

# Is gender an important factor influencing user groups' property rights and forestry governance? Empirical analysis from East Africa and Latin America

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## SUMMARY

This article explores the effects that gender composition of forest user groups has on property rights and forestry governance, based on data from 290 forest user groups in Kenya, Uganda, Bolivia, and Mexico. Findings indicate gender composition of user groups is important, but not always in the expected ways. Female-dominated groups tend to have more property rights to trees and bushes, and collect more fuelwood but less timber than do male-dominated or gender-balanced groups. Gender-balanced groups participate more in forestry decision-making and are more likely to have exclusive use of forests. Female-dominated groups participate less, sanction less and exclude less. Although policy makers and practitioners are advised to seek interventions that strengthen women's groups by delivering information, technologies and capacity-building programs in formats that take into account women's constraints, it is also important to gain better understanding of the dynamics of mixed-gender groups, including the nature and types of cooperation among males and females.

Keywords: gender, forest management, forest user groups, institutions, IFRI

## Le sexe est-il un facteur important influençant les droits à la propriété et la gestion forestière des groupes utilisateurs de la forêt? Analyse empirique en Afrique de l'est et en Amérique latine

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Cet article explore l'effet de la répartition des sexes dans les groupes utilisant la forêt sur la gestion forestière et les droits de propriété, en se basant sur des données prélevées sur 290 groupes d'utilisateurs de la forêt au Kenya, en Uganda, en Bolivie et au Mexique. Les résultats indiquent que la composition des sexes dans les groupes est importante, mais pas toujours de la manière escomptée. Les groupes principalement féminins ont tendance à avoir plus de droits de propriété sur les arbres et les buissons, et à recueillir davantage de bois de combustion mais moins de bois que les groupes principalement masculins ou équilibrés hommes-femmes. Les groupes équilibrés participent davantage aux prises de décision de foresterie, et sont plus à même d'avoir une utilisation exclusive de la forêt. Les groupes principalement féminins investissent moins, sanctionnent moins et excluent moins. Bien que les concepteurs de politique et les parties pratiques soient conseillés de rechercher des interventions qui puissent fortifier le rôle des femmes en délivrant des informations, des technologies et des programmes pour fortifier la capacité dans des formats prenant en compte les restrictions féminines, il est également important d'obtenir une meilleure compréhension de la dynamique des groupes bi-séxués, en incluant la nature et les types de coopération entre les hommes et les femmes.

## ¿Es el género un factor importante y con influencia en los derechos de propiedad de grupos de usuarios y en la gobernanza forestal? Análisis empírico en África Oriental y Latinoamérica

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Este artículo explora los efectos causados por la composición de género de grupos de usuarios del bosque en los derechos de la propiedad y la gobernanza forestal, utilizando datos de 290 grupos de usuarios forestales de Kenya, Uganda, Bolivia y México. Los resultados indican que la composición de género de los grupos de usuarios es importante, pero no siempre de la manera esperada. Los grupos con una mayoría de mujeres tienden a tener más derechos de propiedad sobre árboles y arbustos, y recolectan más leña pero menos madera que los grupos con una mayoría de hombres o los grupos con equilibrio de género. Los grupos con equilibrio de género participan más en la toma de decisiones forestales y es más probable que disfruten de un acceso exclusivo a ciertos bosques. Los grupos con mayoría de mujeres participan menos, autorizan menos, y excluyen menos. Aunque se aconseja a los formuladores de políticas y los profesionales forestales que persigan acciones que refuercen a los grupos de mujeres proporcionándoles información, tecnología y programas de desarrollo de capacidades en formatos que tengan en cuenta los factores que las limitan, es importante también conocer mejor la dinámica de los grupos mixtos en cuanto a género, incluyendo la naturaleza y formas de cooperación entre hombres y mujeres.

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INTRODUCTION<sup>1</sup>

The issues of women's participation in forest management merits attention, as it impacts on both the welfare of women and their households and, potentially, on the condition of the resource itself. Gender roles and responsibilities mean that men and women tend to have different interests in forests and, consequently, different priorities in terms of increasing timber versus firewood, fodder, or other nontimber forest products. A broad range of studies in forest and natural resource management have provided valuable insights into women's roles in forest use and management. While these insights have been useful in informing project interventions aimed at strengthening and amplifying women's contributions, a focus on women on their own tends to remove them from the social, cultural and political milieu that often determines the nature, extent and effectiveness of their participation. A major lesson drawn from gender mainstreaming activities of the past decade is the need to analyse and understand the dynamic relationships between men and women, rather than focusing on men and women in isolation from each other.

Researchers in natural resource management are increasingly interested in understanding the relative effects on forest management of varying proportions of male and female participants. Studies in forest management suggest that female-only groups often lack information and are frequently allocated forest resources that are of marginal quality (Cornwall 2001, Pandey 2003, Rai and Buchy 2004). Female dominant groups have been found to have lower rates of enforcement, and are less likely than mixed groups or male dominant groups to adopt regeneration practices and other forestry investments (Mwangi *et al.* 2011). Mixed male and female user groups may encourage the use of their complementary strengths; men in mixed groups undertake monitoring when long distances are to be covered or due to dangers in forest patrolling (Watkins 2009, Westermann *et al.* 2005).

Despite these early findings, the study of the emergence, functioning and performance of mixed men's and women's user groups in forestry is still in its infancy and presents a promising avenue to better inform policy and practice. The research presented in this article addresses the question of whether the proportion of women is related to the property rights that groups hold, the amount of different products harvested, and forest governance, especially rule making and internal enforcement. It adopts a cross-national approach and employs quantitative techniques to analyse the relative performance of female-dominated, mixed-gender, and male dominated user groups in forest management using a sample of 290 forest user groups in Kenya, Uganda, Bolivia and Mexico. While cross-national studies are often reproached for glossing over nuances in relationships, they often expose

broad patterns that can serve as a basis for detailed analyses and to identify broad lessons that can be applied across regions.

This article begins with a review of the literature on gender and forest governance, then provides a brief overview of the forestry governance context in the study countries. The subsequent sections describe the data and methods used, then examine empirical results on the relationships under consideration. The final section discusses results and conclusions, including implications for policy makers and practitioners.

## GENDER IN LOCAL FOREST MANAGEMENT INSTITUTIONS: A REVIEW

Bina Agarwal's (2010) recent volume on *Gender and Green Governance* highlights the importance of looking at the two-way relationship between gendered participation in forest management and the resources themselves: not only do men and women have interests and dependence on different forest products, but the participation of women and men may have different outcomes for the condition of the resource. Women's participation in decision making has been found to significantly improve forest regeneration (Agarwal 2007, 2010), it reduces the incidence of illegal harvesting and other unsanctioned activities (Agarwal 2009, Agrawal *et al.* 2004), and their presence in forest user groups enhances the capacity to manage and resolve conflicts (Westerman *et al.* 2005).

Many of these gains are attributed to higher levels of social capital among women due to work responsibilities and frequent collaboration (Agarwal 2010, Westerman *et al.* 2005). They are also because women who bear the responsibility for feeding families have greater interactions with forest resources and have a tendency to want to conserve in order to mitigate the burdens that may be associated with deteriorating forest condition (Acharya and Gentle, 2006, Agarwal 1999, 2010, and Gbadesin 1996). Moreover, higher levels of altruism among women than men may increase their tendency to cooperate (Molinas 1998). Controlled experiments demonstrate that women are twice as likely as men to donate to anonymous partners, suggesting that cooperative outcomes are more likely to occur in groups with higher female participation (Eckel and Grossman, 1996 cited in Molinas 1998). Other experimental studies show that mixed teams of men and women outperform male only or female only teams, with the female teams performing least effectively in decision-making (Apesteguia *et al.* 2010). A meta-analysis of 100 studies analyzing sex differences in the social dilemma literature finds that all male groups or dyads are more cooperative than all female groups/dyads (Balliet, pers com).

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The full potential of women's contributions to sustainable resource management, however, are often limited by their insecure rights to forests and trees, which constrains their incentives for undertaking sustainable management practices and further limits the range of actions they can take with regard to forest management (Meinzen-Dick *et al.* 1997, Quisumbing *et al.* 1997, Rocheleau and Edmunds 1997 and Yadama *et al.* 1997). Cultural constructions and perceptions of women's roles may also constrain their participation in management decisions, while male bias in the provision of information and extension, or even the timing and length of meetings can increase the limitations to women's participation (Agarwal 1997, 2001, 2003, 2010). Demographic factors such as age, wealth levels or ethnicity can further condition their participation (Davidson-Hunt 1996, Nuggehali and Prokopy 2009). In some relatively uncommon settings, women may choose not to participate in forest management because of wealth and status or because they attach negative stigma to such activities (Jewitt 2000, Resurreccion 2006).

An important factor affecting women's effective participation is the number of women participating in the groups. When there are very few women participating, they may feel isolated, or not represent women's interests as effectively as when there is a critical mass of women. This threshold effect is not limited to forest governance, but also arises in many public forums, from local government to parliaments: "Although empirical verification of effective proportions is, to date, rather limited, among policy-makers and practitioners globally it is the figure of one-third that has become widely accepted as *the critical mass*" (Agarwal 2010: 170–171). Agarwal's own studies in Nepal and India test primarily for the effect of women in the Executive Committees, and found that the likelihood of women speaking up is significantly higher with one third or more women. At the same time, all-female groups may also be marginalized, or lack some of the skills and connections that men may have, especially for linking with outsiders.

Acharya and Gentle (2008) found that in Nepal, integration of a critical mass of women into the regular user groups led to better outcomes than all-women's user groups, which lacked the support of men, and had smaller overall forest areas and less land per household than the mixed groups.

Participation in user groups becomes all the more important in the context of decentralisation reforms that have gained popularity in the past two decades. It is generally anticipated to enhance the delivery of public services by lowering costs and enhancing the speed and quality of responses to local problems as government is in principle brought closer to people (Meinzen-Dick and Knox 2001). In forest management decentralised arrangements are thought to also offer rules related to access, harvesting, and management that are reflective of local needs and knowledge and thus allow for more efficient monitoring and sanctioning (Agrawal and

Ostrom 2001). In addition, local institutions can provide low cost and faster conflict resolution. In Africa and Latin America decentralisation has taken a variety of forms, ranging from community based co-management approaches where rights, responsibilities and benefits are shared between forestry administrations and local user groups, to complete devolution of ownership and authority from the central government to intermediate organisations (such as District Councils or Municipalities) or local level organisations, including community-based ones.

Agrawal and Ostrom (2001) suggest that to better understand the resource management outcomes of decentralisation programs it is worthwhile to examine the rights and capacities that are transferred to actors at lower levels. Because property rights determine who bears the costs and benefits of resource interventions, they provide incentives for resource management. Different combinations of property rights will be the means through which new actors and institutions come to gain new powers of decision making. Property rights can be disaggregated into use and control rights. Use rights include access and/or withdrawal rights, while control rights include management, exclusion and alienation rights. These different bundles of rights, and their security, have varying consequences for resource use and management. The range of rights held by local actors, including women and the poor, during the implementation of decentralisation reforms will likely influence the burdens and benefits of resource appropriation. Therefore, it is important to look at what use or management rights are transferred, and whether these differ for men's and women's groups. For example, in Nepal, women's groups often receive smaller or more degraded forest areas compared to what male-dominated groups receive (Acharya and Gentle 2008).

Forestry decentralisation reforms are decidedly ambivalent on outcomes and pay scant attention to gender equity, even though a growing number of studies are concerned with women's access to and management of forest resources. A more detailed review of gendered participation is provided in Mwangi *et al.* (2011) and Hoang Yen *et al.* (this volume). The analysis in this article focuses on the relationship between women's and men's participation in forest user groups and a range of outcomes, in the context of forest decentralization.

Controlling for a range of factors known to influence harvesting levels, de facto property rights/tenure, and management (such as wealth differentials among users, group size, forest size, its physical accessibility and legal ownership, external enforcements and the onset of decentralization reforms)<sup>2</sup>, this article addresses the following questions:

- Is there is any differentiation in property rights and harvesting levels among female-dominated, male-dominated and gender-balanced groups?

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<sup>2</sup> See Mwangi *et al.* (2011) for a full discussion of determinants of sustainable management.

- Does the gender composition of groups affect resource-enhancing behaviours and practices, including rule-making and internal enforcement?
- How is the gender composition of groups related to the likelihood that the group will have exclusive rights to the forest, or have to share it with other user groups?

In particular, based on past literature one could hypothesize that women's groups would have less property rights over forest resources, less involvement in rule-making, monitoring and sanctioning, and less exclusive use of the forest. Also based on the literature on threshold effects of women's participation and findings that gender-balanced groups may perform differently from predominantly male or predominantly female groups, the analysis tested for these factors using gender composition as a continuous variable, as well comparing categories of female-dominated, gender-balanced, and male-dominated user groups, as discussed below.

#### THE CONTEXT: FORESTS AND GOVERNANCE REFORMS IN KENYA, UGANDA, BOLIVIA AND MEXICO

The study context is four countries in East Africa and Latin America: Kenya, Uganda, Bolivia and Mexico. Though all four countries have undertaken reforms of their forestry sectors in the past decade, the specific design of the relevant institutions differ among them. Bolivia introduced forestry reforms in 1996 that transferred substantial power and resources to local governments, but retained national ownership of all forest resources. Mexico has also decentralised some of its forest governance functions and ownership rights to communities, but has retained more political and financial control at the federal and state levels. Uganda, which has implemented forest decentralisation reforms since 1996 has devolved authority to the District level with state centred control of budgets and revenues. Kenya's 2005 reform promises to devolve to community associations but with responsibility in nested hierarchies that overlap governance/administrative levels and ecological scales.

Though all four countries initiated and implemented reforms in the last decade and a half, the conditions that form the backdrop to this governance reform are diverse. Mexico for instance has a long history of community involvement in forest management, while Kenya has the longest history of state control over forest resources. Uganda on the other hand has oscillated between state and local control, while Bolivia exhibits the most progressive and most numerous formal institutions for community control. Whereas the East African countries have a long history of protectionist objectives the Latin American countries exhibit a longer history of

community forestry enterprises and of the struggle for a more inclusive forestry practice and an equitable distribution of benefits from the forest enterprise.

#### DATA AND METHODS

Data were collected using the methodology of the International Forestry Resources and Institutions (IFRI) research program<sup>3</sup>. This included collecting information on institutions affecting resource use (such as *de jure* and *de facto* property rights to forest resources and enforcement mechanisms), including resource users' participation in rule making and enforcement as well as exclusion of other groups. Data on user groups' socio-economic and demographic status (such as size, gender composition, wealth differentiation, population, forest dependence, land ownership) were also collected. Other forest data collected included topography, legal ownership and size. These variables (especially the institutional and demographic factors) have been theorized and illustrated to influence incentives for management and sustainable use (Agrawal 2001, Agrawal and Chatter 2006).

Community focus groups were used to explore institutions and local perceptions of forest conditions and demographics. Key informant interviews with forestry officials and other local authorities were also conducted to establish the number and nature of activities conducted by community based, private, and government organizations with mandates and/or activities that have implications for local forest management.

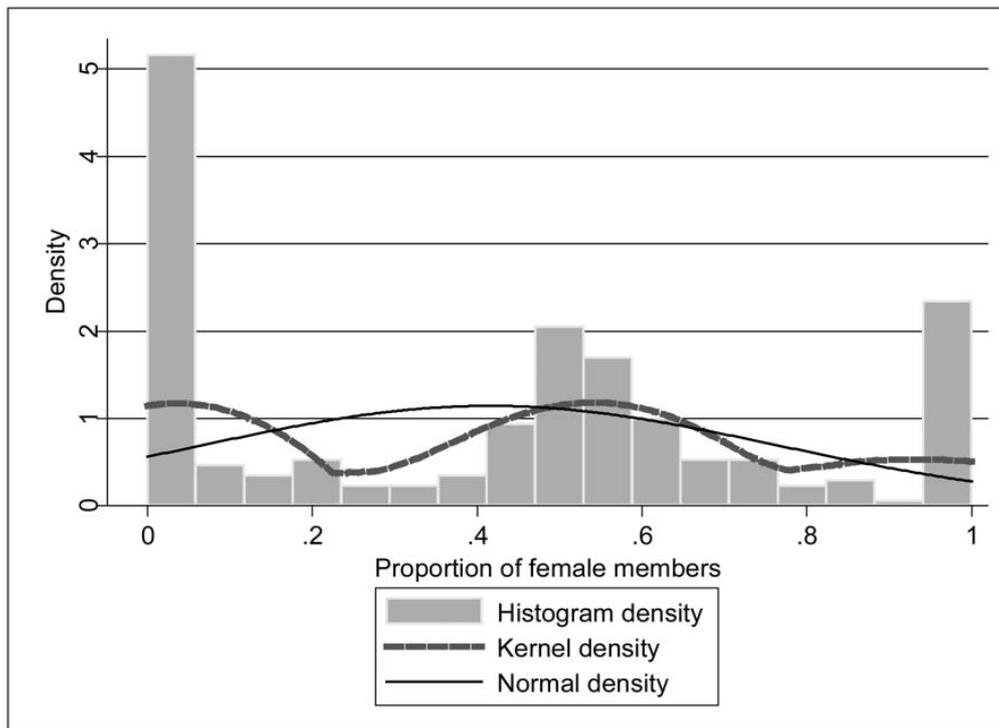
While the IFRI data have been collected in 15 countries, the present analysis focuses on forests in Kenya, Uganda, Mexico and Bolivia. Data were collected over a 15 year period (1993–2008), with 3–5 year intervals between visits to the same forest<sup>4</sup>. An IFRI forest is an area of at least .5 ha containing woody vegetation exploited by at least three households and governed by one legal structure. There are 91 forests in the sample. Within a forest, a user group is a group of people who harvest from, use, and maintain a forest and who share the same rights and duties to products from it. Pooling all the user groups gives a total of 290 user groups that have gender composition identified (see Appendix I).

Figure 1 describes the gender distribution of the user groups: the solid black curve is a normal density and the dotted red curve is a kernel density. The kernel density curve indicates that the sample user groups fall roughly into three segments, based on the female member proportion: male-dominated (female proportion less than or equal to one-third), gender-balanced (female proportion between one-third and two-thirds) and female-dominated (female proportion more than two-thirds), accounting for 40%, 37% and 23%, respectively, of our total 290 user groups. Our classification of three user group categories based on gender composition is also

<sup>3</sup> <http://www.sitemaker.umich.edu/ifri/home>

<sup>4</sup> Of the total 91 forests, half have multiple visits (mostly in East Africa). Of the sites with multiple visits, there was considerable fluidity among the user groups, with some groups disappearing, new groups emerging, and size of membership of other groups varying through the years. So although we have panel data at the forest level, user groups could not be matched from one year to another.

FIGURE 1 Distribution of the proportion of female members in sample user groups



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consistent with general citations of one-third as the critical mass for women’s participation (Agarwal 2010). However, rather than looking at all groups with at least one-third female participants as the same, because of the number of all-female groups, we consider whether female-dominated groups might differ significantly from those that are more gender balanced.

Note that there are potential endogeneity concerns with the gender composition variable, because it is not exogenously determined. However, no appropriate instrumental variable is available. Hence, the relationships between gender composition and property rights or governance arrangements should be seen as correlations, not necessarily causality.

## DESCRIPTIVE STATISTICS OF THE USER GROUPS

### Property rights and actual harvested amount

The IFRI protocol collects data on eight main forest products: trees, bushes, grasses, ground leaves, climbing leaves, water, soils and minerals, and wildlife. This article focuses on trees and bushes, since the latter six products do not differ much between groups based on gender composition<sup>5</sup>. For trees and bushes, female-dominated groups are more likely to have rights to harvest (Table 1, Part A). For example, the average rate for a user group having the right to harvest trees is 55%, but for female-dominated groups, the rate is as high as 64%,

compared with 44% for male-dominated groups and 61% for gender-balanced groups. Conversely, male-dominated groups have the least likelihood of having the right to harvest bushes (56%), compared with 73% for gender-balanced groups and 79% for female-dominated groups. The Pearson correlation between gender composition and property right shows significant linkage between gender and right to harvest, but the direction of the relationship, with women’s groups *more* likely to have rights, may surprise those who expect that women are discriminated against in terms of forest rights. However, it may be that female-dominated groups are set up under special conditions, or are not seen as likely to deforest as men’s groups might be. For example, in the Mabira forest in Uganda, the forest officers worked with women’s groups to help them identify non-timber forest products that could be used for handicrafts, whereas the young men’s group that collected wood for barbecue skewers was seen as a threat to forest regeneration, and was chased from the forest whenever caught.

It is not only whether groups have the right to harvest a resource, but also the amount actually harvested that matters for the livelihoods of local people, as well as for forest condition. IFRI asks user groups what percent of their needs for certain products the forest supplies. For food and fodder, there is no significant difference between groups, but for fuelwood and timber, gender composition is associated with differences in the amounts harvested, but in two different directions. As indicated in Table 1, Part B, for fuelwood, the

<sup>5</sup> Due to the length limitation, they are omitted from the Appendix. Detailed results for the later six forest products are available upon request.

TABLE 1 Relation of user groups' gender composition to property rights, actual harvested amount, and forest governance

**Part 1A: User groups' property rights (proportion of user groups who have the right to harvest certain forest products)**

Right to harvest	Average		Male dominated group		Mixed group		Female dominated group		P value of Pearson's Chi (2)
	Total obs.	(prop.)	Obs.	(prop.)	Obs.	(prop.)	Obs.	(prop.)	
Trees (dummy, 1=yes)	242	55%	96	44%	82	61%	64	64%*	0.016
Bushes (dummy, 1=yes)	215	68%	79	56%	75	73%	61	79%*	0.008

Note: 1) "\*" stands for significantly higher than the average; 2) Right to harvest is a binary variable

**Part 1B: Percent of user group's needs harvested from the forest, by gender composition of groups**

Forest products harvested	Average		Male dominated group		Mixed group		Female dominated group	
	Total obs.	(%)	Obs.	(%)	Obs.	(%)	Obs.	(%)
Fuelwood	258	65%	106	59%	86	57%	66	84%*
Timber	252	39%	103	41%	83	45%	66	30%*

Note: 1) "\*" stands for significantly higher or lower than the average; 2) This actual harvest amount is a continuous variable (percent of the user group's need)

**Part 1C: Forest governance 1--participation and internal enforcement, by gender composition of groups**

Participation and enforcement	Average		Male dominated group		Mixed group		Female dominated group		P value of Pearson's Chi (2)
	Total obs.	(prop.)	Obs.	(prop.)	Obs.	(prop.)	Obs.	(prop.)	
Rule making (dummy, 1=yes)	257	30%	101	27%	96	42%*	60	17%	0.003*
Sanctioning (dummy, 1=yes)	282	23%	115	23%	103	33%	64	9%*	0.002*

Note: 1) "\*" stands for significantly higher or lower than the average; 2) Rule making and sanctioning are binary variables

**Part 1D: Forestry governance 2--exclusion, by gender composition of groups**

Are there any other groups who harvest from this forest?	Average		Male dominated group		Mixed group		Female dominated group		P value of Pearson's Chi (2)
	Total obs.	(prop.)	Obs.	(prop.)	Obs.	(prop.)	Obs.	(prop.)	
Yes (dummy, 1=yes)	254	89%	105	92%	83	81%*	66	95%	0.006*

Note: 1) "\*" stands for significantly lower than the average; 2) "Are there are other groups who harvest from this forest" is a binary variable

male-dominated groups collect a significantly lower proportion of their needs compared to female-dominated groups: 59% versus 84%, respectively. But for timber, the trend is the opposite: male-dominated groups collect significantly more than female-dominated groups: 41% versus 30%. In both cases, the gender-balanced groups were close to the male-dominated groups.

In summary, 55% and 68% of forest user groups have harvest rights to trees and bushes, respectively. Actual harvest rates (measured in percentage of their needs collected from forests) are 65% of fuelwood and 39% of timber. Female-dominated groups tend to have more harvesting rights for both trees and bushes than male-dominated or gender-balanced groups; they collect more fuelwood from forests, but less timber.

**Forestry governance**

Our examination deals with three kinds of forestry governance: participation, internal enforcement, and exclusion. In most of the forests studied, several user groups share one forest resource. In this article, participation is defined by whether any member of the user group is responsible for making rules about the forest. It is assumed that if just one user in a group actively participates and articulates the group's needs during management meetings, other members are likely to benefit from resultant rules and policies, relative to members of user groups without a member participating in rule-making. Internal enforcement in this article is defined by whether any member of the user group sanctions or monitors infractions regularly. Sanctioning and monitoring

are important enforcement behaviours, to reward good performance and to punish harmful action. Exclusion in this article refers to whether other user groups have rights to harvest from the same forest.

Bivariate descriptive statistics show gender-balanced groups as the most active in participation, with a much higher probability (42%) of at least one members' involvement in forest decision-making than the other two groups (Table 1, Part C), with the female-dominated group participating the least (17%). A similar pattern is evident for internal enforcement, with gender-balanced groups being most likely to undertake monitoring and sanctioning (33%), and female-dominated groups, least likely (9%). The pattern differs, however, for exclusion (Table 1, Part D): there is a strong correlation between a group's gender characteristics and other groups having the right to harvest from the forest. Gender-balanced groups have the lowest probability (81%) of allowing other groups to harvest from the forest, while female-dominated groups are most likely to have other groups "share" the forest (95%).

Overall, the rates of participation, internal enforcement and exclusion of the user groups are low: on average, only 30% of user groups are involved making rules governing the forests; the percentage of user groups which implement sanctioning and monitoring is even lower, around 23%; and only 11% respond in the negative when asked "are there any other groups that have rights to harvest from the same forest." Female-dominated groups are disadvantaged in all the three forestry management practices (their rates are 17%, 9% and 5%, respectively, for participation, internal enforcement and exclusion).

## EMPIRICAL ANALYSIS

While this descriptive analysis points to certain relationships between gender composition and user groups' property rights and forestry governance, regression analysis allows us to probe further on how gender might influence these outcomes after controlling for other important variables which might also impact property rights and forestry governance. The additional variables we want to analyze are: user group characteristics (including group size, homogeneity, agricultural land holdings, and distance from forest), forest characteristics (forest size, topography, forest land ownership, forest owner's property rights, and forest open access rule), external enforcement in the forest by government, community-based, forest-specific, or private organizations, forestry decentralization, time trend and regional dummy. The variables, their assessment measures, definitions and descriptive statistics are provided in Appendix II.

### **Analysis with gender composition of groups as a continuous variable**

On average, 42% of the user groups' members are female. Regression results on whether the female proportion of the

user groups affects the user groups' property rights and governance are summarized in Table 2 and Table 3, respectively.

Table 2 shows that a higher proportion of female members in a user group is associated with a significantly higher probability that the user groups have property rights to harvest trees and bushes, holding all else constant. Specifically, a 1% increase in the proportion of female members would increase the likelihood that a group has the right to harvest trees or bushes by 0.4%.

The higher the female proportion in the user groups, the higher the actual fuelwood collection by the group from the forest: a 1 percent increase in proportion of female membership is likely to increase by 3% the percentage of fuelwood needs harvested. The marginal effect of female composition on the amount of timber collected from the forest is negative, but not significant. In Table 3, if gender composition is defined as a continuous variable, we do not detect a significant impact of user groups' gender composition on forest governance. Rather, we propose that the impact of the gender composition on governance might not be a simple linear relationship.

### **Analysis with gender composition of groups as a categorical variable**

As the descriptive analysis showed, the gender composition of forest user groups is not normally distributed, but is rather clustered in three categories. So this section changes the format of the gender composition from a continuous variable to categorical variables, with the male-dominated groups as a base, and two dummies to represent the gender composition—gender-balanced groups and female-dominated groups. The regression results are shown in Table 4 and Table 5.

For both the property rights to harvest and the quantity collected, the regression results from discrete gender variables (Table 4) are similar to the results from continuous gender variables (Table 2). This confirms that gender composition does influence the right to harvest trees and bushes, even after controlling for a wide range of user group and forest characteristics. This result is robust for different formats of the gender variable. Table 4 shows that female-dominated groups are one-third more likely to have a right to harvest either trees and/or bushes compared with male-dominated groups. Female-dominated groups collect more fuelwood and less timber from the forest than male-dominated groups, even though the latter impact is not significant in the continuous gender variable regression. This is probably because the relationship is not linear. That is, female-dominated groups are significantly different from male-dominated, but mixed groups are not very different from male-dominated. Furthermore, there may be threshold effects of gender composition—when the variable's value (e.g., female proportion) is above certain amount (e.g., two-thirds), the further increase of this variable (e.g., 68% or 75%) does not matter. The linear regression assumes that the group with the higher proportion of females would have a different impact on the outcome (as compared to the group with the lower proportion of females), while the discrete regression would assume the two groups

TABLE 2 Empirical results for property rights and actual harvested amount (gender composition is continuous variable)

Category	Explanatory Variables	Property rights (Probit)				Harvested from forest (OLS)			
		Right for trees		Right for bushes		Fuelwood		Timber	
Gender variable	Proportion of female members	M.E.	t Stat.	M.E.	t Stat.	M.E.	t Stat.	M.E.	t Stat.
User groups' characteristics	User group's member size (log form)	0.42	3.65***	0.44	5.44***	29.95	4.04***	-6.89	-0.89
	User group's wealth difference (1=yes)	0.00	0.07	0.00	-0.10	-0.84	-0.55	1.85	0.91
	User group's agricultural land owned	0.06	0.65	0.16	2.13**	-0.02	0.00	-9.96	-1.23
	Distance of the ind. in group live from forest	0.01	0.12	-0.06	-0.56	4.26	0.70	10.59	1.02
	Forest size (log form)	0.14	1.53	0.07	0.87	-2.55	-0.63	-7.61	-1.26
	Forest topography (1=flat, ..., 5=steep)	0.12	3.65***	0.05	1.70*	4.54	2.61**	3.89	1.22
	Forest land owner is government (ref.=pri.)	-0.08	(-1.67)*	-0.07	(-1.94)*	4.22	2.25**	-3.65	-1.11
	Forest land owner is community (ref.=pri.)	-0.24	-0.75	-0.18	-0.67	-10.82	-0.95	22.25	1.15
	Forest owner has right to harvest (1=yes)	0.08	0.16	-0.24	-0.60	-35.87	(-1.88)*	29.20	1.10
	Forest open access (1=yes, 0=no)	0.21	1.92*	0.08	0.80	8.33	1.56	-3.80	-0.34
	External enforcement, govt. organizations	-0.47	(-2.78)***	0.06	0.44	14.20	2.11**	13.81	1.31
	External enforcement, comm. based org.	-0.08	-1.03	0.00	0.08	0.71	0.21	-1.76	-0.32
	External enforcement, forest specific org.	-0.03	-0.55	0.15	2.79***	-2.32	-0.90	-5.30	-1.2
	External enforcement, private org. external	-0.23	-1.42	-0.17	-1.41	-3.28	-0.78	-7.78	-1.13
	Decentralization (dummy, 1=yes, 0=no)	-0.16	(-1.87)*	-0.10	-1.25	-3.70	-0.92	6.83	1.20
	Year of the visit	0.22	1.07	0.36	2.59**	-28.91	(-2.68)**	-17.35	-1.19
	Regional dummy, Latin America (base is Africa)	-0.03	(-1.81)*	0.00	-0.10	4.69	3.38**	0.15	0.09
	Number of observations	-0.01	-0.02	0.08	0.48	-7.73	-0.72	-5.64	-0.37
	Pseudo R2 for Probit (or R-square for OLS)	157	0.2774	141	0.3204	170	0.3869	167	0.2108

Note:

1) All regressions are corrected for heteroscedasticity and clustered on forest level

2) \*, \*\*, \*\*\* present significance at 10%, 5% and 1%, respectively

TABLE 3 Probit results on forest governance (gender composition is continuous variable)

Category	Explanatory Variables	Rule making and internal enforcement			Exclusion		
		Rule making		Monitoring and sanctioning		Other groups harvesting from this forest	
		M.E.	t Stat.	M.E.	t Stat.	M.E.	t Stat.
Gender variable	<b>Proportion of female members</b>	0.07	1.55	-0.06	-0.70	0.00	0.03
	User group's member size (log form)	-0.01	-0.94	-0.03	-1.47	0.00	-1.18
	User group's wealth difference (1=yes)	0.24	3.34***	0.20	3.00***	-0.02	(-2.37)**
	User group's agricultural land owned	0.06	0.90	0.02	0.24	0.03	3.09***
User groups' characteristics	Distance of the ind. in group live from forest	0.02	0.51	0.06	1.03	0.00	0.70
	Forest size (log form)	-0.01	-0.62	0.01	0.48	0.01	2.17**
	Forest topography (1=flat, ..., 5=steep)	-0.04	(-2.28)**	0.03	1.24	0.01	2.24**
	Forest land owner is government (ref.=pri.)	0.04	0.47	-0.08	-0.51	-0.01	-0.76
Forest characteristics	Forest land owner is community (ref.=pri.)	0.01	0.04	-0.09	-0.55	-0.12	-1.22
	Forest owner has right to harvest (1=yes)	-0.12	(-2.18)**	0.06	0.82	0.02	1.42
	Forest open access (1=yes, 0=no)	0.06	0.81	0.10	1.06	0.01	0.62
	External enforcement, govt. organizations	-0.03	-1.00	0.02	0.38	0.01	2.04**
Forest external enforcement	External enforcement, comm.-based org.	0.09	4.70***	0.05	2.17**	0.00	0.43
	External enforcement, forest specific org.	-0.13	(-2.37)**	-0.14	(-1.97)*	0.02	2.94***
	External enforcement, private org. external	-0.10	(-2.87)**	-0.02	-0.42	0.01	1.64*
	Decentralization (dummy, 1=yes, 0=no)	0.63	2.44**	0.47	1.92*	0.00	-0.10
Other variables	Year of the visit	-0.01	-1.02	-0.01	-0.64	0.00	-0.09
	Regional dummy, Latin America (base is Africa)	0.93	4.52***	0.27	1.97**	-0.17	(-2.21)**
Number of observations			161		167		168
Pseudo R2 for Probit			0.6218		0.2711		0.3707

Note:

1) All regressions are corrected for heteroscedasticity and clustered on forest level

2) \*, \*\*, \*\*\* present significance at 10%, 5% and 1%, respectively

TABLE 4 Empirical results for property rights and actual harvested amounts (gender composition is discrete variable)

Category	Explanatory Variables	Property rights (Probit)			Harvested from forest (OLS)		
		Right for trees M.E. t Stat.	Right for bushes M.E. t Stat.	Fuelwood M.E. t Stat.	Timber M.E. t Stat.		
Gender dummies	Mixed gender group (base is male-dominant group)	0.01 0.13	0.11 1.21	5.39 0.62	3.17 0.35		
	Female dominant (base is male-dominant group)	0.33 3.09***	0.32 4.58***	26.19 3.92***	-15.26 (-2.27)**		
User groups' characteristics	User group's member size (log form)	0.02 0.61	0.01 0.18	-0.23 -0.14	2.13 1.07		
	User group's wealth difference (1=yes)	0.04 0.54	0.15 2.09**	0.02 0.00	-10.30 -1.35		
	User group's agricultural land owned	0.01 0.10	-0.05 -0.51	4.16 0.66	10.16 0.98		
	Distance of the ind. in group live from forest	0.13 1.46	0.08 0.94	-2.48 -0.59	-8.83 -1.48		
Forest characteristics	Forest size (log form)	0.10 3.19***	0.04 1.21	3.68 2.04**	4.42 1.42		
	Forest topograph (1=flat, ..., 5=steep)	-0.09 (-1.77)*	-0.08 (-1.98)*	4.10 2.19**	-3.41 -1.07		
	Forest land owner is government (ref.=pri.)	-0.21 -0.64	-0.17 -0.67	-9.73 -0.85	21.42 1.17		
	Forest land owner is community (ref.=pri.)	0.08 0.15	-0.26 -0.68	-36.74 (-1.93)*	30.89 1.16		
	Forest owner has right to harvest (1=yes)	0.20 1.8*	0.08 0.75	8.04 1.46	-3.63 -0.33		
	Forest open access (1=yes, 0=no)	-0.46 (-2.76)***	0.08 0.52	15.89 2.41**	11.95 1.13		
	External enforcement, govt. organizations	-0.06 -0.84	0.02 0.30	2.09 0.63	-2.96 -0.55		
Forest external enforcement	External enforcement, comm. based org.	-0.04 -0.67	0.15 2.95***	-2.76 -1.11	-5.19 -1.17		
	External enforcement, forest specific org.	-0.21 -1.32	-0.16 -1.32	-2.11 -0.48	-9.02 -1.34		
	External enforcement, private org. external	-0.16 (-1.83)*	-0.10 -1.36	-3.41 -0.89	7.18 1.27		
Other variables	Decentralization (dummy, 1=yes, 0=no)	0.24 1.16	0.36 2.42**	-27.12 (-2.46)**	-17.70 -1.22		
	Year of the visit	-0.04 (-1.94)*	0.00 -0.06	4.54 3.28***	0.14 0.09		
	Regional dummy, Latin America (base is Africa)	0.13 0.59	0.15 0.85	-0.91 -0.07	-13.59 -0.87		
Number of observations	157	141	170	167			
Pseudo R2 for Probit (or R-square for OLS)	0.2795	0.3173	0.3881	0.2108			

Note:

1) All regressions are corrected for heteroscedasticity and clustered on forest level

2) \*, \*\*, \*\*\* present significance at 10%, 5% and 1%, respectively

TABLE 5 Probit result on forestry governance (gender composition is discrete variable)

Category	Explanatory Variables	Rule making and internal enforcement					
		Rule making			Monitoring and sanctioning		
		M.E.	t Stat.		M.E.	t Stat.	
Gender dummies	Mixed gender group (base is male-dominant group)	0.20	2.49**	0.05	0.68	-0.02	(-1.72)*
	Female dominant (base is male-dominant group)	0.02	0.74	-0.11	(-1.74)*	0.00	0.31
User groups' characteristics	User group's member size (log form)	-0.01	(-2.02)**	-0.03	-1.52	0.00	-0.31
	User group's wealth difference (1=yes)	0.23	3.58***	0.19	2.80***	-0.01	(-2.47)**
	User group's agricultural land owned	0.04	1.03	0.01	0.14	0.02	3.29***
	Distance of the ind. in group live from forest	0.01	0.49	0.05	0.79	0.00	0.77
	Forest size (log form)	0.00	0.25	0.02	0.74	0.00	1.90*
Forest characteristics	Forest topography (1=flat, ..., 5=steep)	-0.02	(-2.61)***	0.02	1.05	0.00	2.07**
	Forest land owner is government (ref.=pri.)	0.02	0.73	-0.06	-0.41	0.00	-0.82
	Forest land owner is community (ref.=pri.)	0.09	0.70	-0.04	-0.24	-0.20	-1.53
	Forest owner has right to harvest (1=yes)	-0.06	(-2.03)**	0.06	0.77	0.02	1.54
	Forest open access (1=yes, 0=no)	0.05	1.63	0.08	0.84	0.01	1.58
Forest external enforcement	External enforcement, govt. organizations	-0.03	(-2.04)**	0.00	-0.03	0.01	2.28*
	External enforcement, comm. based org.	0.06	3.71***	0.05	2.16**	0.00	0.01
	External enforcement, forest specific org.	-0.10	(-2.63)***	-0.16	(-2.26)**	0.02	3.03***
	External enforcement, private org. external	-0.06	(-2.84)***	-0.02	-0.46	0.01	2.29**
Other variables	Decentralization (dummy, 1=yes, 0=no)	0.70	2.55**	0.43	1.80*	-0.01	-0.48
	Year of the visit	-0.01	-1.15	-0.01	-0.52	0.00	0.53
Number of observations	Regional dummy, Latin America (base is Africa)	0.93	3.88***	0.14	1.00	-0.04	-1.19
		161	167				168
Pseudo R2 for Probit		0.6609	0.2947				0.4071

Note:

1) All regressions are corrected for heteroscedasticity and clustered on forest level

2) \*, \*\*, \*\*\* present significance at 10%, 5% and 1%, respectively

belong to one category and thus share a general impact. The latter is more consistent with the literature on threshold effects of participation, as discussed above.

For forestry governance, using categorical gender dummy variables reveals the impact of group gender composition more clearly than a continuous gender variable, because the impact of gender composition is not linear. Instead, gender-balanced groups stand out as significantly higher on rule making compared to male groups, but female-dominated groups do not differ significantly from male-dominated groups. This effect would not be captured by a continuous gender variable. Table 5 demonstrates that gender-balanced groups are 20% more likely than male-dominated groups to have some representatives participate in forest rule making. But members of female-dominated groups are 11% less likely to participate in sanctioning, as consistent with the findings of Westerman *et al.* (2005). Gender-balanced groups are significantly more likely to be the only group using the forest, but the magnitude of this effect is small (2%). The lack of other groups may be because gender-balanced groups are more inclusive, so less need for other types of groups to operate in those forests. These findings seem to support the proposition by Pandolfelli *et al.* (2008) that mixed groups can be more effective.

Referring to other explanatory variables in the regressions (Table 4), we find that formal ownership of the resource (whether government, communal or private) does not necessarily preclude a property right to harvest. Users have rights to harvest resources regardless of broad ownership structures. This finding supports the “bundle of rights” approach, which suggests that rights regimes can be further disaggregated into their constituent parts, and that resource ownership is not the only or most relevant right in all resource settings; nor is it the only property arrangement that creates incentives for sustainable use and management (Agrawal and Ostrom 2001).

Decentralization tends to significantly expand user groups’ rights to bushes, but actual fuelwood harvests have fallen with decentralization. Thus, while decentralization strengthens users’ rights, users themselves appear to have adopted stricter access rules. Over time, users’ property rights to trees have decreased, and actual fuelwood harvests have increased.

Looking at other explanatory variables in Table 5, we find that decentralization reforms increased user groups’ participation in forest rule-making and in monitoring and sanctioning processes. This result is consistent with the intent of such reforms to actively engage communities in management, decision-making, and responsibility. Community-based organizations promote user groups’ participation in forest management, especially in rule-making and internal enforcement.

Wealth differentials among users within groups positively impact participation in rule-making and sanctioning, as does the number of community based organizations. Wealth disparities within user groups also promote the exclusion of other users. This result may support Olson’s (1971) theory of collective action which suggests that privileged individuals

within groups can underwrite the costs of collective action by disproportionately contributing their resources towards collective activities in anticipation of greater benefits. On the other hand, it may indicate elite capture, where wealthier, more influential individuals are more likely to participate in critical group functions in order to influence outcomes in their favour.

## DISCUSSION AND CONCLUSIONS

The analysis presented in this article employs multiple methods to explore the gender dimensions of forest user groups: both a continuous gender proportion variable and dichotomous gender dummies were analyzed, and the two techniques were found to complement each other as well as the latter one revealing relationships which could not be captured by simple linear analysis. The user-group level analysis offers two important findings. First, gender composition is important, but not always in the expected ways. Female-dominated groups tend to have more property rights to trees and bushes, and collect more fuelwood and less timber than do male-dominated or gender-balanced groups. The stronger property rights for women’s groups is somewhat surprising, but the harvesting data are consistent with gender roles: women are more likely to be responsible for fuelwood collection, while men are more responsible for household timber needs and involved in timber-based enterprises. Note, however, that because gender composition is not an endogenous variable, these results should be regarded as indicative, rather than as establishing causation.

Gender-balanced groups participate more in forestry decision-making and are more likely to exclude other groups from harvesting from the forest. Female-dominated groups participate less, sanction less and exclude less. The finding that female-dominated groups specialize in certain forest products agrees with findings by other researchers, who have demonstrated that women tend to collect certain forest products in line with their gendered roles and responsibilities (Agrawal 2010). The finding that female-dominated groups are less likely than other groups to participate in decision-making or invest in forest improvements is not controversial. Time constraints, male bias in the delivery of extension services and a lack of information can depress women’s investments and participation. Moreover, a huge literature has shown that, due to social and cultural norms that limit their roles to the private sphere, women often lack the experience, confidence and skills to engage in the public sphere (see Agarwal 2010 for a review). Gender-balanced groups, in contrast, perform consistently better in all forestry functions, including in exclusion of other users. Pandolfelli *et al.* (2008) suggest that gender-balanced groups exploit the complementary advantages of men and women and have better access to information and services from external agents, and this is supported by Mwangi *et al.* (2011).

Although policy makers and practitioners are advised to seek interventions that strengthen women’s groups by delivering information, technologies and capacity-building programs

in formats that take into account women's constraints, they should also recognize, support and strengthen other types of groups such as mixed-gender ones. It is important, however to gain better understanding of the dynamics of mixed-gender groups, including the nature and types of cooperation among males and females and their determinants, leadership, the division of labour, and the distribution of benefits and costs.

An unresolved issue is whether there is a threshold number of women and men in mixed-gender groups that may be associated with higher levels of cooperation. The findings presented here indicate that the relationship between gender composition of groups and collective outcomes is not linear, and that a rough division of groups into female-dominated (more than two-thirds female), gender-balanced (one-third to two-thirds female), and male-dominated (less than one-third female) is consistent with the distribution of our empirical data and helps to identify key patterns. Further qualitative research would be useful to determine the group dynamics in each of these types of groups, and how that affects group performance.

The implementation of decentralization reforms has strengthened user group rights to forest products, yet has reduced user groups' actual harvest levels. Furthermore, decentralization has encouraged user groups to participate in forest management activities, including decision-making and sanctioning. These gains accord with the normative expectations of decentralization reformers. By expanding and strengthening property rights and management responsibilities, the reforms were intended to create incentives for sustainable use and management. However, such incentives are even more effective when users also have full rights to resource benefits, including incomes.

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#### APPENDIX I Summary of forests in Latin America and East Africa

Region	Country	Forests visited (numbers)	Forest user groups visited (numbers)
Latin America	Bolivia	27	45
	Mexico	14	37
East Africa	Uganda	34	141
	Kenya	16	67
<i>Total</i>		<i>91</i>	<i>290</i>

#### APPENDIX II Definition and descriptive statistics of the variables

Category	Definition	Obs.	Mean	Min.	Max
<b>Dependent variables</b>					
<i>Property right and actual harvest amount</i>					
Right to harvest trees	dummy, 1=yes	242	0.55	0	1
Right to harvest bushes	dummy, 1=yes	215	0.68	0	1
Fuelwood harvested	% of group's need of fuelwood harvested from forest	258	65%	0	100%
Timber harvested	% of group's need of timber harvested from forest	252	39%	0	100%
<i>Forestry governance</i>					
Rule making	dummy, 1=yes, member is involved in rule making of forest	257	0.30	0	1
Internal enforcement	dummy, 1=yes, sanction regularly	282	0.23	0	1
Exclusion	dummy, 1=yes, other groups have right to harvest	254	0.89	0	1
<b>Independent variables</b>					
<i>User group's gender composition (continuous)</i>	proportion of female members	290	0.42	0	1

<i>User groups' gender dummies</i>					
Mixed gender group (base is male-dominant)	dummy, 1=user group is gender mixed, 0=otherwise	290	0.37	0	1
Female dominant (base is male-dominant)	dummy, 1=user group is female-dominant, 0=otherwise	290	0.23	0	1
<i>User groups' characteristics</i>					
User group's member size	total number of user group members	290	536	3	32000
User group's wealth difference	dummy, 1= wealth difference among within the group	279	0.42	0	1
User group's agricultural land owned	% of households who own agricultural land in user group	255	0.58	0	1
Distance group members live from forest	dummy, 1=< 1 km, 2=1 to 5 km, 3=>5 to 10 km, 4=>10 km	256	1.73	1	4
<i>Forest characteristics</i>					
Forest size	size of the forest, in hectares	268	2829	2.3	44900
Forest topography	dummy, 1=flat,2=flat with rolling terrain, ..., 5=steep	275	3.1	1	5
Forest land owner is government	dummy, 1=land owner is govt, ref=owner is private	273	0.74	0	1
Forest land owner is community	dummy, 1=land owner is community, ref=owner is private	273	0.19	0	1
Forest owner has right to harvest	dummy, 1=forest owner has right to harvest from forest	281	0.71	0	1
Forest open access	dummy, 1=forest is open accessible, 0=not open access	274	0.73	0	1
<i>External enforcement</i>					
External enforcement, govt. organizations	number of govt. organizations in the forest	231	0.75	0	5
External enforcement, comm. based org.	number of community based organizations in the forest	231	1.48	0	4
External enforcement, forest specific org.	number of forest specific organizations in the forest	231	0.93	0	4
External enforcement, private org. external	number of private organizations external to the forest	231	0.56	0	5
<i>Other variables</i>					
Forestry decentralization	dummy, 1=in or after the year of decentralization, 0=before	290	0.29	0	1
Year of the survey visit		290	2000	1993	2009
Regional dummy, Latin America (base Africa)	dummy, 1=Latin America, 0=Africa	290	0.28	0	1