project** map.

The number of maps, map size and scale, legend, and level of detail should be appropriate for the complexity of the project.

All maps will include the following standard map elements

- Title
- Name of Preparer(s)
- Date
- North Arrow
- Scale
- Legend

(USDA and U.S. DOI, 2008, p. 21)

Vicinity Map

Map scale will be such that the burn units can be located on the ground and in sufficient detail to guide implementation.

Project Map

Identifies features in sufficient detail to guide and assist in operational implementation of the prescribed fire.

Note: in the generated burn plan, maps are located in Appendix A.

The process of how to save a map image to your local computer and how to edit a map in the generated Burn Plan are discussed in the following pages.

Appendices

(Appendix A – Maps)

The following pages show how to

- Open Data Studio to view your Project Area.
- Save a map image to your local computer.
- Paste a map into the generated burn plan in Microsoft Word.
- Edit a Vicinity Map in Microsoft Word.

For step-by-step instructions on how to export maps to Google Earth for advanced editing, refer to the tutorial: [How to use Hazard Analysis tools in the IFTDSS for Prescribed Fire Planning](#).

Appendices

(Appendix A – Maps)

Navigate back to your Red Bull **Project Summary** page. To do so, you can either

A Click on the **Red Bull** link at the top left of the page,

or

B Access the **Projects** tab and navigate to your project (in this example, **Red Bull**).

The screenshot displays the IFTDSS 1.0 beta web application. At the top, there is a navigation bar with tabs for Home, Collaborate, Projects, and Data. The Projects tab is highlighted with a pink box and labeled 'B'. Below the navigation bar, there is a breadcrumb trail: Red Bull > Red Bull Burn Plan - Create a burn plan document. The Red Bull link is highlighted with a pink box and labeled 'A'. Below the breadcrumb trail, there are two buttons: Appendices and Run Summary. Below these buttons, there is a section titled Model Information. Below that, there is a section titled Red Bull Burn Plan - Create a burn plan document. Below this section, there is a note: Note: The following Appendices will be created once the burn plan is generated into a Microsoft Word document: A. Maps, B. Technical review checklist, C. Complexity analysis, D. Agency-specific job hazard analysis, E. Fire behavior modeling documentation and/or empirical documentation. Below the note, there is a button with a Word document icon and the text Generate Burn Plan. At the bottom, there are two buttons: < Back and Finish >>.

Appendices

(Appendix A – Maps)

At the bottom of the **Project Summary** page, under the **Project Data** section, select **Edit**.

The Data Studio window appears.

Note: Pop-up blockers must be disabled in order to open Data Studio.

The screenshot displays the IFTDSS 1.0 beta web interface. The top navigation bar includes 'Home', 'Collaborate', 'Projects', and 'Data'. The main content area is titled 'Red Bull' and features a 'Project Summary' section. This section contains a 'Description' box with the text: 'BJA Crow Creek Agency Buffalo County, South Dakota -Burn Plan -Fire Behavior and Effects Monitoring' and 'Created: 01/10/2012'. To the right is a 'Project Data and Area of Interest' section with a satellite map showing a yellow-outlined area. The map includes a scale bar (200m/1000ft) and navigation controls. To the right of the map, corner coordinates are listed: Southwest corner (Latitude: 44.0525601°, Longitude: -99.4346766°) and Northeast corner (Latitude: 44.0578435°, Longitude: -99.4281761°). The total area is 68.05 Acres (275,400 m²). Below the map, the coordinate system is noted as 'Albers USGS' with a resolution of 30.0 meters. At the bottom of the page, there are two tables. The 'Runs' table has columns for Run Name, Run Group, Pathway, Date Created, and Actions. It lists 'Red Bull Burn Plan' with a 'Create a burn plan document' pathway and a '01/10/2012' date. The 'Project Data Sets' table has columns for Name, Creation Date, Status, and Actions. It lists 'Red Bull Unit (copy)' with a '01/10/2012' creation date and a 'Ready' status. The 'Edit' button in the 'Project Data Sets' table is circled in pink.

Run Name	Run Group	Pathway	Date Created	Actions
Red Bull Burn Plan		Create a burn plan document	01/10/2012	Copy Delete

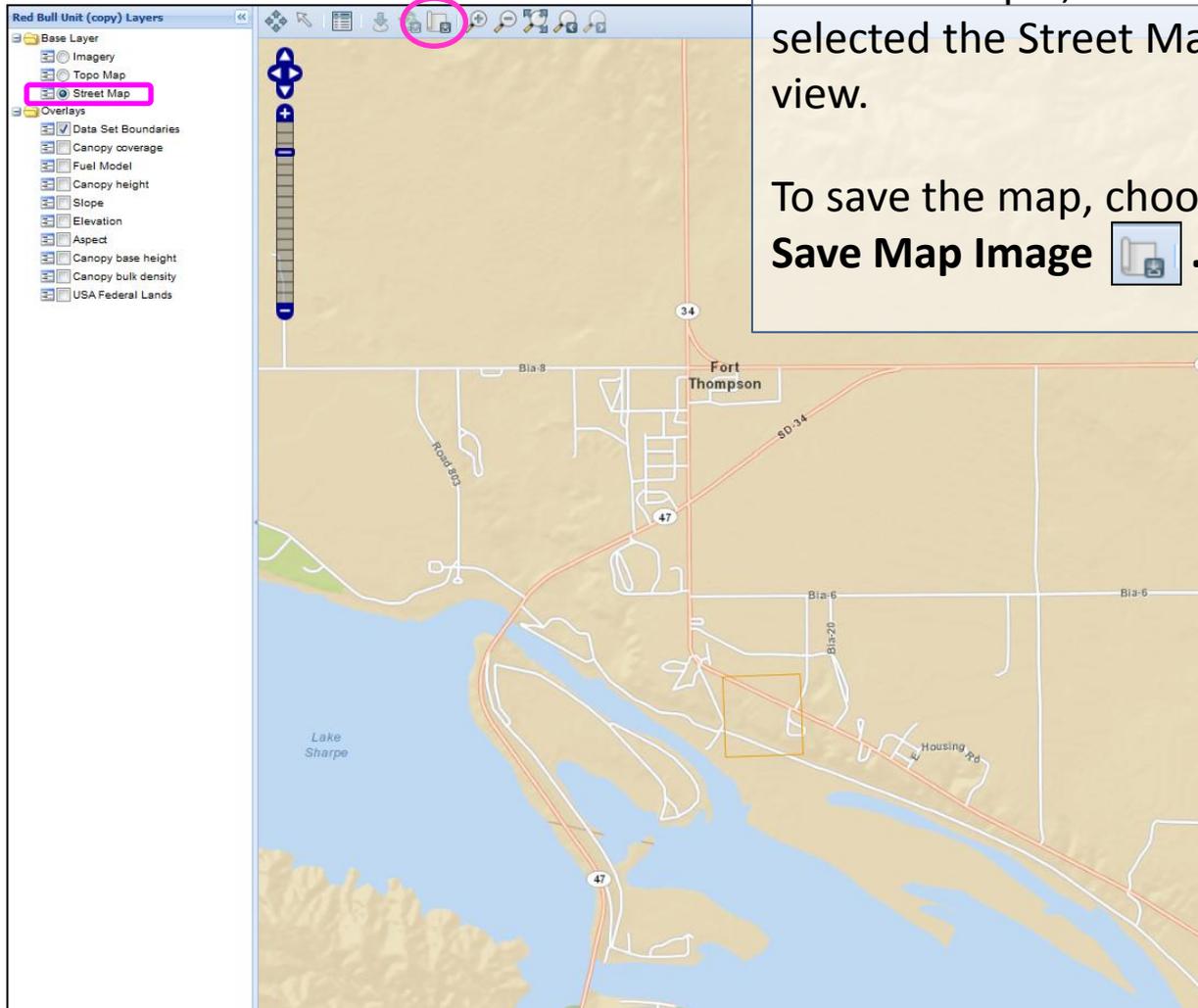
Name	Creation Date	Status	Actions
Red Bull Unit (copy)	01/10/2012	Ready	Edit Delete Rename Copy

Save a Map Image (Appendix A – Maps)

In Data Studio, you can save an image of your project area and the surrounding area for your Vicinity Map.

In this example, we've selected the Street Map view.

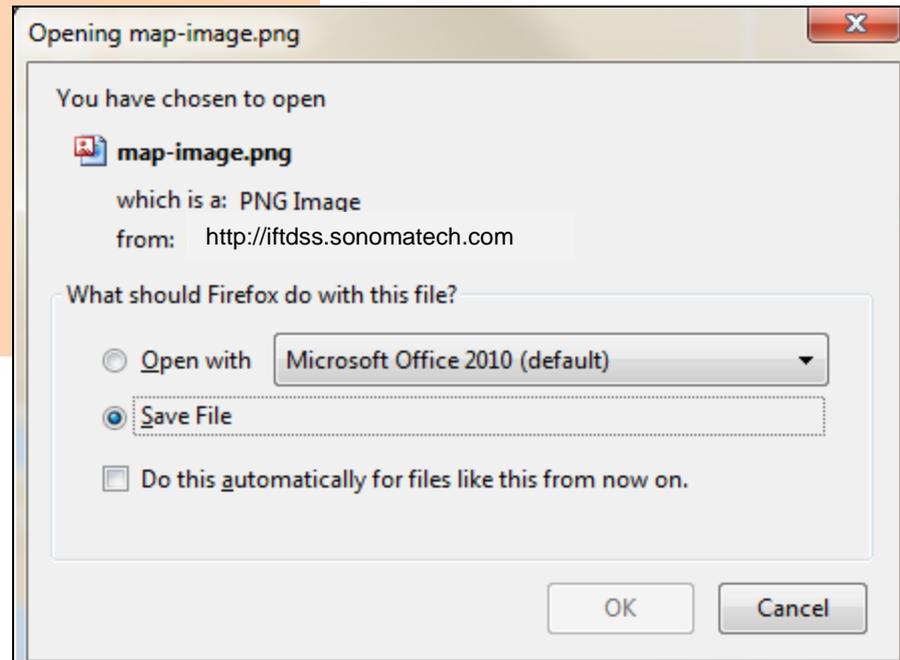
To save the map, choose **Save Map Image**  .



Save a Map Image to Your Local Computer (Appendix A – Maps)

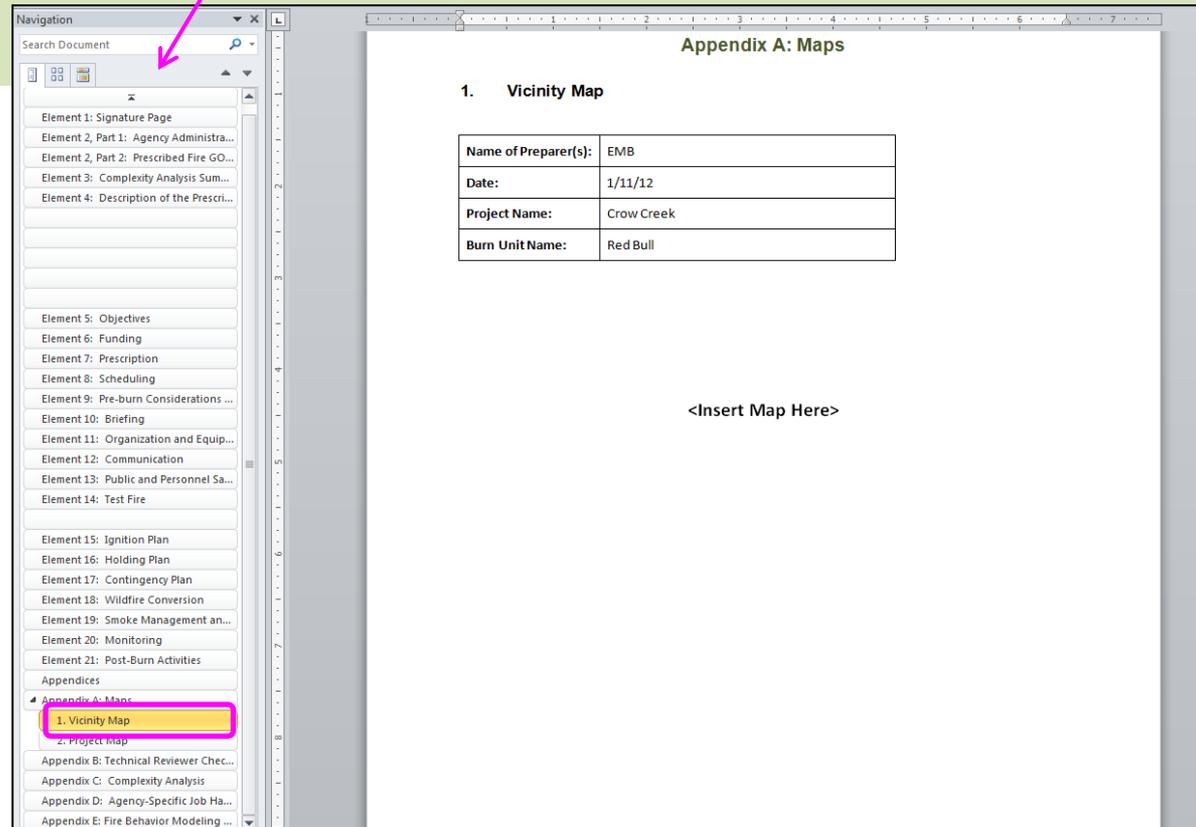
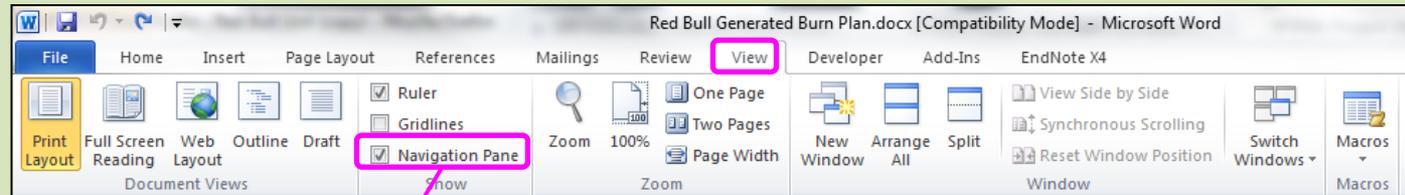
When you choose **Save Map Image**, you can open your image or save your image.

In this example, we are going to **save the image** and then paste it into our generated burn plan document.



Navigate to the Vicinity Map in the Generated Burn Plan (Appendix A – Maps)

Tip: For easy navigation in Microsoft Word 2010, access the **View** tab and select **Navigation Pane**.

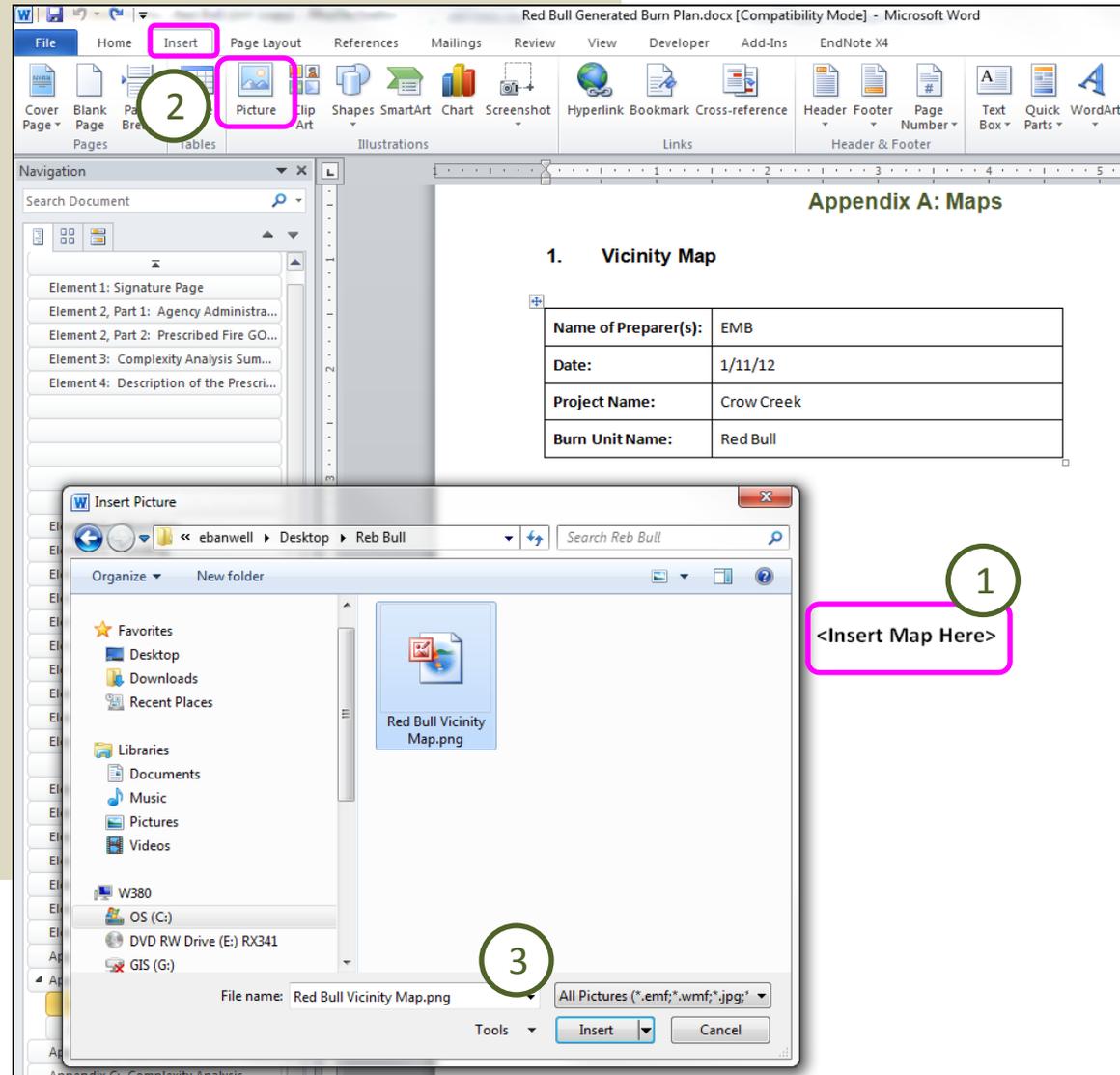


Open your generated burn plan in Microsoft Word and navigate to **1. Vicinity Map**.

Inserting a Saved Map Image into Word (Appendix A – Maps)

To insert a saved map image into a Microsoft Word document,

- 1 Highlight the **<Insert Map Here>** text.
- 2 Access the **Insert** tab and select **Picture**.
- 3 Navigate to your saved map image and select **Insert**.



Drawing the Burn Unit Onto the Map

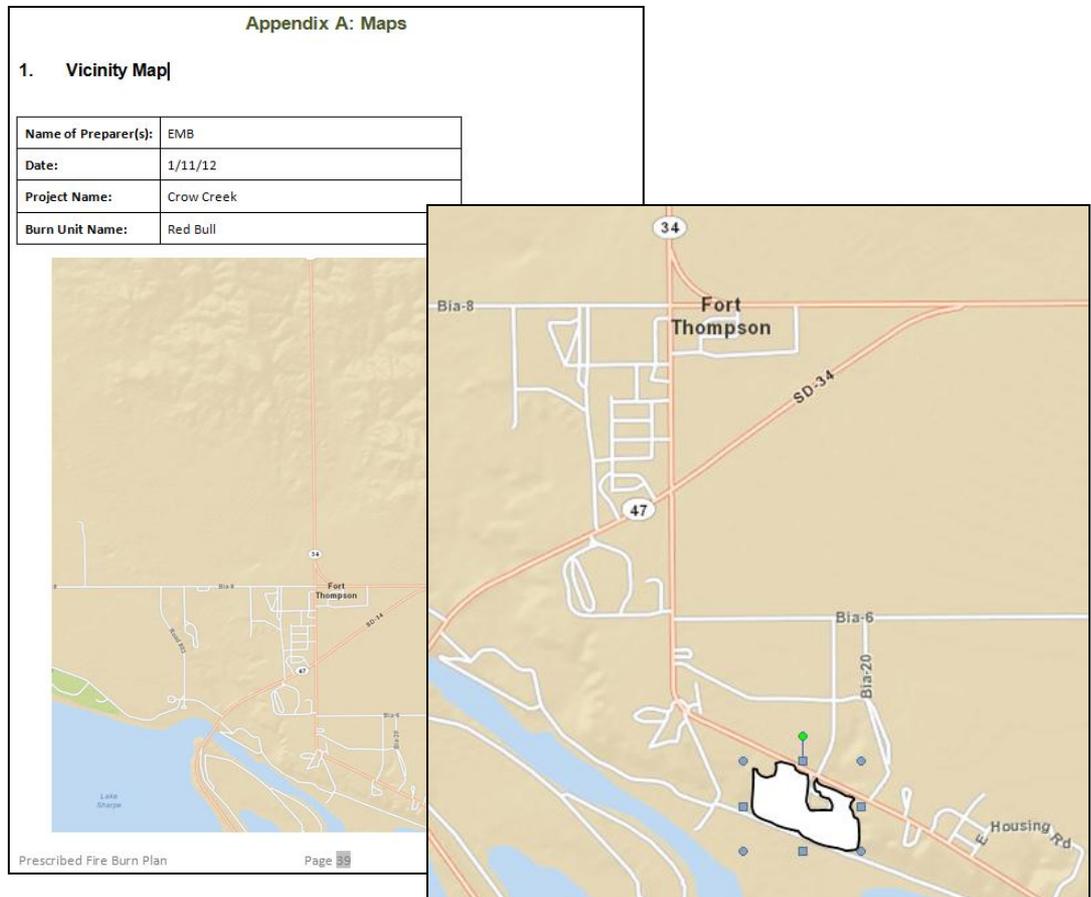
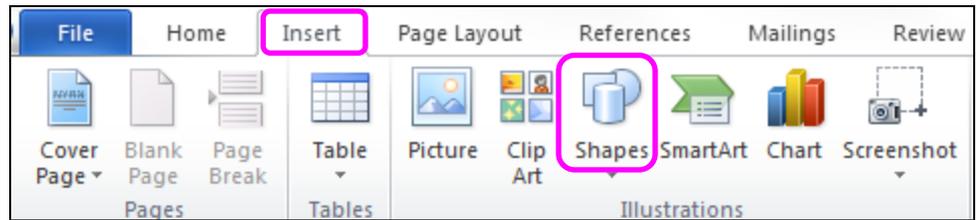
(Appendix A – Maps)

1. Resize the image to fit on the Vicinity Map page.
2. Right-click on the map, select **Wrap Text**, then select **Behind Text**.

This makes it easier to move the map around on the page.

3. Access the **Insert** tab and choose **Shapes**.
4. Under **Lines**, select the **Scribble** option.
5. Using the **Scribble** feature, draw an outline of your burn unit.

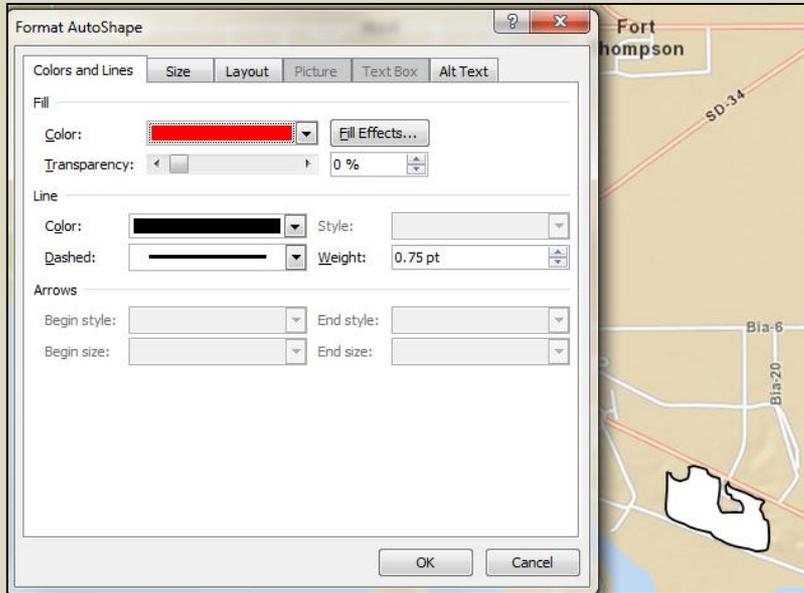
Zooming in will help you accurately draw the burn unit.



Editing and Labeling the Burn Unit

(Appendix A – Maps)

1. Right-click on your burn unit and select **Format AutoShape**.
2. Choose a red **fill color** and choose **OK**.



3. Click on **Shapes** again and select a **callout** shape.
4. Use this shape to label your burn unit.

Appendix A: Maps

1. Vicinity Map

Name of Preparer(s):	EMB
Date:	1/11/12
Project Name:	Crow Creek
Burn Unit Name:	Red Bull

A vicinity map showing the location of the Red Bull Burn Unit. The map is titled 'Vicinity Map' and includes a table with project details. The map shows a topographic view of the area around Fort Thompson, with roads labeled SD-34, Bia-6, and Bia-20. The Red Bull Burn Unit is highlighted in red and labeled with a callout box. A north arrow and a scale bar (0 to 200 meters) are also present.

Red Bull Burn Unit

Prescribed Fire Burn Plan Page 39 January 10, 2012

Appendices

(Appendix B – Technical Reviewer Checklist)

The technical reviewer

- Ensures that prescribed burn plans meet policies.
- Ensures that the complexity analysis accurately reflects the project(s).
- Ensures that the prescription parameters meet the resource and control objectives.
- Ensures that the ignition, holding, and contingency plans are consistent with the predicted fire behavior.
- Completes and signs the Technical Reviewer Checklist and the [Prescribed Burn Plan Signature Page](#).

Appendix B: Technical Reviewer Checklist		
Prescribed Fire Plan Elements	S/U	Comments
1. Signature page	S	
2. GO/NO-GO Checklists	S	
3. Complexity Analysis Summary	S	
4. Description of the Prescribed Fire Area	S	
5. Objectives	S	see objective additions
6. Funding	S	
7. Prescription	S	clarify questions in narrative
8. Scheduling	S	
9. Pre-burn Considerations and Weather	S	
10. Briefing	S	
11. Organization and Equipment	S	clarify tender operation question
12. Communication	S	
13. Public and Personnel Safety, Medical	S	
14. Test Fire	S	see clarification
15. Ignition Plan	S	
16. Holding Plan	S	see clarification
17. Contingency Plan	S	
18. Wildfire Conversion	S	
19. Smoke Management and Air Quality	S	
20. Monitoring	S	
21. Post-burn Activities	S	
Appendix A: Maps	S	
Appendix B: Technical Review Checklist	S	subject to changes and answering comments – plan signed by each tech reviewer
Appendix C: Complexity Analysis	S	
Appendix D: Agency-Specific Job Hazard Analysis	S	
Appendix E: Fire Prediction Modeling Runs or Empirical Documentation	S	
Other	S	

S = Satisfactory U = Unsatisfactory
 Recommended for Approval: _____ Not Recommended for Approval: _____

 Technical Reviewer Qualification and currency (Y/N) Date

Approval is recommended subject to the completion of all requirements listed in the comments section, or in the Prescribed Fire Plan.

Appendices

(Appendix C – Complexity Analysis)

The Complexity Analysis contains 14 elements with three factors to consider for each element:

- Factor 1 is **Risk**: the probability an adverse event will occur.
- Factor 2 is **Potential Consequences**: the measure of cost/result of an adverse event.
- Factor 3 is **Technical Difficulty**: the skill needed to implement the burn and deal with potential adverse events.

Values are assigned for each of the factors: low, moderate, or high.

Note: Refer to the [Prescribed Fire Complexity Rating System Guide](#) for more details.

Appendix C: Complexity Analysis

Instructions: This worksheet is designed to be used with the Prescribed Fire Complexity Rating descriptors on Page 6 of the [Prescribed Fire Complexity Rating System Guide](#).

1. Potential for Escape

Risk	Rationale
Preliminary Rating: <i>Low</i> <input checked="" type="checkbox"/> <i>Moderate</i> <i>High</i>	Although holding forces have access around the entire unit, PI is at 60% at the hot end of the prescription
Final Rating: <input checked="" type="checkbox"/> <i>Low</i> <i>Moderate</i> <i>High</i>	Ignition procedures won't create intense fire until adequate buffers are in place. Grass fuels will not hold fire longer than the day of ignition. Fire behavior calculations and procedures for ignition, holding, mopup and patrol are outlined in the burn plan.
Potential Consequences	Rationale
Preliminary Rating: <i>Low</i> <i>Moderate</i> <input checked="" type="checkbox"/> <i>High</i>	Potential for multiple simultaneous spot fires can propagate at moderate rates of spread but can be held by skilled and prompt holding actions. Contingency forces must be available on call-up commensurate with local wildfire standards.
Final Rating: <i>Low</i> <input checked="" type="checkbox"/> <i>Moderate</i> <i>High</i>	Mow lines and wet lines will be constructed around the burn unit. Fire control resources will be placed at key locations on and adjacent to residential property. Lookouts will be placed at key locations to watch for slopovers and spot fires. Slow methodical backfiring techniques will be used along all burn unit boundaries to reduce the risk of escape. Engines will patrol the area after ignition to extinguish any remaining hot spots.
Technical Difficulty	Rationale
Preliminary Rating: <input checked="" type="checkbox"/> <i>Low</i> <i>Moderate</i> <i>High</i>	Holding operations will be supervised at the Single Resource Boss level. The entire burn unit is accessible to holding resources. No abnormal weather is anticipated and all key implementation personnel will be from the local area or from within the Great Plains Region.
Final Rating: <input checked="" type="checkbox"/> <i>Low</i> <i>Moderate</i> <i>High</i>	Ignition and holding procedures and organization are outlined in the burn plan.

Appendices

(Appendix D – Agency-Specific Job Hazard Analysis)

A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur.

This analysis focuses on the relationship between the worker, the task, the tools, and the work environment.

Ideally, after you identify uncontrolled hazards, you will take steps to eliminate or reduce those hazards to an acceptable risk level.

Appendix D: Agency-Specific Job Hazard Analysis		
JOB/ACTIVITY:	AGENCY NAME:	NAME OF ANALYST:
Prescribed Burning	Crow Creek	XXXX XXXXX
JOB TITLE OF ANALYST:	DATE PREPARED:	NAME OF RX-BURN:
Ign. Spec/ Burn Boss Trainee	3/10/2004	Red Bull Prescribed Burn
TASK	HAZARDS	ABATEMENT ACTIONS
Vehicle travel to, on and from the worksite.	Poor driving; mechanical malfunctions; slippery road surfaces; soft shoulders; unimproved or narrow roadways; inclement weather; improper backing or parking; obstructed visibility from crooked roads, heavy vegetation, time-of-day or smoke.	Drive defensively. Use seat belts and headlights. Identify road conditions prior to travel and during briefings. Post road guards. Mark hazards. Perform pre-use inspections on all vehicles. Scout ahead to identify vehicle turnouts. Maintain communication. Provide road system maps. Use backers and spotters. Leave keys in the ignition and park vehicles where and how they are most easily driven out in an emergency.
Pre-burn briefing.	Lack of communications; reluctance to ask questions.	Conduct a thorough pre-burn briefing to clarify safety concerns, burn objectives, position assignments and responsibilities, expected weather and fire behavior.
Functioning as qualified in any position on a prescribed burn.	Injury due to lack of experience and/or qualifications.	Employees must meet the physical and qualification requirements for their respective positions as established in Wildland and Prescribed Fire Qualification System Guide, PMS 310-1.
Preparing drip torch fuel.	"Hot Mix" burns from improper fuel mixture ratio or unwanted ignitions; Fuel-saturated clothing from spills.	Use approved containers and pour spouts. Mix and fill on the ground in secure locations. Avoid fuel contact with skin, clothing and boots. Mix 4 parts diesel to 1 part gasoline. No smoking or cell phone use within 25 ft. of mixing and fueling area.

Appendices

(Appendix E – Documentation)

You can paste the exported Microsoft Excel table(s) ([see page 38](#)) into the Word document in **Appendix E. Fire Behavior Modeling Documentation or Empirical Evidence.**

Appendix E: Fire Behavior Modeling Documentation or Empirical Documentation					
Table 1. Surface Fire Behavior (as implemented in BehavePlus) inputs and outputs					
	Parameters	Fire Behavior			Units
		Minimum	Maximum	Worst-Case	
Outputs	Head Fire Spread Rate	41.81	323.05	595.36	chains/hour
	Backing Fire Spread Rate	4.11	5.95	6.59	chains/hour
	Flanking Fire Spread Rate	7.49	11.69	13.03	chains/hour
	Surface heat per unit area	635.18	742.42	835.12	Btu/ft ²
	Head Fire Fireline Intensity	486.89	4397.1	9115.31	Btu/ft/s
	Backing Fire Fireline Intensity	47.87	81.04	100.86	Btu/ft/s
	Flanking Fire Fireline Intensity	87.17	159.15	199.51	Btu/ft/s
	Head Fire Flame Length	7.75	21.33	29.83	ft
	Backing Fire Flame Length	2.67	3.4	3.76	ft
	Flanking Fire Flame Length	3.51	4.63	5.14	ft
	Reaction Intensity	2481.15	2900.07	3262.17	Btu/ft ² /min
	Head Fire Spread Direction	110	110	113	degrees
	Backing Fire Spread Direction	290	290	293	degrees
	Flanking Fire Spread Direction	200	200	203	degrees
	Head Fire Spread Distance	41.81	323.06	595.36	chains
	Backing Fire Spread Distance	4.11	5.95	6.59	chains
	Flanking Fire Spread Distance	7.49	11.69	13.03	chains
	Residence Time	0.26	0.26	0.26	min
	Effective Wind Speed	3.01	11	15.22	miles/hour
Inputs	Fire Behavior Fuel Model	FM3: Tall grass	FM3: Tall grass	FM3: Tall grass	
	1-hr fuel moisture	14	6	4	percent
	10-hr fuel moisture	16	8	6	percent
	100-hr fuel moisture	20	10	8	percent
	Live herbaceous fuel moisture	100	90	80	percent
	Live woody fuel moisture	180	170	160	percent
	Midflame Wind Speed	3	11	15	miles/hour
	Wind Direction (from North)	290	290	290	degrees
	Slope	5	5	40	percent
	Aspect	0	0	0	degrees
	Flanking Fire Direction	90 degrees	90 degrees	90 degrees	
	Elapsed Time	1	1	1	hours