DOI: 10.1590/1413-81232022273.04852021

Social and environmental conflicts caused by agrochemical use in Salta, Santiago del Estero and Santa Fe, Argentina

Mariana Schmidt (https://orcid.org/0000-0003-4606-7692) [1]
Virginia Toledo López (https://orcid.org/0000-0003-0901-8285) [2]
Melina Tobías (https://orcid.org/0000-0002-7929-5395) [1]
Ezequiel Grinberg (https://orcid.org/0000-0002-5920-1080) [1]
Gabriela Merlinsky (https://orcid.org/0000-0001-9343-8658) [1]

Abstract *The purpose of this article is to contribute to the understanding and visibility of conflicts and disputes over the use of agrochemicals in the provinces of Santa Fe, Santiago del Estero and Salta, in Argentina. Secondary information sources were gathered and systematized to perform a first contextual analysis of regulatory frameworks, public policies and the emergence of social construction processes related to environmental and health risks. This analysis revolved around three dimensions: a regulatory dimension, a political-institutional dimension, and a territorial-health dimension. In all three jurisdictions, there are specific laws that govern the use of agrochemicals and certain institutionalization intended to implement, control and monitor them. However, similarly to what has happened at the regional and international levels, the study revealed multiple conflict situations and/or events that call environmental and health impacts into question. Agrochemical use policy is shattered into multiple regulations, institutions and levels of competence, a framework in which health and environmental policies are left behind. Despite some progress, there is no official recognition of the health and environmental damage caused by the use of agrochemicals.*

Key words *Environmental impact, Impacts on health, Social vulnerability, Risk, Agrochemicals*

[1] Instituto de Investigaciones Gino Germani, Universidad de Buenos Aires. Pres. José Evaristo Uriburu 950. C1114 AAD, Buenos Aires Argentina. marianaandreaschmidt@gmail.com
[2] Instituto de Estudios para el Desarrollo Social, Universidad Nacional de Santiago del Estero. Santiago del Estero Argentina.

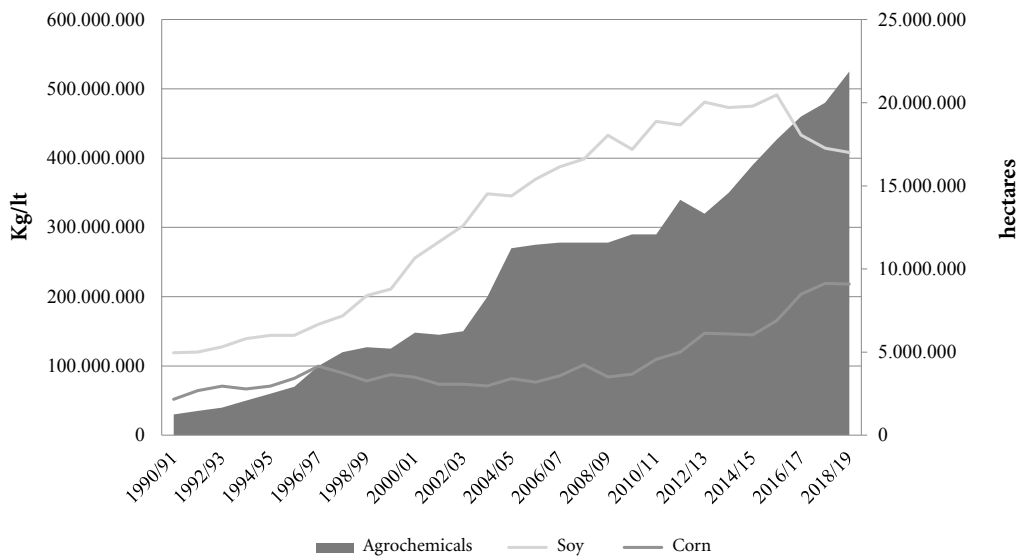
Introduction

Towards the end of the 20th century, agribusiness consolidated in the countries of the Southern Cone (Brazil, Argentina, Paraguay, Uruguay, and Bolivia) – a production model rooted in the use of genetically modified seeds and agrochemicals[1,2]. Globally, the area implanted with genetically modified crops has shown an upward trend in the last thirty years, and over 78% of the 189,800,000 hectares planted in 2017 are found in the United States, Brazil and Argentina (as of 2020, 85 genetically modified organisms have been approved in Brazil, while over 60 have been approved in Argentina)[3].

In Argentina, out of an aggregate of 39,000,000 hectares planted in 2018/19, soy and corn account for 66.7% of the total agricultural area[4]. In parallel, the volume of chemical products used has grown exponentially, exceeding 500,000,000 kg/l in the past few years (an average of 13 kg/l per hectare) (Graph 1)[5]. While the use of glyphosate prevails, the problems extends to a large amount and diversity of chemical products (2,4-D, endosulfan, atrazine, dicamba, cipermetrine and chlorpyrifos, to name the most important ones,) which form the array of the so-called "phitosanitary" products.

In this context, conflicts and disputes over the environmental and health consequences of exposure to agrochemicals have surged in society. In line with what has happened at the international[6-10] and regional[11-13] levels, in Argentina, research and monitoring studies have pinpointed the presence of agrochemicals in the air, surface water, underground water, rainwater, agricultural soil, as well as urban and peri-urban areas[14-17]. Literature also points out the effects of exposure to pesticides for flora and fauna[18-20], as well as the existence of residue in food and personal hygiene products[21-22]. As for human health, their role as endocrine disrupting chemicals[23] and as substances that cause genetic material damage has been reported[24,25]. An increase in medical conditions such as hypertension and hypothyroidism, a higher impact on allergic, respiratory and obstructive lung diseases, Alzheimer and Parkinson diagnosis, rheumatic and skin diseases, neurological and neurocognitive disorders, together with an increase in miscarriages, congenital malformations and oncological diseases (cancer, lymphoma, leukemia) that exceed the national average by far[26-28].

In the absence of official statistics that measure the annual volume of chemical substances used, there is no public data providing accurate



Graph 1. Argentina. Evolution of Fields with Soy and Corn Crops (hectare) and Agrochemical Use (kg/l). 1990/91-2018/19 Seasons.

Source: Prepared by the authors based on Agricultural Estimations by the Argentine Ministry of Agriculture, Livestock and Fishing (http://datosestimaciones.magyp.gob.ar/), Chamber of Agricultural Health and Pesticides (CASAFE) and http://www.naturalezadederechos.org/501.htm

Ciência & Saúde Coletiva, 27(3):1061-1072, 2022

information on the health situation of exposed populations. In addition, there are deficits in diagnoses by health teams that translate into defects in registration (failure to load data, insufficient loading, wrong registration, among others) and notification, as well as a failure to follow up cases. Further, chronic exposure events are not quantified nor recorded. Moreover, public policies are still set in connection with palliative measures and non-structural dimensions, such as restrictions on application in urban areas and the deployment of mechanisms referred to as "Good Agricultural Practices" (BPA, for its Spanish acronym).

The debate usually revolves around two arguments: a pragmatic one, which states there is no evidence of a direct relation between exposure to spraying and diseases (and which claims that through correct use, any potential risk virtually disappears) and a cautious one, which emphasizes that damage has been verified as well as the negative impact on human life and community health[29]. In this scenario, while scientific knowledge plays a central role when it comes to defining, estimating and assessing the associated risks, creating such knowledge also involves a social and cultural process where the parties affected usually spark public debate, revealing the inherently political nature of scientific and health issues[30-32].

As for diseases presumed to be linked to environmental exposure, affirming a cause-effect relationship is tricky, given the impossibility of isolating other variables involved. The search for evidence thus brings heterogeneous elements together and pierces through different fields, requiring a "constellation of evidence": a diversity of disciplines, forms of knowledge, as well as the mobilization of technical, institutional, social, political and economic actors and devices[33]. Given the insufficiency of official records or the lack of answers by the authorities, collective questionings and challenges come into play which result in the emergence of popular[34] and/or critical[35] epidemiologies, based on the very own knowledge and experiences of local communities[36].

In Argentina, the first conflicts and disputes arose in provinces that were early incorporated into the agro-industry model[37-40]. In other jurisdictions, studies enabling a diagnosis of the effects of such model's implementation are still incipient, even more so in regions with different production functions and diverse ecological and social features[41-45]. These processes become especially relevant in the three jurisdictions under analysis. In recent seasons, Santa Fe has ranked third amongst top soy plantation provinces (3,011,720 hectares planted in 2017/2018). In Salta and Santiago del Estero, the expansion of these crops is more recent and has had an impact on disputes over land, biodiversity and the disruption of native and peasant ways of life[46-47]. In these last two provinces, soy-planted areas have increased while forests have decreased[48], with an average of 600,000 hectares – exceeding 1,000,000 hectares in 2010/11, respectively.

Methods

The article shows the main findings of a study that intends to contribute to the understanding and visibility of the social and political construction of the risks associated with agrochemical use based on the analysis of existing regulations and institutional frameworks, and the emergence and path of the conflicts and/or disputes that have arisen from their forms of regulation and/or use[49]. For the analysis, two Argentine provinces were used as case studies where the expansion of the farming border has been recent (Santiago del Estero and Salta), as well as a jurisdiction where the agro-industry model has a long-standing tradition (Santa Fe).

The research is based on the survey and analysis of secondary information sources. These include the material prepared and disseminated by multiple and diverse actors involved in the conflicts and disputes over the use of agrochemicals in the referred provinces: technical documents and reports; reports and claims; scientific articles and studies; case-law and legislation; statistics and journalistic material. To systematize these documents, a comprehensive approach was adopted and matrices were prepared that helped perform readings by case, dimension and/or scale. The analysis was structured around three primary dimensions: a regulatory dimension, a political-institutional dimension, and a territorial-health one. The results will be shown in that order.

For the territorial-health dimension, situations and/or events where there is evidence of conflict and/or disputes concerning the use, application and/or storage of agrochemicals in the three jurisdictions under study were investigated. Theoretical perspectives were used that propose considering conflicts as moments of construction and installation of a problem in the public forum (not as anomalies)[50]. A total of two hundred and

thirty-two (232) conflict situations and/or events related to the use, application and/or storage of agrochemicals were found (127 in Santa Fe, 22 in Santiago del Estero, and 83 in Salta), which took place between 1994 and 2018, while most cases registered occurred after 2000 (previous cases were found in Santa Fe only).

It is worthy of note that these conflicts do not account for all cases, but rather cases that came to our knowledge based on the information available and/or accessible. Therefore, our findings do not intend to be thorough nor representative of the entire set of existing environmental and health problems. Rather, this is an approximation that helps get a glimpse of certain trends at the general level – and at each provincial level in particular – and, above all, draw a comparison between them.

Finally, we will point to certain limitations in the study related to the lack of access to public information sources that allow for a recreation of the health issues faced by the populations involved and the complexity that the lack of articulation between competent agencies in different territorial levels brings to them. This makes it hard to reconstruct the actual capacity of the regulations that exist at the national, provincial and municipal levels, as well as the history and specific actions of the institutions related to these conflicts. However, these hurdles become useful data in themselves, if interpreted as a feature of each province's institutional fabric, giving clues to answer the primary questions raised in this investigation.

Results

Regulatory dimension: environmental and agrochemical regulations

In Argentina, a wide array of regulations govern the scope of application related to the so-called phytosanitary products. The country, however, lacks a comprehensive national law. Jurisdiction over the setting of rules related to agrochemicals is shared between the National State, the provinces and municipalities, which results in an "infralegal regulation" in the form of resolutions and administrative orders[51].

The Argentine Constitution (1994) created a scheme of concurrent competences. It is the power of the National State to issue rules that contain minimum environmental standards (Section 41), while the provinces hold ownership over natural resources (Section 124). Moreover, Section 75(13) delegates to the Argentine Congress the power to regulate interjurisdictional trade and traffic, which means that regulations on the approval, production, sale and use of agrochemicals are national.

Among the laws in place on minimum standards, two stand out: Law No. 25,675/2002 (General Law on the Environment) and No. 27,279/2016 (Minimum Standards of Environmental Protection for the Management of Empty Packages of Phytosanitary Products), whose provisions propose a less rigorous treatment than that of Law No. 24,051/1991 (Hazardous Waste), also considered a regulation of the activity under study. In sum, from the federal perspective, no federal rules have been enacted that govern distance of use and toxicity categories, while there is one rule governing package disposal.

At the provincial level, all three jurisdictions have specific regulations on agrochemicals in place (Chart 1). Laws feature similarities in terms of spraying distances allowed based on toxicity categories. It is worthy of note, however, that in Santiago del Estero and Santa Fe, as the rules were enacted over two decades ago – before the liberalization of genetically modified organisms in Argentina –, product classification precedes the classification currently in force. In all cases, regulatory decrees authorize exceptions to recommendations of use at the request of production sectors (except where there are educational, health, recreational or living centers in the vicinity). In this context, "good application practices" are considered sufficient protection against potential toxic effects for the nearby environment, population or crops.

According to the classification introduced by the World Health Organization in 2009, pesticides are classified based on their acute toxicity as: extremely hazardous (Ia, red), highly hazardous (Ib, red), moderately hazardous (II, yellow), slightly hazardous (III, blue), and unlikely to present acute hazard in normal use (IV, green).

The enactment and implementation of these laws have been no strangers to debate. In all three provinces (while more recently in Santiago del Estero and Salta,) progress has been made in the drafting of bills and/or the issuance of municipal rules that create exclusion zones and govern agrochemical use, management and transportation in areas located close to settlements and/or educational facilities. These municipal orders derive, in most cases, from claims filed by neighbors as well as environmental and/or social groups.

Ciência & Saúde Coletiva, 27(3):1061-1072, 2022

Chart 1. Provinces of Santa Fe, Santiago del Estero, and Salta. Rules on Agrochemicals.

Law/Year	Administering Authority	Ground Spraying	Aerial Spraying
Santa Fe N° 11,273/1995	Ministry of Production - General Office of Plant Health	Forbids products classified as toxicological classes A and B within a radius of 500m from urban plans Spraying of C and D products is authorized within the 500-m radius	Forbids products classified as toxicological classes A and B within a radius of 3,000m from urban plans By way of exception, products classified as toxicological classes C or D may be sprayed within a radius of 500m, while B products may be sprayed within a radius of between 500 and 3,000m
Santiago del Estero N° 6,312/1996	Ministry of Production, Natural Resources, Forestry, and Land – General Office of Agriculture and Livestock		
Salta N° 7,812/2013	Ministry of Production, Employment and Sustainable Development - Secretary's Office of Environment and Sustainable Development	Forbids spraying Ia and Ib products within 500m (only II-, III- and IV-class products may be sprayed)	Forbids spraying Ia, Ib and II toxicological products within 3,000m from urban and suburban areas, and III- and IV products within 500m

Source: Authors.

In November 2019, the House of Representatives of Santa Fe gave preliminary approval to a bill amending Law No. 11,273 which provides for 1,000 meters free of ground spraying and 5,000 meters free of aerial spraying.

Political and institutional dimension: competencies and administering authorities

Different national agencies are involved as Administering Authorities (AA) of existing rules. The National Food, Drug and Medical Technology Administration (ANMAT, for its Spanish acronym) is in charge of regulating "domisanitary" (cleaning) products, while the National Agricultural Food Health and Quality Service (SENASA) is the authority in charge of applying and enforcing the regulations governing "phytosanitary" products. The top national health agency only becomes involved in connection with household products but not those used in farming. The national environmental agency is also excluded from agrochemical regulation.

This shattered institutionality and national regulation replicates at the provincial level. Pursuant to the rules in force (Chart 1), jurisdictional AAs fall – the same way they do at the federal level – in the hands of agencies entrusted with production and/or farming policies. With the exception of Salta, where the environmental agency is involved, intervention by sanitary and environmental authorities is completely absent.

In sum, the progress made in terms of regulations and institutions have not shown a trend towards limiting the use of agrochemicals or promoting the involvement of environmental and health authorities; rather, they simply set permitted distances. The capacity of provincial and municipal institutions to enforce the rules in force has been limited in terms of human and material resources. Under these circumstances, the growing demands of civil society concerning the effects of spraying on health and the environment have been, for the most part, disregarded.

Territorial and health dimension: low and high intensity conflicts

The spatial distribution of the situations of conflict under analysis shows that, in the case of Santa Fe, most departments are involved, albeit not consistently. A large number of conflicts are associated with the port and other areas close to urban centers. In Salta, 89.5% of the cases are found in four of the jurisdictions that have been more seriously affected by the expansion of agro-industry (San Martín, Anta, Orán, and Metán,) while in Santiago del Estero, most conflicts have been found in the departments of Belgrano and Moreno (40% of the total), which cor-

responds with the areas where agribusiness first expanded in the province (Figure 1).

Measures taken and judicialization of conflicts

The measures through which social collectives have voiced their demands show a diversity of channels and expressions (Graph 2). In Salta and Santiago del Estero, informal claims or reports with some degree of formality (before the police and/or governmental authorities) prevail. Santa Fe shows a more consistent distribution of the different remedies used, with a large number of cases being made visible through initiatives promoted by university and research teams. In line with what has happened in other provinces with similar agricultural matrices, a vast history of struggle and social construction of the risks related to the impact of agrochemicals has consolidated there for years, paving the way for organizational processes and the emergence of "challenging collectives"[52] in multiple local spaces. Rule judicialization, drafting and appropriation processes have been fostered, and issues have jumped to other spheres, in alliance with different actors, despite the persistent rejection and/or denial by government authorities and the production sector.

In Santiago del Estero and Salta, the debate takes less institutionalized forms. This does not mean the problem is less important; rather, it means that the issue has not become visible beyond the local level nor has it become the object of demands or claims in public debate, before courts and/or states, safe a few exceptions. Notably, as for native peoples and peasants, the consequences of exposure to agrochemicals are

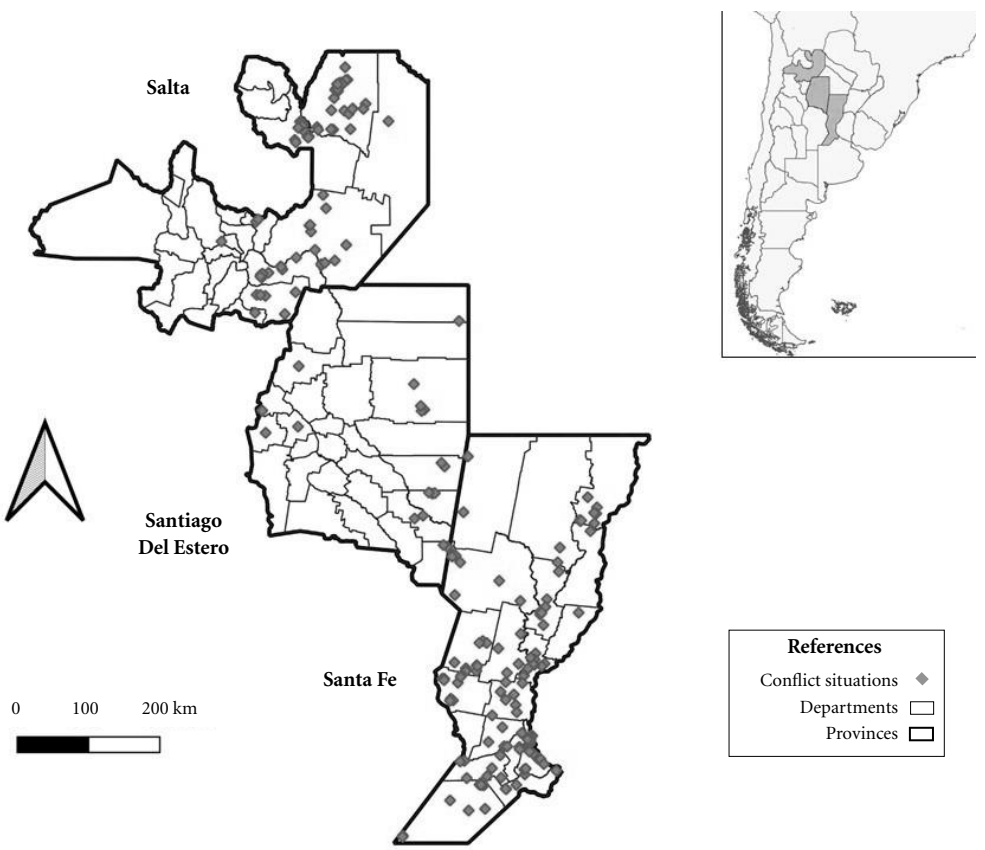
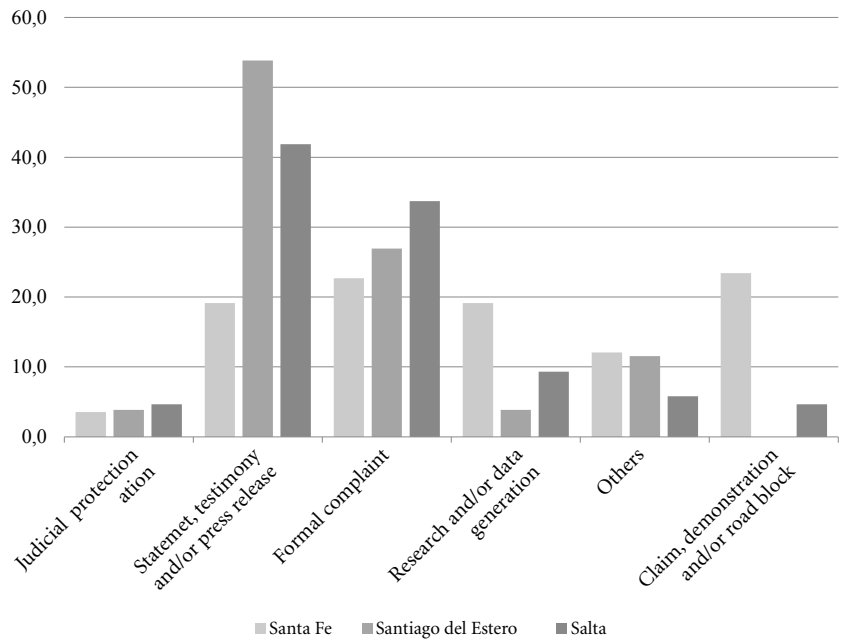


Figure 1. Provinces of Santa Fe, Santiago del Estero, and Salta. Conflict Situations and/or Events by Department.

Source: Authors.

Ciência & Saúde Coletiva, 27(3):1061-1072, 2022



Graph 2. Provinces of Santa Fe, Santiago del Estero, and Salta. Conflict Situations and/or Events Based on Measures Taken (%).

Source: Authors.

indissolubly linked to another historically rooted problem: the issue of access and possession of land.

One of the primary means through which populations have managed to spark public debate around their claims are courts. In Santa Fe, the most relevant case is that of San Jorge, whereby spraying in soy fields near one of the city neighborhoods was restricted in 2009[53]. This court decision set precedent, introducing new elements such as the use of the "precautionary principle" and the reversion of the burden of proof. Other cases can be highlighted, such as Totoras (2015), Ibarlucea (2011), Firmat (2011), Sastre, Ortiz (2018), and Piamonte (2016).

In Santiago del Estero, a protective action of *amparo* was admitted near Bajo Hondo, department of Juan Felipe Ibarra, where in 2016, aerial spraying was forbidden within a radius of 3,000 meters and ground spraying was forbidden within 500 meters from a rural plot where peasants live and produce[54]. Another case is that of Bandera, a town where a baby girl with multiple malformations related to exposure during pregnancy died in 2010. That case involved a collective precautionary measure filed by several social and non-governmental organizations (NGOs) with the Argentine Supreme Court in 2012[55].

Finally, Salta's case-law includes the case of Antillas, a small town in the department of Rosario de la Frontera. There, several neighbors filed an environmental *amparo* action against private parties responsible for agricultural exploitation around the town for spraying over plots adjacent to the town. The court in that case admitted the action against such private parties and the Municipality of Potrero. In 2011, the court forbade all aerial and ground spraying activities (within 1,500m and 300m, respectively,) as well as light aircraft overflight, it ordered reforestation with shelterbelts and urged the Municipal Council to issue rules on the subject[56].

Risk perception and primary actors involved in the conflicts

In most cases, the construction of risk creates a tight link with impacts on health and the envi-

ronment. However, there are records of conflict situations and/or events specifically mentioning environmental and/or health risks.

In the first case, they arise whenever some "natural resource" has been directly affected: malformations and/or death in flora and fauna, pollution of water courses, among others. In the second case, they arise when there is evidence of diseases and/or poisoning caused by exposure to toxic products, or through contact with polluted water, soil and/or air.

Cases have been found involving neighborhoods adjacent to crop fields where people reported having suffered from respiratory problems, vomiting, itchiness, and other immediate effects following spraying near their home and/or educational facilities. Acute toxicity was also observed (in some cases, followed by death) in agro-industrial workers. Another series of cases involve health problems associated with indirect, everyday and long-term exposures: cancer, congenital malformations, miscarriages, among others. These problems have often been reported as occurring simultaneously to what have been categorized as "bad practices", breaching the regulations in force: spraying in fields near households and/or schools without observing protected areas, toxicity categories and/or hours; storage and/or disposal of packages in urban areas, parking and/or circulation of agricultural machinery in urban areas, etcetera.

The map of the main actors affected shows that, in Santa Fe, urban populations prevail (both large conglomerates and small towns), whereas in Santiago del Estero and Salta – while the proportion of urban population affected is significant – the impact on rural population and/or native peoples stands out (who live in rural areas and/or in urban peripheries.) Furthermore, there are cases where the population affected are workers of the sector and educational communities from schools. In addition, the environment itself is an affected actor – cases where there is no specific individual or group recognized as being at risk but, rather, an impact on water courses, flora and fauna, air and/or soil is reported (Graph 3).

The population affected does not always match the claimant. A complex network of connections and alliances between actors who get together to disseminate the event through different channels comes into play[59]. This is the case of university and research teams whose interventions contribute to systematize and assess existing and/or potential risks, as well as their probable cause-effect relation with exposure to spraying. NGOs operating in the referred territories also prepare reports and draw up documents. In other cases, it is the top-level staff and/or workers in educational and/or health centers who raise their voice, as well as different governmental agencies through the statements made by some of their officials and/or technical staff.

If we look into the actors who are charged with the damage, private parties stand out (44%): farming businesspersons and/or producers, fumigators, merchants and/or transportation owners. However, responsibility is also allocated to governmental agencies (municipalities, 25%; provinces, 10%) on account of their role as AAs of the legislation in force and the absence of control, monitoring and sanctioning.

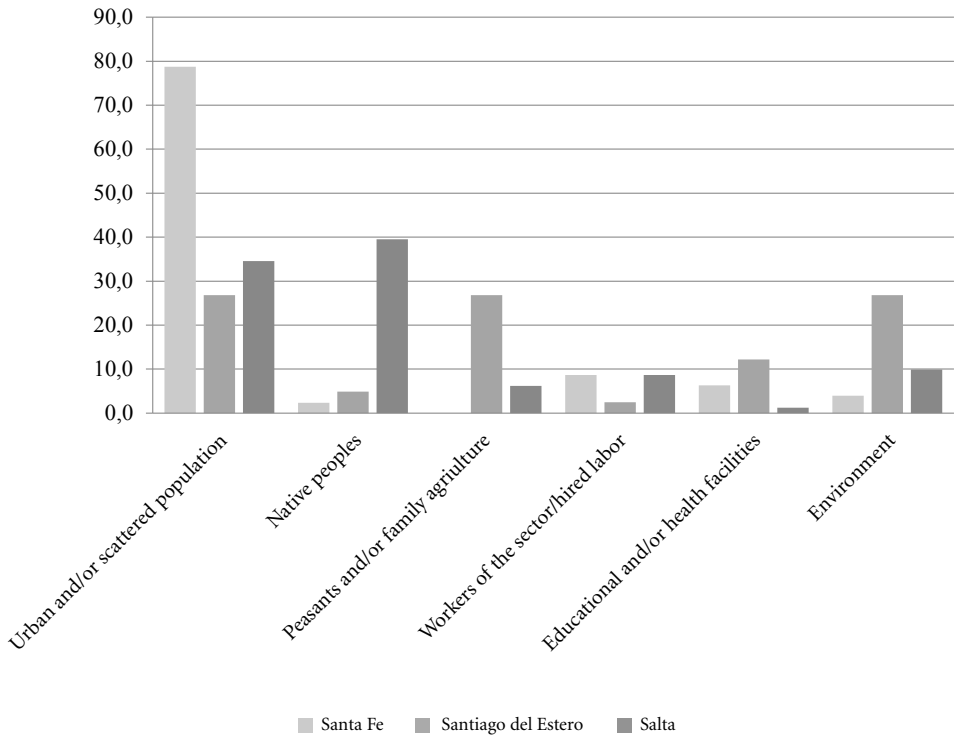
Identifying those who are held responsible in the claims and reports shows that, while in Santa Fe, the main recipients of the complaints have been municipal governments (32%), in Santiago del Estero and Salta, the media prevails as the primary recipient (25% and 24% of cases, respectively, as against 9.4% and 2,2% of claims filed against municipalities). In Santa Fe, the strategy of filing reports against local governments shows that, in some cases, because of the strength of organized collective action, such claims resonate with municipalities, with the ensuing legal and institutional changes to channel the conflicts. On the contrary, in Santiago del Estero and Salta, local governments do not seem to be the fora where claims can be channeled or resolved.

Discussion

In the early 1960s, and after extensive research on the effects of pesticides on the environment and human health, Rachel Carson wondered: "Where do pesticides fit into the picture of environmental disease? They now contaminate soil, water, and food, and they have the power to make our streams fishless and our gardens and woodlands silent and birdless. Man, however, much he may like to pretend the contrary, is part of nature. Can he escape a pollution that is now so thoroughly distributed throughout his world?"[57].

Over half a century has gone by since those first warnings, but surfaces sprayed with an increasing variety of toxic products continue to grow. The social and political construction of risks associated with agrochemicals is becoming stronger as a field of dispute at different levels. The dynamics that these processes acquire in each specific case can be understood based on

Ciência & Saúde Coletiva, 27(3):1061-1072, 2022



Graph 3. Provinces of Santa Fe, Santiago del Estero, and Salta. Conflict Situations and/or Events Based on Affected Actors (%).

Source: Authors.

the historical path of the conflicts and resistances of each place, and the ability of the social actors involved to mobilize resources, build strategic alliances and create networks.

The analysis of the regulatory dimension made it possible to get an insight into critical observation of the legal framework in Argentina. Faced with the environmental and health impacts to which they are exposed in their daily lives, and given the lack of information and official response, local actors take the existent legal repertoire as their own, file legal claims, and draft new regulatory proposals. From this federal scheme, a question follows in connection with the necessary consensus or coordination at the provincial and/or local levels to set and enforce rules, and exercise the power of police over the use of agrochemicals. Economic, social and environmental differences between countries – and the jurisdictional heterogeneities and inequalities within them – pose a challenge in this regard.

As for the political-institutional dimension, our findings show there are different agencies responsible for the management and enforcement of the relevant policy. An analysis at the national and provincial levels highlights the partial and shattered competence of the federal government over the regulation of agrochemical use and application. Such use and application are delegated to provinces and, within provinces, their regulation is transferred to local authorities. Thus, a large portion of control and monitoring tasks fall into the hands of the municipalities which often feature serious difficulties in terms of institutional capacities, as well as human and financial resources. This adds complexity to the matter, as, more often than not, conflicts of interest arise amongst provincial and/or municipal law-

makers, between their public duties and private business. Coupled with the lack of streamlining between agencies and offices, there is also little intervention by health and environmental agencies. The issue of an increasingly extensive use of agrochemicals is not regarded as a matter of health and environmental policy, being left in the realm of agro-industry decision-making. Under these circumstances, Good Agricultural Practices call for reflection. Responsibility for BPA application falls in the hands of local authorities and/or individuals or business owners, while reducing the influence of health and environmental agencies. BPAs also serve as a means to end all debates on the risks associated with agrochemical use.

The social-territorial dimension accounted for the emergence of multiple conflicts and disputes over agrochemical use and the way they are linked to the depth and history of the production model and the networks built around it. In addition to explicit conflicts, this research unveiled the existence of low-intensity conflict situations and events related to the level of naturalization of the risks faced by some social groups who are exposed to high levels of social, economic, environmental and/or health vulnerability (land possession, access to water, poverty and food deficiency, among many others).

In rural and peri-urban areas, most people are victims of "silent poisoning"[58] worsened by the lack of health records, legal fragmentation and absence of control. A significant element that should be highlighted is that, while laws set a cautious criterion which provides that the population affected does not carry the burden to prove the causation link between exposure to agrochemicals and risks, more often than not, such burden is shifted, forcing people to expose their bodies and diseases. Conflicts and disputes over agrochemical use put the existing rules of the game into question and promote the creation of new rules and institutional frameworks, while becoming spaces for collective learning that may serve as reference for the generation of public policies and as an example to prevent similar problems in other areas of Argentina and the region.

In the current scenario, debate over the risks associated with exposure to agrochemicals at the international level is renewed with reports, diseases and death that become part of the public domain on a daily basis, while hurdles to record and systematize health impacts persist. Driving research studies that break the silence by echoing the voices involved is of the essence, especially by recovering the voice of those whose rights are undermined.

Collaborations

M Schmidt: data collection, analysis and interpretation (Salta province), writing and critical revision of the manuscript. V Toledo López: data collection, analysis and interpretation (province of Santiago del Estero), writing and critical revision of the manuscript. Ezequiel Grinberg: data collection, analysis and interpretation (Santa Fe province), writing and critical revision of the manuscript. M Tobías: data analysis and interpretation, writing and critical revision of the manuscript. G Merlinsky: data analysis and interpretation, writing and critical revision of the manuscript. All authors worked equally in the writing and critical revision of the manuscript and contributed to the approval of the final version.

References

1. Gras C, Hernández V, coords. *El agro como negocio. Producción, sociedad y territorios en la globalización*. Buenos Aires: Biblos; 2013.
2. Leguizamón A. *Seeds of Power. Environmental Injustice and Genetically Modified Soybeans in Argentina*. Durham: Duke UP; 2020.
3. International Service for the Acquisition of Agri-biotech Applications. *Global Status of Commercialized Biotech/GM Crops*.NY: ISAAA; 2017.
4. Ministerio de Agrícultura, Ganaderia y Pesca. Presidencia de la Nación. Estimaciones Agrícolas. [acceso 2021 Fev 10]. Disponible en: http://datosestimaciones.magyp.gob.ar/
5. http://www.naturalezadederechos.org/501.htm. [acceso 2021 Fev 10]. Disponible en: http://datosestimaciones.magyp.gob.ar/
6. Myers J, Antoniou M, Blumberg B, Carroll L, Colborn T, Everett L, Hansen M, Landrigan P, Lanphear B, Mesnage R, Vandenberg L, vomSaal F, Welshons W, Benbrook C. Concerns over use of glyphosate-based herbicides and risks associated with exposures: a consensus statement. *Environ Health* 2016; 15:19.
7. Mesnage R, Séralini GE. Editorial: Toxicity of Pesticides on Health and Environment. *Pub Health* 2018; 6:268.
8. Hertz-Picciotto I, Sass JB, Engel S, Bennett DH, Bradman A, Eskenazi B, Lanphear B, Whyatt R. Organophosphate exposures during pregnancy and child neurodevelopment: Recommendations for essential policy reforms. *PLoS Med* 2018; 15(10).
9. Gillezeau C, van Gerwen M, Shaffer R, Rana I, Zhang L, Sheppard L, Taioli E. The evidence of human exposure to glyphosate: a review. *Environ Health* 2019; 18:2.
10. Van Bruggen A, He M.M, Shin K, Mai V, Jeong K, Finckh M, Morris, J. Environmental and health effects of the herbicide glyphosate. *Sci Total Environ* 2018; 616-17:255-268.
11. Domínguez D, Sabatino P. *La muerte que viene en el viento. La problemática de la contaminación por efecto de la agricultura transgénica en Argentina y Paraguay*. Buenos Aires: CLACSO; 2005.
12. Benitez Leite S, Franco de Diana D, Segovia Abreu J, Avalos D, Almada Denis M, Coronel Ovelar C, Samaniego Royg MJ, ThielmannArbo B, Corvalan R. DNA damageinducedbyexposure to pesticides in children of rural areas in Paraguay. *Indian J Med Res* 2019; 150:290-296.
13. Souza MMO, Folgado CR, organizadores. *Agrotóxicos e agroecologia: enfrentamentos científicos, jurídicos, políticos e socioambientais*. Anápolis: Ed. UEG; 2018.
14. Aparicio V, Aimar S, Gerónimo E, Mendez M, Costa JL. Glyphosate and AMPA concentrations in wind -blown material under field conditions. *Land Degrad Dev* 2018:1-10.
15. Alonso L, Demetrio P, Etchegoyen A, Marino D. Glyphosate and atrazine in rainfall and soils in agroproductive areas of the pampas region in Argentina. *Sci Total Environ* 2018; 645:89-96.
16. Aparicio V, Costa JL. *Los plaguicidas agregados al suelo y su destino en el ambiente*. Buenos Aires: INTA; 2017.
17. Etchegoyen M, Ronco A, Almada P, Abelando M, Marino D. Occurrence and fate of pesticides in the Argentine stretch of the Paraguay-Paraná basin. *Environ Monit Assess* 2017; 189:63.
18. Paganelli A, Gnazzo V, Acosta H, Lopez S, Carrasco A. Glyphosate-Based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling. *Chem Res Toxicol* 2010; 23:1586-1595.
19. Pochettino A, Hapon MB, Biolatto S, Madariaga MJ, Jahn G, Konjuh C. Effects of 2,4-dichlorophenoxyacetic acid on the ventral prostate of rats during the peri-pubertal, pubertal and adult stage. *Drug Chem Toxicol* 2016; 39(4):392-399.
20. Lajmanovich R, Peltzer P, Attademo A, Cabagna Zenklusen M, Junges C. Los agroquímicos y su impacto en los anfibios: un dilema de difícil solución. *Química Viva* 2012; 3(11):184-198.
21. Mac Loughlin T, Peluso L, Etchegoyen MA, Alonso L, Castro MC, Percudani MC, Marino D. Pesticide residues in fruits and vegetables of the argentine domestic market: Occurrence and quality. *Food Control* 2018; 93:129-138.
22. Marino D, Peluso L. Residuos de glifosato y su metabolito AMPA en muestras de algodón y derivados. *III Congreso de Médicos de Pueblos Fumigados*; 2015.
23. Moya A, Kronberg F, Clavijo A, Mazzarella D, Pagano E, Munarriz E. Plaguicidas disruptores endócrinos, uso del nematodo Caenorhabditis Elegans como modelo biológico. *Rev Senasa* 2015; 7:80-89.
24. Mañas F, Peralta L, Gorla N, Bosh B, Aiassa D. Aberraciones Cromosómicas en Trabajadores Rurales de la Provincia de Córdoba Expuestos a Plaguicidas. *J Basic Appl Genet* 2009; 20(1):9-13.
25. Bernardia N, Gentilea N, Mañas F, Méndez A, Gorla N, Aiassa D. Evaluación del nivel de daño en el material genético de niños de la provincia de Córdoba expuestos a plaguicidas. *Arch Argent Pediatr* 2015; 113(2):126-132.
26. Ávila-Vázquez M, Difilippo F, Mac Lean B, Maturano E, Etchegoyen A. Environmental exposure to glyphosate and reproductive health impacts in agricultural population of Argentina. *J Environ Prot* 2018; 9:241-253.
27. Ávila-Vázquez M, Maturano E, Etchegoyen A, Difilippo F, Mac Lean B. Asociación entre cáncer y exposición ambiental a glifosato. *Rev Col Médicos 1ra Circ* 2018; 2(3):10-16.
28. Verzeñassi D, Vallini A. *Transformaciones en los modos de enfermar y morir en la región agroindustrial de Argentina*. Rosario: InSSa-UNR; 2019.
29. Skill K, Grinberg E. Controversias sociotécnicas en torno a las fumigaciones con glifosato en Argentina. Una mirada desde la construcción social del riesgo. En: Merlinsky G, comp. *Cartografías del conflicto ambiental en Argentina*. Buenos Aires: Ciccus; 2013. p. 91-117.
30. Douglas M. *La aceptabilidad del riesgo según las ciencias sociales*. Barcelona: Paidos; 1996.
31. Beck U. *La sociedad del riesgo. Hacia una nueva modernidad*. Barcelona: Paidós; 1998.
32. Callon M, Lascoumes P, Barthe Y. *Acting in an uncertain world: an essay on technical democracy*. London: The MIT Press; 2009.
33. Gaille M. Des preuvesincertaines, un savoir sans effet? Développer une demarche de connaissance des pathologiesenvironnementales. En: Gaille M, dir. *Pathologiesenvironnementales. Identifier, comprendre, agir*. Paris: CNRS eds; 2018. p. 11-44.

34. Brown P. Popular Epidemiology and Toxic Waste Contamination: Lay and Professional Ways of Knowing. *J Health Soc Behav* 1992; 33(3):267-281.
35. Breilh J. *Epidemiología crítica. Ciencia emancipadora e intercultural*. Buenos Aires: Lugar editorial; 2006.
36. Akrich M, Barthe Y, Rémy C. Les enquêtes "profanes" et la dynamique des controverses en santéenvironnementale. En: Akrich M, Barthe Y, Rémy C. *Sur la piste environnementale: Menacessanitaires et mobilisations profanes*. Paris: Presses des Mines; 2010. p. 7-52.
37. Arancibia F, Bocles I, Massarini A, Verzeñassi D. Tensiones entre los saberes académicos y los movimientos sociales en las problemáticas ambientales. *Metatheoria* 2018; 8(2): 105-123.
38. Berger M, Carrizo C. *Afectados ambientales: aportes conceptuales y prácticos para la lucha por el reconocimiento y garantía de derechos*. Córdoba: Ed. Ciencia y Democracia; 2019.
39. Souza Casadinho J. Los conflictos ambientales en torno a las pulverizaciones con agrotóxicos, actores, luchas y logros alcanzados. En: Suárez F, Ruggiero C. *Los conflictos ambientales en América Latina I*. Los Polvorines: Ed. UNGS; 2018. p. 353-386.
40. Larsen B. Homogeneización productiva. Análisis de riesgos en la salud de la población rural por agroquímicos. Estudio de caso en la pampa argentina. En: Lan D, comp.*Geografías en diálogo, Tomo I (Aportes para la reflexión).* Tandil: UNCPBA; 2016. p. 501-509.
41. Mas L, Aparicio V, Geronimo E, Costa JL. Pesticides in water sources from the East of Santiago del Estero, Argentina. *SN Appl Sci* 2020; 691(2).
42. Sánchez DC, Echalar R, Romero GM, Aparicio S. Relación de pesos al nacer con la procedencia de la madre en localidades con uso intensivo de agroquímicos. *Rev Salud Publica* 2012; XVI(3):21-6.
43. Ramírez M, Belingheri B, Nícoli MB, Seveso MC, Ramírez L, Garcete M. *Relación entre el uso de agroquímicos y el estado sanitario de la población en localidades de los Departamentos Bermejo, Independencia y Tapenagá de la Provincia del Chaco*. Informe final presentado ante la Comisión Nacional Salud Investiga; 2012.
44. Lapegna P. *La Argentina transgénica. De la resistencia a la adaptación, una etnografía de las poblaciones campesinas*. Buenos Aires: Siglo XXI; 2019.
45. Seveso MC. *Resistiendo al modelo agrobiotecnológico. Para evitar la complicidad de las víctimas.* Rosario: CB Ediciones; 2020.
46. Aguiar S, Texeira M, Paruelo J, Román M. Conflictos por la tenencia de la tierra en la provincia de Santiago Del Estero. Su relación con los cambios en el uso de la tierra. En: Román M, González MC, coordinadores. *Transformaciones agrarias argentinas durante las últimas décadas: una visión desde Santiago del Estero y Buenos Aires*. Buenos Aires: FAUBA; 2016. p. 199-225.
47. Schmidt M. *Crónicas de un (Des)Ordenamiento Territorial. Disputas por el territorio, modelos de desarrollo y mercantilización de la naturaleza en el este salteño*. Buenos Aires: Ed. Teseo; 2017.
48. Laboratorio de Análisis Regional y Teledetección de la Facultad de Agronomía de la Universidad de Buenos Aires, el Instituto Nacional de Tecnología Agropecuaria y la Red Agroforestal Chaco Argentina. *Monitoreo de Deforestación En El Chaco Seco*. [acceso 2021 Fev 10]. Disponible en: http://monitoreodesmonte.com.ar/
49. Schmidt M, Grinberg E, Langbehn L, Álvarez A, Pereyra H, Toledo López V, Tobias M, García Battán J, Merlinsky G, Ceirano V. *Riesgos e impactos socio-sanitarios de las fumigaciones con agroquímicos en las provincias de Salta, Santiago del Estero y Santa Fe.* Informe final presentado a la Convocatoria a Becas de Investigación SALUD INVESTIGA "Dr. Abraam-Sonis" 2018; 2019.
50. Merlinsky G. Introducción. La cuestión ambiental en la agenda pública. En: Merlinsky G, comp.*Cartografías del conflicto ambiental en Argentina*. Buenos Aires: Ciccus; 2013. p. 19-60.
51. Cabaleiro F, Avila D. Juridicidade e praxis em agrotóxicos na Argentina. En: Mendonca Oliveira de Souza M, Rodrigues Folgado C, organizadores. *Agrotóxicos e agroecologia: enfrentamentos científicos, jurídicos, políticos e socioambientais*. Anápolis: Ed. UEG; 2018. p. 195-228.
52. Akrich M, Barthe Y, Rémy C. Les enquêtes "profanes" et la dynamique des controverses en santéenvironnementale. En: Akrich M, Barthe Y, Rémy C. *Sur la piste environnementale: Menacessanitaires et mobilisations profanes*. Paris: Presses des Mines; 2010.
53. Juzgado de Primera Instancia de Distrito N° 11 en lo Civil de la Provincia de Santa Fe. *Peralta, Viviana c. Municipalidad de San Jorge y otros s/ Amparo*. Provincia de Santa Fe; 2009.
54. Juzgado de Paz N° 4 de la Provincia de Santiago del Estero (Capital). *Basualdo, Ramón y otros vs. Canido Stella Maris y otros s. Acción de Amparo.* Provincia de Santiago del Estero; 2016.
55. Ministerio Público. Procuración General de la Nación. *Giménez, Alicia Fany y Otros s/ EN- Ministerio de Agroindustria y Otros s/ Medida Cautelar*. [acceso 2021 Mar 2]. Disponible en: https://www.mpf.gob.ar/dictamenes/2021/LMonti/marzo/Gimenez_Alicia_CAF_22336_2014_CA1CS2.pdf
56. Juzgado Correccional y de Garantías y Menores de Segunda Nominación del Distrito Judicial del Sur Circunscripción Metán. *Arata, Antonio y otros. Solicitan medida cautelar con la suspensión inmediata de fumigaciones aéreas y/o terrestres.* Provincia de Salta; 2011.
57. Carson R. *Primavera silenciosa*. s/d; 1962.
58. Auditoría General de la Nación. *Informe de auditoría en la Dirección Nacional de Agroquímicos, Productos Veterinarios y Alimentos del Servicio Nacional de Sanidad y Calidad Agroalimentaria (SENASA).* Buenos Aires: AGN; 2012.

Article submitted 05/04/2020
Approved 01/03/2021
Final version submitted 03/03/2021

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva