

The Impact Of Wildlife Conservation On Rural Welfare In Zambia

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OUTLINE

- ◆ Food Security Research Project
- ◆ Zambia and sustainable tourism
- ◆ Game Management Areas
- ◆ Data and methods
- ◆ Model results
- ◆ Conclusions



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UNIVERSITY



USAID
FROM THE AMERICAN PEOPLE

 **Sida**

The World Bank

IBRD & IDA: Working for a World Free of Poverty

Food Security Research Project

- ◆ Objective: *to integrate research into policy dialogue and program design to promote sustainable agricultural growth as a means to cut hunger and poverty*
- ◆ Focus on individual and collective action
- ◆ Regional, village, household, gender-level impacts
- ◆ Impacts on policy analysis
- ◆ Partnerships with African institutions

Food Security (*continued*)

Research themes:

1. Improving food systems performance
2. Understanding household income and livelihood dynamics
3. *Understanding food security and natural resource management interactions*

Zambia

- ◆ Landlocked country in southern Africa
- ◆ Tropical climate
- ◆ Flat plateau (1000-1500 meters)
- ◆ Nine provinces



Zambia (*continued*)

- ◆ Population: 11.5 million
- ◆ Rural population: 65%
- ◆ GDP per capita: \$1,273
- ◆ Living below \$1 per day: 64%
- ◆ Living below \$2 per day: 87%
- ◆ Malnourished population: 46%



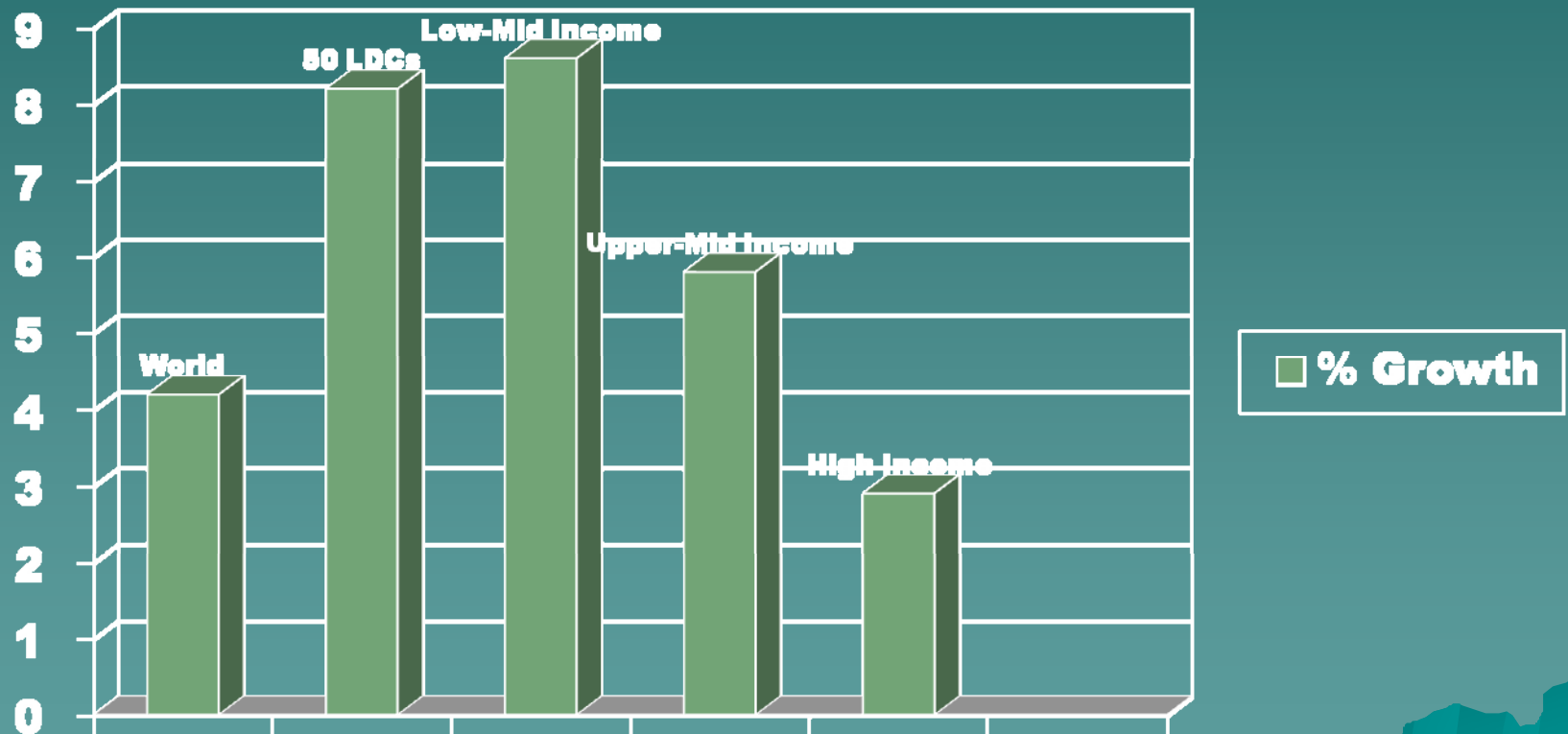
- ◆ Life expectancy at birth: 41.2 yrs (178/179)
- ◆ People without improved water: 42% (106/123)
- ◆ Illiteracy rate: 32% (93/127)
- ◆ Human development index: 0.43 (165/177)

Sustainable Tourism

- ◆ Tourism increasingly important source of economic development
 - Dependent on wildlife, habitat, natural resources
 - Micro-level impacts (job creation, income)
 - Macro-level impacts (foreign exchange, GDP)
- ◆ Rural tourism
 - Potential impact on livelihoods and income
- ◆ Impact of policies on rural development
 - Wildlife conservation
 - Tourism development

Average Annual Tourism Growth

(1990-2005)



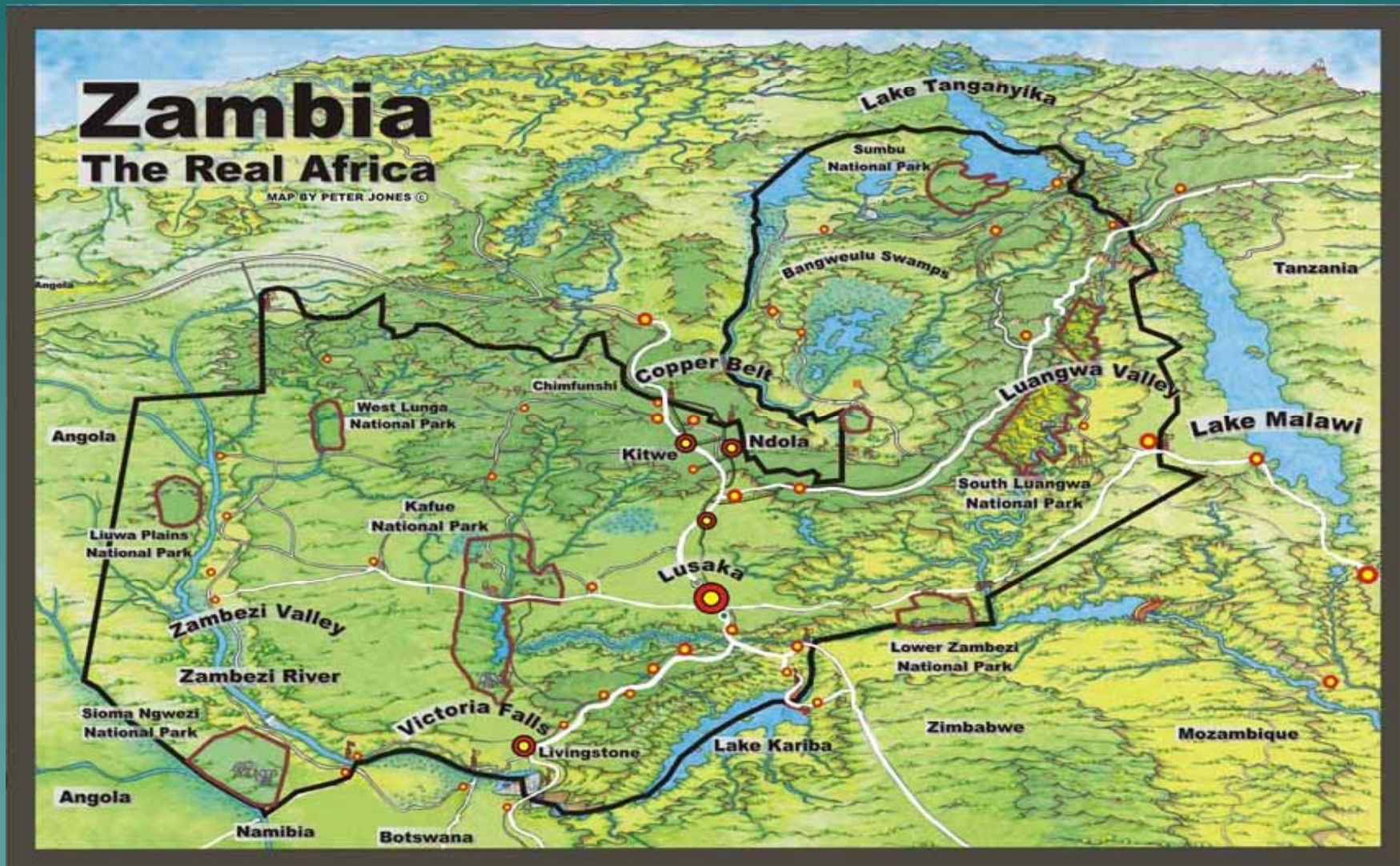
Source: UN World Tourism Organization

Tourism in Zambia

- ◆ International tourist arrivals
 - 2004: 515,000
 - 9.7% avg annual growth (1990-2004)
- ◆ Tourism receipts (US\$)
 - 2004: \$161 million
 - 9.8% avg annual growth (1990-2004)
 - 12.7% of exports
- ◆ One of three priority sectors in national development plan



Zambia Map

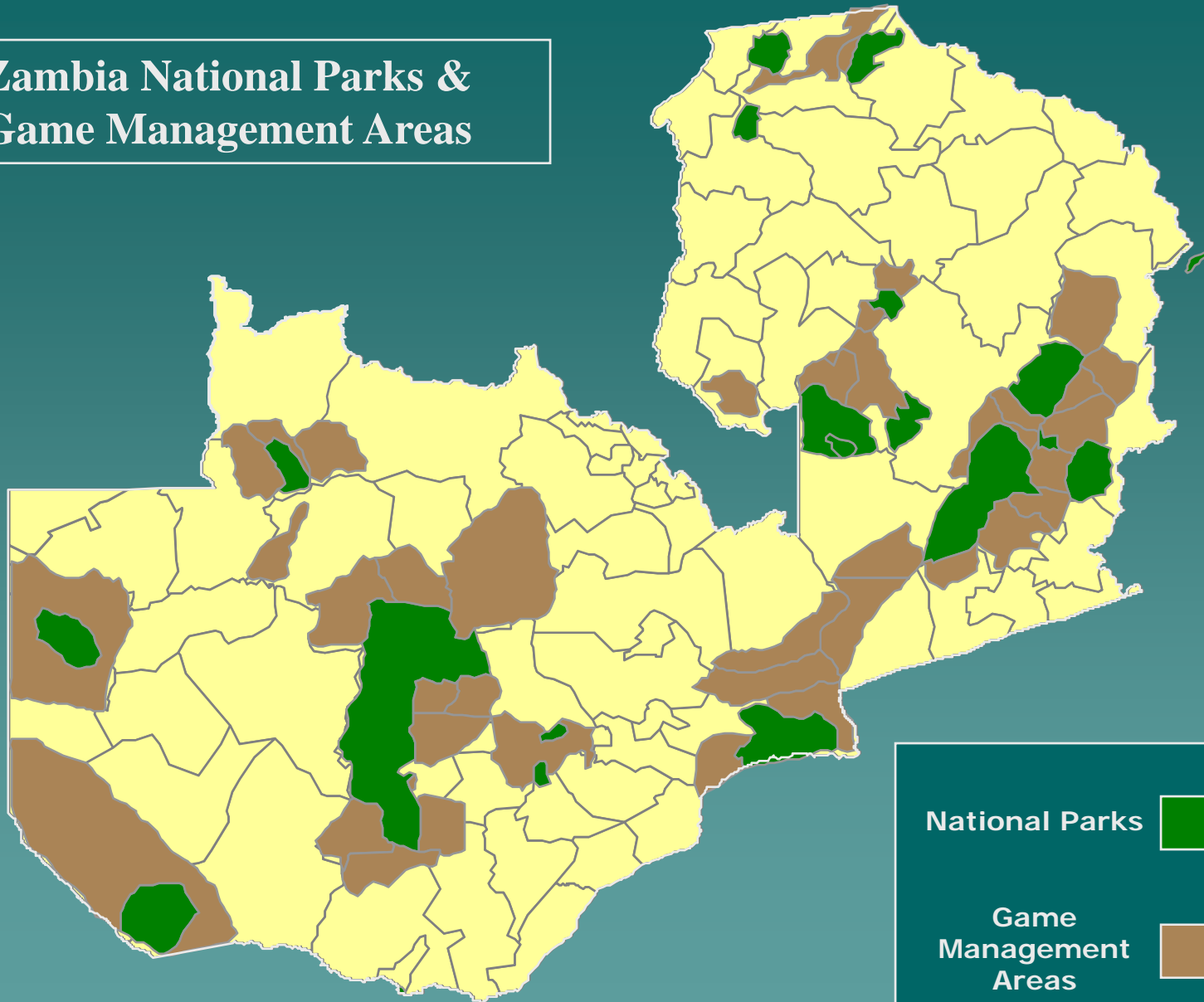


Game Management Areas

- ◆ Buffer zones around national parks
- ◆ Licensed safari and subsistence hunting are controlled by permit
- ◆ Protected Area system covers about 30% of Zambia
 - 19 national parks
 - 35 game management areas (GMAs)



Zambia National Parks & Game Management Areas



National Parks



Game Management Areas



Game Management Areas *(continued)*

- ◆ Zambia Wildlife Authority (ZAWA)
- ◆ Shares hunting license revenues and wildlife management responsibilities with communities
 - Community Resource Boards (CRBs)
 - Village Action Groups (VAGs)
- ◆ Dual objectives of wildlife conservation and rural development
 - Employment of village scouts
 - Development projects

Impact of Game Management Areas

- ◆ Benefits
 - Rural employment
 - Revenue sharing
 - Meat distributed after hunting
 - Development projects
- ◆ Crop damage
- ◆ Opportunity cost of alternative land uses



Research Questions

- ◆ How do GMAs affect household welfare?
 - Household income
 - Distributional effects
- ◆ What are the marginal effects of GMAs on crop losses from wildlife damage?



Data

- ◆ Stratified two-stage cluster sampling
- ◆ 139 statistical enumeration areas (SEAs) adjacent to four national park systems
- ◆ Rural household survey (cross-sectional data)
- ◆ 2,800 households selected
 - About half GMA and non-GMA (control)
 - Only about 32 non-response (1.1%)

Methods

Two models

1. Ordinary least squares (OLS) regression
 - Determinants of household income
2. Cragg double-hurdle model
 - Probability and value of crop losses from wildlife damages



Model 1: OLS Regression

- ◆ Welfare measured as total household income
- ◆ OLS regression

$$\ln Y_i = \alpha + \beta X_i + \gamma G + \varepsilon_i$$

- ◆ Y_i = total income for household i
- ◆ X_i = vector of household and community characteristics (education, size of household, assets, infrastructure)
- ◆ $G = 1$ if household lives in a GMA

Empirical Model

- ◆ OLS estimation
 - Welfare regression (determinants of income)
- ◆ Independent variables
 - Age, sex of head of household
 - Maximum education of household
 - Size of household (# males, females, children)
 - Remoteness (distance to main road)
 - Assets – durable assets, land holdings, livestock
 - Population density, infrastructure
 - GMA classification (stocking levels, diversity)

Descriptive Statistics

	Full Sample	GMA	Non-GMA	
Number of sample households	2,717	1,574	1,143	
Total household income (Kw)	4,235,762	3,591,253	5,123,301	*
Household size	5.28	5.08	5.57	***
Age of household head (in years)	42.46	41.00	44.48	***
Sex of household head (=1 if male)	0.74	0.73	0.76	**
Maximum education (in years)	6.78	6.42	7.27	***
Number of children (< 15 years)	2.55	2.46	2.67	***
Number of female adults	1.10	1.08	1.12	
Number of male adults	1.03	1.00	1.07	**
Distance to nearest main road (km)	5.09	6.08	3.80	***
Cropped area (hectares)	0.92	0.93	0.92	

Significance based on t-test of unequal variance:

* 10% significance ** 5% significance *** 1% significance

Descriptive Statistics: *(continued)*

	Full Sample	GMA	Non-GMA	
Value of consumer assets (Kw)	401,588	285,362	561,641	**
Value of productive assets (Kw)	618,036	256,729	1,115,584	***
Population density (per sq km)	35.20	41.41	26.97	***
Infrastructure	3.62	3.64	3.59	
Tourist lodge in SEA (=1)	0.07	0.10	0.02	***
GMA-1 classification (=1 if primary)	0.17	0.30	n.a.	
GMA-2 classification (=1 if secondary or specialized)	0.20	0.35	n.a.	

Significance based on t-test of unequal variance:

* 10% significance ** 5% significance *** 1% significance

Impact on Household Income

Variable	Coeff (std error)	Sig.
Intercept	13.101 (0.12)	***
Age of household head (in years)	- 0.003 (0.00)	*
Sex of household head (=1 if male)	0.069 (0.06)	
Maximum education (in years)	0.043 (0.01)	***
Number of children (< 15 years)	0.019 (0.01)	
Number of female adults (15-60 years)	0.113 (0.03)	***
Number of male adults (15-60 years)	0.070 (0.03)	**
Distance to nearest main road (km)	- 0.005 (0.00)	***
Cropped area (hectares)	0.039 (0.02)	*
Log of consumer assets (Kw)	0.020 (0.00)	***
Log of productive assets (Kw)	0.010 (0.00)	***
Population density (per sq km)	0.001 (0.00)	***
Infrastructure	0.032 (0.01)	***
Tourist lodge in SEA (=1)	0.186 (0.10)	*
GMA-1 classification (=1 if primary GMA)	0.170 (0.08)	**
GMA-2 classification (=1 if secondary or specialized GMA)	0.022 (0.07)	

R-squared: 0.213

Significance based on t-test of unequal variance:

* 10% significance

** 5% significance

*** 1% significance

Impact on Household Income (*continued*)

- ◆ Education, number of adults, value of assets – positively associated with income
- ◆ Population density, infrastructure – significant positive association with income
- ◆ Remoteness, age of household head – negatively associated with income
- ◆ Tourist lodge, primary GMAs – positively associated with income
 - Household income in primary GMAs is 17% greater than without the GMA designation

Distribution of GMA Effect

- ◆ Stratified households by asset quintiles to investigate how GMA effect is distributed

Consumption assets	GMA 1	GMA 2
Lower 2 quintiles	0.033	-0.059
Lower 3 quintiles	0.031	0.040
Upper 2 quintiles	0.046**	-0.008

- ◆ Poorest 40% (and 60%) of the population are not significantly affected by GMAs
- ◆ Wealthiest 40% of the population are significantly and positively affected by GMAs
 - Income gains from living in a GMA are likely to be captured by non-poor segments of the population (better access to financial, human capital)

Model 2: Cragg Double-Hurdle

- ◆ Impact of GMA and household characteristics on crop damage
- ◆ Two-stage model
 1. $P(CD_i=1|X_i) = \gamma X_i + \mu_i$
 2. $\ln Y_i = \alpha + \beta X_i + \varepsilon_i$
 - CD = crop damage variable
 - X_i = vector of household and community characteristics (education, size of household, assets, infrastructure)
 - Y_i = value of crop losses



Variable Means – Crop Damage

	Full Sample	GMA	Non-GMA	
Number of sample households	2,717	1,574	1,143	
% of households that reported crop damage	13.6	16.5	9.6	***
Value of crop damage (Kw)	28,423	30,079	26,140	
Age of household head (in years)	42.46	41.00	44.48	***
Sex of household head (=1 if male)	0.74	0.73	0.76	**
Distance to nearest main road (km)	5.09	6.08	3.80	***
Cropped area (hectares)	0.92	0.93	0.92	
Population density (sq km)	35.20	41.41	26.97	***
Number of scouts	1.00	1.56	0.24	**

Cragg Double-Hurdle Results – Impact on Crop Damage

	Probit		CAPE		UAPE	
Age of household head	-0.000		0.002		-0.001	
Sex of household head	-0.006		0.032		-0.046	
Household size (#)	-0.006	**	-0.003		-0.076	**
Distance to nearest road (km)	0.001	**	-0.002		0.009	*
Cropped area (hectares)	0.010	**	-0.051	*	0.077	
Consumption assets (Kw)	-0.000		-0.000		-0.005	
Production durable assets (Kw)	-0.001	*	-0.002		-0.010	**
Population density	-0.000		-0.000		-0.000	
Infrastructure	-0.001		-0.002		-0.013	
Number of scouts (#)	0.004		0.006		0.053	*
Value of harvest	0.006	***	0.024	***	0.102	***
Primary GMA (=1)	0.161	***	0.010		1.486	***
Secondary GMA (=1)	0.122	***	0.022		1.238	***

Log-likelihood: -1513.7

Significance based on t-test of unequal variance:

* 10% significance

** 5% significance

*** 1% significance

Crop Damage: *(continued)*

- ◆ GMA households more likely to have crop damage
- ◆ Distance to main road - positively associated with crop damage
- ◆ GMA (primary) - positively associated with crop damage
- ◆ GMA (secondary and specialized) - positively associated but to a lesser extent than primary GMAs

Conclusions

- ◆ How do tourism and wildlife conservation affect household income?
 - Tourist lodges and primary GMAs are positively associated with income
 - Gains accrue primarily to non-poor households
- ◆ How do GMAs affect household welfare in terms of crop damage?
 - Primary GMAs are positively associated with both probability and value of crop damage losses
 - Findings suggest broader role for village scouts to curb crop damage
 - Mechanism for compensating farmers for losses?

Thank You!

