Ethnic disparity in economic wellbeing in China

A nighttime light imagery estimation

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Image courtesy of ChinaInsights

What is the economic disparity among ethnic groups in China in the past decade?
中国各个民族之间的经济福祉倒底发展的怎么样？

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1 Significance 研究的意义

"Ethnic disparities are a salient predictor of well-being in many aspects of American society, such as education attainment, health status, employment, and housing quality, reflecting a country's progress and development on race-related issues."

"种族间的差距依然是现代社会中包括教育、健康、住房等等方方面面的一个显著重要的指标，反映了一个国家在种族方面问题的进步和发展状态。"

— **Rebecca M. Blank** (2001)
   The current chancellor of the University of Wisconsin-Madison and former Acting United States Secretary of Commerce. 前美国商业部部长，现任威斯康星大学麦迪逊分校校长

Image courtesy of zonaeuropa.com

March, 2008, Lhasa

Image courtesy of economist.com

July, 2009, Urumqi

"This polarized development is at the heart of a multitude of serious problems that are threatening sustainable development in China, as well as social cohesion in Chinese society"

— Cao (2010)

"…差距的加大不仅会激化中央与地方的矛盾，也将激化地区之间、民族之间的矛盾，进而引起政治和社会的不稳定。"

--- 施玉，2012

Current Research Problem

- Little literature in English discussing this issue has been found. 因为数据的原因很少这方面的研究
  - We attribute this to a lack of solid data.
- Inaccurate measurement due to data limitations. Existing studies were conducted at a provincial or county level using survey data from yearbooks limited by administrative boundaries (Zhang and Dong 2009; Li and Gustafsson 2002).
  - But the inhabiting areas of ethnic groups do not always match with the administrative boundaries.

Existing studies were conducted at a provincial or county level using survey data or statistical data from yearbooks limited by administrative boundaries.

But the inhabiting areas of ethnic groups **do not always match** with the administrative boundaries.

现有的研究多受限于以行政区为基础的统计数据

Qinghai

Tibet

Sichuang

Tibetan

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2 Methodology 研究方法

Assumption of Nighttime Imagery 理论假设

- The rationale: Nocturnal lighting is a proxy of economic activity, and is closely correlated with economic development level, which has been well demonstrated by many documented literature.
  - (Ghosh et al. 2009; Lo 2002; Elvidge et al. 1997; Doll Muller, and Elvidge 2000; Sutton, Elvidge, and Ghosh 2007; Doll 2003; Chen and Nordhaus 2011; Ghosh et al. 2010).

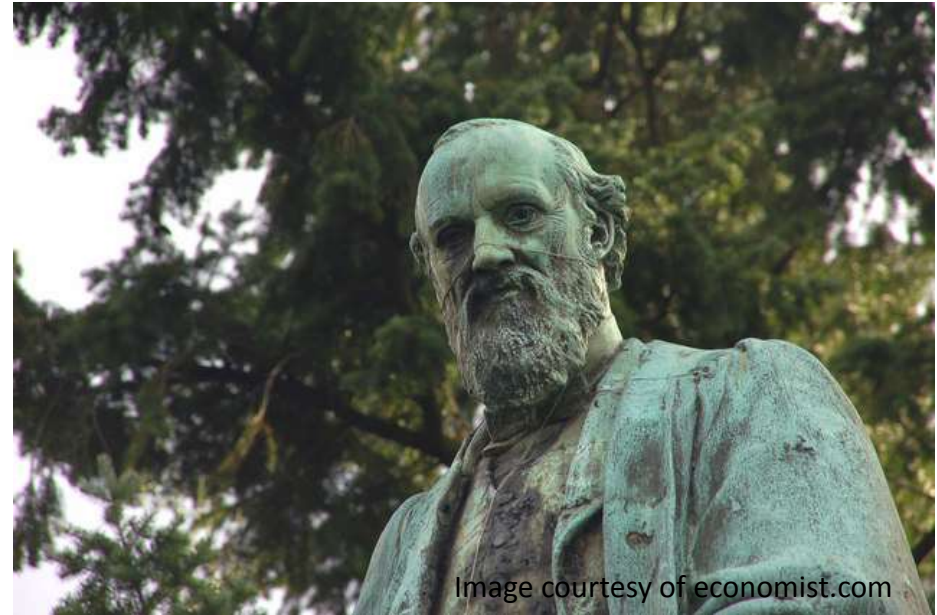- 背后的机理就是灯光其实是经济活动的一种表现。而且很多研究在不同尺度上证明这两者之间强烈的相关性。
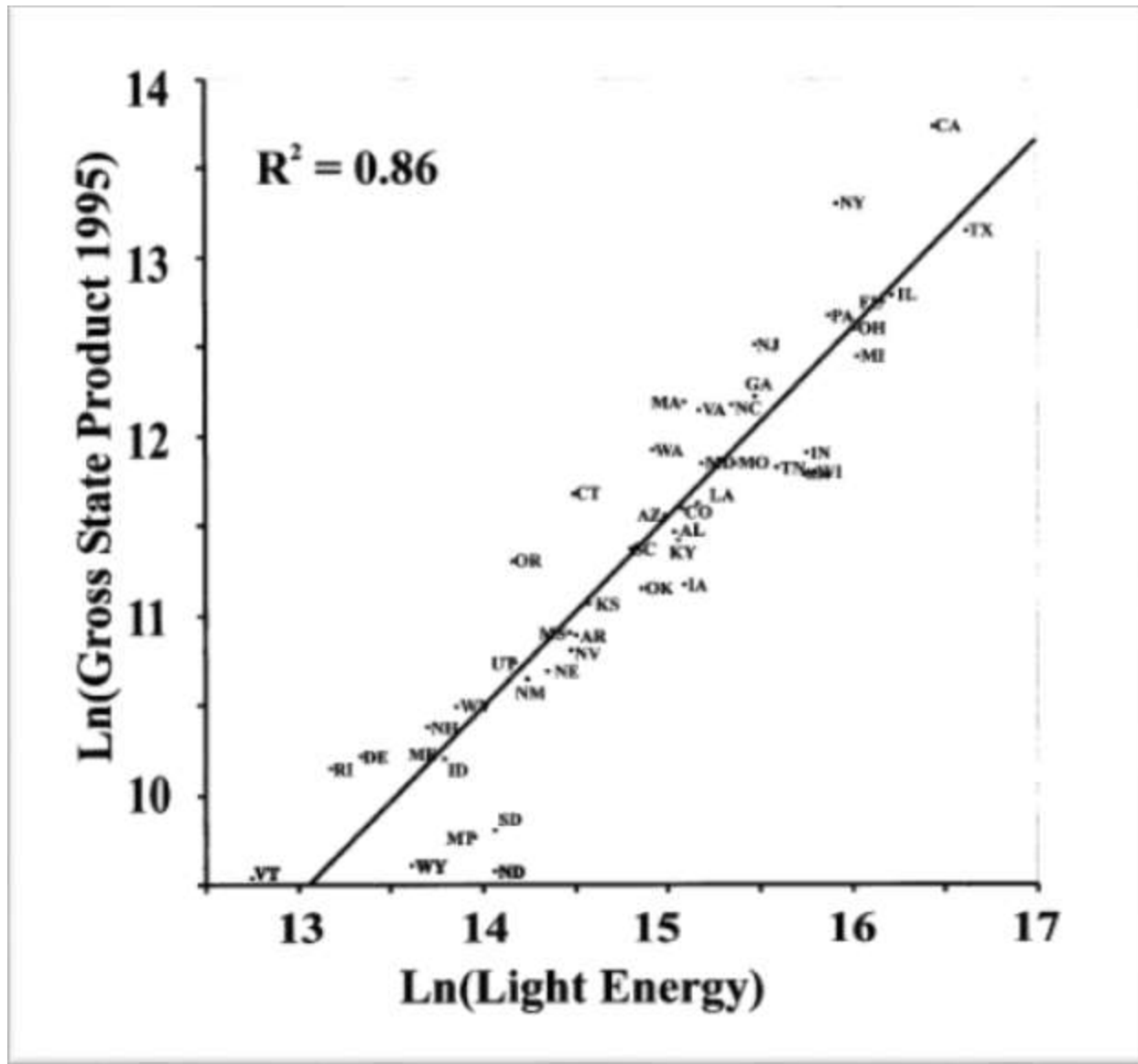
Strong correlation

强烈的相关性

Source: Sutton, P. C. and R. Costanza (2002)

Measurement 衡量指标

"To **measure** is to know -
If you can not measure it,
you can not improve it."
度量获取真知

Image courtesy of economist.com

—— William Thomson,
1st Baron Kelvin (开尔文勋爵), writing in
1883, Known for absolute zero temperature

Average luminosity per capita 人均灯光强度

- functions like GDP per capita, used to proxy the economic activity level at the ethnic group level.

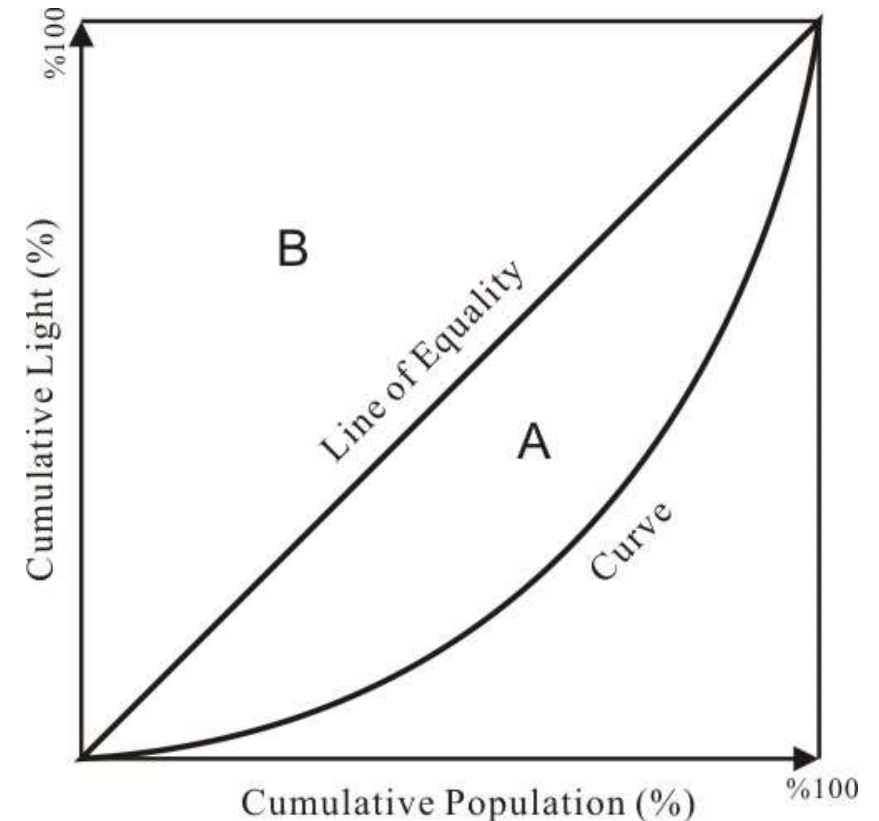- The higher it is, the better economic development it has.

$$\overline{L}_i = \text{DN}_i / P_i$$

- 类似于人均GDP，衡量是民族的人均经济水平。

Night Light Development Index 灯光发展指数

- developed by ELVIDGE et al. (2012) to measure the level of human development.

- The higher it is, the lower human development level it indicates

  - NLDI=A / B

计算过程类似于Gini系数，衡量的是民族的社会综合发展水平。值越低，发展程度越好。

DMSP/OLS nighttime imagery 灯光影像数据

- made using US Air Force Defense Meteorological Satellite Programs (DMSP) Operation Linescan System (OLS) night images.

- Global coverage, 1992-2013, 1km spatial resolution.

- But is absent of an on-board calibration system and gain setting of the sensors

Before the inter-caliberation
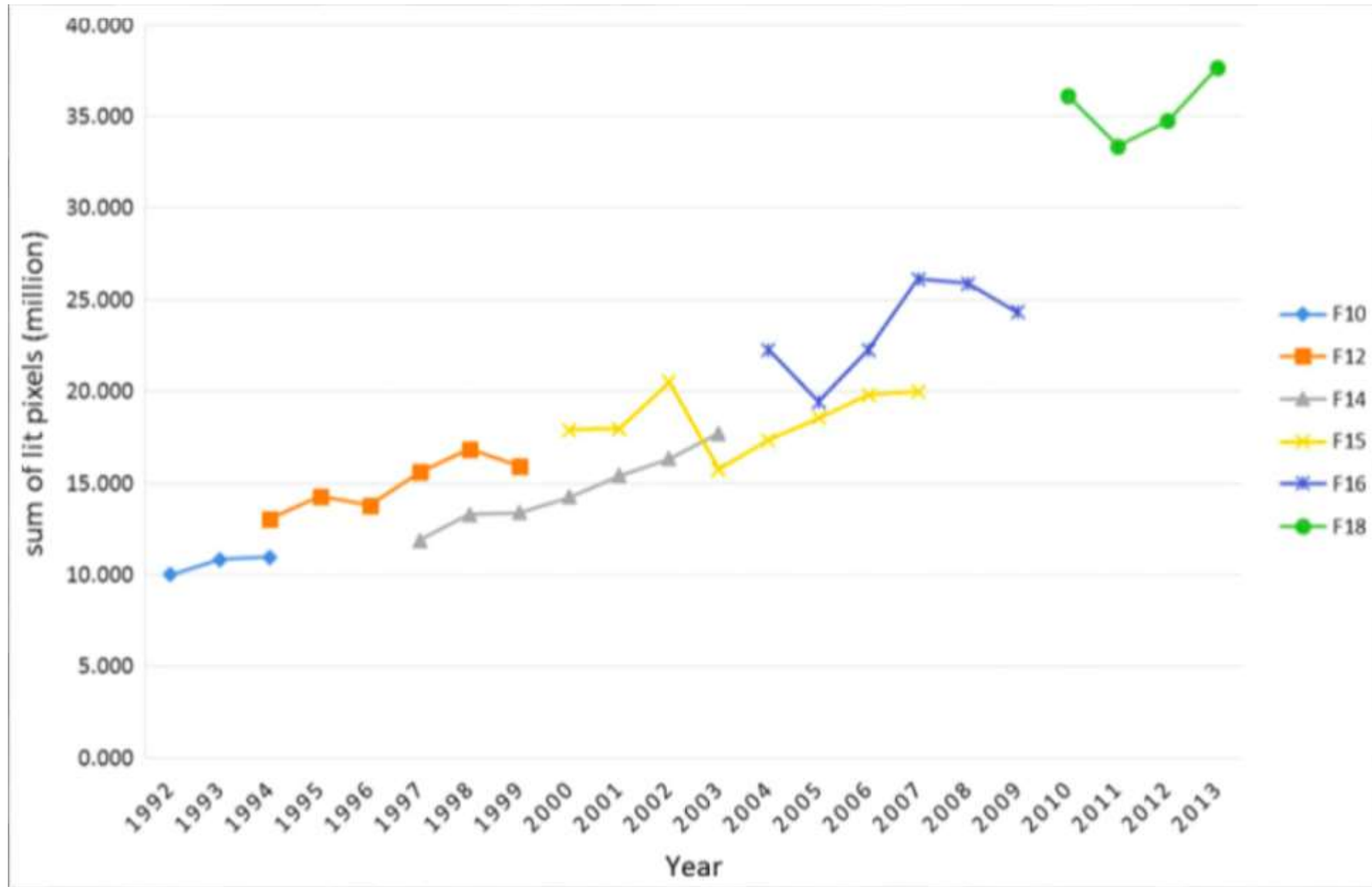
After the inter-caliberation
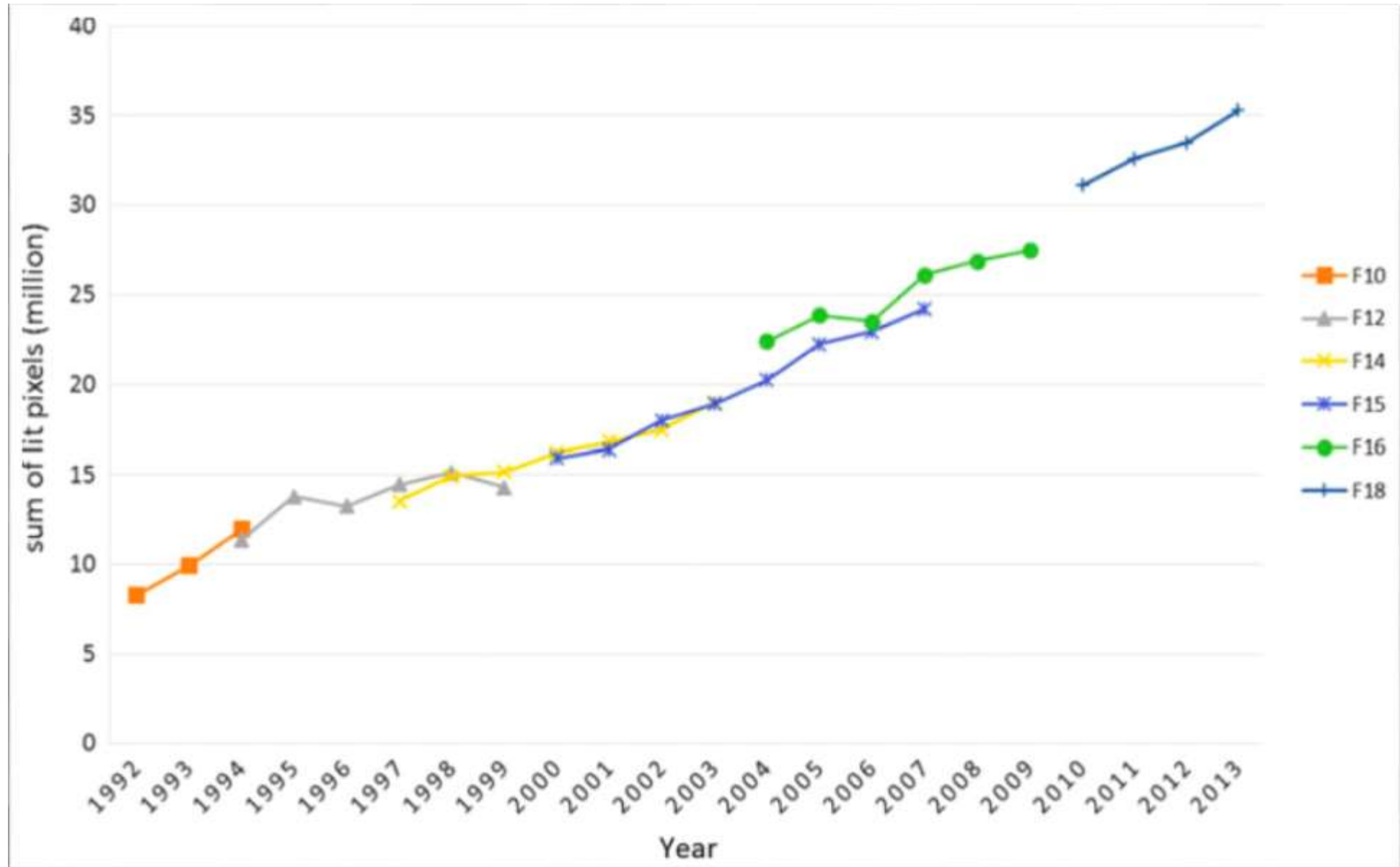
LandScan 2001-2013 人口分布栅格数据

- produced by Oak Ridge National Laboratory (ORNL).
- approximately 30-arc-second resolution.
- 2001-2013

Image courtesy of ORNL
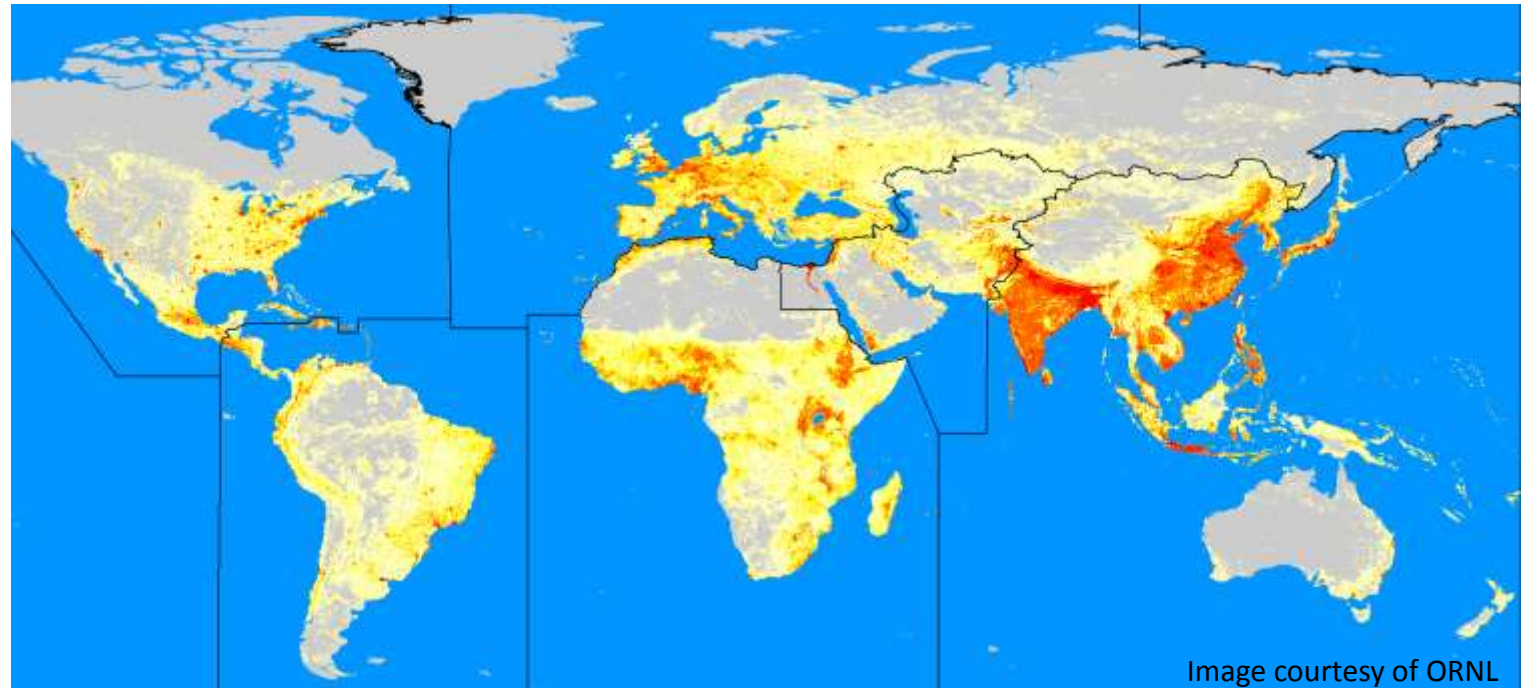
Geo-referencing of Ethnic Groups (GREG) 民族分布图

- by the International Conflict Research Group of ETH Zurich.
- The original data and maps in the GREG dataset are draw from the Soviet Atlas Narodov Mira (Bruk and Apenchenko 1964)
- Only recorded 49 ethnic group.

Image courtesy of PoliSciZurich

Table 1. The 49 ethnic groups in China (including Taiwan) recorded in GREG.

Name	Cont'd	Cont'd
Achang	Lhoba	Salar
Qiang	Manchu	Yugur
Han	Maonan	She
Zhuang	Miao	Sui
Daur	Mongol	Xibe
Ewenki	Mulao	Dai
Hani	Naxi	Tibetan
Hui	Hezhen	Tujia
Jingpo	Nu	Tu
Gaoshan	Oroqen	Derung
Kazak	Bai	Dong
Gelao	Deang	Dongxiang
Kirgiz	Tajik	Uyghur
Korean	Bonan	Va
Lahu	Blang	Yao
Li	Buyei	Yi
Lisu		

Not including Russian, Uzbek, Gin, Monba, Pumi, Jino, and the Tatars;
没有包括俄罗斯族、乌兹别克族、京族、门巴族、普米族、基诺族和塔塔尔族

Accuracy of GREG 民族分布图的精确性

- Does the GREG dataset really match the exact living areas of ethnic groups in China?
  - produced in 1960s.
  - within-group mobility of ethnic groups.
  - Is each polygon in GREG data homogeneous and just for that specific ethnic group

Accuracy Assessment 精确性评估

- If the 1960s GREG data for ethnic population distribution is still accurate, then for each administrative region such as a county, the estimated population for each ethnic group using GREG and LandScan within that administrative region should be consistent with the ethnic population census data within that administrative region.

如果GREG数据准确的话，那么对于每一个县，GREG和LandScan人口栅格数据叠加后得到的各个民族的人口数据，应该与这个县各个民族的人口普查数据一致。

Accuracy Assessment 精确性评估

- we overlay the GREG data with the national county administrative map and LandScan 2000 to get the estimated ethnic population for each county in the year 2000, then compare this data array with the 2000 population census data at the county level and compute the correlation coefficient Pearson's r.

- As long as GREG data is more accurate to the true distribution of each ethnic group, Pearson's r should be closer to 1.

  如果GREG数据准确的话，那么GREG和LandScan叠加后得到的民族人口数据数组，和人口普查得到的各个民族的人口数据数组，之间的相关系数应该接近1.
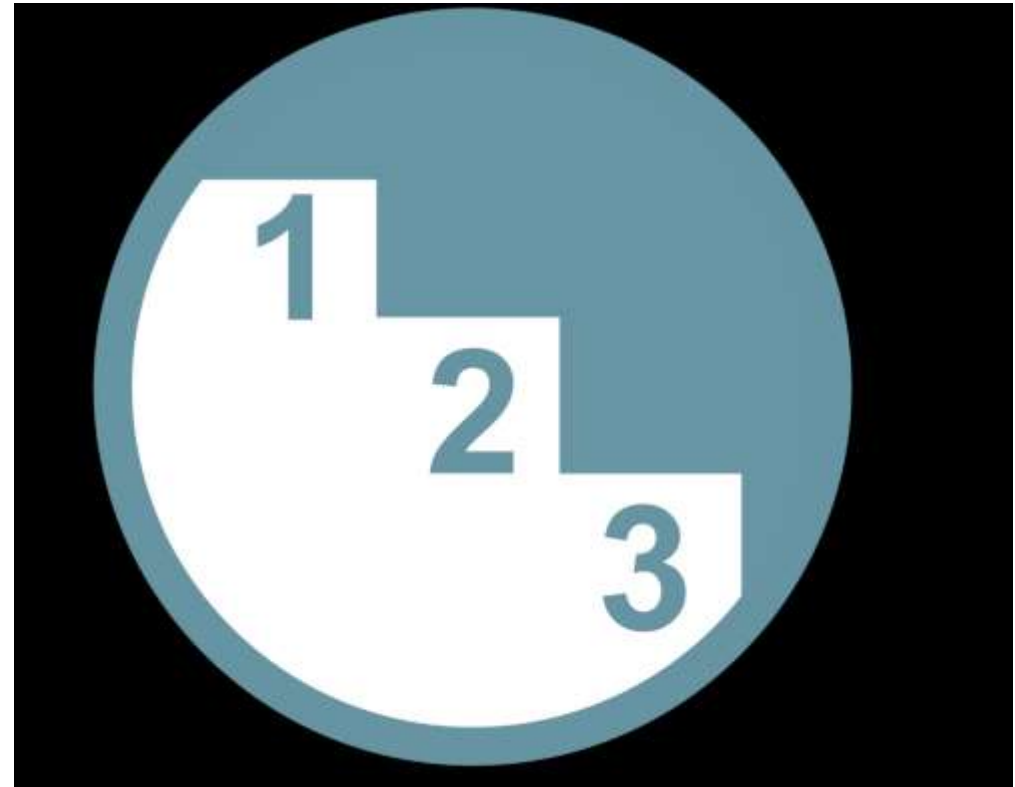
Accuracy Assessment 精确性评估

- 2484 counties (86.9% of the 2860 counties within mainland China) have a high Pearson's r of more than 0.9.
- The average Pearson's r for all 2860 counties is 0.9303.

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3 Result 研究的结果

Ranking of ethnic groups
各个民族经济福祉的排序

Appendix 1

This supporting information consists of tables that are not essential but supplementary to the study:

Table A1. Light per capita for each ethnic group in China from 2001 to 2013.

Ethnic group	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Achang	12.673	9.97	12.017	12.321	18.127	17.277	22.042	29.507	32.919	43.670	40.244	38.003	33.974
Bai	8.047	7.706	8.1	7.024	11.498	14.031	17.179	18.592	19.165	29.688	35.851	29.311	32.240
Blang	5.727	5.75	9.506	6.744	3.762	4.488	4.015	5.329	4.076	5.375	8.327	5.104	3.735
Bonan	1.997	2.295	2.037	2.913	5.534	8.562	8.228	15.811	14.887	15.069	15.718	15.765	13.596
Buyei	4.249	4.25	5.141	5.296	6.129	5.644	6.865	6.524	6.636	8.117	8.884	10.488	9.971
Korean	16.83	17.796	18.474	21.735	25.073	21.564	25.501	26.775	38.35	37.059	31.937	35.368	43.080
Dai	9.554	11.059	11.088	11.982	14.965	15.989	17.966	20.177	17.338	24.129	28.683	26.064	26.437
Daur	19.916	16.388	14.57	22.522	23.105	15.652	18.455	21.04	34.405	38.143	58.788	61.647	53.253
Deang	4.633	2.709	0.994	0	0	0.368	9.682	13.177	0	39.404	27.762	7.816	26.595
Derung	0	0	0	0	0	0	0	0	2.877	0.000	0.000	0.000	0.000
Dong	1.277	1.604	2.422	2.929	3.289	2.752	2.914	4.626	5.824	7.431	8.194	5.859	6.775
Dongxiang	5.728	7.631	6.81	6.715	10.271	14.296	8.963	9.922	6.33	20.355	24.493	24.268	29.644
Ewenki	10.904	13.959	14.603	19.078	17.395	20.75	16.629	24.361	23.043	36.417	40.107	37.040	43.292
Gaoshan	126.089	140.577	136.999	135.455	152.173	151.165	154.964	175.547	159.813	200.283	198.645	181.615	129.153
Gelao	1.38	1.15	1.266	1.274	1.49	1.767	1.537	1.697	2.225	3.155	2.867	4.262	5.756
Han	12.76	13.563	14.359	15.955	17.117	17.129	18.425	19.467	19.835	22.382	23.187	23.721	24.936
Hani	4.113	4.851	4.39	5.598	5.834	6.378	6.655	7.186	6.863	9.988	12.934	7.475	7.626
Hezhen	24.539	24.557	14.726	33.08	79.161	76.175	71.437	89.631	51.302	89.764	67.681	67.658	57.857
Hui	13.496	15.821	16.144	17.031	17.517	16.517	17.669	18.317	19.7	23.246	28.131	32.028	30.743
Jingpo	12.311	16.459	16.982	17.232	23.13	23.309	28.486	32.155	32.174	46.313	40.285	41.243	41.995
Kazak	26.959	28.558	33.028	35.39	46.405	44.983	51.086	49.463	64.424	83.921	104.785	93.872	90.869
Kirgiz	6.429	7.364	10.278	16.425	17.062	12.876	10.283	10.914	9.178	13.233	15.578	24.366	22.433
Lahu	5.145	4.823	6.037	6.331	6.814	7.647	7.711	12.023	10.457	10.964	14.488	11.065	14.491
Lhoba	4.122	3.921	3.831	5.325	4.98	5.259	6.086	6.627	6.377	9.272	8.937	7.541	7.222
Li	16.778	22.12	22.196	23.973	23.48	23.452	23.313	31.817	32.729	38.950	38.557	44.465	43.318
Lisu	3.836	4.822	5.533	6.343	8.557	9.5	11.397	13.68	13.623	18.998	23.005	15.969	17.457
Manchu	25.387	25.659	28.019	32.9	36.668	32.137	37.607	42.938	52.137	55.088	46.088	49.785	50.991

(Continued)

Table A2. NLDI for each ethnic group in China from 2001 to 2013.

Ethnic group	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Achang	0.789	0.806	0.814	0.834	0.806	0.800	0.802	0.812	0.827	0.836	0.806	0.818	0.797
Bai	0.926	0.932	0.930	0.939	0.919	0.914	0.908	0.913	0.917	0.913	0.895	0.900	0.887
Blang	0.984	0.968	0.966	0.968	0.973	0.972	0.979	0.947	0.968	0.967	0.931	0.973	0.974
Bonan	0.950	0.929	0.941	0.898	0.881	0.857	0.893	0.889	0.864	0.861	0.797	0.847	0.877
Buyei	0.934	0.936	0.931	0.924	0.916	0.923	0.915	0.928	0.938	0.932	0.913	0.910	0.916
Korean	0.799	0.800	0.793	0.750	0.756	0.757	0.763	0.767	0.783	0.786	0.786	0.794	0.794
Dai	0.907	0.899	0.903	0.903	0.897	0.891	0.885	0.890	0.898	0.887	0.875	0.879	0.878
Daur	0.934	0.940	0.946	0.897	0.894	0.897	0.897	0.905	0.899	0.906	0.898	0.896	0.908
Deang	0.942	0.917	0.997	1.000	1.000	0.998	0.872	0.895	1.000	0.901	0.896	0.943	0.911
Derung	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000	1.000	1.000	1.000
Dong	0.982	0.983	0.981	0.975	0.973	0.972	0.970	0.969	0.974	0.960	0.955	0.962	0.966
Dongxiang	0.907	0.858	0.865	0.879	0.828	0.778	0.846	0.888	0.925	0.824	0.778	0.789	0.712
Ewenki	0.925	0.940	0.941	0.921	0.909	0.911	0.935	0.923	0.946	0.930	0.924	0.920	0.877
Gaoshan	0.835	0.861	0.856	0.858	0.838	0.839	0.840	0.841	0.839	0.844	0.850	0.841	0.724
Gelao	0.972	0.977	0.969	0.965	0.950	0.946	0.950	0.953	0.946	0.918	0.910	0.894	0.883
Han	0.814	0.809	0.807	0.790	0.793	0.796	0.790	0.801	0.816	0.811	0.784	0.792	0.790
Hani	0.964	0.959	0.960	0.947	0.950	0.941	0.942	0.946	0.955	0.947	0.928	0.952	0.945
Hezhen	0.965	0.911	0.962	0.939	0.902	0.907	0.911	0.890	0.942	0.922	0.914	0.925	0.939
Hui	0.927	0.918	0.918	0.897	0.880	0.884	0.882	0.892	0.909	0.907	0.886	0.893	0.884
Jingpo	0.897	0.901	0.905	0.907	0.901	0.893	0.885	0.886	0.892	0.885	0.878	0.874	0.875
Kazak	0.964	0.964	0.961	0.946	0.917	0.920	0.919	0.923	0.932	0.917	0.910	0.917	0.913
Kirgiz	0.995	0.992	0.991	0.982	0.965	0.964	0.966	0.963	0.971	0.954	0.946	0.920	0.949
Lahu	0.946	0.942	0.942	0.944	0.945	0.935	0.933	0.931	0.943	0.937	0.933	0.932	0.928
Lhoba	0.986	0.991	0.989	0.973	0.972	0.973	0.971	0.972	0.958	0.955	0.951	0.952	0.954
Li	0.866	0.841	0.844	0.825	0.849	0.842	0.861	0.844	0.862	0.857	0.852	0.850	0.846
Lisu	0.980	0.981	0.978	0.975	0.968	0.962	0.961	0.967	0.970	0.958	0.954	0.965	0.955
Manchu	0.749	0.749	0.766	0.719	0.739	0.749	0.755	0.747	0.778	0.773	0.790	0.769	0.774
Maonan	1.000	1.000	0.986	0.986	0.985	0.994	0.997	1.000	1.000	1.000	1.000	0.990	0.991
Miao	0.964	0.960	0.956	0.949	0.947	0.946	0.944	0.946	0.956	0.953	0.943	0.940	0.945

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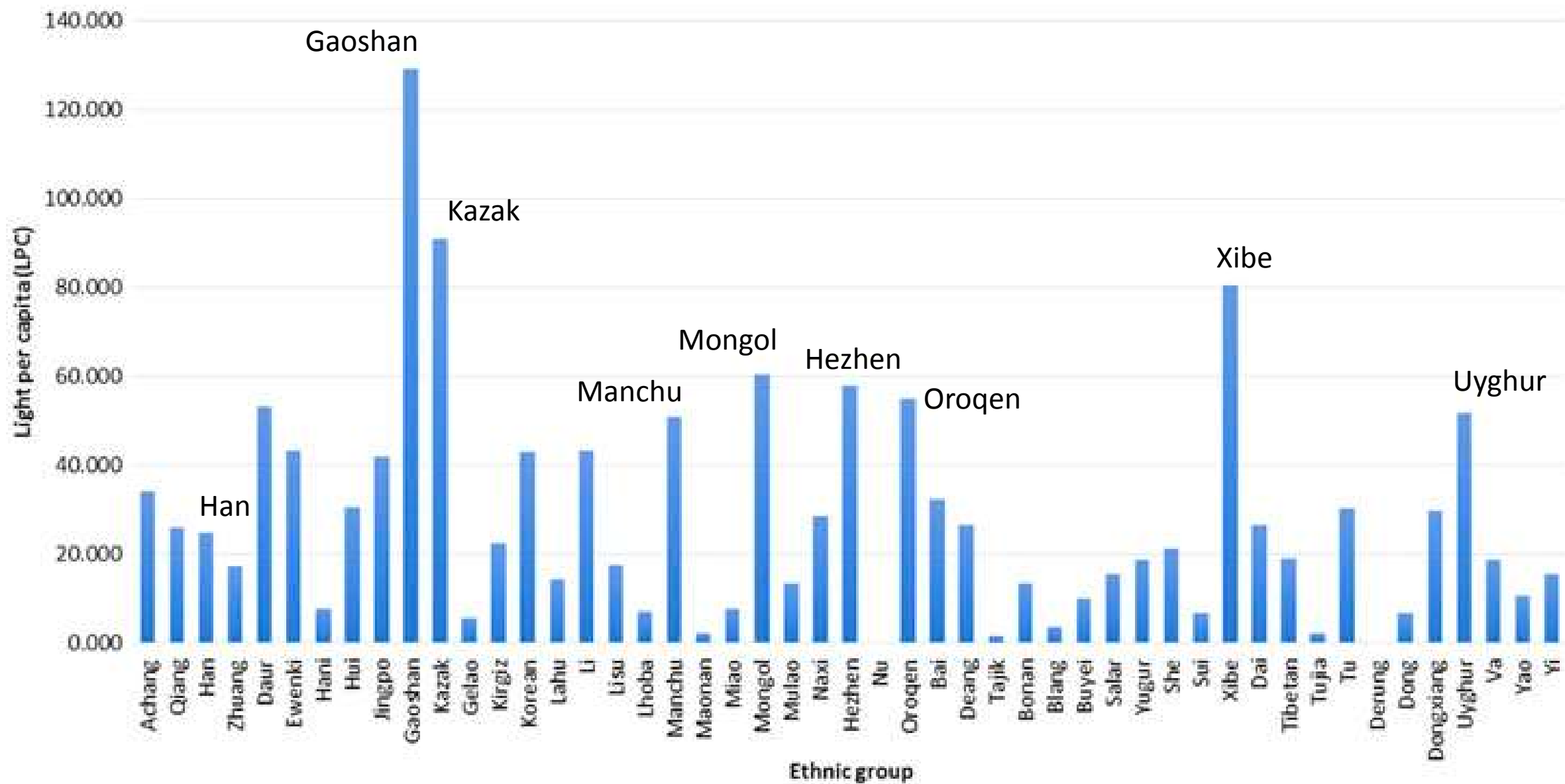
Evidenced by other studies 佐证

- According to Poston, Chang, and Dan (2006), Shu (1989), and Poston and Shu (1987), Manchu and Korean are among the most advanced of all the Chinese minorities in terms of education, occupation, and socioeconomic status.

- Goodman's (2004) shows Tibetan lives are not good in terms of economic growth as well as in terms of provision of welfare including health and education.

Evidenced by other studies 佐证

- Wang and Fan (2004), southwest China, where the Sui, Blang, Gelao, Tujia, Derung, Maonan, and Nu reside, has a lower economic development level than the rest of China.

- The Hezhen, Manchu, Xibe, and Oroqen have grown faster due to the preferential policies it received, its better industrial foundation including ports and road infrastructures, more skilled workers, more capital investment, and geographical location benefits (Wang and Fan 2004; Démurger et al. 2002).
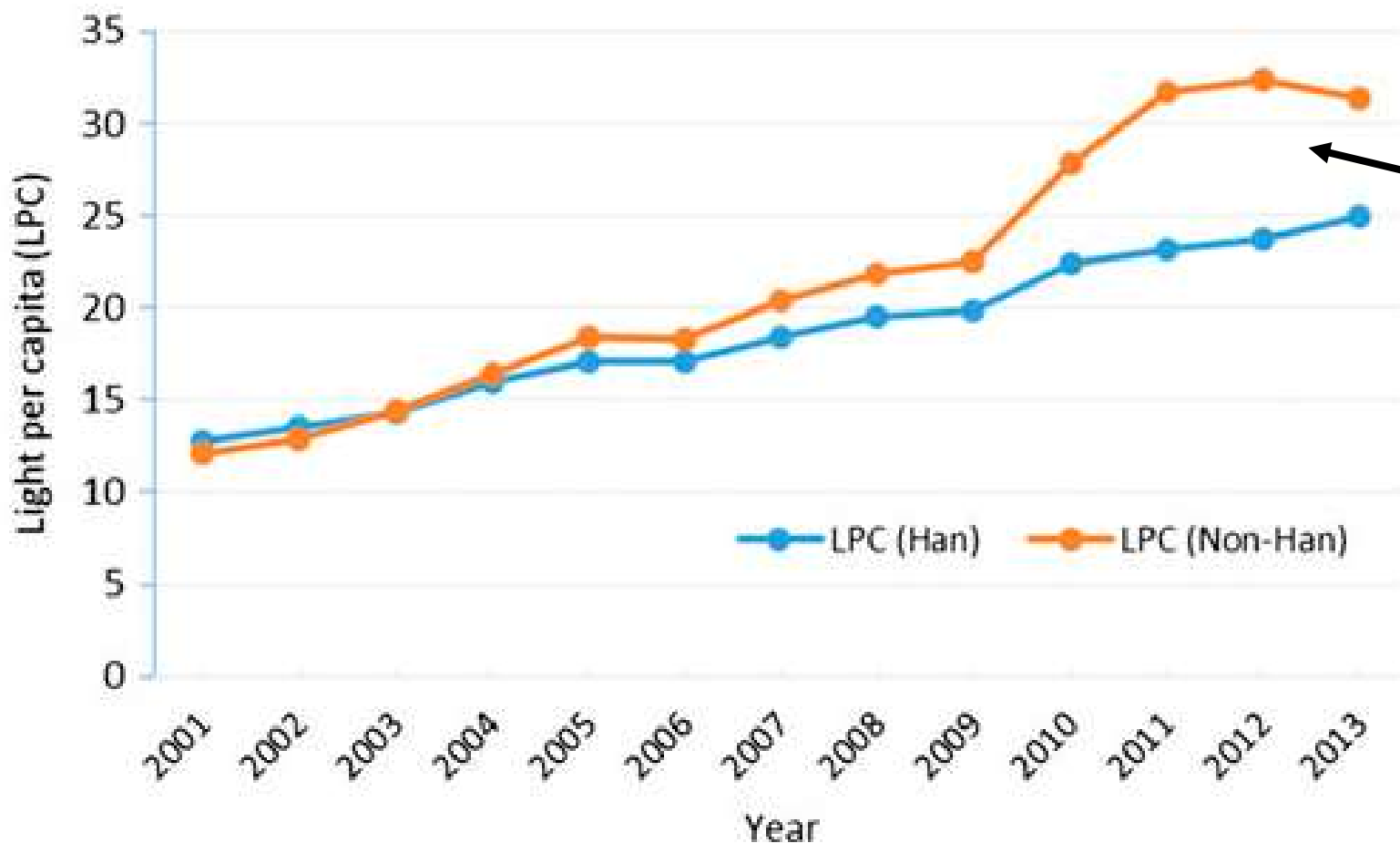
The Han vs Non-Han groups
汉族与非汉族

The Han Chinese 汉族

- the Han Chinese are not among the wealthiest ethnicities in China in terms of light per capita. In fact, the position of the Han in terms of light per capita is in the middle of all ethnic groups.

- the Han have a higher human development level than most other groups.
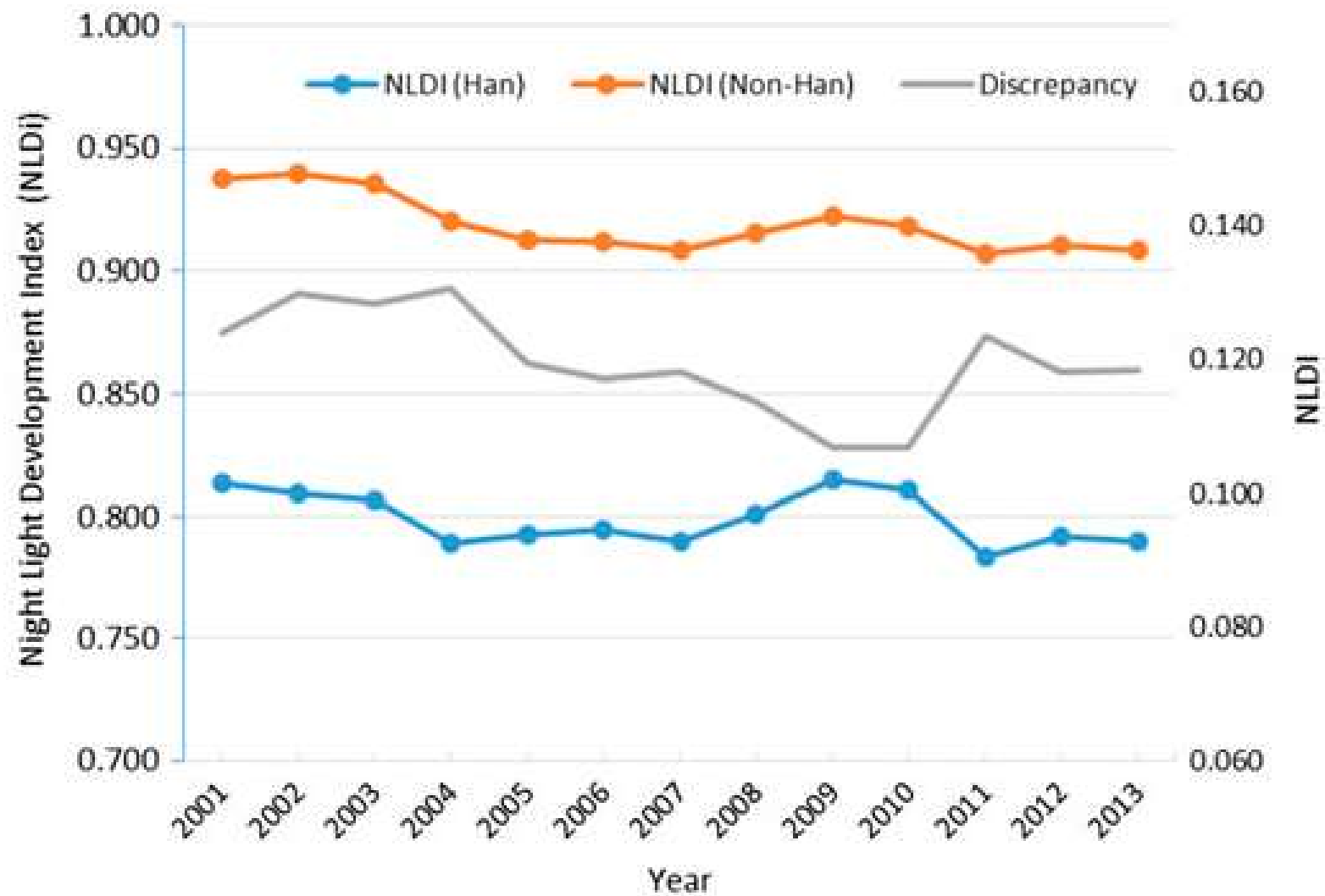
Han vs Non-Han in terms of light per capita
从人均灯光强度来比较汉族和非汉族族群

Non-Han ethnic groups overtook the Han's.
The gap is growing

Han vs Non-Han in terms of Night light development Index
从灯光发展指数来比较汉族和非汉族族群

the discrepancy between the Han and non-Han narrowed

Interpretation 解读

- "Open Up the West" campaign, which aimed to encourage economic growth and ensure social and political stability in non-Han areas (Goodman 2004) boosted light production in western China, thus substantially increasing the light per capita in those non-Han areas. "西部大开发"战略

  - "Make Electricity Available to the Countryside" project "送电下乡"
  - Qinghai-Tibet railway 青藏铁路

4

4 Summary 要点

Take-home Message 关键信息

- We introduces a simple, convenient, and cost-effective way (Nighttime Light Approach) to measure ethnic disparities in economic well-being across ethnic groups and provide a detailed approximation of these disparities in China over a 13-year period

- We presents and discusses the ranking of ethnic groups in China in terms of economic well-being and human development level

Take-home Message 关键信息

- Non-Han ethnic groups as a whole have higher economic levels of well-being than do the Han Chinese.

- Although the human development level of the non-Han Chinese is lower than that of the Han Chinese, the human development level of non-Han Chinese is increasing all the time, and the disparity between them fell from 2001 to 2013, except in 2011.

Limitation 不足

- We recommend that more specific analysis be conducted in the future to reveal more accurate results for ethnic groups which have a high within-mobility.

  我们的研究提供了一个对中国各个民族经济福祉的大概估计。但对于一些杂居程度高、人口迁移活动较多的族群，我们建议有针对性的具体的数据支持和数据分析。

Thank you!

www.jzliu.net