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Participatory, Multi-Criteria Evaluation Methods as a Means to Increase the Legitimacy and Sustainability of Land Use Planning Processes. The Case of the Chaco Region in Salta, Argentina

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Abstract Conflicts over land use and ownership are common in South America and generate frequent confrontations among indigenous peoples, small-scale farmers, and large-scale agricultural producers. We argue in this paper that an accurate identification of these conflicts, together with a participatory evaluation of their importance, will increase the social legitimacy of land use planning processes, rendering decision-making more sustainable in the long term. We describe here a participatory, multi-criteria conflict assessment model developed to identify, locate, and categorize land tenure and use conflicts. The model was applied to the case of the "Chaco" region of the province of Salta, in northwestern Argentina. Basic geographic, cadastral, and social information needed to apply the model was made spatially explicit on a Geographic Information System. Results illustrate the contrasting perceptions of different stakeholders (government officials, social and environmental non-governmental organizations, large-scale agricultural producers, and scholars) on the intensity of land use conflicts in the study area. These results can help better understand and address land tenure conflicts in areas with different cultures and conflicting social and enviornmental interests.

Keywords Argentina · Conflict assessment model · Land rights · Land tenure · Land use planning · Salta

Introduction

According to the Food and Agriculture Organization (FAO) of the United Nations, land tenure is "a set of rules that define the rights of access by people to [land and] particular natural resources, and is also the form of social endorsement of these relationships" (Herrera and da Passano 2006, p. 9). This definition considers that a land tenure system "comprises the set of possible bases on which land may be used… [and] includes rural and urban tenures and ownership, tenancy and other arrangements of land use". Rules of tenure define how property rights to land are to be allocated within societies. They define how access is granted to rights to use, control, and transfer land, as well as associated responsibilities and restraints. Conflicts over land tenure have been ubiquitous throughout human history and could be located at the interface between environmental and social issues (Powelson 1987). These conflicts have sometimes led to different types of land "reform", both in times of peace or following political upheavals (Besley and Burgess 2000). Reform interventions have generally followed three main approaches or combinations of them (Anaafo 2013). Market-driven privatization of land rights, an approach supported by the property rights theory, postulates that the

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efficiency of land markets increases with unambiguous specification of property rights. State-controlled land-titling processes, on the other hand, are based on the allegedly superior capacity of the state to ensure equitable land delivery and distribution. A third approach is the reinforcement of community-based land rights, which intends to transcend the market-state dichotomy and can be appropriate to manage common-pool resources (Ostrom 2010).

The idea that granting land property rights increases land tenure security and fosters settlements, and rural development has been particularly strong within Western government-backed development aid institutions and multilateral organizations (van Gelder 2010; Loehr 2012; Havel 2014). In fact, most of recent land reforms in developing countries have been based on the property rights theory and have focused primarily on facilitating land markets (Barnes 2003). There are a number of benefits from more secure land tenure, such as increased incentives for investment by legitimate owners who can use land as collateral for credit (Childress 2008). Yet as shown in many tenure formalization processes (both urban and rural), access to credit and the effective use of natural resources might not necessarily be facilitated by official land titles, particularly in the case of women or in specific regions such as the so-called "agricultural frontiers" (Deere and León 2001; Gould 2006; Meinzen-Dick and Mwangi 2009; Feiring 2013). It has also been pointed out that land tenure formalization, a process that might take years or even decades, does not always lead to more secure tenure, poverty reduction, and enhanced agricultural productivity (Bromley 2009; Anaafo 2013; Zevenbergen et al. 2013). Land tenure rights, security of tenure, and land access are not solely related to legal documents. Several instruments and practices that go beyond deeds or titles involve a varying degree of legal complexity and social acceptability (Wehrman and Antonio 2011). While the terms "land reform" or "agrarian reform" have fallen into relative oblivion (Bernstein 2002), governments and other social stakeholders such as multilateral organisms, non-governmental organizations (NGOs), peasants, and indigenous peoples, often engage in so-called Land Use Planning (LUP) processes meant to achieve more sustainable land use scenarios (Herrera and da Passano 2006; Rudel and Meyfroidt 2014). When linked to land use, sustainability has been defined as the "decoupling of economic growth from environmental degradation while supporting social cohesion in rural areas" (Helming et al. 2008). Local land tenure systems and tenure-related conflicts are often an important variable during those planning activities (FAO 2002). Land tenure and use conflicts can go from legal disagreements over family land to multi-cultural discussions about the original and therefore legitimate inhabitants of a particular area. In the latter cases, conflicts are particularly difficult to address, let alone solve to the satisfaction of all parties.

Cross-cultural land use conflicts are common in Latin America, where indigenous peoples and farmers are struggling to make their rights recognized by highly unequal, westernized, and even colonial land tenure and use systems (Barnes 2003; Childress 2008). Despite commitments to the United Nations Declaration on the Rights of Indigenous Peoples and formal adherence to International Labor Organization (ILO) Convention N° 169, land conflicts are frequent in this part of the world, with particularly bad consequences for indigenous communities and small-scale agricultural producers (Feiring 2013; Siegel et al. 2013). Some of these conflicts have even made it to the Inter-American Commission of Human Rights (IACHR) of the Organization of American States[1]. The advent of export-driven large-scale industrialized agriculture (particularly soybean) and intensive livestock raising systems has drawn a lot of attention to land use change and related conflicts in some South American countries (Baldi and Paruelo 2008; Viglizzo et al. 2011; Volante et al. 2012, 2016; le Polain de Waroux et al. 2016). This process of progressive change from existing native forests into pastures and agricultural land has been extensively studied in the Amazon forest since the first development interventions more than half a century ago (Schmink and Wood 1984; Walker and Homma 1996; Walker and Richards 2013). In this region, the expansion of the agricultural frontier forced the displacement of local dwellers and led to several violent struggles referred to as the "Amazon land war" (Simmons 2005; Simmons et al. 2007). Other countries in the region have also experienced similar land change processes and land-related conflicts, though not always associated with the cultivation of soybeans or cattle ranching. In the Toledo District of Belize, intense land use changes took place in the last century due mainly to increased population, migrations, the improvement and construction of roads, and timber extraction practices (Emch et al. 2005). Land conflicts in Chile have also affected indigenous peoples since colonization processes reduced the areas available for grazing and other subsistence activities (Azócar et al. 2005). Conflicts over land tenure and control have also been observed in Central American countries such as Panama, Nicaragua, and Honduras (Herlihy and Leake 1990; Herlihy 2003; Herlihy and Knapp 2003).

The "Chaco" (or "Gran Chaco") region, a relatively homogeneous ecosystem shared by Argentina, Bolivia, Brazil, and Paraguay, and seat of one of the largest

[1] Such as the complaint filed in Report N° 78/06 on Petition N° 12,096. This complaint, submitted by "Lhaka Honhat", an organization representing indigenous communities in northwestern Argentina, was declared admissible in 2006.

seasonally dry forests in the world, has been strongly affected by deforestation and land use change in the last decades (REDAF 1999; Grau et al. 2005). Deforestation rates in this region largely exceed Latin American and world averages (Zak et al. 2008; Volante et al. 2012). Associated land use changes are affecting indigenous communities and small-scale farmers whose livelihoods depend on the products and services provided by forests (Foley et al. 2005; Grau and Aide 2008; Grau et al. 2008). Surveys in the Chaco region report that there are hundreds of unsolved conflicts affecting more than 100,000 people (REDAF 2013). These conflicts are the result of historical processes, explicit policies in other areas such as agriculture and urbanization, and tacit policies on land tenure and use. Since economic and political power is concentrated on large agricultural firms with connections with local and national governments, land use conflicts are unlikely to be solved any time soon despite long-term efforts by local and international NGOs, universities, and research centers (Seghezzo et al. 2011). The few spatial plans tried by governments have mainly followed centralized, techno-centric approaches and have been very rarely connected to the needs, values, priorities, and practices of local peoples (Wollenberg et al. 2009). This is undesirable in complex environments such as remote forest areas, where cultural and environmental diversity are high, local technical capacity is frequently insufficient, information is scarce at best, and power relationships between different stakholders are highly asymmetrical. Transparent governance systems and ample participation of all relevant stakeholders are required to avoid arbitrary decision-making under these circumstances (Carsjens and Ligtenberg 2007). For that reason, understandable decision-support methodologies are important to help stakeholders deal with problems of land allocation, nature preservation, and environmental justice. The use of such methodologies does not preclude the use of modern techniques and does not necessarily imply losing the technical efficiency usually ascribed to traditional, centralized planning processes (McCall 2003; Peel and Lloyd 2007).

In this study, we set out to develop a relatively simple decision-support tool that allows one to compare outcomes when land use conflicts are systematically taken into account. We believe that, if adopted by decision makers, this tool could be helpful to improve the legitimacy and sustainability of LUP processes plagued by disempowerment of minorities, land "grabbing", forced displacements, abandonment of traditional livelihoods, and environmental degradation (Robertson and Pinstrup-Andersen 2010; Borras et al. 2012; Anseeuw et al. 2013; Rudi et al. 2014). We used a methodological approach that combines methods and analytical tools from Land Change Science (LCS) and Political Ecology (PE) (Turner and Robbins 2008; Brannstrom and Vadjunec 2013). LCS provides PE with analytical focus via remote sensing and Geographic Information Systems (GIS) techniques that can be used to identify and assess impacts associated with land use and cover changes. PE strengthens LCS with a theoretical framework that addresses the distribution of political and economic power in social and environmental conflicts (Walker and Richards 2013). To develop and assess this tool, we: (1) collected information on land tenure and use conflicts in the study area; (2) identified and mapped different variables that can attenuate or exacerbate these conflicts; (3) categorized tenure and use conflicts according to the perceptions of a number of locally relevant stakeholders; and (4) discussed the potential implications of this approach for a more legitimate and sustainable LUP in the region. Our case study was the LUP process of the province of Salta, in northwestern Argentina. This process, made in accordance to a specific National law and controlled by a small number of powerful stakeholders, failed to adequately take into account existing land conflicts. By means of a conflict assessment model (CAM), we will also show that land tenure and use conflicts may have different "intensity", understood as the variable degree of importance assigned to those conflicts by the stakeholders affected, according to their subjective perception of the legitimacy and/or urgency of their claims. Our method could be useful to tackle tenure issues according to an approach that is both rational and sensitive to cultural diversity. We argue that land conflicts need to be identified and addressed at the very beginning of planning processes as a way to increase the legitimacy and sustainability of land use in areas with different cultures and conflictive interests. We acknowledge that, in our particular case study, solving the legal aspects of land tenure and use conflicts is probably not enough to guarantee sustainable livelihoods for small-scale farmers and indigenous communities currently relying on already degraded environments and immersed in an economic and political system that systematically favors large-scale agricultural activities.

Materials and Methods

Case Study

Our study was performed in the Chaco region of the province of Salta, in northwestern Argentina, which extends over almost 7.2 million hectares, an area larger than Ireland (Fig. 1).

Rainfall patterns in this area range from about 800 mm in the West to 550 mm in the East. This gradient largely defines the characteristics of the Chaco's native forests: from relatively dense forests with a variety of tree species in the West to fewer, but also valuable tree species with larger

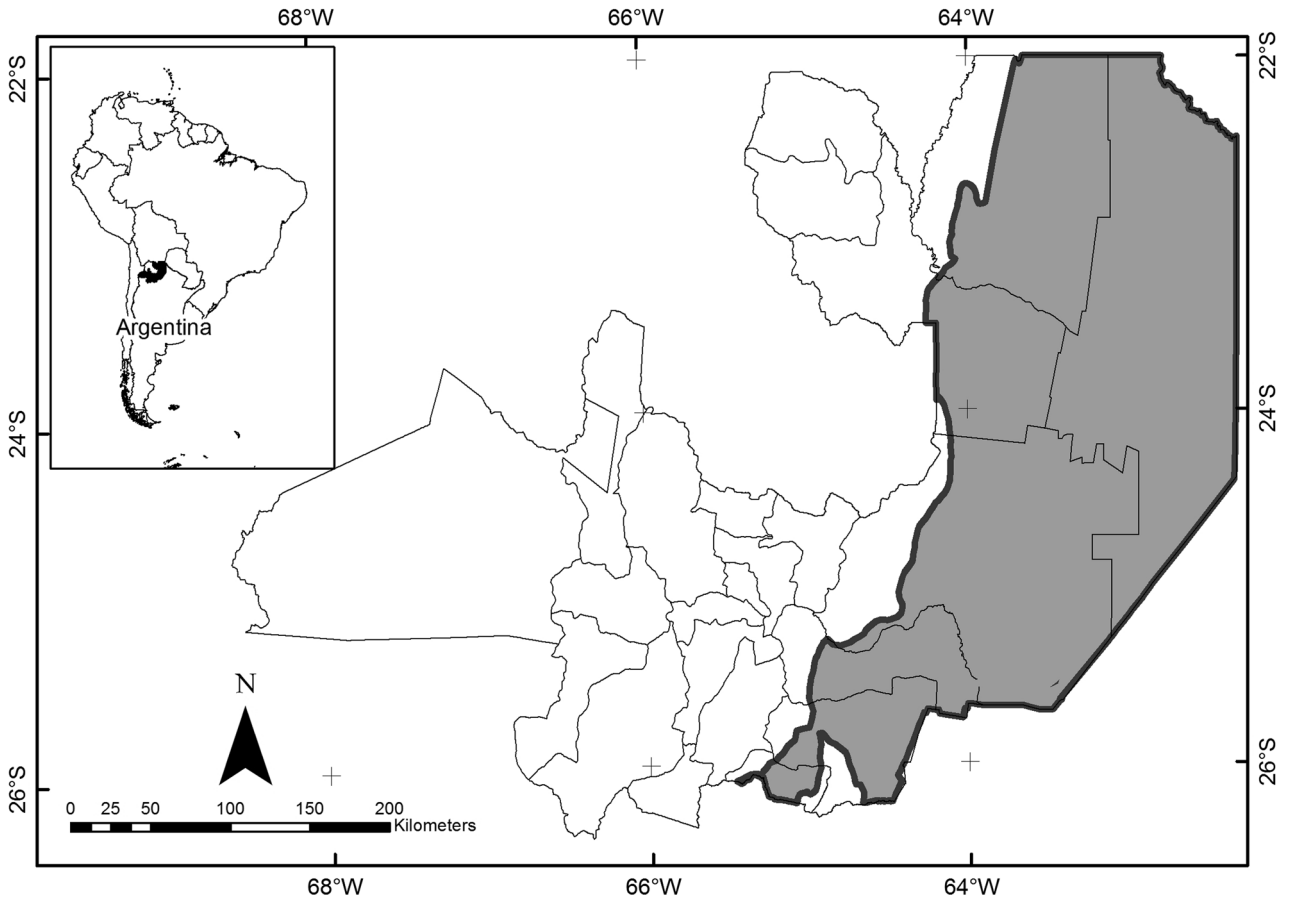

Fig. 1 Province of Salta, in northwestern Argentina, showing the study area, part of the region known as the "Chaco". Thin lines indicate internal administrative boundaries

proportion of shrubs and undergrowth, and patches of grasslands in the East. These ecosystems have also slightly different types of soils and therefore their agricultural potential is different. Main crops in both areas include soybean, corn, wheat, sorghum, and different types of beans, with scattered but increasingly important farms dedicated to cattle ranching on natural and implanted pastures or feed-lot systems (Piccolo et al. 2008). Salta is the province with the largest amount of native forests in Argentina and has been at center of the national attention since 2007, when Argentina passed Law 26,331 (the Forest Law) intended to regulate the protection, enrichment, restoration, utilization, and management of native forests and the environmental services produced therein. Provincial states were requested to set up participatory LUP processes in order to classify existing native forests in three categories (high, medium, and low conservation value) according to a number of technical and social criteria. This process was supposed to produce maps portraying these categories in different colors (red, yellow, and green, respectively).

The Forest Law theoretically endorsed the recognition of ancestral land rights to the large number of indigenous communities living in the area. Yet it included no provisions to explicitly address historic land claims by these communities, and by a number of small-scale farmers (usually referred to as *criollos* to highlight their cultural origin and European descent), as part of the LUP process. As discussed more at length elsewhere (Seghezzo et al. 2011), the LUP process in Salta was highly contentious. The map produced by the government of Salta in 2009 generated heated debates between large-scale agricultural producers, environmental organizations, *criollos*, and indigenous peoples. Some indigenous communities and *criollos* farmers took this opportunity to make their causes more visible at provincial, national, and international level, demanding their territorial claims be solved prior to any planning process. The government, under pressure from large-scale agricultural producers, was unable or unwilling to solve tenure conflicts during the LUP process. However, allegedly as a precautionary measure, some of the territories

claimed or used by indigenous communities were grouped under the medium conservation value category in the final map (yellow).

Criollos and representatives of indigenous communities considered that classifying their lands according to a simplistic worldview was a potential hindrance to their rights to preserve and/or use the forests according to their interests and cultural perspectives. Large agricultural producers, on the contrary, considered that tenure and use conflicts were little more than an obstacle to their development agenda and lobbied against a concerted solution[2]. To make things even more controversial, a government decree from 2010 (Decree 2211) allowed yellow and red areas to be "re-categorized" green at the request of current title-holders following a relatively straightforward administrative procedure (Seghezzo et al. 2011). As denounced by academics and NGOs, tens of thousands of hectares have been re-categorized using this Decree and some of them are currently being cleared for agriculture (Greenpeace et al. 2013). This added a new layer of forest loss to the steady rate of "legal" deforestation of green areas and to the illegal deforestation that was and still is taking place in yellow and red areas. Estimations made by INTA and the University of Buenos Aires indicate that since the passing of the Forest Law in November 2007, about 360,000 hectares have been deforested in Salta, of which more than 100,000 were in protected areas (REDAF 2012)[3]. Recent official estimates from the government of Salta put the overall figure to 458,351 ha, of which 257,828 ha (56.3 %) were illegally deforested (Greenpeace 2016). Land tenure and use conflicts have a painful contemporary importance in Salta. Ineffective policies and long-standing, unfulfilled electoral pledges made by successive provincial administrations generated a deep distrust of the government, heavily criticized for its apparent lack of political will and deficient institutional capacity. At the end of 2012, discontent in some areas was so serious that Governor Juan Manuel Urtubey and the then acting Catholic Archbishop had to personally visit some communities in the Chaco region and talk to local communities to avoid clashes between indigenous groups and local farmers. In the framework of the demand filed by some indigenous communities against the National State (see footnote number 1), the Executive Secretary of the IACHR (Emilio Álvarez Icaza) paid a visit to Salta to see firsthand areas claimed by indigenous communities and *criollos* farmers and assess developments on the ground. After his visit, he urged the Governor and other provincial authorities to accelerate on-going processes of land tenure regularization to avoid further violations of human rights of ancestral and customary land holders at the expense of deforestation and large-scale agriculture[4]. At the same time, indigenous communities and *criollos* had renewed their intentions to reach final agreements on land allocation in some contested territories[5]. Part of these agreements, fostered by local NGOs, had already been acknowledged by the government in 2007 (Decree 2786) after years of negotiations between the parties. In May 2014, the government finally issued Decree 1498 formally transferring ownership of 227,000 hectares to 382 *criollos* families and 375,000 hectares to 71 indigenous communities, leaving 40,000 hectares to institutional uses (roads, schools, urban areas, etc.). Although Decree 1498 concerns only a fraction of all land claimed by these collectives in the Chaco region, this has certainly been a sign of progress and an acknowledgment of the legitimacy and fairness of the struggles of indigenous communities and *criollos*. Whether or not legal land ownership will automatically translate into improvements in the local livelihoods of the people living in these areas still remains to be seen, particularly because improvements are highly dependent on public investments on infrastructure and public services.

Conflict Assessment

Conflict assessment was performed following a conflict resolution approach consisting of three main steps (Bruckmeier 2005; Zhang et al. 2012). The first step included stakeholder analysis and identification of key issues, discourses, and motivations for conflict resolution. This stage included literature retrieval, participant observation, involvement in debates and roundtables, and production of technical reports throughout the discussion and implementation of the Forest Law (since 2007). Main results obtained at this stage of the research were reported elsewhere (Seghezzo et al. 2011). The second step was the detection, mapping, and evaluation of land tenure and use conflicts. It was performed following a sequential procedure as follows (methodological details below, in the respective sub-sections): (1) selection of a specific conflict zone within the study area; (2) identification of complementary variables that might influence conflicts in this zone; (3) development of a CAM; and (4) participatory construction of different conflict scenarios. Methods used included surveys and structured interviews with key stakeholdes to investigate the nature and severity of land use conflicts. The third step to resolve the conflicts should be led by the government and is therefore beyond the scope of this article. This last step should include participatory approaches where parties share their concerns, but learn about other parties' interests in a

[2] Newspaper *Clarín*, 6 April 2013; Newspaper *El Tribuno*, 19 June 2013.
[3] Newspaper *Página 12*, 23 January 2014.
[4] Newspaper *Nuevo Diario de Salta*, 12 May 2013.
[5] Newspaper *Nuevo Diario de Salta*, 11 June 2013.

facilitated way. The findings of this research and other similar studies about land conflicts can be used to inform the government and other stakeholders about possible views and proposals for practices since our ultimate goal is not simply retrospective or reactive, but progressive (Robbins 2004).

Selection of a Conflict Zone

Information for the identification and selection of a conflict zone within the study area was obtained from the following governmental and NGOs: (1) Salta's provincial statistics office (Dirección General de Estadísticas); (2) the National Ministry of Science and Technology (MINCyT); (3) the National Institute of Agricultural Technology (INTA); (4) the National Administration of National Parks (APN); (5) FUNDAPAZ (Fundación para el Desarrollo en Justicia y Paz; Foundation for Development in Justice and Peace); and (6) ASOCIANA (Acompañamiento Social de la Iglesia Anglicana en el Norte Argentino; Social Support from the Anglican Church in Northern Argentina). Land tenure and use are highly dynamic processes and therefore the accuracy and reliability of the information used in this study varies according to the source, the date of collection, and the persons in charge of the surveys. For these reasons, before actual political decisions are made, more field studies might be necessary to confirm, update, or reject some of the data used in this study. Information was geographically situated in maps built at a scale of 1:250,000 using free GIS software (GvSIG and QGIS). Areas claimed by indigenous communities included current and ancestral territories defined by long-term data on dwelling areas, trajectories followed for hunting and gathering, rivers used for fishing, sacred places, cemeteries, and other important subsistence and cultural sites. A preliminary map with this information was officially presented by representatives of several indigenous peoples to the Government of Salta during the LUP process in 2008 to support their territorial claims. Small-scale *criollos* farmers and their families concentrate their presence and claims mainly in the northeastern section of the study area, following a scattered pattern characteristic of extensive cattle ranching (FUNDAPAZ 2012, 2013). The area effectively occupied by each family depends on several variables, but has been largely based on the amount of livestock owned. In fact, this specific variable has been used by the government to grant some land rights to long-term dwellers in the North of the province. Other, less important variables are the presence of built infrastructure such as enclosures and water wells, distance to surface water and watering holes, roads, and nearby towns, among others. Based on these considerations, areas used by *criollos* families were estimated by assigning an area of 5-km radius around each settlement, which could be safely assumed to be the maximum area effectively used for grazing and other productive activities (Blanco et al. 2005; Grau et al. 2008). A certain degree of overlapping between settlements is inevitable since there are no regulations on the number of cattle a person can own and enclosures are almost non-existent. We defined a variable called ACTORS with three classes: indigenous claims, *criollos* claims, and both claims combined. By merging the areas used or claimed by indigenous communities and *criollos* families, the entire study area was then reduced to a specific "conflict zone". Outside this zone, only infrequent and mostly confined land use conflicts have been reported.

Identification of Complementary Variables

On top of actual ownership or use claims by indigenous communities and *criollos* families, we identified three important complementary variables that might exacerbate or attenuate land tenure and use conflicts in the conflict zone, and can therefore be helpful to analyze and categorize them:

1) *Land tenure system (TENURE)*: This variable represents the current ownership status in the conflict zone. Tenure in this area can be divided in four classes: (1) State-owned (the State as registered title-holder); (2) Private; (3) Communal (collective titles held by indigenous communities); and (4) Unknown (areas with no registered proprietor, but most likely also private). The latter is a somewhat irregular tenure situation that might be due to outdated databases, potential administrative irregularities, or other historical reasons.
2) *Plot size (SIZE)*: Size of the area of each farm or otherwise homogeneous land unit. Plots were divided in four classes: (1) Large (more than 5000 ha); (2) Medium (200–5000 ha); (3) Small (20–200 ha); and (4) Very small (0–20 ha). Categories were obtained from several sources, such as the National Agricultural Censuses (CNA) performed in 1998 and 2002, a description of the study area made by INTA (Piccolo et al. 2008), and other related studies conducted in the area (van Dam 2008; González 2000).
3) *LUP map (PLANNING)*: This variable includes areas that are already under agricultural production and areas with native forests. Classes in this variable are: (1) Agriculture; (2) Green (forests with low conservation value); (3) Yellow (forests with medium conservation value); and (4) Red (forests with high conservation value).

These variables were selected by the research team and discussed with several local stakeholders and experts. Criteria used to select these variables were the following: (a) existence of antecedents on their use as direct or indirect

proxies for land tenure or use conflicts; (b) relevance for LUP processes; (c) availability and reliability of information; and (d) potential for public participation. Maps showing the geographical distribution of complementary variables were also built at a scale of 1:250,000. In these maps, land units (farms, communal areas, State-owned land, or any other otherwise homogeneous plot of land) fall into one and only one class for each variable. Other variables, such as economic indicators, large land acquisitions, "land grabbing" processes, national security in international borders, ownership of carbon stocks, among others, could be necessary or useful to characterize conflicts in other areas, in different periods of time, or for different geographic scales (Doherty and Schroeder 2011; Loehr 2012; López-Ridaura et al. 2005). A situated assessment by experts and stakeholders is recommended to identify locally relevant variables.

Development of a CAM

A CAM was built for the conflict zone by overlapping variables ACTORS, TENURE, SIZE, and PLANNING. The CAM combines multi-criteria decision-making (MCDM) methodologies with GIS techniques, a growing and promising practice used to perform land-use suitability analysis for a variety of purposes (Lahdelma et al. 2000; Malczewski 2000; 2004; 2006; Joerin et al. 2001; Higgs 2006; Carsjens and Ligtenberg 2007; Passuello et al. 2012; Zhang et al. 2012; Feizizadeh and Blaschke 2013; Kerselaers et al. 2015). This integration combines and transforms spatial and non-spatial data into a spatially explicit output by using geographical data and the decision maker's preferences. The procedure requires the transformation of the data and preferences into variables expressed in comparable units (Malczewski 2004). Built in this way, the CAM allows for a more nuanced categorization of land tenure and use conflicts. To estimate the CAM we used the Simple Multiple Attribute Ranking Technique (SMART) (Edwards 1977; Edwards and Newman 1982), a MCDM method based on the Multiple Attribute Value (or Utility) Theory (MAUT) (Keeney and Raiffa 1976). SMART is widely applied for decision analysis (Belton and Stewart 2001; Mustajoki et al. 2005). As discussed by Belton (1986), the SMART competes well with the Analytical Hierarchy Process (AHP) developed by Saaty (2008) in terms of sensitivity and analytical power, but it is simpler and easier to understand by stakeholders and decision makers, increasing its potential for public participation and facilitating the transparent aggregation of conflicting preferences. Beyond mathematical technicalities, the main goal of applying any MCDM methodology is to encourage decision makers to think about what is important in a particular decision and rank available alternatives according to an explicit set of objectives. The CAM was calculated with the following equation:

$$\mathrm{CAM_i} = \sum_{i=1}^{n} w_\mathrm{j} * v_\mathrm{ij}$$

where CAM_i = overall conflict value for each homogeneous piece of land (or pixel) i within the area under assessment; w_j = normalized weight of variable j to reflect its importance relative to the other variables; and v_{ij} = score assigned to the applicable category of each variable. In our case study, the different categories within each variable represent the alternatives or options in traditional SMART applications. Variables go from j to n, with $n = 4$ (ACTORS, TENURE, SIZE, and PLANNING). For a specific pixel of land within our conflict zone, the CAM was built by adding up the product between the absolute scores assigned to the applicable category of each variable and their respective normalized weights. Assigning different weights to the variables allows for better representation of different perspectives. As required by the method, all variables were converted to a centesimal "conflict scale". This transformation was made by assigning a value between 0 and 100 to each class of each variable according to its contribution to the exacerbation or attenuation of land tenure and use conflicts. This change of units from qualitative categories into a numerical scale requires estimations reflecting opinions and other subjective, expert and non-expert value judgments. A basic assumption behind this procedure is that the selected variables and their classes are all amenable to numerical translation (Dinar and Saleth 2004). For each variable, the best and worst classes, in terms of their perceived (actual or potential) contribution to land tenure and use conflicts, were linked to the extremes of the numerical scale (0–100, respectively). Classes in between were assigned intermediate values, this is any number between 0 and 100. We assumed that functions to transform variables from their original units to the normalized scale were all linear. Other types of functions can be necessary or useful for some quantitative variables. Should some indicators show hierarchical, synergistic, antagonistic, or any other type of interactions between them, these relationships could also be incorporated into the model by means of appropriate techniques. It has to be noted, however, that simplicity, applicability, and replicability should always be the guiding principles behind MCDM processes (Bossel 1999; Bell and Morse 2001).

Participatory Construction of Conflict Scenarios

Conflict scenarios were built with information gathered in two rounds of face-to-face structured interviews. In the first round, 28 separate interviews were conducted with

representatives of the following groups of stakeholders: (1) government officials; (2) associations of large-scale agricultural producers; (3) scholars with different backgrounds (anthropology, environmental sciences, law, sociology, and agricultural engineering); (4) environmental NGOs; (5) social NGOs (with long-term experience working with indigenous communities and small-scale *criollos* farmers); and (6) students (graduate and undergraduate students of environmental engineering and anthropology). Stakeholders interviewed during this first round roughly represented all possible social perspectives at play during the LUP process that took place in Salta, since they all participated or were otherwise involved in this process, as described in Seghezzo et al. (2011). Other stakeholders could have been interviewed as well, notably direct representatives of indigenous communities and *criollos* farmers (not only members of NGOs working with them). Even though we strongly believe that they must participate in planning processes convened to take actual decisions on land use, we decided not to include them in these particular surveys to avoid generating false expectations on the political or legal implications of our research. For the sake of this study, the opinion of members of social NGOs working with these collectives was assumed to represent their perceptions to a reasonable degree. The first round of interviews allowed us to identify archetypal stakeholders who were later selected to illustrate the opinion of their respective groups. These interviews also provided valuable insight to adjust the method and fine tune the structured survey for the second round. The second round of interviews was conducted with only 5 stakeholders (out of the initial 28) who represented the first five groups interviewed in the first round. These 5 stakeholders will be from now on referred to as "participants" to avoid confusion with the broader group of 28 stakeholders. The selection was also aimed at maximizing the differences between responses in order to better illustrate the wide diversity of opinions around the issue under study and the potential of the method to identify and characterize different perspectives. Students were left out of the second round because their divergent opinions made it difficult to select a distinctive, original response.

During both rounds of interviews, interviewees (stakeholders and participants) were informed about the objectives of the research and were presented with a thorough description of the case study (including LUP maps, documents, laws, technical documents, and media reports). Most stakeholders (and the five participants of the second round) were well aware of the details of the LUP process and commented on their experiences and opinions during the interviews. These comments were registered and helped understand their points of views and characterize their distinguishing profiles. After that, they were given a form and/or spreadsheet and were asked to assign relative weights to the four variables of the CAM. Possible weights ranked from 0 to 100. Most important variable was first assigned a value of 100, with the rest of the variables receiving lower weights in comparison (if all variables were equally important, they were all assigned 100 points). Weights were later transformed to a percentage scale (if all variables received a value of 100, their relative weights were therefore 25 each). Once interviewees (stakeholders and participants) were satisfied with their answers, they were asked to assign numerical conflict values to the classes of each variable. Again, possible values ranked from 0 to 100. Very lively debates followed the assignment of each and every value, with interviewees very often changing their opinions as a result. An approach similar to the Delphi method (Linstone and Turoff 1975) was followed during the interviews, meaning that interviewees were able to change their answers during several rounds until they "converged" on a definitive response. Each round of answers from each stakeholder and participant was processed in a spreadsheet and then made spatially explicit using the Multi-Criteria Evaluation tool provided by the GIS software IDRISI (Zhang et al. 2012). Conflict values obtained by calculating the CAM for each land unit were averaged for all variables, rounded up to integer numbers, and judged against the following conflict categories: 0 to 24 = Low; 25 to 49 = Medium; 50 to 74 = High; 75 to 100 = Very high. After converting classes into conflict units for each variable, layers for all variables were overlapped to build composite "conflict maps" where conflict categories were represented by different tones of gray. A specific conflict map was generated for each round of answers of each stakeholder or participant (28 maps during the first round of interviews and 5 maps during the second round). Interviewees could change these maps by going back to the form or spreadsheet and changing weights and/or scores until fully satisfied with the final cartographic outcome. Each map obtained using this technique depicted the severity or "intensity" of land tenure and use conflicts in the conflict zone according to the perception of one specific interviewee. Since our objective was to identify differing perspectives on land conflicts, we did not include a phase in which different groups of stakeholders were allowed to share their views and discuss among each other. However, a phase of interaction, negotiation, and consensus building is required during government-led participatory processes (Bruckmeier 2005; Zhang et al. 2012).

Results and Discussion

Current Situation in the Conflict Zone

Figure 2 shows our specific conflict zone, this is the spatial distribution of the area inhabited, used or claimed by

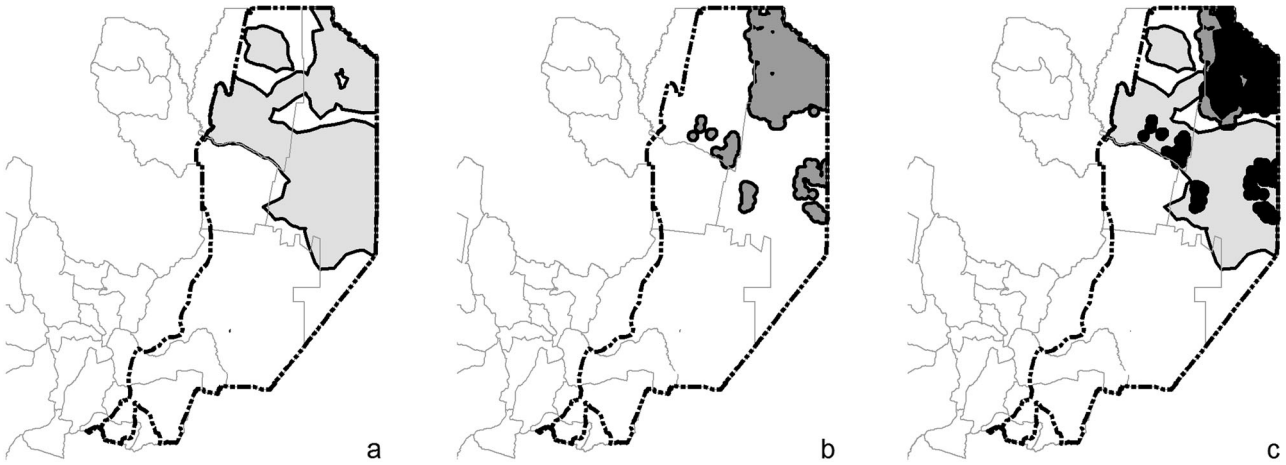

Fig. 2 Definition of the conflict zone (variable ACTORS). Map **a** (left): area used and/or claimed by indigenous peoples. Map **b** (center): area used and/or claimed by small-scale *criollos* farmers. Map **c** (right): uses and claims combined. *Dark areas* in Map **c** show areas claimed by both collectives (see Table 1 and text for more details). Study area indicated by the *dotted line*

Table 1 Variables and classes of the Conflict Assessment Model (CAM)

Variable	Class	Area		Respondents									
		%	Total	Government		SNGO		ENGO		LSAP		Scholar	
				Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value
ACTORS	Indigenous	25.3		100	80	75	60	100	100	80	75	100	75
	Criollos	2.7			60		50		80		50		25
	Both	12.4	40.4		100		90		100		100		100
TENURE	State-owned	25.8		80	50	50	100	20	60	100	25	100	50
	Private	70.7			100		100		100		100		100
	Communal	0.3			50		5		10		10		25
	Unknown	3.3	100.0		50		20		90		0		100
SIZE	Large	69.1		20	50	50	25	50	100	10	10	25	25
	Medium	30.3			80		50		100		50		50
	Small	0.6			100		75		50		75		75
	Very small	0.01	100.0		100		100		50		100		100
PLANNING	Agriculture	8.8		50	100	30	5	100	60	70	90	75	50
	Green	0.8			100		25		50		75		25
	Yellow	75.0			80		100		100		50		100
	Red	15.4	100.0		30		50		100		10		25

Areas were calculated over the entire study area for variable ACTORS but only over the conflict zone for the rest of the variables. Weights and conflict values shown were assigned by five archetypal stakeholders.

SNGO social NGO, *ENGO* environmental NGO, *LSAP* Large-scale agricultural producer

indigenous communities and *criollos* farmers in the study area (variable ACTORS). Virtually all of this area is legally owned by either private land holders or the government, as indicated in more detail in Table 1 and Fig. 3 (left). The geographical distribution of the three complementary variables and their respective classes can be seen in Fig. 3.

As seen in Table 1 (variable ACTORS, column Area), 40.4 % out of the 7,158,239 hectares of the study area (2,893,669 hectares, an area larger than Albania) is inhabited, used, or legally claimed by either indigenous communities alone (25.3 %), small-scale *criollos* farmers alone (2.7 %), or both (12.4 %) (total claims per group can be

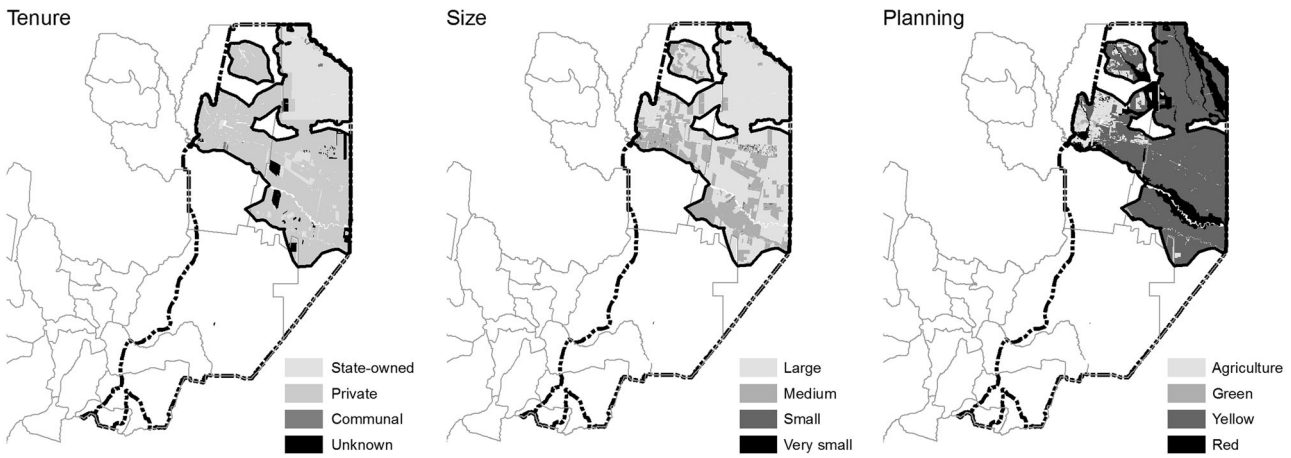

Fig. 3 Additional variables TENURE, SIZE, and PLANNING, and their respective classes over the conflict zone

obtained by adding the area claimed only by the group to the area claimed by both groups). Most of the conflict zone is currently state-owned (25.8 %) or in private hands (70.7 %), while communal (indigenous) territories represent only a tiny fraction (0.3 %) (Table 1, column Area, variable TENURE). This ownership bias is a primary source of conflicts. Formal agricultural activities are the norm in privately owned land while state-owned land is mostly devoted to informal uses such as livestock raising or subsistence activities. Native forests are still standing on most private and state-owned land, as shown in Fig. 3 (right). Another source of actual or potential land conflicts relates to property size and the number of owners of each plot. Small and very small farms combined occupy little more than 0.6 % of the conflict zone (Table 1, column Area, variable SIZE) although, as reported by van Dam (2008), they represent more than 40 % of the total number of farms in this area. At the other end of the spectrum, large farms, which amount to less than 10 % of all farms (van Dam 2008), occupy more than two thirds of the conflict zone (69.1 %). The remaining properties are medium-size and occupy 30.3 % of the conflict zone. These figures denote a highly asymmetrical land distribution in the study area. With some regional variations, this tenure situation is similar in the rest of the province and in a considerable part of the entire country. Uneven land distribution and large-scale agricultural activities generate increasing job dependency on big farmers, aggravated by the fact that most of these activities are not labor intensive (such as soybean cultivation). Poverty and lack of markets for local products have also contributed to the gradual concentration of land in fewer and fewer hands and to the migration of small-scale farmers and indigenous peoples to the fringes of towns and cities (Grau et al. 2008). Tenure concentration reduces by itself (even in the absence of legal conflicts) the space and resources available for small-scale initiatives, generates social tensions, and contributes to economic inequality. As shown in Table 1 (variable PLANNING, column Area), only 8.8 % of the conflict zone is currently destined to large-scale agricultural activities. Yet large-scale producers concentrate most of the political and economic power, and can therefore impose their conditions on LUP processes. Power disparity is conflictive since it conspires against long-term, diversified, and negotiated land tenure and use solutions. The three-colored map approved by the government added an extra layer of potential conflict by limiting land use to certain activities depending on the conservation value ascribed to different areas. Within our conflict zone, 15.4 % of the land has been classified red, with 75.0 and 0.8 % under the yellow and green categories, respectively (see Table 1, variable PLANNING, column Area).

Conflict Assessment

The geographical distribution of land conflicts was clearly different for the five participants of the second round of interviews (Fig. 4). These conflict maps were built with the weights and conflict values shown in Table 1. Since basic information used was always the same, maps in Fig. 4 are all equally sound from a purely technical point of view. Differences observed on the ground solely reflect the subjective interpretation of the participants interviewed. As depicted in Fig. 5, the area under different conflict categories also varied markedly between participants. The respondent from the environmental NGO was very strict in her assignment of conflict values. To her, conflicts were very high over almost the entire conflict zone. The respondent from a social NGO was at the opposite end of the spectrum, as far as the percentage of the conflict zone under the very high conflict range was concerned. This may seem somewhat surprising at first, but is probably related to the fact that this particular NGO was involved in the case

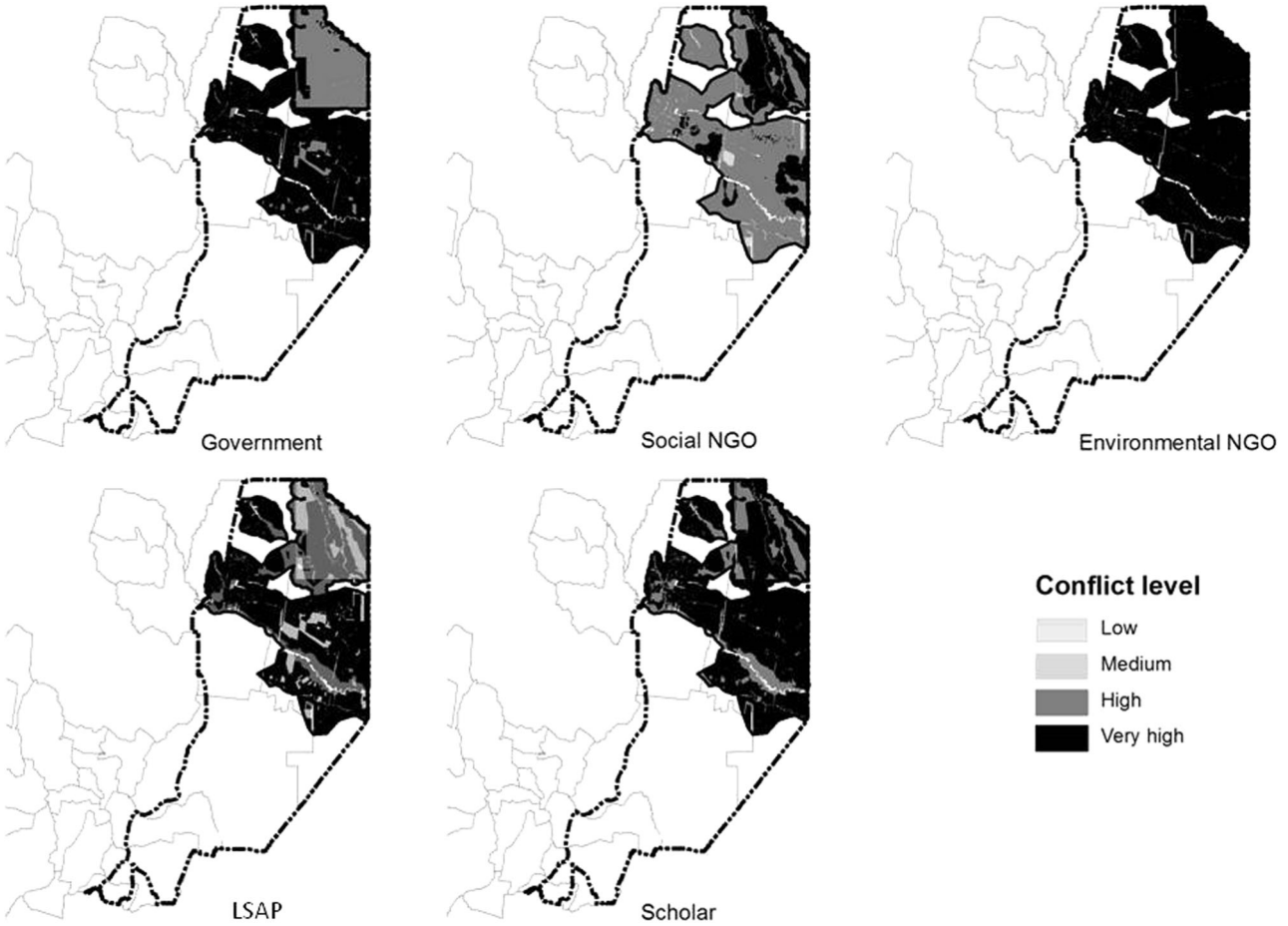

Fig. 4 Conflict maps built by overlapping all variables of the CAM in the conflict zone for five participants, each one representing a specific group of stakeholders. *NGO* non-governmental organization, *LSAP* large-scale agricultural producer

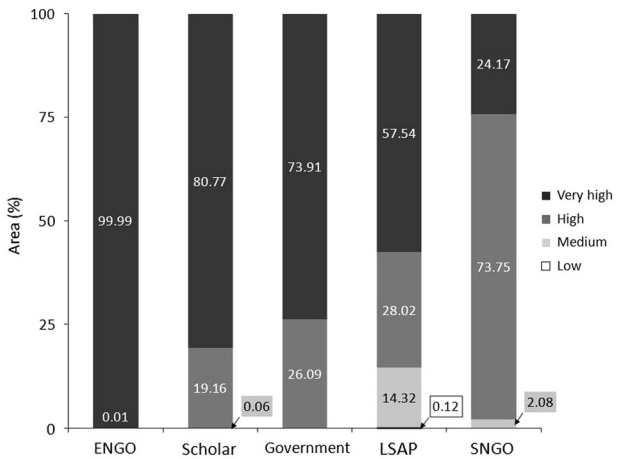

Fig. 5 Distribution of the conflict zone in four conflict ranges for the five participants of the second round of interviews. *ENGO* environmental NGO, *LSAP* Large-scale agricultural producer, *SNGO* social NGO

that led to the above-mentioned Decree 1498, by which indigenous communities and *criollos* families were transferred ownership of more than half a million hectares formerly belonging to the provincial State. Having achieved success in that case, this social NGO may be more confident of the feasibility of solving other land conflicts. The large-scale agricultural produced interviewed in the second round indicated that only half of the conflict area is in the very high conflict range. Large-scale producers, who hold legal property titles, might be tempted to believe that land tenure conflicts do not have the same urgency as for indigenous communities or *criollos* families. However, this participant also indicated that less than 15 % of the conflict zone has medium or low level of conflicts. The position of the participant from the government (an official from the Ministry of the Environment and Sustainable Production) and the scholar (an anthropologist) were quite similar. With minor differences, but probably for different reasons, they assigned high or very high level of land conflicts over the entire conflict zone.

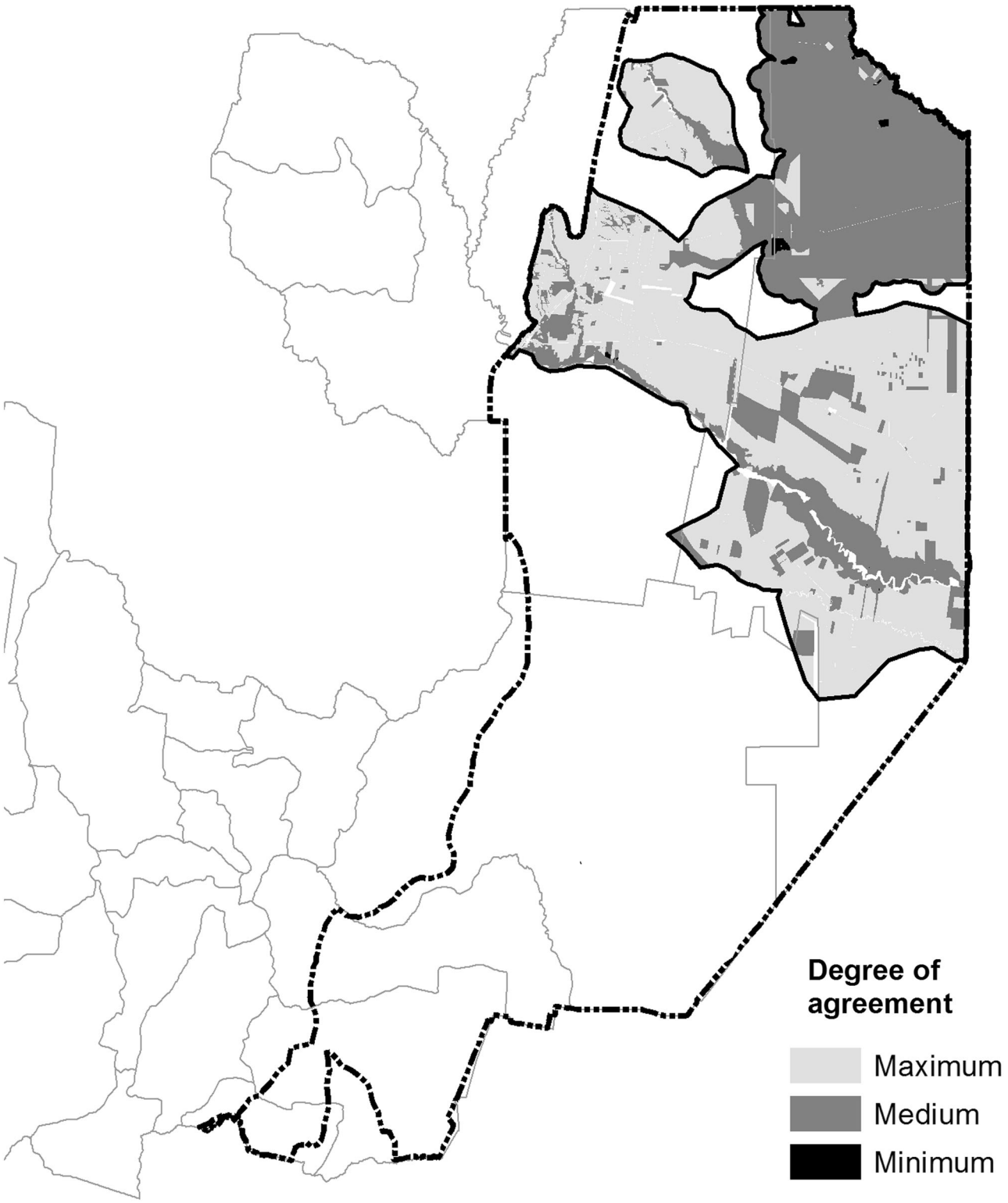

Fig. 6 Areas of agreement and disagreement between participants on the conflict category assigned to homogeneous land units. *Light gray*: 4 or 5 participants agreed on the conflict category; *dark gray*: 3 agreements; *black*: 1 or 2 agreements

Important coincidences have also been observed between participants. Figure 6 depicts the degree of agreement between them with respect to the level of conflict assigned to different pixels. It is interesting to note that maximum agreement (at least 4 participants agreed on the conflict category assigned) was observed in more than half (57.3 %)

of the conflict zone. It is worth noticing as well that coincidences between participants occur mostly in areas belonging to the high or very high conflict ranges. This kind of consensus is highly desirable in actual decision-making. The scope of this work, however, was not to reach any such consensus, but to show that public participation is essential in planning processes if decisions intend to be truly inclusive. Participation should be encouraged not only for ethical reasons but also because, as shown, it can be a powerful tool to reveal agreements and discrepancies between stakeholders. Although public participation introduces an additional layer of complexity, participatory LUP processes are arguably more legitimate and therefore more sustainable. Our results are not a scenario analysis as such, but they can well be an input to building specific strategic scenarios based on the possible consequences of the decisions or combination of decisions that can be made by the stakeholders involved (Postma and Liebl 2005; Duinker and Greig 2007). They can also be seen as a proof of concept and a first step toward building a decision-support system for LUP.

Some Methodological and Political Considerations about Participation and Decision-Making

The conceptual basis of the CAM builds on both the "reductionist" (quantitative and expert-led approach) and the "conversational" (bottom-up, more qualitative and participatory philosophy) methodological paradigms (Bell and Morse 2001). By combining these two approaches, it is arguably possible to acknowledge the importance of local contexts and the variety of social perspectives while keeping the rigor provided by explicitly quantitative indicators (Reed et al. 2006). The model presented in this paper covers many of the variables that directly or indirectly explain a significant proportion of land tenure and use conflicts in the study area. For that reason, it is arguably more sensitive than mere inventories of conflicts or protests. If more information becomes available, more complex models can be built to shed light on subtler or neglected aspects. Lack of information is always a hindrance to building trustworthy decision-support models, but it should not prevent policy-makers from making decisions using the best available information (Kemp et al. 2005). We believe that establishing a working set of explicit criteria and variables is a valuable effort to start building a more rational and potentially more participatory decision-making process. Based on this idea, our model is an attempt to capture the complexity of land tenure and use conflicts in the region, where information is fragmented at best. We acknowledge that a number of different conflict models could be built in different places or for different periods of time. We do not see this is as a drawback of the approach taken, but rather as a reflection of the intricacies of social-environmental issues, which are contingent to local circumstances and bond to a large degree of human subjectivity.

Assigning numerical values to subjective variables is not questionable by itself but poses important methodological and political challenges. In fact, the validity of these values will be directly related to the social acceptability of the person or persons in charge of the assessment. In a participatory process, different stakeholders will assign different and even opposing values to the classes of these variables. They could even select a different set of variables since these models are not objective accounts, but interpretations of reality that are influenced by social contexts (Elgert 2013). Model building is therefore a highly political process and choices made are determined by the categories of concern of the participants. Because the range of possible social perspectives, stakeholders, variables, classes, and values is hypothetically very vast, so is the number of outcomes that might emerge from the assessment. For that reason, for planning processes to be legitimate and democratic, participation of all relevant stakeholders is necessary (Arias-Maldonado 2013). Failure to include relevant stakeholders in terms of power, legitimacy, or urgency (Mitchell et al. 1997) will render the final decision questionable. The role of scientists and experts is important in these assessment processes since they can generate missing information, propose pertinent conceptual models, help identify stakeholders, and assist during decision-making processes (Moreno-Pires and Fidélis 2012). To facilitate the identification of relevant stakeholders when researchers are not familiar with the case study, a systematic insight into the diversity of local social perspectives is necessary. In those cases, it could be useful to resort to Q methodology, a technique developed by psychologists that is currently being successfully applied to a wide range of issues in the social and environmental sciences (Addams and Proops 2000; Vugteveen et al. 2010; Brannstrom 2011; Iribarnegaray et al. 2014).

We believe that the precautionary approach should be one of the guiding principles for all LUP processes. Therefore, we recommend that contested territories should not be included in these processes until tenure issues are fairly resolved. For our case study, this could imply outright exclusion of all areas with current or potential tenure and use conflicts from the LUP process. That would mean that those areas should not be assigned any of the three colors pertaining to the conservation categories established in the Forest Law. A new category should therefore be added to the map (i.e., "conflict zone") and it should be identified with another color (i.e., gray). As shown in Fig. 4, different tones of gray could indicate the severity of the conflicts. A more nuanced approach could be, for instance, to apply this new gray category only to areas where a significant majority

of stakeholders perceive conflicts as very high (as shown in Fig. 6). Alternatively, conflict areas could be temporarily categorized under a high conservation value category (red) that would preclude most uses and reduce the possibility of human rights abuses and irreversible changes in land use. Whatever the decision might be, some kind of temporary policy must be implemented on these areas, coupled with a strict control system, since outright exclusion could be an excuse for business as usual or might trigger illegal activities. Large-scale producers will surely see such policy as an obstacle to the expansion of agriculture in the region and as an interference with their economic and political interests. If only for those reasons, they might feel more inclined to join indigenous communities and *criollos* farmers in their plea to make the government intensify efforts to solve tenure problems before the LUP process can continue. A multi-stakeholder, State-led tenure regularization process is probably the only way to move this issue forward and avoid that large-scale land owners or other powerful parties take control of the process and impose their own agenda on less powerful stakeholders such as indigenous communities and *criollos*.

Land tenure and use conflicts are essentially different from other LUP criteria because they relate to fundamental human rights of minorities and disempowered constituencies. In our case study, and probably in many regions of Latin America as well, unsolved land tenure and use conflicts are an obstacle to the public acceptance of planning processes. In Salta, indigenous communities and *criollos* farmers, but also environmentalists and scholars, asked for the suspension of the LUP process until tenure conflicts were resolved to a satisfactory degree. Whether as a previous step or as an integral part of the planning process, conflict maps such as the ones presented in this paper can be a useful input for more comprehensive and equitable LUP processes. These maps can also be appealing for policymakers and land use planners since they allow for the identification of areas where conflicts are reduced and where, as a consequence, LUP processes will not face significant opposition. It is important to notice that a significant proportion of our study area (100–40.4 = 59.6 %; see Table 1, variable ACTORS, column Area) fell outside of the conflict zone. We therefore believe that it would not be necessary to halt the LUP process over the entire study area, but only in the conflict zone or parts of it. A categorization of the severity of the conflicts and the degree of agreement or discrepancy between stakeholders is also a road map for action and priority-setting.

In Salta, land tenure conflicts have not been appropriately taken into account during the LUP process. As indicated above, the only provision made by the government to acknowledge land rights during this process was to classify some of the areas claimed by indigenous peoples under a so-called "social yellow" category, even in those cases where technical criteria would have led to green or red (REDAF 2012)[6]. Claims by *criollos* were not included in this vague new category. Yet by overlapping the land use map approved by the government with the area claimed by indigenous peoples (shown in Fig. 2, left), we found that only 75 % of this area has been actually painted yellow. More than 15 % of this zone has been categorized red, about 1 % was green (and can therefore be subject to immediate deforestation and land use change), and almost 9 % fell on already transformed agricultural land. Besides, as indicated above, indigenous communities and *criollos* families do not necessarily agree on a single conservation category for their lands. Some indigenous representatives even argued that their ancestral lands should all be categorized green (low conservation value), leaving to them the task of taking care of the natural and cultural integrity of these territories.

In response to mounting pressure from NGOs and the media, but also from the national government[7], the provincial Ministry of Environment and Sustainable Production finally issued a resolution (Resolution 381) suspending all re-categorizations of forest lands and calling environmentalists, large-scale producers, scholars (including some of the co-authors of this paper), and other stakeholders to a roundtable on LUP. After a number of meetings, but especially after a very active national campaign launched by Greenpeace and other environmental NGOs, the governor finally derogated Decree 2211 by the end of 2014[8]. At the beginning of 2016, a draft with the results described in this paper was officially presented to the government as an input for the revision of the LUP map. However, no changes were introduced so far to the original map approved in 2009, with the exception of those pieces of land re-categorized during the validity of Decree 2211.

Concluding Remarks

We presented some results that show that a semi-quantitative assessment of land tenure and use conflicts is potentially very useful to improve the legitimacy and sustainability of LUP processes. The methodology applied is relatively simple from a technical point of view, even when information is scarce, and can be implemented using easily available GIS software. According to the opinion the stakeholders interviewed, it was relatively easy for them to

[6] Newspaper *Nuevo Diario de Salta*, 7 July 2009; Digital news service *Informatesalta*, 14 July 2009.

[7] Newspaper *El Tribuno*, 30 August 2014. See also: http://www.greenpeace.org/argentina/es/noticias/La-Auditoria-General-de-la-Nacion-alerta-sobre-la-violacion-de-la-Ley-de-Bosques/, accessed 04 September 2014.

[8] By means of Decree 3749.

evaluate their responses by looking at the conflict maps generated during the interviews, and this arguably enhances the participatory potential of the method. The CAM presented has been developed to understand a particular situation at a given point in space and time. Whether this or a similar analysis can be applied to other cases remains to be seen. In any case, a more wide-ranging participatory process intended to lead to actual decisions on LUP has to be facilitated by local governments.

The set of variables used in this study are by no means universal since many other variables might be useful in specific cases. The selection of the "right" variables for each case requires in-depth understanding of local circumstances and consultation with relevant stakeholders. Knowledge of historical and political contexts is also necessary to put the information provided by variables and other indicators in perspective. Subjective estimations are also prone to changes and depend to a great extent on the personal experience, culture, degree of education, and interests of the assessment team. Decision-making will always be bound to a certain degree of subjectivity since there is no such thing as a purely objective analytical tool that can make decisions on our behalf.

Conflicts reflect opposing interests. Solving conflicts will benefit some and will negatively affect others. In our case study, we contend that the beneficiaries of more participatory decision-making will surely be indigenous peoples and small-scale *criollos* farmers who, for decades, have been the direct victims of the continuous expansion of the agricultural frontier. We acknowledge that solving tenure problems does not necessarily mean that future land use will automatically be more sustainable. There are plenty of issues that need additional attention to ensure that new titleholders do not repeat the destructive behaviors of previous ones under the incessant pressure of international markets and increasingly permissive domestic policies. Yet we are convinced that recognizing the rights to the land of disempowered minorities is a starting point in the direction of more sustainable land use. Land tenure security is also seen by indigenous leaders as a way to receiving better public services (such as running water and health services) and improving their livelihoods[9]. In the specific case of communal ownership, it has been demonstrated that not always the governance of public land leads to the "tragedy of the commons" (Hardin 1968; Ostrom 2007, 2010). The same applies to small-scale, diverse rural livelihoods that can arguably improve food security and sovereignty. It will be up to future policymakers to ensure that land use becomes more sustainable and fair under the new land tenure setting.

[9] As indicated by Qom leader Félix Díaz in a recent interview published by newspaper *El Tribuno*, 8 March 2016.

We believe that a participatory identification and evaluation of land conflicts will certainly increase the social legitimacy of LUP processes, making decisions more sustainable in the long run. Our framework could be applied in more depth in the study area or on a wider regional scale. It can provide important input to LUP processes since it allows some progress even if land tenure issues are not resolved at once. It could also contribute to moving forward a process for resolving land tenure by better focussing the discussion. We also believe that current legal frameworks are not an impediment in the search of long-term solutions to land tenure and use conflicts such as the ones described in this article. However, legislation is dynamic and better and more equitable laws are desirable and possible. For instance, we believe that the National Forest Law should be amended based on the findings of this study in order to include land tenure and use conflicts as an additional criterion for all national LUP processes. This new criterion should preferably have hierarchical preeminence over current criteria contained in this law since it reflects a rights-based approach. Needless to say, any amendment should respect norms and jurisprudence of the inter-American human rights system, in particular article XXIII of the American Declaration of the Rights and Duties of Man, Article 21 of the American Convention on Human Rights, the provisions of ILO Convention N°169, and the draft American Declaration on the Rights of Indigenous Peoples pending final approval. We think that a more sensible tool such as the identification of conflict zones and the estimation of a CAM such as the one presented in this paper can be an important contribution to protecting the rights of minorities and the environment in the study area.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

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