

Patrick Gonzalez, Benjamín Kroll, and Carlos R. Vargas. 2014. Tropical rainforest biodiversity and aboveground carbon changes and uncertainties in the Selva Central, Peru. *Forest Ecology and Management* 312: 78-91.

Appendix. Supplementary Material

Methods. Supplementary Details

A1. Research area

Elevation ranges from 263 to 4005 m (authors' analysis of the Shuttle Radar Topography Mission (SRTM) digital elevation model (DEM) [Farr et al., 2007]). Broad floodplains characterize the lowlands, while steep slopes and deep river valleys occur at higher elevations. Three soil types predominate: entisols in modern alluvial deposits, inceptisols in former alluvial deposits, and ultisols on hillsides (McClain and Cossío, 2003).

The research area is located administratively in the Provincia (Province) of Oxapampa of the Departamento (Department) of Pasco. The 2008 population density was 8 people km⁻² (authors' analysis of LandScan population data [Dobson et al., 2000]). Two-thirds of the population lives in villages or towns that occupy <5% of the land area. The population of the province grew at a rate of 2.2 % y⁻¹ between the 1993 and 2007 censuses (INEI, 2008). Four main ethnic groups live in the area: indigenous Yanesha, indigenous Quechua, Peruvian descendants of German immigrants from the 19th century, and immigrants from other parts of Peru.

The environmental history of the Selva Central began with the original habitation of the area by the Yanesha ethnic group (Santos-Granero and Barclay, 1998). Starting in 1635, the Spanish colonized the area and introduced sugar cane agriculture and cattle raising for export. Starting in 1847, German immigrants colonized the area and expanded coffee agriculture for export. After the first major road entered the area in 1943, timber harvesting greatly increased and, by the 1970s, one-fifth of the timber extracted in Peru came from the Selva Central. In 1985, completion of the *carretera marginal* (peripheral road) through the Selva Central brought an influx of immigrants from other parts of Peru and expansion of manioc and corn agriculture. People use fire to clear land. Land tenure is private.

A2. Landsat

We used Landsat satellite data to determine the spatial locations and extent of vegetation types. We used U.S. Geological Survey (USGS) Global Land Survey 2005 (Gutman et al., 2013) Landsat 5 Thematic Mapper (TM), Level 1 precision and terrain corrected (L1T) scenes LT50070672005209CUB00 (July 28, 2005) and LT50060672004216CUB00 (August 3, 2004). We also used images with the least cloud cover available as close as possible to 1990, the baseline year for the United Nations Framework Convention on Climate Change Clean Development Mechanism: Landsat 5 TM L1T scenes L5007067_06719870828 (August 28, 1987) and L5006067_06719890826 (August 26, 1989). The spatial resolution of Landsat data and all subsequent spatial analyses was 30 m.

We used ENVI 4.7/IDL 7.1 software to process Landsat data and conduct spatial analyses. We conducted atmospheric correction through dark-object subtraction (Chavez, 1988; Hilker et al., 2012), performed radiometric calibration with Landsat parameters (Chander et al., 2009), and conducted topographic correction through cosine correction (Teillet et al., 1982) for sun-canopy-sensor geometry (Gu and Gillespie, 1997) using the USGS-supplied DEM, derived from the SRTM DEM (Farr et al., 2007). We built a cloud mask using thresholds of corrected radiance values for all seven TM bands plus a three-pixel buffer to capture diffuse cloud edges and shadows. We built a surface water mask through spectral matching, using the matched filtering: spectral angle mapper ratio (Kruse et al., 1993). We created two image mosaics (hereafter 1989 and 2005) for the rectangular area of Fig. 1 (main article), keeping track of the year of acquisition of each pixel when calculating changes over time.

A3. Multivariate analyses of probabilities of factors explaining forest cover change

To examine the relative importance of different factors in explaining historical patterns of forest cover change, we analyzed seven factors important in the Selva Central: (1) distance to non-forest (for deforestation), (2) distance to forest (for reforestation), (3) elevation, (4) slope, (5) distance to rivers, (6) distance to roads, and (7) distance to villages or towns. For factors 1 and 2, we used the 1989 and 2005 land cover classifications. For factors 3 and 4, we used the USGS-supplied DEM. For factor 5, we manually traced the riverbanks in the 2005 Landsat mosaic. For factors 6 and 7, we manually traced roads and edges of town using the 1:100 000 scale Carta Nacional Topográfica of the Instituto Geográfico Nacional (Lima, Peru) and the 2005 Landsat

mosaic. For factors 5, 6, and 7, we conducted a spatial analysis of the distance of each 30 m pixel to the nearest feature. For all seven factors, we classified the continuous values of variables into discrete bins (ranges of values).

For each bin of each factor, we estimated the historical 1989-2005 probability of deforestation or reforestation as the quotient of the number of pixels deforested or reforested in the analysis area and the total number of forest or non-forest pixels, respectively, in the research area in 1989. For each factor, we fit empirical bivariate curves of deforestation or reforestation probability as a function of the value of a factor. For the curves for factors 1 and 2, we used the 1989 distance to non-forest or forest, respectively. We also determined the parameters of curves of standard error to produce three versions of each probability curve: central estimate, estimate using SE_{lower} (hereafter low), and the estimate using SE_{upper} (hereafter high).

To estimate the relative weight of each factor in explaining observed patterns of deforestation and reforestation, we conducted Principal Components Analyses (PCA; Pearson 1901) on the continuous-value versions of the factors. PCA determines the factors that account for most of the variability in a set of multivariate data. For deforestation, we analyzed factor 1 and factors 3 to 7. For reforestation, we analyzed factors 2 to 7. PCA output included six principal components (each a spatial data layer equal to a linear combination of the six factors), fraction of the variance in the data that each principal component explained, and the eigenvalue loadings of each factor for each principal component. The weight of each factor equals:

$$w_n = \frac{v_m}{\sum_{m=1}^i v_m} \frac{L_{mn}}{\sum_{n=1}^q \sum_{n=1}^i |L_{mn}|} \quad (\text{A1})$$

where w_n is the weight (range 0 to 1) of each factor (n) in explaining deforestation or, separately, reforestation, v_m is the fraction of variance explained by a principal component (m), L_{mn} is an eigenvalue loading, i is the total number of principal components (6), j is the number of factors (6), and q is the number of explanatory principal components (1 to 6), determined using the eigenvalue = 1 test (Kaiser, 1960).

A4. Multivariate analyses of probabilities of factors explaining forest cover change

With the probability curves and the weights for each factor, we calculated central, high, and low probabilities of deforestation and reforestation for each pixel in 2021. For factors 1 and

2, we used the 2005 values of distance to non-forest or forest, respectively. The other five factors remained the same. The mean deforestation and reforestation probabilities for the entire research area are equivalent to the projected rates of deforestation and reforestation. Those probabilities multiplied by the 2005 numbers of forest and non-forest pixels, respectively, in the research area give the number of pixels projected to experience deforestation and reforestation, respectively, by 2021. The locations of deforested and reforested pixels are projected as those pixels with the highest respective probabilities.

Within the projected deforestation area, the numbers of pixels that change from forest to low vegetation and forest to sparse vegetation is estimated by the historical fractions of these changes. The deforestation probability of a pixel determines its projected change, with pixels of higher probability projected as forest changing to sparse vegetation. An analogous process projects the numbers and locations of non-forest pixels changing to secondary and old-growth forest.

The numbers of pixels projected to experience degradation (old-growth to secondary forest) were projected by calculating the fraction of 1989 forest remaining forest in 2005 that was degraded and multiplying that fraction by the 2005 forest projected to remain forest in 2021. The locations of degraded forest pixels were projected as those pixels with the next highest probabilities of deforestation after the deforestation pixels. An analogous process projected the numbers and locations of accumulation (sparse vegetation to low vegetation) pixels.

Table A1. Selva Central field inventory plots.

Plot	Latitude (°S)	Longitude (°W)	Elevation (m)	Area (ha)	Species	Families	Trees	Carbon (Mg ha ⁻¹)	95% CI
<i>Old-growth forest</i>									
PAAZB1	10.45	75.08	586	0.32	85	31	226	72	27
PALLB1	10.34	75.06	469	0.32	83	28	194	104	43
PANEB1	10.25	75.27	392	0.36	87	34	222	89	34
PODEB1	10.14	75.56	1291	1	80	33	725	103	43
POPAB1	10.13	75.54	852	2	162	48	1682	93	41
<i>Secondary forest</i>									
HUPAP10	10.50	75.44	2088	1	37	24	656	35	10
HUPAP20	10.47	75.44	2073	1	51	28	907	51	11
HUPUA42	10.45	75.54	1919	1	29	21	589	28	6
HUPUP40	10.45	75.55	1931	1	30	20	545	23	4
OXSA15	10.57	75.38	2033	1	50	28	710	37	7
PAARA30	10.37	75.12	410	1	52	27	519	56	16
PAEPA20	10.32	75.16	617	1	76	27	649	69	19
PAEPP20	10.31	75.10	396	1	35	17	547	30	7
PAGAP10	10.25	75.16	351	1	46	22	637	41	9
POLTP21	10.04	75.53	1037	1.08	32	19	531	22	6
POPAA20	10.07	75.55	814	0.9	41	23	446	31	8
POPAA30	10.07	75.55	832	1	50	23	599	56	19
POPPP30	10.14	75.54	952	0.64	27	17	454	53	17

Carbon = aboveground live carbon in trees $d_{bh} \geq 10$ cm

Table A2. Variables used in the main article.

Symbol	Variable	Units
\wedge	denotes the form of a variable that includes a modeled estimate of error	
95% CI	95% confidence interval	
A	land area	ha
a	coefficient in an allometric equation of biomass of a tree	
B_{plot}	aboveground tree biomass density of a plot	Mg ha ⁻¹
b	coefficient in an allometric equation of biomass of a tree	
b_{tree}	aboveground biomass of a tree	kg tree ⁻¹
$C^{2.5}$	2.5th percentile of 100 realizations of carbon stock	
$C^{97.5}$	97.5th percentile of 100 realizations of carbon stock	
$C_{\text{forest type}}$	aboveground tree carbon density of a forest type	Mg ha ⁻¹
CI	confidence interval	
$c_{\text{research area}}$	carbon stock of the research area	Mg
d_{bh}	diameter at breast height ($h = 1.3$ m)	cm
$\Delta c_{\text{research area}}$	carbon change of the research area	Mg
$e_{\text{classification}}$	fractional error of our deforestation classification	
f_C	carbon fraction of biomass	g carbon [g biomass] ⁻¹
h	height	m
i	total number of principal components	
j	number of factors explaining deforestation or reforestation	
L_{mn}	eigenvalue loading	
m	principal component	
n	factor explaining deforestation or reforestation	
P	probability of that a test statistic is due to randomness	
q	number of explanatory principal components	
r^2_{adj}	adjusted coefficient of determination	
ρ	wood density of an allometric equation	g cm ⁻³
SD	standard deviation	
SE	standard error	
uncertainty	95% CI as a fraction of the mean	%
v_m	fraction of variance explained by a principal component	
w_n	weight of a factor in explaining deforestation or reforestation	range 0 to 1
X_{variable}	a random number from a normal distribution with mean = 0 and SD = 1	
z	slope of the species-area relationship	

Table A3. Selva Central tree species from original field inventories. Local names are consistent with Aróstegui (1974) and scientific names are consistent with botanical records of the Missouri Botanical Garden (Brako and Zarucchi, 1993; Tropicos database <<http://www.tropicos.org>>).

Genus	Species	Local name	Family
Abuta	sp.	trompetero sachá	Menispermaceae
Agonandra	sp.	estaquilla	Opiliaceae
Alchornea	sp.	palo paloma	Euphorbiaceae
Allophylus	sp.	huacapulillo	Sapindaceae
Amburana	cearensis	ishpingo	Fabaceae
Anacardium	sp.		Anacardiaceae
Anadenanthera	colubrina	vilco	Fabaceae
Aniba	firmula	alcanfor amarillo	Lauraceae
Aniba	megaphylla	moena	Lauraceae
Aniba	puchury-minor	moena amarilla	Lauraceae
Aniba	sp.	alcanfor de altura	Lauraceae
Aniba	sp.	moena de altura	Lauraceae
Annona	sp.	anona	Annonaceae
Annona	sp.	anona cenizo	Annonaceae
Annona	sp.	anonilla	Annonaceae
Annona	sp.	anonilla blanca	Annonaceae
Annona	sp.	anonilla canela	Annonaceae
Annona	sp.	anonilla negra	Annonaceae
Annona	sp.	anonilla verdadera	Annonaceae
Apeiba	aspera	peine de mono, maquizapa nagcha, llausaquiro	Malvaceae
Aspidosperma	macrocarpon	pumaquiro	Apocynaceae
Aspidosperma	parvifolium	quillabordón, quillabordón amarillo	Apocynaceae
Astrocaryum	sp.	masanque, huicungo	Arecaceae
Banara	nitida		Salicaceae
Batocarpus	amazonicus	matapalo de raíz roja	Moraceae
Batocarpus	orinocensis	mallam	Moraceae
Bellucia	pentamera	estrella	Melastomataceae
Bixa	arborea	achotillo	Bixaceae
Bixa	orellana	achiote, achote	Bixaceae
Brosimum	alicastrum	congona, manchinga, charo	Moraceae
Brosimum	lactescens	pan de árbol de monte	Moraceae
Brosimum	sp.		Moraceae
Brosimum	sp.	congonilla	Moraceae
Brosimum	utile	loro micuna	Moraceae
Byrsonima	arthropoda		Malpighiaceae
Cabralea	sp.	cedro macho	Meliaceae
Caesalpinia	spinosa	tara	Caesalpinaceae
Calatola	sp.		Icacinaceae
Calliandra	angustifolia	bobinsana, bobinsana de altura	Fabaceae
Calophyllum	brasiliense	lagarto caspi	Calophyllaceae
Calycophyllum	spruceanum	capirona	Rubiaceae
Cariniana	decandra	cachimba rosada	Lecythidaceae
Cariniana	sp.	cachimba	Lecythidaceae
Caryocar	glabrum	almendro	Caryocaraceae
Caryocar	sp.		Caryocaraceae
Casearia	arborea	limón de monte	Salicaceae
Casearia	sp.	barba de león, garahuasca	Salicaceae
Cecropia	sp.	cetico, tacona	Urticaceae

Genus	Species	Local name	Family
Cedrela	odorata	cedro	Meliaceae
Cedrela	sp.	cedro cotrina	Meliaceae
Cedrela	sp.	cedro perejil	Meliaceae
Cedrela	sp.	cedro rojo	Meliaceae
Cedrelinga	cateniformis	tornillo	Fabaceae
Ceiba	insignis	palo algodón	Malvaceae
Ceiba	pentandra	lupuna, huimba	Malvaceae
Celtis	schippii	quina quina blanca	Cannabaceae
Ceroxylum	sp.	palma real, palmiche	Arecaceae
Cestrum	auriculatum	hierba santa	Solanaceae
Cheiloclinium	cognatum		Celastraceae
Chimarrhis	hookeri	facucho	Rubiaceae
Chimarrhis	sp.	facucho amarillo	Rubiaceae
Chimarrhis	sp.	facucho de altura	Rubiaceae
Chimarrhis	sp.	palo agua	Rubiaceae
Chlorophora	tinctoria	turcash	Moraceae
Chrysochlamys	weberbaueri	lucma colorada, lucma rosada, lucmilla	Clusiaceae
		colorado	
Cinchona	decurentifolia	cascarilla blanca	Rubiaceae
Cinchona	micrantha		Rubiaceae
Cinchona	officinalis	cascarilla	Rubiaceae
Cinchona	sp.	cascarilla colorada	Rubiaceae
Cinchona	sp.	cascarilla macho	Rubiaceae
Cinnamomum	camphora	alcanfor	Lauraceae
Clarisia	biflora	pan de fruta	Moraceae
Clarisia	racemosa	machonaste, turpay, turpay amarillo	Moraceae
Clarisia	sp.	tulpay blanco	Moraceae
Clethra	scabra	paco paco	Clethraceae
Clusia	trochiformis	inciencio	Clusiaceae
Cordia	alliodora	grau anona	Boraginaceae
Cordia	sp.		Boraginaceae
Cordia	sp.	lucumbilla	Boraginaceae
Cordia	sp.	yanagara	Boraginaceae
Couma	macrocarpa	leche caspi	Apocynaceae
Coussapoa	sp.		Urticaceae
Croton	draconoides	rampa rampa, sangre de grado	Euphorbiaceae
Croton	sp.		Euphorbiaceae
Cupania	sp.		Sapindaceae
Cupania	sp.	misho pacay	Sapindaceae
Cyathea	sp.	helecho arboreo, auquish	Cyatheaceae
Cyathea	sp.	San Juan	Cyatheaceae
Dacryodes	roraimensis	copalillo blanco	Bursereaceae
Dendropanax	sp.		Araliaceae
Dictyocaryum	sp.	basanco	Arecaceae
Didymopanax	morototoni	palo pinsha, sachauva	Araliaceae
Didymopanax	sp.	tacona de monterreal	Araliaceae
Diplostropis	martiusii	chontaquiro	Fabaceae
Eriotheca	globosa	algodón de monte	Malvaceae
Erythrina	amazonica	oropel	Fabaceae
Erythrina	sp.	pajuro, pashullo, pucherin	Fabaceae
Eschweilera	juruensis	machimango, palo misho	Lecythidaceae
Euterpe	precatoria	huasaí, chonta	Arecaceae
Ficus	anthelmintica	ojé	Moraceae
Ficus	sp.	matapalo	Moraceae

Genus	Species	Local name	Family
Ficus	sp.	matapalo amarillo	Moraceae
Ficus	sp.	matapalo blanco	Moraceae
Ficus	sp.	matapalo caspi	Moraceae
Ficus	sp.	matapalo colorado	Moraceae
Ficus	sp.	matapalo yuca	Moraceae
Gavaretia	terminalis	palo paloma de monte	Euphorbiaceae
Genipa	americana	palo poto, huito	Rubiaceae
Gordonia	sp.	huamanchilca	Theaceae
Guarea	kunthiana		Meliaceae
Guarea	pteriorhachis		Meliaceae
Guarea	sp.		Meliaceae
Guarea	sp.	cedro de agua	Meliaceae
Guarea	guidonia	requia	Meliaceae
Guatteria	sp.		Annonaceae
Guatteria	sp.	sampama rojo	Annonaceae
Guatteria	sp.	sampama, sampama rojo	Annonaceae
Guazuma	crinita	bolaina	Malvaceae
Guazuma	sp.	bolaina amarilla	Malvaceae
Handroanthus	serratifolius	chontaquiro amarillo	Bignoniaceae
Hasseltia	floribunda		Salicaceae
Hedyosmum	sp.	aitacopa	Chloranthaceae
Heisteria	sp.	corteza colorada	Olacaceae
Helicostylis	sp.		Moraceae
Heliocarpus	popayanensis	huampo	Malvaceae
Heliocarpus	sp.	huampo blanco	Malvaceae
Hevea	brasiliensis	shiringa blanca	Euphorbiaceae
Hevea	guianensis	shiringa amarilla	Euphorbiaceae
Himatanthus	sp.		Apocynaceae
Himatanthus	sucuuba	bellaco caspi	Apocynaceae
Huberodendron	swietenoides	aguano masha	Malvaceae
Huertea	glandulosa	nogal blanco	Tapisciaceae
Hymenolobium	sp.	roble rosado	Fabaceae
Inga	capitata		Fabaceae
Inga	marginata	pacay maní	Fabaceae
Inga	pavoniana	pacaycillo	Fabaceae
Inga	sp.	pacay	Fabaceae
Inga	sp.	pacay ácido	Fabaceae
Inga	sp.	pacay blanco	Fabaceae
Inga	sp.	pacay colorado	Fabaceae
Inga	sp.	pacay de monte	Fabaceae
Inga	sp.	pacay hoja fina	Fabaceae
Inga	sp.	pacay loro	Fabaceae
Inga	sp.	pacay negro	Fabaceae
Inga	sp.	pacay peludo	Fabaceae
Inga	sp.	pacay playa	Fabaceae
Inga	sp.	pacay rojo	Fabaceae
Inga	sp.	pacaycillo blanco	Fabaceae
Inga	sp.	pacaycillo colorado	Fabaceae
Iriarteia	deltoidea	camona, camona sin patas, pona	Arecaceae
Iryanthera	juruensis	cumalilla colorada	Myristicaceae
Iryanthera	laevis	cumalilla colorada	Myristicaceae
Iryanthera	sp.	cumalilla amarilla	Myristicaceae
Iryanthera	sp.	cumalilla amarilla zancuda	Myristicaceae
Iryanthera	sp.	cumalilla rosada	Myristicaceae

Genus	Species	Local name	Family
Iryanthera	tessmannii	cumalilla	Myristicaceae
Jacaranda	copaia	charapach, charapach colorado, huamansamana	Bignoniaceae
Jacaratia	digitata	papaya de monte, papayita de monte, palo queso	Caricaceae
Juglans	neotropica	nogal	Juglandaceae
Lacmellea	peruviana	chochoque	Apocynaceae
Laetia	procera	quillabordón blanco	Salicaceae
Leandra	longicoma	tiri lanudo	Melastomataceae
Lecointea	peruviana	come cebo	Fabaceae
Lecointea	sp.	come cebo blanco	Fabaceae
Leonia	glyycarpa	naranja de mono	Violaceae
Leonia	sp.		Violaceae
Leonia	sp.	huevo de sajino	Violaceae
Lonchocarpus	nicou	barbasco	Fabaceae
Lonchocarpus	sp.	barbasco blanco	Fabaceae
Mabea	maynensis	boquilla	Euphorbiaceae
Mabea	sp.		Euphorbiaceae
Mabea	sp.	boquilla hoja ancha	Euphorbiaceae
Mabea	sp.	boquilla hoja chica, boquilla hoja fina	Euphorbiaceae
Mabea	sp.	boquilla hoja grande	Euphorbiaceae
Macrobium	sp.	palo cal	Fabaceae
Macrobium	sp.	palo cal hoja fina	Fabaceae
Mangifera	indica	mango	Anacardiaceae
Marila	laxiflora	leña cenizo	Calophyllaceae
Marila	sp.		Calophyllaceae
Matisia	bicolor	machín sapote	Malvaceae
Matisia	cordata	sapote, palo tambor	Malvaceae
Maytenus	macrocarpa	chuchuhuasi	Celastraceae
Maytenus	sp.	chuchuhuasi blanco	Celastraceae
Meliosma	bogotana	meón	Sabiaceae
Meliosma	sp.		Sabiaceae
Meliosma	sp.	palo batea	Sabiaceae
Miconia	calvescens	palo gusano	Melastomataceae
Miconia	sp.		Melastomataceae
Miconia	sp.	chilca	Melastomataceae
Miconia	sp.	chilca amarilla	Melastomataceae
Miconia	sp.	chilca blanca	Melastomataceae
Miconia	sp.	monero caspi, manzanilla	Melastomataceae
Miconia	sp.	moronque	Melastomataceae
Miconia	sp.	palo pajarito	Melastomataceae
Miconia	sp.	tiri amarillo	Melastomataceae
Miconia	sp.	tiri naranja	Melastomataceae
Miconia	sp.	tiri tiri	Melastomataceae
Miconia	theizans	tiri blanco	Melastomataceae
Micrandra	sp.	carapacho colorado	Euphorbiaceae
Micrandra	spruceana	carapacho	Euphorbiaceae
Micropholis	sp.		Sapotaceae
Micropholis	sp.	caimito rojo	Sapotaceae
Micropholis	sp.	caimito rupino	Sapotaceae
Minquartia	guianensis	huacapú	Olacaceae
Myrcia	sp.	cien años	Myrtaceae
Myrcia	sp.	shacshapullay hoja menuda	Myrtaceae
Myrcia	sp.	shacshapullay, shacshapullay crespo	Myrtaceae

Genus	Species	Local name	Family
Myroxylon	balsamum	estoraque, quina quina	Fabaceae
Myrsine	sp.	lucma	Primulaceae
Myrsine	sp.	lucma amarilla	Primulaceae
Myrsine	sp.	lucma hoja chica	Primulaceae
Myrsine	sp.	lucma hoja fina	Primulaceae
Myrsine	sp.	lucma hoja grande	Primulaceae
Nealchornea	yapurensis		Euphorbiaceae
Neea	sp.		Nyctaginaceae
Neea	sp.	tuna de monte	Nyctaginaceae
Ochroma	pyramidale	huampo negro, topa	Malvaceae
Ocotea	aciphylla	roble alcanfor	Lauraceae
Ocotea	sp.		Lauraceae
Ocotea	tarapotana	canela	Lauraceae
Oreopanax	sp.	maqui maqui	Araliaceae
Ormosia	coccinea	huayruro amarillo	Fabaceae
Ormosia	schunkei	huayruro	Fabaceae
Ormosia	sp.		Fabaceae
Otoba	parvifolia		Myristicaceae
Oxandra	sp.	pintanilla	Annonaceae
Oxandra	sp.	pintanilla blanca	Annonaceae
Pachira	sp.		Malvaceae
Parkia	nitida	pashaco	Fabaceae
Parkia	sp.	pashaco oreja	Fabaceae
Peltogyne	sp.		Fabaceae
Pentagonia	parvifolia	guayaba maquisapa	Rubiaceae
Pentagonia	sp.		Rubiaceae
Perebea	sp.		Moraceae
Persea	americana	palta	Lauraceae
Persea	sp.	palta plano	Lauraceae
Piper	sp.	matico	Piperaceae
Piptadenia	sp.	vilco amarillo	Fabaceae
Piptadenia	sp.	vilco colorado	Fabaceae
Piptadenia	sp.	vilco espina larga	Fabaceae
Piptadenia	sp.	vilco espinoso	Fabaceae
Pithecellobium	pedicellare	pino blanco, pino de altura	Fabaceae
Platymiscium	sp.		Fabaceae
Pollalesta	sp.	rompe machete	Asteraceae
Poulsenia	armata	llancham	Moraceae
Poulsenia	sp.		Moraceae
Pourouma	cecropiifolia	uvas de monte	Urticaceae
Pourouma	guianensis	tacona de lija	Urticaceae
Pourouma	sp.		Urticaceae
Pourouma	sp.	uvilla	Urticaceae
Pouteria	caimito	caimitillo, caimitillo amarillo	Sapotaceae
Pouteria	sp.		Sapotaceae
Pouteria	sp.	caimitillo blanco	Sapotaceae
Pouteria	sp.	caimitillo lanoso	Sapotaceae
Pouteria	sp.	caimito blanco	Sapotaceae
Pouteria	sp.	caimito ciprel	Sapotaceae
Pouteria	sp.	caimito colorado	Sapotaceae
Pouteria	sp.	caimito orejón	Sapotaceae
Pouteria	torta	caimito, caimito amarillo	Sapotaceae
Protium	sp.		Bursaceae
Protium	sp.	copal	Bursaceae

Genus	Species	Local name	Family
Protium	sp.	copal blanco	Burseraceae
Pseudobombax	septenatum	algodón botella	Malvaceae
Pseudolmedia	laevis	lechero amarillo	Moraceae
Psidium	guajava	guayaba	Myrtaceae
Quararibea	ochrocalyx		Malvaceae
Quararibea	sp.	sapotillo	Malvaceae
Quiina	sp.		Ochnaceae
Rapanea	sp.	gallguan, palo pesado	Primulaceae
Rheedia	sp.		Clusiaceae
Rheedia	sp.	durazno calato	Clusiaceae
Rheedia	sp.	durazno con espina	Clusiaceae
Rheedia	sp.	durazno, durazno amarillo	Clusiaceae
Rinorea	sp.		Violaceae
Rollinia	sp.	anonilla amarilla	Annonaceae
Salacia	sp.		Salaciaceae
Sapium	laurifolium	gutapercha, cortapeche	Euphorbiaceae
Sapium	sp.	palo leche, lechero	Euphorbiaceae
Sarcaulus	brasiliensis		Sapotaceae
Schizolobium	amazonicum	pino	Fabaceae
Sickingia	sp.	huacamayo	Rubiaceae
Simarouba	amara	marupá	Simaroubaceae
Sloanea	sp.		Elaeocarpaceae
Sloanea	sp.	achotillo hoja chica	Elaeocarpaceae
Sloanea	sp.	achotillo pumaquiro	Elaeocarpaceae
Socratea	sp.		Arecaceae
Socratea	sp.	camona con patas	Arecaceae
Sorocea	briquetii		Moraceae
Sorocea	hirtella		Moraceae
Sorocea	sp.		Moraceae
Sterculia	sp.		Malvaceae
Sterculia	stipulifera		Malvaceae
Styrax	sp.		Styracaceae
Swartzia	arborescens	palo ají	Fabaceae
Swartzia	sp.	ají de monte	Fabaceae
Swietenia	macrophylla	caoba	Meliaceae
Symphonia	globulifera	azufre caspi, palo azufre	Clusiaceae
Tabebuia	sp.	palo papelillo	Bignoniaceae
Tachigali	sp.	chaira pacay	Fabaceae
Tachigali	sp.	chaira pacay colorado	Fabaceae
Tachigali	sp.	chaira pacay hoja fina	Fabaceae
Tapirira	guianensis	copal rosado	Anacardiaceae
Tapirira	sp.		Anacardiaceae
Terminalia	amazonica	tacho, tacho cresco	Combretaceae
Terminalia	oblonga	yacushapana	Combretaceae
Tetragastris	sp.	copalillo	Burseraceae
Tetragastris	sp.	copalillo hoja fina	Burseraceae
Tetrorchidium	rubrivenium	col de monte	Euphorbiaceae
Theobroma	cacao	cacao	Malvaceae
Theobroma	obovatum	cacao de monte	Malvaceae
Tovomita	sp.		Clusiaceae
Tovomitopsis	sp.	lucmilla	Clusiaceae
Tovomitopsis	sp.	lucmilla amarilla	Clusiaceae
Tovomitopsis	sp.	lucmilla rosada	Clusiaceae
Toxicodendron	sp.	maico blanco	Anacardiaceae

Genus	Species	Local name	Family
Toxicodendron	striatum	maico	Anacardiaceae
Trema	micrantha	atadijo, chicchilmay, pasalla, pasalla de monte	Cannabaceae
Trichilia	septentrionalis	requia amarilla	Meliaceae
Trichilia	sp.		Meliaceae
Trichilia	sp.	requia paujil	Meliaceae
Triplaris	americana	santo palo, palo santo, tangarana	Polygonaceae
Triplaris	sp.		Polygonaceae
Trophis	sp.		Moraceae
Turpinia	occidentalis		Staphyleaceae
Urera	caracasana	ishanca, ishanga	Urticaceae
Urera	sp.	ishanca buena	Urticaceae
Urera	sp.	ishanca burro	Urticaceae
Urera	sp.	ishanca caliche	Urticaceae
Vatairea	sp.	chontaquiro negro	Fabaceae
Vatairea	sp.	chontaquiro negro hoja lanosa	Fabaceae
Vatairea	sp.	chontaquiro negro hoja fina	Fabaceae
Vernonia	sp.	ticsa micuna	Asteraceae
Viola	calophylla	cumala amarilla	Myristicaceae
Viola	elongata	cumala rosada	Myristicaceae
Viola	sebifera	cumala	Myristicaceae
Viola	sp.		Myristicaceae
Viola	sp.	banderilla	Myristicaceae
Viola	sp.	cumala amarilla zaranda	Myristicaceae
Viola	sp.	cumala gigante	Myristicaceae
Viola	sp.	cumala gigante hoja ancha	Myristicaceae
Viola	sp.	cumala gigante hoja grande	Myristicaceae
Viola	sp.	cumala sajino	Myristicaceae
Viola	sp.	prusiano	Myristicaceae
Vismia	baccifera	café de monte, palo café, sogorapra	Hypericaceae
Vismia	sp.	café caspi	Hypericaceae
Vismia	sp.	café de monte hoja chica	Hypericaceae
Vismia	sp.	café de monte hoja grande	Hypericaceae
Vitex	sp.	huacapú amarillo	Lamiaceae
Vitex	triflora	aceituna caspi	Lamiaceae
Weinmannia	sp.	perejil	Cunoniaceae
Xylopi	sp.	pintana	Annonaceae
Xylopi	sp.	pintana blanca	Annonaceae
Zanthoxylum	sp.	chincho de monte	Rutaceae
Zanthoxylum	sp.	naranja de monte	Rutaceae
Zanthoxylum	sp.	palo espina	Rutaceae
Genus	sp.	anís	Lauraceae
Genus	sp.	azul huayte	Familia
Genus	sp.	callihuanco	Lauraceae
Genus	sp.	capinurí	Moraceae
Genus	sp.	carhuania	Familia
Genus	sp.	cashintoqui	Familia
Genus	sp.	chancaca	Familia
Genus	sp.	chilizo	Familia
Genus	sp.	chirimoya de monte	Annonaceae
Genus	sp.	corteza	Familia
Genus	sp.	cuerpo espin	Familia
Genus	sp.	cuñupa	Familia
Genus	sp.	delfiner	Familia

Genus	Species	Local name	Family
Genus	sp.	fruta negra	Myrtaceae
Genus	sp.	gasacsiqui, tocra	Asteraceae
Genus	sp.	gaspar amarillo, macollo	Lauraceae
Genus	sp.	gavilán	Chrysobalanaceae
Genus	sp.	gavilancillo	Chrysobalanaceae
Genus	sp.	gavilancillo hoja lanosa	Chrysobalanaceae
Genus	sp.	goriplano	Lauraceae
Genus	sp.	goriplano colorado	Lauraceae
Genus	sp.	guayabilla	Myrtaceae
Genus	sp.	guayaquil	Arecaceae
Genus	sp.	huanchuiro	Familia
Genus	sp.	huaya	Familia
Genus	sp.	llaulina	Familia
Genus	sp.	llojtacho	Myrtaceae
Genus	sp.	mancarron blanco	Solanaceae
Genus	sp.	mano del diablo	Araliaceae
Genus	sp.	manzanita de monte	Myrtaceae
Genus	sp.	palo acero	Familia
Genus	sp.	palo cocina	Lauraceae
Genus	sp.	palo cocina amarillo	Lauraceae
Genus	sp.	palo culebra	Rubiaceae
Genus	sp.	palo hueso	Myrtaceae
Genus	sp.	palo liso	Lauraceae
Genus	sp.	palo motelo	Myrtaceae
Genus	sp.	palo perdiz	Rubiaceae
Genus	sp.	pama	Moraceae
Genus	sp.	parihuana, parihuana amarilla	Familia
Genus	sp.	pega pega	Familia
Genus	sp.	piri piri	Familia
Genus	sp.	plano blanco	Lauraceae
Genus	sp.	polipunto	Rubiaceae
Genus	sp.	raquie	Araliaceae
Genus	sp.	roble	Lauraceae
Genus	sp.	roble amarillo	Lauraceae
Genus	sp.	roble blanco	Lauraceae
Genus	sp.	roble canela	Lauraceae
Genus	sp.	roble hueso	Lauraceae
Genus	sp.	roble manzana	Lauraceae
Genus	sp.	roble negro	Lauraceae
Genus	sp.	roble playa	Lauraceae
Genus	sp.	roble zapallo	Lauraceae
Genus	sp.	roblecillo	Lauraceae
Genus	sp.	roblecillo amarillo	Lauraceae
Genus	sp.	sacha plano	Lauraceae
Genus	sp.	sandia olorosa	Familia
Genus	sp.	sara	Meliaceae
Genus	sp.	shatuna	Moraceae
Genus	sp.	suda sangre	Myristicaceae
Genus	sp.	tacho amarillo	Euphorbiaceae
Genus	sp.	tacho de pampa	Combretaceae
Genus	sp.	taparaco	Rubiaceae
Genus	sp.	taurano	Familia
Genus	sp.	trébol	Familia
Genus	sp.	ushpinca	Lauraceae

Genus	Species	Local name	Family
Genus	sp.		Araliaceae
Genus	sp.		Burseraceae
Genus	sp.		Clusiaceae
Genus	sp.		Euphorbiaceae
Genus	sp.		Fabaceae
Genus	sp.		Lauraceae
Genus	sp.		Melastomataceae
Genus	sp.		Meliaceae
Genus	sp.		Moraceae
Genus	sp.		Myrtaceae
Genus	sp.		Rubiaceae
Genus	sp.		Salicaceae
Genus	sp.		Sapotaceae
Genus	sp.		Solanaceae
Genus	sp.		(Old-growth forest)
Genus	sp.		(Secondary forest)

Table A4. Sensitivity of uncertainty estimates to errors of individual variables.

Error source	95% CI	Uncertainty
<i>Old-growth forest carbon density</i>	(Mg ha ⁻¹)	(%)
All variables	39	42
Allometric equations only	38	41
Carbon fraction only	4	4
Diameter measurement only	1	1
Wood density only	2	2
<i>Secondary forest carbon density</i>	(Mg ha ⁻¹)	(%)
All variables	10	24
Allometric equations only	9	21
Carbon fraction only	2	4
Diameter measurement only	0.3	1
Wood density only	1	3
<i>Net Carbon Change 1989-2005</i>	(10 ³ Mg)	(%)
All variables	410	26
Allometric equations only	64	4
Carbon fraction only	40	3
Diameter measurement only	41	3
Remote sensing only	410	26
Wood density only	41	3

Figure A1.

Probability of deforestation (thick red line) \pm SE (thin red lines),
derived from historical deforestation (black dots) in the Selva Central research area.

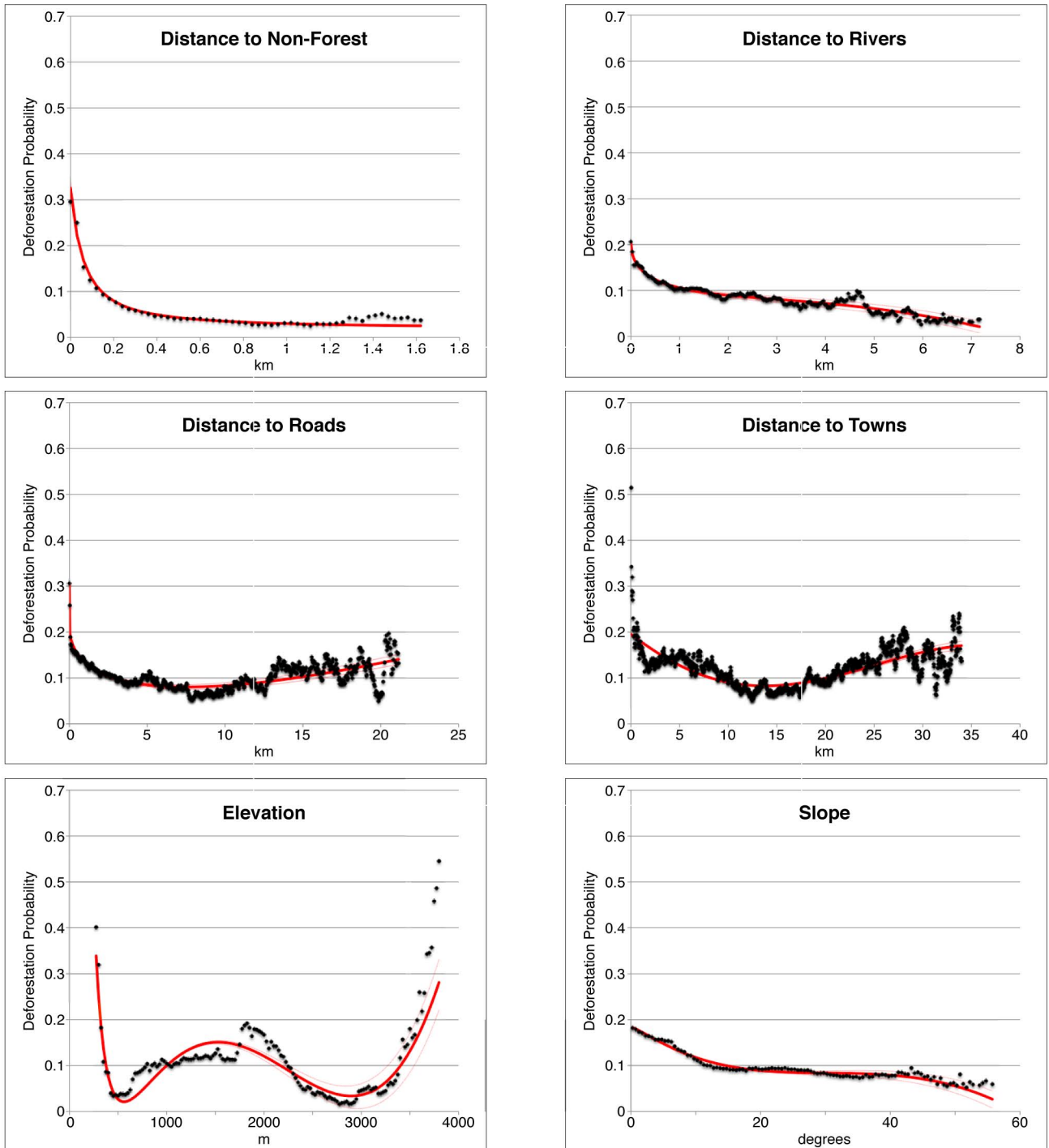
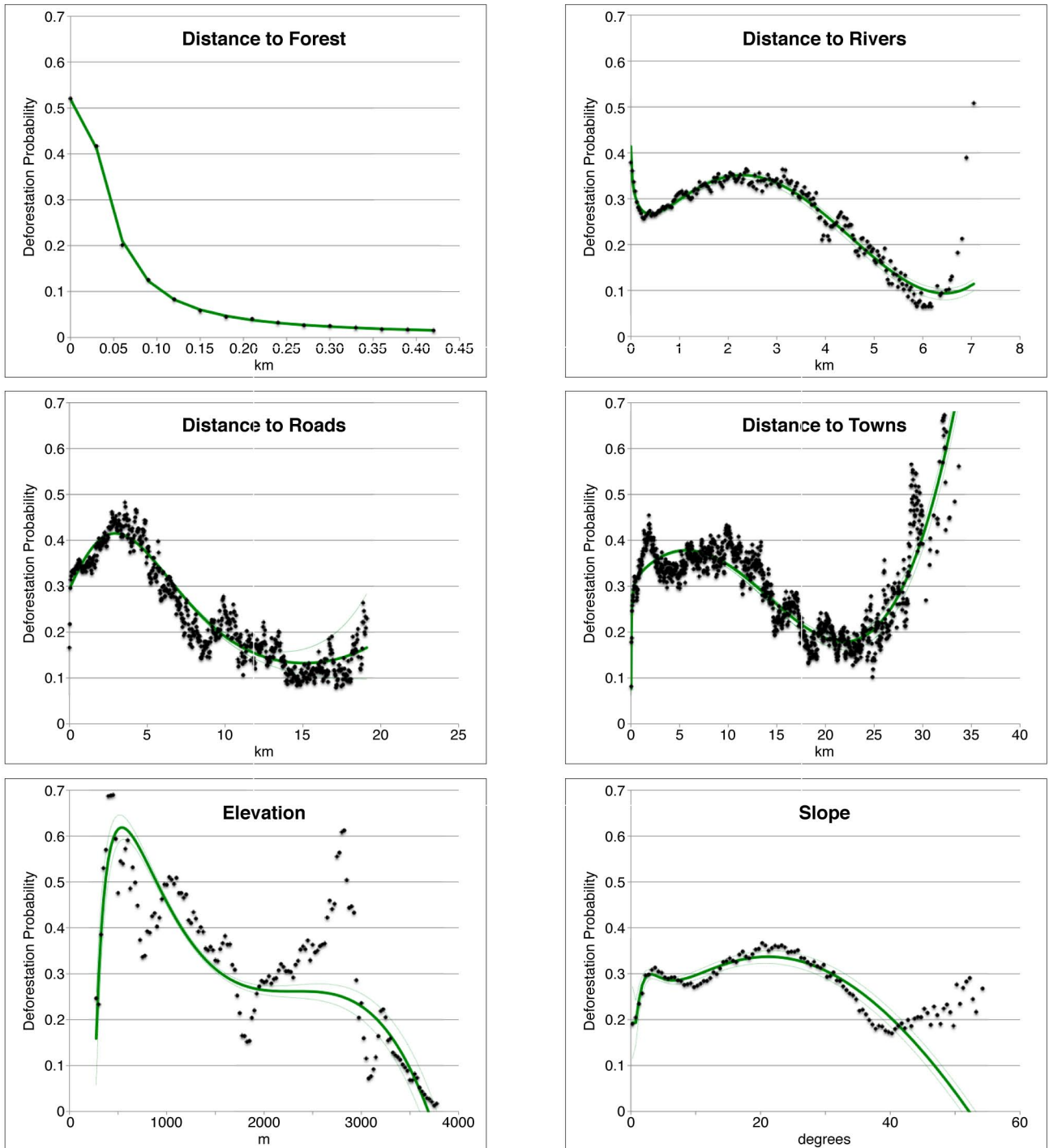


Figure A2.

Probability of reforestation (thick green line) \pm SE (thin green lines), derived from historical reforestation (black dots) in the Selva Central research area.



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