ECONOMIC ANALYSIS OF PAYMENTS REQUIRED TO ESTABLISH LONGLEAF PINE HABITAT ON PRIVATE LANDS TO FACILITATE TRAINING ON MILITARY INSTALLATIONS

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Steady population growth, urbanization, increased military presence, and the 2030 completion of two significant "super highway" infrastructure projects stand to fundamentally reshape the landscape in eastern North Carolina and increase pressure on the state's land-based industries (Marstel-Day 2012). With similar trends occurring throughout rural communities in the Southeast, the question of how to address tradeoffs between land-based economic sectors will become increasingly vital to policymakers and planners. In this paper, we analyze a representative tradeoff in eastern North Carolina: the tradeoff between military training capabilities and the protection of essential habitat for the endangered red-cockaded woodpecker (RCW) (*Picoides borealis*).

The analysis valued land management options consistent with habitat requirements for the endangered RCW and the relevant rural alternatives for the region: private nonindustrial forestry for maximum timber revenue and row agriculture. The habitat scenario is essentially a lengthy longleaf pine (*Pinus palustris* Mill.) rotation while the forestry alternatives include both a short rotation loblolly pine (*P. taeda* L.) scenario and a shorter longleaf pine rotation. Row agriculture is represented by corn and soybean crops. Comparing these economic valuations provided a baseline estimate of the cost to private landowners of managing land for RCW, referred to in this paper as the opportunity cost. The opportunity cost included both: (1) the direct cost to the landowner of managing the forest for habitat (e.g., planting, prescribed burning); and (2) the income the landowner must forgo when choosing to manage for habitat rather than timber revenue.

Opportunity costs are calculated using standard capital budgeting methods with particular emphasis given to the soil expectation value (SEV). SEV is calculated as a function of net present value (NPV) and represents the value today of managing under the same regime into perpetuity. SEV is especially useful in comparing land management options of varying timeframes as it converts everything to the same time scale. A 4 percent real discount rate is assumed throughout. This is standard for longleaf pine literature and consistent with USDA Forest Service methodology.

We developed longleaf management scenarios based on those common in the literature and expert insight from the North Carolina Forest Service (NCFS). Four key components drove the longleaf pine analyses: management intensity, pine straw revenue, timber revenue, and management costs. Timber volume per acre was estimated using three longleaf pine growth and yield models: NATYIELD (Smith and Hafley 1986), Farrar (1985), and Lohrey and Bailey (1977). Each scenario was assessed with three levels of pine straw revenue representing low- to mid-range literature estimates (Dickens and others 2012) and local pine straw sales. Under the conventional scenario, the loblolly pine thinning and harvest volumes and management regime were based on prior research by Siry and others (2001) and Cubbage and others (2012), which used the TAUYIELD growth and yield model.

Results are presented in table 1. The agricultural scenarios assumed average North Carolina coastal plain crop returns for corn and soybean farms each year into perpetuity: $67.57 and $159.92 per acre, respectively (NCSU 2013). These crop assumptions were optimistic and assumed that farmers would get average yields, maintain the current high crop prices, and encounter no weather or climate issues. SEVs

Table 1--SEV, opportunity cost, and annual payments per acre by site index at base age 50 and pine straw revenue for forestry alternatives. Opportunity cost is the difference between the SEV of longleaf managed for habitat and the timber revenue alternatives. Annual payments assume a 10-year contract length

Site Index	Pine straw	SEV Longleaf for habitat	----Timber revenue---- Longleaf	Loblolly	--Opportunity costs-- Longleaf	Loblolly	--Annual payments-- Longleaf	Loblolly
60	None	-$497	-$140	$201	$357	$698	$42	$83
	Conservative	-$218	$104	$201	$322	$419	$38	$50
	Moderate	-$ 54	$303	$201	$357	$255	$42	$30
70	None	-$399	-$ 2	$201	$397	$600	$47	$71
	Conservative	-$125	$242	$201	$367	$326	$44	$39
	Moderate	$ 39	$440	$201	$401	$162	$48	$19
80	None	-$284	$142	$201	$426	$485	$51	$58
	Conservative	-$ 19	$386	$201	$405	$220	$48	$26
	Moderate	$145	$584	$201	$439	$ 56	$52	$ 7

calculated using these assumptions were significantly higher than any forestry scenario: $1,757 per acre for corn and $4,158 for soybeans. Marginal agricultural lands would be more attractive for conversion. An economic analysis of marginal farmland in North Carolina found that between 2007 and 2012 both corn and soybean crops generated negative returns, averaging a loss of $174 per year per acre for corn and $41 per year per acre for soybeans (Cubbage and others 2012). If these losses were repeated annually, they would lead to SEVs of -$4,524 to -$1,066 per acre.

The U.S. Fish and Wildlife and Wildlife Service (USFWS) estimates that each RCW cluster requires 75 to 100 acres of foraging range and 200 acres for breeding (USFWS 2003). We estimated a baseline range of costs to create enough habitat for a single cluster on already forested land: $24,150 to $43,900 per foraging group and $11,200 and $139,600 per breeding pair. This corresponds to the lower end of credit sales which have ranged from $100,000 to $250,000 per cluster (Bayon 2002). These estimates exclude all costs for biological monitoring though these costs may be significant. Annual payments were calculated assuming a 10-year contract. These ranged from $7 to $83 per year per acre and are consistent with payments delivered through existing State and federal forestry programs. However, significant work remains on the best mechanisms for implementation. Landowners near Camp Lejeune are more interested in short-term 10-year contracts that will not be consistent with the long-term goals of RCW

habitat conservation (Rodriguez and others 2012).

Given recent concerns regarding future development in eastern North Carolina, Camp Lejeune has ample incentive to explore all options for balancing training needs with species conservation before more accessible and affordable options become unavailable. Under current timber market conditions, cooperative conservation through the direct payment to private landowners for RCW habitat creation and maintenance may provide one such option, especially given the local community's potential openness to such programs (Rodriguez and others 2012).

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