



## Article

# Mainstreaming Ecosystem-Based Disaster Risk Reduction: Towards a Sustainable and Just Transition in Local Development Planning in Rural South Africa

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**Abstract:** Ecosystem-based disaster risk reduction (Eco-DRR) is gaining momentum globally and is also considered to enhance climate change adaptation and sustainable transition to a low-carbon economy in South Africa. However, there is little evidence regarding how the approach is applied at the local level. It also remains unclear to what extent the approach is integrated into local development planning and what opportunities exist for further integration in rural areas. Therefore, our study examined opportunities for mainstreaming Eco-DRR into local development planning in South Africa. Fourteen integrated development plans from ‘mostly rural’ local municipalities in Limpopo Province were systematically assessed to understand the process of mainstreaming Eco-DRR into their current development plans under the following aspects: localized climate trends, hydroclimatic risks considered, risk and vulnerability assessments, disaster risk reduction (DRR) actions, early-warning systems, financing mechanisms, integration of traditional and technical knowledge, stakeholder engagement, and alignment with district, provincial, and national priorities. Although all plans address DRR, none explicitly addresses Eco-DRR, despite a few similar actions. DRR actions are not aligned to any hydroclimatic risks, and most plans lack localized climate trends and/or vulnerability assessments to indicate the severity of hazards and/or identify populations and areas at risk. Several measures in the plans address disaster preparedness, but none includes early-warning systems. Public participation features prominently in all plans, but the process is marred by challenges and lacks genuineness, e.g., prioritized actions are not reflective of community needs. Based on the findings, we discuss measures to enhance the mainstreaming of ecosystem-based approaches into DRR. We conclude that a huge opportunity exists to institutionalize and mainstream Eco-DRR into local development planning in South Africa’s rural areas. If carefully seized, such an opportunity can also help attract external finance to complement the currently constrained budgets related to addressing hydroclimatic risks.

**Keywords:** climate change adaptation; climate-resilient development; disaster management; knowledge co-production; nature-based solutions; stakeholder engagement



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## 1. Introduction

Climate change impacts continue to threaten sustainable development and livelihoods, particularly in rural areas where people uniquely depend on nature [1,2]. In many African countries, rural areas exhibit unique attributes compared to the rest of the country. These attributes often mean that rural areas are more vulnerable to hydroclimatic disasters and make them a priority for disaster risk reduction [3–5]. For instance, in South Africa, at least 19 million (32%) people reside in rural areas, depending on the natural environment, particularly subsistence farming, and are often poor [6]. Moreover, the often low adaptive capacity of people in rural areas means that livelihood activities such as subsistence agriculture are highly vulnerable to hydroclimatic disasters [7–10].

People in rural areas often lack the agency to institute measures to mitigate disaster risks [11,12]. This is coupled with limited support from local authorities through inadequate budgetary allocations and a lack of implementation of proposed measures [13]. In some areas, developmental organizations are playing a critical role by complementing local authorities in the financing and implementation of disaster risk reduction actions. These organizations have also enhanced the capacity of decision-makers and local communities through training and raising awareness of disaster risk reduction [14–16].

Despite efforts at the global, regional, and national levels to reduce climate-induced disasters, local authorities remain critical in the institutionalization and implementation of location-based actions, including ensuring climate-resilient development [5,17,18]. However, climate change impacts on rural areas, such as severe storms, flooding, heatwaves, dry spells, and droughts, have intensified and become more frequent, leaving communities to grapple with the loss of livelihoods and post-disaster recovery [19]. This threatens the attainment of goals to reduce disaster loss and damage by 2030 as set out in the Sendai Framework for Disaster Risk Reduction and in South Africa's National Disaster Management Framework [20,21]. Without adequate governance systems to cope with incremental climate-induced disaster risks, the capacity of local municipalities and the resilience of rural communities constantly decline [13,18]. Thus, novel approaches are urgently required to reduce disaster risks in rural areas.

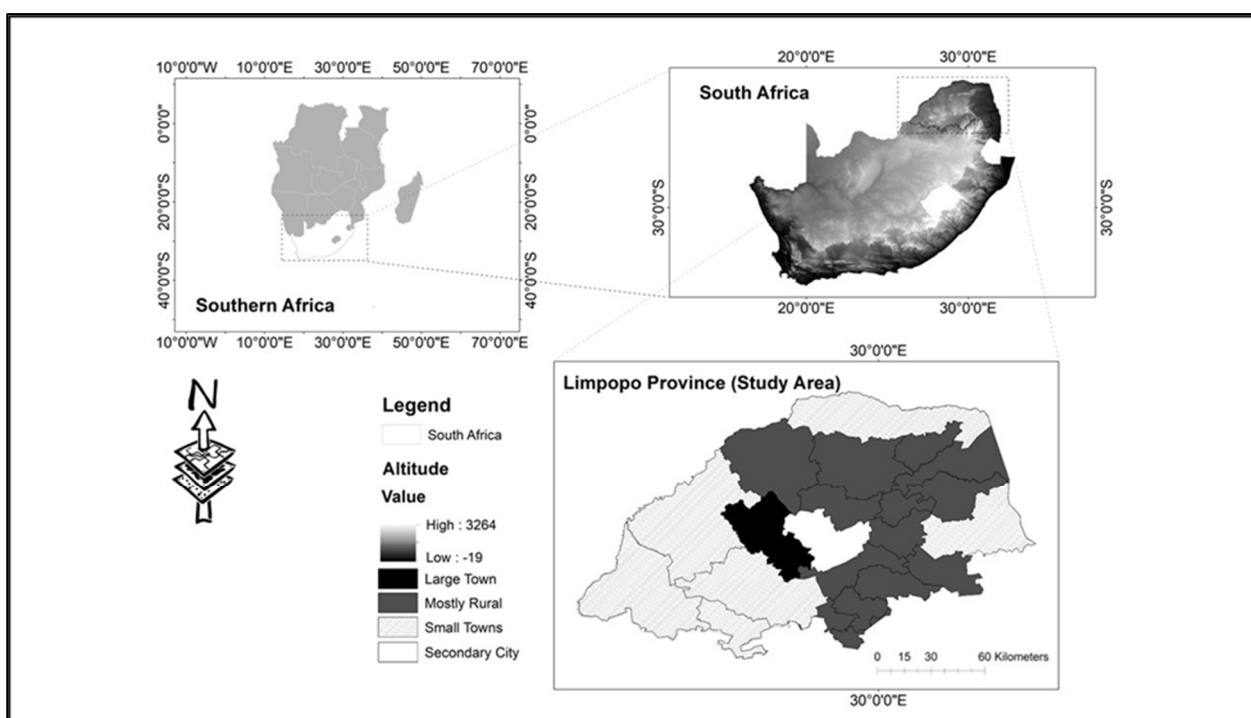
Ecosystem-based disaster risk reduction (Eco-DRR) provides services that reduce disaster risk by mitigating hazards and increasing livelihood resilience through the sustainable management, conservation, and restoration of ecosystems [22]. As an emerging approach, Eco-DRR is gaining recognition globally for its ability to address both climatic and non-climatic risks, near-term and long-term interventions, and integrate early-warning systems [23]. The approach has the benefits of being adaptable to more intense climate risks and enhancing climate change adaptation by providing the essential services that underpin livelihoods in rural areas [24–26]. Eco-DRR integrates ecosystem service provision, disaster risk reduction, and climate change adaptation and thus promotes sustainable, climate-resilient development and a just transition to low carbon economies [22]. The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) acknowledges biodiversity and ecosystems as critical for climate-resilient development, particularly climate change adaptation and disaster risk reduction though both are severely threatened by climate change [27].

Nonetheless, there is a paucity of evidence on the extent to which Eco-DRR is integrated into disaster risk reduction and institutionalized into local development planning [5,28,29]. As a relatively new approach, there is a lack of frameworks to guide local municipalities in the mainstreaming and institutionalization of Eco-DRR [18]. Thus, it is critical to establish the extent to which current development plans integrate Eco-DRR and how rural local municipalities can further mainstream and/or scale-up Eco-DRR into their integrated development plans and processes.

Therefore, this study views it as critical to understand how the disaster risk reduction strategies, actions, and measures outlined in the local development plans were developed and for which disasters, and to examine the opportunities for mainstreaming Eco-DRR into local development planning in rural areas. A systematic assessment of Integrated Development Plans (IDPs), from 14 'mostly rural' local municipalities in South Africa's Limpopo Province, was used to establish the extent to which Eco-DRR is integrated into local development planning. The assessment was guided by 11 aspects: localized climate trends, hydroclimatic risks considered, risk and vulnerability assessments, disaster risk reduction (DRR) actions, early-warning systems, financing mechanisms, integration of traditional and technical knowledge, stakeholder engagement, and alignment with district, provincial, and national priorities. We discuss our findings in the context of comparable studies that have examined the topic elsewhere.

## 2. Materials and Methods

The study focuses on Limpopo province, which is South Africa's northernmost province. Limpopo shares international borders with Botswana, Zimbabwe, and Mozambique, and it also borders the North West, Mpumalanga, and Gauteng provinces [30]. The province has five district municipalities, i.e., Capricorn, Mopani, Sekhukhune, Vhembe, and Waterberg. Out of the 22 local municipalities spread across the five districts, 14 are classified as “mostly rural” (Figure 1).



**Figure 1.** Limpopo Province and its local municipalities.

Limpopo province spans 125,754 km<sup>2</sup>, is rich in biodiversity, and has at least 50 nature reserves, including a larger portion of the Kruger National Park. Three of the ten South African Biosphere Reserves are located in the province: Vhembe, Kruger to Canyons, and Waterberg Biosphere Reserves. The Vhembe Biosphere Reserve is South Africa's second-largest [30]. Limpopo has an estimated population of 5.8 million people (i.e., 10.4% of South Africa's population) and is the 5<sup>th</sup> most populous province in South Africa [6]. The province has the second-highest proportion (24%) of agricultural households. A large proportion of the rural population in Limpopo depends on subsistence agriculture, which remains the most important source of livelihood in rural areas [31].

The province experiences a predominantly subtropical climate with rainy, hot summers and mild winters [31]. There are four notable regions in Limpopo: the subtropical Lowveld region characterized by hot summers and dry winters, the escarpment with higher rainfall levels, the moderate eastern plateau with warmer summers and dryer winters, and the subtropical plateau, which experiences higher levels of humidity [31].

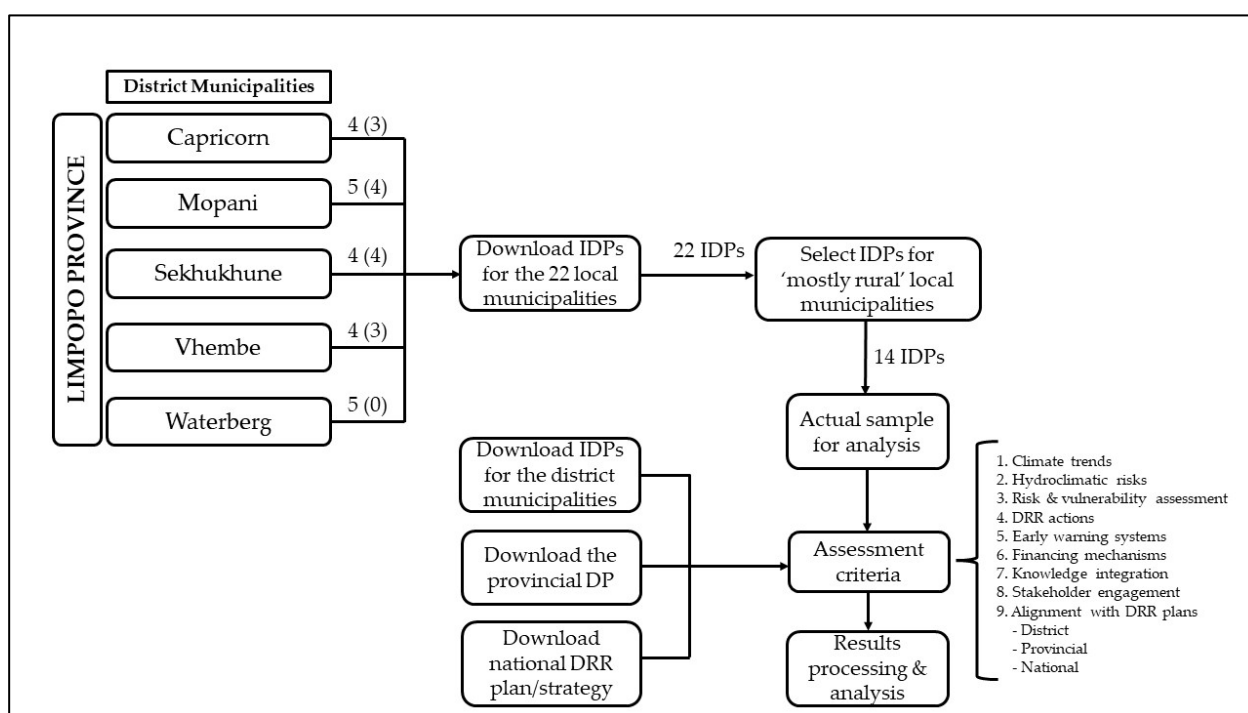
After identifying 14 local municipalities classified as mostly rural in Limpopo Province (Table 1), we downloaded the current integrated development plan for each local municipality from the Department for Cooperative Governance, Human Settlements and Traditional Affairs (CoGHSTA) online repository (<https://www.cogta.gov.za/index.php/municipal-idps/> (accessed on 10 March 2022)). We also downloaded the development plans for the five districts and the province. Thereafter, we searched each IDP document for information using pre-defined assessment criteria, i.e., localized climate trends, hydroclimatic risks considered, risk and vulnerability assessments, disaster risk reduction actions, early-warning systems, financing mechanisms, integration of traditional and technical knowledge, stake-

holder engagement, and alignment with the district, provincial, and national priorities (Figure 2).

**Table 1.** Classification, land size, population, and population densities of mostly rural local municipalities in Limpopo Province, South Africa.

Local Municipality	District	Classification	Area (km <sup>2</sup> )	Population (2016)	Population Density (Persons/km <sup>2</sup> )
Collins Chabane	Vhembe	Mostly rural	5003	347,974	69.6
Makhado	Vhembe	Mostly rural	7605	416,728	54.8
Thulamela	Vhembe	Mostly rural	2642	497,237	188.2
Elias Motsoaledi	Sekhukhune	Mostly rural	3713	268,256	72.2
Ephraim Mogale	Sekhukhune	Mostly rural	2011	127,168	63.2
Fetakgomo Tubatse	Sekhukhune	Mostly rural	5693	489,902	86.0
Makhuduthamaga	Sekhukhune	Mostly rural	2110	284,435	134.8
Greater Giyani	Mopani	Mostly rural	4172	256,127	61.4
Greater Letaba	Mopani	Mostly rural	1891	218,030	115.3
Greater Tzaneen	Mopani	Mostly rural	2897	416,146	143.7
Maruleng	Mopani	Mostly rural	3563	99,946	28.1
Blouberg	Capricorn	Mostly rural	9540	172,601	18.1
Lepelle-Nkumpi	Capricorn	Mostly rural	3484	235,380	67.6
Molemole	Capricorn	Mostly rural	3628	125,327	34.5

Source: Statistics South Africa (2016) [32].



**Figure 2.** Schematic flow chart of the assessment.

The results of each assessment criteria were then summarized and analyzed. The first three assessment criteria established whether the development of each IDP is evidence-based. Specifically, we checked if the IDPs were informed by (or based on) any long-term localized climate trends or climate change scenarios, specific hydroclimatic risks, and risk and vulnerability assessments. The analysis of the DRR actions further verified if these were informed by the climate trends, climate change scenarios, and/or hydroclimatic risks, and if these reflect actual or potential hydroclimatic risks and vulnerabilities of the local communities. The analysis of DRR actions identified ecosystem-based measures. DRR actions were also checked to establish if they integrate traditional and technical knowledge.

In a way, this also provided useful insights into stakeholder engagement in various phases of the development of IDPs, especially in the local communities that are affected by disaster risks. We also checked for the presence of early-warning systems, including their nature if present. The alignment to the district, provincial, and national disaster risk reduction plan or strategy not only checked for consistency from the national to the local level but also tracked the levels at which inconsistencies emanate. In addition, we established the sources of finance and proportions of budgets allocated to DRR by local municipalities.

### 3. Results

#### 3.1. Integrated Development Planning Process Overview

The local development planning process for the local municipalities in Limpopo Province is similar and has six phases: Planning/Preparatory, Analysis, Strategies, Projects, Integration, and Approval (Table 2). Preparation of the integrated development plans in all local municipalities is informed and influenced by district, provincial, and national guidelines.

**Table 2.** Phases and activities of the IDP /Budget/PMS Process Plan.

Phase	Activities	Community Participation
Planning/ Preparatory Phase	<ul style="list-style-type: none"> <li>— Identification and establishment of stakeholders.</li> <li>— Structures and sources of information.</li> <li>— Development of the IDP/Budget Process Plan.</li> <li>— Refinement of the draft approved process.</li> <li>— Approval of process plan and awareness.</li> </ul>	Community participation is through councilors and other stakeholders
Analysis Phase	<ul style="list-style-type: none"> <li>— Legal framework analysis; Leadership Guidelines; Municipality Technical Development Analysis; Institutional analysis; Economic analysis; Socio-economic analysis; Spatial analysis; In-depth analysis.</li> <li>— Identification of key development priorities.</li> <li>— Compilation of levels of development and backlogs that suggest areas of intervention.</li> </ul>	All wards and all councilors
Strategies Phase	<ul style="list-style-type: none"> <li>— Reviewing the Vision, Mission, Strategies, and Objectives.</li> <li>— Linkages of problem statements, development of strategies, and outcome.</li> </ul>	Community participation is through councilors during this stage.
Project Phase	<ul style="list-style-type: none"> <li>— Identification of possible projects and their funding sources.</li> </ul>	Community inputs through ward committees and community development workers
Integration Phase	<ul style="list-style-type: none"> <li>— Committees consider Draft IDP/Budget against sector plans, policies, by-laws summary inclusion, and programs of action.</li> <li>— Public notice issued on the tabled Draft IDP/Budget.</li> <li>— Draft IDP/Budget shared with relevant authorities for assessment (CoGHSTA, National and provincial treasuries, and direct municipality).</li> <li>— Public participation on Draft IDP/Budget in all clusters.</li> </ul>	Public notice issued to communities and other stakeholders. Public participation by the community and other stakeholders
Approval	<ul style="list-style-type: none"> <li>— Submission of Draft IDP/Budget to Council.</li> <li>— Public participation and publication.</li> <li>— Review and amendment of the Draft IDP based on comments and inputs from the community and other stakeholders.</li> <li>— Submission of final IDP/Budget to council for approval and adoption.</li> <li>— Public notice issued on the adopted IDP/Budget and publicized, e.g., on the municipal website.</li> <li>— Adopted IDP/Budget shared with relevant authorities (CoGHSTA, National and Provincial treasuries, District Municipality).</li> </ul>	Public notice issued to communities and other stakeholders

##### 3.1.1. Alignment with District, Provincial, and National Plans

All district municipalities in Limpopo Province have disaster management plans as required by the Disaster Management Act of 2002 (Section 53) [21]. These plans aim to establish a uniform approach to assessing and monitoring disaster risks, implementing integrated disaster risk management plans and risk reduction programs, and effective and appropriate disaster response and recovery. The plans also inform disaster risk management planning and disaster risk reduction. Several local municipalities rely on their



district municipalities for disaster management. Thus, district municipalities established district-wide IDP coordination meetings, which are attended by local municipalities within their jurisdiction, the Department of Co-operative Governance, Human Settlements and Traditional Affairs (CoGHSTA), and other sector departments. These meetings are used to align the District Frameworks with Local Municipalities' IDP and Budget Process Plans. For instance, Vhembe District Municipality developed an IDP Framework Plan, which informs the IDP Process Plans for all its local municipalities.

At the provincial level, the IDP is informed by a leadership agenda—as contained in Provincial policy documents—and the needs of local citizens and public and private community structures. All IDPs make reference to the Limpopo Disaster Management Framework of 2007. The role of the Provincial Sphere of Government is to monitor the IDP process and to ensure vertical/sector alignment. At the national level, all the IDPs refer to the National Development Plan for guidance together with the Disaster Management Act of 2002, and the National Disaster Management Framework. The Disaster Management Act defines disaster management as a continuous and integrated multi-sectoral, multi-disciplinary process of planning and implementation of measures aimed at preventing, or reducing, disaster risks.

### 3.1.2. Stakeholder Engagement and/or Public Participation

Public participation and diverse stakeholders (Table 3) are identified by all local municipalities as critical to the various phases of the IDP process. In order to operationalize the stakeholder engagement and/or public participation strategies and to strengthen community engagement, all local municipalities in this study established ward committees in terms of the Municipal Structures Act of 1998. The ward committees also incorporate community development workers in each ward to enhance community-based planning. Ward committees and ward councilors link the IDP process to their wards, assist in organizing the public consultation and participation, and review ward development plans in line with changing circumstances by giving details of village situational analyses and the progress on implementation of projects in each village.

All the local municipalities have in place an IDP Representative Forum to encourage stakeholder participation. The IDP representative forum is a structure that institutionalizes and guarantees representative participation in the IDP process. Stakeholders of the IDP Representative Forum include ward councilors, ward committees, community development workers, traditional leaders, organized business, women's organizations, youth movements, people with disabilities, advocacy agents of unorganized groups, sector departments, district municipality, parastatals, non-governmental organizations (NGOs), and community-based organizations (CBOs).

On average, there are 28 functional ward committees in each local municipality. Each ward committee comprises 10 members per ward and thus serves as a vital link between the municipality and the community. However, the effectiveness of these committees is negatively impacted by a lack of knowledge of their roles and responsibilities, and inadequate expertise or techniques to solicit community views. Conflicts between ward committees and community development workers are also highlighted by several IDPs. Another common challenge among the local municipalities is the low public participation in IDP/budget consultations due to poor turnout by community members even when free transport is availed.

**Table 3.** Stakeholders critical to the IDP/Budget Process in Limpopo Province.

Stakeholder	Function
Local Municipality Council	<ul style="list-style-type: none"> <li>○ Prepare process plan for IDP Revision.</li> <li>○ Undertake the overall management, coordination, and monitoring of the process as well as drafting the local IDP.</li> <li>○ Approve IDP within the agreed framework.</li> <li>○ Ensures participatory planning that is strategic, and implementation oriented.</li> </ul>
Department of Cooperative Governance, Human Settlements and Traditional Affairs (CoGHSTA)	<ul style="list-style-type: none"> <li>○ Ensures horizontal alignment of IDPs of various municipalities.</li> <li>○ Ensure vertical alignment between provincial sector departments/strategic plans and IDP processes.</li> </ul>
Sector departments i.e., Limpopo Economic Development, Environment and Tourism (LEDET) Dept. of Environmental Affairs (DEA) Dept. of Water and Sanitation (DWS) Dept. of Agriculture	<ul style="list-style-type: none"> <li>○ Contribute technical knowledge, ideas, and sector expertise to the formulation of municipal strategies, projects, and sector plans.</li> <li>○ Provide departmental operational and capital budgetary information.</li> </ul>
Private sector	<ul style="list-style-type: none"> <li>○ Participate in the formulation of the plan.</li> <li>○ Provide information on the opportunities that the communities may have in their industry.</li> <li>○ Submit their projects in the IDP of the municipality.</li> </ul>
Limpopo Economic Development, Environment and Tourism (LEDET)	<ul style="list-style-type: none"> <li>○ Provide advice on environmental, economic development, and trading issues.</li> </ul>
Integrated Development Plan (IDP) Representative Forum	<ul style="list-style-type: none"> <li>○ Inform and consult various interests of the community.</li> <li>○ Platform for all relevant stakeholders.</li> </ul>
Civil society (CBOs, NGOs, organizations for youth, women, and people with disabilities, tertiary, and research institutions)	<ul style="list-style-type: none"> <li>○ Inform and consult various interests of the community.</li> <li>○ Involved in the local IDP Representative Forum.</li> </ul>
Communities	<ul style="list-style-type: none"> <li>○ Identify and prioritize needs.</li> <li>○ Discuss and comment on the draft IDP review.</li> <li>○ Monitor performance in the implementation of IDP.</li> </ul>
Ward Committees	<ul style="list-style-type: none"> <li>○ Articulate community needs.</li> <li>○ Participate in the community consultation meetings.</li> <li>○ Help in the collection of needed data/research.</li> </ul>
Community Development Workers	<ul style="list-style-type: none"> <li>○ Help in the generation of required data, thereby providing requisite support to ward committees.</li> </ul>
Media	<ul style="list-style-type: none"> <li>○ Inform the public about the municipal activities.</li> </ul>

### 3.1.3. Knowledge Co-Production and Integration

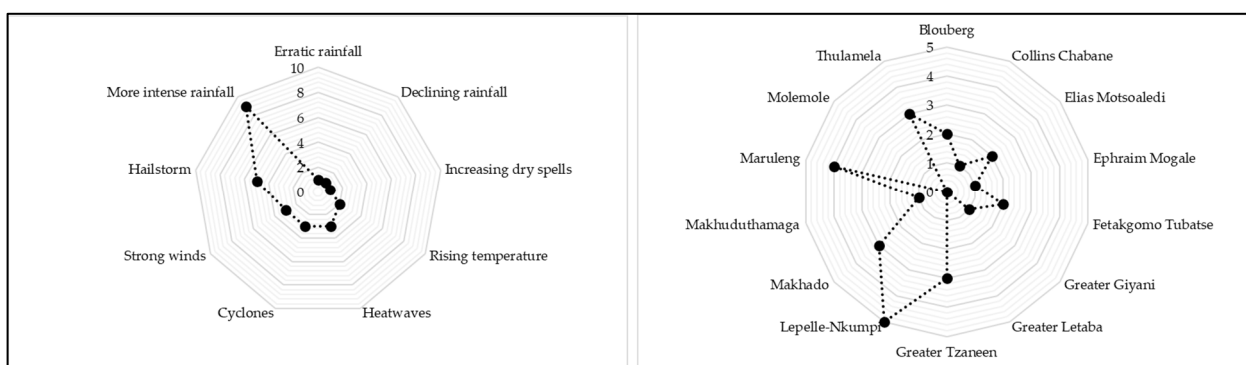
A critical aspect of the IDP process, particularly relevant to disaster management in rural municipalities is the integration of technical knowledge with indigenous knowledge systems. Although public participation is highlighted as fundamental by all the IDPs, evidence to show the integration of technical and indigenous knowledge is largely lacking. For instance, several IDPs do not present localized climate trends even though such knowledge could also be solicited from local communities in the absence of empirical data. The IDPs lack evidence regarding how and what indigenous knowledge contributed to the risk analysis and risk assessment, including how it informs disaster preparedness and early-warning systems.

### 3.2. Localized Climate Trends and Hydroclimatic Hazards

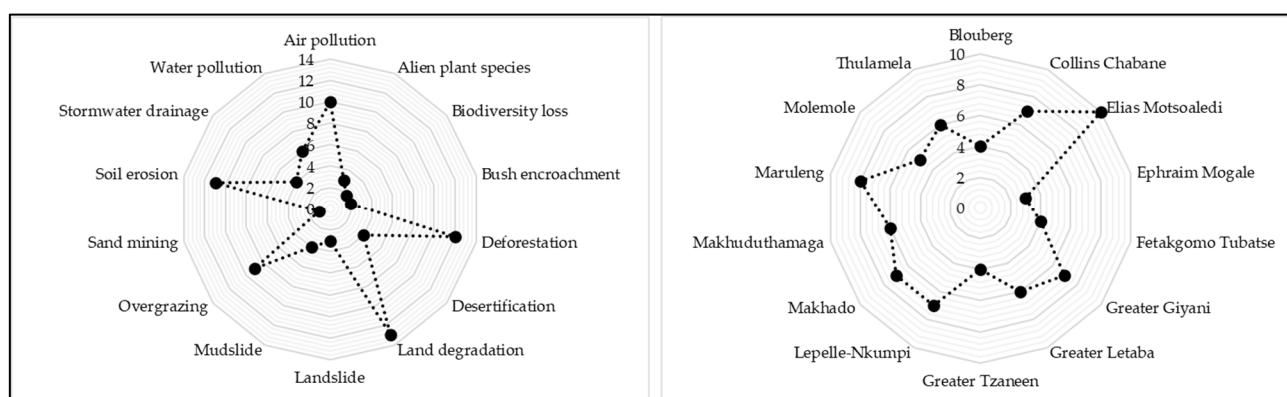
A majority of the IDPs (92.9%) describe local average climatic conditions but rarely present localized climate trends. Only two IDPs (14.3%) characterize local climatic trends (Table S1, Supplementary Materials). In Lepelle-Nkumpi, the IDP even projects changes in local climate up to the 2050s, as follows: declining precipitation and rainfall days and increasing rainfall days, rainfall intensity, dry spell duration, day temperature, extreme temperature days, and heatwave events. Ten other IDPs (71.4%) broadly refer to climate

change and/or global warming and their impacts on South Africa, Limpopo Province, or their local municipality. There is no reference to any climate change scenarios even at the national level.

Several hydroclimatic hazards are identified in the 14 IDPs (Figure 3). The most common hydroclimatic hazards among the 14 IDPs are drought (78.6%), floods (71.4%), veld fires (71.4%), and heavy storms (71.4%). Other less common hazards are hailstorms (35.7%) followed by extreme temperatures (28.6%) and strong winds, hurricanes, cyclones, and heatwaves (21.4%). Erratic rainfall (14.2%) and dry spells (7.1%) are rarely reported (Table S2, Supplementary Materials). More often, reference is made to the effects of climate change and global warming without any specific effects on the local municipality. In Collins Chabane local municipality, climate change is reported to likely increase average temperatures, cause significant changes in rainfall patterns, and increase extreme weather events, giving rise to floods and droughts (Table S3, Supplementary Materials). In some rare instances, such as in Elias Motsoaledi local municipality, hazards are identified and mapped, and a hazard profile compiled. There are no hydroclimatic hazards among the top 10 risks in Ephraim Mogale local municipality (Figure 4).



**Figure 3.** Frequency of localized climatic trends referred across (left panel) and within (right panel) IDPs of mostly rural local municipalities in Limpopo Province ( $n = 14$ ).



**Figure 4.** Environmental vulnerabilities identified across (left panel) and within (right panel) mostly rural local municipalities in Limpopo Province ( $n = 14$ ).

### 3.3. Risk and Vulnerability Assessments

From 14 IDPs for rural municipalities in Limpopo Province, comprehensive risk and vulnerability assessments are largely missing (Table 4). Even in Lepelle-Nkumpi where it indicates that a risk and vulnerability assessment was conducted, it lacks evidence of comprehensiveness. For instance, the proportion of the population that is exposed and at risk to the reported hydroclimatic hazards is lacking. Environmental SWOT analyses were conducted by many local municipalities to identify threats followed by risk analysis and/or assessments (28.6%) to identify priority risks, and risk and/or hazard mapping



(28.6%) to depict areas at risk. For instance, in Elias Motsoaledi, areas that are prone to riverine flooding, severe storms, and hailstorms are identified. In addition, the number of hazards (hydroclimatic and non-hydroclimatic) in each geographic area are also mapped to depict the level of vulnerability, such as the case in Elias Motsoaledi and Ephraim Mogale local municipalities.

**Table 4.** Methods used by local municipalities to identify risks and vulnerabilities.

Method	Proportion (%)
Environmental SWOT Analysis	64.3
In-depth Diagnosis Assessment	7.1
Risk Analysis and/or Risk Assessment	28.6
Risk and Vulnerability Assessment	7.1
Risk Mapping and/or Hazard Mapping	28.6
Vulnerability Assessment Survey and/or Workshop	14.3
Situational Analysis	7.1

Some local municipalities such as Thulamela local municipality used several methods, i.e., risk analysis, risk assessment, and risk mapping. For some local municipalities, such as Collins Chabane, climate change risk and vulnerability assessment is a long-term goal. An in-depth diagnosis assessment conducted by the local municipality, however, identified crop and livestock farmers as being more vulnerable to increasing average temperatures, changing rainfall patterns, and an increase in extreme weather events that give rise to floods and droughts. Makhado local municipality only conducted a vulnerability assessment survey to identify priority risks in the municipality. A majority of the municipalities report a vulnerability to stormwater due to a lack of stormwater drainage.

### 3.4. Disaster Risk Reduction Actions and Early-Warning Systems

#### 3.4.1. Disaster Risk Reduction Actions

The IDPs have some disaster risk reduction and/or preparedness measures, though, in most cases, they are not referred to explicitly as such. None of the IDPs mentions ecosystem-based disaster risk reduction despite having few Eco-DRR measures. Except for Greater Tzaneen Local Municipality, we noted that the DRR measures are not aligned to the hydroclimatic hazards, which they are intended to address. In Lepelle-Nkumpi, the measures are categorized into adaptation and mitigation measures though not aligned to any specific hydroclimatic disasters. The most common measures aimed at the reduction of hydroclimatic disasters in the IDPs are shown in Table 5.

Several IDPs (78.6%) state that specific disaster risk reduction actions are essentially a function of the district municipalities while local municipalities are there to support. However, the disaster management act indicates that local municipalities must actively participate in and include in their plans and strategies measures towards preparedness for emergencies and/or natural disasters.

#### 3.4.2. Disaster Preparedness and Early-Warning Systems

There is no reference to early-warning systems in 93% of the IDPs despite some referring to pre-disaster risk reduction, which includes prevention, mitigation, and preparedness. There is frequent mention of disaster awareness campaigns in the IDPs, which inform the public of impending disasters and what to do in case of disasters. Only one IDP mentions the term “early-warning system” although a few others have what resemble early-warning systems. Lepelle-Nkumpi local municipality relies on the District Management Centre for support and guidance in the event of impending disasters. In addition, early-warning systems for extreme weather events are cited as important but without any existing or planned actions. One IDP even acknowledges that the lack of early-warning systems is a major challenge to flood risk management. Nonetheless, all local municipalities project strong communication strategies and stakeholder engagements.

**Table 5.** DRR actions and preparedness in the IDPs rural local municipalities in Limpopo Province.

Hydroclimatic Hazard	Disaster Preparedness	Disaster Risk Reduction Actions
Droughts Dry spells Erratic rainfall	<ul style="list-style-type: none"> <li>Disaster management plan.</li> <li>Disaster recovery plan.</li> <li>Disaster management center/unit.</li> <li>Disaster management committees.</li> <li>Ward-level communication network.</li> <li>Risk and/or vulnerability analysis.</li> <li>Education and training.</li> <li>Risk management framework/strategy.</li> <li>Relocating vulnerable settlements.</li> <li>Flood forecasting.</li> <li>Flood-proofing—constructing buildings to reduce the potential for flood damage.</li> <li>Warning systems.</li> <li>Protection forests.</li> <li>Risk/hazard mapping.</li> <li>Provision of disaster relief.</li> </ul>	<ul style="list-style-type: none"> <li>Wetland rehabilitation—remove alien species.</li> <li>Drought tolerant plants.</li> <li>Bulk water and irrigation schemes (including use of grey water).</li> <li>Agricultural practices.</li> </ul>
Floods Heavy/severe/intense storms	<ul style="list-style-type: none"> <li>Ward-level communication network.</li> <li>Risk and/or vulnerability analysis.</li> <li>Education and training.</li> <li>Risk management framework/strategy.</li> <li>Relocating vulnerable settlements.</li> <li>Flood forecasting.</li> <li>Flood-proofing—constructing buildings to reduce the potential for flood damage.</li> <li>Warning systems.</li> <li>Protection forests.</li> <li>Risk/hazard mapping.</li> <li>Provision of disaster relief.</li> <li>Wetland rehabilitation.</li> <li>Response plans.</li> <li>Dam management.</li> <li>Awareness campaigns (disaster risk and environmental).</li> <li>Integration of climate change into decision making.</li> <li>Catchment management.</li> </ul>	<ul style="list-style-type: none"> <li>Zoning and land-use control.</li> <li>Dam construction and management.</li> <li>Construct retention basins and diversion channels.</li> <li>Construct buildings to reduce the potential for flood damage.</li> <li>Protection forest and nature reserves.</li> <li>Stormwater drainage/control systems.</li> <li>Disaster relief.</li> </ul>
Heatwaves Hot temperatures	<ul style="list-style-type: none"> <li>Wetland rehabilitation.</li> <li>Response plans.</li> <li>Dam management.</li> <li>Awareness campaigns (disaster risk and environmental).</li> <li>Integration of climate change into decision making.</li> <li>Catchment management.</li> </ul>	<ul style="list-style-type: none"> <li>Tree planting.</li> <li>Conserving nature reserves.</li> </ul>
Strong winds Hailstorms	<ul style="list-style-type: none"> <li>Wetland rehabilitation.</li> <li>Response plans.</li> <li>Dam management.</li> <li>Awareness campaigns (disaster risk and environmental).</li> <li>Integration of climate change into decision making.</li> <li>Catchment management.</li> </ul>	<ul style="list-style-type: none"> <li>Planting of trees to form windbreakers.</li> <li>Proper building construction: training the community in building practices.</li> </ul>
Hurricanes	<ul style="list-style-type: none"> <li>Wetland rehabilitation.</li> <li>Response plans.</li> <li>Dam management.</li> <li>Awareness campaigns (disaster risk and environmental).</li> <li>Integration of climate change into decision making.</li> <li>Catchment management.</li> </ul>	
Cyclones	<ul style="list-style-type: none"> <li>Wetland rehabilitation.</li> <li>Response plans.</li> <li>Dam management.</li> <li>Awareness campaigns (disaster risk and environmental).</li> <li>Integration of climate change into decision making.</li> <li>Catchment management.</li> </ul>	
Veldfires	<ul style="list-style-type: none"> <li>Wetland rehabilitation.</li> <li>Response plans.</li> <li>Dam management.</li> <li>Awareness campaigns (disaster risk and environmental).</li> <li>Integration of climate change into decision making.</li> <li>Catchment management.</li> </ul>	<ul style="list-style-type: none"> <li>Enforcement of the National Forest Veld Fire Act.</li> <li>Upkeep and maintenance of fire breaks.</li> </ul>

### 3.5. Financing Mechanisms

All the local municipalities finance disaster risk reduction using internally generated revenue. The plans never identify those actions that require external funding despite this often coming from district municipalities, national government, private sector, and/or non-governmental agencies.

## 4. Discussion

In rural areas, disaster risk reduction is critical for safeguarding livelihoods that mostly depend on natural ecosystems. The same natural ecosystems remain critical to reducing disaster risks and poverty, while also enhancing livelihoods and climate change adaptation [5,33]. However, the extent to which mainstreaming of ecosystem-based disaster risk reduction into local development planning remains low and haphazard, as shown by previous studies [5]. This assessment revealed that all the rural local municipalities in Limpopo Province mainstream disaster risk reduction into the IDPs. Unfortunately, none of the IDPs explicitly refers to ecosystem-based disaster risk reduction despite having some measures that resemble such. Another study elsewhere found that while ecosystem-based measures are integrated into national plans, such was not the case at the local level where much focus remains on biodiversity conservation rather than reduction of disaster risks [18]. This is despite numerous studies showing several co-benefits of ecological infrastructure and their adaptability to incremental climate risks [10,34–36]. For instance, stormwater management can be enhanced using ecological infrastructure that may span across various governance levels [5,18].

The lack of localized climate trends in the majority of the IDPs could suggest that the hydroclimatic hazards identified in the plans are not informed by scientific evidence. The hydroclimatic hazards outlined as affecting the local municipalities are largely informed by local knowledge. Such lack of integration between technical and traditional knowledge, and overreliance on the latter, highlights important shortcomings of the planning process as reported elsewhere [28,37]. For instance, except for the few IDPs that outline climate trends, most hydroclimatic hazards identified neither indicate their severity nor probability of occurrence. Arguments that the local municipalities in the province experience a similar

climate are often dangerous for local planning. Most of the local municipalities are large and sufficiently far apart to experience different weather patterns, particularly for rainfall, which could vary greatly over shorter distances compared to temperature [38,39].

While almost all the IDPs highlight the importance of public participation and make efforts to engage various stakeholders, especially the local communities, these engagements lack in many ways, as noted elsewhere in Africa [16,28]. Firstly, engaging local communities through ward committees presents its challenges. For instance, members of ward committees are volunteers and often lack the requisite skills and capacity to effectively engage local communities. Without the skills, their capacity to develop and review ward development plans as critical inputs into the IDP process becomes limited [5]. Secondly, the friction between ward committees and community development workers scuttles community-based planning—ward committees are supposed to incorporate community development workers in each ward. Nonetheless, the presence of the IDP Representative Forum in all local municipalities provides a necessary structure that institutionalizes and guarantees representative participation in the IDP process by diverse stakeholders.

If the DRR actions are not reflective of the community needs, their implementation is likely to be a challenge, and community participation in the implementation and monitoring is likely to be minimal [26,40]. A recent study in Namibia also argues that gender-blind actions could perpetuate long-standing inequalities and limit sustained climate change adaptation action [16]. However, participation and engagement are different, the latter being preferable since participation is often taken as an end itself. Moreover, when participation is framed within the paradigm of ‘informing and consultation’, it can easily become tokenism. This provides no guarantee that views brought forth by stakeholders will be heeded by those in authority [28,40].

While the local municipality councils—comprising ward councilors and mayors—manage, coordinate, and monitor the IDP processes, actual planning is by sector departments that contribute technical knowledge, the private sector that provide information on available opportunities in the communities, and CoGHSTA, which ensures horizontal alignment of IDPs. Other stakeholders that participate in the IDP Representative Forum, such as civil society, ward committees, community development workers, and the media, inform and consult on the various interests of the community. Although these stakeholders assist communities to identify and prioritize needs, discuss, and comment on the draft IDP, and monitor the performance in the implementation of IDPs, the general lack of vulnerability assessments and knowledge of priority risks, areas, and populations at risk, and actions necessary to moderate risks limit the participation by local communities [41]. Thus, the efforts and measures by the IDPs to reduce hydroclimatic risks are largely based on limited information, which makes it difficult to guess their outcomes for purposes of monitoring as noted elsewhere [28,29]. For instance, soil type and vegetation cover greatly influence infiltration, and so influence flooding, yet such information is lacking in many IDPs [42].

When the disaster reduction measures are outlined, except for Greater Tzaneen Local Municipality, they are not aligned with the hydroclimatic risks they seek to address. Thus, it presents challenges with regard to monitoring their effectiveness in reducing disasters. Nonetheless, we note that, in some cases, a single action could address several hydroclimatic risks [43,44]. One plan (Lempelle-Nkumpi) outlines measures aimed at disaster mitigation and adaptation. Actions to address droughts are less common in the plans but include drought-tolerant plants and the provision of bulk water and irrigation schemes (including the use of grey water). Storm water drainage, protection forests and nature reserves, dam construction, and land-use control are among the common flood control measures as also noted by a recent study in South Africa [10]. Without information on the severity and frequency of hydroclimatic disasters, including the area and population at risk, it is difficult to judge the adequacy of these measures [1,28]. Early-warning systems are absent in all the plans, save for the awareness campaigns (disaster risk and environmental) by some local

municipalities, as noted in studies elsewhere [15]. This greatly limits disaster preparedness and the implementation of disaster management plans.

The limited financing mechanisms of DRR by local municipalities motivate the need for mainstreaming Eco-DRR, as these are increasingly attracting external funding. For instance, the South African National Biodiversity Institute (SANBI) is spearheading ecosystem-based projects in several locations in South Africa [45]. Enhancing the presence of Eco-DRR actions that are informed by risk and vulnerability assessments in IDPs could be a precursor to SANBI's scaling-up of ecosystem-based projects in vulnerable regions in South Africa, which are in line to be co-funded through the Green Climate Fund (GCF). Thus, local municipalities in Limpopo Province—one of the vulnerable regions in South Africa—have a unique opportunity to attract such projects by increasing the presence of Eco-DRR measures in their IDPs and identifying priority projects to address specific hydroclimatic disasters.

Thus, our assessment suggests the mainstreaming of Eco-DRR in the upcoming IDPs by local municipalities. There exist several opportunities in the current IDPs to integrate ecosystem-based within the wider scope of disaster risk reduction in the local municipalities. Based on our assessment, we proffer the following recommendations:

The first recommendation is that the DRR in the IDPs should be based on, and informed by, comprehensive vulnerability and risk assessments, i.e., include localized climate trends, and identify priority hydroclimatic risks, areas, and populations at risk [28]. The DRR measures should be aligned to the hydroclimatic risks that they are addressing and indicate their targets in terms of disaster reduction. For instance, they could indicate the extent of disaster risk reduction within the five years of their duration. The district municipalities and the provincial government, therefore, need to continuously guide and support local municipalities and not just end at one-off IDP preparation workshops.

Secondly, ward committees need to be trained and skilled to enhance their capacity in engaging their communities. As the link between the community and the IDP process, they require astute skills in community-based planning, conducting situational analysis, and monitoring and reviewing the performance of the IDPs [5]. Ward committees should smoothly integrate community development workers to avoid friction and the duplication of duties if they are to enhance their effectiveness.

Thirdly, the local municipalities need to have Eco-DRR measures that are fundable to attract external finance. However, this requires local municipalities to take full responsibility for the DRR in their areas of jurisdiction rather than depending on the district municipalities for most of their DRR needs [5,28]. Moreover, the IDPs should also specify which measures they are funding and specify those which require external funding rather than leaving it to the imagination of what the available budget is likely to cover.

Lastly, one major investment by external funders should focus on is the setting up of modern weather stations in different local municipalities and co-developing early-warning systems with local communities as these are non-existent in the local municipalities considered. However, the early-warning systems need to integrate both technical and indigenous knowledge of the local communities. Early-warning systems need to also be integrated into, and take advantage of, the strong presence of communication and public participation strategies in the local municipalities.

## 5. Conclusions

This study assessed the development plans of 14 rural local municipalities in South Africa's Limpopo Province and examined the extent to which they mainstreamed ecosystem-based disaster risk reduction to foster a sustainable and just transition to a lower carbon economy under a changing climate. Initially, the paper provides an overview of the planning process. Thereafter, we present empirical evidence of each of the assessment criteria that guided the assessment and helped to identify entry points for mainstreaming Eco-DRR into local development planning.

Localized climate trends are largely missing from the plans. Except in one local municipality, DRR actions are not aligned with the hydroclimatic risks that they seek to address.

The lack of vulnerability and risk assessments from most of the actions highlighted some critical deficiencies, which suggest that public participation is not genuine. The DRR actions are less informed by actual community needs despite public participation being prominent in all the IDPs. This was attributed to poor attendance at public participation events and the lack of capacity among some ward committees to effectively engage their communities. Despite several disaster preparedness measures, such as disaster management plans, setting up of disaster management centers, and setting aside protection forests and nature reserves, early-warning systems are non-existent in all the plans, save for the few awareness campaigns mentioned by some IDPs.

Although all the IDPs address disaster risk reduction, the mainstreaming of Eco-DRR, in particular, is non-existent at the moment, with much focus on biodiversity conservation instead. The non-existence of Eco-DRR in almost all the plans is a unique opportunity for local municipalities to attract external funding for DRR actions. However, they need to first mainstream Eco-DRR actions in such a way that they become bankable projects that attract such investments. Just like DRR actions, Eco-DRR projects need to be informed by actual community needs. Thus, genuine public participation and engagement are critical such that plans are reflective of this.

It is high time that local municipalities become less dependent on the district municipalities for much of their disaster risk reduction when, in fact, they are mandated to place measures to reduce disasters in their jurisdictions. A framework to assist local municipalities in rural South Africa with mainstreaming Eco-DRR actions into their development plans is thus required but needs further research. Such a framework should benefit from risk and vulnerability assessments and co-created early-warning systems. In addition, ward committees need to be knowledgeable about ecosystem-based disaster risk reduction and be capacitated to effectively engage communities, conduct situational analyses, enhance community-based planning, and review plans so that they can enrich the IDP process. Eco-DRR measures that are co-produced with local communities tend to gain more traction during implementation and are often sustainable. Otherwise, failure to mainstream and institutionalize Eco-DRR in local development planning will constrain climate change adaptation and a sustainable, just transition to a low-carbon economy.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su141912368/s1>. Table S1. Localized climate trends mentioned by rural local municipalities in Limpopo Province; Table S2. Hydroclimatic hazards referred to by rural local municipalities in Limpopo Province; Table S3. Environmental vulnerabilities identified by rural local municipalities in Limpopo Province.

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