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RESEARCH BRIEF

Household dynamics and fuelwood consumption in developing countries: a cross-national analysis

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Abstract Previous research has suggested a link between household dynamics (i.e., average household size and number of households) and environmental impacts at the national level. Building on this work, we empirically test the relationship between household dynamics and fuelwood consumption, which has been implicated in anthropogenic threats to biodiversity. We focus our analysis on developing countries (where fuelwood is an important energy source). Our results show that nations with smaller average households consume more fuelwood per capita. This finding indicates that the household economies of scale are, indeed, associated with the consumption of fuelwood. In addition, we found that number of households is a better predictor of total fuelwood consumption than average household size suggesting a greater relative contribution to consumption levels. Thus, insofar as declining average household sizes result in increased number of households and higher per capita consumption, this trend may be a signal of serious threats to biodiversity and resource conservation. We also found further support for the "energy ladder" hypothesis that economic development reduces demand for traditional fuels.

Keywords Households · Fuelwood · Ecological footprint · STIRPAT

Household size has attracted interest in the socio-ecological literature due partly to demographic trends showing a steady decline in household size accompanied by an increase in the number of households. From 1970 to 2000, the average household size decreased from 5.1 to 4.4 in less developed countries and from 3.2 to 2.5 in more developed countries (Keilman 2003). As Bongaarts (2001) observes, the

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developing countries are slowly moving toward smaller, primarily nuclear households.[1] Combined with a stable or increasing population, this trend is accompanied by an increase in the number of households.

Empirical research has clearly established the scale of human populations as a key driving force,[2] along with consumption and technology, of threats to the environment and to sustainability more generally (Erlich and Holdren 1971; Commoner 1971; Dietz et al. 2007; Rosa et al. 2004; York et al. 2003a). However, the environmental effects of household dynamics (i.e., household size and number of households) have been relatively neglected, though it has begun to attract the attention of researchers in a variety of disciplines (MacKellar et al. 1995; Cramer 1998; O'Neill and Chen 2002; Cole and Neumayer 2004; Keilman 2003; Bin and Dowlatabadi 2005; Liu et al. 2001, 2003).

Our guiding question is this: Does an emphasis on total population as the key demographic variable in previous research mask other important ecological population-impact dynamics? To address this question, we analyze the effects of total population, number of households, and household size on fuelwood consumption.

Household dynamics and resource consumption

The household is an important, social unit that shapes individual consumption.[3] Considering both direct (i.e., utilities, transportation) and indirect household energy consumption (i.e., energy used in production and distribution of household goods and services and in disposal of consumer waste) up to 70–80% of a nation's energy consumption and greenhouse gas emissions may be related to household consumption (Moll et al. 2005). In addition, households exhibit economies of scale in the per capita consumption of food, transportation, and energy and other resources, meaning per capita consumption is higher in smaller households (Nelson 1988; Moll et al. 2005; O'Neill and Chen 2002; Ironmonger et al. 1995). This occurs because, among other things, household members share space, furniture, appliances, transportation, and energy (Keilman 2003).

[1] Research indicates that three factors explain the majority of cross-national variation in average household size among developing countries: level of fertility, mean age at marriage, and the level of marital disruption (i.e., divorce rates) (Bongaarts 2001). Furthermore, the decline in average household size has been attributed to a number of factors, such as increased standards of living, cultural and social change (e.g., gender norms), population aging, and declining fertility (Keilman 2003).

[2] The term "driving forces" or "drivers," familiar to several areas of research in the physical sciences such as plate tectonics and statistical thermodynamics, is new to the social sciences. More importantly, it has been universally adopted by natural scientists studying global environmental change to refer to what are presumed to be the most important factors producing environmental change. In the more generic language of science they are independent variables, particularly ones shown to have environmental effects.

[3] The household is both the physical structure and the locus of the majority of the decisions individuals make about environmentally significant consumption: about housing type, size, and location, types of temperature control and patterns of use, levels of energy efficiency in behavior or infrastructure, and households pattern a broad similarity in occupant lifestyles.

Liu et al. (2001, 2003) advanced the literature on households by examining the effect of household dynamics on threats to biodiversity. In a case study of Wolong Nature Reserve in China, Liu et al. (2001) found that a reduction in household size, and the associated increase in the number of households, resulted in increased fuelwood consumption, thereby decreasing the size of the giant panda habitat. Liu et al. (2003) attempted to generalize this finding. In particular, Liu et al. (2003) examined 76 hotspot countries and 65 non-hotspot countries and found that a combination of declining average household size and population growth resulted in more rapid growth in the number of households in hotspot countries than in non-hotspot countries.[4] They concluded that this represented a "double threat" to the environment, and especially biodiversity, because in addition to increased per capita consumption, smaller households also mean more households for a given population size that results in urban sprawl and higher demand for housing materials and other resources.

However, the generalizability and validity of these findings remain largely unsubstantiated for a number of reasons. First, Liu et al. (2001) provide a case study of only one location and Liu et al. (2003) did not directly, empirically assess the effect of household dynamics on resource consumption or biodiversity; the analysis only documented the differential trends in declining household size and asserted a link between this and biodiversity loss due to resource consumption. In addition, while household-level data indicate that larger households consume less fuelwood per capita, it is unclear if this relationship holds at the national level (Fleuret and Fleuret 1978; Ouerghi 1993). Second, other relevant factors were not controlled for (e.g., economic development and urbanization), so the relationship could be spurious. More generally, the literature as a whole suffers from several shortcomings. Many studies focus, not on actual impacts, but on precursors to impacts such as greenhouse gas emissions (MacKellar et al. 1995; Bin and Dowlatabadi 2005). Others restrict their analyses to the United States (O'Neill and Chen 2002), or to states within the US (Cramer 1998), leaving open the question of generalizability. However, some of the strongest evidence comes from multivariate cross-national panel analyses by Liddle (2004), who found that OECD countries with smaller average households exhibit higher per capita road energy use, and Cole and Neumayer (2004), who found that smaller average household size is associated with higher carbon dioxide emissions.

We hypothesize that household size has a negative effect on fuelwood consumption while number of households has a positive effect. We also assess the relative importance of these two variables in predicting fuelwood consumption. To test our hypotheses, we use the STIRPAT model with data on 87 developing countries. We focus on the links between household size, number of households, and fuelwood consumption since the context of our analysis is the Liu et al. (2001, 2003) results.

[4] Hotspots are "areas featuring exceptional concentrations of endemic species and experiencing exceptional loss of habitat" (Meyers et al. 2000:853).

Environmental implications of fuelwood consumption

It was estimated that in the late 1990s, about 3 billion people in the world (more than half of the global population at that time) relied on fuelwood for cooking and heating (Population Action International 1999). In addition, more than half of *all* wood harvested is used, not for products such as paper, building products, or veneer, but for fuel (Food and Agriculture Organization 2000). Developing countries account for most fuelwood consumption and more than 75% of wood harvested in these countries is for fuel (Food and Agriculture Organization 2000; Bearer et al. 2008). Deforestation and increasing demand for fuelwood have resulted in a looming fuelwood shortage crisis in many areas (Heltberg et al. 2000; Macht et al. 2007).

Fuelwood harvesting has been linked to deforestation (Amacher et al. 1993), but critics argue that most wood collected for fuel is dead wood and, therefore, does not exacerbate rates of deforestation (Nagothu 2001; Arnold and Persson 2003). Recent research indicates that fuelwood consumption is rarely a primary driver of large-scale deforestation (Arnold and Persson 2003). Fuelwood extraction has also been implicated in biodiversity loss. This occurs in at least three ways. First, fuelwood extraction destroys habitat for cavity-using birds and mammals (Du Plessis 1995) and reduces habitat for other forest-dwelling species such as giant pandas (Bearer et al. 2008; Liu et al. 2001). Second, habitat for saproxylic species (those which rely on dead wood for survival, such as wood-decomposing fungi and certain types of beetles) is reduced by fuelwood harvesting (Jonsell 2007). Third, the extraction of deadwood disrupts the nutrient recycling process in forests (Shankar et al. 1998). Given these environmental implications, it is important to understand the factors influencing fuelwood consumption.

Methodology

To test our hypotheses, we use the STIRPAT model, a stochastic reformulation of the well-known IPAT accounting equation for assessing anthropogenic environmental impacts, which has been utilized in a large number of studies (Dietz and Rosa 1997; Dietz et al. 2007; Rosa et al. 2004; York et al. 2003a, b). The STIRPAT (**ST**ochastic **I**mpacts by **R**egression on **P**opulation, **A**ffluence, and **T**echnology) model estimates the net effect of population (P), affluence (A), and technology (T) on environmental impacts (I) using the following basic multiplicative specification:

$$I_{\mathrm{i}} = \mathrm{a}P_{\mathrm{i}}^{\mathrm{b}}A_{\mathrm{i}}^{\mathrm{c}}T_{\mathrm{i}}^{\mathrm{d}}e_{\mathrm{i}} \qquad (1)$$

The constant “a” scales the model while “b”, “c”, and “d” are the parameters to be estimated, and e is the error term. The subscript “i” indicates that the quantities—*I*, *P*, *A*, and *T*—vary across observational units—nations in this analysis. Since there is no widely accepted single measure for *T*, it is typically included in the error term as we do here (York et al. 2003a). Taking the logarithmic transformation of each variable results in a model that is linear in the logs and whose parameters can be estimated with conventional regression techniques. The estimation formula that results from the log transformation is as follows:

$$\log I = \mathrm{a} + \mathrm{b}\,(\log P) + \mathrm{c}\,(\log A) + e \qquad (2)$$

The coefficients a, b, and c of the STIRPAT-logged model can be interpreted as measures of ecological elasticity (i.e., the coefficient indicates the percentage change in I for a 1% increase in that specific driver while holding all others constant). The model is modified here by decomposing population into average household size and number of households and by including control variables for biogeographical features of the countries analyzed.

Sample

Our analysis includes only developing countries for which the necessary data are available. We focus on developing countries because this is where the impact we examine, fuelwood consumption, is concentrated (Food and Agriculture Organization 2000). Developing countries are those classified as low, lower middle, and upper middle income (i.e., not high income) by the World Bank (2009). These criteria resulted in a cross-sectional sample of 87 countries.

Dependent variable

The dependent variables are total and per capita fuelwood footprint in 2000.[5] The ecological footprint (EF) is a hypothetical, aggregate measure based on the fact that land (and productive sea area) is the basis for three functional human needs provided by the environment: living space, resources, and a sink for wastes. It is calculated by summing the land areas, adjusted for their biological productivity, required to meet the human consumption of energy and materials. It, thus, represents the amount of biologically productive space at world average productivity, measured in hectares, to sustainably support a society's consumption. The fuelwood footprint, then, is the estimated area in hectares of forest land at global average productivity required for a country's consumption of fuelwood including charcoal (see Ewing et al. 2008; Kitzes et al. 2007; Wackernagel et al. 2005).

The Global Footprint Network bases their calculations of the fuelwood footprint on international data published by the United Nations Food and Agriculture Organization (FAO). The source of these data is national fuelwood and charcoal statistics reported to the FAO as well as the FAO's own estimates. The FAO uses a synthetic method that combines data collected by questionnaire from national statistical correspondents, statistics collected by other international organizations or in the literature, expert judgments, and estimates based upon regression modeling.

[5] Fuelwood footprint data were provided by Brad Ewing of the Global Footprint Network, to whom we are grateful.

During 1999–2001, it collected and analyzed 1,635 and 541 observations on fuelwood and charcoal consumption from these sources (Whiteman et al. 2002). National inventories in tropical zones are augmented by remote sensing data from high-resolution Landsat satellites covering ten percent of those zones (WRI n.d.).

Despite FAO efforts to use all available sources to create a harmonized data set, the data are widely known to be less precise than data on other environmental outcomes that are able to be observed more directly and with less use of estimation techniques.

The FAO is developing new methods (e.g., WISDOM) to improve that quality, but thus far the method has been applied to only three countries: Mexico, Slovenia, and Senegal (Masera et al. 2006). However, at this time, the precision problem persists for most countries. Nevertheless, the FAO-reported magnitudes are sufficiently accurate to reflect the relative consumption levels of the countries in the data set (World Energy Council 2004). Recognizing this, we have proceeded with our analyses on the basis that while these are not the best possible data, they are the most authoritative existing data with which to test our hypotheses. Furthermore, we exercise due caution in interpreting our results.

Independent variables

As noted above, we decompose the *P* term (i.e., population) into two components: average household size and number of households. These data are from the United Nations Center for Human Settlements (2001) and are for the year 2000. Total population data are for the year 2000, from United Nations (2009). The year 2000 is the most recent year for which data on all variables in the analysis are available.

The *A* term in the model is measured as Gross Domestic Product (GDP) per capita in US dollars based upon prevailing exchange rates in 2000 (World Bank 2007). Typically, GDP per capita has a positive effect on environmental impacts, such as the ecological footprint (Dietz et al. 2007; York et al. 2003a). However, research indicates that economic development and urbanization are negatively related to fuelwood consumption (Whiteman et al. 2002; Arnold and Persson 2003). In particular, the “energy ladder” hypothesis predicts that economic development leads to a decline in the consumption of traditional biomass fuels and a transition to alternative fuels such as kerosene, natural gas, and electricity (Hosier and Dowd 1987; Leach 1992; Macht et al. 2007). Therefore, we predict that GDP per capita will have a negative effect on fuelwood consumption.

We include urbanization, the percentage of the population living in urban areas in 2000, also from the World Bank (2007), as a control variable. It has been suggested that urbanization reduces demand for fuelwood because those living in urban areas have easier access to alternative energy sources, such as electricity, and less access to forests (e.g., Brouwer and Falcão 2004).

We also include two control variables to account for the biogeographical features of countries. The availability of fuelwood likely shapes the level of consumption; so, we include total forest area (in square kilometers) as measured in 1990. These data are from World Bank (2007).[6] Additionally, climate has been found to affect resource consumption with countries in tropical areas consuming less (York et al. 2003a). As such, we include a dichotomous variable, based on latitude, indicating a tropical climate; countries with predominant latitude less than 30 degrees are coded as tropical; these data are from Veregin (2005).

Model specifications and diagnostics

We estimate three specifications of the STIRPAT model using OLS regression with robust standard errors to correct for heteroscedasticity.[7] The three specifications are based upon the decomposed population measures and alternative dependent variables. A number of researchers have suggested that robust regression should be used in conjunction with OLS when analyzing cross-national data because robust regression is less susceptible to influential cases and to violations of the assumption of normality in the error term (Dietz et al. 1987; Jorgenson 2006). Robust regression downweights observations that have larger residuals, thus providing more conservative estimates. We perform robust regression (iteratively reweighted least squares) with Huber and biweight functions tuned for 95% Gaussian efficiency as a check on the OLS results (Hamilton 2003). Regression diagnostics (i.e., Cook's D) and the robust regression results indicate no serious problems with influential cases. OLS and robust regression models are presented in Table 2.

A high level of collinearity between GDP per capita and urbanization ($r = .76$) was, however, found to be problematic. This resulted in nonsignificant coefficients for each when included together, with each being significant and negative when included separately. We resolved this issue by excluding urbanization from the models presented below.[8] After omitting urbanization, the maximum variance inflation factors (VIFs) in the OLS models range from 1.31 to 1.54—well below conventional levels—indicating no serious multicollinearity.

Results and discussion

We begin our analysis by investigating trends in household size, household numbers, and population between 1985 and 2000 for the 87 developing countries in our sample. Table 1 shows that, on average, household size decreased from 1985 to 2000 by 5.27% (from 5.6 to 5.3), while population and the overall number of households increased by 40.86 and 51.77%, respectively.[9] The growth in number of

[6] We measure forest area in 1990 because past forest endowment is likely to be just as or more important in explaining fuelwood consumption patterns as present endowment. We thank an anonymous reviewer for this suggestion.

[7] A condition that violates the assumption of OLS estimation that the error term has a constant variance.

[8] All other coefficients were not substantially affected by excluding urbanization.

[9] The data on the overall change in household size among developing countries differ from those offered by Keilman (2003) above because of the composition of our sample; we do not include data for all developing countries in our analysis due to data limitations.

Table 1 Average percent change in household size, number of households, and population, 1985–2000 ($N = 87$)

	Avg. pct. change
Avg. household size	−5.27%
Number of households	51.77%
Total population	40.86%

Sources: Number of households data is from UN (2001); Population data are from UN (2009); Household size data were calculated by dividing total population by number of households

households outpaced population growth due to the decline in average household size. Furthermore, 65 of the 87 countries in our sample (75%) experienced a decline in average household size and therefore a greater percent increase in number of households than in population during this period. These data are consistent with the findings of Liu et al. (2003) that declining average household size is associated with an increase in number of households and thus may pose a double threat to the environment. Next, we turn to our regression results.

In support of our primary hypothesis, Model 1 (see Table 2) demonstrates that average household size has a significant, negative effect on total fuelwood consumption.[10] This means that among developing countries, those with smaller average households consume more fuelwood.

Furthermore, the negative effect of household size on fuelwood consumption is significant while controlling for other relevant variables, thus providing evidence that the relationship is not spurious given the model specification.

Due to the specification of Model 1, it is difficult to determine the independent effect of household size on total fuelwood consumption. This is because in linear regression, the coefficients indicate the net effect of a variable while holding all others constant. The negative, significant coefficient for household size represents the net effect of a one percent increase, while holding population constant. This is problematic because a decrease in household size while holding population constant represents an increase in number of households, which may account for the negative coefficient for average household size. Furthermore, an increase in population while holding average household size constant represents an increase in number of households, which may be reflected in the significant, positive coefficient for population.

We address this issue by specifying an additional model. In Model 2, we decompose population into number of households and average household size; the product of these two variables is total population. In these models, average household size is not significant, while number of households is positive and significant. This suggests that of the two variables, number of households, rather than average household size, is a more important driver of total fuelwood

[10] Note that each of our three model specifications are calculated using both ordinary least squares and robust regression. In order to make this discussion more readable, we refer to each pair of models in the singular (e.g., Model 1). Where important differences in estimates occur, we refer to the specific model (e.g., Model 1.2).

Table 2 Unstandardized coefficients for multivariate regression analyses of fuelwood consumption ($N = 87$)

Model Estimation technique Fuelwood measure	1.1 OLS[a] Total	1.2 Robust[b]	2.1 OLS Total	2.2 Robust	3.1 OLS Per capita	3.2 Robust
Avg. household size	−0.97**	−0.67**	−0.15	0.12	−0.95**	−0.61**
	(.418)	(.275)	(.443)	(.281)	(.430)	(.310)
Number of households			0.82***	0.79***		
			(.078)	(.053)		
Population	0.82***	0.79***				
	(.078)	(.053)				
GDP per capita	−0.17***	−0.14**	−0.17**	−0.14**	−0.17**	−0.13*
	(.075)	(.069)	(.075)	(.069)	(.071)	(.092)
Forest area (km^2), 1990	0.17***	0.16***	0.17***	0.16***	0.12***	0.10***
	(.052)	(.037)	(.052)	(.037)	(.040)	(.038)
Tropical[c]	0.41	0.18	0.41	0.18	0.54*	0.36*
	(.307)	(.187)	(.307)	(.187)	(.320)	(.206)
Constant	2.04	2.21	2.04	2.21	−0.55	−0.95
R^2	.786		.786		.252	
Mean/high VIF	1.38/1.48		1.42/1.54		1.31/1.48	

Standard errors are in parentheses. All variables have been natural log-transformed

* $p \leq .10$

** $p \leq .05$

*** $p \leq 01$ (two-tailed tests)

[a] Robust standard errors in parentheses for all OLS regressions

[b] Estimated with robust regression

[c] Non-tropical is the reference category

consumption. This, along with the coefficient estimate for number of households in Model 2 being identical to that of population in Model 1, supports the above interpretation of Model 1. However, because we have thus far analyzed only total fuelwood consumption, it remains a possibility that average household size is a significant predictor of per capita fuelwood consumption. In Model 3, we exclude total population and number of households and estimate the net effect of average household size on per capita fuelwood consumption. Model 3 indicates that average household size has a significant, negative effect on per capita fuelwood consumption. Therefore, these findings suggest a nuanced demographic pattern where number of households is an important driver of total fuelwood consumption while average household size is more important in its effect on per capita consumption.

Consistent with previous research (York et al. 2003a and Rosa et al. 2004), total population has a significant, positive effect on total fuelwood consumption in Model 1. This supports the widely verified finding that population size is a major driving force of resource consumption and environmental degradation.

GDP per capita has a predicted significant, negative effect on fuelwood consumption in all models. This supports the "energy ladder" hypothesis (Hosier and Dowd 1987; Leach 1992; Macht et al. 2007).[11]

As noted above, we found that urbanization was highly correlated with GDP per capita and thus we omitted it from the regression models. However, when we replaced GDP per capita with urbanization (not presented here), it had a significant, negative effect on fuelwood consumption, similar to GDP per capita. This occurred because urbanization is primarily driven by economic development and thus the relationship between urbanization and fuelwood consumption also reflects the energy ladder (Davis and Golden 1954; Moomaw and Shatter 1996). Indeed, Liddle and Lung (2010) recently argued that urbanization reflects the level of access to a country's power/electricity grid. Thus, urbanization and economic development together may lead to a reduction in demand for traditional fuels such as fuelwood. However, the collinearity between economic activity and urbanization makes it difficult to accurately measure the separate effects of each variable.

Forest area has a significant, positive effect on total fuelwood consumption in all models.[12] Climate is not significant in the models predicting total fuelwood consumption, but it is significant at the .10 level in predicting per capita fuelwood consumption. This is inconsistent with the findings of previous research showing that tropical countries consume fewer resources (York et al. 2003a). This is likely due to the composition of our sample with its clustering of less developed countries in tropical areas where more fuelwood is consumed.

Conclusion

This study contributes to the literature on household dynamics and environmental impacts by empirically testing the effects of household size and number on fuelwood consumption using the STIRPAT model with data for 87 developing countries. Our principal findings, given the data limitations of our dependent variable, suggest the importance of household dynamics for resource consumption and biodiversity. Specifically, we found evidence that among developing countries, those with smaller average household sizes consume more fuelwood per capita. This indicates that household economies of scale, do indeed affect national-level per capita consumption of fuelwood. However, we found that number of households is a better predictor of total fuelwood consumption than average household size. This suggests that declining household size may contribute to greater total consumption more through its contribution to rising household numbers than from the economies of scale dynamic. We also found support for the "energy ladder" hypothesis in that economic development (and urbanization) reduces demand for fuelwood. As they

[11] Following the thoughtful suggestion of one anonymous reviewer, we also estimated models including the percent change in GDP per capita 1970–2000 and Gini coefficient (alternatively measured in 1990, 1995, and 2000). Neither variable was found to be significant in any model.

[12] Results are substantively similar when forest area is measured in 1995. When measured in 2000, forest area is significant and positive, though with an extremely small coefficient, in Models 1 and 2, but not in Model 3 in which per capita consumption is the dependent variable.

develop, countries shift their mix of fuel sources away from wood and toward other energy resources.

Thus, insofar as the trend in declining average household size in the face of population growth continues, resulting in increased number of households, we can expect increases in fuelwood consumption, a critical energy source for many countries of the world. At the same time, the decline in average household size leads us to expect an increase in per capita consumption. These trends, in combination with the findings of Liu et al. (2001, 2003) and Keilman (2003), point to a troubling threat to sources of fuelwood, at least over the short and medium term.

Because the basis for the evolving household dynamics of more households with fewer occupants lies with the social and cultural concomitants of development—including declining fertility rates, the decline in extended families, changing norms about the desired number of children, population aging, etc.—policies designed to alter these trends directly are likely to be ineffective. Furthermore, while family planning and associated policies and programs are the typical response to population growth, our results indicate that these responses may have unintended consequences that diminish their environmental benefits. In particular, reducing fertility rates decreases population growth, but at the same time may contribute to decreasing household sizes and growth in the number of households.

Our findings raise the troubling question of whether other resources and biodiversity are similarly impacted by these demographic trends. There is a clear need for future research that addresses how household size, number of households, and other components of gross population drive other types of resource consumption that threaten the supply of natural capital. Future quantitative, cross-national research should investigate the effect of household dynamics on a broad range of environmental impacts.

Appendix: List of countries ($n = 87$)

Albania	Chile	Guatemala
Algeria	China	Guinea
Argentina	Colombia	Guinea-Bissau
Bangladesh	Congo	Haiti
Benin	Congo, Dem. Rep.	Honduras
Bolivia	Costa Rica	Hungary
Botswana	Djibouti	India
Brazil	Dominican Republic	Indonesia
Bulgaria	Ecuador	Iran
Burkina Faso	Egypt	Iraq
Burundi	El Salvador	Ivory Coast
Cambodia	Fiji	Jordan
Cameroon	Gabon	Kenya
Central African Republic	Gambia	Laos
Chad	Ghana	Liberia

Libya	Pakistan	Sudan
Madagascar	Panama	Syria
Malawi	Papua New Guinea	Tanzania
Mali	Paraguay	Thailand
Mauritania	Peru	Togo
Mexico	Philippines	Tunisia
Mongolia	Poland	Turkey
Morocco	Romania	Uganda
Mozambique	Rwanda	Uruguay
Nepal	Saudi Arabia	Venezuela
Nicaragua	Senegal	Viet Nam
Niger	Solomon Islands	Yemen
Nigeria	South Korea	Zambia
Oman	Sri Lanka	Zimbabwe

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