A tool for Measuring Vulnerability and Resilience of Indigenous Communities to Climate Change ©

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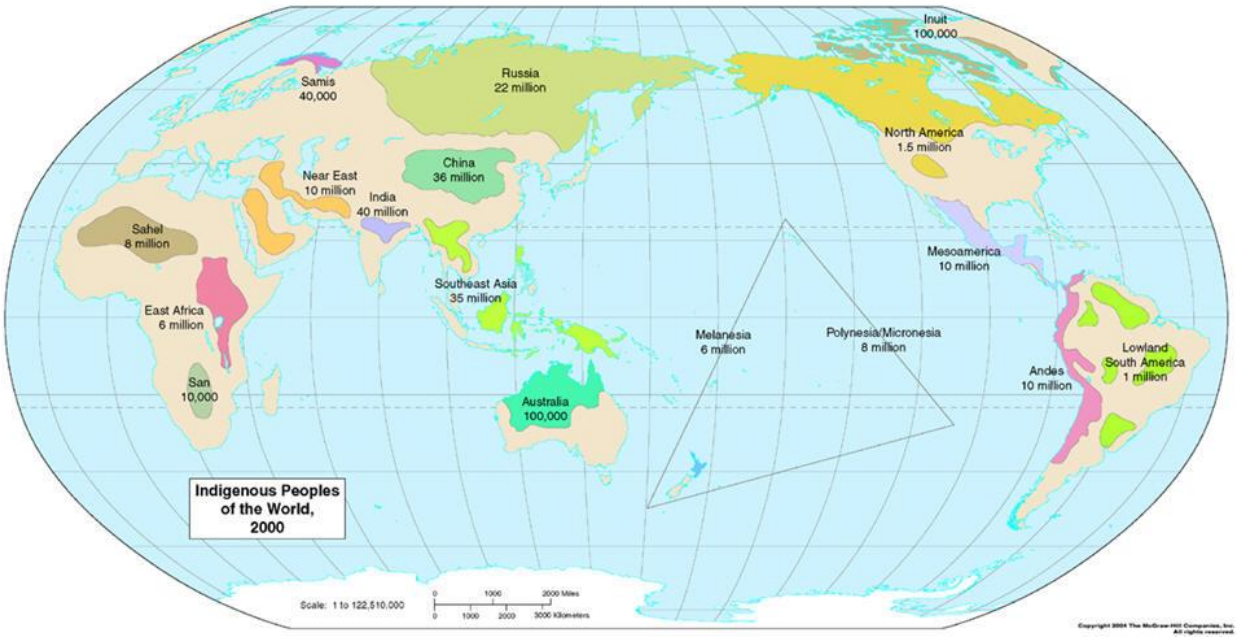
Map of Indigenous Peoples of the World (2000)



http://www.westga.edu/~gvanvale/map_of_indigenous_people.htm accessed Sept.30 2013

Part I: Concepts for Measuring Indigenous Vulnerability and Resilience

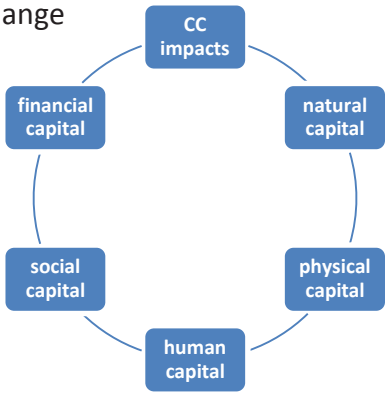
The UNFCCC in 2008 selected a set of methods and tools to *evaluate impacts of vulnerability and adaptation to climate change*. Updates and new frameworks are substantially moving evaluation methods for vulnerability - forward. Nevertheless, the UNFCCC called for the inclusion of "indigenous peoples, women and forest peoples" in a global framework to ensure forests are "conserved and benefits captured by marginal groups". The Convention calls for their inclusion as an indicator for assessment of "efforts of the LDCs and their development partners in addressing vulnerability of the LDCs".[1] UNFCCC's identification of indigenous peoples as an indicator of participatory assessment stems from the difficulty in asserting international policy standards for indigenous participation to national level policymakers and national adaptation planners.

Indeed, governments are challenged as to how to include indigenous knowledge about climate. Their inclusion both informs and challenges top down national adaptation planning based on modeling with SRES climate scenarios. Indigenous have been identified by UN bodies as both among the *marginal* and *most vulnerable to climate change* [2], and as peoples who have *specialized knowledge about ecosystems impacted by climate change*.[3] This essay attempts to positively addresses this asymmetrical status by proposing a tool
for measuring indigenous vulnerability and their capacity for adaptability to the impacts of climate change in order that they may contribute to the bottom and the top of the adaptation planning process. A measurement tool is proposed to help narrow the gap between consideration of indigenous as *subjects* of adaptation and indigenous as *agents* of adaptation.

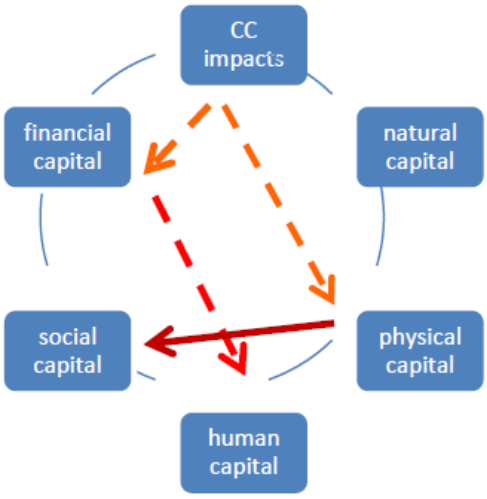
Concepts of Adaptatabity to Climate Impacts

Measuring Vulnerability and Resilience of Indigenous Communities to Climate Change Impacts in Latin America

The UNFCCC has recognized that impacts from climate change include the loss of livelihoods.[4] While livelihoods are drawn from social, natural, physical, human, and financial capital, the conceptual agglomeration of the five capitals constitutes adaptive capacity, a larger universe. After natural capital, defined here as the capacity of an environment to withstand or recoup from climate impacts, and physical capital (the human built environment), social and human capitals are arguably the next linchpins in the casual relationship between impacts and vulnerability or resilience to the impacts. However, creating a causal (clockwise) sequence of relations between capitals or assets, as demonstrated in the diagram illustrates that the concept, while instructive, lacks relational aspects between capitals or assets.



It is precisely the relational aspects and multi-dimensionality of adaptive capitals that necessarily challenge policy makers and adaptation planners, as the need to use standardized methodologies of measurement for adaptation program planning is contrasted with differentiated impacts. In the 2006 Stern Review, human and physical capitals were considered vital components of adaptation in economic systems. In an example cited by Stern, changes in adaptive capitals were interrelated, temporal, and transformational. Drought had an impact on an African families and their pastoral life. Their agricultural and ecological practices changed in the face of climate change impacts. In the second



diagram, a positive change in social capital occurred in the form of improved local institutions and networks' response to changes in physical capital from climate impacts.[5] However the same example, the 1991-1992 drought in Zimbabwe - presented untenable choices for households that deliberately shed their short term household financial capital (goats as savings) and then compensated by withholding payment for their children's education; thus diminishing their own longer term human capital. Without short term financial replenishment, the long term consequences for their risk reduction strategy was a trade-off which lowered their human capital in the form of less educational achievement.

As these two examples portray, the multiple dimensionality of climate change impacts on all communities require consideration of multiple domains for adaptation planning. The unique aspects of indigenous communities, such as mobility, natural resource use, social organization, language, and communal cultural practices, further require a method to both distinguish and measure according to indicators that are derived from indigenous societies in the context of developing countries.

Stern's work established that conceptually, economic output (y) is a function of financial capital (K), labor or human capital (L), and environmental quality or services (E). He posed their relationship in the formula where (T) is a year's time, Y (t) = F (K,L,E).[6] An expanded conceptual formula derived from the Stern concept is V = E X S – A, whereas vulnerability is the product of sensitivity to impacts and exposure to a magnitude of impacts - less adaptive capacity. If this holds true, then *A = V – E x S; or* Adaptability = vulnerability – exposure X sensitivity, should also hold true. From an adaptive perspective, the corollary formula appears to measure only deficit values as an expression of adaptability capacity, thus illustrating its limitation as a concept for measuring positive adaptive capacity. While Stern's use of discount rates to measure future costs of impacts is imprecise at best, but Stern has proven correct in his principle that unmitigated GHG's globally leads to costs rising exponentially. The predictive capacity of Stern's economic modeling to measure unmitigated impacts from climate change is limited. The secondary concern of measuring vulnerability to impacts is largely, but not entirely, limited to a deficit approach.

Several other dimensions of how adaptation is defined and operationalized are present in a discussion (Olmos 2001) based largely on Smit et al (2000) and the IIPCC Third Assessment Report (2001) whether it is by climate region (Watson et al 1996), access to resources in a political economy (Liverman 1994; Adgar and Kelly 1999; Sen 1981), income as a standard proxy for poverty in defining vulnerability (Adger,1999) [7], on the international gaps between rich and poor instead of intra-country levels of development (Kates 2000), and the associated perspective of multiple vulnerabilities due to climate change and globalization (O'Brien and Leichenko 2000). [8] More recent evolution in climate adaptation studies (Corell et al 2010) link vulnerability, resilience, and climate change in the interplay between ecological and human interaction in the face of climatic stressors on land (Bohle et al 1991)[9].

The scale for adaptation as determined by adaptation planners, and equitable considerations of the capacity for adaptation not just across groups but within groups (Schneider et al, 2007)[10] are key in assessing indigenous vulnerability and resilience to climate impacts. Additional concepts from the literature focus on economic costs for individuals and social groups, and the types of adaptive actions - whether spontaneous or planned, one off or iterative actions (Frankhauser et al 1999). This *lag of impacts* concept is particularly relevant in the relationship between mitigation and adaptation since the effects of warming caused by CO^2 may be delayed from 5 to 200 years. The impact lag between Green House Gases emissions and their effect on the natural, physical and social systems, poses an "intergenerational storm". (Gardiner, 2006).

How Indigenous Vulnerability Differs

For indigenous identified as vulnerable to impacts in Latin American regions, collective adaptive capacity may only partially depend on income due to: 1) A large proportion of indigenous people are employed in the informal economy making income hard to measure, 2) They represent a more complex set of historical and current migratory responses often with stratified stages, 3) Aggregated income averaged from census data may obscure minority

indigenous populations within non-indigenous populations (for example, at the municipal level in Mexico)[11] , and 4) Indigenous peoples' own organizational structures that coped historically with weak links to state political power and its incumbent legitimacy may exist outside formal markets and with little access to institutions.

As measures of collective capacity to withstand impacts, income levels do not capture adaptive knowledge and practices of indigenous peoples collectively. For example, higher income levels due to dynamic migration may indicate weaker community decision making capacity and less access to natural resources.

The temporal separation of the cause of climate impacts and their effects is exacerbated by a disintegration of mitigating actions and institutions in modern societies over time, [12] however many rural indigenous cultures already inculcate low CO2 emissions and sustainable land use practices. Also, given states' historical and institutional disregard for prior consultation on their social development in national planning, their capacity for social mobilization is a key domain for gauging indigenous adaptability. Indigenous often can make collective decisions only on collectively held land, and disparate income levels may disincentivize collective action. Deeper insights from social scientists about distributional differences point to the need for finer methods of measure that value the inclusion of indigenous' social and cultural life at the national planning level.

A simpler but more direct concept for measuring vulnerability is that adaptability is subject to exposure and impacts over time. Resilience under this definition is certainly a a continuum. Both vulnerability and adaptability are values on opposite ends of the same adaptability range when a base line measure is taken. Over time resilience can then be calculated based on the initial findings. Thus when conceived of as a range, adaptability in light of known climate impact exposure can more robustly be measured.

Indigenous Incorporation by UNFCCC

Consistent incorporation by states of an assessment of the adaptive capacity of indigenous peoples is not evident from the cursory inclusion of indigenous in national adaptation reports oriented to the UNFCCC. Indigenous are unique; they are more closely tied than other populations to natural capital based on their relationships with traditional lands. The social

capital of indigenous peoples evolved from their association with the great variety of ecosystems that circumvent the planet. Yet their relative position of poverty in modern industrial economies was recently categorized at an official UN conference as **"**Indigenous Peoples, Marginalized Populations and Climate Change"[13]. While recognizing that peer reviewed scientific journals are not the traditional means for transmission of traditional indigenous knowledge and that *"observations and assessments by indigenous peoples, marginalized populations and developing country scientists have remained relatively inaccessible to the IPCC process mostly due to language and socio-cultural barriers"*[14]*,* a UN sponsored workshop nevertheless sought out indigenous knowledge about climate.

On the one hand, it describes indigenous knowledge as *"… knowledge that is relevant to community level responses…"* but on the other, it was described as *"grey literature"* outside the realm of IPCC assessments.[15] Why then, we might ask, was the UNFCCC researching traditional indigenous knowledge regarding climate change when differentiated impacts will contain a great range of variability? Is indigenous knowledge only to be employed in bottoms up adaptation strategies at the local program level and excluded from the larger scale adaptation planning that informs the National Plans of Adaptation Actions (NAPA's)?

The UN Declaration on the Rights of Indigenous Peoples states indigenous peoples have the right to prior consultation on matters affecting their cultures and traditional lands[16], but it appears that land areas inhabited by indigenous peoples stems not from an approach of states nor of UN bodies employing a rights based approach to measuring their vulnerability, but rather it stems from a land use approach. Strikingly,

> *Indigenous peoples own, occupy, or use resources on some 22% of the global land area, which in turn harbors 80% of the world's biological diversity.*[17]

Indigenous peoples primarily live where land use was historically the least destructive of natural vegetation. In large part, these are in or near forests that serve as the largest carbon

sinks on earth. Indigenous management of forests for carbon sinks was initially discussed and then dismissed at Copenhagen with the passage of the Reducing Emissions from Deforestation and Forest Degradation (REDD) program. Nevertheless, given the preponderance of forest dwellers in Latin America are indigenous, some Andean countries are now engaged with indigenous networks in planning for REDD and REDD + programs, formally through National Program Documents (Plurinational State of Bolivia, Ecuador, Panama, Paraguay), and informally in Readiness Preparation Proposals (Argentina, Chile, Colombia, Guatemala, Mexico, and Peru.[18] NAPAs however should cover indigenous populations in all climes and bio-regions, not just forest dwelling indigenous - as per international REDD agreements.

Indigenous Peoples and NAPAs: Africa

Inclusion of indigenous representation at the national or regional level though NGO's, regional councils, or other indigenous political institutions within the framework of NAPA's in Africa and Latin America is highly uneven. It often is not proportionately to scale for indigenous populations affected, nor cognizant of their unique vulnerabilities to climate impacts in their bioregions. By regional comparison, the International Institute of Sustainable Development's 2011 Review of Current and Planned Adaptation Action[19] of East African Countries as of 2011, integrated indigenous into NAPA planning and regional efforts more commonly than such planning in Central America. For example, agro-pastoralists in Ethiopia's Borana and Shinile zones were noted as particularly vulnerable to climate change, as the state sought planning informed by local-level climate data and "traditional indigenous strategies for adapting to climatic extremes". Kenya demonstrated considerable integration of indigenous agriculturists in efforts to integrate indigenous knowledge into "climate risk management" and to research "indigenous technologies" for adaptation among pastoralists in the Turkana and Mandera districts. Regional efforts of UNDP and UNEP in fifteen Sub-Saharan countries focused on short term financial and technical aid for integrating national adaptation planning into national development planning. One out of two of Tanzania's related adaptation projects was designed to "identify, document, and disseminate indigenous forecasting to adapt to climate change within selected communities."

Indigenous Peoples and NAPAs: Latin America

In Central America, Belize's participates in the Central American Commission for Environment and Development (CCAD) and the Central American Integration System (SICA) joint effort which proposed a regional climate change strategy with six strategic areas; one of which was "vulnerability and adaptation to climate variability and change, and risk management" where indigenous are listed among nine objectives, without any elaborated participatory process, approach, or identification of mechanisms to consult indigenous in planning. In Guatemala, as of September, 2013 a consultative group including indigenous, was the Forests, Biodiversity, and Climate Change Group (GBBCC) chaired by the Ministry of Environment and Natural Resources. It appeared to include indigenous in a consultative process sanctioned by legislative intent, but no indication of how they participated was evident.[20] In South America, only Peru demonstrated adaptation planning regarding indigenous communities. It employed two strategies as of 2011. The first was to promote improvement in livelihoods and traditional methods to lower Alpaca mortality rates in two areas of the High Andes, and the other to recuperate Pre-Columbian mountain terracing for agricultural uses.[21] As Latin American NAPAs progress, symbolic inclusion of indigenous in adaption planning may proceed, but a coherent common tool for measuring indigenous vulnerability and adaptive capacity is lacking.

More recently, calls for greater consideration of inclusion of indigenous knowledge were made in submissions related to Mountains and Climate Change by Costa Rica, The Least Developed Country Group (via Gambia) Nepal, and the NGO - International Centre for Integrated Mountain Development, the UNFCCC Secretariat of the Convention on Biological Diversity, and the United Nations Commission to Combat Desertification. Most commonly they called for inclusion of traditional and indigenous knowledge about land use practices. The Secretariat of the Convention on Biological Diversity asked for a deeper commitment to the:

> *. . . Integration of traditional and local knowledge within climate change impact and vulnerability assessments with free prior and*

informed consent and with the full and effective participation of indigenous and local communities.

This "free and prior consent" is language from the 2007 UN Declaration of the Rights of Indigenous Peoples; language which implies participatory adaption planning at the national level, not solely on local projects.[22]

Vulnerability and Resilience

The UNFCCC adaptation policy initiatives are designed to assist developing countries prepare for adaptation on national and sectorial bases. Both climate science driven (climate modeling and scenario analysis) and national policy approaches (National Communications and National Adaptation Programs of Action [NAPA]) are promoted.[23] National level planning largely determines what sectors are rewarded and which are denied programs for adaptation.

Though current methods consistently concede that determining vulnerability is fraught with "normative and subjective elements", that indigenous will be adversely impacted compared to other populations is problematic. [24] IPCC WG II contributing authors cite seven risk criteria for estimating vulnerability universally: magnitude of impacts, timing of impacts, persistence of impacts, likelihood of impacts and vulnerabilities measured by estimates of uncertainty with levels of confidence, potential for adaptation, and distributional aspects of impacts and vulnerabilities[25].

Exposure and sensitivity to climate change impacts are key components of understanding how to assess the vulnerability to and the adaptive capacity of societies to climate impacts. Can we accurately measure the vulnerability and resilience of countries with considerable indigenous populations without integration of indigenous into adaption planning to climate impacts? Given their knowledge of local environmental conditions, In Latin America, the evidence points to an extensive underutilization of indigenous knowledge as essential to garnering national level human and social capital for adaptation.

Without capturing that knowledge, from a statist point of view, under business as usual scenarios indigenous are routinely placed in the deficit category, instead of in an asset category. How can we distinguish indigenous societies' knowledge of changes to natural capital across the spectrum, i.e. across the environments affected by climate change impacts?

> *Indigenous cultures fall within the ambiguity of "distributional aspects". They may receive adaptation instructions, but will disproportionately be excluded from official planning - unless there is political will and a tool capable of measuring indigenous vulnerability and adaptability.*

For indigenous peoples' adaptive capacity be fully realized, they must be part of a process for assessment of their vulnerability and adaptability to climate impacts through consultation. Their effective involvement necessarily requires going beyond "traditional knowledge and inputs from indigenous communities"[26] being considered only at the local level, rather, they have a role to play at the national and sub-national planning level. Rural indigenous communities in total are more heterogeneous and complex than urban and peri-urban communities in relatively more homogenous human built environments. Most of the 47 million[27] indigenous people in Latin America live in diverse ecosystems at risk for large impacts from climate change in: Chile, Bolivia, Ecuador, Peru, Brazil, Colombia, Guatemala, and Mexico. Vulnerability is multifaceted and culturally situated; a tool that only measures it for urban populations is inadequate for rural indigenous populations with unique social relations, languages, and land tenure.

Domains for Measuring Indigenous Adaptive Capacity

Four socio-cultural domains are all affected by the domain of climate impacts where indigenous live in Latin America: Andean glacier retreat leading to water scarcity, prolonged drought in arid lands, severe flooding of lowlands, and coastal flooding from sea level rise. A second domain is the *ethnic and geographical identification of indigenous* where impacts occur: in Andean highlands, in warm inland and coastal tropical lowlands, in rainforests of

Mesoamerica and the Amazon, and in desert regions in Northern Mexico and Southwest United States.[28] A third domain addresses *land use of the identified indigenous populations.* A majority of indigenous peoples in Latin America generate their household livelihoods from natural resources: forestry, agriculture and livestock, pastoralism, and fishing.[29] Losses in commercial agriculture due to extreme events in Latin America can serve as a *proxy for indigenous small holder subsistence producers* involved in agriculture, as demonstrated in regional impacts[30]:

- As a % of total sectorial damage, agricultural damage from the ENSO affect (1997-1998 in select Andean countries with indigenous populations was from 17% to 47% (Peru, Col., Bolivia).
- Hurricane Mitch (1998) damage to Guatemalan agriculture was 68% of the total sectorial damage.
- Future scenarios for coffee (by 2050) in Mexico project a reduction in production of 73%-78%, and in Brazil a reduction of 10% in cultivatable land suitable for coffee.

These trends, in addition to actual and anticipated shifts in crop production,[31] magnify the negative impacts of extreme weather events on indigenous land use.

A fourth domain focuses on *the stages of migration and remittances generated by indigenous communities, whether it is seasonal, cyclical, transnational, iterative or permanent.* A fifth domain focuses on their *adaptive capacity and self-reliance in meeting basic needs.* Together, the five domains largely regulate indigenous life in Latin America. Indigenous communities receive widely different levels of governmental services, a practice that can make accurate assessments of readiness fraught with inequitable distributions of adaption funding. According to a 2002 worldwide poll - rural poor consider *CBO´s, Religious, and NGO´s* the most effectual institutions, while government institutions of *health, education, police, municipality, and national ministries* as the least effective.[32] Trust must be built to engender better collaboration given traditionally weak working relationships between government institutions and indigenous populations. An emergent example of trust building is indigenous engagement as forest managers with Andean governments in national REDD agreements. However, a 2010 study was critical of Latin American countries' REDD + proposals as lacking in mechanisms for

indigenous participation, land tenure rights, and for REDD program transparency, accountability, coordination, and monitoring[33].

In general, inadequate structures in civil society dominate relations between indigenous and Latin American governments. This business as usual scenario may replicate analyses of Indigenous communities from a deficit point of view, exclusive of the collective social capacity of indigenous populations for collaboration, or skew resources to political forces. To resolve this socio-cultural reality, both an endogenous and an exogenous assessment of indigenous vulnerability and resilience are called for in order to measure their adaptive capacity. Indicators must be designed to capture both negative and positive values, i.e., *not only their vulnerabilities, but their resilience to climate change impacts as well.*

Five domains in the proposed tool attempt to balance measures of indigenous vulnerability and resilience by measuring by positive and negative values and by having perspectives from two unique stakeholders. The domains comprise a tool that rests on downscaled regional climate data coupled with a process for qualitatively estimating four social domains pertinent to indigenous communities. The first three domains approximate values for indigenous settlements in sub-regions of Latin America*:* regional climate change, ethnic identification, and the use of natural resources for livelihoods. The fourth and fifth domains measure relative ratios of exogenous and endogenous socio-economic support: migration and remittance, and adaptive knowledge and practice.

The 2011 UNFCCC Nairobi Work Programme suggests that downscaling approaches are best informed by need, assessment and adaptation decision contexts, and access to resources and time."[34] This tool could be applied with the constraints of a down scaled 100 year climate change estimation for the period 2000-2100 or preferably with a 30 year estimation. Decadal estimates on the 100 year timescale can be calculated, but such estimates magnify the impacts by 87% for that period when viewed in 2013. However, as impacts are updated, and because they are expected to adversely disrupt indigenous nations, decadal re-estimation of domain values would optimize adaptation planning.

Part II: Tool for Measuring Indigenous Vulnerability and Resilience.

Methodology: The first domain, *Bio-Regional Impacts of Climate Change,* estimates the severity of negative impacts from regional climate scenarios for a 1-2^0 C rise in temperature by the year 2100 based on a 1980-1990 baseline[35]. Pre-assigned negative weights are built into the first domain estimation process for severity of impacts from four sub-regional climes based on confidence levels taken from Schneider et al. in Assessing key vulnerabilities and the risk from climate change.[36] This tool uses estimated future impacts from the literature to engage indigenous and government stakeholders for preparing estimates on vulnerability and resilience of extant indigenous populations based on decadal projections for 2010-2020. If 2010 is used as a benchmark for estimated impacts, values for four socio-cultural non-climate domains can be estimated and thus they become assessments of indigenous adaptive capacity at the beginning of the ten year period 2010-2020. Given that some assumptions about how climate impacts will affect humans in the future, the 30 year near term downscaled models become more useful for no regrets adaptation planning.

Limitations: The tool is currently limited by impacts reported for 100 year scales to year 2100 which over magnifies projected impacts before we experience them. However, as 30 year downscaled data becomes available, estimations on climates and confidence levels of impacts on sub-regions can be updated, thus making the impacts more manifest within shorter periods. To this author's knowledge, for indigenous populations in the identified Latin American sub-regions, only NW Mexico / SW United States for desert climes are reported for high end (SRES A2) and low end (B1) emissions scenarios *on a 30 year scale* (2021-2050).[37]

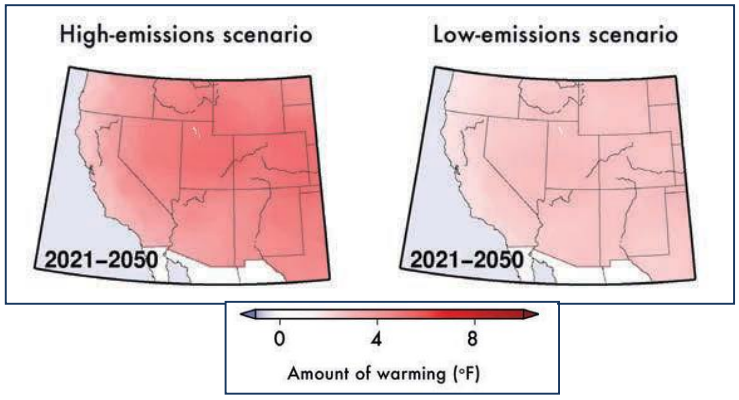


Figure 1.5 Projected temperature changes for the high (A2) and low (B1) GHG emission scenario models,
Garfin, G., A. Jardine, R. Merideth, M. Black, and S. LeRoy, eds. 2013. Assessment of Climate Change in the Southwest United States

For example, in 2010, applying climate change estimates from models for the period 2000-2100 will produce an estimate that over magnifies future climate impacts by 88.8 % in 2010 down to 10% by 2100. However from the same 2010 snapshot measure, impacts from a downscaled 30 year model (for 2021 to 2050) give us estimates in climate, for example in regional warming as in the figure 1.5 above, with a shorter term horizon, and therefore less forward magnification. This produces estimates with over-magnification that reduces, *albeit unevenly*, from 75% to 25% over a timespan / time period (2021-2050) that ends 50 years sooner. Thus the murky picture for adaptation from trying to use a 100 year scale, is made clearer with 30 year (2021-2050) downscaled estimates. As climate modeling improves, near term estimates on climate impacts and the confidence levels that climate scientists assign to them also improve.

How to Use the Tool

Qualified parties for assessment activities include both indigenous [**I**] (communities, networks, nations, or federations) and government [**G**] institutions (local, national, or international) and an Independent Advisory Body appointed by the UNFCC to review submitted assessments. Both I and G are tasked with estimating values for each of five domains. Indigenous communities, nations, and federations may use their traditional representative bodies, or ad hoc organizations to assign their own experts for estimating values for each indicator; expert NGO's and or scholars with technical expertise known to indigenous organizations, and chosen by them. Findings must be previewed and approved by representative indigenous organizations.

Given the complexity and diversity of indigenous contexts, government agencies are best served by referencing their domain estimates according to international standards for each domain; they should not rely on long standing funding mechanisms, outdated data, nor pre-determined values for indicators. Governments, for example, may not use native language capacity as a sole indicator of indigenous identity. Each party may use technical assistance for its own estimates on indicators for each domain.

Domain specific instructions are found in the domain tables below. The values for domains no. 2 through no. 5 represent expected social changes that occur from the impacts of

climate change for estimated values in the first domain. Domains no. 1, no. 3, and no. 4 require one indicator be estimated for the entire domain score, whereas domains no. 2 and no. 5 require estimates of values be averaged from all indicators. 3) A single composite score for the defined indigenous group is then calculated as the average of the five values from the five domains and expressed as a percentage from 0-100. If domain composite scores vary more than 15% between I & G, subsequent harmonization may occur if both parties agree to review the estimations jointly, but only after separate assessments are completed and submitted. Submissions can be sent to national level body appointed by UNFCCC with indigenous and government participants not directly involved in the assessment activity. The review body is tasked with assuring the methodology for the assessment was completely to the written standards outlined in the tool. Members appointed to the body are drawn from these areas: 1) Land management experts, 2) Indigenous cultural experts/social anthropologists, 3) Native linguists, linguistic expert, 4) Indigenous organization administration (with prior policy or community level work history), 5) Work Specialist: farmer, pastoralist, fishers, etc. according to the predominant natural resource activity which affected indigenous populations engage in, and 6) a climate scientist with expertise on the clime of concern. Both I and G can use the same source. Since there is no UNFCCC legal mandate for an Independent Advisory Body, fast tracking priority can be offered for projects where assessments use this methodology including the IAB.

Interpretation of Results

Domain scores represent positive values of 0%-100%. Domain scores allow for pinpointing specific and general strengths and weaknesses for each unique domain. Higher values show more resilience, and lower ones, more vulnerability. At a gross level, composite scores can facilitate comparisons between indigenous groups, while at the domain level; scores are more useful for adaption planning for a particular indigenous population. Composite scores for group comparisons are contextually based and therefore their distribution across domain scores provide for disaggregated data for adaptation planning with specific indigenous populations. For example peri-urban indigenous communities may have higher *Adaptive Knowledge and Practices values,*

but lower *Land Use for Subsistence/ Livelihood values* than indigenous with more intact *Land Use* values, whereas indigenous communities undergoing *Migration/Remittances* may have higher *Land Use Values* compared to communities that were historically disposed of more than half of their land base. Indigenous communities with their own internal extant census for population and speakers of their native language may have higher values for indigenous identification than those that are used by a government institution that relies out of date or ill-defined demographic data and vice versa.

Tool for Measuring Vulnerability and Resilience of Indigenous Communities to Climate Impacts in Latin America			
Domains (1-5) and Indicators (a,b,c, etc.)	**Estimations of vulnerability and resilience**		
1st Domain: Bio-Regional Impacts of Climate Impacts			
Bio-regional impacts of climate impacts measures confidence in known CC impacts from indigenous experience and from 100 yr. scale modeling to 30 yr. down-scaled modeling. (***Note: Only one indicator (a-d) is estimated.)*** *(For confidence levels in value scale, see endnote no.12.) Values are averaged. The higher the confidence in the predicted impacts, the better the information for adaptation, even if impacts are more intense.* **Numeric Scale**: **L** = 5 to27.5%; **M**= 27.5% to 50%; **H** - 50% to 72.5 %, **VH** = 72.5 to 95%. **Value Scale:** **Low:** if *either* govt. (G) or indigenous (I) planners have little or no estimable data or experience **Medium:** when *either* G or I are confident about data quality, but the other is not **high**: when *both* reach consensus about type of impacts, but not on timing or magnitude **very high:** when *both* G & I concur on impacts, their timing, and magnitude.	**(I) Indigenous estimate**	**(G) govt. estimate**	**total estimate**
a. Warm inland and Tropical lowlands and rainforests (Mesoamerica and the Amazon) Inland flooding from tropical storms. 16 (% score= 9 %)	-___	-___	-___
b. Highlands (Andes) Glacier melts threaten water shortages. 39 (% score= 22 %)	-___	-	
c. Desert lands (NW Mex. / SW US,) Heat, drought reduces livelihoods, increases mortality rates**]** 61 (% score= 34.5 %)	-___	-___	-___
d. Coastal Lowlands *Sea level rise on coastal areas threatens potable water access.* 61 (% score= 34.5 %)	-___	-___	-___
1st Domain score (0-100%, coverts to 0 -100.)	-___	-___	-___

Domains (1-5) and Indicators (a ,b ,c, etc.)	Estimations of vulnerability and resilience		
2nd Domain: Indigenous Group/Nation			
Indigenous Group/Nation measures estimated confidence (from 0-100%) in indigenous as defined by ethnicity, land tenure, language, and population. Indicators estimated by traditional and contemporary indigenous governance structures with assistance from specialists in: environmental networks, linguistics, anthropology, development, and UN DRIP standards. ***Note: all indicators are estimated.***	**(I) Indigenous estimate:**	**(G) Govt. estimate:**	**Total Estimate;**
a. Delineated ethnic group: ___ (name) over a defined geographic range_____ in hectares squared. (0 to 100%)	+__	+__	+__
b. Current Land tenure relationship: *Notes:* only one sub-indicator (b1-b3) is scored. *Use best fit. Sub- Indicators* b1, b2, and b3 are for changes older than two generations) Ancestral Homeland = AH. **b1.** ***Most population is Living in AH;*** 55-100% of population _____ **b2.** ***Partially dispossessed or displaced*** **from AH**; - 10 to 45% of population from AH _____ **b3.** ***Permanently removed from AH***; 5% -55% of population from AH. _____	+__	+__	+__
c. Language family and language _____ &_____ (Lang. family & language name in Indigenous language. note: language, not dialect. Estimate is in the % of speakers of an indigenous language within resident population. For (G), estimate requires linguistic specialist. (0 to 100%)	+__	+__	+__
d. Population counts for group size_____ and unit counted geo - graphically bound community, cluster, tribe/nation) _____ (score is confidence of estimate, 0 to 100%)	+__	+__	+__
2nd Domain score (Value of 0 -100: average of a-d)			

Domains (1-5) and Indicators (a,b,c, etc.)	Estimations of vulnerability and resilience		
3rd Domain: Land Use for Subsistence/ Livelihood			
Land use for subsistence/ Livelihood measures % (0-100) of indigenous families engaged in land use for subsistence / livihood activities in one type land use 1-5. Estimates are averaged for the measured unit of population: community, clan, indigenous tribe/nation in the pre-defined language/ geographic area. *Note: Only one indicator (a,b,c, or d) is estimated.*	**(I) Indigenous estimate:**	**(G) Govt. estimate:**	**Total Estimate**
a. Tropical Forest rubber, fisheries, swidden (slash & burn) agriculture, building materials.	+__	+__	+__
b. Highlands: silviculture, agriculture, silviculture livestock	+__	+__	+__
c. Desert / savannah: pastoralism, livestock, grain and/or feedstock Production.	+__	+__	+__
d. Symbiotic Ecosystems: combined from two of the above as the dominant indigenous land use.	+__	+___	+__
3rd Domain score (value of 0 to 100, Chose one: a,b,c, or d.)	+__	+__	+__

Measuring Vulnerability and Resilience of Indigenous Communities to Climate Change Impacts in Latin America

Domains (1-5) and Indicators (a,b,c,etc.)	Estimations of vulnerability and resilience		
4th Domain: Migration and Remittance Structure			
Migration and Remittance Structure measures 0-100 % of indigenous population's stage of migration, if any. ***Note:*** *Only one indicator (a-d) is estimated. If no migration, value = 0%.* HH = head of household	**(I) Indigenous estimate:**	**(G) Govt. estimate:**	**Total Estimate;**
a. Low - **Incipient migration** of - **5 to -15%** of community members/communities; more single youth migrants, less head of household (HH), not the most poor.	-___	-___	-___
b. Medium Low: Catalectic migration for - **15% to -25**% of families experience regularized individual migration or start of family migration, changes in migrant demographic, mix of youth and HH, remittances sent periodically, system established.	-___	-___	-___
c. Medium: Patterned and Cyclical Migration for -**25% to - 40%** of HH receive individual or family livelihood from remittances frequent not periodic, reduced community participation and educ. enrollment. Maximum of this stage is the tipping point for community's economic displacement. This is considered tipping for local economy.	-___	-___	-___
d. Medium High: Remittance dependency for **- 40% to -60%** of HH remittances on par or overtaking HH income/livihood, hollowed out male gender effect, community decision making stagnation, social structures emerge in intact immigrant community	-___	-___	-___
e. High: Transformative Migration for -**75 to -100%** of families rely on migrant remittances, cyclical migration acutely decreases. Community is path dependent on outside capital, land tenure vulnerable to outside acquisition, community based decision making collapses.	-___	-___	-___
4th Domain Score: (value of 0 to 100, average of: a – e.)			

Domains (1-5) and Indicators (a,b,c,etc.)	Estimations of vulnerability and resilience		
5th Domain: Adaptive Knowledge and Practices[38] for CC adaptive planning and implementation			
Adaptive Knowledge and Practices for CC adaptive planning and implementation measures the capacity for acquisition of five basic services and inherent cultural capacity as positive % of self –reliance for each indictor a-e. Partially acquired services are indicated by degree of coverage for population. The composite average of the five indicators is the domain score. Each indicator is scored separately on a 0-100% scale.	**(I) Indigenous estimate:**	**(G) Govt. estimate:**	**Total Estimate**
a. Shelter (% of population with access to durable shelter)	+___	+___	+___
b. Access to Water (% of population with access to potable water)	+___	+___	+___
c. Use of natural resource materials (% of population w/ access to use natural resources.	+___	+___	+___
d. Health (% of majority with access to adequate health services)	+___	+___	+___
e. Traditional knowledge regeneration (% of confidence that indigenous experience and traditional indigenous knowledge and customs in land use practices, knowledge of climate, and flora provide capacity to regenerate knowledge for youth)	+___	+___	+___
5th Domain Score (value of: 0 -100: ave. of: a - d)			
Total Unique Composite Scores on all 5 domains for Indigenous vulnerability and resilience = 0 – 500.	+/- ___	+/- ___	+/- ___

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