Mapping the Educational Landscape: New Techniques to Meet Educational Challenges

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Introduction

- International and national comparisons of achievement drive reform efforts: **PISA**
- **Narrow range** of educational data used: reading and mathematics
- **Limits understanding**: What? Why? How to Improve?
- Conversations: **Polarized and Politicized**
- Student Achievement: **Complex and Nuanced**
- Need a **different way** to visualize data:

Geospatial Mapping!

What is Geospatial Mapping?

Geospatial mapping is an approach to applying statistical analyses, data visualization, and other analytic techniques to data that have geographical dimensions.

- The UNM Center for Education Policy Research has focused on major educational issues around student achievement and variables that define it.
- Geospatial Mapping approaches make these variables **obvious and easier** to understand in the specific context of educational achievement.
- Some authors argue that a geospatial perspective is essential in developing a type of ***visual political literacy*** in the areas of education, health and human services.

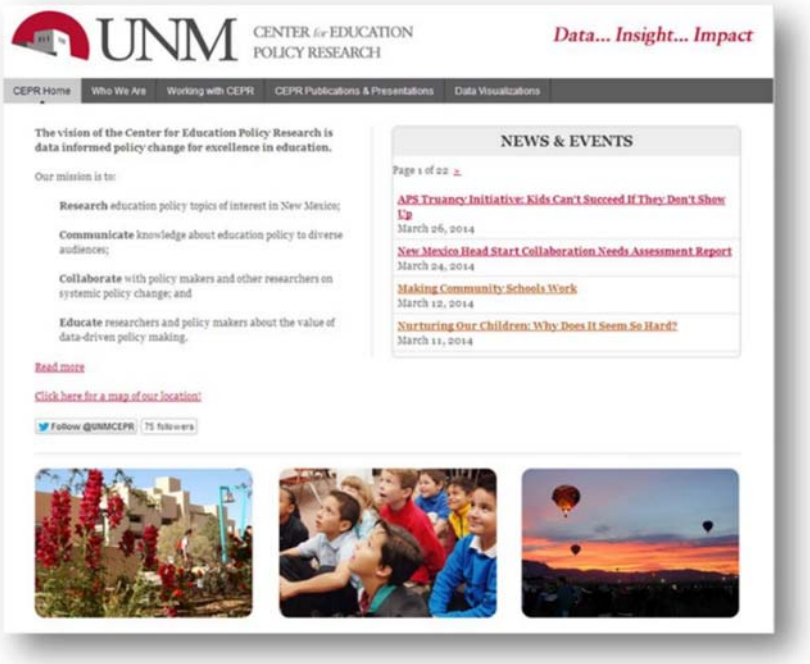
MAPPING IS POWERFUL

- Geospatial mapping is important because:
  - images, illustrations, and graphic representations strongly **support learning, understanding** and other aspects of cognition
  - maps have long been useful in engaging **multiple groups** in civic debates and other political discussions because they can be used as **planning tools**

UNM Center for Education Policy Research (CEPR)

The UNM Center for Education Policy Research (CEPR) has made extensive use of geospatial data presentation and analysis to:

- Inform legislative policy decisions.
- Assist local communities in identifying their assets and challenges.
- Help foundations and agencies determine whether their funding strategies are effective.



CEPR.UNM.EDU

Why Geospatial Mapping?

Asking and answering "critical policy" questions…

What are the key questions that must be answered in order to understand the underlying problem(s)?

- What are the most important issues facing our communities?
- What local, state, national and international data will help us address these issues?
- How can we display the data in ways that enhance people's understanding of the issues?
- How can we analyze the data to highlight priorities, deploy resources, and monitor impact?

The Power Of Geospatial Mapping

- **Description:** Making the data **accessible** to all audiences
  - Painting the picture of urgency
  - Identifying risk, needs, and assets

- **Analysis:** **Making sense** of the data
  - Identifying gaps in resources
  - Setting priorities
  - Measuring impact

- **Action:** Using data for **change**
  - Providing a basis for advocacy
  - Strengthening public engagement
  - Developing policy

A Few Advantages of Geospatial Mapping

- Geospatial mapping is **used extensively in other fields** including health and human services, natural resources, public safety, defense, and urban and regional planning.

- The data in the maps are **immediately accessible to a wide range of audiences** including policy-makers, community members, educators, students, and parents.

- Maps are **powerful conversation starters**. Everybody sees something different in the maps based on their perspectives and experiences.

- Maps **equalize the conversations** among different groups at the table. People want to know what others think!

Types of Data

- **Both** spatial and table-based data are required

- Decisions include at what level data will be **aggregated**, for example:
  - School District
  - Municipality
  - Individual School Location
  - Census Tract (U.S.)

- Aggregation level depends on **data availability** and story to be told.

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Overview of Examples

The following geospatial mapping examples draw data from both the U.S.A. and Spain.

There are **two examples** from the state of **New Mexico**: Albuquerque and Santa Fe

There are **two examples from Spain** – focusing on out-migration from Spain, and one that focuses on immigration into Barcelona

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Nation

Autonomous Communities

Provinces

Municipalities

Types of Data

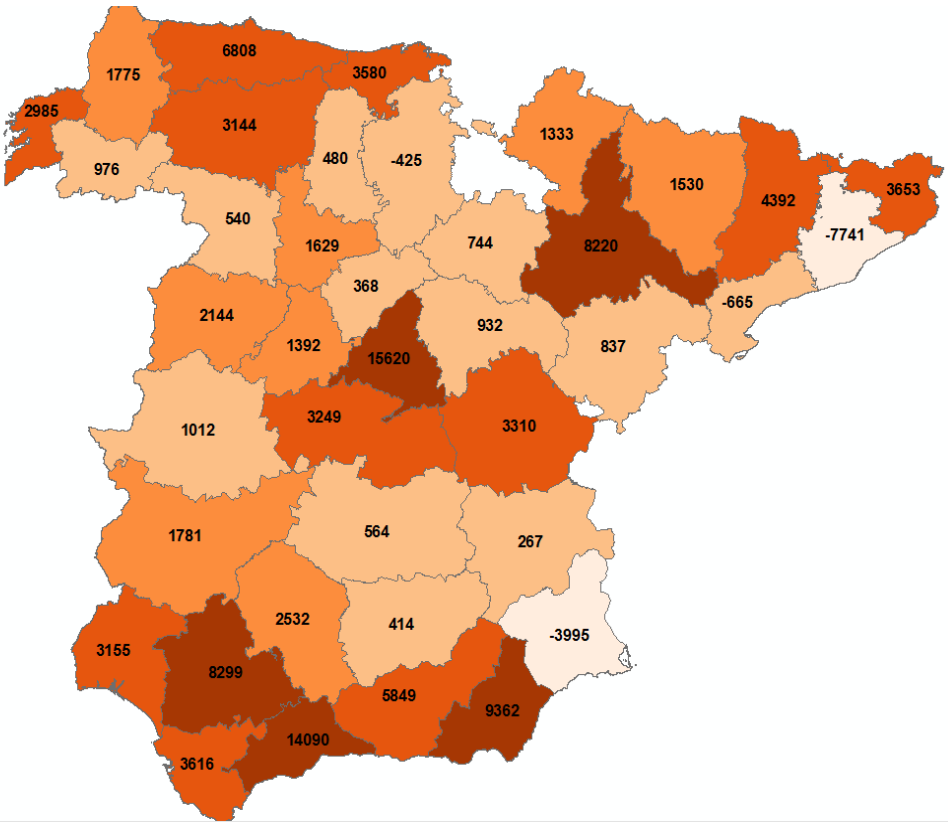
- **Education**
  - **School Data** (graduation rates, early leaver rates, students entering vocational programs, tests scores)
  - **Disaggregated student group data** (gender, language spoken, socioeconomic status, migration status)
  - **Financial** (per-student spending by school)
  - Sources include local schools and governments, Instituto Nacional de Estadistica (INE)
- **Health**
  - Prenatal care, birth weights, food access
  - World Health Organization, INE
- **Economic**
  - Household income, unemployment
  - World Bank, EU Labor Force Survey, INE

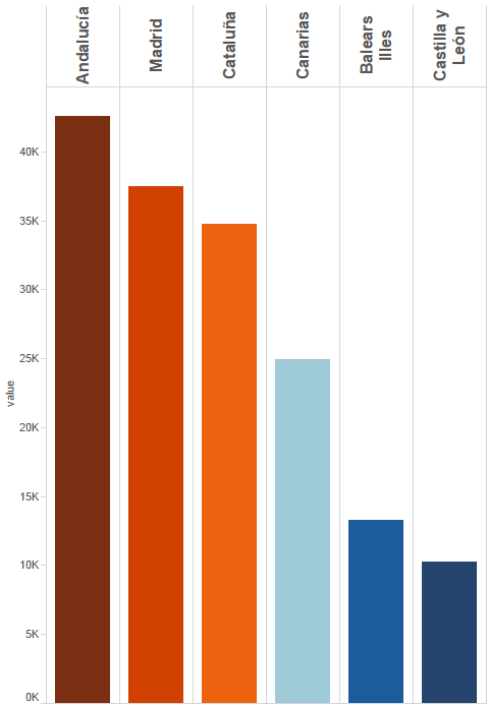
Population Dynamics

- Young students emigrating out of the country because they cannot find jobs to match qualifications[1].
- This is called the, "brain □rain" – removing many talented young, motivated people from the country
- **One Strategy**: present data showing which regions of Spain have been hit particularly hard by this trend
- Focus **economic development** on these areas – give hope to young workers

Source: Education in Crisis website, http://www.educationincrisis.net/ , The story on current education reforms in Spain: The past will come back, by Maria Luisa Sanchez Simon.

Net Migration of 15-34 year olds out of Spain from 2008-2012 by Province (map) and Region (chart, data not available for all provinces)





Organizing Data for Meaning

Examples:

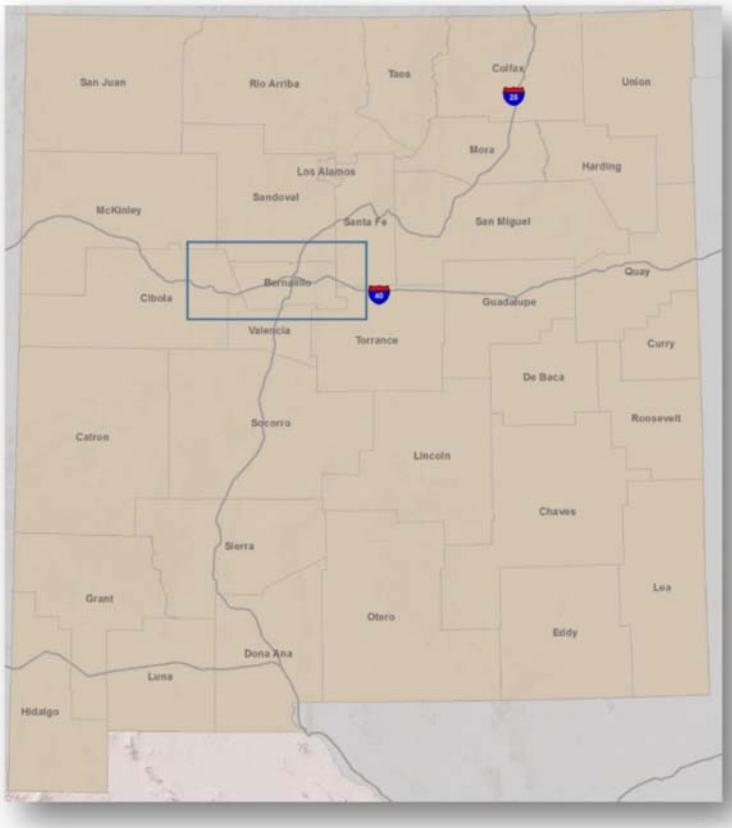
1. Identifying **geographic disparities** between neighborhoods, schools, municipalities, regions or countries.
2. Showing potential **need/asset gaps** related to local resources.
3. Creating **indexes** that combine a collection of indicators to rank geographies along a continuum.
4. Showing **flows of people or things** into and out of a region.

Why is Geospatial Mapping Important?

EXAMPLE # 1: What is an Issue facing Albuquerque?

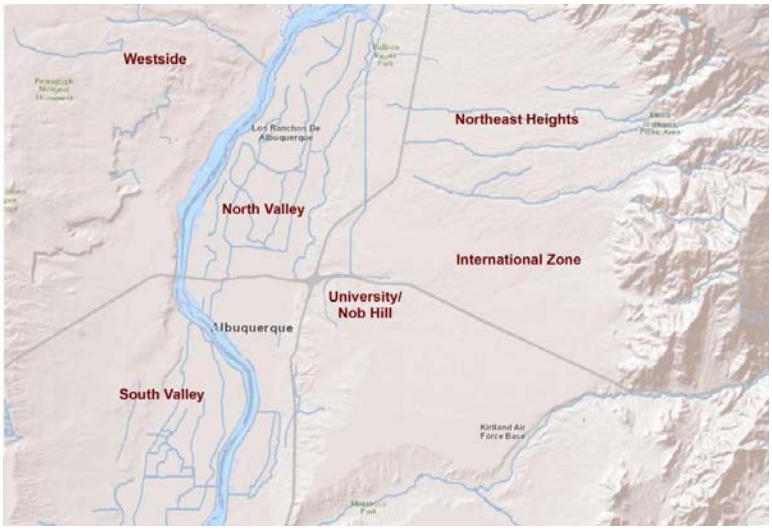
How Do We Address The Educational, Economic, And Health Disparities Among Our Communities And Across Our Generations?

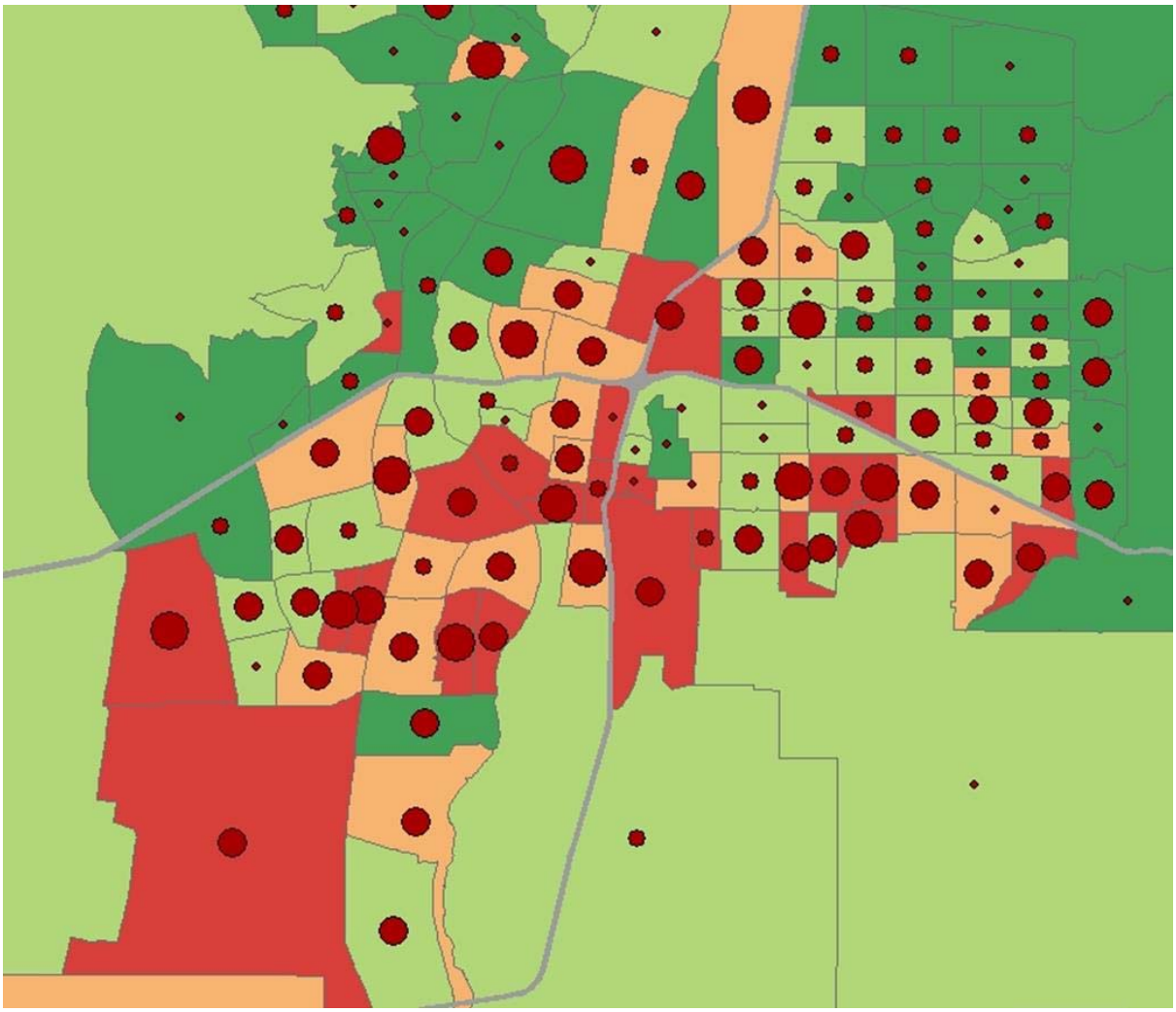
Our State



Our City

Our Neighborhoods





Percentage of Individuals Living In Albuquerque Below Poverty Level with Less than High School Education

Less than High School Graduate

- 0% - 8.9%
- 9% - 21%
- 21.1% - 37.7%
- 37.8% - 82.6%

Percentage Below Poverty Level

- 0% - 10%
- 10.1% - 20%
- 20.1% - 30%
- 30.1% - 52.8%

Habitual Truancy Is A Problem Across New Mexico

51,034

Students Were Habitually Truant In 2011-2012

>

50,929 Truant Students are Enrolled In 66 Of New Mexico's 89 Districts

BERNALILLO, BLOOMFIELD, LOVINGTON, TAOS, PORTALES, RUIDOSO, POJOAQUE, LAS VEGAS CITY, SOCORRO, WEST LAS VEGAS, ZUNI, HATCH, TRUTH OR CONSEQUENCES, COBRE, RATON, TUCUMCARI, DEXTER, TULAROSA, ESTANCIA, DULCE, CUBA, PECOS, SANTA ROSA, LORDSBURG, LOVING, EUNICE, CLAYTON, TEXICO, QUESTA, CAPITAN, PEÑASCO, MORA, JEMEZ VALLEY, CIMARRON, MAGDALENA, CLOUDCROFT, HAGERMAN, CHAMA, JAL, MESA VISTA, JEMEZ MOUNTAIN, MOUNTAINAIR, TATUM, FT. SUMNER, FLOYD, ANIMAS, DORA, LOGAN, SPRINGER, MELROSE, QUEMADO, CARRIZOZO, RESERVE, HONDO, SAN JON, LAKE ARTHUR, ELIDA, GRADY, VAUGHN, DES MOINES, MAXWELL, CORONA, HOUSE, WAGON MOUND, ROY, MOSQUERO

If All These Students Were In One District, It Would Be The <u>Second Largest District</u> In New Mexico And Twice The Size of Las Cruces

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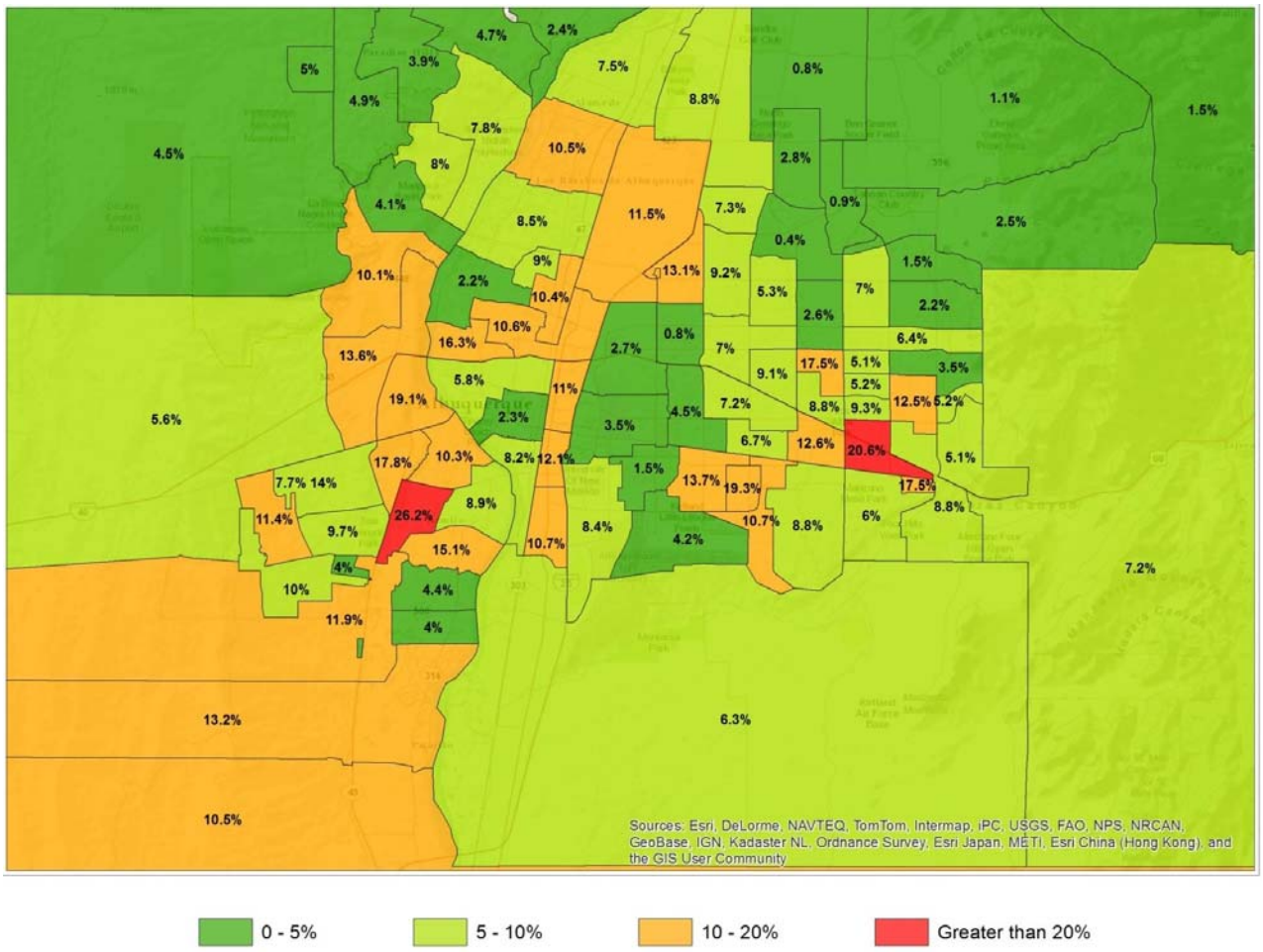
Source: NM Public Education Department: 2010SY 40D Enrollment by District; Habitual Truant Students By District and School Type 2011-2012

Percentage Of APS Elementary School Students Who Were Habitually Truant In 2011-2012



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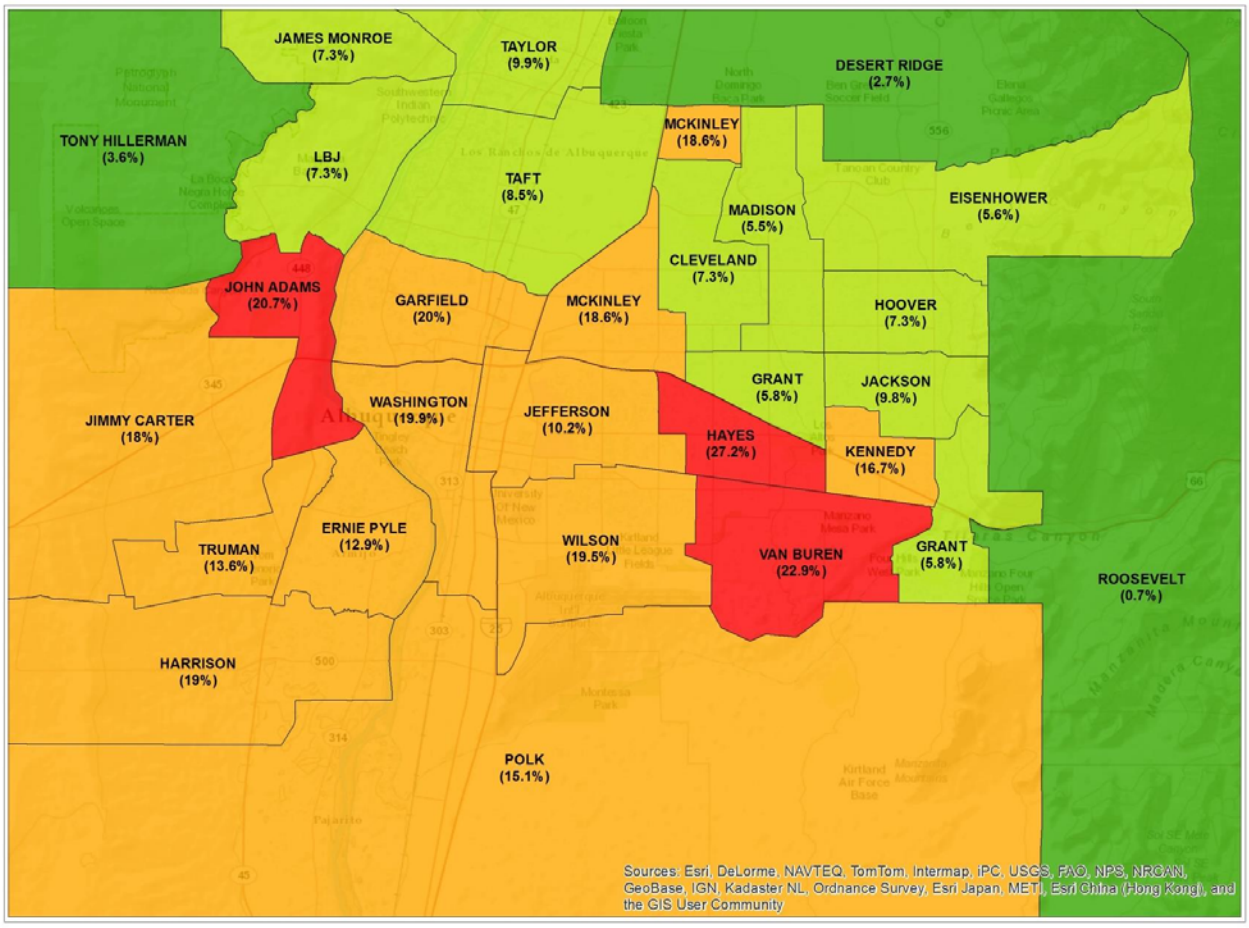
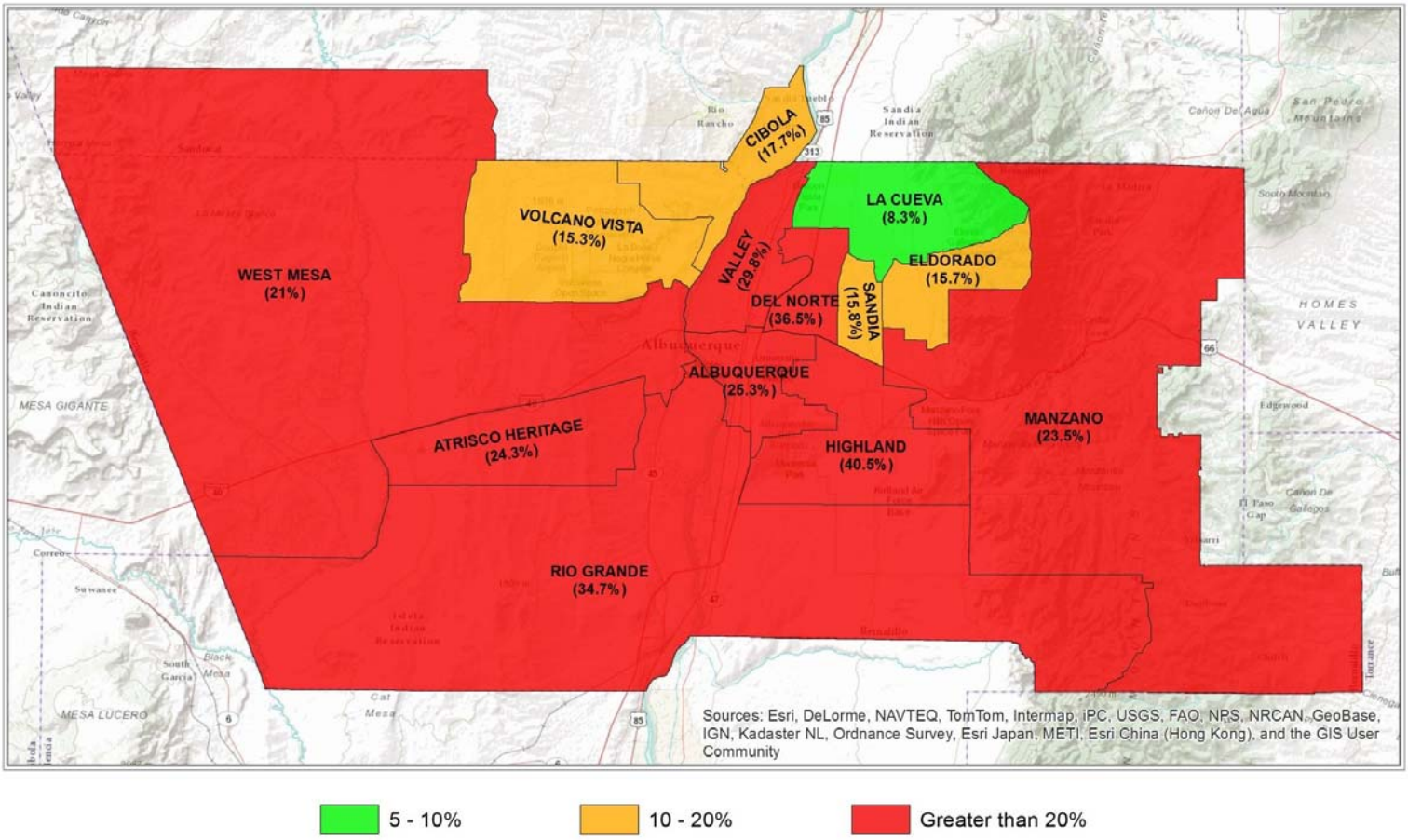
Source: Albuquerque Public Schools, RDA Department, 2011-2012 School Year. A student is identified as a Habitual Truant when the student has accumulated 10 or more days of unexcused absences.

Percentage Of APS Middle School Students Who Were Habitually Truant In 2011-2012



Source: Albuquerque Public Schools, RDA Department, 2011-2012 School Year. A student is identified as a Habitual Truant when the student has accumulated 10 or more days of unexcused absences.

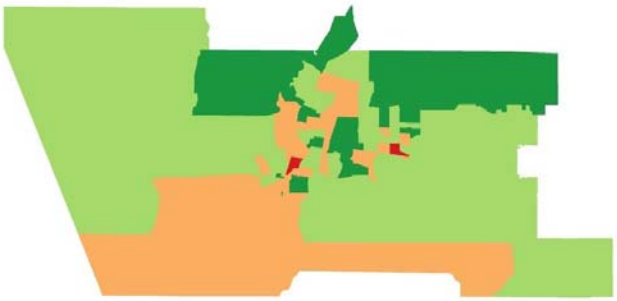
Percentage Of APS High School Students Who Were Habitually Truant In 2011-2012



Source: Albuquerque Public Schools, RDA Department, 2011-2012 School Year. A student is identified as a Habitual Truant when the student has accumulated 10 or more days of unexcused absences.

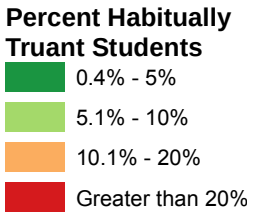
Habitual Truancy In APS Elementary, Middle, And High Schools

Elementary School



Middle School

High School



These maps show truancy moving like a **red tide** that engulfs Albuquerque Public Schools students by the time they are in high school.

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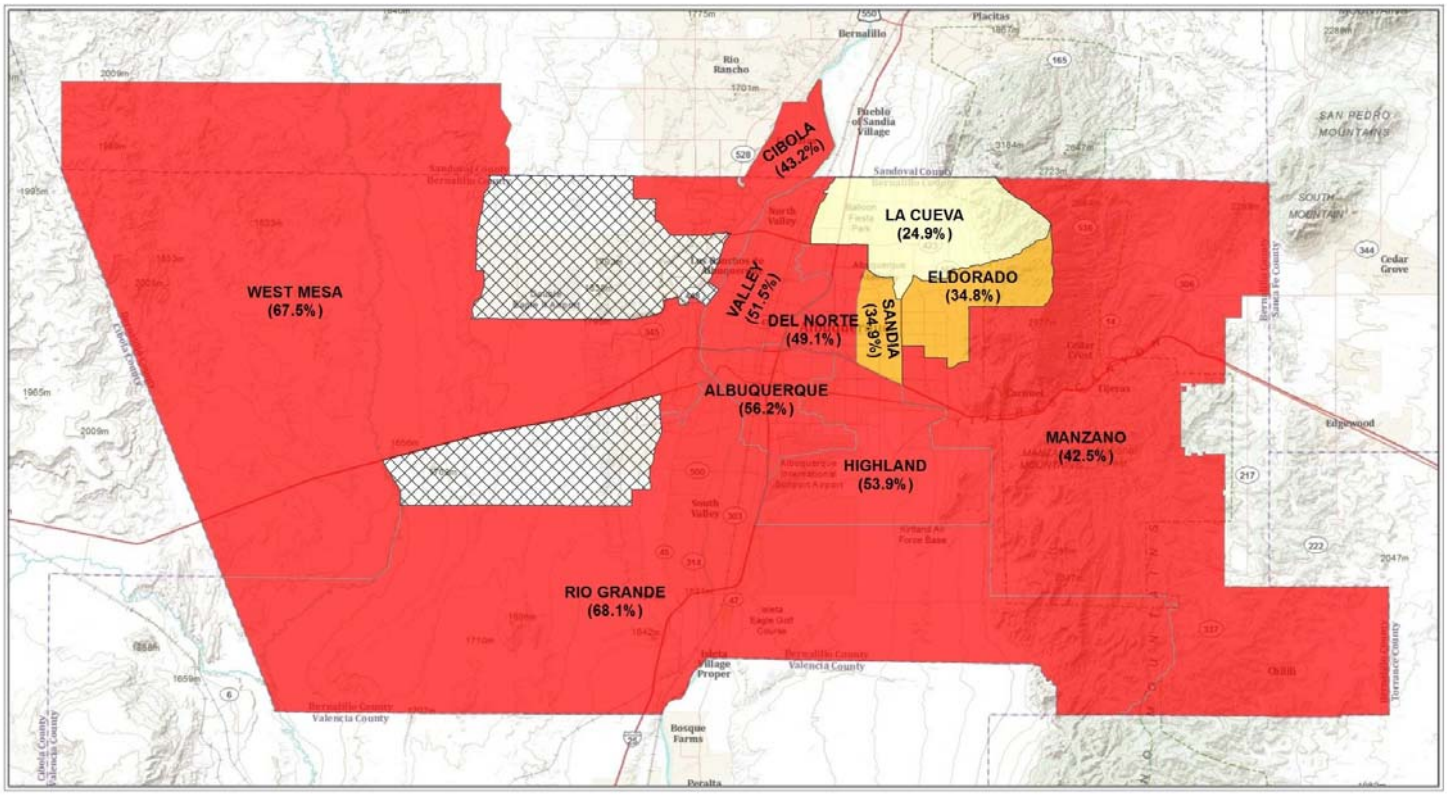
Source: Albuquerque Public Schools, RDA Department, 2011-2012 School Year. A student is identified as a Habitual Truant when the student has accumulated 10 or more days of unexcused absences.

Percentage of APS Students Attending New Mexico Colleges Who Took Remedial Courses, 2000-2009, By Sending High School



Source: "Ready For College? A Report on New Mexico's High School Graduates Who Take Remedial Courses In College," June 2010, New Mexico Office of Education Accountability. Data were unavailable for Volcano Vista & Atrisco Heritage Academy.

Creating An Index

- The previous maps have demonstrated the power of viewing single and multiple variables on a map. An **index** combines multiple variables and provides a means of ranking these in an objective way.
- Indices can **support decisions** about where to allocate funds and focus resources.
- Indices can **focus attention** on negative (risk) factors, or positive (opportunity) factors.
- The Kirwan Institute[1] at Ohio State University and The Trust for Public Land[2] have both used index mapping to **engage community conversation and action** in relation to urban planning issues.

[1]Reece , Jason, Christy Rogers, Matt Martin, Liz Colombo, Dwight Holley, Melissa Lindsjo (2012), Neighborhoods and Community Development in Franklin County,
Kirwan Institute, Ohio State University.
[2]Trust for Public Land, http://oregonexplorer.info/deschutes/MappingTools/GreenprintMaps

Early Childhood Risk-Based Index: Select Indicators

EARLY CHILDHOOD PLANNING

0307 BTH ALL ECIZ SD_E3	DATA DICTIONARY		
COMBINED RISK INDEX FACTOR	**VARIABLE**	**DEFINITION**	**SOURCE**
	DIST_CODE	Numeric code for school district (NMPED)	NMPED & NCES
	DISTRICT	Short name for School District	NMPED & NCES
	RANK # (INDEX)	Numeric Rank of the District based on the combined index of 10 indicators (1=Highest Risk) (NOTE: Not Population Weighted)	
	RANK CATEGORY (INDEX)	Category (text) Rank of the District based on the combined index of 10 indicators (NOTE: Not Population Weighted)	
	EDFErnl	Total Enrollment	NCES, 2008-2009
COMBINED RISK INDEX FACTOR 1	PMMEDu12	Percent Births to mothers who did not complete high school	
COMBINED RISK INDEX FACTOR 2	INVPSBHC	Percent of All Schools that DO NOT have a School Based Health Center	NMASBHC
COMBINED RISK INDEX FACTOR 3	INVPGRDPRT	Percent of female HS Students that were NOT participants in GRADS programs during 2010	GRADS Program
COMBINED RISK INDEX FACTOR 4	invGRA10	Percent of students who did not graduate 4 years after entering 9th grade, school year 2009-2010 (note: there are no zeros, but there are missing values due to low numbers of students assessed)	NMPED & NCES
COMBINED RISK INDEX FACTOR 5	invPRF10	Percent of students who did not score proficient or above in combined reading and math standard based assessment test, school year 2009-2010 (note: there are no zeros, but there are missing values due to low numbers of students assessed)	NMPED & NCES
COMBINED RISK INDEX FACTOR 6	PSFRPM10	Percent of students receiving free or reduced priced meals, school year 2009-2010 (note: only Los Alamos SD is rated zero)	NMPED & NCES
COMBINED RISK INDEX FACTOR 7	PP25on12	Percent Population 25 years and over without high school graduation	US Census American Factfinder, ACS 06-10 5 yr, S1501
COMBINED RISK INDEX FACTOR 8	PctTitI	Percent All Schools that are Title I schools	NCES, 2008-2009
COMBINED RISK INDEX FACTOR 9	PPupPS	Dollars expended on personnel salaries per pupil, All Schools	NCES, 2008-2009
COMBINED RISK INDEX FACTOR 10	PctDF100	Percent Elementary Schools Graded 'D' or 'F' (percent)	NMPED, 2011-2012

Risk-Based Index: Calculate Standard Deviation-Based Ranks

shortname	Index	textindex	totenroll	prctmomnohnum	perctbirthmomnohs	testmomnohs	peterputinmomnohs	Sdrank
HOUSE	1	1 to 10 (Highest)	92	0.15380000	15.38%	15.38%	15.4%	8.2795
MAGDALENA	2	1 to 10 (Highest)	463	0.315	31.46%	31.46%	31.5%	7.5296
HATCH	3	1 to 10 (Highest)	1390	0.504	50.37%	50.4%	50.4%	7.2356
GADSDEN	4	1 to 10 (Highest)	13865	0.492	49.22%	49.2%	49.2%	6.6560
DEXTER	5	1 to 10 (Highest)	1057	0.361	36.07%	36.1%	36.1%	5.8671
DEMING	6	1 to 10 (Highest)	5281	0.467	46.71%	46.7%	46.7%	5.4907
ESPANOLA	7	1 to 10 (Highest)	4409	0.317	31.67%	31.7%	31.7%	4.9900
EUNICE	8	1 to 10 (Highest)	589	0.307	30.66%	30.7%	30.7%	4.7777
ZUNI	9	1 to 10 (Highest)	1434	0.282	28.24%	28.2%	28.2%	4.6617
ESTANCIA	10	1 to 10 (Highest)	959	0.292	29.23%	29.2%	29.2%	4.6291
CUBA	11	11 to 20 (High)	727	0.348	34.84%	34.8%	34.8%	4.3239
GALLUP	12	11 to 20 (High)	12507	0.279	27.86%	27.9%	27.9%	4.0649
DULCE	13	11 to 20 (High)	681	0.312	31.16%	31.2%	31.2%	3.4424
WEST LAS VEGAS	14	11 to 20 (High)	1728	0.278	27.82%	27.8%	27.8%	3.4263
TUCUMCARI	15	11 to 20 (High)	1077	0.309	30.92%	30.9%	30.9%	3.2236
QUESTA	16	11 to 20 (High)	491	0.157	15.70%	15.7%	15.7%	3.0541
LOVING	17	11 to 20 (High)	620	0.216	21.60%	21.6%	21.6%	2.7818
JEMEZ MOUNTAIN	18	11 to 20 (High)	373	0.258	25.81%	25.8%	25.8%	2.6202
BLOOMFIELD	19	11 to 20 (High)	3134	0.295	29.51%	29.5%	29.5%	2.4060
HAGERMAN	20	11 to 20 (High)	433	0.327	32.70%	32.7%	32.7%	2.3870
TULAROSA	21	21 to 40 (Above Average)	975	0.376	37.64%	37.6%	37.6%	2.3814
CARRIZOZO	22	21 to 40 (Above Average)	193	0.229	22.92%	22.9%	22.9%	2.1056
BELEN	23	21 to 40 (Above Average)	4664	0.308	30.80%	30.8%	30.8%	1.9064
JAL	24	21 to 40 (Above Average)	405	0.203	20.30%	20.3%	20.3%	1.8348
LORDSBURG	25	21 to 40 (Above Average)	681	0.321	32.13%	32.1%	32.1%	1.6432
FLOYD	26	21 to 40 (Above Average)	244	0.286	28.57%	28.6%	28.6%	1.6321
SANTA FE	27	21 to 40 (Above Average)	12090	0.342	34.22%	34.2%	34.2%	1.4716
MOUNTAIN AIR	28	21 to 40 (Above Average)	319	0.212	21.17%	21.2%	21.2%	1.3096
TATUM	29	21 to 40 (Above Average)	309	0.337	33.72%	33.7%	33.7%	1.2149
HOBBS	30	21 to 40 (Above Average)	7943	0.349	34.86%	34.9%	34.9%	1.1700
CLOVIS	31	21 to 40 (Above Average)	7968	0.246	24.59%	24.6%	24.6%	1.0317
PECOS	32	21 to 40 (Above Average)	676	0.220	22.03%	22.0%	22.0%	0.9620
JEMEZ VALLEY	33	21 to 40 (Above Average)	511	0.158	15.82%	15.8%	15.8%	0.9417
SANTA ROSA	34	21 to 40 (Above Average)	634	0.220	21.99%	22.0%	22.0%	0.8809
CLAYTON	35	21 to 40 (Above Average)	601	0.232	23.20%	23.2%	23.2%	0.8777
ROSWELL	36	21 to 40 (Above Average)	9751	0.315	31.50%	31.5%	31.5%	0.7648
RATON	37	21 to 40 (Above Average)	1369	0.310	31.03%	31.0%	31.0%	0.6258
LAS VEGAS CITY	38	21 to 40 (Above Average)	2003	0.190	19.02%	19.0%	19.0%	0.6076
SPRINGER	39	21 to 40 (Above Average)	197	0.210	20.99%	21.0%	21.0%	0.3542

Opportunity-Based Index

The CDC has identified several factors related to high risk for child maltreatment. The goal is to introduce a possible technique for identifying neighborhoods that may benefit from resources.

The best opportunity for children to grow up without becoming victims of maltreatment include:

- Having parents with higher education levels;
- Living in a household with 2 parents;
- Living in a household with income above poverty level;
- Living in a household with fewer dependent children;
- Living in neighborhoods with low unemployment;
- Living in neighborhoods where people have lived at least a year in the same house;
- Living in neighborhoods with a lower density of alcohol outlets.

Source: http://www.cdc.gov/violenceprevention/childmaltreatment/riskprotectivefactors.html

Opportunity Mapping in Santa Fe: A Tale of Two Cities

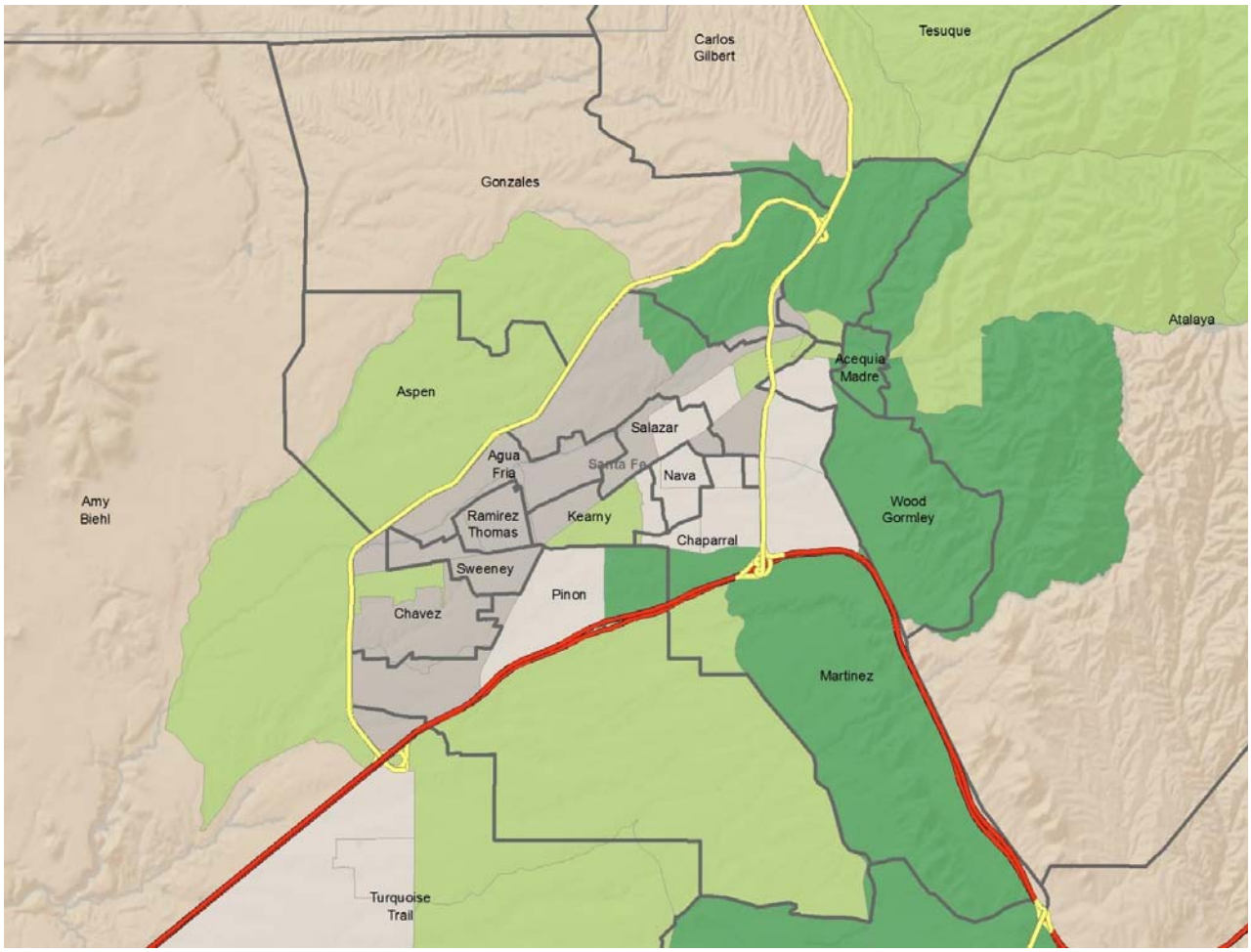
Opportunity Index

To better understand the factors within the City of Santa Fe that affect educational and other life outcomes, we constructed a **composite index of opportunity** that combines 3 socioeconomic indicators:

- **educational attainment (bachelor's degree or higher),**
- **poverty level (100% FPL), and**
- **households with children under 18 headed by a single female**

Assumption - areas with high educational attainment, low poverty and fewer households headed by single mothers, may offer the best opportunities for success to children living there.

Elementary School Boundaries and Opportunity Index



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Early Childhood Challenges in Barcelona
Infancia Temprana

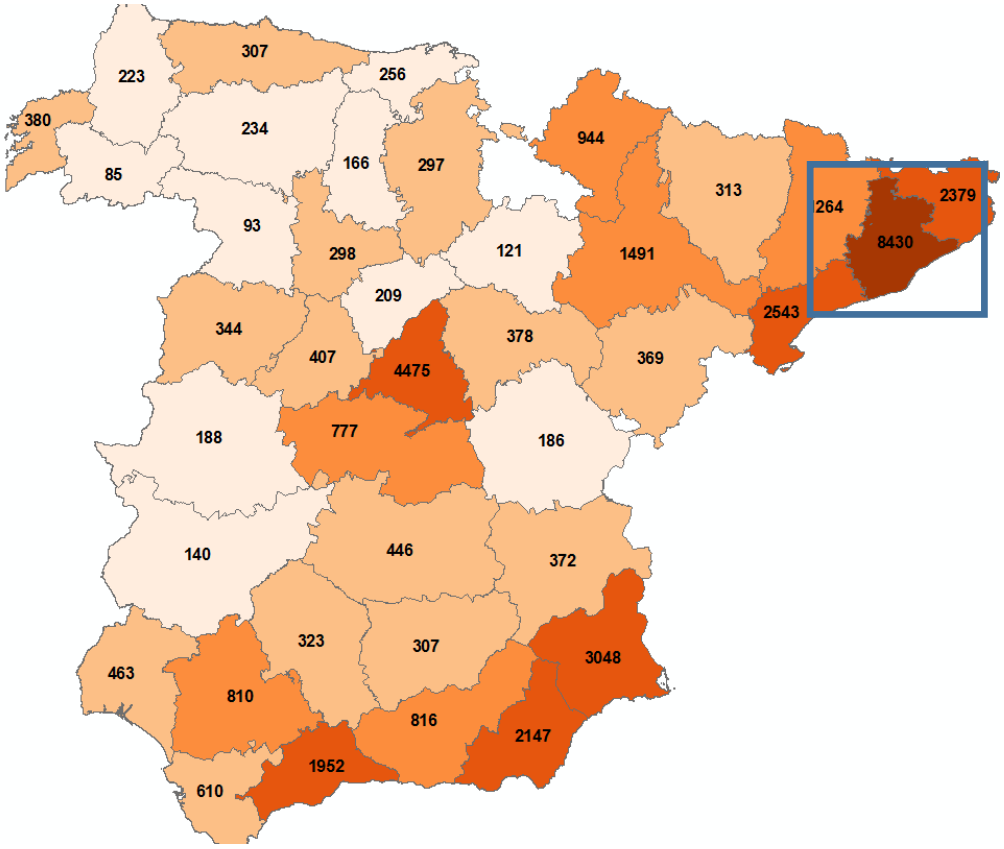
Early Childhood Challenges Index

Large numbers of recent, young immigrants from non-Spanish-speaking countries can put strain on an educational system.

Barcelona has experienced **high rates of immigration** from Africa in the past few years. The First Map shows the numbers of **0-4 year olds** by province who have immigrated recently.

Education Challenges: Early Childhood (Infancia Temprana)

Map Shows Total 0-4 year olds immigrating from Africa between 2008-2012 by Province (data not available for all provinces)



Early Childhood Challenges Index in Barcelona

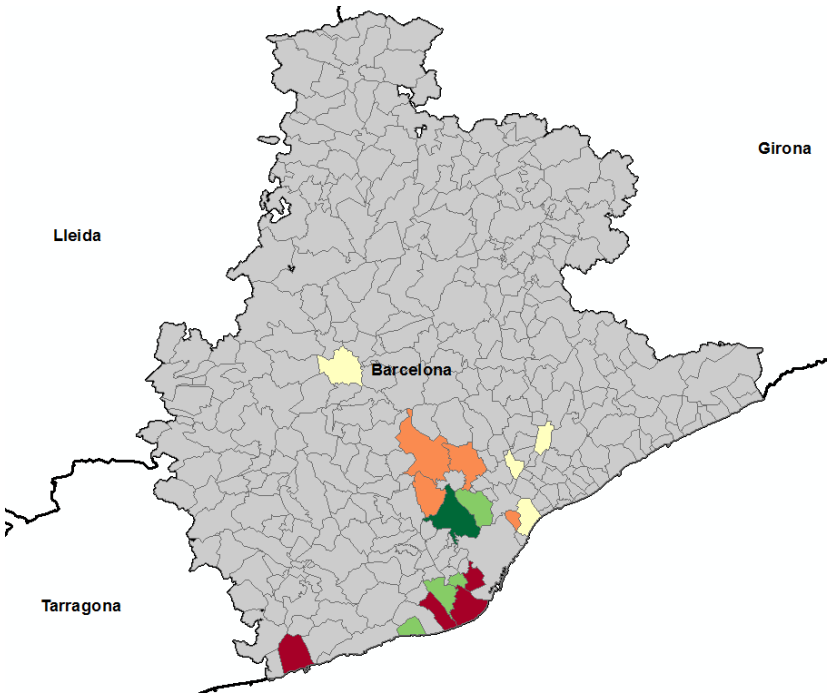
- In order to better understand the context for early childhood education and outcomes we have created an index for municipalities with populations >50,000 combining the following:

  - Mother's educational attainment (less than **compulsory education diploma),**
  - **Preterm birth rate, and**
  - **Births to unmarried mothers**

- **Assumption** - children born before their due date, to single mothers, or to mothers with low educational attainment, may require greater support early in life than others

Education Challenges: Early Childhood in Barcelona

Map Shows Municipalities in Barcelona Ranked by Early Childhood Risk Indicators Including Births to Unmarried Mothers, Pre-term Births and Births to Women with Less Than A Compul□or□Level E□uca□ion Degree in Barcelona'□Municipali□ie□> 50K Popula□ion



Municipality	Combined Z Score
Sant Cugat del Vallès	-2.777969676
Cerdanyola del Vallès	-2.010516041
Cornellà de Llobregat	-1.696076914
Sant Boi de Llobregat	-1.435732226
Castelldefels	-1.31205436
Mollet del Vallès	-0.778535801
Manresa	-0.628895715
Granollers	-0.554394256
Badalona	-0.440030982
Rubí	-0.177406397
Sabadell	0.003299857
Santa Coloma de Gramenet	0.063252752
Terrassa	0.194550043
Mataro	0.65480963
Vilanova i la Geltrú	1.233730184
Viladecans	1.534914874
El Prat de Llobregat	1.566343381
L'Hospitalet de Llobregat	1.829417523

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The Future of Geospatial Mapping

1. The **future is very bright** for these kind of mapping technologies. GM compresses the masses of data so that they are more understandable and usable.

2. Create **real-time, dynamic displays** of multiple variables interacting simultaneously.

1. We will be able to use GM as a **research tool** in a dynamic manner.

SUMMARY

First, these statistical tools, conceptual frameworks and analytical techniques can offer ***unique insights*** when specifically applied to complex educational issues.

Second, geospatial data visualization are **immediately accessible** to a wide range of audiences including policy-makers, community members, educators, students, and parents.

Third, geospatial maps can help convey the message that ***we are one community, bound together by a sense of place***.

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