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U.S.-Mexican Border Region and Border 2012 Program Environmental Indicators

Southwest Center for Environmental Research and Policy (SCERP)

ABSTRACT

The Border 2012 U.S.-Mexico Environmental Program is “unique in the world,” in the words of Dr. Olga Ojeda of Mexico’s Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), because it involves the cross-border collaboration of governmental and nongovernmental stakeholders at all levels, working together toward a common goal. That goal is:

“to protect the environment and public health in the U.S.-Mexico border region, consistent with the principles of sustainable development.”

Created pursuant to the La Paz Agreement, the Border 2012 Program closely follows the success of the five-year Border XXI program, which began in 1996. The primary developers of the Border 2012 Program include the U.S. Environmental Protection Agency (EPA), SEMARNAT, the U.S. Department of Health and Human Services, and Mexico’s Secretaría de Salud, but participation is by no means limited to these groups.

Anticipating the release of the Border 2012 Program, one of the aims of which was to develop environmental indicators, EPA and SEMARNAT requested that the Southwest Center for Environmental Research and Policy (SCERP), an independent consortium of U.S. and Mexican universities in the border region, get involved because of the consortium’s ability to collect, manage, and analyze data independent of program design and success. SCERP was also an obvious partner because its vision for the U.S.-Mexican border region complements the goal of the Border 2012 program. As articulated in the first of its Border Institute think tank series, SCERP envisions a border region with:

“a dynamic and diverse economy, sustainable environmental quality, intact ecological systems and processes, and a more equitable quality of life.”

Consequently, Border 2012 Program partners enlisted SCERP’s participation in developing community-accessible environmental indicators and performance measures of the program’s effectiveness. Community-accessible environmental indicators are loosely defined as signs of change and warnings of danger.

To be effective, indicators must be “*TRUE*”: *T*imely, targeted, and threshold-sensitive; *R*eliable, relevant, and responsive; *U*seful to the public, policy-makers,

and program administrators; and *Easily accessible* from both sides of the border, from reputable sources, periodically. In the process of developing the Border 2012 Program indicators, SCERP found that one of the main challenges in deriving and using multinational indicators is accessing and reconciling quality data across boundaries. Another challenge is creating an open, transparent process that affords professionals and stakeholders of both nations an active voice and forum. Together with EPA and SEMARNAT, SCERP articulated these facts as the principles that should be used when selecting and developing indicators.

A common theme of the new Border 2012 Program is that health is the “bottom line.” SCERP’s process of selecting environmental indicators for the program has considered health in the context of sustainability, which must address economic, environmental, community, and individual human health factors in the present and future. Bearing this principle in mind, SCERP developed a suite of environmental quality and environmental health indicators. The process involved the insights and expertise of individuals knowledgeable about U.S.-Mexican border environmental issues and was supported by skilled researchers prepared to coordinate, manage, and circulate expert observations and questions. It also built upon past efforts by compiling an inventory of datasets and activities of all agencies and organizations in the border region that address environmental quality or environmental health.

Thus, the Border 2012 Index of Indicators developed by SCERP includes data and activities that span far beyond the four agencies of the Border 2012 Program and integrates the efforts of four other types of organizations dealing with the U.S.-Mexican border environment. First, some indicators address activities and measurements from entities that were established by U.S.-Mexican treaty, such as the U.S.-based International Boundary and Water Commission and its Mexican counterpart, Comisión Internacional de Límites y Agua. Second, the index incorporates information from existing organizations whose scope is border-wide, such as the Good Neighbor Environment Board, Border Trade Alliance, and U.S.-Mexico Chamber of Commerce. Third, activities and data from binational and trinational commissions created by NAFTA, such as the Commission for Environmental Cooperation, Border Environment Cooperation Commission, and the North American Development Bank, are also integrated. Finally, information and activities created after NAFTA’s implementation are included, such as the Border Health Commission in the United States, the Comisión de Asuntos de la Frontera Norte or Mexico’s Northern Border Affairs Commission, and others.

The Border 2012 Index of Indicators also includes data from the net outcomes of projects funded by the largest funding streams available to and for the border region—the Border Environmental Infrastructure Fund. This fund has recently been used to support projects targeting water conservation and reuse, air quality, and other projects above and beyond its original mandate,

which dealt only with drinking water treatment systems, wastewater treatment systems, and solid and municipal waste disposal. The inventory also considers the role of other collaborating agencies, such as the U.S. Department of Interior, which has a border component and is important for water and natural resource issues. As well, information from the activities of non-cooperating agencies, such as the U.S. Department of Energy, which has an important role in the multinational U.S.-Mexican border region, are integrated into the indicator suite.

The primary purpose of the Border 2012 indicators is to serve as a reference point for communities comparing environmental quality and health conditions in their areas with conditions in other communities. Further, the Border 2012 indicators enable community members to measure improvement from baseline conditions in their region. Beyond the scope of a local community, the Border 2012 indicators enable stakeholders throughout the U.S.-Mexican border region, such as government, industry, non-governmental organizations, advocacy organizations, and academia, to measure progress toward a clean and sustainable future with good environmental quality and environmental health.

A particular challenge for communities is to make the connection between environmental health and human health. The Border 2012 Index of Indicators is the first step toward developing activities and policies that communities can implement to increase data access and availability in these areas. Designing the suite of Border 2012 Program indicators has illuminated areas where data are sparse and has presented opportunities for policy to help fill information needs. Familiarity with these data gaps enables Border 2012 Program managers to identify critical projects for communities that still need baseline data about their environmental quality and health.

The suite of indicators provides a wealth of ideas for projects and programs that can contribute to information and data to facilitate the understanding of the health threats and risks resulting from exposure to poor environmental quality. Reports on the indicators can also help community members understand the tenuousness of the connection between environmental exposure and actual health effects. Stakeholders can also use the information found in the indicators to develop and monitor programs for environmental and health protection.

The current index of Border 2012 Program indicators is found in Appendix B of this report. The list, which is the product of the first phase of this process, is segregated into 11 “clusters” or groups of environmental indicators. Future steps will require data acquisition, maintenance of databases, and dissemination of these unbiased community indicators. The indicators and the evaluation architecture promote the success of new and continuing programs as they enable stakeholders to evaluate effectiveness and needs.

WHY SCERP CONDUCTED THIS PROJECT

Early in the five-year Border XXI Program (1996-2000), the U.S. Environmental Protection Agency (EPA) and its Mexican counterpart, Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), prepared a monitoring program known as a community indicator program (CIP), which contained preliminary data on the state of the region's human and natural environment. The material, organized as a set of binational border environmental indicators, was supposed to serve, as the name implies, as indicators for community use and to assist in the evaluation of the border environmental policy's effectiveness. This effort was truly a milestone binational accomplishment and was later published as *U.S.-Mexico Border Environmental Indicators 1997*. At EPA's request, a SCERP researcher team subsequently evaluated the Border XXI index of indicators and when weaknesses were identified, suggested ways the program could be strengthened (Blair 2001). That report assessed the CIP against several criteria and among its conclusions were:

- Only 20% of the Border XXI objectives are measured by indicators, and of the program's 50 indicators in nine policy areas, only 60% were activated with any data; one policy area had no data at all
- The attempt to define, develop, and use "sustainability" indicators was unrealized
- The overall program was rated "low" for overall adequacy and resources, "medium" for effectiveness and measurability, and "high" for reliability, plausibility, and validity

On the value of the CIP, the author also concluded:

"From discussions with regional representatives, it is apparent that the CIP is regarded as a valuable tool for checking progress and bringing a host of issues to public and government attention. The program was created to monitor the effectiveness of border environmental policy. The EPA/SEMARNAT has devoted considerable resources to create the program. Using it proactively for policy adjustment and not merely for tracking, should be a prime purpose for the CIP. Another important function is its role in educating, informing, and linking [the binational region] communities on many common issues. Indeed, the coordination function of the [the binational region] program is one of its unsung successes. It could well have been a formal program purpose—and have been part of the effectiveness criteria."

Researchers from SCERP and the Institute for Regional Studies of the Californias (IRSC), based at San Diego State University, had conducted a number of cross-border indicator studies since the 2001 study by Blair, including a binational quality of life survey for San Diego and Tijuana and an

environmental quality data search for the same area. Based upon that background, the EPA asked SCERP to assist in developing the indicators that are presented in this report.

SOME CRITERIA AND QUALIFICATIONS FOR SELECTION OF INDICATORS

Indicators are statistical data about characteristics of the physical world and human society over a period of time. They measure variation during a specific interlude and eventually will provide a longitudinal comparison of physical and human changes, in this instance, along the U.S.-Mexican border. If properly used, through the measurement of environmental change, they will test program effectiveness and thus may provide guidance for policy-makers. On the other hand, they may provide information that is too late to be useful. These indicators will measure both change within the physical environment on the U.S.-Mexican border as well as public institutions' efforts to effect positive changes in this environment.

The entire index tells as complete a "story" of the border as possible. The indicators fell into 11 "chapters" or clusters and have been chosen to meet five basic criteria:

- Can the indicator be somehow measured?
- Is the data to measure the indicator available from a reliable source on a recurring basis? Or, is it feasible to establish a new collection process?
- Does the indicator provide a reasonable indication of some change for the cluster?
- Is the indicator generally understandable by a range of potential users?
- Can the indicator react to change in public policy or are the indicators timely enough to be useful in suggesting change in public policy? (The Border 2012 program will span ten years [2002-2012] and has a mid-term evaluation and course correction in 2007.)

Difficulties in Developing and Using Environmental/Health Indicators

Indicators are not, nor are not meant to be, a comprehensive indication of the state of a particular cluster. Rather they are meant to provide evidence of the change or stasis of the cluster over time. A caveat is also appropriate to warn against expecting that this or any other set of indicators can solve or even address problems. The sample sizes involved in the science behind indicators and in the epidemiology of environmental health indicators, as well as the numerous complicating factors—poverty, to mention a large one—make identification and development of quality indicators very difficult. For example some may want to identify their neighborhood as a "hot spot" for an environmental contaminant—this is certainly a worthy cause but it is far beyond the ability of indicators to discern such differences among locations. Similarly, indicators can be very effectively designed and developed to ultimately warn of health risk. To translate environmental quality and even exposure levels into direct and precise health effects and consequences is problematic due to the various pathways, doses, receptor vulnerabilities,

modes, and other unconsidered causal factors. Thus, several indicators describe environmental quality and population exposure levels but do not make the leap to assume causality of actual health effect even while strong correlations exist. Those conclusions are left to the regulatory and policy makers, the health practitioners, and the organizations charged with protecting human health. However, Environmental health *indicators* are provided to serve the classic role of indicators—to sense and measure change.

Indicators also have limits in how elastic they are spatially. An indicator for the entire border region meant to serve a certain audience and client may reveal very little about a community. Likewise, indicators at the community level may when they are not able to be lumped together as a regional tool. Even if they were, the aggregated indicator has then lost the ability to discriminate among, and thereby serve, sub-regions (Table 1).

CREATING THE INITIAL INDICATOR INDEX

During an initial meeting with EPA, SCERP established the following principles for inclusion of indicators: binational availability, reliability and quality, regularity of measurement and reporting, and relevance to border issues. SCERP began analysis of the mission, goals, objectives, sub-objectives, and components of the draft of the then-unnamed new border program. The SCERP team designed and conducted a work plan to identify clusters or categories that would include a number of indicators within them, and also determine the availability of databases to support them. The work plan concurrently:

- Searched for an index of transboundary indicators
- Convened a focus group to examine and suggest indicators
- Mined for indicator definitions, sources, and data
- Selected among various potential indicators

Table 2 explains the MuSlc development principles.

After establishing the principles for inclusion of indicators, the first step was to search for and/or develop an index of Multinational Sustainability Indicators (MuSlc)—an index that would be larger in context and ambition than mere environmental, health, or quality of life indicators. Indeed, this index would encompass them. The MuSlc index was larger in scope than the Border 2012 partners mandate and responsibilities, examining infrastructure, natural resources, water supply, energy, and associated issues. Drawing upon the work that had been done in the field of trans-boundary indicators, an initial set of clusters and indicators was developed and work started on identifying their data sources.

Preliminary work on a quality of life indicator project for San Diego-Tijuana was undertaken by IRSC and SCERP suggested that finding and verifying

data sets would be the greatest challenge. It was. This task involved identifying compatible data for both sides of the border that was available, useable, and collected on a regular basis.

Focus Group Role and Efforts

The key activity in the development of indicators was the convening of a binational focus group of indicator experts from such representative organizations as SCERP, EPA, SEMARNAT, the Border Environment Cooperation Commission (BECC), the North American Commission for Environmental Cooperation (CEC), Comisión para Asuntos de la Frontera Norte (CAFN), various universities in Mexico and the United States, local and tribal government, local indicators groups, and other nongovernmental organizations (NGOs) (Appendix A provides a list of all attendees). The focus group met in San Diego on July 24, 2002. The initial MuSIC list was provided in advance of the meeting and participants were asked to review the list and be prepared to make suggestions for additions, deletions, changes in methodology, data bases, or any other comments that would improve and inform the overall process.

The immediate objective of the workshop and project was to select and tailor a set of indicators for community use in tracking environmental quality knowing the indicators will also ultimately be used by private and public agencies to design and measure the progress of their programs in addressing environmental health risk concerns. In a day-long series of discussions, breakout groups, and presentations by SEMARNAT and EPA, hundreds of potential indicators, data sources, and suggestions for further research were developed and refined.

Data Mining Process

The index staff gathered, discussed, and analyzed the minutes of the breakout sessions and other general notes from that day. Additional ideas were derived from organizations, individuals, and publications. Throughout the process of data mining, countless documents, publications, and websites were reviewed by the SCERP investigators. The following list of sources represents only a minute portion of those actually visited:

- *Summary of Selected Environmental Indicators from the U.S.-Mexico Border XXI Program: Progress Report 1996-2000*; EPA
- *Sustainable Development Indicators of Mexico*; INE/INEGI/SEMARNAT
- *A Community Indicator Program for the San Diego-Tijuana Metropolitan Region*; Institute for Regional Studies of the Californias (IRSC)
- *Disposal Alternatives for Waste Tires in the Border Region*; C. L. Lin, J. D. Miller, and J. R. Parga; SCERP Project Number P2-01-2
- *Border EcoWeb*; <http://www.borderecoweb.sdsu.edu/>
- *U.S.-Mexico Border Information Center on Air Pollution*; <http://www.epa.gov/ttn/catc/cical/>; EPA
- *Anuarios Estadísticos Por Entidad INEGI*; <http://www.inegi.gob.mx>

- *Healthy Border 2010 Program Objectives*; U.S.-Mexico Border Health Commission n.d.
- *San Diego-Tijuana Regional Quality of Life Indicators (Working Draft)*; Institute for Regional Studies of the Californias, 2001
- *Sustainable Development Indicators of Mexico*; SEMARNAT n.d.
- *U.S.-Mexico Border XXI Program: Progress Report 1996-2000*; U.S.-Mexico Border XXI Program, 2001
- *U.S.-Mexican Border Environment: U.S.-Mexican Border Communities in the NAFTA Era*; *SCERP Monograph Series No. 4, 2002*
- *U.S.-Mexico Border Program (2002-2012)*; EPA presentation on July 24, 2002

The first list of indicators developed was integrated into the MuSIC list, and that was then re-divided into 13 clusters, a process that resulted in the inclusion of more than 100 indicators. In six lengthy and thoughtful meetings with binational experts from SCERP and IRSC, additional modifications were made. The list was then circulated among the Focus Group session attendees. The responses were considered and the list was again discussed and revised. EPA headquarters and SCERP held conference calls from late September through March to finalize this first draft of the index.

SCERP staff interviewed several EPA and SEMARNAT indicator experts and also traveled to, briefed, and received input from the San Diego Association of Governments, the Good Neighbor Environment Board (GNEB), BECC, the Border Health Commission, the Pan American Health Organization (PAHO), and the Border Health Association. Additionally, a data-mining specialist traveled to Brownsville, Texas, to the PAHO environmental health indicators workshop and to SEMARAT and INEGI in Mexico City to collect relevant data.

The question of which indicators to choose is answered primarily by the availability of quality data, but also by consideration of the uses and users of the index. As examples, indicators can be groomed to:

- Respond to threats and vulnerabilities
- Warn and assess human health risk
- Provide program evaluation criteria
- Strive for sustainability ideals
- Address issues raised in reports
- Motivate funding for specific projects
- Further develop program objectives

It is a rare index that can do all, and this is no exception. SCERP was contracted to develop an index for use by the communities of the border to “sense” their own environmental conditions as well as develop an “evaluation architecture” for the Border 2012 program and its partners.

SCERP took advantage of the opportunity and the challenge to focus on indicators for its annual think tank (the Border Institute series) by commissioning State of the Border Environment Reports (SOBER) by bi-state sub-regions to fully identify issues that need indicators. Those identified issues will be juxtaposed against the draft index at Border Institute V. Together with SCERP's predictive decision-support system (Border Plus Twenty Years, or B+20) the SOBERs and the index will be used together to extrapolate a human health risk assessment for the border region for this year, as well as a projection of future risk under various scenarios.

Among the difficulties of picking indicators is balancing specificity and data maturity, both of which have cost and time concerns for developers and users. For example, coliforms, including the sometimes-pathogen *Escherichia coli* or *E.coli*, are typically used to indicate water quality because of the relatively simple and inexpensive diagnostic test. The problems with this indicator are they:

- Are not human-specific (they are found in many warm-blooded vertebrates)
- Are more concentrated in Mexican sewage because there are more conservative water use patterns there
- Persist for a relatively long time even in marine environments

The *Enterococci* group is more specific but more expensive and less responsive to use due to the expense and time involved in the testing for the bacteria. The presence of the virus *Hepatitis A*, which is specific to humans, can be used, but its testing is even more expensively determined and measured. Testing for very specific molecules promises a quick and cheap answer but it is technologically years away. Likewise, the associated health indicators (gastrointestinal disorders, diarrhea, Hepatitis, etc.) have varied availability, precision, cost, and time concerns. To obtain environmental health data, questionnaires or surveys that will be valid and useful can be properly designed, randomly implemented (for example, in *colonias* by *promotoras*), and appropriately analyzed to elicit self-reporting of gastrointestinal disorders.

Some of the indicators that the Centers for Disease Control (CDC) and EPA want to develop are frustrated by privacy protections that prevent access to death certificates, insurance records, hospital reports, and other personal information.

String of Measures

For the various reasons above, a "strings of measures" begins to help make preliminary, primitive, precursor, or proxy indicators available while working on the optimum measure. Many times before a relatively complicated indicator can be measured, a database, a monitoring system, or preliminary data is needed. The data can then be collated and analyzed into intermediate information and finally an ultimate, mature measure. It may or may not inform some associated environmental health indicators, ecological index, or institutional data need. (Table 3).

INDICATOR STRUCTURE

The index is structured in two ways. The Border XXI indicators structure of Pressure-State-Response (P-S-R) is replaced by a Threat-Capacity/Capital-Response structure. Because the old P-S-R framework had semantic and interpretation problems in the binational-bilingual context, SCERP decided to take another approach. To make indicators most relevant, and the programs they design and measure most responsive to need, indicators should relate to threats and vulnerabilities. They should examine the capacity of the existing agencies to respond to those threats as well as the human, natural, and financial capital those organizations have available. Finally, they should reflect the changes, effects, and results of projects or lack of engineering or other technological interventions. Thus a Threat-Capacity/Capital-Response (T-C-R) framework is suggested.

Perhaps the best example is the biggest need—environmental infrastructure deficit. NAFTA created BECC and the North American Development Bank (NADBank) to address the deficit and build enough infrastructure to respond to the growing population. The U.S. and Mexican governments fund such development through the Border Environmental Infrastructure Fund (BEIF). The success of that massive and expensive effort is variously measured as number of projects, number of household hook ups, and number of people served, but it is not—so far—measured by the quality of the receiving body of water or number of cases of intestinal disorders prevented or still extant. Thus, the T-C-R framework for this example is T—infrastructure deficit, C—BEIF, R—infrastructure, surface water quality, or health measure. Efforts to return fees or taxes to the border region (C) that can be used to address the infrastructure deficit (T) can be measured and their effects seen (R).

In an effort to display the EPA/SEMARNAT U.S.-Mexico Border Program (2002-2012) and relate it to the SCERP clusters and primary and secondary indicators in a manner that supports the EPA/SEMARNAT program's objectives, SCERP created an Indicator Organization and Data Availability Pyramid (Figure 1). The pyramid is designed to illustrate the manner in which the clusters of indicators support the effort to achieve clarity in “addressing significant environmental and environmentally related health problems in the U.S.-Mexico border region.”

The pyramid displays the Health and Quality of Life as the apex, as these are the focus of the EPA-SEMARNAT effort and the ultimate concern.

On the second level are the media and fora that EPA describes as the “most critical environmentally related public health challenges in the border,” including Air, Water, Hazardous/Solid Wastes and Toxic Substances, and Cross-media. These will be the focus of the Policy Forums, as described in *Border 2012: U.S.-Mexico Environmental Program*. They “will have a *media-specific focus* and will concentrate on *broad policy issues* that require an

ongoing dialogue between both countries” (emphasis original). These represent the “Goals and Measurable Objectives” of the plan.

The third level contains “chapters” or clusters including: Air Quality, Energy, Water Quality and Quantity, Pollution Prevention Techniques, Waste, Land Use, Pesticides, Environmental Information, Regulation and Policy Development, Cooperative Enforcement and Compliance, Environmental Education and Training, Infrastructure Planning and Development, and Emergency Preparedness and Response. This level illustrates the clusters that contain the indicators from the two lower pyramid levels, issues that will be concentrated on by border-wide workgroups through the *Border 2012: U.S.-Mexico Environmental Program*, and “tools” we propose could be populated with data that could be gathered yearly through a questionnaire administered to binational influential actors.

The fourth pyramid layer contains the primary indicators. These are the “populated” indicators for which there is good, fairly compatible, binational data.

At the base of the pyramid are the secondary supporting and “chain of measures” indicators. These are the indicators that are valuable in the attempt to reach the indicators’ goal to “measure change within the physical environment,” but for which data availability is either poor or non-existent.

Establishing the Index of Primary and Secondary Indicators

The main intent and result of this effort by SCERP is an index of indicators. This index of indicators is captured within the Indicator Organization and Data Availability Pyramid (Figure 1). Inevitably, data availability affected the make up of the index. This was due to the fact that it was deemed extremely important by the involved parties that the final index include a set of indicators that contained actual data. These indicators that contained data (and received SEMARNAT and EPA initial approval) have been called primary indicators. A number of supporting indicators that are not populated with data but have otherwise been considered important in the measurement of the ultimate concerns of environmental health and quality of life along the U.S.-Mexican border have been called secondary indicators and have been placed at the bottom of the pyramid.

Because data played a crucial role in determining the ultimate index of indicators it is constructive to examine briefly the process of data mining that was undertaken. After this examination, a sample of data sources that were visited is provided. Lastly, the availability and quality of the relevant data uncovered is assessed.

Most experts assert that environmental data for the border region (and in particular, binational or multinational data) is quite scarce. Furthermore, these experts will point out that the data is not always highly accurate or up to date.

In general, this project's findings confirm these assertions. In particular, data gaps were found when comparing the border region with the interior regions of the two nations (there tends to be less data available for the border region) and when comparing the Mexican border region to the U.S. border region (there tends to be less data available for the Mexican border region). Data compatibility was another problem that arose when comparing the United States to Mexico because often the two countries measure similar things in very different manners.

When examining specific areas, however, the picture is slightly brighter. For example, the following clusters contain a few indicators characterized by fairly compatible binational data: Air, Water, Environmental Health and Quality of Life. The remaining clusters, on the other hand, do not have much accurate, binational data. Unfortunately, these remaining clusters constitute a majority.

The final index of indicators and the Indicator Organization and Data Availability Pyramid (Figure 1) can be best thought of as tools for measuring the current state of and progress toward improving the environment in the U.S.-Mexico border region. While adoption of these tools are a major step in the right direction, it will also be necessary to invest heavily in data collection in order to reap the full benefits. Clearly, the data collection efforts will need to be binational or multinational to help reduce data gaps and incompatibility.

The identification and analysis of the database continued to be the most time-consuming portion of the work. Initially, the presence or absence of a data source was initially considered a critical factor in selecting indicators. It is now clear that the availability or non-availability of a data source should not be the major determinant in the selection or use of indicators. If an indicator meets the need and is judged as critical for its cluster, yet has neither information nor reliable data, it should not be eliminated. A supplementary set of indicators that are valuable, although currently lack data, has been established. But, through some effort, this data could be collected.

While SCERP's task was to develop an index of indicators of available data the researchers were also able to discern data sets that, though unavailable, are of significant value and in fact, are potentially greater indices of health risk than any available data. Many explore differences across the border. For example, a report by the World Health Organization released in late October 2002 revealed that indoor burning for heating and cooking was equal to tuberculosis in health impact, especially in developing nations. The health consequence rank of such activities closely followed lack of access to safe drinking water and ranked far ahead of ambient (outdoor) air quality.

Likewise, drawing from groundwater reserves is increasingly becoming a source of municipal water for several water-stressed border communities risking subsidence, salt intrusion, and lost storage capacity. The lack of aquifer quality, quantity, flow, and recharge rates may be the biggest data void in the border.

Nevertheless, SCERP did develop at least one populated indicator per cluster and per Border 2012 objective. These have been designated primary indicators because they are available on both sides of the border, serve the CIP role for the community, and are related to evaluation measures for program effectiveness.

Less developed, less rigorous, and less “important” so-called secondary indicators will, in the final report, be dealt with selectively. For some, the creation of a database is recommended and the initiation of data collection is proposed. For example, for data regarding governing jurisdictions in the border region, SCERP recommends the development of a yearly survey of cities, counties, *municipios*, and states. The development of a longitudinal database will be valuable for determining the levels and tracking of infrastructure, service delivery, contingency and emergency planning and response, and changes to these functions.

The attached index of indicators remains a fluid list intended to be reviewed, modified, refined, appended, and matured. The nature of indicators is that they remain responsive to their users and the Border 2012 index has high expectations of them to do that.

REFERENCES

Blair, John. 2001. *An Evaluation of the EPA's Border Environmental Indicators: Are They Measuring Up?* Project Number CX827370-01-0. San Diego: Southwest Center for Environmental Research and Policy.

Figure 1. Indicator Organization and Data Availability Pyramid

Legend

HSWTS: Hazardous/Solid Wastes and Toxic Substances

P2T: Pollution Prevention Techniques

EI: Environmental Information

RPD: Regulation and Policy Development

CEC: Cooperative Enforcement and Compliance

EET: Environmental Education and Training

IPD: Infrastructure Planning and Development

EPR: Emergency Preparedness and Response

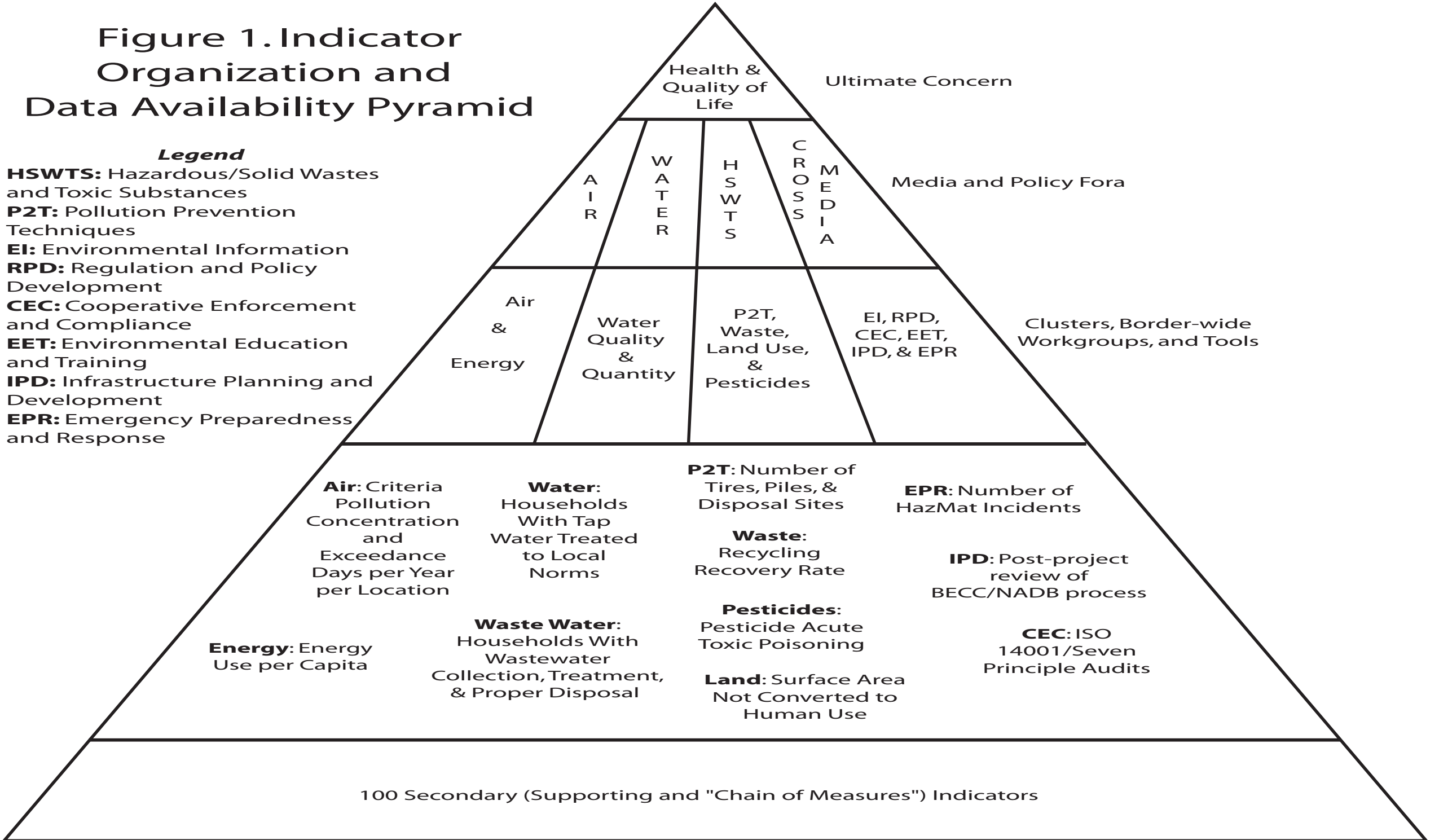


Table 1. Matrix of Nested State Pairs, Sub-Regions, and Media Foci

	California-Baja California	Arizona-Sonora	New Mexico, West Texas- Chihuahua	Texas-Coahuila, Nuevo Leon, Tamaulipas
Air	Imperial-Mexicali Air Basin	Twin cities		
Water	Colorado	San Pedro and Santa Cruz		Río Bravo
Land			Upper Chihuahua Ecosystem	
Cross-media	Energy- Transportation Development			
Contingency Planning and Emergency Response				Twin City, County, State Plans

Table 2. MuSIC Development Principles

Available	on both sides of the border, periodically and in perpetuity from reputable source
Builds	on old ones, on other efforts
Comparable	to interiors
Compatible	with the other side
Health	directly or indirectly connected
Mature	preliminary data indicated, precursor or primitive data as place holders transferable/translatable, substitutes if necessary
Quality	I “available, ongoing, systematic”
	II “partial, not full cycle, analysis needed”
	III “not ongoing, conceptual, not developed”
Relevant	to community
Reliable	by various users and uses
Responsive	to demographic momentum
Sensitive	to change at appropriate scales
Timely	indicates near real-time trends
Usable	by administrators to guide actions and priorities, by government to design and fund program, by communities to gauge risks, by NGOs to advocate for their agenda

Table 3.

	Air	Water	Land/Soil (Pesticides)	Cross-media (Lead)
Database designed	CICA	Total Max Daily		
Monitoring System	Criteria pollutant sensors	Well/surface waterbody	Personal meters	Various ie soil, air, water, paint
Preliminary Data	Criteria pollutant levels	TDS, Temp, E. coli, N, P, DO,	Amount used	Proximity to sources and smelters
Intermediate Data	Hourly, daily, annual exceedances		Proximity, Training, Compliance	Amount in packaging, water, food
Ultimate Data	Attainment status	Potability	Amount in food, dust,	Blood levels
Associated Raw Health Data*	Asthma	Gastro-intestinal disorder,	Acute poisoning	Symptoms
Ecological Data	Carbon	Mussels,	Residual amounts	
Institutional Data	Paving cost benefit analysis	Revenues per cubic meter	Risk to benefit assessment	Remediation effects

*EPA and CDC have intentions of analyzing raw data to develop regional, annual, age-adjusted, temporal trend-revealing, clustered, geographic differential, or epidemic indicators

Appendix A

**MuSic
Multinational Sustainable Indicators Participant List
July 24, 2002**

Hector Aguirre	EPA
Jorge Aguirre	FUMEC
Jessica S. Amezcua	SCERP
Jane Barr	CEC
Alberto Barud	UTEP
Russ Bennett	Consultant
Kimberly Collins	SDSU
Mike Connolly	Campo Band of Mission Indians
Felipe Cuamea V.	UABC
Bob Currey	UTEP
Heather Davis	City of San Diego
J. Luis Ferman Almada	UABC
Paul Ganster	IRSC
Jim Gerber	SDSU
Bob Gray	UTEP
Colin Griswold	SCERP
Michael Hadrick	EPA
Iris Jiménez C.	SEMARNAT
Elena Lelea	IRSC
Walter Oechel	BAQA
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Angelica Villegas	IRSC
Margaret Walters	EPA
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