

Beyond Land Titles: Rights Documentation, Boundary Clarity and Exposure to Community Land Conflicts in Kimbinga, Democratic Republic of the Congo

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Publication Date: 2026/09/28

Abstract: In legally plural settings, land tenure security depends not only on the existence of a formal title but also on the ability to prove a right, identify and recognize its spatial boundaries, and coordinate the authorities that make it socially and institutionally enforceable. This article presents an analytical reanalysis of a cross-sectional household survey conducted in Kimbinga, Bulungu Territory, Kwilu Province, Democratic Republic of the Congo (DRC), involving 384 households. It examines the association between rights documentation, boundary clarity, and reported exposure to land conflict using descriptive statistics, chi-square tests, effect-size measures reconstructed from published aggregate tables, and the multivariable logistic model reported in the source study. Overall, 174 households (45.3%) reported at least one land conflict. Conflict prevalence was 54.9% among households without documentary evidence compared with 18.0% among those with documented rights (absolute difference: -36.9 percentage points; crude prevalence ratio: 0.33, 95% CI 0.21-0.50; adjusted OR: 0.23, 95% CI 0.13-0.41). It was 59.3% where boundaries were unclear versus 31.1% where they were clear (absolute difference: -28.2 points; prevalence ratio: 0.52, 95% CI 0.41-0.67; adjusted OR: 0.42, 95% CI 0.26-0.65).

Boundary disputes were the most frequent conflict type (33.9%). The findings suggest that conflict exposure is particularly associated with two forms of uncertainty - evidentiary and spatial - and that community-land security should combine verifiable evidence of rights, social recognition, boundary clarity, and institutional coordination. Because the data are observational, the results support association rather than causal inference.

Keywords: Boundary Clarity; Community Land; Democratic Republic of the Congo; Land Conflict; Land governance; Land Tenure Security; Legal Pluralism; Rights Documentation.

How to Cite: Kingambo Muyamba Arthur; Kuyunsa Mayu Alain (2026), Beyond Land Titles: Rights Documentation, Boundary Clarity and Exposure to Community Land Conflicts in Kimbinga, Democratic Republic of the Congo. *International Journal of Innovative Science and Research Technology* 11(9), 1614-1626. <https://doi.org/10.38124/ijisrt/26sep384>

I. INTRODUCTION

Land is simultaneously a productive asset, a family patrimony, a residential space, and a basis of social belonging. In rural territories where multiple authorities intervene in access, transmission, recognition, and dispute settlement, land tenure security cannot be equated with possession of an administrative document alone. The FAO Voluntary Guidelines emphasize the protection of legitimate tenure rights and responsible tenure governance, particularly for vulnerable groups [1].

This issue is especially salient in the DRC, where the statutory land order coexists with customary practices that continue to organize substantial parts of land access,

inheritance, use, and local recognition. Institutional plurality does not necessarily imply disorder: it may generate complementarity, but it may also multiply competing sources of legitimacy when authorities, evidence, or boundaries do not converge [2]. Recent work in South Kivu similarly highlights persistent tenure uncertainty where customary and state systems overlap [3].

The Congolese literature also shows that formalization is not a uniform solution. In North Kivu, Fatema [4] found that land titles were associated with a lower probability of certain low-intensity interhousehold conflicts, although titles did not necessarily reduce damages once conflict occurred. Van Leeuwen et al. [5] show that localized registration can clarify rights and prevent some disputes in Burundi and

eastern DRC, yet remains vulnerable to weak state capacity, institutional competition, and elite capture. In Bukavu, Hoffmann et al. [6] further demonstrate that property certainty is not a binary title/no-title condition, but is negotiated through resources, recognition, and public authority.

These findings point to two analytical problems that are often conflated. The first is evidentiary: a socially recognized right may become difficult to prove when witnesses disappear, succession occurs, or competing documents emerge. The second is spatial: a right may be acknowledged while parties attach different meanings to a river, path, tree, marker, or historical landmark. Land tenure security therefore depends both on identifying the right and on making the space to which it applies sufficiently intelligible and mutually recognizable.

Much recent empirical research on land conflict in the DRC remains concentrated in the eastern provinces, where displacement, armed conflict, and competition over resources are prominent. Security dynamics in western rural areas remain comparatively under-documented. Kimbinga, located in the Imbongo Sector of Bulungu Territory, Kwilu Province, therefore provides a useful setting for examining everyday community-land disputes under institutional pluralism without reducing them to mechanisms specific to war-affected zones.

This article asks: to what extent are rights documentation and boundary clarity associated with household exposure to land conflict in Kimbinga? Two hypotheses guide the analysis. H1 proposes that households with documented rights have lower conflict exposure; H2 proposes that households reporting clear boundaries have lower conflict exposure. The contribution is threefold: empirically, it brings micro-level evidence from an underrepresented part of Kwilu; analytically, it distinguishes evidentiary from spatial uncertainty; and for policy, it discusses how this distinction can inform land-governance reform centered on security, traceability, and administrative modernization.

II. THEORETICAL FRAMEWORK AND HYPOTHESES

➤ *Legal Pluralism and Land Tenure Security*

Legal pluralism is understood here as the coexistence of multiple sources of rules and authority capable of recognizing, documenting, or adjudicating land rights. The central issue is not merely the number of institutions involved but the way their decisions interact. A customary right may be locally robust yet difficult to produce as administrative evidence; conversely, an administrative document may be legally meaningful while remaining socially contested. Property and authority are therefore constituted through relationships of recognition among right-holders, communities, and institutions [2].

Land tenure security is accordingly treated as a relative condition of predictability. A right-holder should be able to identify the right, explain its origin, understand its boundaries, transmit it under intelligible rules, and access an

appropriate avenue of recourse. This view is consistent with common-pool resource governance, particularly the importance of clearly defined boundaries and locally intelligible rules [7].

➤ *Two Mechanisms: Evidentiary and Spatial Uncertainty*

Documentation acts primarily on evidentiary uncertainty. Traceable evidence can preserve the memory of an allocation, transaction, or succession; identify the parties; and provide a basis for verification when a dispute emerges. Yet the mere existence of a paper is insufficient. Its practical value also depends on origin, preservation, verifiability, and the degree of social and institutional recognition attached to it.

Boundary clarity acts on a different dimension: spatial uncertainty. Two parties may agree that a right exists while disputing the extent of the space to which it applies. Delimitation is therefore both geographic and social. A visible marker becomes security-enhancing only when relevant parties attribute a sufficiently compatible meaning to it.

The analytical framework therefore assumes that land tenure security is strengthened when four dimensions converge: evidence of the right, social recognition, spatial clarity, and institutional coordination. This expression is conceptual rather than a causal equation.

Land tenure security = f(evidence of right, social recognition, boundary clarity, institutional coordination)

➤ *Hypotheses and Analytical Model*

- H1 - Rights documentation: $P(\text{Conflict} \mid \text{documented right}) < P(\text{Conflict} \mid \text{undocumented right})$.
- H2 - Boundary clarity: $P(\text{Conflict} \mid \text{clear boundaries}) < P(\text{Conflict} \mid \text{unclear boundaries})$.

The multivariable specification can be summarized as:

$$\text{logit}[P(Y_i = 1)] = \beta_0 + \beta_1 D_i + \beta_2 L_i + \sum \beta_k X_{ki}$$

Where Y denotes the existence of at least one reported land conflict, D denotes rights documentation, L denotes boundary clarity, and X represents the available control variables. The model estimates statistical associations and, by itself, does not establish causal effects.

III. MATERIALS AND METHODS

➤ *Study Design and Setting*

This article presents an analytical reanalysis of the quantitative component of a cross-sectional study conducted in Kimbinga, Imbongo Sector, Bulungu Territory, Kwilu Province, in southwestern DRC. Family farming is central to the local economy, while households, families, customary authorities, and public institutions jointly shape access to, transmission of, and dispute resolution over land. Available geographic information places Kimbinga at approximately 5°14' S and 19°04' E, at about 578 m above sea level; these coordinates are used only to locate the study area and do not constitute a cadastral delimitation.

➤ Population, Sample Size, and Selection

The target population comprised households and land users in the study area. In the absence of an exhaustive official register matching the exact survey perimeter, the reference sample size was calculated using Cochran's formula for a large or unknown population:

$$n_0 = Z^2 p(1 - p) / e^2 = 1.96^2 \times 0.50 \times 0.50 / 0.05^2 = 384.16 \approx 384 \text{ households}$$

The source study reports empirical results for 384 households. The protocol describes a probabilistic selection procedure based on household listing, proportional allocation across local units, and systematic sampling with a random starting point. However, the final local units covered, the exact fieldwork dates, and the response rate are not documented with sufficient precision in the materials available for this reconstruction and are therefore not invented.

➤ Instrument and Variables

The household questionnaire covered six domains: respondent and household characteristics; plots and modes of access; evidence and mechanisms of recognition; exposure to land conflict; knowledge, participation, and institutional trust; and economic and social consequences. The dependent variable is whether the household reported at least one land conflict (1 = yes; 0 = no).

Two explanatory variables are central. Rights documentation is binary and captures the reported existence of an attestation, deed, procès-verbal, title, or other documentary evidence. Boundary clarity indicates whether boundaries are known and recognized. Additional available variables include access mode (inheritance, customary allocation, purchase, donation, rental/loan), gender, knowledge, participation, institutional trust, and duration of occupancy.

➤ Statistical Strategy

Descriptive analysis uses frequencies, percentages, and conflict prevalence. Bivariate associations between categorical factors and conflict exposure are evaluated with chi-square tests at the 5% significance level. To avoid an interpretation based solely on p-values, effect-size measures are reported whenever the available aggregates permit: absolute prevalence difference, crude prevalence ratio (PR), crude odds ratio (OR), and Cramer's V.

For documentation, effect sizes are calculated directly from the published 2 x 2 table. For boundary clarity, cell counts are arithmetically reconstructed from the published prevalences (59.3% and 31.1%), the total sample of 384 households, and the 174 reported events. This reconstruction reproduces the continuity-corrected chi-square reported in the source study and is explicitly labeled so that a mathematical derivation is not confused with new access to individual-level data.

The multivariable analysis is the binary logistic regression already estimated in the source study. Results are reported as adjusted ORs with 95% confidence intervals. Reference categories are no documentation, unclear boundaries, female gender, good knowledge, and low participation. Access mode, although significant in bivariate analysis, is not included in the available adjusted model; no re-estimation including this variable is fabricated in the absence of the individual-level dataset.

➤ Interpretation and Ethical Safeguards

All findings are interpreted as associations. The cross-sectional design, self-reported outcome, and potential residual confounding preclude causal inference. The study protocol records free and informed consent, coded questionnaires rather than participant names, and enhanced protection for sensitive location data. The approving ethics body and reference number are not sufficiently documented in the available source materials and must be verified before journal submission.

IV. RESULTS

➤ Sample Profile

The analysis includes 384 households. Distributions by gender, knowledge, participation, and institutional trust are summarized in Table 1.

Table 1 Descriptive Characteristics of the Sample (n = 384)

Variable / category	n	%
Gender - Male	216	56.2
Gender - Female	168	43.8
Knowledge - Low	174	45.3
Knowledge - Moderate	131	34.1
Knowledge - Good	79	20.6
Participation - Low	166	43.2
Participation - Moderate	147	38.3
Participation - High	71	18.5
Trust - Low	193	50.3
Trust - Moderate	131	34.1
Trust - High	60	15.6

Source: Field Survey, 2026.

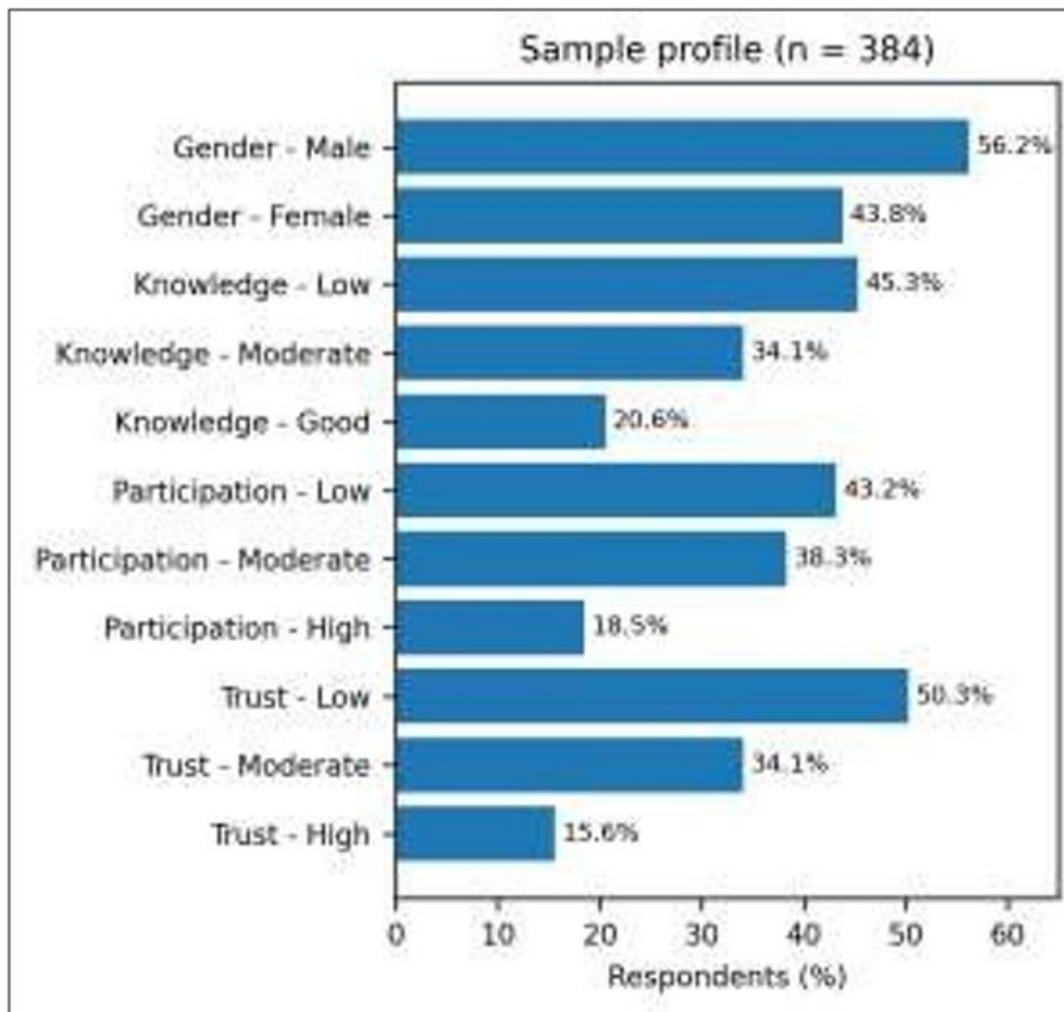


Fig 1 Descriptive Profile of the Study Sample

- Analytical Comment.*

The sample is sufficiently heterogeneous to support comparison across several social and institutional dimensions. These descriptive distributions do not by themselves identify factors associated with conflict; that question is addressed by the bivariate and multivariable analyses below.

- *Overall Conflict Prevalence*

Overall, 174 of 384 households reported at least one land conflict, corresponding to a prevalence of 45.3%. Nearly one household in two was therefore affected by the outcome analyzed, providing a substantive basis for examining which characteristics differentiate more and less exposed situations.

- *Access Mode, Documentation, and Conflict*

Table 2 Land-Access Mode, Documentary Evidence, and Conflict Exposure

Access mode	n	%	h evidence n (%)	With conflict n (%)
Inheritance	160	41.7	31 (19.4%)	73 (45.6%)
Customary allocation	99	25.8	14 (14.1%)	44 (44.4%)
Purchase	60	15.6	38 (63.3%)	18 (30.0%)
Donation	31	8.1	12 (38.7%)	17 (54.8%)
Rental/loan	34	8.9	5 (14.7%)	22 (64.7%)
Total	384	100.0	100 (26.0%)	174 (45.3%)

Source: Field Survey, 2026; Documentation Percentages Recalculated from Published Counts.

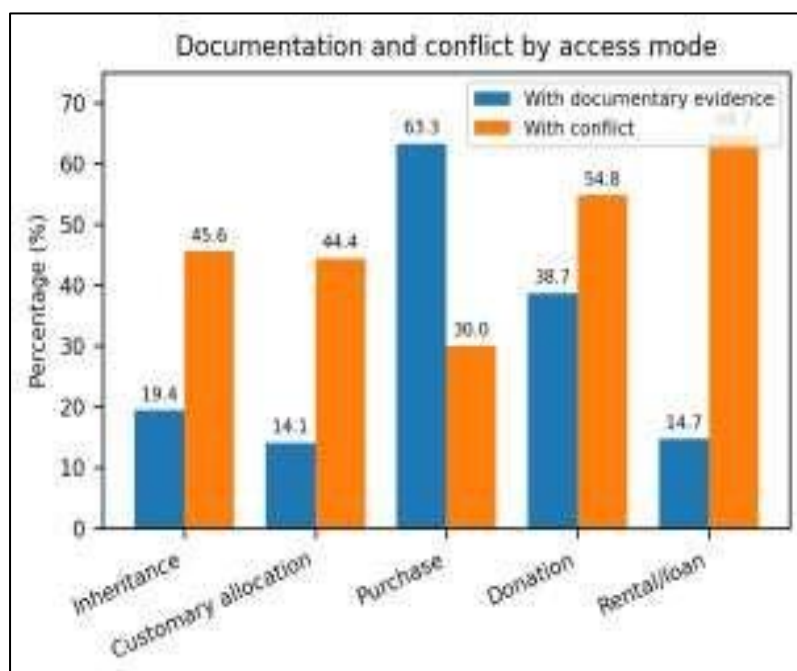


Fig 2 Documentation and Conflict Prevalence by Mode of Land Access.

- Analytical Comment.*

Purchase combines the highest documentation rate (63.3%) with the lowest conflict prevalence (30.0%), whereas rental/loan combines low documentation (14.7%) with the highest conflict prevalence (64.7%). Access mode is globally associated with conflict ($\chi^2 = 12.01$, $p = 0.0173$), but these profiles suggest interdependence with documentation and do not establish an independent effect of access mode.

➤ *Rights Documentation and Conflict Exposure*

Table 3 Rights Documentation: Conflict Prevalence and Effect-Size Measures

Documentation	Conflict/Total	Prevalence	Absolute Difference (95% CI)	Crude PR (95% CI)	Crude / adjusted or (95% CI)
Undocumented	156/284	54.9%	Reference	Reference	Reference
Documented	18/100	18.0%	-36.9 pts [-46.4; -27.4]	0.33 [0.21; 0.50]	0.18 [0.10; 0.32]
Adjusted model	-	-	-	-	0.23 [0.13; 0.41]

Source: Field Survey, 2026; Reanalysis from Published Counts. Continuity-Corrected $\chi^2 = 39.23$; $p < 0.001$. PR = Prevalence Ratio; OR = Odds Ratio.

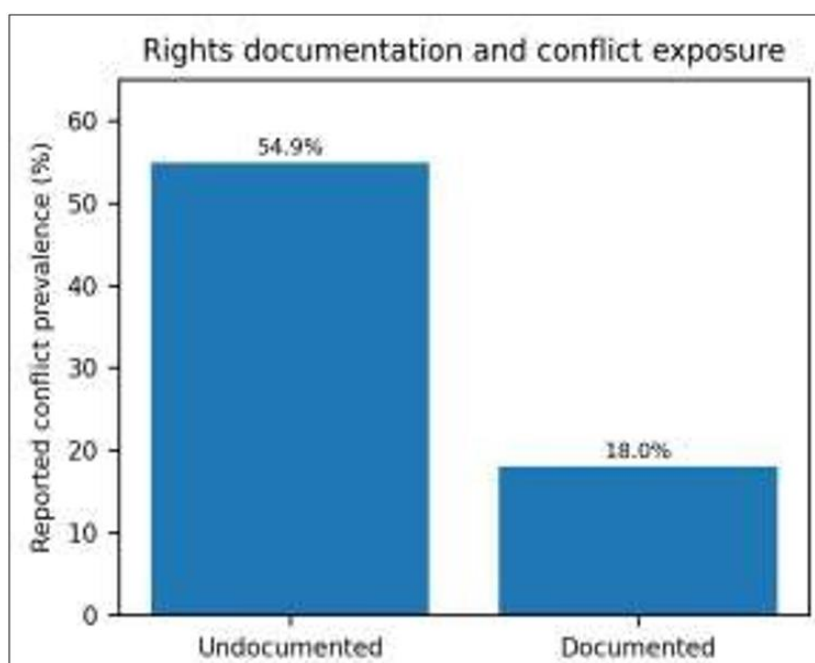


Fig 3 Rights Documentation and Reported Conflict Prevalence.

- Analytical Comment.*

The contrast is both statistically strong and substantively large: reported conflict prevalence is 36.9 percentage points lower among documented households. A PR of 0.33 indicates a prevalence roughly two-thirds lower in this group. The adjusted OR of 0.23 points in the same direction, while still not supporting a causal interpretation.

➤ *Boundary Clarity and Conflict Exposure*

Table 4 Boundary Clarity: Conflict Prevalence and Effect-Size Measures

Boundary Clarity	Conflict/Total	Prevalence	Absolute Difference (95% CI)	Crude PR (95% CI)	Crude / Adjusted or (95% CI)
Unclear	115/194†	59.3%	Reference	Reference	Reference
Clear	59/190†	31.1%	-28.2 pts [-37.8; -18.7]	0.52 [0.41; 0.67]	0.31 [0.20; 0.47]
Adjusted model	-	-	-	-	0.42 [0.26; 0.65]

Source: Field Survey, 2026; Reanalysis of Published Aggregates. Continuity-Corrected $\chi^2 = 29.73$; $p < 0.001$. † Cell Counts Reconstructed Arithmetically from Published Aggregates.

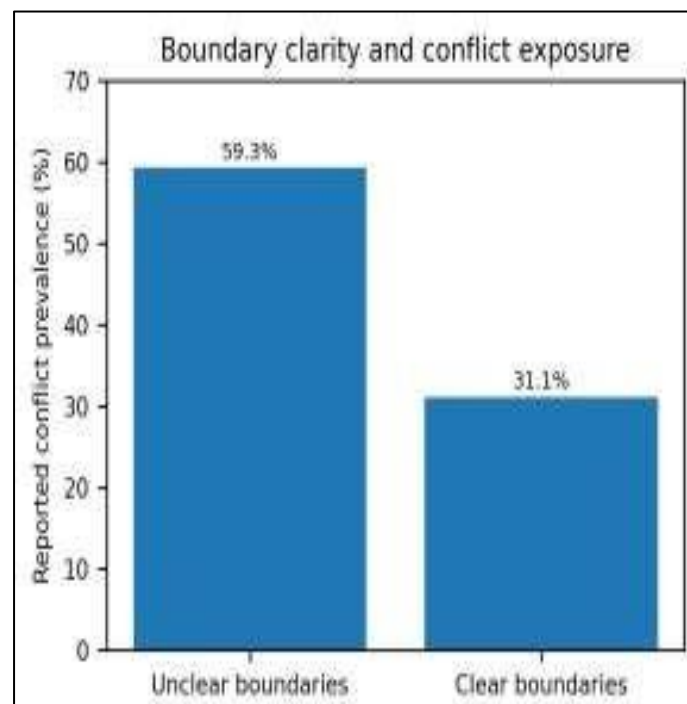


Fig 4 Boundary Clarity and Reported Conflict Prevalence.

- Analytical Comment.*

Clear boundaries are associated with a 28.2-percentage-point lower prevalence of reported conflict. The PR of 0.52 and adjusted OR of 0.42 show a consistent association in the same direction as documentation, supporting the interpretation of a spatial mechanism that is analytically distinct from the evidentiary mechanism.

➤ *Comparison of Bivariate Associations*

Table 5 Bivariate Tests Between Selected Factors and Conflict Exposure

Factor	χ^2	df	p	Cramer's V*	Associated at 5%
Documentation	39.23	1	< 0.001	0.32	Yes
Boundary clarity	29.73	1	< 0.001	0.28	Yes
Access mode	12.01	4	0.0173	0.18	Yes
Gender	1.74	1	0.1877	0.07	No
Knowledge	3.43	2	0.1799	0.09	No
Participation	2.98	2	0.2252	0.09	No
Trust	0.34	2	0.8424	0.03	No

Source: Field Survey, 2026; V Calculated from Reported χ^2 . *For 2 x 2 Tables the Source χ^2 Uses Continuity Correction; V is Therefore Presented as an Approximate Descriptive Effect-Size Indicator.

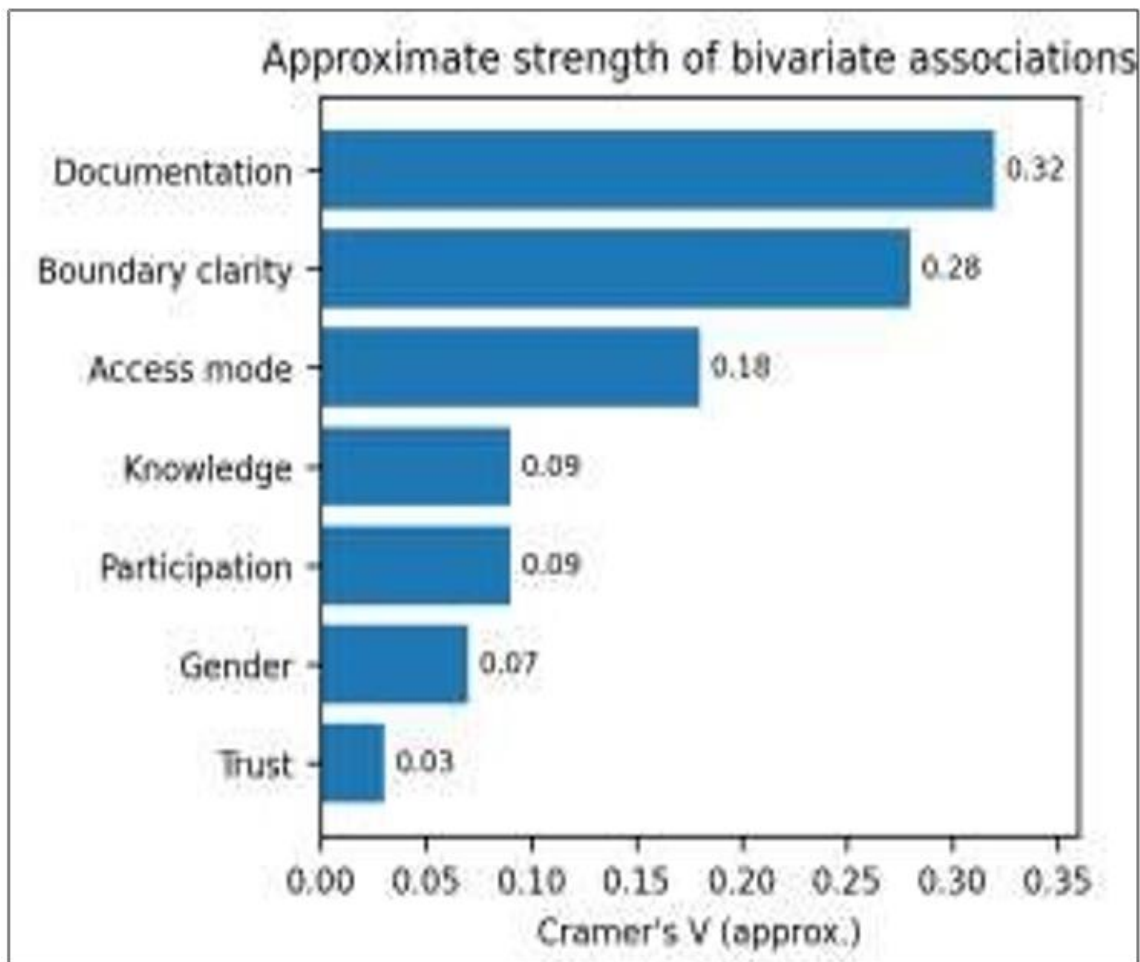


Fig 5 Approximate Strength of the Bivariate Associations.

- Analytical Comment.*

Documentation displays the strongest association, followed by boundary clarity and access mode. Gender, knowledge, participation, and trust do not cross the 5% significance threshold. Non-significance should not be read as social irrelevance; it only indicates that the available sample does not provide sufficient statistical evidence of association with the binary outcome.

➤ *Multivariable Logistic Model*

Table 6 Logistic Regression of Factors Associated with Conflict Exposure

Variable	Adjusted OR	95% CI	p	Conclusion
Documented right	0.23	0.13-0.41	< 0.001	Significant
Clear boundaries	0.42	0.26-0.65	< 0.001	Significant
Male	0.68	0.43-1.07	0.0934	No
Low knowledge	1.79	0.98-3.25	0.0564	No
Moderate knowledge	1.33	0.71-2.48	0.3773	No
Moderate participation	0.91	0.56-1.48	0.7018	No
High participation	0.68	0.36-1.25	0.2143	No
Occupancy duration (per year)	0.99	0.97-1.01	0.4514	No

Source: Logistic Model Reported in the Source Study, 2026 Survey. Reference Categories: Undocumented Right; Unclear Boundaries; Female; Good Knowledge; Low Participation. Access Mode is not Included in the Available Model.

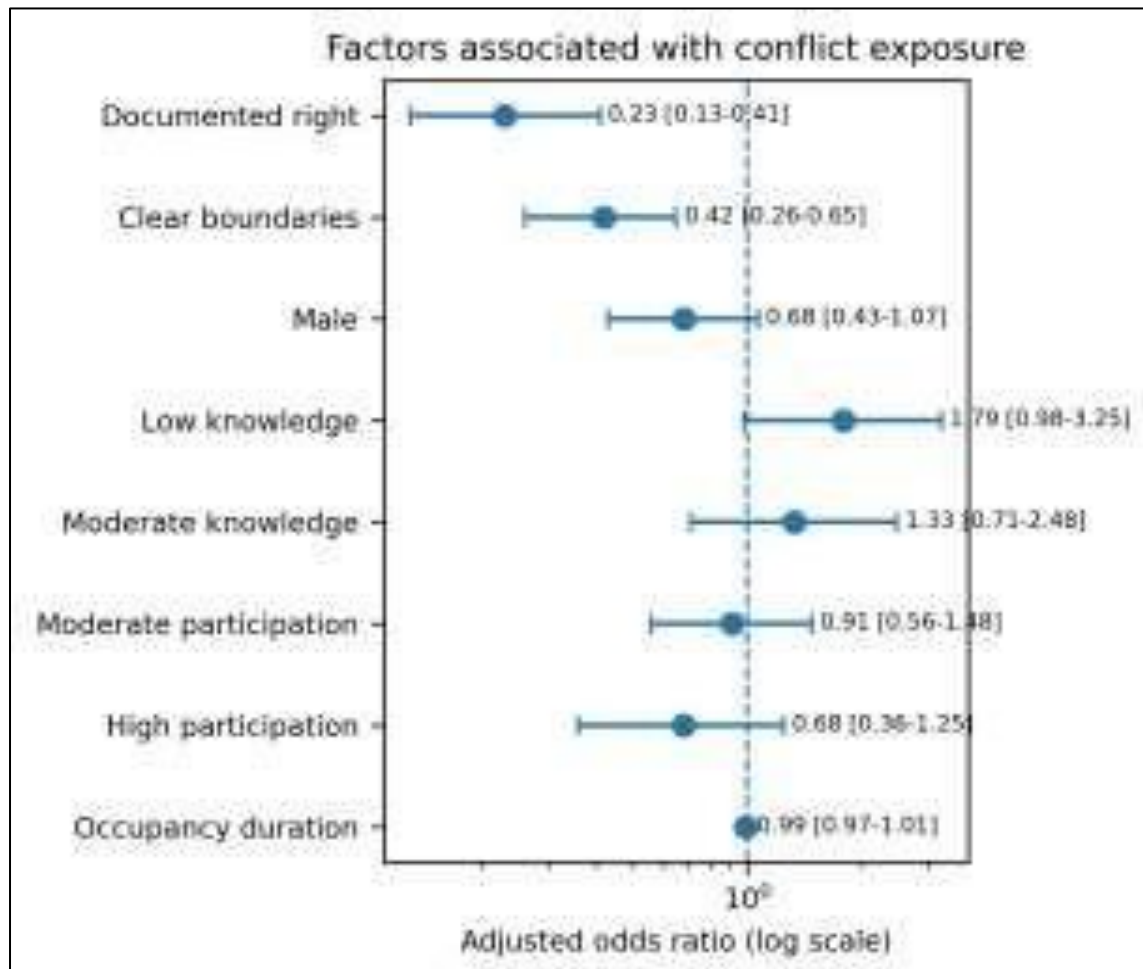


Fig 6 Forest Plot of Adjusted Odds Ratios and 95% Confidence Intervals.

- Analytical Comment.*

Two variables retain statistically clear associations after adjustment: documentation and boundary clarity. An OR of 0.23 corresponds to 77% lower odds relative to the undocumented reference group, while an OR of 0.42 corresponds to 58% lower odds for clear boundaries. These are reductions in odds, not causal reductions in probability. Low knowledge remains close to, but does not cross, the conventional significance threshold ($p = 0.0564$).

➤ *Conflict Typology*

Table 7 Observed Land-Conflict Typology (N = 174)

Conflict Type	N	%
Boundary Disputes	59	33.9
Succession/Inheritance	43	24.7
Contested Occupation	28	16.1
Double Allocation/Sale	27	15.5
Interfamily/Intercommunity	17	9.8
Total	174	100.0

Source: Field Survey, 2026.

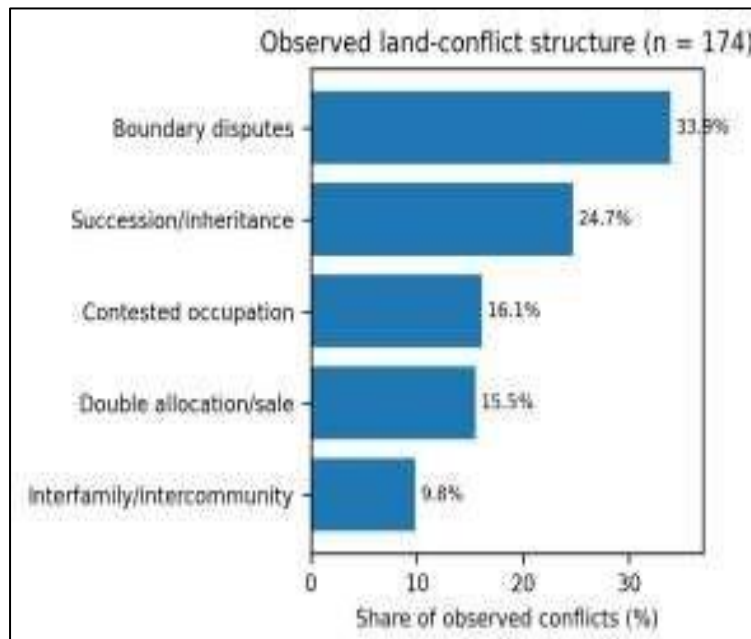


Fig. 7. Structure of Observed Land Conflicts.

- *Analytical Comment.*

Boundary disputes constitute the most frequent category (33.9%), followed by succession-related disputes (24.7%). This structure is consistent with the statistical association between clear boundaries and lower conflict exposure. It strengthens the plausibility of the spatial mechanism without constituting an independent causal test.

➤ *Risk Prioritization*

Table 8 Land-Risk Prioritization Matrix

Risk	Probability	Impact	Score	Level
Boundary Disputes	5	5	25	Critical
Double Allocation	4	5	20	Critical
Succession	4	4	16	High
Contested Occupation	3	4	12	High
Jurisdictional Conflict	3	4	12	High
Exclusion Of Women/Youth	3	3	9	Moderate

Source: Field Survey, 2026 and Authors' Analytical Synthesis. This Matrix is an Operational Prioritization Tool, not a Statistical Test Equivalent to Chi-Square or Regression.

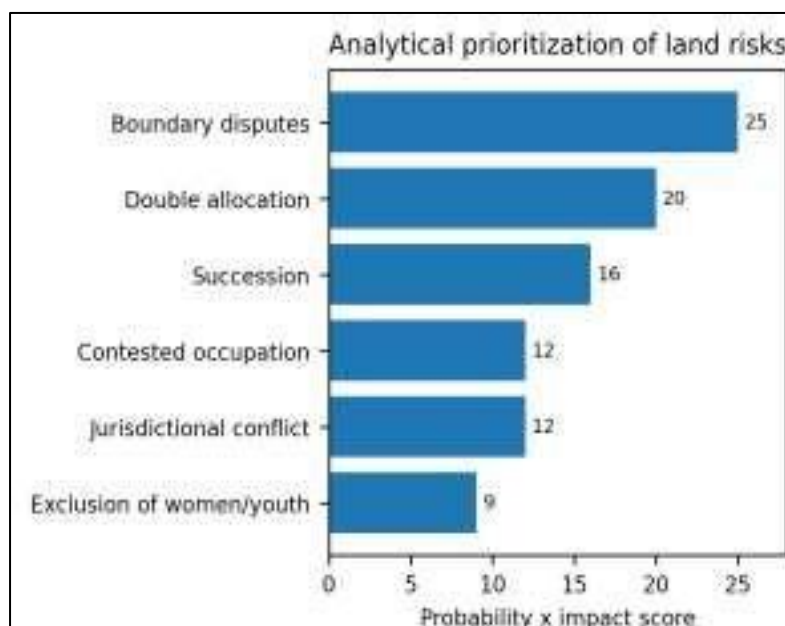


Fig 8 Priority Scores of the Main Land-Related Risks.

- *Analytical Comment.*

Boundary disputes and double allocations concentrate the highest priorities. The matrix translates the empirical diagnosis into an intervention order: contradictory boundary clarification and mapping for boundary disputes, and historical verification and transaction traceability for double allocations.

➤ *Dispute-Resolution Mechanisms*

Table 9 Mechanisms Used in Reported Conflict Cases (N = 174)

Mechanism	N	%
Customary	58	33.3
Administrative	39	22.4
Mediation/Conciliation	34	19.5
Judicial	24	13.8
Unresolved	19	10.9
Total	174	100.0

Source: Field Survey, 2026.

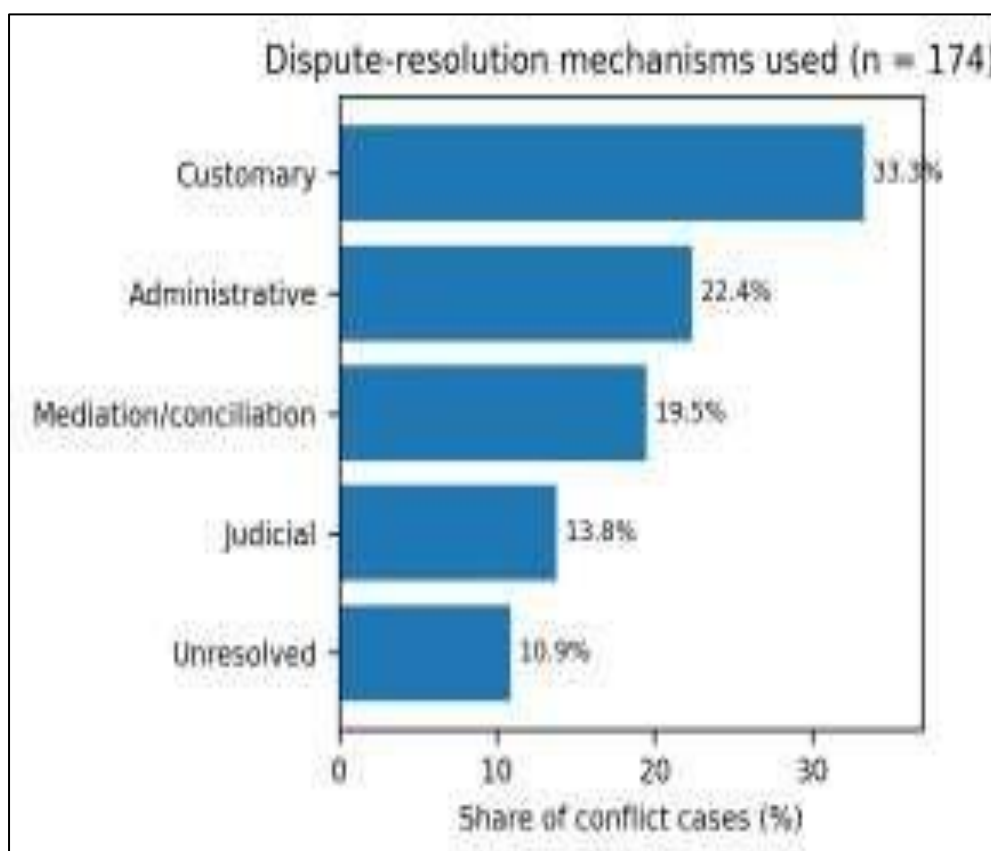


Fig 9 Distribution of Mechanisms Used for Dispute Resolution.

- *Analytical Comment.*

Customary mechanisms are the most frequently used (33.3%), but frequency is not a measure of effectiveness. The available aggregates do not permit valid comparison of costs, delays, enforcement, satisfaction, or recurrence; no hierarchy of effectiveness is therefore claimed.

V. DISCUSSION

➤ *Evidentiary and Spatial Uncertainty at the Core of Conflict Exposure*

The central result is the convergence of two strong associations. Rights documentation sharply differentiates households by reported conflict exposure, while boundary clarity produces a similarly coherent gradient. These

dimensions are not interchangeable: documentation addresses the question of which right is held, by whom, and on what evidentiary basis; boundary clarity addresses the spatial extent over which that right is exercised. The Kimbinga case therefore supports an analytical distinction between evidentiary uncertainty and spatial uncertainty.

This interpretation is more informative than a simple customary-versus-formal dichotomy. A customary right may be stable when it is traceable, socially shared, and spatially intelligible, whereas a written right may remain fragile when it is ambiguous, contested, or attached to competing boundary claims. The governance problem is therefore the convergence of recognition sources rather than the mechanical replacement of one source by another.

➤ *Documentation: A Convergent Result, but Not a Panacea*

The Kimbinga finding is directionally consistent with Fatema [4], who reported in North Kivu that land titles were associated with a 10-18 percentage-point reduction in the probability of low-intensity interhousehold conflict, while not necessarily reducing damages once conflict occurred. The difference observed in Kimbinga is larger, but the documentation variable is also broader, encompassing several forms of evidence rather than formal title alone. Comparison should therefore focus on the direction and mechanism of association rather than equality of effect sizes.

Van Leeuwen et al. [5] further show that local registration can clarify rights without, by itself, creating durable land peace where public authority is weak, institutions compete, or procedures are captured. The Kimbinga result should be read in the same way: documentation is associated with lower uncertainty, but its security value depends on traceability, verifiability, and social recognition.

• *Social Recognition and Institutional Power*

Hoffmann et al. [6] show in Bukavu that property certainty depends on negotiation and on resources that enable actors to obtain recognition from public authorities. Rights do not operate independently of power relations. This insight clarifies an important limitation of the Kimbinga findings: households able to document rights may also be better connected to institutions, possess greater resources, or occupy less contested spaces. Adjustment reduces some observed confounding but cannot eliminate unmeasured differences.

For this reason, the article does not conclude that 'documents prevent conflict.' A more defensible mechanism is that verifiable evidence can reduce ambiguity about the origin and holder of a right, while its potential effect remains conditional on the social and institutional environment in which that evidence is produced and recognized.

➤ *Boundary Clarity and the Governance of Space*

Boundary clarity is particularly coherent with the observed conflict structure: boundary disputes account for 33.9% of cases, and households reporting clear boundaries show markedly lower conflict prevalence. This finding is consistent with the importance of clearly defined boundaries in common-pool resource governance [7].

The practical implication is nevertheless social as much as technical. A river, tree, path, or marker does not automatically secure a right; a boundary is stable when relevant parties assign a sufficiently compatible meaning to it. Participatory mapping should therefore not mechanically precede contradictory clarification. Digitizing a contested boundary may freeze or amplify a dispute rather than resolve it.

➤ *Access Mode: An Important Signal and Residual Confounding*

Access mode is significantly associated with conflict in bivariate analysis. Purchase combines the highest documentation rate with the lowest conflict prevalence, whereas rental/loan presents the opposite pattern. This is substantively informative but methodologically complex

because access mode is related to documentation, kinship, duration of occupancy, and probably land value.

Its absence from the available adjusted model is therefore a meaningful limitation. Individual-level data would be required to test whether the documentation and boundary associations remain stable after introducing access mode and possible interactions. The limitation is made explicit rather than hidden.

➤ *Relevance to Land Reform in the DRC*

The discussion is timely in the context of national land reform. Law No. 25/062 of 30 December 2025 reinforces legal security, administrative modernization, and protection of local-community lands [8], while the National Land Plan 2026-2040 provides a strategic framework for reform implementation [9]. Recent public orientations also emphasize digitization, traceability, and conflict prevention.

The Kimbinga results support these directions but suggest a sequence of implementation: clarify right-holders and boundaries before digitization, document agreements in verifiable form, and then connect the resulting information to competent institutions. Technology should stabilize an adequately clarified situation; it cannot substitute for contradictory social recognition and institutional coordination.

➤ *Limitations and Robustness of Interpretation*

- The cross-sectional design establishes association rather than causal temporality.
- The conflict outcome and boundary clarity are household-reported and may be affected by recall, perception, and asymmetry between disputing parties.
- Final fieldwork details - local units, exact dates, and response rate - are insufficiently documented in the available source materials for full reproduction here.
- Access mode is significant in bivariate analysis but absent from the available adjusted model.
- Cell counts for the boundary-clarity 2 x 2 table are reconstructed from published aggregates; no new individual-level data were created.
- Generalization should remain limited to Kimbinga and sufficiently comparable settings; the findings do not automatically represent all of Kivu or the DRC.
- These limitations do not erase the internal coherence of the findings; they define the level of evidence. The study identifies robust, theoretically plausible associations that require further validation using complete individual-level data, longitudinal follow-up, or evaluated interventions.

VI. IMPLICATIONS FOR LAND GOVERNANCE

➤ *Guiding Principle*

The operational framework derived from the findings aims to reduce three sources of uncertainty: evidentiary, spatial, and institutional. It is not presented as an intervention whose effectiveness has already been experimentally demonstrated; rather, it translates empirical findings into a testable governance sequence.

➤ *Proposed Securing Sequence*

- Identify the right, its origin, current right-holders, and potential co-right-holders.
- Clarify boundaries contradictorily with relevant parties before definitive mapping.
- Document rights, agreements, and transfers in a traceable and verifiable format.
- Verify the historical chain before any new allocation or transaction to reduce double allocation.
- Use graduated mediation for disputes suitable for consensual settlement, with referral to administration or courts where competence or coercive authority is required.
- Monitor implementation and preserve physical and digital evidence.

➤ *Priorities Derived from the Findings*

The first priority is boundary clarification because boundary disputes combine high frequency, a significant association with conflict exposure, and the maximum score in the risk matrix. The second is traceable rights documentation, given the observed prevalence gradient. The third concerns double allocations, for which historical verification before new transactions is a logical response. Succession constitutes a further priority because of its substantial share in the conflict typology.

➤ *Institutional Articulation*

The frequent use of customary mechanisms shows that an exclusively administrative policy would be disconnected from local practice. Conversely, some disputes require statutory or judicial competence. A graduated pathway is therefore more appropriate: local prevention -> mediation where suitable -> documentation of agreements -> administrative or judicial referral according to the nature of the dispute -> follow-up of implementation. This logic is consistent with conflict-sensitive land mediation approaches developed from eastern DRC experience [10].

➤ *Monitoring Indicators*

A future pilot should monitor at least: the proportion of rights with traceable evidence; the proportion of boundaries mutually recognized through contradictory processes; the number of detected double allocations; median dispute-resolution time; the proportion of documented agreements; recurrence rates; and the proportion of case files that can be retrieved and verified. These indicators would permit progression from a normative framework to an empirically evaluated governance intervention.

VII. CONCLUSION

In Kimbinga, 45.3% of the 384 surveyed households reported at least one land conflict. Two dimensions distinguish households particularly strongly: rights documentation and boundary clarity. Conflict prevalence declines from 54.9% to 18.0% according to the presence of documentary evidence and from 59.3% to 31.1% according to boundary clarity. Both associations persist in the available logistic model, with adjusted ORs of 0.23 and 0.42, respectively.

The main contribution is to move the debate beyond land title alone. Under legal pluralism, community-land security appears to depend on reducing evidentiary uncertainty - who holds which right and on what basis - and spatial uncertainty - where that right begins and ends. Evidence, social recognition, boundary clarity, and institutional coordination should therefore be treated as complementary dimensions rather than competing alternatives.

This conclusion remains deliberately cautious. The data are observational, several variables are self-reported, and the available adjusted model does not include access mode despite its bivariate significance. The results therefore do not demonstrate that documentation or mapping interventions would automatically generate the observed reductions.

A next scientific step should use the complete individual-level dataset, document fieldwork precisely, test specifications that include access mode, and follow households over time. A quasi-experimental or experimental evaluation of an intervention combining contradictory boundary clarification, traceable documentation, mediation, and institutional coordination could then test the proposition generated by this study: land tenure security is strengthened when rights are simultaneously identifiable, verifiable, spatially intelligible, socially recognized, and institutionally defensible.

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