



LUND UNIVERSITY

Integrating climate change adaptation, disaster risk reduction and urban planning: A review of Nicaraguan policies and regulations

Rivera, Claudia; Wamsler, Christine

Published in:
International Journal of Disaster Risk Reduction

DOI:
[10.1016/j.ijdr.2013.12.008](https://doi.org/10.1016/j.ijdr.2013.12.008)

2014

[Link to publication](#)

Citation for published version (APA):
Rivera, C., & Wamsler, C. (2014). Integrating climate change adaptation, disaster risk reduction and urban planning: A review of Nicaraguan policies and regulations. *International Journal of Disaster Risk Reduction*, 7, 78-90. <https://doi.org/10.1016/j.ijdr.2013.12.008>

Total number of authors:
2

General rights

Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

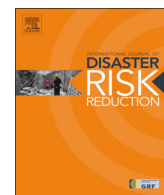
Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00



Integrating climate change adaptation, disaster risk reduction and urban planning: A review of Nicaraguan policies and regulations



Claudia Rivera^{a,*}, Christine Wamsler^b

^a Lund University Centre for Risk Assessment and Management (LUCRAM), PO Box 118, SE-221 00 Lund, Sweden and Institute of Geology and Geophysics, National Autonomous University of Nicaragua (IGG-CIGEO/UNAN-Managua), PO A-131 Managua, Nicaragua

^b Lund University Centre for Sustainability Studies (LUCSUS), PO Box 170, SE-221 00 Lund, Sweden

ARTICLE INFO

Article history:

Received 11 June 2013

Received in revised form

12 December 2013

Accepted 18 December 2013

Available online 28 December 2013

Keywords:

Disaster risk reduction

Climate change adaptation

Climate change

Policies

Regulatory frameworks

Urban planning

Mainstreaming

Nicaragua

ABSTRACT

The integration of risk reduction and climate change adaptation has become an urgent task in addressing increasing urban risk more effectively and efficiently. This paper analyses the extent to which climate change adaptation is integrated into the policies and regulatory frameworks that guide urban risk reduction in Nicaragua, and discusses related progress. The results reveal significant progress in integrating climate change adaptation into the policy and regulatory frameworks of the three relatively new fields of (a) disaster risk reduction, (b) environmental management and (c) urban planning. They show that differences in the degree of integration relate to the development and updates to policy instruments in each field, and the extent to which they are related to the implementation of international climate change agreements. Although initially climate change adaptation integration was focused on the protection of natural resources in general, and food production in particular, since 2008 authorities have shown increasing interest in a more comprehensive and integrated approach. Nevertheless, the integration of climate change adaptation into disaster risk reduction and urban planning still lags behind the advances made in the environmental management field. It is concluded that in order to achieve greater and more coherent integration of CCA and, ultimately, improve the way climate-related risks is dealt with, urban authorities need to systematically review current policies and regulations to assess the synergies and gaps. This requires inter-sectoral and participative work with the actors concerned at national and local level, as well as the establishment of related monitoring and learning mechanisms.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Climate change (CC) contributes to more frequent and more severe disasters [1]. During the last three decades,

two-thirds of the world's disasters have been caused by climate-related phenomena [2–4]. So-called developing countries are most affected by climate-related events, with Nicaragua being classified as one of the most affected countries in the last two decades [5].

Given that climate change adaptation (CCA) and disaster risk reduction (DRR) both aim to reduce the impacts of climate-related disasters and associated risks [6,7], the need to integrate them in a coherent way is receiving increasing attention from international communities and academics in both fields (e.g. [7–14]).

Abbreviations: DRR, disaster risk reduction; CCA, climate change adaptation; CC, climate change; UP, urban planning

* Corresponding author. Tel.: +46 764 089 050/+50 583 232 339;

fax: +46 462 224 612.

E-mail addresses: claudia.rivera@brand.lth.se, clauriverae@gmail.com (C. Rivera).

In the field of DRR, the World Conference on Disaster Reduction (WCDR) held in 2005 in Kobe, Japan [9] sparked discussions about the importance of integration. As a result, CC considerations were incorporated into the risk reduction strategies of the Hyogo Framework for Action 2005–2015 [15]. In the field of CC, related discussions slowly emerged in 2009 in the context of the United Nations Framework Convention on Climate Change in Copenhagen. It is only recently that the Intergovernmental Panel on Climate Change (IPCC) published a report, which tries to address and link both fields: the special report “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (IPCC-SREX)” [7]. It is now one of the most relevant documents for both disaster risk reduction and climate change adaptation [13].

The increased attention given to the integration of CCA and DRR also relates to the urgency of addressing growing urban risk. There is widespread consensus that urban disasters are increasing exponentially, resulting in escalating human and economic losses [6,16]. In urban settings, hazard impacts are intensified by high levels of vulnerability [17]. There is substantial population growth in risky areas, particularly through unplanned urban development. With an influx of poor and marginalized groups in cities, the proportion of the at-risk population increases [18]. This situation, where cities expand without adequate attention being given to the links between urban planning (UP) and risk increases the potential for disaster [19]. Hence, UP processes, both planned and unplanned, can intensify existing vulnerabilities if DRR and CCA are not fully integrated [20].

The importance of the integration of the three fields of CCA, DRR and UP at policy level was outlined in the latest review of the implementation of the Hyogo Framework for Action 2005–2015 [21]. For instance, the first core indicator of Priority Four that measures progress and challenges in “reducing the underlying risk factors” states:

Disaster risk reduction is an integral objective of environment-related policies and plans, including for land use planning, resource management and adaptation to climate change [21] (p. 29).

This indicator calls for a better integration of DRR, CCA and UP policies and regulatory frameworks, in order to achieve the goals established by the Hyogo Framework for Action 2005–2015.

Against this background, this paper analyses whether, and if so, to what extent CCA is integrated into current policy and regulatory frameworks for DRR and UP. The research question is: *“How is climate change adaptation integrated into current policies and the regulatory framework that promote urban risk reduction planning in Nicaragua?”* Nicaragua was selected as the focus for the case study as, since 1885, the country has experienced frequent damage and serious losses due to hazards such as earthquakes and floods [22]. Nicaragua is also an interesting case because of recent significant advances in adaptive capacity at institutional level. Following Central America’s most recent large-scale disaster, namely Hurricane Mitch in 1998, the government has actively encouraged DRR efforts, which have been

supported by a range of international aid organizations [23,24]. As a result, the national framework for DRR has made significant progress and is considered to be one of the best in the region [25]. It therefore provides a good basis for a study of the integration of CCA, DRR and UP, which can provide valuable insights for other countries.

The remainder of this article is divided into four parts: methodology (Section 2); the results of the analyses of policies and regulatory frameworks (Section 3); a discussion of advances in climate change integration into urban risk reduction at policy level (Section 4); and finally the conclusions (Section 5).

2. Methodology

Our work is based on a case study of Nicaraguan policies and regulatory frameworks and a content analysis. Case studies are a useful way to explore new processes and their outcomes [26]. They provide reliable information, which can be used to generalize a phenomenon [27]. Our data was mainly drawn from existing policies and regulatory frameworks concerning DRR, UP and environmental management, and our aim was to explore the extent to which CCA is integrated into them, and, if so, how. Content analysis was selected as the method for the analysis as it leads to valid inferences and makes it possible to highlight aspects related to CCA integration in the documents examined [28]. It enabled a systematic exploration of policies and regulatory frameworks by identifying sections of text that were related to aspects of CCA.

This examination of Nicaraguan policies and regulatory frameworks is based on the following definitions: Climate change adaptation (CCA) is understood as the process and related actions that aim to reduce the vulnerability of systems (e.g. cities) to the adverse impacts of anticipated climate change [29]. Climate change (CC) refers here to any change in climate over time, whether due to natural variability or as a result of human activity [1]. The concept of disaster risk reduction (DRR) is broader. It can be seen as a conceptual and operational approach that aims to reduce risk through systematic efforts to analyse and manage the causal factors of both climate and non-climate related disasters. This includes measures to reduce hazard exposure and vulnerability as well as to improve response and recovery preparedness [30]. Regarding the term urban planning (UP), it is seen both as a discipline and a practical way to shape and modify urban settlements and space [31]. Furthermore, integration is understood here as part of a mainstreaming process, where mainstreaming involves modifications to specific, core operations in order to incorporate and indirectly act upon new aspects or topics [6,32]. In the context of this study, UP and DRR are the core operations, and CCA is the new aspect to be incorporated.

The documentation reviewed in this study consists of those policies and regulations that provide guidance to practitioners in the field. Policies are understood as rules or principles that a group or organization uses to guide its decisions and actions [33]. Regulations are rules or directives drawn up and maintained by an authority [34]. Documents were selected using various Internet search engines.

As regards CC and CCA, three key documents were identified to guide the selection of relevant national policies and regulations:

- “Mapping of Risks, Processes, Public Policies and Actors Related to Climate Change in Nicaragua” [35];
- “Policies, Programs and Case Study about Climate Change in Nicaragua” [36]; and
- “Nicaragua Toward Climate Change” [37].

These documents were compared and a preliminary list of policies and regulations was established using the snowball method [38].

An initial finding was that CC and CCA are generally included in national environmental frameworks. Consequently, the focus of the study was broadened to include an analysis of the integration of CCA into Nicaraguan policies and regulations related to (a) environment, (b) DRR, and (c) UP.

Next, the websites of government institutions responsible for environmental issues, DRR and UP were assessed. This included the website of the National Assembly of Nicaragua, which provides a comprehensive list of the policies and regulatory frameworks approved by the government. The material gathered from this website and legal texts related to the fields of DRR, UP and environment were part of this review.

In addition, the website of the municipality of Managua was examined for material related to the regulation of UP. Managua is the capital of Nicaragua and has the highest number of UP regulations. Many legal instruments were proposed in 1982, following the earthquake in 1972 [39]. Certain aspects of these texts were later updated [40]. For example, the 1982 regulatory plan for Managua was updated by partial plans approved between 1998 and 2001 [40], which were also added to the review. However, the validity and usefulness of these texts was very limited as this study only included UP policies and regulations dating from 1995 or later. This is because in 1992, Nicaragua signed the United Nations Framework Convention on Climate Change (UNFCCC), and in 1995 the National Assembly approved the agreements reached under the UNFCCC with the Decree 50–95: “Ratification of the United Nations Framework Convention on Climate Change” [41]. Consequently, only documents created after this time are likely to contain specific information about CC and CCA.

As a result of this process, a total of 36 relevant documents were identified. They were classified into three groups: environment, DRR and UP. Each document was categorized according to the issuing body and the content of the regulation. Nineteen of the identified policies and regulatory frameworks related to the environment, while four related to DRR. Although there is no national DRR policy, several instruments have been put forward (e.g. national preparedness and response plans, and disaster risk management plans). Most of these proposals are based on the four documents selected for this study. Finally, 13 of the identified policy and regulatory instruments related to UP.

Each category was divided into three sub-categories: legislation, policies and other relevant documents. The

“legislation” sub-category consisted of non-policy documents, such as laws and decrees approved by the National Assembly. Although policies could be added to this group (as they are created in the same way), they were included in a separate sub-category. This provides a better overview of policy compared to other regulatory material. The “other relevant documents” sub-category consisted of other official documents, drawn up and published by public institutions.

In the field of environment, six policies, nine legislative instruments, and four other documents were analysed (Table 1). Most of these documents were published in 1996, following the restructuring of the Ministry of Environment and Natural Resources (MARENA),¹ which is responsible for environmental issues. National communications on CC and plans and strategies proposed by the government were included in the sub-category “other relevant documents”. The analysis of DRR documents included the “National policy for social protection”, a legislative instrument, and two national plans, one for response and the other for disaster risk management (Table 1). The selection of UP documents included a land use planning policy and five legislative instruments (Table 1). Other relevant documents included seven strategy plans and several norms aimed at both national and local (Managua) level.

A content analysis examined the content of the selected policies and regulatory frameworks. Texts were reviewed using keywords (codes). These codes were used to identify sections of text that provided information about the relation of each field to the others, the nature of the connection between them, and synergies. CCA codes were “climate” (clima/climático), “change” (cambio), and “adaptation” (adaptación). UP codes were “urban” (urbano), “planning” (planificación), “land use” (uso de suelo), “land use planning” (ordenamiento territorial) and “cities” (ciudades). DRR codes were: “disaster” (desastre), “risk” (riesgo), “reduction” (reducción), “management” (gestión), “mitigation” (mitigación), “prevention” (prevención), and “vulnerability” (vulnerabilidad).

When a code was found in a document, the section containing the code was classified according to one of the six categories given below:

- (A1) CCA: Extract includes CCA codes.
- (A2) DRR: Extract includes DRR codes.
- (A3) UP: Extract includes UP codes.
- (A4) CCA–DRR: Extract includes codes that show links between CCA and DRR.
- (A5) CCA–UP: Extract includes codes that show links between CCA and UP.
- (A6) DRR–UP: Extract includes codes that show links between DRR and UP.

Next, the results of the content analysis for each classification (environment, DRR and UP) were tabulated. For the review of environmental policies, the six categories listed above were used. For the review of DRR policies and instruments, it was logical to exclude category A2, while category A3 was excluded in the review of the UP material.

¹ Ministerio de Medioambiente y Recursos Naturales (MARENA).

Table 1

List of selected documents.

Environment**Policies**

1. Environmental Policy and Plan of Nicaragua 2001–2005 [42]^a
2. Decree No. 25-2001. Establishment of the Environmental Policy and the Approval of the Environmental Plan of Nicaragua [43]^b
3. Decree No.107-2001. National Policy of Water Resources [44]^c
4. Decree No. 70-2006. General Framework for Land Policies [45]^d
5. Decree No. 22-2006. National Policy of Cleaner Production [46]^e
6. Decree No. 69-2008. National Policy for the Sustainable Development of the Forestry Sector of Nicaragua [47]^f

Legislation

7. Decree-Law No. 17-90. Executive Decree for the Creation of the National Commission of Environment and Land Use Planning [48]^g
8. Law No. 217. General Environment and Natural Resources Law [49]^h
9. Decree No. 9-96. Regulation for the General Environment and Natural Resources Law [50]ⁱ
10. Ministerial Resolution No. 014-99. Creation of the Commission for Climate Change [51]^j
11. Decree No. 21-2002. Creation of the National Office of Cleaner Development [52]^k
12. Ministerial Resolution No. 27-2002. National Strategy of Biodiversity and its Action Plan [53]^l
13. Law No. 559. Special Law of Crimes Against the Environment and the Natural Resources [54]^m
14. Law No. 647. Reforms and Additions to the Law No. 217 “General Environment and Natural Resources Law” [55]ⁿ
15. Resolution of the National Assembly No. 003-2009. About Climate Change and its Adaptability in Nicaragua [56]^o

Other relevant documents

16. First National Communication on Climate Change [57]^p
17. National Action Plan for Climate Change [58]^q
18. National Environmental Strategy and Climate Change. Action Plan 2010–2015 [59]^r
19. Second National Communication on Climate Change [60]^s

Disaster risk reduction**Policies**

20. National Policy for Social Protection [61]^t

Legislation

21. Law No. 337. The creation of the National System for Disaster Management and Prevention and its Normative [62]^u

Other relevant documents

22. National Disaster Management Plan [63]^v
23. National Disaster Response Plan [64]^w

Urban planning**Policies**

24. Decree No. 90-2001. General Policy for Land Use Planning [65]^x

Legislation

25. Decree No. 28-95. Creation of the National Commission for Housing and Human Settlements [66]^y
26. Law No. 309. Regulations, Land Use and Entitlement for Spontaneous Human Settlements [67]^z
27. Decree No. 78-2002. Standards, Guidelines and Criteria for Land Use Planning [68]^{ab}
28. Municipal Ordinance No. 01-2007 Modifications and Amendments to the Regulations of Urban Development for the Municipality of Managua [69]^{ac}
29. Law 792. Law of Reforms to the Law No. 40 “Law of Municipalities” [70]^{ad}

Other relevant documents

30. Proposal of the General Law for Land Use Planning and Territorial Development of the Republic of Nicaragua [71]^{ae}
31. Regulations for the Central Area of Managua [72]^{af}
32. General Plan for Municipal Development [73]^{ag}
33. Minimum Standards for the Dimensioning of Housing Projects [74]^{ah}
34. Partial Plans of Urban Planning of Managua North-Central, South-West and East [75]^{ai}
35. National Construction Code [76]^{aj}
36. National Plan for Human Development 2012–2016 [77]^{ak}

^a Política y Plan Ambiental de Nicaragua 2001–2005.^b Decreto No.25-2001. Establece la Política Ambiental y Aprueba el Plan Ambiental de Nicaragua 2001–2005.^c Decreto No.107-2001. Establece la Política Nacional de los Recursos Hídricos.^d Decreto No.70-2006. Marco General de las Políticas de Tierras.^e Decreto No. 22-2006. Política Nacional de Producción más Limpia.^f Decreto No. 69-2008. Política Nacional de Desarrollo Sostenible del Sector Forestal de Nicaragua.^g Decreto-Ley No. 17-90. Decreto Ejecutivo Creador de la Comisión Nacional del Ambiente y Ordenamiento Territorial.^h Ley No. 217. Ley General del Medio Ambiente y los Recursos Naturales.ⁱ Decreto 9-96. Reglamento de la Ley General del Medio Ambiente y los Recursos Naturales.^j Resolución Ministerial No. 014-99. Creación de la Comisión de Cambios Climáticos.^k Decreto No. 21-2002. De Creación de la Oficina Nacional de Desarrollo Limpio.^l Resolución Ministerial No. 27-2002. Estrategia Nacional de Biodiversidad y su Plan de Acción.^m Ley No. 559. Ley Especial de Delitos Contra el Medio Ambiente y los Recursos Naturales.ⁿ Ley No. 647. Ley de Reformas y Adiciones a la Ley No. 217, “Ley General del Medio Ambiente y los Recursos Naturales”.^o Resolución No. 003-2009. Sobre el Cambio Climático y su Adaptabilidad en Nicaragua.^p Primera Comunicación Nacional sobre Cambio Climático.^q Plan de Acción Nacional Ante el Cambio Climático.^r Estrategia Nacional Ambiental y del Cambio Climático, Plan de Acción 2010–2015.^s Segunda Comunicación Nacional sobre Cambio Climático.

^t Política Nacional de Protección Social.

^u Ley 337. Ley Creadora del Sistema Nacional para la Prevención, Mitigación y Atención de Desastres, sus Reglamentos y Normas Complementarias.

^v Plan Nacional de Gestión del Riesgo.

^w Plan Nacional de Respuesta del SINAPRED.

^x Decreto No. 90-2001. Decreto que Establece la Política General para el Ordenamiento Territorial.

^y Decreto No. 28-95. Creación de la Comisión Nacional de Vivienda y Asentamientos.

^z Ley No. 309. Ley de Regulación, Ordenamiento y Titulación de Sentamientos Humanos Espontáneos.

^{ab} Decreto No. 78-2002. De Normas, Pautas y Criterios para el Ordenamiento Territorial.

^{ac} Ordenanza Municipal No. 01-2007. Modificaciones y Adiciones a las Regulaciones de Desarrollo Urbano del Municipio de Managua.

^{ad} Ley No. 792. Ley de Reformas a la Ley No. 40, "Ley de Municipios".

^{ae} Proyecto de Ley General de Ordenamiento y Desarrollo Territorial de la República de Nicaragua.

^{af} Reglamento del Área Central De Managua.

^{ag} Plan General de Desarrollo Municipal.

^{ah} Normas Mínimas de Dimensionamiento de Desarrollos Habitacionales.

^{ai} Síntesis de los Planes Parciales de Ordenamiento Urbano (Sectores Nor-Central, Sur-Occidental y Oriental).

^{aj} Reglamento Nacional de la Construcción.

^{ak} Plan Nacional de Desarrollo Humano 2012–2016.

Finally, the historical development of the regulatory framework for each classification was examined, as this provides relevant background in understanding how integration between the fields has developed.

3. Results

The following [Sections \(3.1–3.3\)](#) describe the results of the analysis of the integration of CCA into the 36 selected policies and regulatory frameworks from the fields of environment, DRR and UP.

3.1. Review of the integration of CCA into environmental policies and regulatory frameworks

In 1991, Nicaraguan authorities became interested in the creation of environmental strategies in order to contribute to sustainable development [58]. Five years later, in 1996 the entity that was in charge of environmental issues, the "Institute of Natural Resources" (IRENA),² was upgraded to a Ministry, named MARENA. Since then, the new Ministry has gone through a major restructuring process. In 1996, Law No. 217 entitled the "General Law of environment and natural resources" was adopted. This legislative instrument was a major achievement, and the starting point for the creation of policies and instruments for the sustainable management and protection of the environment [58].

By 1992, the Nicaraguan government had accepted the principles and the institutional framework proposed in the UNFCCC and Nicaragua acceded to the Kyoto protocol in 1999. At regional level, in 2008 Nicaragua made a commitment to implement the "Regional Strategy for Climate Change" approved at the Summit on Climate Change and the Environment for Central America and the Caribbean. As a result of these international commitments, MARENA proposed actions to address CC, which were initially focused on CC mitigation and adaptation measures related to ecosystem protection and food production.

3.1.1. Environment: Policies

From the overall list of environmental policies, six documents were identified as relevant ([Tables 1 and 2](#)). A review of these policies found little information about CC and CCA. There was only one text that addressed all categories (A1–A6). This is the "Decree No. 69-2008: National Policy for the Sustainable Development of the Forestry Sector of Nicaragua". The text promotes the adaptation of land use for vulnerability reduction through, for instance, the restoration of ecosystems, reforestation and the avoidance of deforestation. Because category A1 (CCA) was only mentioned in the above text extract, categories A4 (CCA–DRR) and A5 (CCA–UP) could not be identified in the rest of the documents.

Codes from categories A2 (DRR) and A3 (UP) were more common ([Table 2](#)). Twenty-nine references were made in environmental policies to category A2 (DRR) codes and 44 included category A3 (UP) codes. The combined category A6 (DRR–UP) was referenced in six sections of text. There were two policies in particular that included most of the references in this category. They are the "Environmental Policy and Plan of Nicaragua 2001–2005" and the "General Framework for Land Policies" ([Table 2](#)). These two documents focus on environmental protection through land use planning and vulnerabilities associated with the degradation of natural resources and productivity. Additionally, both documents highlight links with DRR. For example, the first expresses the importance of monitoring and forecasting disaster risk in order to reduce the negative effect of disasters on the environment.

3.1.2. Environment: Legislation

Three of the nine selected documents in the "legislation" sub-category address CC ([Table 2](#)). These documents are:

- "The Ministerial Resolution for the Creation of the Commission for Climate Change" [51]
- "The Decree for the Creation of the National Office of Cleaner Development" [52]
- "The Resolution of the National Assembly: About Climate Change and its Adaptability in Nicaragua" [56].

The first document listed above established a National Commission for Climate Change. It only includes two

² Instituto de Recursos Naturales (IRENA).

Table 2Classification of references to CCA, DRR and UP codes in current environmental policies and regulatory frameworks^a.

Environment		(A1) CCA	(A2) DRR	(A3) UP	(A4) CCA-DRR	(A5) CCA-UP	(A6) DRR-UP
Year	Policies						
2000	Environmental Policy and Plan of Nicaragua 2001–2005	0	4	7	0	0	2
2001	Decree No. 25–2001. Establishment of the Environmental Policy and the Approval of the Environmental Plan of Nicaragua	0	4	8	0	0	1
2001	Decree No.107–2001. National Policy of Water Resources	0	2	0	0	0	0
2006	Decree No. 70–2006. General Framework for Land Policies	0	17	25	0	0	2
2006	Decree No. 22–2006. National policy of Cleaner Production	0	0	0	0	0	0
2008	Decree No. 69–2008. National Policy for the Sustainable Development of the Forestry Sector of Nicaragua	1	2	4	1	1	1
	Legislation						
1990	Decree-Law No. 17–90. Executive Decree of the Creation of the National Commission of Environment and Land Use Planning	0	0	5	0	0	0
1996	Law No. 217. General Environment and Natural Resources Law	0	7	2	0	0	0
1996	Decree No. 9–96. Regulation of the General Environment and Natural Resources Law	0	0	1	0	0	0
1999	Ministerial Resolution No. 014–99. Creation of the Commission for Climate Change	2	0	0	0	0	0
2002	Decree No. 21–2002. Creation of the National Office of Cleaner Development	0	0	0	0	0	0
2002	Ministerial Resolution No. 27–2002. National Strategy of Biodiversity and its Action Plan	0	2	0	0	0	0
2005	Law No. 559. Special Law of Crimes Against the Environment and the Natural Resources	0	1	1	0	0	1
2008	Law No. 647. Reforms and Additions to the Law No. 217 “General Environment and Natural Resources Law	7	3	0	1	0	0
2009	Resolution of the National Assembly No. 003–2009. About Climate Change and its Adaptability in Nicaragua	6	4	0	2	0	0
	Other relevant documents						
2001	First National Communication on Climate Change	15	3	6	0	1	0
2003	National Action Plan for Climate Change	11	6	3	1	0	0
2010	National Environmental Strategy and Climate Change. Action Plan 2010–2015	6	6	3	4	1	2
2009	Second National Communication on Climate Change	14	9	2	5	0	0

^a The values 0 to X, are the number of document sections containing codes of each field, which are classified according to the following categories: (A1) CCA: Extract includes CCA codes; (A2) DRR: Extract includes DRR codes; (A3) UP: Extract includes UP codes; (A4) CCA-DRR: Extract includes codes that show links between CCA and DRR; (A5) CCA-UP: Extract includes codes that show links between CCA and UP; (A6) DRR-UP: Extract includes codes that show links between DRR and UP.

references to code A1 (CC), which describe the Commission's responsibility for coordinating actions related to CC. This responsibility includes the promotion of participatory approaches to the identification and implementation of CCA measures. The “Decree for the Creation of the National Office of Cleaner Development” allocates institutional responsibilities for follow-up on national commitments made under the UNFCCC agreement and the Kyoto protocol in all sectors. However, this document does not include any codes. The “Resolution of the National Assembly” refers to three categories: A1 (CCA), A2 (DRR) and A4 (CAA-DRR). It emphasizes the importance of CCA due to by the predicted negative effects of CC on human systems in Nicaragua.

The “General Environment and Natural Resources Law” was modified and published as the “Law of Reforms and Additions to the Law No. 217 General Environment and Natural Resources Law”. This document includes seven A1 (CCA) codes, but only one A4 (CAA-DRR) code. The same document also contains the definition of CCA proposed by the Intergovernmental Panel on Climate Change (IPCC). This document also shows the importance of incorporating

both CC mitigation and adaptation into the planning frameworks of all (urban) sectors:

Article No. 60. The executive branch of the state must formulate and drive an adaptation policy for climate change, in order to incorporate adaptation and mitigation into sectoral planning (...) ³ [55]

3.1.3. Environment: Other relevant documents

The four documents in the sub-category “other relevant documents” related to environment (Table 2) refer to all six category codes, and include 46 references to code A1 (CCA). The “First Communication on Climate Change” includes one A5 (CCA-UP) code, and the “Second National Communications on Climate Change make five references to A4 (CCA-DRR) codes. The “National Action Plan for Climate Change” suggests CCA measures for the forestry, farming, energy and water resource sectors. Furthermore,

³ “(...) Artículo. 60. El Poder Ejecutivo deberá formular e impulsar una Política de Adaptación al Cambio Climático, a fin de incorporar la adaptación y mitigación en los planes sectoriales (...)”.

in this document CCA is considered in relation to both environmental and more general societal issues:

(...) adaptation measures are aimed at fulfilling two objectives: to reduce damage and increase the flexibility of societies and ecosystems to unavoidable climate change impacts. In this sense, they usually target the most vulnerable sectors (...) ⁴ [58]

The “National Environmental Strategy and Climate Change, Action Plan 2010–2015” [59] contains references to all six categories (Table 2). Compared to the other documents in this section it has the largest number of references to categories A4 (CAA–DRR) and A6 (DRR–UP). This document clearly links CCA with DRR, and includes aspects of UP. DRR and CCA are understood as two fields that need to be integrated for the protection of human life. Furthermore, the document shows the need to build capacities and access resources that support integrated actions for DRR, mitigation and adaptation:

(...)The government has made an effort to build capacity and obtain resources in order to ensure that our population has the capacity to adapt, mitigate and reduce risks in the face of climate change and its negative effects (...) ⁵ [59]

Most of the environmental policies and legislation that were reviewed focus on the vulnerability of natural resources and the commitments made under international agreements to mitigating CC. Nevertheless, the analysis of other documents highlighted that authorities are expected to integrate CC and CCA issues into all sectoral planning frameworks. In fact, these documents contain the majority of references to the combined categories A4 (CCA–DRR), A5 (CCA–UP), and A6 (DRR–UP).

3.2. Review of the integration of CCA into DRR policies and regulatory frameworks

The negative consequences of the many natural hazards that have affected Central America in the past decade have led to the promotion of DRR both regionally and nationally. A direct outcome was the strengthening of the “Central American Coordinating Centre for Natural Disaster Prevention” (CEPREDENAC) ⁶ from 1993 to 1998, which coordinates DRR at regional level. In Nicaragua, the “National System for Disaster Management and Prevention” (SINAPRED) ⁷ coordinates similar work.

SINAPRED was created in 2000 by Law 337 “The Creation of the National System for Disaster Management and Prevention”. It remains the most important DRR instrument.

Other relevant documents are “The National Plan for Disaster Management” and “The National Response Plan”. Many other documents have been proposed by the government in collaboration with other institutions, mostly based upon Law 337.

3.2.1. DRR: Policies

There are no DRR policy documents as such. Although SINAPRED's Executive Secretariat announced on its website plans to develop a DRR policy; since then, nothing has been published. Therefore the analysis focused on the “National Policy for Social Protection”, which aims to protect the country's social values.

Category A1 (CCA) codes were not found in any of the DRR documents (Tables 1 and 3). In addition, the “National Policy for Social Protection” contains very little information about UP and DRR. It focuses on addressing poverty and, in this context, includes category A6 (DRR–UP) codes. It outlines the impact of disasters on the urban poor and how this relates to low-quality housing.

3.2.2. DRR: Legislation and other relevant documents

Law 337 “The Creation of the National System for Disaster Management and Prevention and its Normative”, the “National Disaster Management Plan” and the “National Disaster Response Plan” include category A6 (DRR–UP) codes. They highlight the importance of land use planning to reduce disasters:

(...) Article 7. Functions of the National System: (...) No. 5. Anticipate possible damage to the population, physical infrastructure, and environment through a permanent and sustainable process of vulnerability reduction. This must be an essential part of the national development planning through implementation of guidelines and regulation of land use planning (...) ⁸ [62]

Although this analysis is focused on policies and regulatory instruments at national level, it is important to include relevant instruments at regional level. Nicaragua, like other Central American countries, recognizes the strategic framework for DRR proposed by the Central American Integration System (SICA), ⁹ coordinated by CEPREDENAC. Related guidelines and commitments are included and coordinated by the “Central American Policy on Comprehensive Disaster Risk Management”, which was approved in 2010 [78]. CCA is an integral part of this framework, which aims to strengthen the region's adaptive capacity. In this context, the “Regional Strategy for Climate Change” [79] was proposed. This strategy document reflects the increasing interest of regional authorities in harmonizing current DRR and CC frameworks in Central America.

⁴ “(...) las medidas de adaptación persiguen dos propósitos: reducir los daños y aumentar la flexibilidad de las sociedades y ecosistemas a los aspectos inevitables impactos del cambio climático. En este sentido suelen estar orientadas hacia los sectores más vulnerables (...)”.

⁵ “(...) (el gobierno) ha venido implementando sus propios esfuerzos de gestión, creación de capacidades y consecución de recursos para procurar a nuestra población la capacidad de adaptación, mitigación y reducción de riesgo ante el cambio climático y sus efectos negativo (...)”.

⁶ Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (CEPREDENAC).

⁷ Sistema Nacional Para la Prevención, Mitigación y Atención de Desastres (SINAPRED).

⁸ “(...) Art. 7: Funciones del Sistema Nacional: (...) No. 5. Prevé los posibles daños a la población, infraestructura física y el medio ambiente en general, mediante un proceso permanente y sostenido de reducción de la vulnerabilidad, como parte esencial de la planificación del desarrollo nacional, mediante la aplicación de las directrices y regulaciones del ordenamiento territorial (...)”.

⁹ Sistema de Integración Centroamericana (SICA).

Table 3Classification of references to CCA and UP codes in DRR policies and regulatory frameworks for DRR^a.

DRR		(A1) CCA	(A3) UP	(A4) CCA-DRR	(A5) CCA-UP	(A6) DRR-UP
Year	Policies					
2003	National Policy for Social Protection	0	1	0	0	1
	Legislation					
2000	Law No. 337. The Creation of the National System for Disaster Management and Prevention and its Normative	0	4	0	0	4
	Other relevant documents					
2004	National Disaster Management Plan	0	13	0	0	6
2008	National Disaster Response Plan	0	4	0	0	3

^a The values 0 to X, are the number of document sections containing codes of each field, which are classified according to the following categories: (A1) CCA: Extract includes CCA codes; (A2) DRR: Extract includes DRR codes; (A3) UP: Extract includes UP codes; (A4) CCA-DRR: Extract includes codes that show links between CCA and DRR; (A5) CCA-UP: Extract includes codes that show links between CCA and UP; (A6) DRR-UP: Extract includes codes that show links between DRR and UP.

(...) The council of Ministers of the 'The Central American Commission of Environment and Development' (CCAD), in coordination with the board of representatives of CEPREDENAC, will issue measures for aligning the policies, strategies, and strategic plans for both risk reduction and environmental management, within their different components and joint instruments. This refers mainly to components and instruments related to climate change adaptation, the management of the cultural heritage, and more specifically to the prevention of forest fires and the comprehensive management of water resources (...) ¹⁰ [78]

3.3. Review of the integration of CCA into UP policies and regulatory frameworks

UP regulations in Nicaragua are very limited [25]. Following the 1982 earthquake in Managua, some important UP instruments were proposed. Nonetheless, few were successfully implemented because of the political situation at the time and their failure to address the national context [39]. Thus, the local authorities of Managua and other major cities still lack planning instruments for the regulation of urban development. The documents related to UP used in the analysis are shown in Tables 1 and 4.

3.3.1. UP: Policies

Neither the "General Policy for Land Use Planning", nor ten of the other 13 documents in the UP section refer to category A1 (CC) codes. However, the "General Policy for Land Use Planning" does include seven references to both category A2 (DRR) and A6 (DRR-UP) codes (Table 4). This document highlights the importance of linking DRR and UP for achieving sustainable development by considering hazards and the vulnerabilities of natural resources and

human settlements in land use planning. The following quotation from this policy shows that the general objective of this document directly relates to DRR.

Article 1. The establishment of the policy of land use planning has the objective to guide the use of the land in a sustainable way. Including natural resources and the prevention and mitigation of natural disasters (...) ¹¹ [65]

3.3.2. UP: Legislation

No codes were identified in the following two pieces of legislation: the decree "The Creation of the National Commission for Housing and Human Settlements"; and the municipal ordinance "Modifications and Amendments to the Regulations of Urban Development for the Municipality of Managua".

In the "Regulations, Land Use and Entitlement for Spontaneous Human Settlements" law, three sections were identified which contain category A2 (DRR) codes and two references were found to category A6 (DRR-UP) codes. The document highlights the importance of avoiding risk areas in urban development. Similarly, the "Law of Reforms to the Law No. 40: Law of Municipalities" includes one reference to both category A2 (DRR) and A6 (DRR-UP) code. Both texts highlight the significant responsibility of urban authorities in the implementation of the construction code to reduce risk.

3.3.3. UP: Other relevant documents

In the "other relevant documents" sub-category, the "National Plan for Human Development 2012–2016" [77] has twenty examples of category A1 (CC) codes. These sections of text show that some aspects of CCA are considered to be of utmost importance to the country's food production, economic development, environment, security and sustainable development. The document encourages the countries of the region to make a joint

¹⁰ "(...) El Consejo de Ministros de la CCAD en coordinación con el Consejo de Representantes del CEPREDENAC, dictarán las medidas para alinear en la escala nacional, las políticas, estrategias y planes de gestión de riesgo y de gestión ambiental en sus componentes e instrumentos comunes, principalmente los de adaptación al cambio climático, de gestión del patrimonio natural, en particular la prevención de incendios forestales y de gestión integral de los recursos hídricos (...)".

¹¹ "Artículo 1.—Se establece la Política General para el Ordenamiento Territorial, con el objetivo de orientar el uso del territorio en forma sostenible; entre los cuales se incluyen los recursos naturales, la prevención y mitigación de desastres naturales (...)".

Table 4Classification of references to CCA and DRR codes in current UP policies and regulatory frameworks^a.

UP		(A1) CCA	(A2) DRR	(A4) CCA-DRR	(A5) CCA-UP	(A6) DRR-UP
Year	Policies					
2001	Decree No. 90-2001. General Policy for Land Use Planning	0	7	0	0	7
	Legislation					
1995	Decree No. 28-95. Creation of the National Commission for Housing and Human Settlements	0	0	0	0	0
1999	Law No. 309. Regulations, Land Use and Entitlement for Spontaneous Human Settlements	0	3	0	0	2
2002	Decree No. 78-2002. Standards, Guidelines and Criteria for Land Use planning	0	10	0	2	8
2007	Municipal Ordinance No. 01-2007 Modifications and Amendments to the Regulations of Urban Development for the Municipality of Managua	0	0	0	0	0
2012	Law 792. Law of Reforms to the Law No. 40 "Law of Municipalities"	0	1	0	0	1
	Other relevant documents					
1995	Regulations for the Central Area of Managua	0	20	0	0	6
2002	General Plan for Municipal Development	0	6	0	2	2
2005	Minimum Standards for the Dimensioning of Housing Projects	0	1	0	1	1
2005	Partial Plans of Urban Planning of Managua—North Central, South-West and East	0	18	0	0	8
2007	National Construction Code	0	9	0	0	0
2012	National Plan for Human Development 2012-2016	20	19	3	1	2
2012	Proposal of the General Law for Land Use Planning and Territorial Development of the Republic of Nicaragua	5	6	2	4	6

^a The values 0 to X, are the number of text section that contain codes of each field, which are classified in the following categories: (A1) CCA: Text section including codes from the CCA field; (A2) DRR: Text section including codes from the DRR field; (A3) UP: Text section including codes from the UP field; (A4) CCA-DRR: Text section including codes that show links between CCA and DRR; (A5) CCA-UP: Text section including codes that show links between CCA and UP; (A6) DRR-UP: Text section including codes that show links between DRR and UP.

effort to manage and finance CCA initiatives. It also argues that public and private investors must consider CCA measures and associated budgets:

(...) the adaptation (to climate change) is closely linked to a model of sustainable development that requires strong public and private investments in infrastructure to reduce vulnerabilities of the population (...) ¹² [77]

The "Proposal of the General Law for Land Use Planning and Territorial Development of the Republic of Nicaragua" includes all six category codes (A1–A6). In this document, CCA is presented as an essential condition that has to form part of urban development and land use planning processes to ensure an increase in the adaptive capacity of the country, food security, productivity and the protection of human life:

(...) Guiding principles: No. 1. Climate change adaptation and mitigation: The territorial development and land use planning processes must take into account both the environmental transformations and the existing risks in the national territory which result from

climatic change, and establish the needed measures to increase the adaptive capacity of the country (...) ¹³ [71]

4. Discussion

In Nicaragua, many of the developments in the fields of environment, DRR and UP have only happened recently. The Ministry of Environment and Natural Resources (MARENA) was established in 1996, and the National System for Disaster Management and Prevention (SINAPRED) was created in 2000. As regards UP, most of the current regulatory instruments have only entered into force in the past decade.

The ratification of the UNFCCC in 1995 and the adoption of the Kyoto protocol in 1999 (through the Decree 94–99: "Ratification of the Kyoto Protocol of the United Nations Framework Convention on Climate Change" [80]) coincided with the restructuring of MARENA, beginning in 1996, which became the institution responsible for CC management. This is why CC and CCA codes were not found in the older instruments included in this analysis.

¹² "(...) La adaptación está íntimamente vinculada a un modelo de desarrollo sostenible que requiere por lo tanto fuertes inversiones públicas y privadas en infraestructuras que reduzcan la exposición de la población a vulnerabilidades (...)".

¹³ "(...) Principios rectores: No 1. "Adaptación y Mitigación al Cambio Climático: Los procesos de ordenamiento y desarrollo territorial deben tomar en cuenta las transformaciones ambientales y riesgos en el territorio nacional, como producto del cambio climático, y estableciendo las medidas necesarias para elevar la capacidad de adaptación del país (...)".

Following the restructuring of MARENA, new policies and regulatory instruments have been created and existing ones have gradually been improved through additions and complementary instruments. This has led to significant advancements in the integration of CC, including mitigation and adaptation aspects. The “Ministerial Resolution for the Creation of the National Commission for Climate Change” in 1999 is an example of significant progress.

The development of policies and regulatory frameworks related to the issues of the environment, DRR and UP reflects general developments in the understanding of CCA. It has evolved from a very restricted concept to a more comprehensive approach, which includes the protection of the natural and human environment and need to be mainstreamed into all kinds of urban sector work. The 2003 “National Action Plan for Climate Change” presents CCA as a broad and inclusive concept and refers to the adaptation strategies and measures proposed by the IPCC. However, it was not until 2008 that a more comprehensive approach to CCA began to be integrated into existing regulatory frameworks. Before 2008, efforts to address CC purely focused on climate change mitigation, the protection of natural resources in general, and food production in particular. Since 2008, new environmental decrees and instruments have been proposed that address CC-related risk and vulnerability. Examples are the “Law of Reforms and Additions to Law No. 217” from 2008, which is an update to the national environmental law, and the “National Environmental Strategy and Climate Change Action Plan 2010–2015” from 2010, which states that the infrastructure of cities needs to be adapted to CC.

This review shows that the integration of CCA has seen greatest advances in the context of existing environmental and planning policies and regulations, and not in the field of DRR. However, it is only the government's most recent environmental and planning documents that clearly recognise the need to build on the synergies between CCA, DRR and UP. These are the “National Environmental Strategy and Climate Change, Action Plan 2010–2015”, and the “Proposal of the General Law for Land Use Planning and Territorial Development of the Republic of Nicaragua”. Both documents promote UP as a tool for the reduction of CC-related vulnerabilities and disasters in general. In contrast, DRR is regulated by Law 337, which lacks policies and other regulatory instruments to support its implementation and integration with CCA.

Whilst links between DRR and UP were seen most frequently in the documents reviewed, there were few concrete proposals for strategies, plans and/or measures to adapt urban environments to CC. This is because of the lack of: (a) up-to-date regulatory frameworks for UP; (b) related operational instruments; and (c) effective enforcement. All of these aspects present a major obstacle to the development and implementation of concrete CCA plans and measures in the urban context.

At the regional level, CCA has only recently been integrated into policies and strategies, but a comprehensive approach that would create synergies between DRR, CCA and UP is lacking. The “Central American Policy on Comprehensive Disaster Risk Management” [78] hardly considers urban risk and vulnerability since it forms part of the “The Regional

Agro-Environmental and Health Strategy” [81], which is very much focused on issues of agriculture and health.

Finally, the results of this review show that policies and related changes are strongly influenced by the international community. Many policies related to CCA explicitly refer to regional and international obligations that Nicaragua needs to meet. When it comes to DRR, the lack of national policy means that actions in the field are mostly supported and guided by regional and international frameworks, such as the Central American Policy on Comprehensive Disaster Risk Management [78] and the Hyogo Framework for Action [15]. The policies and regulations examined in the analysis that included CCA information are consistent with the recommendations found in key international documents for improving coordinated action between CCA and DRR (such as the Hyogo Framework for Action 2005–2015 [15] and the IPCC-SREX [7]). For example, recommendations related to participative decision-making processes for the inclusion of mitigation and adaptation measures into all planning sectors is one of the responsibilities of the National Commission for Climate Change. Similarly, the “National Environmental Strategy and Climate Change, Action Plan 2010–2015” promotes education programmes that involve local government and the inclusion of traditional knowledge into CCA. In addition, this document indicates that adaptation is possible by using a comprehensive DRR approach that is implemented before, during and after potential hazard occurrence.

In sum, although there seems to be no explicit intention to integrate CCA into DRR and UP, there is a clear concern that coordination between the three fields is needed. However, it is fragmented; it is found in various policies and regulatory instruments, supported in part by international agreements.

5. Conclusions

This study shows the potential challenges that developing countries, mostly in Central America, face in integrating CCA at policy level, and the influence of international and regional agreements. There is clear progress in the integration of CCA into policy and regulatory frameworks concerning the environment, DRR and UP in Nicaragua, although integration is still in an early stage. The integration of CCA into policies and regulations has gradually evolved since it began in 1999. It is subject to ongoing national, regional and international developments. The extent of integration is different in each field. This review demonstrates that CCA integration is most advanced in the field of the environment since Nicaragua's international commitments, such as the adoption of the Kyoto Protocol in 1999, have had a strong influence on the CC integration progress.

The recent creation of the CCA, DRR and UP fields in Nicaragua has brought important advantages and disadvantages for their integration. The analysis shows that whilst regional, national and local authorities are increasingly concerned with CC management, current policies and regulatory frameworks do not yet include consolidated guidance about how to manage CCA in a holistic manner. Nevertheless, the lack of adequate general frameworks also

translates into continuous modifications and the creation of new policies and regulatory frameworks, which offer new opportunities for the integration of CCA.

Although the main focus of current CC-related policies and regulatory frameworks is still the protection of natural resources, agricultural and food production, policy advances and related institutional structures have the potential to increase the effectiveness of CCA integration. The integration process started with a focus on climate change mitigation, during which time official documents and policies were created to manage the causes of CC. Nowadays, related instruments and structures (such as the National Commission for Climate Change) have the potential to assist in supporting and improving the integration of CCA into DRR, UP and other sectors. To tap into this potential, a regular and systematic review of existing policies and regulatory instruments needs to be performed in order to assess the synergies and gaps between CCA, DRR and UP. This requires inter-sectoral and participative work with the actors concerned at national and local level, as well as the establishment of related monitoring and learning mechanisms.

Currently the integration of CCA into DRR regulations is almost non-existent because of the lack of policy and official instruments. Although Nicaragua has achieved significant progress in DRR, its regulatory framework is limited. In practice, DRR actions are mainly supported by regional and international, rather than national instruments. The integration of CCA and DRR is thus not evident at the national policy level. However, the on-going creation of a DRR policy in Nicaragua provides a great opportunity to improve CCA integration. In this process, the authorities need to take into account recommendations found in international policies and documents to increase CCA integration, experience from countries with similar contexts, and identify potential national policies and regulations in order to avoid parallel mechanisms and make the most effective use of resources.

With respect to current UP, this review shows that the integration of UP and CCA is very limited because of the lack of up-to-date regulatory and related operational planning instruments. On the one hand, the review highlights that there are many links between UP and DRR, and most of the instruments show that land use planning and UP in general are seen as important tools for DRR. On the other hand, links between UP and CCA are weak. This relates to the lack of up-to-date regulatory planning policies and regulations, which hinders comprehensive integration. Existing frameworks do not address climate-related problems and vulnerabilities in urban areas. The restructuring and evaluation of current UP policy and the regulatory framework is thus an urgent task. Modifications to these instruments to take into consideration synergies between CCA and DRR are crucial for improved risk reduction and adaptation planning.

Finally, the early stages of the integration of CCA into DRR and UP are an opportunity to consolidate and evaluate strategies for reducing the impacts of CC. In general, this review shows that policies and regulatory frameworks for the environment, DRR and UP include important provisions for the reduction of vulnerabilities to CC in

urban systems. The main limitation is that the information in these documents is fragmented. Once again, this shows the need to create mechanisms to evaluate current policy and regulatory frameworks, to monitor related modifications, and to learn from the implementation of urban risk reduction and adaptation planning.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.ijdr.2013.12.008>. These data include Google map of the most important areas described in this article.

References

- [1] IPCC. Fourth assessment report: climate change. Available from: http://www.ipcc.ch/publications_and_data/ar4/syr/en/main.html; 2007 accessed: [05.04.13].
- [2] Satterthwaite D, et al. Adapting to climate change in urban areas: the possibilities and constraints in low- and middle-income nations. Human settlements discussion paper series, 2007 (Theme: Climate change and cities-1).
- [3] UNISDR. Disaster statistics 2011. Available from: http://www.preventionweb.net/files/24697_246922011disasterstats1.pdf; 2012 accessed: [19.04.13].
- [4] Visser H, et al. A statistical study of weather-related disasters: past, present and future. The Netherlands: The Hague: PBL Netherlands Environmental Assessment Agency; 2012.
- [5] Harmeling S, Eckstein D. Global Climate Risk Index 2013: who suffers most from extreme weather events? Weather-related loss events in 2011 and 1992 to 2011 In: Baum D, Kier G, editors. Berlin. The German Federal Ministry for Economic Cooperation and Development (BMZ); 2012.
- [6] Wamsler C. Cities, disaster risk, and adaptation. Routledge series on critical introduction to urbanism and the city. London: Routledge; 2014.
- [7] IPCC. Managing the risks of extreme events and disasters to advance climate change adaptation, in a special report of working groups I and II of the Intergovernmental Panel on Climate Change, Field CB, Barros V, Stocker TF, Qin D, Dokken DJ, Ebi KL, Mastrandrea MD, Mach KJ, Plattner G-K, Allen SK, Tignor M, Midgley PM, editors.; 2012: New York. p. 582.
- [8] Sperling F, Szekely F. Disaster risk management in a changing climate. In: Discussion paper prepared for the world conference on disaster reduction on behalf of the Vulnerability and Adaptation Resource Group (VARG); 2005.
- [9] Few R, et al. Linking climate change adaptation and disaster risk management for sustainable poverty reduction—synthesis report; 2006. p. 30.
- [10] Venton P, La Trobe S. Linking climate change adaptation and disaster risk reduction. United Kingdom: Tearfund; 2008.
- [11] Birkmann J, von Teichman K. Addressing the challenge: recommendations and quality criteria for linking disaster risk reduction and adaptation to climate change. Bonn: DKKV Publications Series 38; 2009.
- [12] UNISDR. In: Proceedings: creating linkages for a safer tomorrow. In Second session of the Global Platform for Disaster Risk Reduction 2009. United Nations.
- [13] Birkmann J, Teichman K. Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms. *Sustainability Sci* 2010;5(2):171–84.
- [14] Schipper L, Pelling M. Disaster risk, climate change and international development: scope for, and challenges to, integration. *Disasters* 2006;30(1):19–38.
- [15] UNISDR. Hyogo framework for action 2005–2015: building the resilience of nations and communities to disasters. In: World Conference on Disaster Risk Reduction (WCDR). 2005. Kobe.
- [16] Pelling M. The vulnerability of cities: natural disasters and social resilience. Earthscan; 2003.
- [17] UNISDR. Making cities resilient: my city is getting ready, in 2010–2011 World Disaster Reduction Campaign. United Nations International Strategy for Disaster Reduction (UNISDR); 2009.

- [18] IFRC. World disasters report 2010: focus on urban risk. Geneva: International Federation of Red Cross and Red Crescent Societies (IFRC); 2010.
- [19] Bulkeley H, Betsill M. Cities and climate change: urban sustainability and global environmental governance. London: Routledge; 2003.
- [20] The World Bank. Urban risk assessment: an approach for understanding disaster and climate risk in cities. Washington, DC.: The World Bank: Urban Development and Local Government Unit; 2011.
- [21] UNISDR. Implementation of the Hyogo framework for action. 2013 (Summary of reports 2007–2013).
- [22] Kates RW, et al. Human impact of the Managua Earthquake. *Science* 1973;182(4116):981–90.
- [23] Lavell A, Mansilla E, Smith D. Regional programme for risk management in Central America: ideas and notions relating to concept and practice. Coordination Centre for Natural Disasters Prevention in Central America (CEPRENAC) and United Nations Development Program (UNDP); 91.
- [24] Lavell A. Local level risk management: concepts and experience in Central America, in paper presented at the International Seminar on Disaster Preparedness and Mitigation Summit 2002: New Delhi.
- [25] The World Bank and the Global Facility for Disaster Risk Reduction and Recovery (GDFRR), Disaster risk management in Central America: GDFRR Country notes, 2009, Sustainable Development Unit—Latin American and The Caribbean; Washington, DC.
- [26] Cassell C, Symon G. Essential guide to qualitative methods in organizational research. London: SAGE Publications Ltd; 2004.
- [27] Yin R. Case study research: design and methods. London: SAGE; 2009. (Applied social research methods series, 99-0497898-0; 5).
- [28] Weber R. Basic content analysis quantitative applications in the social sciences: 49. 2nd ed Newbury Park: Sage; 1990.
- [29] Bicknell J, Dodman D, Satterthwaite D. Adapting cities to climate change: understanding and addressing the development challenges. London: Earthscan; 2009.
- [30] UNISDR. Terminology on disaster risk reduction. United Nations International Strategy for Disaster Reduction (UNISDR); 2009.
- [31] Almandoz A. Urban planning and historiography in Latin America. *Prog Plann* 2006;65(2):81–123.
- [32] Wamsler C, Brink E, Rivera C. Planning for climate change in urban areas: from theory to practice. *J Cleaner Prod* 2013;50(0):68–81.
- [33] Trochim W. Evaluation policy and evaluation practice. New Directions for Evaluation 2009;2009(123):13–32.
- [34] Stevenson A. Oxford dictionary of English. Oxford: Oxford University Press; 2010.
- [35] Campos V, et al. Mapeo de Riesgos, Procesos, Políticas Públicas y Actores Asociados al Cambio Climático en Nicaragua [Mapping of risks, processes, public policies and actors related to climate change in Nicaragua]. Nicaragua: Humboldt Center in Nicaragua; 2011.
- [36] SUSWATCH Políticas, Programas y Estudios de Caso sobre Cambio Climático en Nicaragua [Policies, programs and case studies on climate change in Nicaragua], 2011, Sustainability watch-Observatory of sustainability/Latin American Network, Nicaragua.
- [37] Hernández J, Viteri JA. Nicaragua Frente al Cambio Climático [Nicaragua toward climate change]. Food and Agriculture Organization (FAO); 2003.
- [38] Babbie E. In: Caldeira C, Money Penny D, editors. The practice of social research. Belmont: Wadsworth, Cengage Learning; 2010. p. 528.
- [39] Chávez R. Planning in Nicaragua. *Latin Am Perspect* 1987;14(2):226–35.
- [40] Parés ML. Estrategia Municipal para la Intervención Integral de Asentamientos Humanos Espontáneos de Managua, Nicaragua [Municipal strategy for intervening spontaneous urban settlements of Managua, Nicaragua], in the framework of the project “Urban poverty: an action-oriented strategy for urban governments and institutions in Latin America and the Caribbean”, United Nations, Editor 2006, Economic Commission for Latin America and the Caribbean (CEPAL); Nicaragua.
- [41] National Assembly of Nicaragua. Ratificación de la Convención Marco de las Naciones Unidas Sobre el Cambio Climático [Ratification of the United Nations Framework Convention on Climate Change], in Decree No. 50-95, 1995, La Gaceta No.199: Nicaragua.
- [42] MARENA. Política y Plan Ambiental de Nicaragua 2001–2005 [Environmental policy and plan of Nicaragua 2001–2005]. The Ministry of Environment and Natural Resources (MARENA); 37.
- [43] National Assembly of Nicaragua. Establece la Política Ambiental y Aprueba el Plan Ambiental de Nicaragua 2001–2005 [Establishment of the environmental policy and the approval of the environmental plan of Nicaragua], in Decree No. 25-2001, 2001, La Gaceta No. 44: Nicaragua.
- [44] National Assembly of Nicaragua. Establece la Política Nacional de los Recursos Hídricos [National policy for water resources] in Decree No.107–2001, 2001, La Gaceta No. 233: Nicaragua.
- [45] National Assembly of Nicaragua. Marco General de las Políticas de Tierras [General framework for land policies], in Decree No. 70-2006, 2006, La Gaceta No. 217: Nicaragua.
- [46] National Assembly of Nicaragua. Política Nacional de Producción más Limpia [National policy for cleaner production], in Decree No. 22-2006, 2006, La Gaceta No. 68: Nicaragua.
- [47] National Assembly of Nicaragua. Política Nacional de Desarrollo Sostenible del Sector Forestal de Nicaragua [National policy for the sustainable development of the forestry sector of Nicaragua], in Decree No. 69-2008, 2008, La Gaceta No. 3: Nicaragua.
- [48] National Assembly of Nicaragua. Decreto Ejecutivo Creador de la Comisión Nacional del Ambiente y Ordenamiento Territorial [Executive Decree for the creation of the National Commission of Environment and Land Use Planning], in Decree-Law No. 17-90,1990, La Gaceta No.112: Nicaragua.
- [49] National Assembly of Nicaragua. Ley General del Medio Ambiente y los Recursos Naturales [General environment and natural resources law], in Law No. 217, 1996, La Gaceta No. 105: Nicaragua.
- [50] National Assembly of Nicaragua. Reglamento de la Ley General del Medio Ambiente y los Recursos Naturales [Regulation of the general environment and natural resources law], in Decree No. 9-96, 1996, La Gaceta No. 163: Nicaragua.
- [51] National Assembly of Nicaragua. Creación de la Comisión de Cambios Climáticos [Creation of the commission for climate change], in Ministerial Resolution No. 014-99, 1999, La Gaceta No. 161: Nicaragua.
- [52] National Assembly of Nicaragua. Creación de la Oficina Nacional de Desarrollo Limpio [Creation of the National Office of Cleaner Development], in Decree No. 21-2002, 2002, La Gaceta No. 56: Nicaragua.
- [53] National Assembly of Nicaragua. Estrategia Nacional de Biodiversidad y su Plan de Acción [National strategy of biodiversity and its action plan], in Ministerial Resolution No. 27-2002, 2002, La Gaceta No. 156: Nicaragua.
- [54] National Assembly of Nicaragua. Ley Especial de Delitos Contra el Medio Ambiente y los Recursos Naturales [Special law of crimes against the environment and natural resources], in Law No. 559, 2005, La Gaceta No. 225: Nicaragua.
- [55] National Assembly of Nicaragua. Ley de Reformas y Adiciones a la Ley no. 217, “Ley General del Medio Ambiente y los Recursos Naturales” [Reforms and Additions to Law No. 217 “General Environment and Natural Resources Law”], in Law No. 647, 2008, La Gaceta No. 62: Nicaragua.
- [56] National Assembly of Nicaragua. Sobre el Cambio Climático y su Adaptabilidad en Nicaragua [About climate change and its adaptability in Nicaragua], in Resolution No. 003-2009, 2009, La Gaceta No. 126: Nicaragua.
- [57] MARENA-PNUD. Primera Comunicación Nacional sobre Cambio Climático [First national communication on climate change] MARENA, Editor 2001, The Ministry of Environment and Natural Resources (MARENA) and The United Nations Development Programme (UNDP); Nicaragua.
- [58] Picado F. Plan de Acción Nacional Ante el Cambio Climático [National action plan for climate change]. Nicaragua: National Office of Cleaner Development and Climate Change of The Ministry of Environment and Natural Resources (MARENA); 2003.
- [59] MARENA. Estrategia Nacional Ambiental y del Cambio Climático - Plan de Acción 2010-2015 [National environmental strategy and climate change—action plan 2010–2015], MARENA, Editor 2010, The Ministry of Environment and Natural Resources (MARENA).
- [60] MARENA-PNUD. Segunda Comunicación Nacional sobre Cambio Climático [Second national communication on climate change] MARENA, Editor 2009, The Ministry of Environment and Natural Resources (MARENA) and The United Nations Development Programme (UNDP); Nicaragua.
- [61] Secretariat of the President of Nicaragua. Política Nacional de Protección Social [National policy for social protection], 2003: Nicaragua.
- [62] Executive Secretariat-SINAPRED, Ley Creadora del Sistema Nacional para la Prevención, Mitigación y Atención de Desastres, sus reglamentos y normas complementarias [The creation of the National System for Disaster Management and Prevention and its Normative], 2010, La Gaceta No. 70: Nicaragua.
- [63] Executive Secretariat-SINAPRED. Plan Nacional de Gestión del Riesgo [National disaster management plan], World Bank, Editor 2004, Executive Secretariat of the National System for Disaster Management and Prevention (SINAPRED); Nicaragua.
- [64] Executive Secretariat-SINAPRED. Plan Nacional de Respuesta del SINAPRED [National disaster response plan of SINAPRED], 2008, Executive Secretariat of the National System for Disaster Management and Prevention: Nicaragua.

- [65] National Assembly of Nicaragua. Decreto que Establece la Política General para el Ordenamiento Territorial [General policy for land use planning], in Decree No. 90-2001, 2001, La Gaceta No. 4: Nicaragua.
- [66] National Assembly of Nicaragua, Creación de la Comisión Nacional de Vivienda y Asentamientos Humanos [Creation of the National Commission for Housing and Human Settlements], in Decree No. 28-95, 1995, La Gaceta No. 118: Nicaragua.
- [67] National Assembly of Nicaragua. Ley de Regulacion, Ordenamiento y Titulacion de Sentamientos Humanos Espontáneos [Regulations, land use and entitlement for spontaneous human settlements] in Law No. 309, 1999, La Gaceta No.143: Nicaragua.
- [68] National Assembly of Nicaragua. De Normas, Pautas y Criterios para el Ordenamiento Territorial [Standards, guidelines and criteria for land use planning], in Decree No. 78-2002, 2002, La Gaceta No. 174: Nicaragua.
- [69] Municipality of Managua. Modificaciones y Adiciones a las Regulaciones de Desarrollo Urbano del Municipio de Managua [Modifications and amendments to the regulations of urban development for the Municipality of Managua], in Municipal Ordinance No. 01-2007, 2007: Nicaragua.
- [70] National Assembly of Nicaragua. Ley de Reformas a la Ley no 40, "Ley de Municipios" [Law of reforms to the Law No. 40 "Law of municipalities"], in Law No. 792, 2012, La Gaceta No 109: Nicaragua.
- [71] National Assembly of Nicaragua, Proyecto de Ley General de Ordenamiento y Desarrollo Territorial de la República de Nicaragua [Proposal of the general law for land use planning and territorial development of the Republic of Nicaragua], 2012: Nicaragua.
- [72] Municipality of Managua. Reglamento del Área Central de Managua [Regulations for the Central Area of Managua], 1995: Managua.
- [73] Barahona M, et al. [Plan General de Desarrollo Municipal, Managua](#) [General plan for municipal development, Managua].Managua: Municipality of Managua; 2002.
- [74] MTI. [Normas Mínimas de Dimensionamiento de Desarrollos Habitacionales](#) [Minimum standards for the dimensioning of housing projects].Nicaragua: Ministry of Transport and Infrastructure (MTI); 2005.
- [75] Rothschuh R. [Síntesis de los Planes Parciales de Ordenamiento Urbano](#) [Partial Plans of Urban Planning of Managua North-Central, South-West and East], in Faculty of Architecture.Managua: National University of Engineering; 2005.
- [76] MTI. Reglamento Nacional de la Construcción [National Construction Code], in Ministerial Resolution No. 01-2007, MTI, Editor 2007, Ministry of Transport and Infrastructure (MTI): Managua.
- [77] Secretariat of the President of Nicaragua. Plan Nacional de Desarrollo Humano 2012–2016 [National plan for human development 2012–2016], in draft under referendum 2012: Nicaragua.
- [78] SICA-CEPREDENAC. Política Centroamericana de Gestión Integral de Riesgo de Desastres (PCGIR) [Central American policy on comprehensive disaster risk management], 2010, The Central American Integration System (SICA) and the Central American Coordinating Centre for Natural Disaster Prevention (CEPREDENAC).
- [79] CCAD-SICA. Estrategia Regional de Cambio Climático [Regional strategy for climate change], 2010, The Central American Commission for Environment and Development (CCAD) and the Central American Integration System (SICA).
- [80] National Assembly of Nicaragua. Ratificar el Protocolo de Kyoto de la Convención Marco de Las Naciones Unidas sobre el Cambio Climático [Ratification of the Kyoto Protocol of the United Nations Framework Convention on Climate Change], in Decree No. 94-991, 999, La Gaceta No. 168: Nicaragua.
- [81] CCAD-CAC-COMISCA. Estrategia Regional Agroambiental y de Salud de Centroamérica 2009–2024 [The regional agro-environmental and health strategy 2009–2024], 2008, Central American Commission on Environment and Development (CCAD), Central American Agricultural Council (CAC), Central American Council of Ministers of Health (COMISCA): Panama.