

FIRE RETURN FREQUENCY IN THE PLANT COMMUNITIES  
OF AVON PARK AIR FORCE RANGE, FL

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ABSTRACT

The Avon Park Air Force Range (Range) in central Florida has applied prescribed burns, wildfires, and mission-ignited fires to the landscape for land management purposes over its 57-year history. In the last 21 years records have been kept of the fires that have occurred, and this information has been automated into the Range's GIS as one burn coverage per fire season (Oct.-Sept.). The Spatial Analyst module of ArcView has been used to determine the frequency with which fire has been applied and occurred by accident to the various plant communities on the Range, which include planted pine stands, natural timber stands, cutthroat grass lawns, and marshes. Results include trends based on the type of community, annual hydrology, the fire management officer's preferences, and proximity to targets to which high explosive ordnance are most often delivered. The results also give an indication that some communities are not being burned as often as should be, and where adjustments to the annual prescribed burn plan should be made to ensure better prescribed fire application in the future.

INTRODUCTION

Avon Park Air Force Range comprises 106,075 acres of central Florida, and is one of the largest practice ranges in the eastern United States. The property has been managed with fire over the course of the Air Force's 57-year ownership, but it has only been in the last twenty or so years that records were kept on paper maps by the Fire Management Officer (FMO). In 1996, these paper maps were converted to the Geographic Information System (GIS), and records for subsequent years have been kept through entry directly into the GIS throughout the burn season. Currently the Range has a coverage for each year between 1978 and 1999, with Fiscal Year (FY) 2000 just completed as of September 30<sup>th</sup>.

The purpose of this analysis was to utilize this fairly large set of data to determine whether the Fire Management program has been reaching the goals it has set for managing the landscape with prescribed burns. Avon Park contains a wide variety of vegetative communities, some very unique even for central Florida, that are managed for cattle grazing, forestry, wildlife, endangered species, and landscape health. The FMO strives each year to burn those communities on a regular enough schedule to ensure that the needs of each of these programs are met. However, a variety of factors encourage or discourage the completion of these scheduled burns each year, including El Nino-driven deluges, air-to-ground missions, drought conditions that induce the state to ban all prescribed burns, lack of personnel or equipment, and so on. By using the GIS to determine how often fire is applied to each area of the Range, the FMO will be able to determine whether he is on track, or if not, where to adjust the prescriptions for the oncoming year.

Figure 1 shows the desired frequency with which the different vegetative communities are to be burned for various management purposes. It is noted that these are not scientifically identified natural fire return frequencies, but the frequency that each manager wishes to accomplish with the fire management program in order to meet management objectives. These goals drive the annual burn prescription plan.

Figure 1. Burn schedule required to meet landscape management objectives

	Vegetative Communities	Goal
Grazing	Typical/Dry/Wet Flatwoods, Cutthroat Grass Communities, Planted Pine	Burn every 2-3 years to regenerate grasses for grazing

Forestry Management	Planted Pine, Forested Typical/Dry/Wet/Cutthroat Flatwoods	Burn every 3 years in winter to reduce fuel loads in understory, reduce competition
Forestry Management	Sand Pine	Every 10 years to reduce understory fuel loads, reduce competition
Wildlife - General	Most Communities	Burn when possible in conjunction with other management goals to maintain communities as is
Wildlife – Alligators (Special Concern)	Marshes, Sawgrass	Burn every 2-5 years to maintain/improve nesting habitat
Wildlife - Florida scrub-jay (Endangered)	Oak Scrub, Forested Dry Flatwoods, Turkey Scrub	Burn every 7 years to suppress sand pine and rejuvenate habitat
Wildlife – Florida scrub-jay	Sand Pine	Every 50 years, with repeat burn 5 years later to kill seedlings, to eliminate overstory
Wildlife - Florida grasshopper sparrow (Endangered)	Typical/Dry/Wet Flatwoods on historic prairie sites	Burn every 2-3 years to suppress trees/regenerate grasses
Wildlife - Red-cockaded woodpecker (Endangered)	Forested Typical/Dry/Wet Flatwoods	Burn every 3-5 years to maintain parklike stands
Landscape health and maintenance – unique landscapes	Cutthroat, Cutthroat Flatwoods, Forested Cutthroat, All other Flatwoods	Burn every 2-3 years during growing season to encourage flowering of cutthroat grasses, seepage slope forbes
Landscape health and maintenance - wetlands	Cypress, Hardwood Swamps, Ponds	Burn into wetland when possible to maintain wetland edge
Landscape health and maintenance – wetlands	Pine Swamp (the Deadins)	Burn every 10 years to maintain health of wetland/reduce fuels
	Oak Hammock, Cabbage Hammock, Bahia, Ponds	No burn management goals for these communities

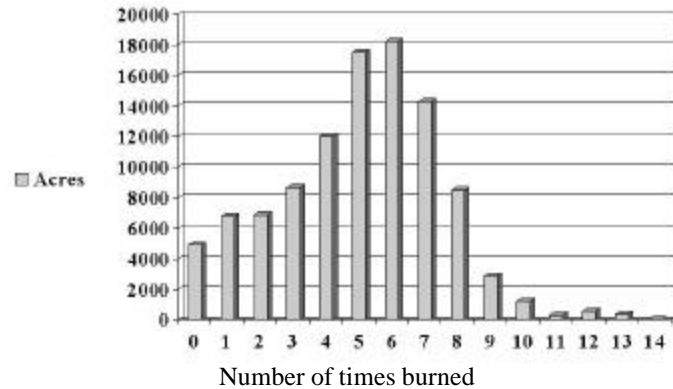
## ANALYSIS

The Range GIS runs on an Intel Pentium II PC with 128 MB Ram at 450Mhz and the Windows NT operating system. The GIS consists of ArcView, the Spatial Analyst extension, and the 3D Analyst extension, and utilizes the Oregon Department of Forestry's Xtools extension often to complete many of the everyday analysis functions. For this exercise, the Spatial Analyst extension was the main analytical tool.

Each of the annual burn records coverages consists of data representing the month, day and year each area was burned, if recorded on the paper maps. In later years, the FMO also kept records of the type of burn the fire was (wildfire, prescribed, mission) and what the ignition type was (backfire, headfire, lightning strike, ordnance-ignited). For the analysis, the only information needed from the coverage was whether or not an area was burned. To accomplish this, each annual burn coverage was converted to a 10-meter raster grid with values of one and zero, with the value one representing a burned cell and zero a cell that went unburned that year.

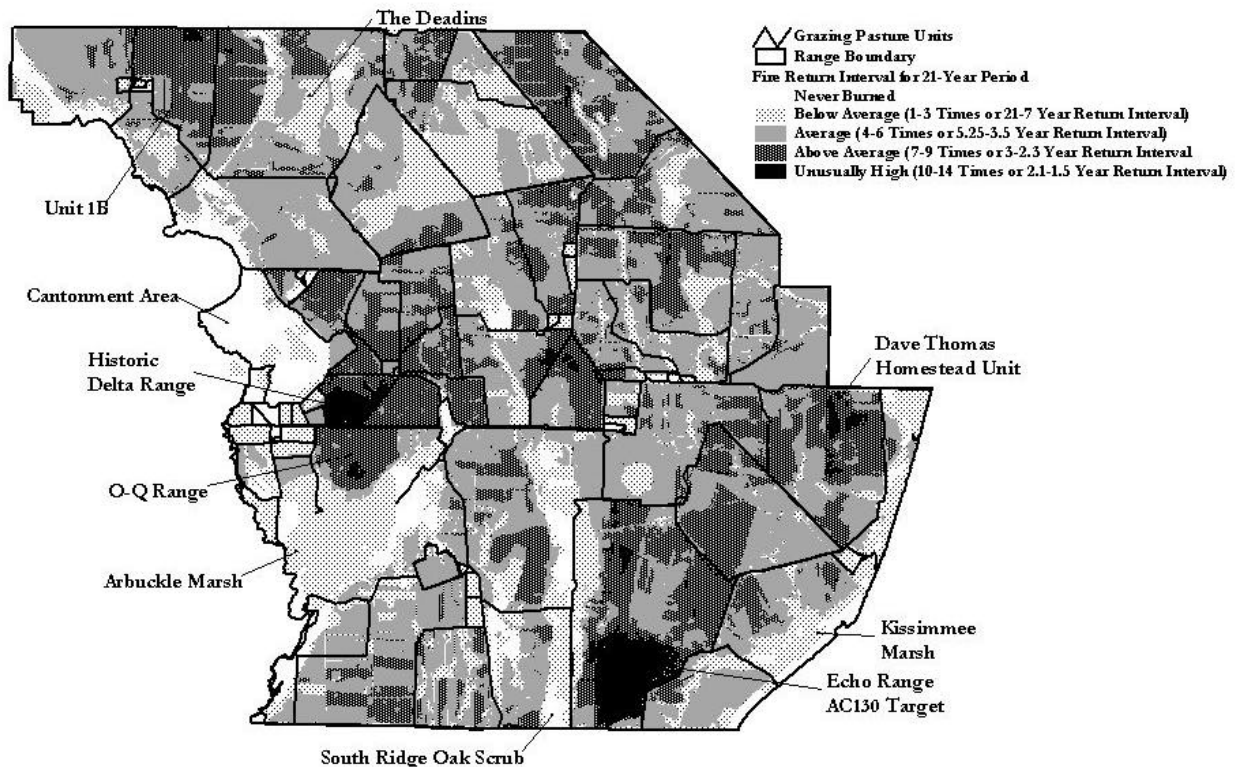
The resulting 21 raster grids were then added together mathematically (burn1978 + burn1979 + burn1980 + etc) to create a composite grid in which each cell represented the number of times that the cell was burned over the 21-year period between 1978 and 1999. The 2000 burn coverage was not included in this analysis because the fire season was still in progress at the time this paper was due for publication. The least number of times that a cell was burned was zero; the most number of times a cell was burned was 14. More acres (18,600, or 17.5%) of the Range were burned six times than any other number of times (Figure 2). In a 21-year period this indicates that more acres are burned with a fire return interval of 3.5 years, very close to the normal three-year rotation which the FMO plans every year for most vegetative communities at Avon Park. However, the average number of times an acre might be burned on the range was 4.97 times, for an average fire return interval of once every 4.2 years, falling short of some of the FMO's goals. This less-frequent result is probably affected by the fact that some of the acreage included in the average is covered by vegetative communities that are not burned as often, such as Marsh, Oak Hammock and Cypress. More on the effect of the vegetative community on the average later.

Figure 2. Total acres burned for number of times burned in 21 years



A map displaying the number of times areas have been burned (Figure 3) reveals areas that have been burned more frequently than other areas. The map by itself does not reveal reasons why certain areas are burned more often, except in areas where extremes in the fire return frequency are extremely low or high. For instance, the two largest areas that have been burned more than 9 times are located in weapons ranges, one in a closed range known as historic Delta, and the other near the AC130 target in Echo Range, which is active. In the case of the closed range, ordnance buried by impact over 20 years ago surfaces during extremely wet years and the intact phosphorus charges are ignited by the heat of the Florida summers. In the case of the active Echo Range, the incendiary type of ordnance delivered by air-to-ground training missions to that target begin fires in the open flatwoods. The AC-130 target in south Echo Range in fact has the highest fire return interval, being burned up to 14 of the last 21 years, and containing most of the acreage that burned 12 and 13 times. This gives this area of Echo Range, a key location for the Florida grasshopper sparrow, an average fire return rate between 1.75 and 1.5 years. This high rate of return is created by the addition of wildfires, not the execution of the annual burn plans alone.

Figure 3. Fire Return Frequency on Avon Park Air Force Range



The second reason for frequent fire returns appears to be FMO preference or emphasis. This is evident by the fact that frequent fire areas on the map tend to fit within current grazing pasture units. By their own admission, the Dave Thomas Homestead pasture has been more carefully managed by both the FMO and the Range Timber manager to encourage regeneration of pine, and therefore more frequently burned, even if other units scheduled for the same year were neglected. The 1B/Big Pine Plantation unit and the land west of Willingham Creek has also received special treatment over the years. The pattern of similar burn frequencies within the pasture boundaries suggests that these areas are burned by pasture unit regardless of vegetative community.

Areas that have not been burned as frequently tend to be those skirting the large marsh complexes on Arbuckle Creek and the Kissimmee River, and the Deadins Pine Swamp. Obviously it is more difficult to burn in these areas because of the higher water tables; the FMO has to wait until a dry year to attempt a marsh burn. The Cantonment area is not burned very often in general because of considerations for smoke near the airfield, the numerous paved and developed surfaces, and the generally disturbed vegetation in that area. Lastly, the north-south South Ridge feature of the Range has not been burned often because of the presence of Oak Scrub vegetation, which is difficult to burn often. Again, more on that in the following section.

The frequency with which an area is burned takes on more significance if it is known what plant community types were burned in that area. The final frequency grid was converted back to a polygon shape file and intersected using Xtools with the Range vegetative community coverage. The result was a database representing the kinds of communities and how many acres of each were burned at what frequency. Using the mean and the median that each community was burned, a picture of how often these communities are being burned individually begins to form (Figure 4). The mean was generated using the equation  $\frac{\text{Total number of units burned over 21 years}}{\text{Number of burnable acres}}$ .

where the total number of units burned over 21 years = (1 x acres burned once + 2 x acres burned twice + 3 x acres burned three times + ... + 14 x acres burned 14 times), and the number of burnable acres is the total acres of that community that can be burned, including those acres that have never been burned. The median is the number of times burned for the most number of acres in that community.

Figure 4. Mean and Median Fire Return Interval (FRI) by Vegetative Community Type

Community	Mean Times Burned/FRI	Median Times Burned/FRI	Prescribed Burn FRI Met?
Bahia (Tame Pasture)	1.9 Times / Every 10.6 years	1 Time / Every 21 years	0
Cabbage Hammock	1.7 Times / Every 12.4 years	2 Times / Every 10.5 years	0
Cutthroat Flatwoods	5 Times / Every 4.2 years	5 Times / Every 4.2 years	4
Cutthroat	5.9 Times / Every 3.5 years	4 Times / Every 5.25 years	3
Cypress	1.1 Times / Every 19.1 years	0 Times / Not Burned	0
Dry Flatwoods	4.37 Times / Every 4.77 years	5 Times / Every 4.2 years	4
Forested Cutthroat Flatwoods	5.82 Times / Every 3.6 years	6 Times / Every 3.5 years	3
Forested Cutthroat	5.5 Times / Every 3.8 years	6 Times / Every 3.5 years	3
Forested Dry Flatwoods	2.25 Times / Every 9.3 years	0 Times / Not Burned	4
Forested Typical Flatwoods	5.7 Times / Every 3.7 years	6 Times / Every 3.5 years	3
Forested Wet Flatwoods	5.2 Times / Every 4.0 years	6 Times / Every 3.5 years	3
Hardwood Swamp	2.1 Times / Every 10.0 years	0 Times / Not Burned	0
Marsh	2.4 Times / Every 8.75 years	1 Time / Every 21 years	4
Oak Hammock	2.47 Times / Every 8.5 years	0 Times / Not Burned	0
Oak Scrub	2.97 Times / Every 7.1 years	1 Time / Every 21 years	1
Pine Swamp	3.1 Times / Every 6.8 years	2 Times / Every 10.5 years	2
Planted Pine	5.6 Times / Every 3.75 years	5 Times / Every 4.2 years	3
Pond	5 Times / Every 4.2 years	5 Times / Every 4.2 years	0
Sand Pine	1.8 Times / Every 11.6 years	1 Times / Every 21 years	2
Sawgrass	1.7 Times / Every 12.4 years	1 Times / Every 21 years	4
Turkey Scrub	1.7 Times / Every 12.4 years	1 Times / Every 21 years	4
Typical Flatwoods	6 Times / Every 3.5 years	6 Times / Every 3.5 years	3
Wet Flatwoods	5.8 Times / Every 3.6 years	7 Times / Every 3.0 years	3

Prescribed Burn Fire Return Interval Met Code:

0 = No objective set for this community

1 = FRI objective met

2 = Community burned more often than set objective on average

3 = Community burned less often than set objective on average, but within 1 year of objective

4 = Community burned less often than set objective on average, greater than 1 year difference

The lack of “ones” in the column for Prescribed Burn FRI shows that many of the communities are not being burned as often as desired by the natural resources managers, although Oak Scrub appears to be right on schedule. Several communities like the Typical/Wet/Dry Flatwoods and Planted Pine stands are getting burned often enough for the interval goal to be considered met, the “threes” in the table. Only two communities, the Pine Swamp and Sand Pine, are getting burned more often than the prescribed FRI. The Pine Swamp may be higher than prescribed because of a wildfire that burned the swamp in the drought year of 1998. In the case of Sand Pine, the two very different objectives for forestry management and wildlife habitat cause enough of a conflict that the resulting fire return interval may be misleading; each stand would have to be evaluated based on the objectives for managing that stand. The hydrology of wet communities like Marsh, Sawgrass and Cypress typically is the reason for lack of success in those areas, drawing a “four” for those communities. We knew we were falling behind on most of these communities for the reasons mentioned in the introduction, and this table not only proves that general knowledge, but tells us by how much we are behind in those cases.

## CONCLUSION

The average fire return intervals for the various vegetative communities suggests that many communities are being burned with the general frequency that is desired for that community (once every 3.5 to 4.2 years), but not quite as often as the different program managers would like (usually 3 years). The Fire Management Officer can utilize these results to adjust next year’s prescribed burn plan to try and pick up on those communities that are not getting burned as often as prescribed. It is only left to see if El Nino and the hurricane season has other plans in store for Avon Park Air Force Range’s Fire Management program.

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