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Territories of water (in)security: The political economy of water governance reform for irrigation and its implications for territorial inequality

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ABSTRACT

As climate change progresses and water supplies become increasingly unpredictable; world population grows; human diets change; and the bio-economy expands into new business spheres, competition for water intensifies both within the agricultural sector and among sectors.

In response to – and sometimes in anticipation of – such competition, countries around the world have embarked upon water governance reform in order to ensure the attainment of social, economic and environmental goals. To varying degrees, these goals include achieving water security for all and in some cases also preventing the accumulation and unequal distribution of water rights; ensuring food security and in some cases also food sovereignty; stimulating economic growth; contributing to energy security; and guaranteeing environmental integrity and ground water quality. Key reform features include the establishment of a unified legal and administrative framework for water allocation through a statutory water rights registry, administered by a water administration agency, and water allocation to take place based on a set of pre-defined social, environmental and economic criteria.

Drawing upon research conducted in Nicaragua, this paper examines the extent to which these sets of societal goals are pursued in the implementation of water governance reform in the case of water governance for irrigation. The paper suggests that rather than assuming their envisaged water allocation role, the newly created national water agencies are increasingly called upon by strong economic actors whose access to finance and to commodity markets is conditioned on their ability to demonstrate legally sanctioned water-use rights for irrigation.

While the provision of this legal service may be societally beneficial – at least in the short run – the paper concludes that it risks cementing and perhaps even amplifying territorial inequalities in terms of legally sanctioned access to water due to not taking the territorial dimension of irrigation into account and due to being only partially implemented. Over time and with increasing competition for water, this may contribute to also deepen inequality in terms of *de-facto* water security and access to water for agricultural production among different segments of agricultural producers and among different parts of the country.

Keywords: Water governance reform, water rights, water security, irrigation, concession, Nicaragua

[1] This working paper is based upon research conducted as part of the project "The political economy of water governance reform: The implications for territorial inequality", which forms part of the programme "Territorial Cohesion for Development", coordinated by Rimisp – Latin American Center for Rural Development, and supported by IDRC, Canada and the Danish Institute for International Studies (DIIS). The working paper draws upon a manuscript submitted for possible publication in Water International (Ravnborg, forthcoming). The author wishes to thank Daniel Chillon Olmos and Francisco Perez, IXMATI, Nicaragua, and Jorge Rubiano and Fabio Castro, Universidad del Valle, Colombia, for their invaluable support in identifying and tabulating published administrative resolutions issued by the National Water Authority, Nicaragua, and for establishing the geographical information system for analyzing the data published from the Cenagro IV (INIDE, 2011).

1. WATER SECURITY – A SHARED CONCERN

Water security is a key concern, not only to people all over the world, but also to farmers and industry. Water security is defined by UN-Water as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" (UN-Water, 2013).

Consumers around the world have begun to recognize and also question the social, economic and environmental impacts of the water footprint (e.g. Hoekstra, 2013; Hoekstra and Chapagain, 2007; Hoekstra *et al.*, 2011), which is embedded throughout the supply chain in specific products and production processes, and therefore also large – multi-national – companies and financial institutions have started to direct their attention to the issue of water security (Daniel and Sojamo, 2012; Sojamo and Larson, 2012; Mason, 2013).

Thus, since 2012 water has figured among the top-five global risks in environmental as well as in societal terms, identified by the World Economic Forum through their global risks perception survey (WEF, 2016) and private sector-led initiatives to demonstrate water stewardship have been mushrooming during the last decade. These include the CEO Water Mandate under the auspices of the UN Global Compact which in 2007 was launched 'to mobilize business leaders to advance water stewardship', the Water Resources Group launched under the auspices of the World Economic Forum 'to help convene and build coalitions to develop transformational policies and programmes as well as public-private projects and partnerships in the water sector',[2] and the Alliance for Water Stewardship, 'a multi-stakeholder organization dedicated to enhancing water stewardship capacity, and guiding, incentivizing and differentiating responsible water use', founded by stakeholders from industry, agriculture, public sector and civil society.[3] In 2015, the Alliance for Water Stewardship launched the certification requirements and verification procedure according to the AWS International Water Stewardship Standard.

This even further accentuates water security and the need for effective water governance as a key concern also to governments. Nicaragua is one of the many countries which are taking steps to address this concern (e.g. Burchi, 2012; Ravnborg, 2015; Ravnborg, forthcoming). Following almost a decade of political and public debate (Romano, 2012; Ravnborg, forthcoming), in 2007 Nicaragua passed its first General Water Law. The objective of the law and the water governance reform of which the water law forms part, is to ensure the sustainable and *equitable* use of water and the conservation of the country's water resources in terms of quantity as well as quality' [emphasis added] with the aim 'to promote social and economic development', through the regulation of rights to access and use water resources (Law 620: Preamble and Articles 1, 2 and 14c). At the core of Nicaragua's new legal and institutional water governance framework is the introduction of a water-rights regime which within the context of hydrological units has 'the objective to ensure the control of the use of water both from a quantitative and a qualitative perspective, and to enable the effective exercise of the rights to access to water' (Law 620: Article 14). Thus, according to the law, all water use, whether by individuals or by public or private legal entities such as water utilities and companies, has to be formally sanctioned through a concession, license[4] or an authorization (Law 620: Article 41). To regulate the allocation of rights to use or benefit from water resources (Law 620: Article 2) and thus as a custodian of Nicaragua's water resources, the water law establishes the National Water Authority as the executive body charged with the regulatory and technical responsibility for water governance in the country (Law 620: Articles 24-30). Moreover, to register water rights, the water law establishes the National Public Registry of Water Rights. This registry is envisaged as separate from- yet to be administered by - the National Water Authority. The law specifies that public access to the water rights registry should be guaranteed (Law 620: Article 40). The Nicaraguan

[2] http://www.weforum.org/content/pages/world-economic-forum-water-initiative, last consulted November 22, 2015.
[3] http://www.allianceforwaterstewardship.org, last consulted November 22, 2015.
[4] Licenses are intended exclusively for public water utilities providing drinking water as well as involved in hydro-power generation.

water law thus enlists itself among the so-called 'modern' water laws which a whole range of countries have adopted during recent decades (e.g. Burchi, 2012; Ravnborg, 2015).

With respect to water use rights for irrigation, Nicaragua's new water rights regime distinguishes between two types of use permits or rights, namely concessions and authorizations, both being valid between five and 30 years and both potentially to be subjected to a water use fee, for which, however, the specific design and law are still pending. According to the law, users of water for the irrigation of areas larger than 20 hectares should solicit a concession while users of water for small-scale irrigation, defined as the irrigation of areas smaller than three hectares are required to solicit an authorization. Thus, probably unintended, the law is silent with respect to how to formalize water use rights for irrigation of areas between three and 20 hectares. This omission was subsequently rectified when the water law regulation, issued in 2010 (Decree 44-2010), introduced a new set of criteria for determining whether the right to use water for irrigation should be formalized through a concession or an authorization. Rather than considering area under irrigation, which was the basis for the criteria stipulated by the water law, the new set of criteria is based on farm size, and on the destination of the produce. According to the 2010 regulation, a concession of water use right for irrigation should be solicited from the National Water Authority when the farm where the irrigation will take place is larger than 70 hectares or when, irrespective of farm size, the produce is intended for what is referred to as 'industrial marketing', whereas the use of water for irrigation of farms smaller than 70 hectares and where the produce is not intended for 'industrial marketing' requires the authorization from district authorities. Thus, while rectifying the ambiguity introduced by the water law with respect to how to formalize the use of water for irrigation of areas between three and 20 hectares, the 2010 water law regulation introduced a new source of ambiguity since no definition of what is implied by the term 'industrial marketing' is provided, nor does a common reference exist, e.g. in national statistics. Irrespective of the criteria, concessions are to be issued by the National Water Authority, while authorizations of water use in minor quantities for irrigation, but also for other purposes, may be granted by the district authorities, or in the autonomous regions, by the regional councils. The latter, however, requires that a signed collaboration agreement exists between the district authority/regional council and the National Water Authority. Apart from the issuing authority, no further differences are stipulated with respect to the legal requirements or provisions for the concessions and authorizations, respectively.

Hardly any attention was paid to the territorial dimensions of irrigation and how these would translate into territorially differentiated administrative implications as well as impacts in terms of water security for irrigation farmers of the proposed irrigation water rights regime during the legislative process and the implementation process which started in 2010 with the establishment of the National Water Authority. In a certain way, the omission to devize how to formalize water use rights for irrigation of areas between three and 20 hectares testifies to the limited attention given during the legislative process to the context into which the new water rights regime was to be implemented as well as to the implementation challenges that would ensue once the law is enacted.

2. DATA AND METHODS

In addition to interviews with key actors with respect to water governance reform and its implementation at national, district and local level, conducted over a period of more than a decade, this paper is based upon three data sets. The first data set is constructed as a subset of the fourth national agricultural census data set from 2011 (Cenagro IV; N=262,546 farms) (INIDE, 2011) containing those farms which according to the census employ some form of irrigation (n=11,599 farms). This data set provides a profile of the 11,599 farms which report to have an irrigation system and thus of the context in which the implementation of the water governance reform with respect to irrigation takes place. In addition, the entire national agricultural census data set is used as the basis for calculating the degree of land inequality at national as well as at sub-national level, measured through the 'Palma ratio' (Palma, 2011), in this case calculated as the combined farm size of the 10 percent largest farms within a specific geographic unit divided by the combined farm size of the 40 percent smallest farms within that unit.

The second data set draws on geographical information to describe Nicaragua with respect to altitude, slope, precipitation, etc. In addition to departments and districts, Nicaragua is sub-divided into so-called 'agricultural segments' (N=3,374 segments), referring to the geographical unit used by the Ministry of Agriculture and Livestock as the basis for developing national production estimates. These agricultural segments are not only sub-national but sub-district geographical units with an average size of 29 km^2. Therefore, using this geographical unit as the basis for analysis allows for a detailed spatial analysis of the territorial dimension of irrigation and water governance.

The third data set is a tabulation of concessions granted by the National Water Authority for irrigation. Ideally all administrative resolutions issued by the National Water Authority e.g. with respect to applications for permission to develop and inscribe water infrastructure as well as for water use rights, should be published in the national gazette at the cost of the applicant. Hence the third data set is constructed through a review of all issues of the Nicaraguan national gazette published since the establishment of the National Water Authority in 2010 and up to August 17, 2015, in order to identify and record all published administrative resolutions related to the National Water Authority, and as a subset of these, all published administrative resolutions which announce concessions of water use rights granted. This inventory was supplemented with periodic reviews of the National Public Registry of Water Rights and tabulated as a database. A total of 399 administrative resolutions were identified of which 236 announce concessions of water use right.

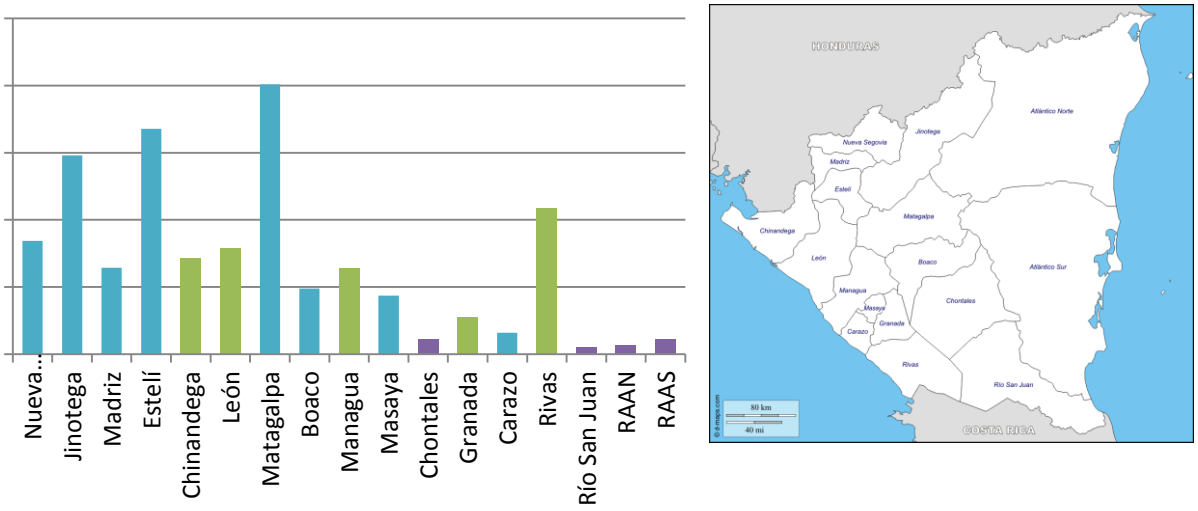
3. IRRIGATION IN NICARAGUA AND ITS TERRITORIAL DIMENSIONS

As already indicated, hardly any attention was paid to the territorial dimensions of irrigation during the legislative process, neither with respect to the actual distribution of irrigation, nor with respect to the potential territorial implications of the governance reform. Yet, the territorial dimension in the distribution of irrigation and the profile of farms with irrigation is profound.

While most of the land (64%) under irrigation is located at the Pacific plains of Chinandega, León, Managua, Granada and Rivas where the majority of the large banana and particularly sugarcane estates are located, the majority of *farms* with irrigation (57%) are located in northern hillsides of Matagalpa, Estelí, Jinotega, Madriz and Nueva Segovia (Figure 1). This territorial mismatch not only follows from, but contributes to amplify, the notoriously unequal land distribution which still today is a salient feature of the Nicaraguan agrarian structure.

Figure 1 shows how farms with irrigation are distributed in among Nicaragua's 15 departments and two autonomous regions. In terms of number of farms, the northern departments of Matagalpa, Estelí, Jinotega, Madriz and Nueva Segovia dominate, while irrigation, at least as reported in the Cenagro IV in 2011, is very limited in the two autonomous regions (RAAN and RAAS) as well as in the department of Rio San Juan along the Costa Rican border, and Chontales. Combined, the five northern departments account for 57 percent of farms with irrigation in Nicaragua, while the five departments at the pacific plains account for 30 percent of farms with irrigation and the two autonomous regions, Rio San Juan and Chontales, combined, account for three percent of farms with irrigation. The remaining 10 percent of farms with irrigation are located in Boaco in the central part of the country and in the small mountainous departments of Masaya and Carazo along the Pacific coast.

Figure 1. Number of farms with irrigation according to irrigation type, by department; N=11,599 farms



Note: RAAN corresponds to Atlántico Norte and RAAS corresponds to Atlántico Sur in the explanatory map.
Source: Own elaboration based on Cenagro IV (INIDE, 2011)

There is a close correlation between the degree of land inequality and topography, reflecting in part the concentration of the large agro-industrial estates in the Pacific plains. Leaving aside the two autonomous regions and the department of Río San Juan, where a considerable part of the land is demarcated as Indigenous territory as well as forming part of the Nicaragua's system of protected areas and where certain data gaps exist, as illustrated in Map 1 (see below), 1,796 agricultural segments are identified and linked to the Cenagro IV database (INIDE, 2011). These agricultural segments vary in size from 154 hectares to 24,767 hectares with an average size of 2,757 hectares. Based on the distribution of land according to slope, these agricultural segments have been classified with respect to topography as 'predominantly relatively flat', being the case for 526 agricultural segments, or as 'predominantly sloping', being the case for 1,270 agricultural segments.[5]

Calculated on the basis of data from the Cenagro IV (INIDE, 2011) at the level of agricultural segment, the degree of land inequality varies from close to equality[6] to almost infinity, as the land-based Palma ratio[7] is found to oscillate between 0.6 and 49,277 with an average of 124. On average, the land-based Palma ratio is more than four times higher in the predominantly flat agricultural segments compared to the predominantly sloping agricultural segments. The land-based Palma ratio is 64 for the 1,236 predominantly sloping agricultural segments, while it is 273 for the 496 relatively flat agricultural segments.[8] In 'only' 16 percent of the predominantly sloping agricultural segments, the land distribution is characterized as 'unequal' or 'highly unequal', corresponding to land-based Palma ratios above 32, whereas this is the case for 37 percent of the predominantly flat agricultural segments. Maps 1 and 2 show respectively the predominant slope category and the land-based Palma ratio category at the level of agricultural segment.

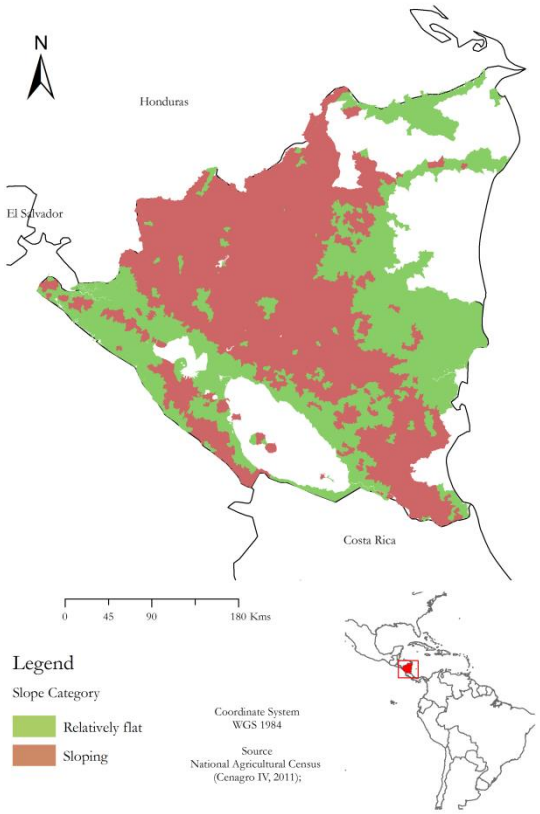
[5] For each agricultural segment, the area under each of the following four slope classes was determined: 0-7%; 7.1-30%; 30.1-70% and >70%. Given that only a limited part of the agricultural segments contain areas with slopes above 70% and that among these only a very limited part of the area is characterized by such slopes, the two most steep slope classes were combined. Thus, using the proportion of the area under each of these three slope classes (0-7%; 7.1-30% and >30%) as input variables, a cluster analysis was performed and a solution with two clusters was chosen, distinguishing between agricultural segments characterized as predominantly 'relatively flat' and agricultural segments characterized as predominantly 'sloping'.

[6] Measured by the Palma ratio, equality equals a Palma ratio of 0.25.

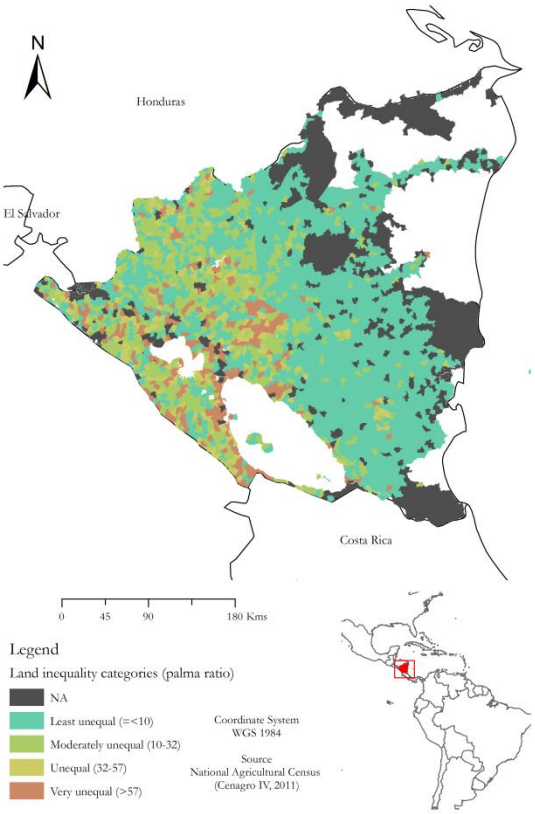
[7] As some of the agricultural segments contain less than five farms, the land-based Palma ratio could only be calculated for 1,732 agricultural segments.

[8] Significance of $F < 0.05$, one-way ANOVA.

Map 1. Slope category by agricultural segment
Predominant slope category



Map 2. Land inequality by agricultural segment
Land-based Palma ratio category



Source: Own elaboration based on Cenagro IV (INIDE, 2011).

As shown in Tables 1 and 2 as well as in Map 3 below, the majority of farms with irrigation are located in agricultural segments with the lowest or moderate degree of land inequality (69% of farms with irrigation) and with a predominantly sloping topography (65% of farms with irrigation), respectively. On average in these areas, the irrigated area is just above three hectares and the vast majority of the farms with irrigation in these areas (88% in the least and moderately unequal segments and 92% in the sloping segments) irrigate less than three hectares. Also in the agricultural segments with higher degrees of land inequality and with a relatively flat topography, small-scale irrigation predominates in terms of number of farms with irrigation, but in these areas, small-scale irrigators are accompanied by large-scale farms and agricultural enterprises which implies that the average area under irrigation is significantly higher, namely 21 hectares in the agricultural segments where land distribution is characterized as 'unequal' and 45 hectares in the 'highly unequal' agricultural segments. Similarly, in the relatively flat agricultural segments, the average area under irrigation is 32 hectares. Thus, 69 percent of land under irrigation is located in agricultural segments characterized by an 'unequal' or 'highly unequal' land distribution (Table 1) and as much as 85 percent of all irrigated land is located in agricultural segments characterized as predominantly 'relatively flat' (Table 2), as also shown in Map 4.

Table 1. Distribution of irrigation by degree of land inequality, according to agricultural segment
Number of farms and irrigated area (hectares) by land inequality category

Land inequality category (based on land-based Palma ratio)	Farms				Land			
	Number of agricultural sectors	Number of farms	Number of farms with irrigation	Percent farms having irrigation**	Total farm area (ha)	Irrigated farm area (ha)	Irrigated farm area as percent of total farm area**	Average irrigated area for farms with irrigation (ha)***
Least unequal	785	82,935	3,207	3.9	1,421,732	7,673	0.5	3.0
Moderately unequal	563	82,613	4,620	5.6	1,117,734	14,560	1.3	3.7
Unequal	157	19,856	1,718	8.7	339,201	11,565	3.4	20.7
Highly unequal	227	22,589	1,735	7.7	595,518	38,629	6.5	44.6
All	1,732[a]	207,993	11,280	5.4	3,474,186	72,427	2.1	11.7

Source: Own elaboration based on Cenagro IV (INIDE, 2011).
** Correlation is significant at 0.01 level (2-tailed; Pearson correlation)
*** Significance of F < 0.001, One-way ANOVA. Average irrigated area in agricultural segments with highly unequal land distribution is significantly higher than in agricultural segments with least and moderately unequal land distribution; Scheffe's test (at 0.05 level).
[a] The land-based Palma ratio is only calculated for agricultural segments containing five farms or more.

Table 2. Distribution of irrigation by predominant topography, according to agricultural segment
Number of farms and irrigated area (hectares) by slope category

Slope category	Farms				Land			
	Number of agricultural sectors	Number of farms	Number of farms with irrigation	Percent farms having irrigation**	Total farm area (ha)	Irrigated farm area (ha)	Irrigated farm area as percent of total farm area**	Average irrigated area for farms with irrigation (ha)***
Sloping	1,270	150,446	7,362	4.9	2,474,854	11,140	0.5	3.4
Relatively flat	526	57,880	3,954	6.8	1,045,923	63,777	6.1	32.4
All	1,796[a]	208,326	11,316	5.4	3,520,776	74,917	2.1	12.3

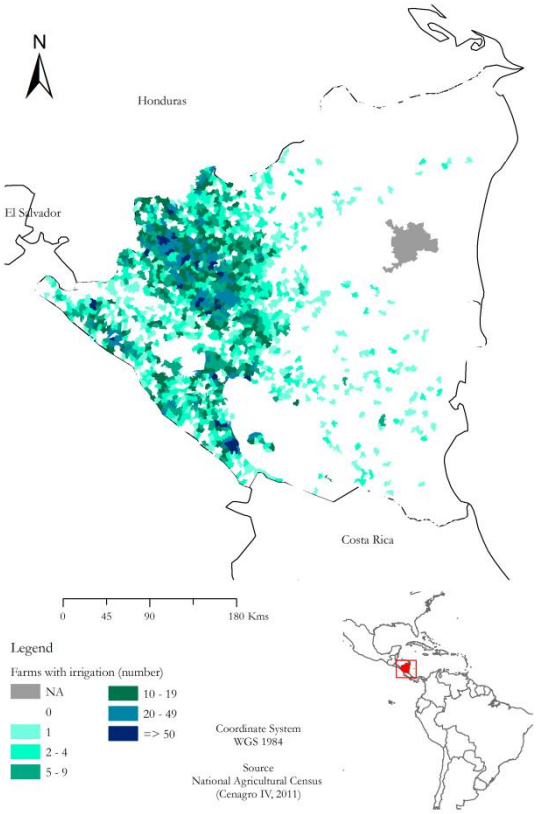
Source: Own elaboration based on Cenagro IV (INIDE, 2011).
** Correlation is significant at 0.01 level (2-tailed; Pearson correlation)
*** Significance of F < 0.001, One-way ANOVA.

This territorial diversity is not only found when comparing broad agro-ecological zones such as the Pacific plains and the northern hillsides. As irrigation is gaining importance, such territorial diversity is also found at a sub-national scale. Take the example of the district of Chichigalpa, renown as 'the town of sugar and rum' as it houses San Antonio, the country's largest sugar refinery. Chichigalpa is also the district where, by mid-2015, most concessions of water use rights for irrigation have been granted by the newly established National Water Authority, namely 18 (see Map 5), 12 of which for the irrigation of sugarcane. Moreover, according to data from Cenagro IV (INIDE, 2011), Chichigalpa is the second most unequal district in Nicaragua with respect to land distribution, with a land-based Palma ratio of 167, only surpassed by the district of Granada which has a Palma ratio of 205. Chichigalpa is comprised by 11 agricultural segments and there are farms with irrigation reported in five of them. Four of the segments are characterized as 'moderately unequal' in terms of land distribution and one as 'highly unequal'. Among the 37 farms which have irrigation on part of their farm in the four agricultural segments characterized as moderately unequal in terms of land distribution and which have reported their area under irrigation, the average irrigated area is 3.7 hectares, whereas for the 12 farms in agricultural

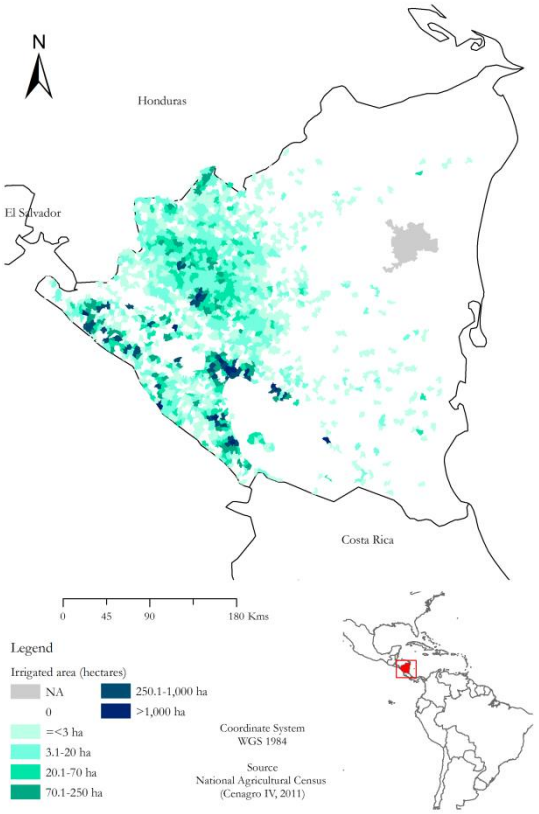
segment characterized as highly unequal in terms of land distribution, the average irrigated area is 29.5 hectares, ranging from 0.3 hectares to 343 hectares. In addition to pumping out ground water to feed the irrigation systems, the large sugar estates which are situated along the coast in the low-lying part of the district, have submitted applications for permission to construct dams in the upper part of the district[9] where the small-scale irrigation takes place.[10] This may risk cutting the water supply for some of the small-scale irrigation currently taking place.

In the hillsides, the dominant crops grown under full or supplemental irrigation are maize, beans, tomatoes and other vegetables, rice and then the rapidly expanding crop of tobacco,[11] while along the Pacific coast, the main crops grown under irrigation are sugarcane, banana and plantain.

Map 3. Farms with irrigation by agricultural segment
Number of farms with irrigation by range per agricultural segment



Map 4. Irrigated area by agricultural segment
Irrigated area (hectares) by range per agricultural segment



Source: Own elaboration based on Cenagro IV (INIDE, 2011)

[9] According to our inventory of administrative resolutions issued by the National Water Authority, 14 permissions have been granted for major hydraulic works, mainly dams, and three have already been inscribed.
[10] In Chichigalpa, there is an inverse relationship between the mean altitude above sea level of the agricultural segment and the average size of the irrigated land per agricultural segment.
[11] According to the Nicaraguan Tobacco Association, Nicaragua had around 5,000 hectares planted to tobacco in the beginning of 2015 (La Prensa, January 26, 2015; Available at http://www.estanquers.cat/docs/1111.pdf), compared to the 1,600-1,900 hectares estimated in 2011 by the Cenagro IV and FAO AQUASTAT.

Based on data available from Cenagro IV, Table 3 provides an estimate of the number of farms which according to the criteria established in respectively the 2007 national water law and the 2010 water law regulation would require to formalize their irrigation water use right through a concession and through a district-issued authorization. It shows that in order to accomplish the intentions of the 2007 water law, the National Water Authority should anticipate to process applications for water use rights concessions from somewhere between 381 and 1,166 farms while the 147 district administrations where small-scale irrigation takes place, should anticipate between 3,522 and 8,700 applications for water use rights authorization, ranging from somewhere between 498 and 123 for a district like Jinotega, and between 329 and 222 for a small district like Condega.

Table 3. Profile of farms with irrigation according to irrigation type and type of legal water right requirement

Number of Farms

Irrigation type[a]	According to 2007 water law[b]			According to 2010 water law regulation			Total
	Requiring concession	Requiring authorization	*Requirement is unknown*	Requiring concession	Requiring authorization	*Requirement is unknown*	
	Irrigated area >20 ha	Irrigated area =<3 ha	*Irrigated area > 3 ha and =< 20 ha*	Farm size > 70 ha	Farm size =< 70 ha and produce intended for own consumption	*Farm size =< 70 ha but significance of 'industrial market' is unclear*[c]	
Gravity	260	3,773	*740*	622	1,286	*3,072*	4,980
Sprinkler	127	2,258	*368*	450	1,075	*2,512*	4,037
Drip	244	3,519	*706*	674	1,581	*3,519*	5,774
Manual	119	4,427	*428*	434	1,599	*3,011*	5,044
Other	9	183	*37*	26	84	*126*	236
All	381	8,700	*1,180*	1,166	3,522	*6,911*	11,599

Source: Own elaboration on the basis of Cenagro IV (INIDE, 2011)

[a] Each farm with irrigation may have more than one type of irrigation system.

[b] The area under irrigation is unknown for 1,338 of the 11,599 farms reported to have irrigation. Therefore, only 10,261 farms may be categorized with respect to water right type required according to the 2007 water law.

[c] The Cenagro IV records whether the produce from a farm is primarily for own consumption or intended for the national market or for export. Assuming that farms that are smaller than 70 hectares and from which the produce is primarily for own consumption will be required to apply for an authorization rather than a concession, the degree of water right formalization achieved to date ranges between 1 to 10 percent in terms of number of farms.

4. WATER GOVERNANCE IMPLEMENTATION

Although the law was passed in 2007, it was not until 2010 that the National Water Authority was formally established and became operational. This led to the elaboration of a new water law regulation (Decree 44-2010), and the preparation of a regulation which made the National Public Registry of Water Rights functional (Decree 33-2011). Hence, the National Water Authority received the first applications for water use rights concessions in 2010 and the first concessions were granted and published as administrative resolutions in 2011. As a legal practice, the National Water Authority introduced a standard clause in its administrative resolutions conditioning the validity of the resolution upon its publication in two national newspapers as well as in the national gazette at the cost of the applicant. According to our records based on a revision of the national gazette and the National Public Registry of Water Rights, the National Water Authority had issued 399 administrative resolutions by August 17, 2015, of which 332 (83 percent) had been published in the national gazette. A total of 236 of the administrative resolutions were concessions of water rights, of which 116 were related to irrigation. Of these, 100 (86 percent) had been published in the national gazette. A bit more of half of the 116 concessions granted for irrigation (64) were granted for the irrigation of sugarcane (Figure 2). The 19 concessions granted by the end of 2011 corresponded to 104 million m^3 of water annually (Figure 3) and combined, the 116 concessions of water

use rights for irrigation by August 17, 2015, correspond to water use rights for 390 million m^3 of water annually, corresponding to one third of the amount of water which FAO AQUASTAT estimates is withdrawn annually for irrigation (2011 data). Map 5 and 6 show the geographic distribution of the irrigation water use rights concessions and of the water quantities conceded by district.

Figure 2. Irrigation concessions (number) granted by the National Water Authority, 2011 – 2014, by crop to be irrigated

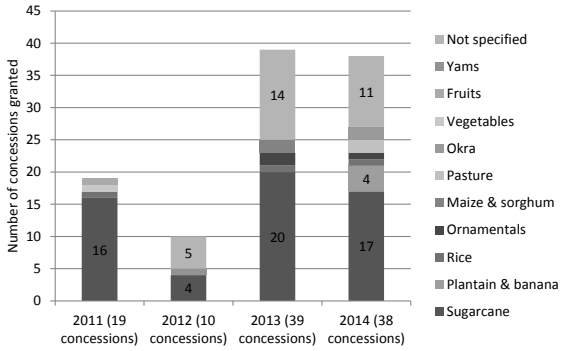
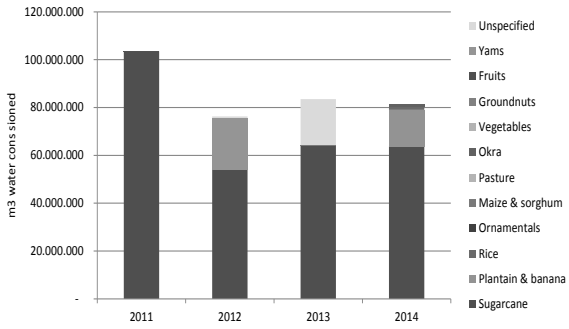
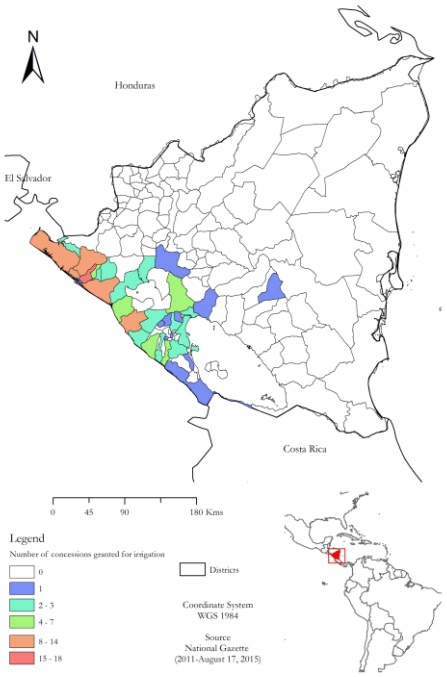


Figure 3. Water quantity (m^3) conceded for irrigation by the National Water Authority, 2011 – 2014, by crop to be irrigated

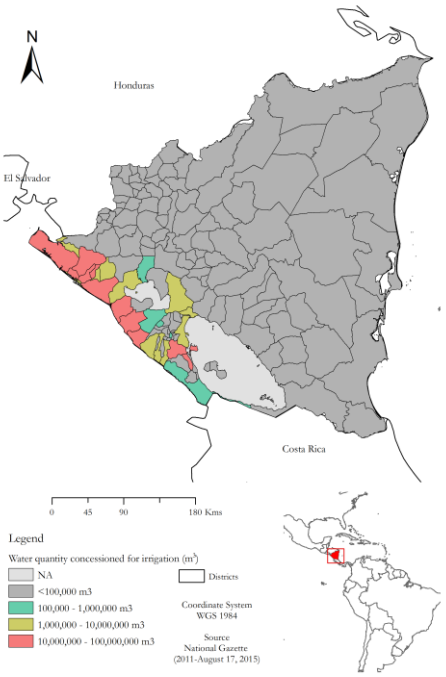


Source: Own elaboration based on revision of the national gazette, "La Gaceta – El diario oficial de Nicaragua" (2010 to 2014) available at http://www.lagaceta.gob.ni, supplemented with consultation of the National Public Registry of Water Rights. Unfortunately not all of the administrative resolutions contain information about the quantity of water granted in concession.

Map 5. Distribution of concessions (number) granted for irrigation by the National Water Authority, 2011 – 2014, by district



Map 6. Distribution of water quantity (m^3) conceded for irrigation by the National Water Authority, 2011 – 2014, by district



Source: Own elaboration based on revision of the national gazette, "La Gaceta – El diario oficial de Nicaragua" (2010 to 2014) available at http://www.lagaceta.gob.ni, supplemented with consultation of the National Public Registry of Water Rights. Unfortunately not all of the administrative resolutions contain information about the quantity of water granted in concession.

The vast majority of the concessions of irrigation water rights granted, namely 93 (80 percent) out of the 116 concessions granted to date for irrigation, have been granted to companies, rather than individual farmers. In most cases (83 of the 93 concessions) these companies have been represented by a lawyer during the application process. The sugarcane estates were the early movers with respect to presenting their application for water rights concessions when this became possible in late 2010 and early 2011. As shown in Figure 2, sugarcane estates accounted for 16 out of the 19 concessions of irrigation water rights granted in 2011. Although the sugarcane estates have now been accompanied by companies outside the sugarcane sector, so that today the sugarcane sector 'only' accounts for 55 percent of the concessions granted for irrigation, it still accounts for most of water for which irrigation use rights were granted. Virtually all of the water given in concession for irrigation by the end of 2011 was given for the irrigation of sugarcane and by mid-2015, 83 percent of the total volume of water for which irrigation water use rights had been conceded, had been conceded to sugarcane estates (Figure 3). In addition to a wish to comply with existing legislation, a strong incentive which allegedly has contributed to motivate the sugarcane estates to formalize existing or planned irrigation water use (Personal communication, National Water Authority officials, January 2014), has been the need to meet the requirement to document legal compliance, including with respect to water access, posed by financial institutions such as the International Finance Corporation (IFC, 2012) as well as increasingly also in the commodity markets, including the biofuel market (e.g. Ponte and Daugbjerg, 2015), for which an increasing share of the sugarcane is destined. This has repercussions for the standards gradually elaborated within the auspices of the UN Global Compact, i.e. the CEO Water Mandate,[12] the World Economic Forum,[13] etc. (e.g. Daniel and Sojamo, 2012, Mason, 2013). With sugarcane being a commodity in expansion from an annual production of 4.3 million tonnes in 2008 to 7.0 million tonnes in 2013 (FAOSTAT; http://faostat3.fao.org/), partly financed by the IFC,[14] and consuming large volumes of water, it has made the sugarcane sector particularly forthcoming with respect to soliciting the formalization of their water use and thus investing the resources necessary in terms of contracting the services of lawyers as well as of hydrologists to undertake the technical studies required to accompany the applications.

With respect to formalizing the water use right and providing water security for small-scale irrigation, limited progress has been made. Much of the impasse owes to the legal and administrative ambiguity with respect to the content and the conditions to be met to enable the National Water Authority to establish a cooperation agreement with a district authority or regional council necessary for them to authorize the right to use water for small-scale irrigation. Neither the water law, nor its regulation provides any guidance in this regard. Although recognizing the role which many district authorities previously have played in regulating the use of water resources in order to provide for the diverse needs of their citizens for domestic, productive and recreational purposes, National Water Authority staff also express certain reservations, both with respect to whether district authorities possess the necessary technical skills to authorize water use, and with respect to the administrative capacity of the National Water Authority to actually handle and honour cooperation agreements with Nicaragua's 153 district authorities and two regional councils. In 2013, the National Water Authority established a territorial delegation in Estelí, intended to cater for the five northern departments of Estelí, Matagalpa, Jinotega, Madríz and Nueva Segovia. The delegation counts on two technical staff members. In comparison, the environmental office of Estelí district which had previously dealt with water and irrigation issues usually counts on two to four staff members and a smaller district like Condega, still within the department of Estelí, would normally count on one staff member for environmental issues. The main task of the delegation is to receive and examine applications and serve as the liaison to the district authorities as well

[12] http://ceowatermandate.org/

[13] http://www.weforum.org/content/pages/world-economic-forum-water-initiative

[14] http://ifcextapps.ifc.org/ifcext/spiwebsite1.nsf/SearchView?SearchView&Query=(FIELD%20DocType%20=%20"Summary%20of%20Proposed%20Investment"%20OR%20FIELD%20DocType%20=%20"Summary%20of%20Project%20Information"%20OR%20FIELD%20DocType%20=%20"Environmental%20Documents"%20OR%20FIELD%20DocType%20=%20"Summary%20of%20Investment%20Information"%20OR%20FIELD%20DocType%20=%20"Early%20Disclosure"%20OR%20FIELD%20DocType%20=%20"Summary%20of%20InfraVentures%20Project")%20AND%20(FIELD%20Country%20=%20"Nicaragua")%20AND%20((NOT%20FIELD%20HideFromWeb%20=%20True))&SearchOrder=4&SearchMax=0&page=1&tc=1

as to other national agencies. Efforts have been made to develop cooperation agreements with district authorities. By June 2015, draft cooperation agreements, e.g. with Estelí district, had been developed. However, by the end of 2015, they had still not been signed and no authorizations of the right to use water in minor quantities for irrigation had therefore been issued. Thus, what may have been envisaged as a legal option to provide equal opportunities for formalizing water use rights for irrigation, irrespective of the scale of water use, namely the district authorizations, so far has turned out rather as an administrative 'cul-de-sac.'

5. IMPLICATIONS FOR TERRITORIAL INEQUALITY

The partial – if not selective – implementation of the new water rights regime for irrigation in Nicaragua risks amplifying the already profound inter- as well as intra-territorial inequalities in a number of ways.

First of all, it adds a new dimension to the existing range of dimensions of inequalities, namely that of legal water (in)security. As speculated by Woodhouse (2012), even if implemented in full, introducing two types of irrigation water use rights, backed by two different institutions may entail the risk that one type of right, in this case concessions which are backed by an institution whose director has rank of minister, takes precedence over the other, in this case a district authorization, in case of competition for water. Yet, in the actual context, this remains hypothetical, all the while that the first district-level water use authorization is yet to be issued, let alone inscribed in the National Public Registry of Water Rights. However, should that moment and situation arise where holders of district-authorized water use rights have their rights overridden by concession holders on a systematic basis, the result will be a structural increase in territorial inequality with respect to not only legal but physical water insecurity, and thus in wider economic terms due to the loss of the economic opportunities which (formally sanctioned) irrigation provides, precisely because of the structural and significant territorial dimension that characterize irrigation in Nicaragua.

In the actual context, however, produced by the partial implementation of the new water rights regime for irrigation, the majority of irrigation water users, and with them a significant part of the country, are effectively prevented from formalizing their right to use water for irrigation. This not only implies legal water insecurity which may, at least in the longer run, hamper investments; it also increasingly prevent them from participating in markets – capital as well as product markets – which require the presentation of formally sanctioned water rights. This may increasingly emerge as an issue e.g. in certified coffee production and also in tobacco production for high quality cigars.

In the meantime, a small segment of first – and fast – movers have obtained water rights concessions for significant quantities of water, so far without having to pay the envisaged but not yet implemented water tariffs. Combined, the 116 concessions of irrigation water rights issued by mid-2015 that constitute less than 10 percent of the farms which according the 2010 water law regulation would be required to formalize their irrigation water use through a concession and only one percent of all farms with irrigation in Nicaragua, have obtained the right to use close to one third of the total amount of water which FAO estimates is used annually for irrigation in Nicaragua. This obviously places the new concession holders in an advantaged position. The concession holders overwhelmingly belong to a particular segment of the agricultural sector, namely agro-industrial companies primarily engaged in the sugarcane industry, and they tend to be located in a particular part of the country (Map 5) and, within territories, in a particular part of the terrain, namely in the relatively flat parts. Therefore, the partial implementation of the water rights regime for irrigation whereby the option to acquire private rights to use part of what is regarded as 'national patrimony' for periods of up to 30 years is provided only for some, but not for all, will almost inevitably contribute to not only cement but also amplify existing inequalities between as well as within territories as competition for water intensifies. Already today, the construction and expansion of up-stream reservoirs and dams in a district like Chichigalpa with a view to supplement the groundwater-based irrigation of sugarcane in the lower-lying sugar estates, limits the free water flow of the streams running towards the Pacific ocean and thus limits the irrigation opportunities for the small-scale farmers

who remain in the vicinity of the large estates. Without immediate and substantial efforts to re-balance the implementation of the new water rights regime for irrigation and without effectively establishing legal parity between the National Water Authority-issued concessions and the district-issued authorizations, the result of Nicaragua's irrigation water rights regime will be the creation of territories of *de-jure* as well as *de-facto* water insecurity and thereby a further deepening of territorial inequalities.

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