Documentation for using the FireFreqAndRecency tool: fire frequency, rough accumulation and seasonality tool

Purpose and Goal:

Prescribed fire is used widely to mitigate wildfires and restore ecosystems. However, there are few tools developed to evaluate fires cumulative impact, calculate frequency, examine seasonality and estimate fuel accumulation to facilitate decision making in targeting successive prescribed fire application. An ESRI shapefile of all wildfire and prescribed fire events was assimilated from 1978-2012 for the 95,100ha (235,000ac) Talladega Division in east central Alabama. A python script-based tool was developed for ArcGIS 10 to calculate the duration of time in the dataset in years and months divided by the total number of fire events in each polygon to calculate the annualized average fire return interval, years of fuel accumulation (date last burned), and frequency of growing to dormant season fire events. The tool allows for dynamic entry of the analysis period and creates a geodatabase output in a designated work space. Development of a comprehensive fire database that can calculate generalized fuel accumulation will allow for more targeted pairing with appropriate smoke dispersion conditions and better smoke management. Calculations of fire frequency will determine if adequate fire return intervals are occurring to the landscape and focus on areas that need increased effort to meet frequency targets for restoration. The tool can also locate areas with historic wildfires which may benefit from targeted prescribed fire to reduce liability and dampen wildfire recurrence. The fire frequency tool can ultimately illustrate and facilitate better planning, prioritization and decision making in future prescribed fire events.

How to execute the tool:

First you must have all data in order - All recorded fires place in one shapefile with at minimum the date the fire occurred preferably in the YEARMMDD format. The script will convert other date values to the YEARMMDD value if it is in another format such as MM/DD/YEAR. In our data file we include objectives, time, fire type, fire weather parameters to create a holistic fire history tool with all relevant data about all past fire events. The tool will only accept dates stored in a field of type 'date'.

Take the current master fire data. Confirm that you have all fire events (wildfire and rxfire) in the shapefile by cross referencing tabular data kept by the dispatcher each year. Also confirm that you do not have duplicate values. Cleaner data provides better analysis.

Open a new ArcMAP session. The FireFreqAndRecency tool will only work in ArcGIS 10.0 or newer versions.

Make a copy of the master file in the catalogue or select and export out the data you wish to analyze. Export out the time span you want to analyze into a new shapefile. A good file naming convention is to include the year dates for the beginning and end of the timespan examined and the fire type (rxfire,

wildfire or all DivALLfire1978_2013May29). This allows for precise knowledge of the range of data values in the file as the fire events are updated.

Open the tool box and search for the Integrate tool. Integrate tool is within the standard tool box in ArcGIS 10. With the exported shapefile execute the Integrate tool. The Integrate tool makes similar lines coincident and removes many of the silvers in the dataset reducing the number of polygons and making analysis cleaner. Integrates will adjust and move lines so you might try and ranking streams and roads to pull the burn boundaries to fixed landscape features that do not change. You will also loose very small polygons with the integrate tool. I note this but I do not think fire events less than 5 acres have much bearing on a landscape level fire history analysis. In some situations it is merited to keep all these fire events so the very small fire events they can be selected out and buffered with the Buffer tool and placed back into the dataset so they will not be lost in the integrate operation. Most integrates are likely on the order of 10 to 20 meters but this is contingent on how variable your polygons are defined. The more precise your data to the shape of roads or streams the less integrate will adjust the boundaries.

Take the FireFreqAndRecency tool and copy and paste it into a new folder where you plan to work. Your results can also be placed in this folder. Open the tool in the catalogue and click on the tool. You will then:

1) Browse to the feature class (shapefile you created) to analyze.
2) Enter the begin and end of your growing season - A common default is (MMDD) April 1 to September 30th.
3) Click the navigate icon on the right side and enter the "Output Workspace" (folder where you want the output to be placed).
4) Then click "OK". The macro should run in less than 5 minutes.

If you experience errors the simplest remedy is to open and place the tool in a new folder and run it again. If the tool crashes again check that date is formatted correctly, that you don't have excessive polygons (tens of thousands of slivers, the integrate tool takes care of this). The tool has been created so it can take multiple runs in the same output workspace but sometimes the tool can fail and that seems to be the easiest work around. If the tool fails repeatedly please contact jstober@fs.fed.us with a detailed email with the specific error message. The output is placed in one file called FireFreqAndRecency_YYYYMMDD_time.mdb and when you double click on it a Personal Geodatabase Feature Class called FireFreqAndRecency is located. You can open it and make multiple copies in the TOC and adjust the symbology to illustrate your data. See examples below.

Output is the FireFreqAnd Recency feature file that contains the following summary data.

FireCount_All- Count of all fire events in each polygon.

RecentDate_All – This is the date in YYYYMMDD that the burn unit was burned can be manipulated to represent years of rough accumulation

FireFreq_All- This is the average fire return interval as calculated by taking the first date and the last date of the dataset analyzed and dividing by the FireCount_All. This gives an annualized average fire return interval not absolute.

FireCount_Growing- Count of all fires that occurred between April 1 and September 30 or the designate time span.

RecentDate_Growing- Date YYYYMMDD of the last growing season burn.

FireFreq_Growing- Calculates in the same manner as FireFreq_All the average fire return interval for all growing season fires.

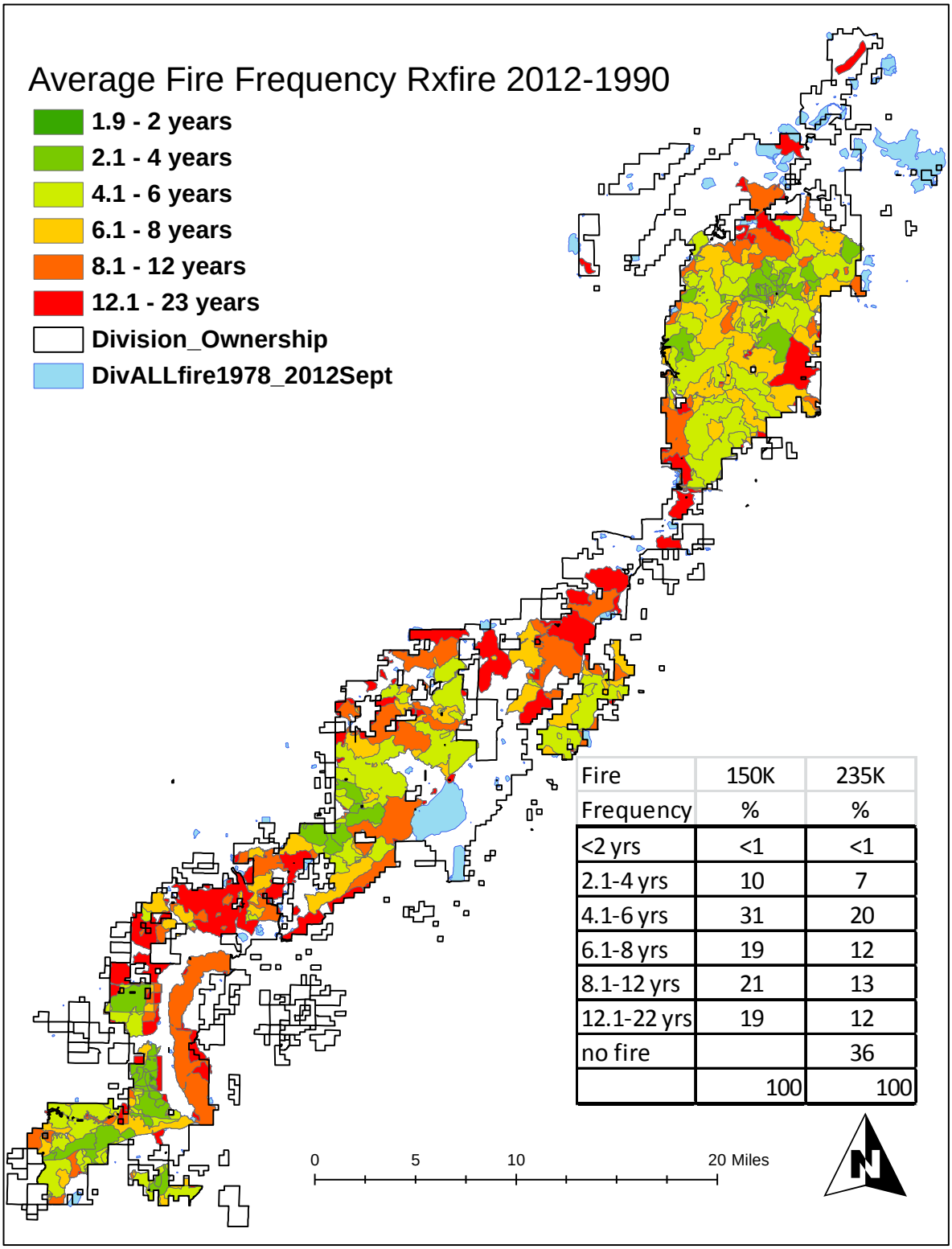
FireCount_Dormant- Count of all fires that occurred between October 1 and March 31 or the designated time span.

RecentDate_Dormant- Date YYYYMMDD of the last dormant season burn.

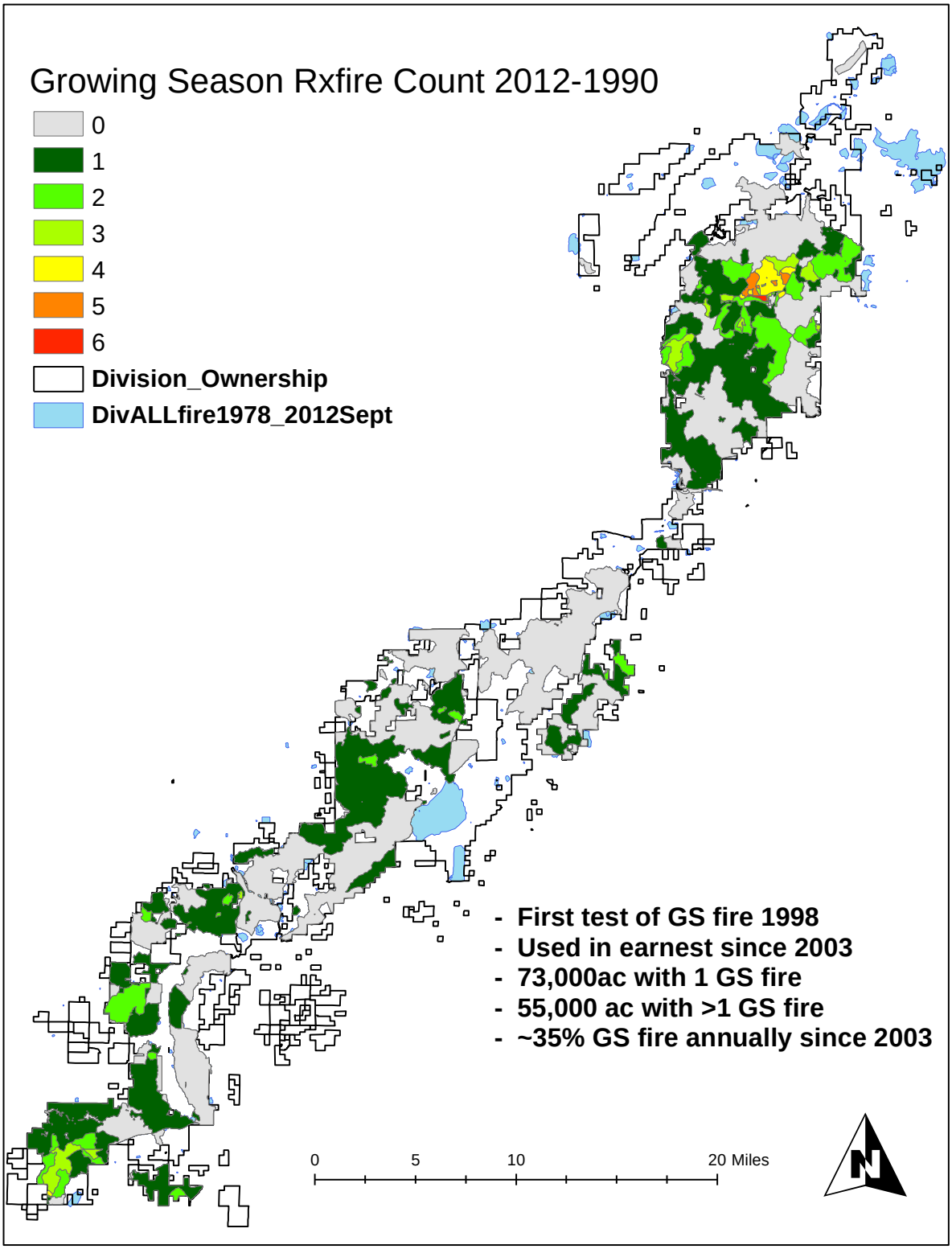
FireFreq_Dormant- Calculates in the same manner as FireFreq_All the average fire return interval for all dormant season fires.

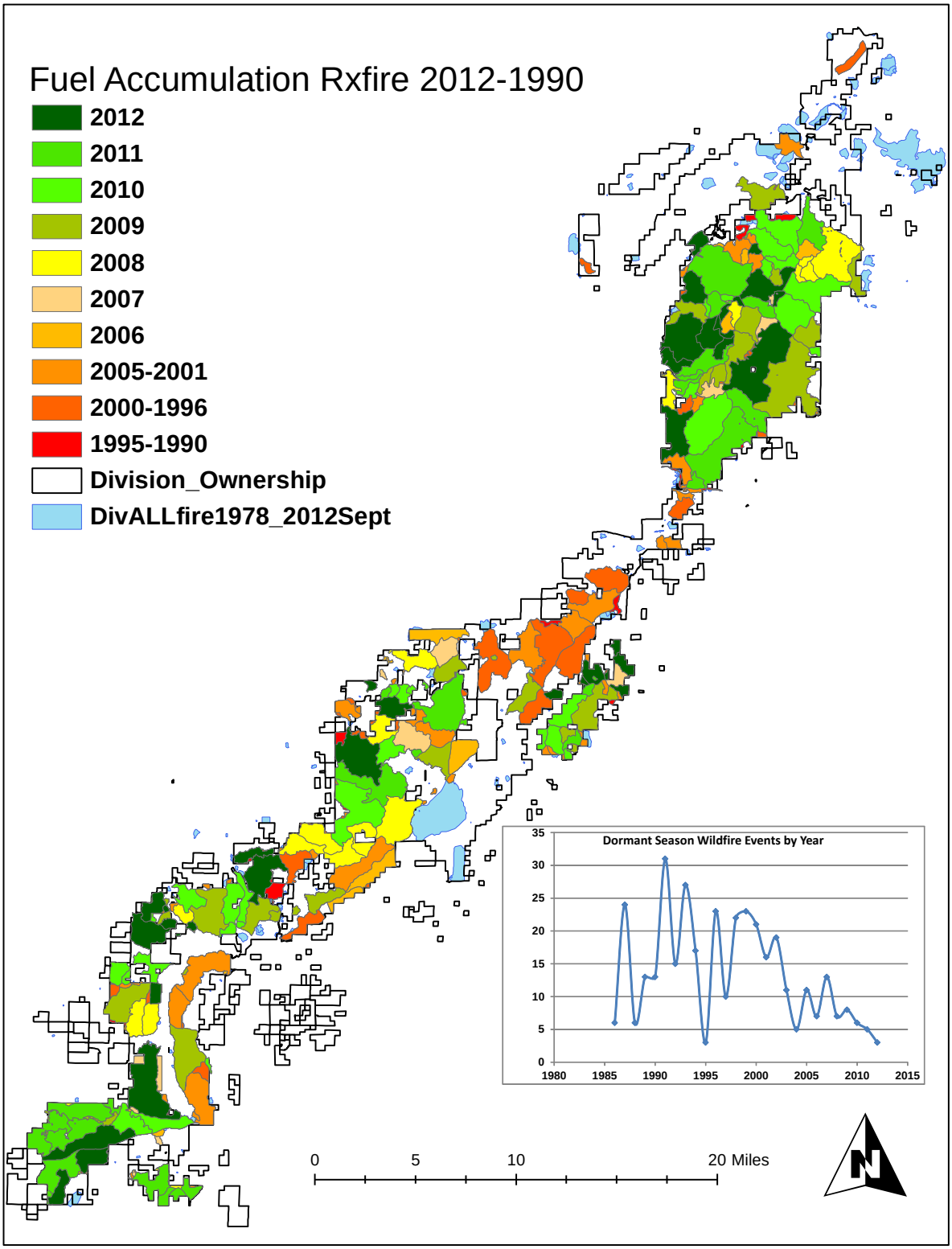
You can then take XTools or other means to calculate acreages. This can then be used to examine relative percentage of fire on the landscape being managed.

Below are some examples of output from the tool.



Fire Frequency	150K %	235K %
<2 yrs	<1	<1
2.1-4 yrs	10	7
4.1-6 yrs	31	20
6.1-8 yrs	19	12
8.1-12 yrs	21	13
12.1-22 yrs	19	12
no fire		36
	100	100


Growing Season Rxfire Count 2012-1990
0
1
2
3
4
5
6
Division_Ownership
DivALLfire1978_2012Sept
- First test of GS fire 1998
- Used in earnest since 2003
- 73,000ac with 1 GS fire
- 55,000 ac with >1 GS fire
- ~35% GS fire annually since 2003
0
5
10
20 Miles
N


Fuel Accumulation Rxfire 2012-1990
2012
2011
2010
2009
2008
2007
2006
2005-2001
2000-1996
1995-1990
Division_Ownership
DivALLfire1978_2012Sept
Dormant Season Wildfire Events by Year
35
30
25
20
15
10
5
0
1980
1985
1990
1995
2000
2005
2010
2015
0
5
10
20 Miles
N