The Central American Dry Corridor: a consensus statement and its background

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Introduction

A unique gathering of climate, development and environmental experts took place from September 25-28, 2017 in San José and Guanacaste Province, Costa Rica. The subject of their deliberations was the Central American Dry Corridor (CADC)[1], which extends along the Pacific littoral from western Guatemala through northern Costa Rica[2]. This trans-frontier territory includes a population approaching 11 million, roughly a quarter of Central America's total population. The CADC is a mainly rural area characterized by a marked precipitation seasonality, climate change vulnerability, rich biodiversity, entrenched poverty, food insecurity and outmigration.

The specialists attending the conference inaugurated both the Integrated Program on the Central American Dry Corridor (IPCADC)[3] and its first project, Space of Advanced Studies of the University of Costa Rica (Estudios Avanzados de la Universidad de Costa Rica - UCREA), which focuses on the Guanacaste Province, with the financial support of a grant provided by the University of Costa Rica[4]. The experts attended lectures, participated in field visits, and pooled information regarding the common challenges that the CADC presents. Hailing from all of the countries of the CADC as well as Israel[5], the experts engaged in an intensive exchange of experiences relating to Dry Corridor conditions and the difficulties engendered by a changing environment that impedes development.

Following three days of site visits in and adjacent to the Costa Rican Dry Corridor, there was ready agreement among the participants concerning the common challenges that the CADC presents. Consensus was reached relating to

1 Known in Spanish as the *Corredor Seco Centroamericano*.
2 Some studies include the Dry Arc (*Arco Seco*) of Panama as part of the CADC due to shared climatic and socioeconomic conditions. However, the Dry Arc areas is geographically detached at a distance of approximately 600 km from the southern reaches of the CADC (in Guanacaste Province, Costa Rica) and for this reason it is not currently included in the CADC discussions presented here.
3 El Programa Integrado del Corredor Seco Centroamericano (PICSC) in Spanish.
4 Funded by the UCR's Center for Advanced Studies, the UCREA investigators will research two field sites in the Guanacaste Province and make recommendations relating to building resilience to climate change variability and climate change. The methods to be applied and the lessons gained will inform similar studies elsewhere in the CADC. More information about the IPCADC-UCREA project can be obtained at http://cigefi.ucr.ac.cr/ucrea-picsc/
5 The IPCADC, an intra-regional and international collaboration, was initiated by several of the coauthors, Yosef Gotlieb of Israel and Hugo G. Hidalgo and Eric J. Alfaro of Costa Rica.

priorities and a common approach to ameliorating the situation in the CADC, namely that the adaptive capacity of the regional populations must be fortified to make their communities resilient to climate variability and climate change. A statement to that effect was read at the conference's final session where government officials, representatives of nongovernmental organizations and the public had been invited

This paper describes the shared characteristics and environmental and socioeconomic challenges projected for the CADC that informed this Consensus Statement. It proceeds by discussing the physical, ecological and socioeconomic continuities that characterize this region, how the field tour of Guanacaste contributed to clarifying the challenges encountered throughout the CADC, and the key messages inherent to the Consensus Statement.

CADC Characterization and Background

The CADC is an area of the Central America (CA) land bridge situated between the northern and southern American continents. The width of this isthmus varies between 100-400 kilometers and its length is more than 1,600 km. Characterized by volcanic mountain ranges, the isthmus extends along a northwesterly to southeasterly axis. In terms of terrain, the CADC is mainly mountainous with sharp declines to sea level on the approach to the Pacific Coast with approximately 16% of its land area lying at elevations of five meters or less (Center for International Earth Science Information Network [CIESIN], 2013). This topography along with its proximity to two great bodies of water (the Caribbean Sea and the Pacific Ocean), each with distinct but interacting weather systems, greatly influence the climates, biodiversity and natural resource endowment of the region.

The delineation of the CADC varies from study to study. One often cited definition is based on the Climate Risk Index as applied by (Centro Internacional de Agricultura Tropical [CIAT]-World Bank and United Nations Environmental Programme [UNEP] (1999). It includes those areas on the isthmus that exhibit a dry season of at least four months in duration, as depicted in Figure 1.

Figure 1. The CADC defined by drought risk

Satellite data indicates that forest cover throughout the CADC countries declined by 7.9% during the period from 2001-2016 (Hansen et al. 2013) largely due to unsustainable land use practices (Fund & Hogan, 2014) and agriculture and ranching generally (Magrin et al., 2014).

Climate.

The CADC is characterized by a drier climate than the other areas of Central America and is prone to drought (Pennington, Lewis and Ratter, 2006). It has a well-defined and long dry season in boreal winter, a marked Mid-Summer Drought (MSD; see Maldonado, Rutgersson, Alfaro, Amador and Claremar, 2016) in July-August, and frequent dry spells during the wet season (Peralta, Carrazón and Zelaya, 2012), normally from May to October. The annual rainfall is characterized by a bimodal distribution with two peaks located in June and September (Taylor and Alfaro, 2005). The warmest season is March-April and the minimum temperatures are normally registered in December-January (Taylor and Alfaro, 2005).

The Intergovernmental Panel on Climate Change (Inter-Governmental Panel on Climate Change [IPCC], 2014) warns that severe climate change-related events have already affected Central America and while it does not specify observations and projections for the CADC in particular, it notes that increased warming has already been

observed for the region as a whole and predicts a continuation of the trend throughout the century. These same observed tendencies and projections apply to stream runoff and water availability, particularly due to precipitation reduction and evapotranspiration in semi-arid areas, with a likely negative effect on urban areas, agriculture and hydroelectrical generation (Magrin et al., 2014) and which will significantly threaten ecosystems (Magrin et al., 2007). The Climate Change Index indicates that three of the five CADC countries (Honduras, Nicaragua and Guatemala) are in the top ten countries world-wide most at risk of severe climate change effects (Kreft, Eckstein, Dorsch and Fischer, 2015). Hidalgo, Amador, Alfaro and Quesada (2013) found an increase in the aridity of the region, especially for those countries located in the north of the isthmus.

The impacts of droughts, floods and other extreme hydro-meteorological events threaten food security (Amador, Alfaro, Hidaldo, Durán and Calderón, 2016) given the dependence of the population on subsistence agriculture (Peralta, Carrazón & Zelaya, 2012; van der Zee Arias, van der Zee, Meyrat, Poveda & Picado, 2012a;b; Perez-Briceño, Alfaro, Hidalgo & Jiménez, 2016).

Biodiversity and Environmental Services.

Central America boasts seven percent of the world's biodiversity (CCAD, 2003; Nature Conservancy, 2017) and is characterized by a high proportion of the world's tropical forests, large numbers of mammalian, reptilian and amphibian species and is distinguished by a high level of endemism (Harvey, Alpizar, Chacón & Madrigal, 2005). This natural wealth notwithstanding, species and habitat loss due to deforestation and other anthropogenic practices are reducing the region's natural biological endowment on land, in inland waters as well as in coastal marine areas. Many flora and fauna species are endangered or threatened (Harvey et al., 2005).

While tropical rain forests may have a greater number of species than tropical dry forests, the multitude of species found in the latter is enormous, as Janzen (1988) noted with respect to the Santa Rosa National Park in Guanacaste, Costa Rica (see also Ariano-Sánchez, 2018; Gillespie, Grijalva and Farris, 2000; Griscom and Ashton, 2011). Further, areas of the CADC such as the Guanacaste Conservation Area (GAC) is the wealth of ecosystem and habitat diversity and its interconnectedness to other ecosystems including wet tropical forests along the Caribbean (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2017).

Socioeconomic Dimension.

The CADC is characterized by a high degree of social vulnerability. Subsistence farming supports an estimated one million families (Food and Agricultural Organization [FAO], 2015a) and an estimated 60% of its inhabitants live under varying conditions of poverty (van der Zee Arias *et al*., 2012a; 2012b). Most livelihoods depend on the production of basic grains such as rice, beans and maize (FAO, 2015). The majority of this land is low yield due to a lack of commercial and irrigation technology. Only 2.4 percent of cultivated land is irrigated (Ramírez *et al.*, 2010).

Against this background the potential for continuing crisis in the region is clear. "Even without additional stress from climate change, the region has multiple risk factors for instability including areas vulnerable to water stress, high birth rate, crop decline, hunger, the risk to coastal communities due to sea level rise, and a history of recent conflict" (Fetzik, 2009). Poverty and extreme poverty is profound in the CADC countries, as indicated by figure 2 (Economic Commission for Latin America and the Caribbean [ECLAC], 2015).

The agrarian communities of the CADC especially in the northern states are at particular risk to increased aridity deriving from global warming (Hidalgo et al., 2017) given their dependence on natural resources, especially water, for their subsistence-oriented activities. Aggravating these risks are the observations of an increasing number of extreme hydro-climatic events such as flooding which are the result not only of physical but social factors that increase vulnerability (Hidalgo and Alfaro, 2012; Pérez-Briceño et al., 2016).

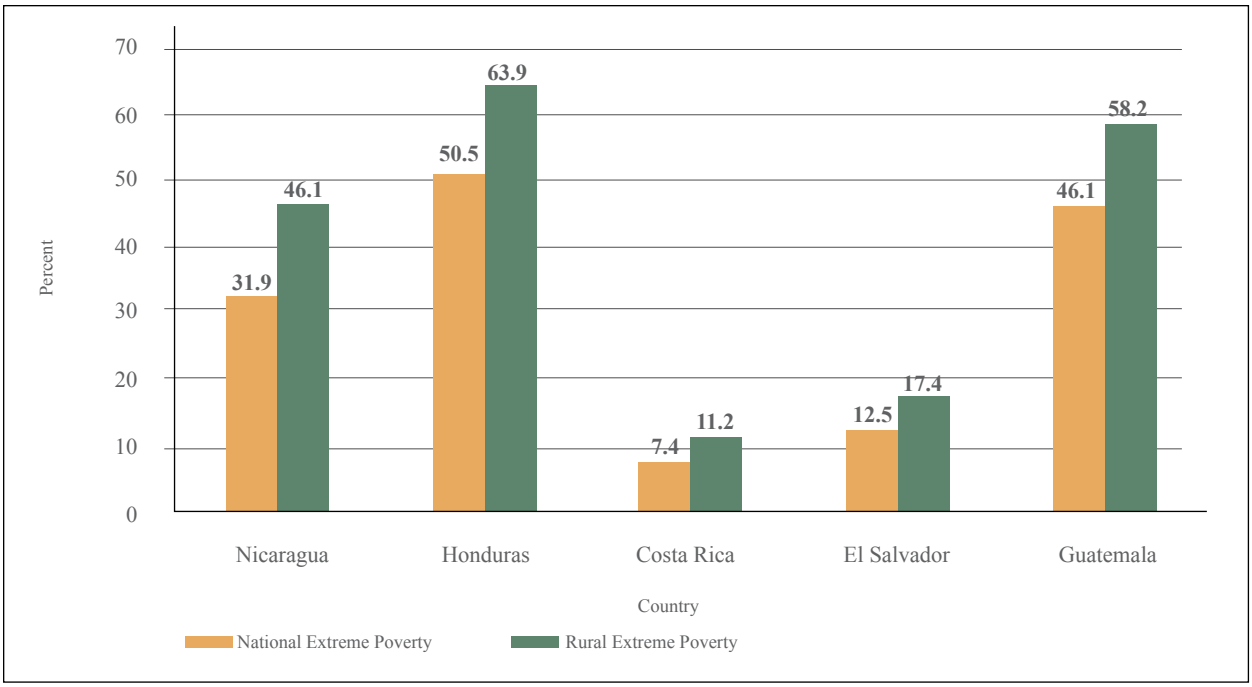

Figure 2.

Percent Population Below Extreme Poverty Line. Source: CEPALSTAT, 2018.

Guanacaste as a Microcosm.

The UCREA Project entails the intensive field study to be conducted in two communities of Guanacaste representatives of others elsewhere in the CADC (Representative Areas (RAs). On the basis of these studies, guidelines for the development of these communities will be formulated. Lessons gained from the study of the RAs during the UCREA Project are anticipated to provide lessons for application elsewhere in the Dry Corridor during the planned five-year lifespan of the IPCADC.

In 2012, 39% percent of Guanacaste's population was considered poor, while 14.6%, lived in extreme poverty, compared to the Costa Rican averages of 23.6% and 7.2%, respectively. The number of households categorized as poor were 34.5% of the total and those classified extremely poor represent 12.6% of the total. Of these poor households some 44.1 are headed by women. The average income is 60,694 Costa Rican colones (approximately $119 in current USDs) per month, or two thirds of the national average (Ministerio de Planificación Nacional y Política Económica [MIDEPLAN], 2014). A major reason for this situation is unemployment, chronic unemployment and a lack of opportunities (MIDEPLAN, 2014).

In Guanacaste, the impacts of natural climate variability are manifested principally in terms of water supply and the economic activities that depend on them. Changes in observed precipitation trends appear to date to be marginal, but as is the case in a large part of Central America, warming trends are significant and widespread (Hidalgo et al., 2017). Warmer temperatures augment the demand of water from the atmosphere, increasing aridity and resulting in drier soils. Anthropogenic CC will worsen this, as projections suggest greater aridity at the end of the century (Hidalgo et al., 2013; 2017). Yet, the concern that figures more prominently among Guanacaste's farmers today are extreme events such as episodic flooding and severe droughts mainly deriving from the yearly fluctuations of El Niño y La Niña events (natural causes) which exacerbate their existing socioeconomic vulnerabilities.

The Costa Rican Index of Social Development, identified three of Guanacaste's districts as being at the country's lowest level of social development and states that all of the 11 cantons or municipalities (e.g. sub-provincial governmental units) in the province have districts (local-level administrative division) with low level development (MIDEPLAN, 2017). The

representative aspect of the localities visited was commented on by participants from the other countries, who identified conditions to those existing in their own Dry Corridor communities.

One of the localities visited was Cuajiniquil in the Santa Elena district where the Junquillal Bay Wildlife Sanctuary[6] a combined marine-forestry nature reserve that is part of the Guanacaste Conservation Area,[7] is located. The inhabitants of an adjacent coastal community are in a state of crisis that includes food insecurity and unemployment owing to their inability to continue fishing, which had been their primary economic activity. Overfishing as well as effects that appear to be climate-related (see Moreno, Moya and Alfaro, 2017) have largely emptied local waters of sufficient stocks to support them. These people are searching for alternative livelihoods to preserve their community and stanch the outmigration of youth seeking prospects elsewhere. Among the options, they are considering are agricultural pursuits and rural tourism based on home hospitality. At present they have little experience and few resources to pursue these activities.

"A few days after the conference participants' visit, a fierce tropical storm, Nate, ravaged Cuajiniquil and much of northern Guanacaste.

The environmental impacts left the storm in the region were evident months later when visits by several of the authors.[8] The entire area was affected with some families losing all their assets, including homes and livestock resulting in food insecurity.

Key Messages

During the participants' discussions following the Guanacaste visit, a number of common positions readily emerged and would later be formulated in a Consensus Statement (*Declaración de participantes*; see page 51).

In the preamble to this document, the participants note that they had attended the gathering in light of "various scientific analysis and studies that indicate that the CADC is one of the areas [of the world] most vulnerable to climate change in socioeconomic and biophysical terms." Accordingly, they assembled "mindful of the necessity, responsibility and urgency of taking action in advance of the adverse effects of climate change in the Central American Dry Corridor region."

The points of agreement expressed in the Consensus Statement concerning such action include the following key messages:

Message One: Pivotal to appropriate action is understanding how the dynamics of climate change will specifically affect the CADC (as opposed to a generalized view of effects expected in Central America);

Message Two: The CADC has the characteristics of a distinct territory, though each community is "different with respect to the problematics of development it faces."

Message Three: Effective research initiatives and programs of action deriving from them will necessarily be multi-sectoral, encompassing environmental, economic, social, human, political and institutional dimensions, due to the interwoven nature of the realities in the predominantly agrarian Dry Corridor. The participants resolved that "Our research will be multidisciplinary, including the natural and social sciences…they are indivisible in order to achieve integrated development."

Message Four: Notes that "the effects of extreme events like drought and floods especially affect the populations with the highest levels of poverty, causes losses in productive activities (agriculture, ranching and fishing), changes life conditions and creates inequalities on the distinct territorial levels." Accordingly, it was determined that the first priority is to focus on those communities that are the most vulnerable to food insecurity and resource degradation and lose. "Food First" was adopted as a guiding principle and communities that are most imperiled should be the first to be assisted within the framework of integrated development programs.

Message Five: To achieve food security throughout the region, the participants affirmed

6 https://www.acguanacaste.ac.cr/turismo/sector-junquillal
7 http://www.sinac.go.cr/EN-US/ac/acg/Pages/default.aspx
8 Eric Alfaro, Yosef Gotlieb, Hugo Hidalgo (in Guanacaste).

that an immediate objective was the appropriate management of the essential resources [soil, water, land].

Message Six: While the Program should "identify the basic needs of people, prioritizing those who are most vulnerable," it should also "take into account the needs of the various countries and promote the necessary alliances between the distinct sectors (public, private, civil society and academic) with the objective of coordinating and strengthening forces" for development.

Message Seven: The experts stated the importance of the regional academic community in supporting "strategies and approaches to sustainable integrated development based on interventions that are science- and research-based."

Message Eight: The importance of "learning from the experiences of other countries like Israel, which have developed technologies and innovations in the efficient management of their scarce natural resources, especially water and soil in various states of aridity," was stressed. "We are confident that we can replicate these in the Central American countries in dialog with experts in the spirit of friendship, solidarity and collective action," the document reads.

The participants' endorsed the organizers' proposed action-research and planning guidance approach, which is based on the premise that while the communities of the CADC share many physical and socioeconomic characteristics, the context in which interventions for development and climate change adaptation takes place is at the micro and meso levels where the physical setting and state of human development vary. Accordingly, solutions must be place-specific. Yet, given that it is not possible to study each community individually, identifying RAs for intensive study is necessary. This entails formulating a typology of physically and socially similar communities characterized by similar environments and systems of production (ex. coastal fishing, highlands subsistence farming).

Conclusion

The inaugural meeting of the IPCADC brought together experts from all five of the countries in the contiguous Dry Corridor region and provided an opportunity for knowledge enrichment, the sharing of experience and discussion of shared challenges and potential solutions.

The participants in the workshop have noticed that several analysis and scientific studies indicate that the actual state of the CADC is one of the most vulnerable areas to climate change, due to its social-economical and biophysical context. The effects of extreme events such as droughts and floods impact population with high levels of poverty, causing losses in productive activities and livelihoods, generating unequal development at different territorial levels.

That a Consensus Statement advocating joint research, educational exchanges, coordinated planning and ongoing exchange was so readily achieved despite the distinct national realities, attests to the urgency of their common challenges, the shared experience of the CADC communities, and the importance of cooperative action. Guidelines for an action plan resulted from the meeting and the desire to collaborate in pursuing this plan in the IPCADC framework were noteworthy.

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Ápendice 1

Universidad de Costa Rica
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Centro de Investigaciones Geofísica
Taller UCREA - PICSC

Declaración de participantes del Taller UCREA-PICSC

25-29 sept, 2017

En el marco del Taller UCREA, como parte del Programa Integral del Corredor Seco Centroamericano (PICSC) celebrado en las provincias San José y Guanacaste en Costa Rica del 25 al 29 de septiembre de 2017, representantes de Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica e Israel, conscientes de la necesidad, responsabilidad y urgencia de tomar acciones ante los efectos adversos del cambio climático en la región del Corredor Seco Centroamericano, expresamos que:

Se tienen varios análisis y estudios científicos que indican que el Corredor Seco Centroamericano es una de las áreas más vulnerables al cambio climático debido a su contexto socio-económico y biofísico. Los efectos de eventos extremos como sequías e inundaciones afectan especialmente a las poblaciones con altos niveles de pobreza, ocasionando pérdidas en las actividades productivas (agricultura, ganadería y pesca) y medios de vida, generando desarrollo desigual en los distintos niveles territoriales.

A pesar de que ya existen distintas acciones y proyectos en las áreas del Corredor Seco de cada uno de los países de la región, creemos que es necesario unir esfuerzos a nivel regional tomando en cuenta las similitudes y continuidades de nuestros territorios. Visualizamos el área como una unidad de trabajo, considerado como un solo territorio percibido desde las distintas dimensiones del desarrollo: económico, ambiental, social, político-institucional, cultural.

En ese sentido, definimos y coincidimos en que el objetivo principal del Proyecto es establecer los recursos esenciales para mejorar la calidad de vida de las comunidades en la región. Nuestra investigación será multidisciplinaria, incluyendo a científicos naturales y sociales porque no es posible separar los temas para lograr un desarrollo integral.

Consientes que no es posible abarcar todo el territorio, se identificarán espacios representativos relativamente homogéneos, pero diferentes en relación a su problemática de desarrollo dentro del CSC.

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Para lograrlo, se realizará investigación en 3 niveles espaciales:

- Macro, que abarca toda la región del CSC y para lo cual se están elaborando índices naturales y humanos.
- Meso, como partes integrales de unidades física (cuencas o microcuencas) o política-administrativa (municipios o cantones); y
- Micro, a nivel de comunidad, pueblo o grupo de pueblos.

Esperamos identificar las necesidades básicas de las personas, priorizando a las más vulnerables, pero también tomando en cuenta las necesidades de los países, fomentando las alianzas estratégicas entre los distintos sectores (público, privado, sociedad civil y academia) con la finalidad de coordinar y fortalecer los esfuerzos.

Aprendiendo de la experiencia de otros países como Israel, que ha desarrollado tecnología e innovación en la gestión eficiente de los escasos recursos naturales que poseen, especialmente agua y suelo, bajo escenarios de alto nivel de aridez. Conocimientos que pueden ser replicados en los países centroamericanos, a través del diálogo de saberes, basados en un espíritu de amistad, solidaridad y acción colectiva.

Es de suma importancia recalcar la necesidad de integración académica regional, para lo cual reiteramos nuestro apoyo en las estrategias y propuestas de desarrollo integral sostenible, basadas en medidas fundamentadas en la ciencia e investigación.

Agradecemos a todas las personas vinculadas en el Taller UCREA, desde los organizadores hasta las personas que nos recibieron en los sitios de visita, y felicitamos la presente iniciativa de colaboración Israel-Centroamérica para fortalecer el desarrollo sostenible y adaptación al cambio climático.

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