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Soil and Plant Characteristics compared between abandoned natural gas drill pads and adjacent areas, Barksdale Air Force Base, Louisiana

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### Abstract

Natural gas demand is projected to continue to rise. To meet this demand an increase in exploration and drilling will occur. This paper identifies some long term ecological impacts that remain following the plug and abandonment of the drill pads.

Keywords: natural gas; drilling land use; drilling pad impact; soil and vegetation impacts.

Soil and plant characteristics were investigated on abandoned natural gas drill pads located within actively managed pine and pine-hardwood forest community types on Barksdale Air Force Base (BAFB), situated in northwest Louisiana. Abandoned drill pads sampled ranged from three to seventy-seven years since date of plug and abandonment. Soils and vegetation were sampled and compared between on-pad and adjacent off-pad areas.

Variables sampled for both soils and vegetation were found to be different between on pad and off pad locations as a result of natural gas drilling, regardless of time since plug and abandonment. Soils on pads were coarser in texture, and found to generally have higher bulk densities, soil strength, pH, and differing nutrient concentrations compared to adjacent off pad soils (Table 1).

Table 1. The overall mean bulk density and soil strength values for the on-pad and off-pad locations sampled.

variable	function	units	sample depths			
			0 – 10 (cm)		10 -20 (cm)	
			on pad	off pad	on pad	off pad
bulk density	mean	Mg m <sup>-3</sup>	*1.49	1.13	*1.54	1.21
	max	Mg m <sup>-3</sup>	1.72	1.25	1.79	1.36
	min	Mg m <sup>-3</sup>	1.10	1.01	1.21	1.07
soil strength	mean	kg cm <sup>-2</sup>	*4.50	3.16		
	max	kg cm <sup>-2</sup>	5.46	3.87		
	min	kg cm <sup>-2</sup>	3.15	2.39		

*Values in a row preceded with an \* are higher, and the difference is statistically significant ( $\alpha=0.05$ ) at the corresponding depth.*

On pad sites were generally vegetationally dissimilar and less diverse when compared to the adjacent off pad locations (Table 2).

Table 2. The overall means for Shannon diversity index, evenness, species richness, and estimated herbaceous cover between on pad and the adjacent off pad area.

Strata	SDI		J'		Richness		common species
	on pad	off pad	on pad	off pad	on pad	off pad	
tree	0.36	*1.22	0.35	0.73	2	6	2
sapling/shrub	0.98	*1.90	0.76	0.81	4	9	2
herbaceous	1.68	2.20	0.68	0.81	12	16	5

Values preceded with an asterisk are statistically significant ( $\alpha=0.05$ ).

Site quality described by site index (base age 25 and 50) for loblolly pine (*Pinus taeda L.*) was found to be on average 15 feet lower on pad (Table 3).

Table 3. Site index, a measurement of site quality, for loblolly pine (*Pinus taeda L.*) measured at four drill pad locations that met the even-aged stand requirement.

pad site serial number	average age years	tree location	average height (ft)	site index	base age (years)
87608	38	on pad	66	75	SI <sub>50</sub>
		off pad	78	90	
88670	18	on pad	42	50	SI <sub>25</sub>
		off pad	54	65	
89500	10	on pad	17	35	SI <sub>25</sub>
		off pad	38	70	
85438	12	on pad	38	60	SI <sub>25</sub>
		off pad	46	70	

Historical aerial photos and recent satellite imagery were used to determine the total surface land area used for natural gas drilling operation dating back to 1966 on BAFB. Beginning in 1966, the total land area in drilling pads alone has increased by over 300%. As of February 2, 2007 the cumulative surface land area used for natural gas production on BAFB is 387 hectares. This fragmentation represents approximately eight percent of the forested eastern portion of the base (Figure 1). Nearly one half of the land area used for natural gas production operations was for drill pads, while the remaining land used was composed of pipelines, access roads, and collection lines.

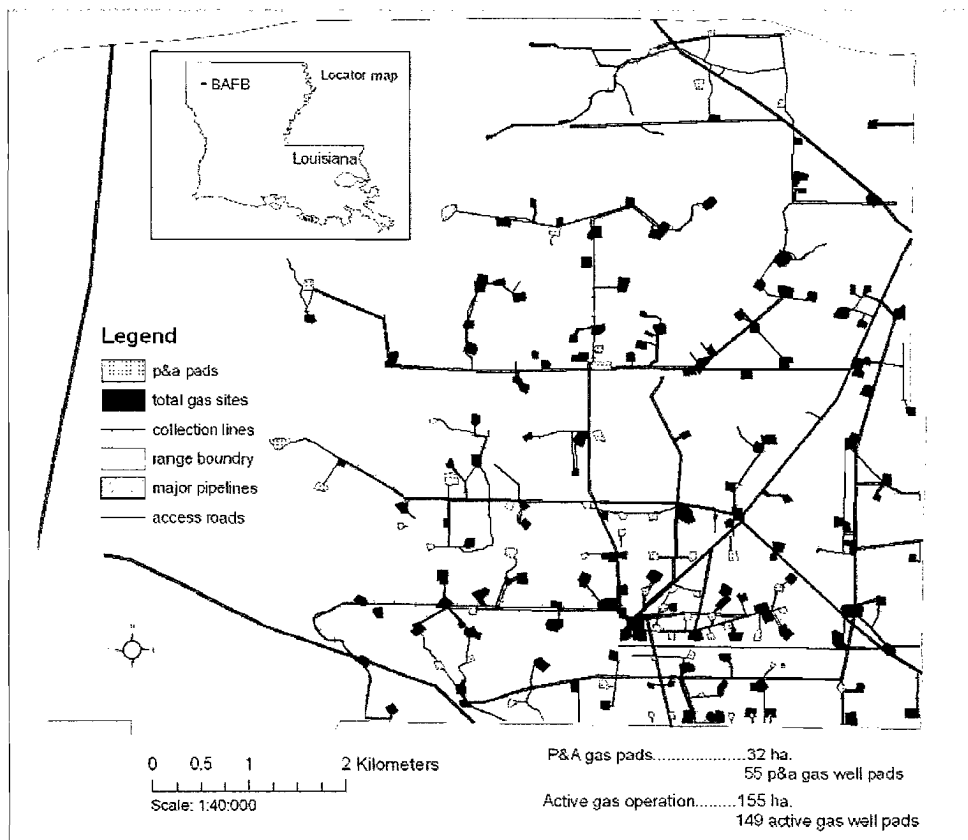


Figure 1. Fragmentation of the forested eastern portion BAFB by active and abandoned gas pads, roads, collection lines, and pipelines, as of February 2007.

Proper remediation with set benchmarks of plugged and abandoned gas pads may be a better alternative to the practice of simply ripping the soil of abandoned pads. Since natural gas is an important resource for mankind it will continue to be extracted and utilized. Properly managed sites have the potential to benefit local wildlife populations, and/or be reclaimed with timber management in mind.