PRESENTATION GIVEN AT LTC SPRING FORUM ENTITLED:

""INTEGRATING GEOSPATIAL AND FIELD-BASED SCIENCE TO ASSESS BIODIVERSITY CONSERVATION: A SPECIAL FORUM OF WOMEN RESEARCH LEADERS"

APRIL 2-3 & 15, 2009

UNIVERSITY OF WISCONSIN, MADISON, WI, USA

HOSTED BY

LAND TENURE SOCIETY

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Land Tenure Center

POVERTY TRAPS, SAFETY NETS OR DEVELOPMENT MAGNETS?

MODELING THE INFLUENCE OF COSTA RICAN PARKS ON HUMAN WELFARE OVER TIME

Maggie Holland

LTC Spring Forum, Integrating geospatial and field-based science to assess biodiversity conservation.

♦♦♦♦♦♦♦♦

Provided by the **Land Tenure Center.** Comments encouraged:

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Poverty traps, safety nets or development magnets?
Modeling the influence of Costa Rican protected areas on household welfare over time

A “collision of goods”

- Hegelian tragedy – biodiversity conservation and poverty reduction
- Global mandates/dual objectives for PAs: 10% targets and call to “do no harm”
- PAs as cornerstones of broader landscape level conservation approach
- Do parks impoverish people?
- Dearth of quantitative analysis… primarily case studies (difficult to synthesize)

Recent global/regional spatial analysis

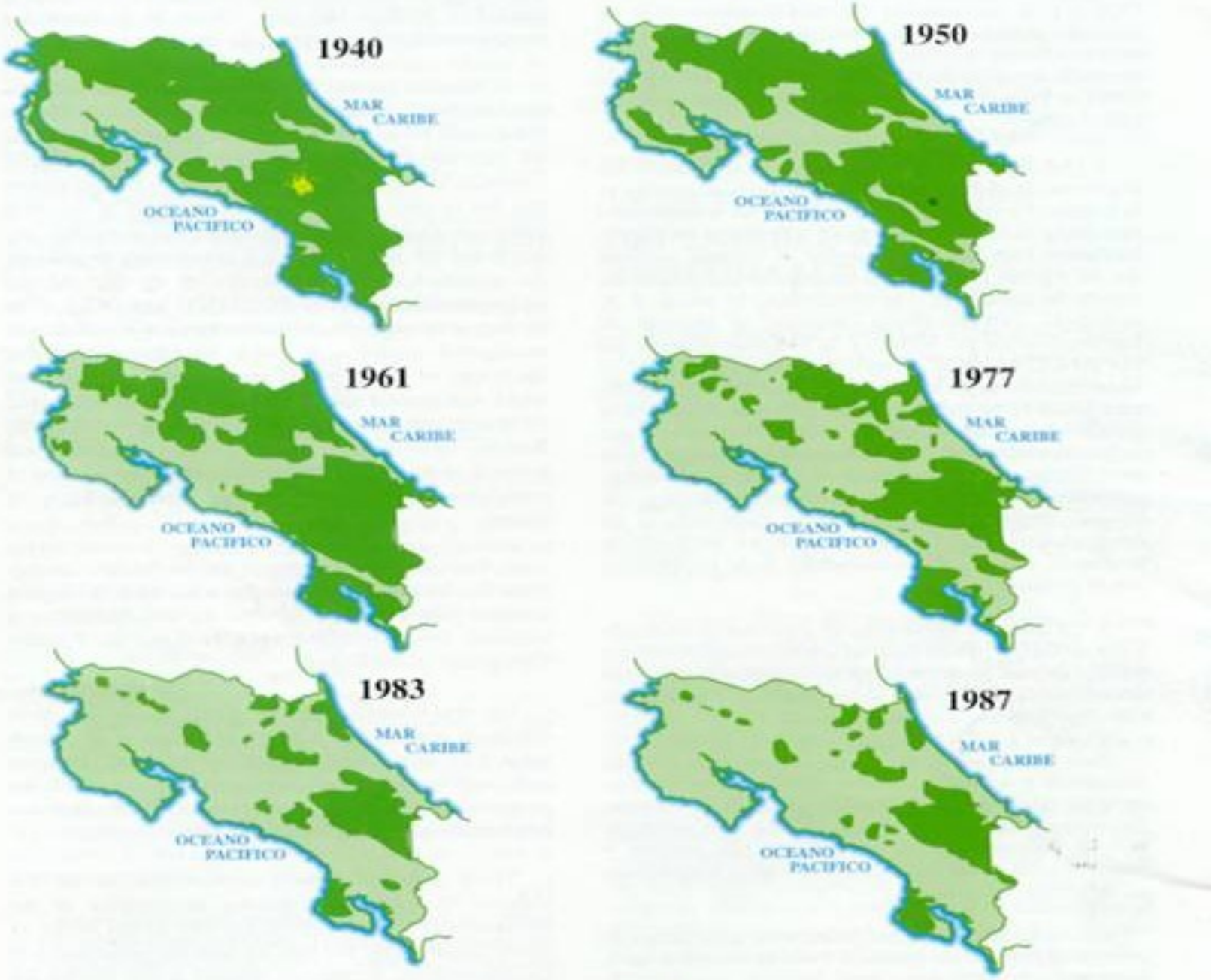
- A fraction (1%) of the world's most poor live in areas of "minimal recent human impact" (Redford et al., 2008, human footprint vs. infant mortality)
- PA networks have no discernible effects at national scale on incidence of poverty (Upton et al., 2008, PA #, area, mgmt cat vs. GNI/PPP)
- No noticeable difference in infant mortality close to strict PAs vs. ntl averages ; some observable increase in infant mortality for large strict PAs (causality hard to establish) (de Sherbinin, 2008)
- Analysis of 300+ PAs in 45 countries (LAC/SSA):
  - Parks = attract human migration
  - No difference in child malnutrition for populations close to vs. far away from PAs

  (Wittemyer et al., 2008)

Case of Costa Rica

- Fascinating conservation history – and present context
- Dramatic land use (deforestation and pasture expansion) post-WWII
- Unique poverty setting
- Key factor = data availability

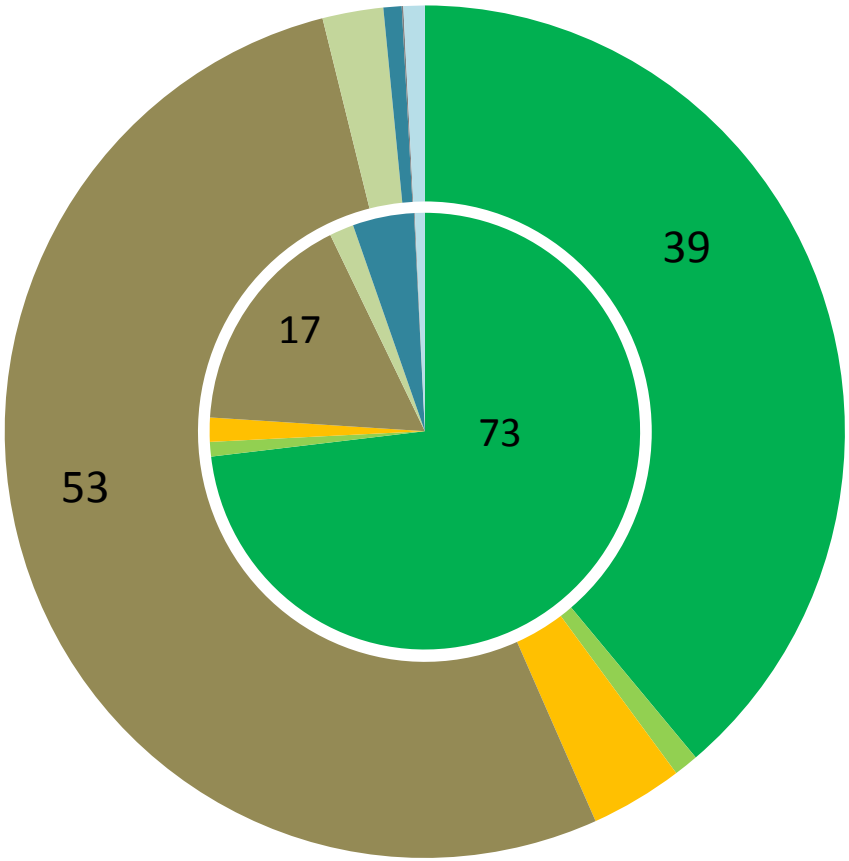
Cobertura Boscosa Densa (80-100% de cobertura del suelo) en Costa Rica en los años 1940, 1950, 1961, 1977, 1983, 1987, 1996/1997

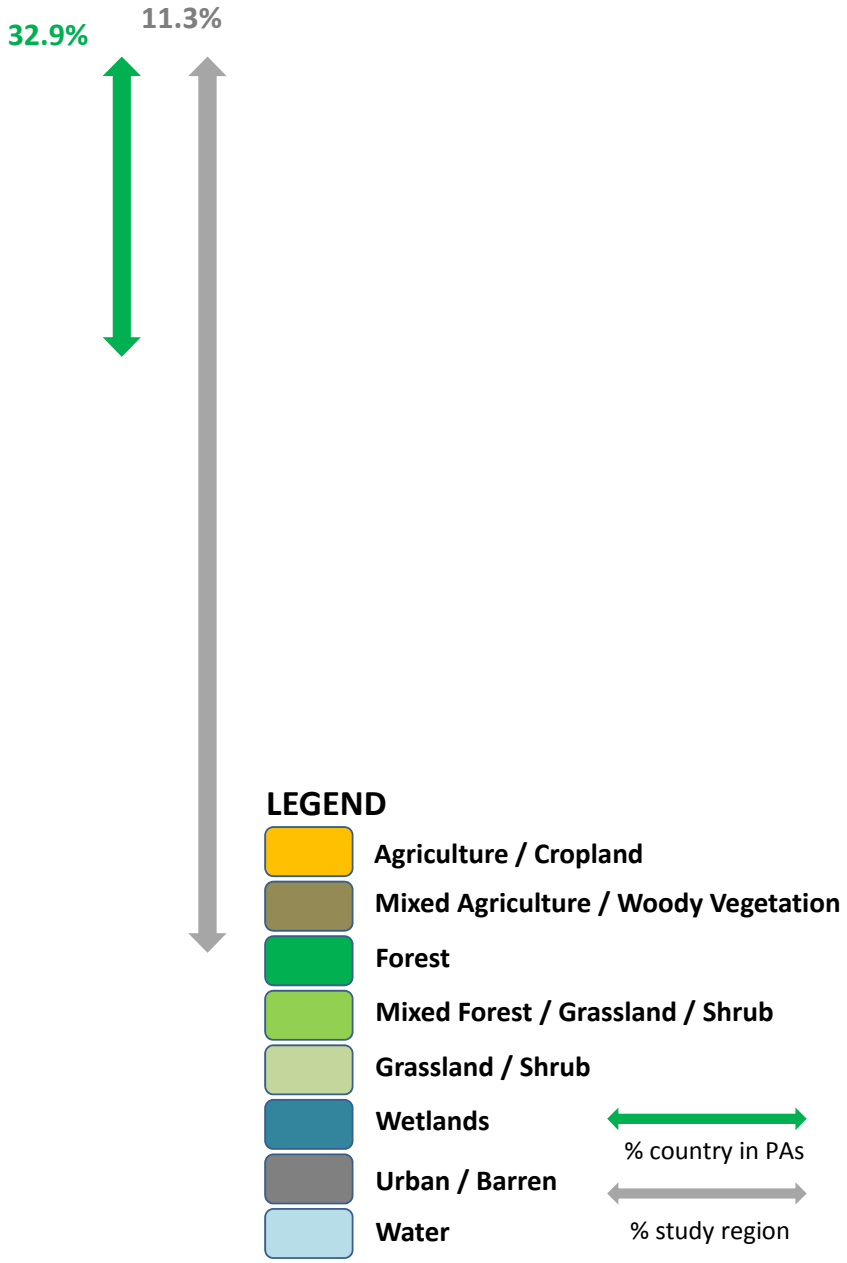


Primary drivers/agents of forest conversion in Costa Rica

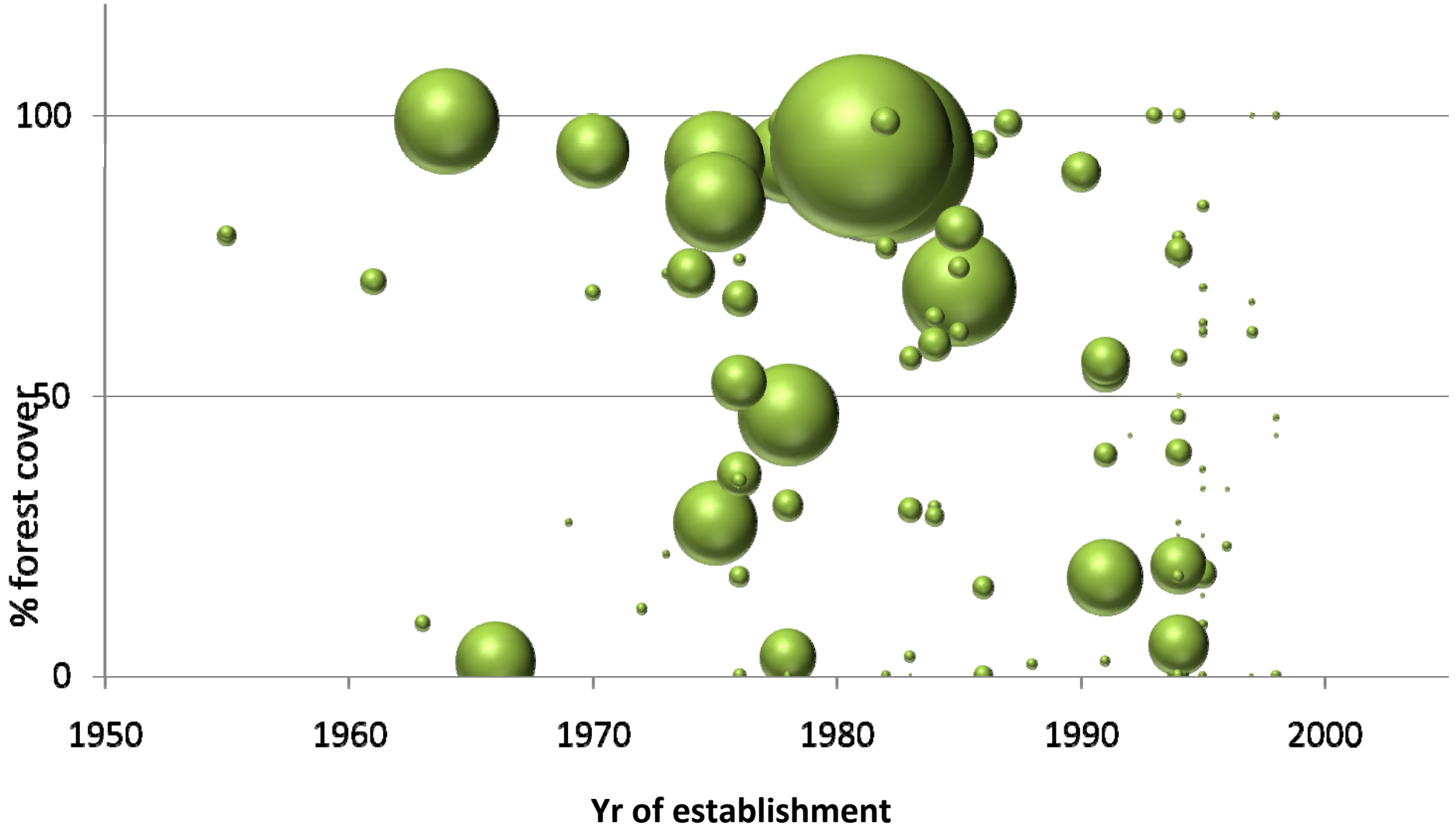
- Rapid increase of overland transportation network (*doubled between 1967-1977; over 27,000 km of roads by late 1980s*)
- Expansion of agriculture and livestock farming (*by 1980, >75% of land with crop production potential = pasture land*)
- Population boom (*fourfold increase in < two generations*)
- Government policies (*must "improve" the land to receive title for it*)

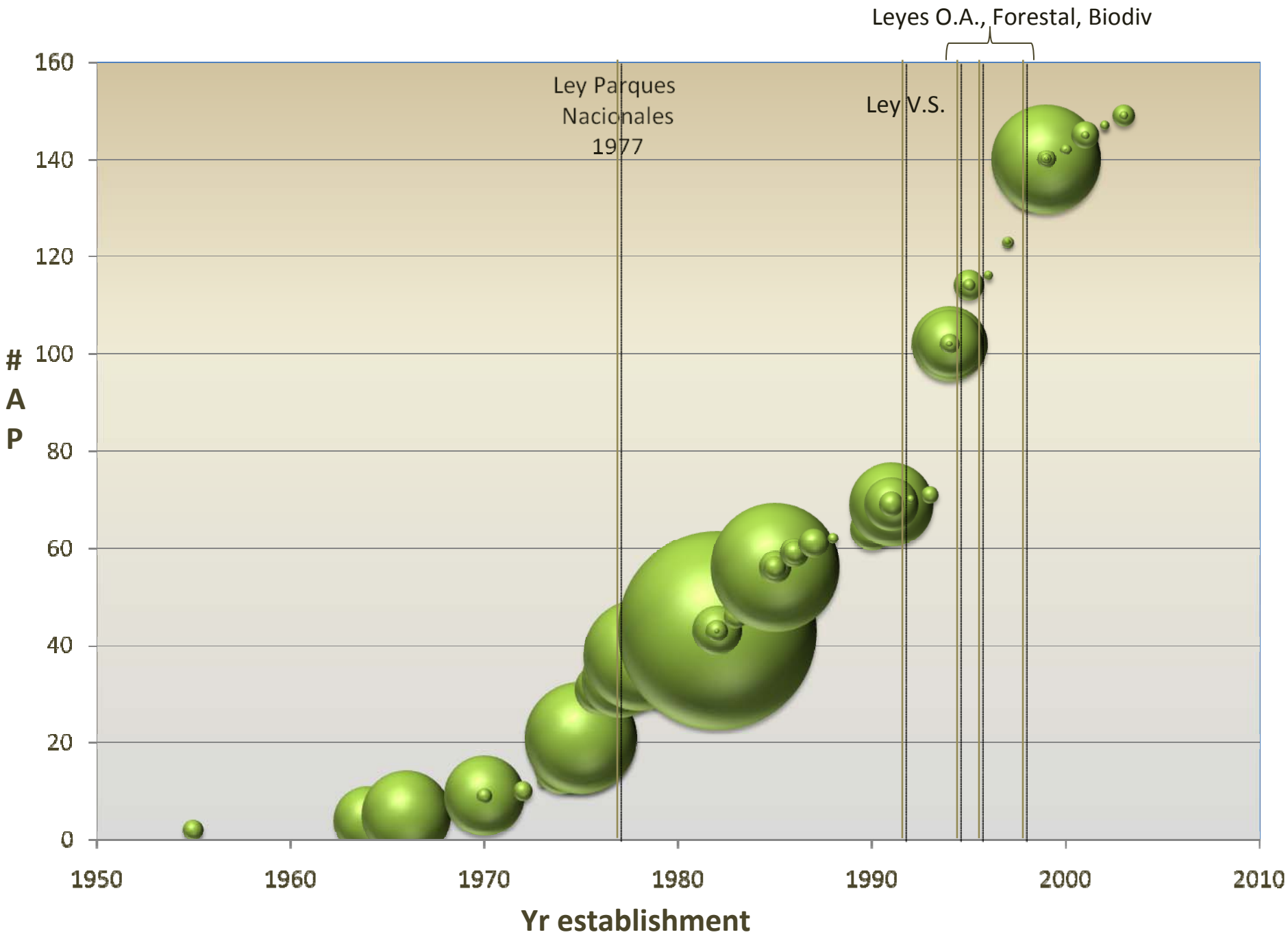
Present land use – nationally and within PA network





Costa Rican PA network
Study focus: 122 terrestrial PAs



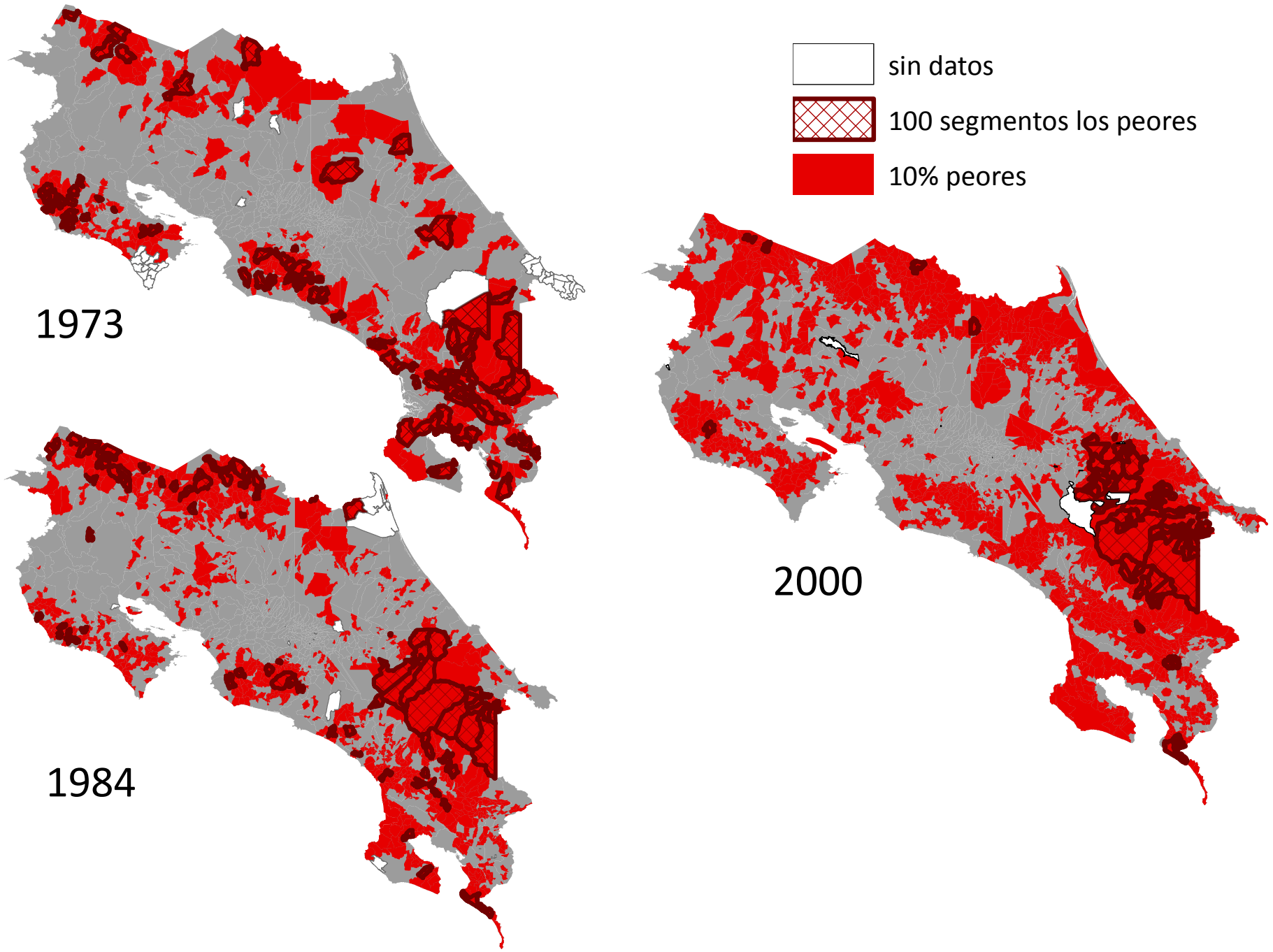

Leyes O.A., Forestal, Biodiv
Ley Parques Nacionales 1977
Ley V.S.
160
140
120
100
80
60
40
20
0
A P
1950
1960
1970
1980
1990
2000
2010
Yr establishment

Poverty – welfare - livelihoods

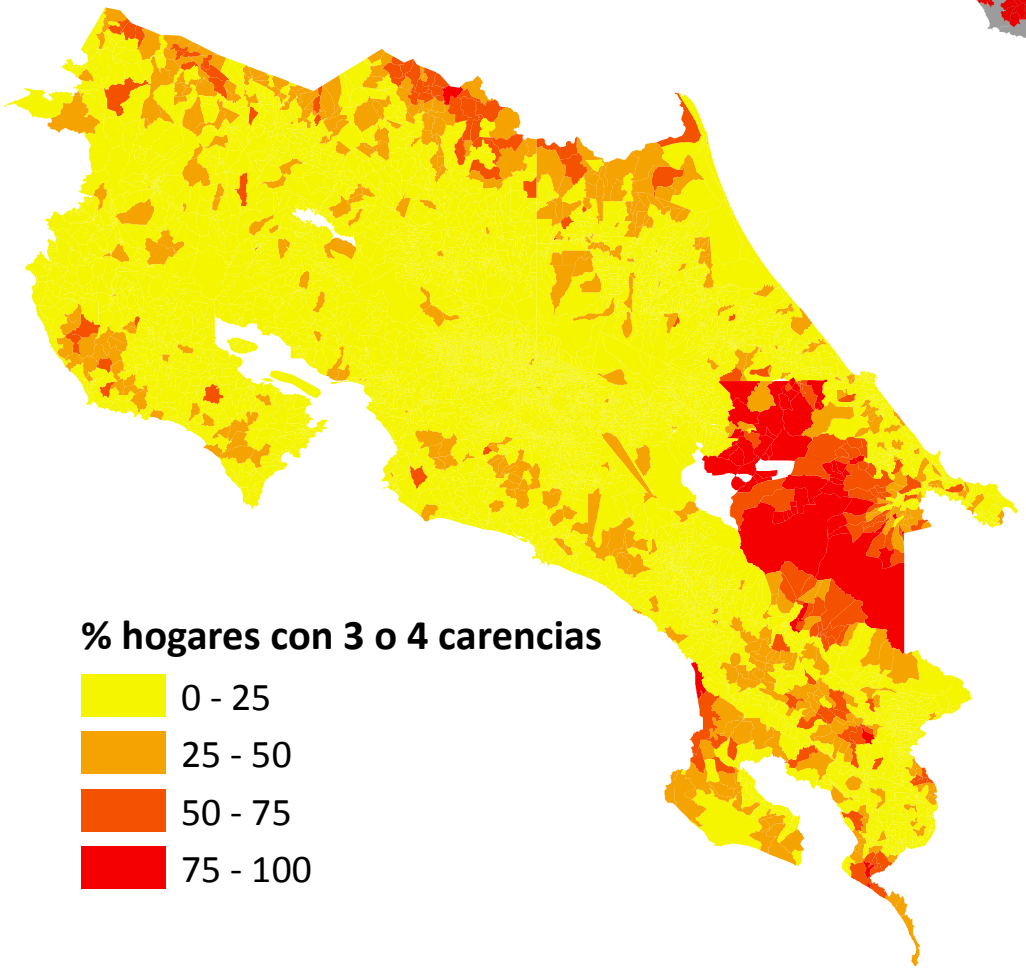
- ***"Poverty is not a natural fact, but a social experience."*** (Green & Hulme, 2005).
- Measuring and mapping poverty:
  - Income/consumption - $1-2/day
  - Unsatisfied basic needs index
  - Small area estimation (WB)
  - Single variable correlates (infant mortality, malnutrition)
- Geospatial modeling challenges:
  - Change over time
  - Data accessibility / availability
  - Reconciling changing census/admin geographies

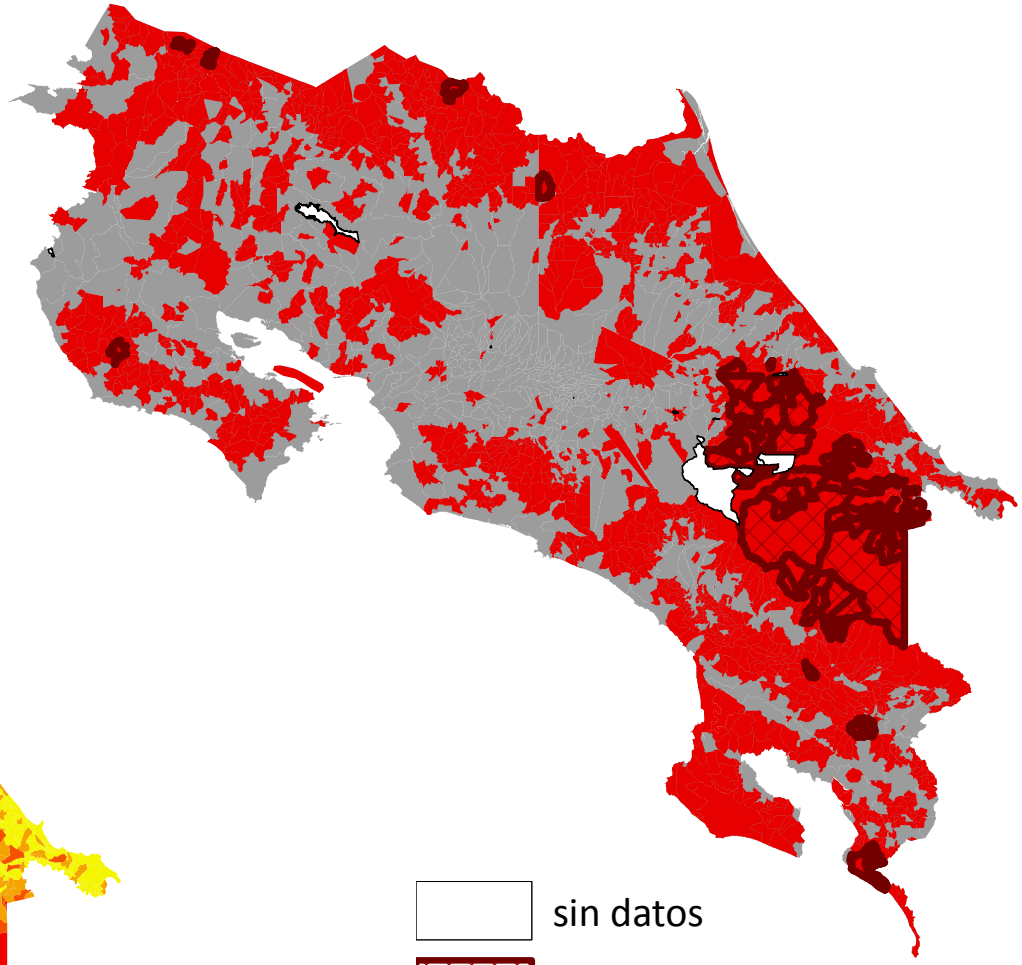
Poverty index for Costa Rica

- Cavatassi & Lipper (FAO, 2004) – time-variant poverty index at district level
- Factor analysis (PCA) to generate index using census data
- Unit of analysis:
  - District (406 in 1973)
    - Mean size = 125.9 km²
    - ASR = 11.22
  - Census segment (4691 in 1973, ~40-60 households)
    - Mean size = 10.9 km²
    - ASR = 3.49
- Census (population, housing, and agricultural) from 1973, 1984 & 2000


sin datos
100 segmentos los peores
10% peores
1973
1984
2000

Comparación entre NBI e Indice de pobreza Censo 2000





PCA results

Based on pooled data:
~60% variance explained by 1st component

Population

Dependency ratio	.871
Illiterate	.825
No insurance	.827
Employed	**-.104**
Worker/subsist agriculture	.771
Adult pop primary/NO	.906
School-aged attends	**-.747**
Female HHD	**-.642**

Housing

Marginal/slum	.205
Bad condition	.457
Dirt floor	.740
No refrigerator	.919
No telephone	.803
No toilet	.893
No electricity	.896
Charcoal/wood	.917
Water source public/river/rain	.733
No indoor plumbing	.878
Crowding	.880

Index variables – Costa Rica

- Population aged <15 & >65 / population aged 15-65 (aka “dependency ratio”)
- Population (aged 10+) that cannot read or write (illiterate)
- Total population without social insurance
- Economically active population that is employed
- Economically active pop who work as agricultural workers or subsistence farmers
- Adult population (aged 18+) that has either primary or NO formal education
- School-aged population (aged 7-17) that attends school
- Heads of households with low level of educational attainment (primary school or NO)
- Female heads of household
- Dwellings classified as “slums” or marginal
- Dwellings classified as in bad condition
- Homes with crowding (3+ people per bedroom)
- Homes with a dirt floor
- Homes without a telephone
- Homes without a refrigerator
- Homes where cooking fuel is charcoal or wood
- Homes without electricity
- Homes without a toilet
- Homes without indoor plumbing
- Homes where source of water is either public well, rainwater, river, or water truck

District-level results – 1973, 1984 & 2000

- Are districts with parks poorer than those without?
- Static results for each year:
  - Districts with best index scores (lowest poverty), tend to be urban (either in 1973, or by 2000)
  - Majority of districts with the worst scores (highest poverty), had no parks in 1973, but parks created by 2000
- In each time step, pov index score improved for ALL districts

1973-1984

20 districts with *smallest* gains:

- **50% urban**
- 6 districts with PAs by 1984 covering > 10% district area

20 districts with *largest* gains:

- **100% rural**
- **no** parks present in 1973
- 6 districts with PAs by 1984 covering >10% area

District-level results

1984 – 2000

20 districts with *smallest* gains

– > 50% urban by 2000

– 4 districts with parks by 2000 covering > 10% area

20 districts with *biggest* gains

- 100% rural
- ~50% with parks by 2000 covering > 10% area

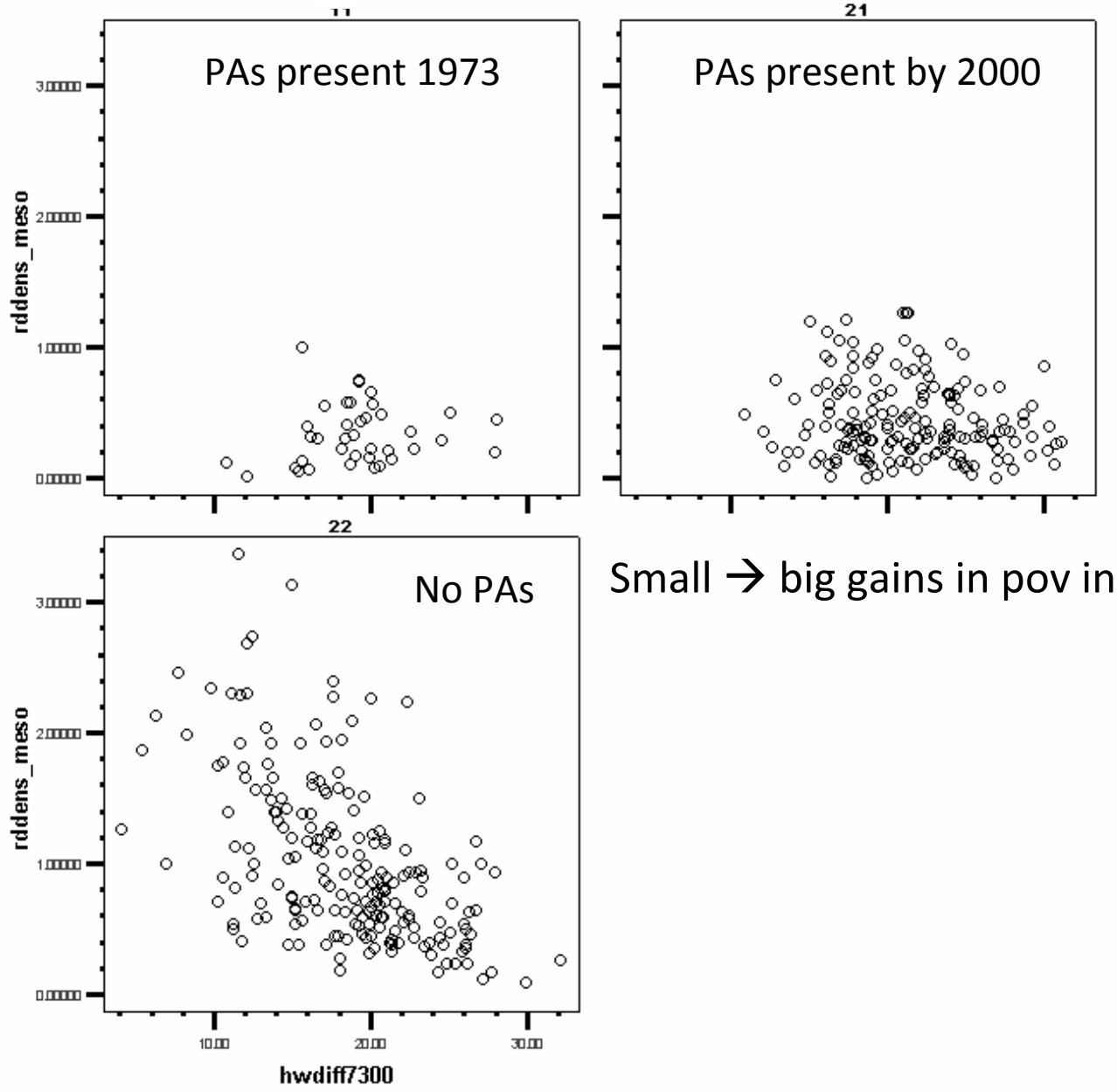
Preliminary observations:

•Rural districts experienced most improvement over time

•Little difference in park presence for districts with small vs. big gains in hw index

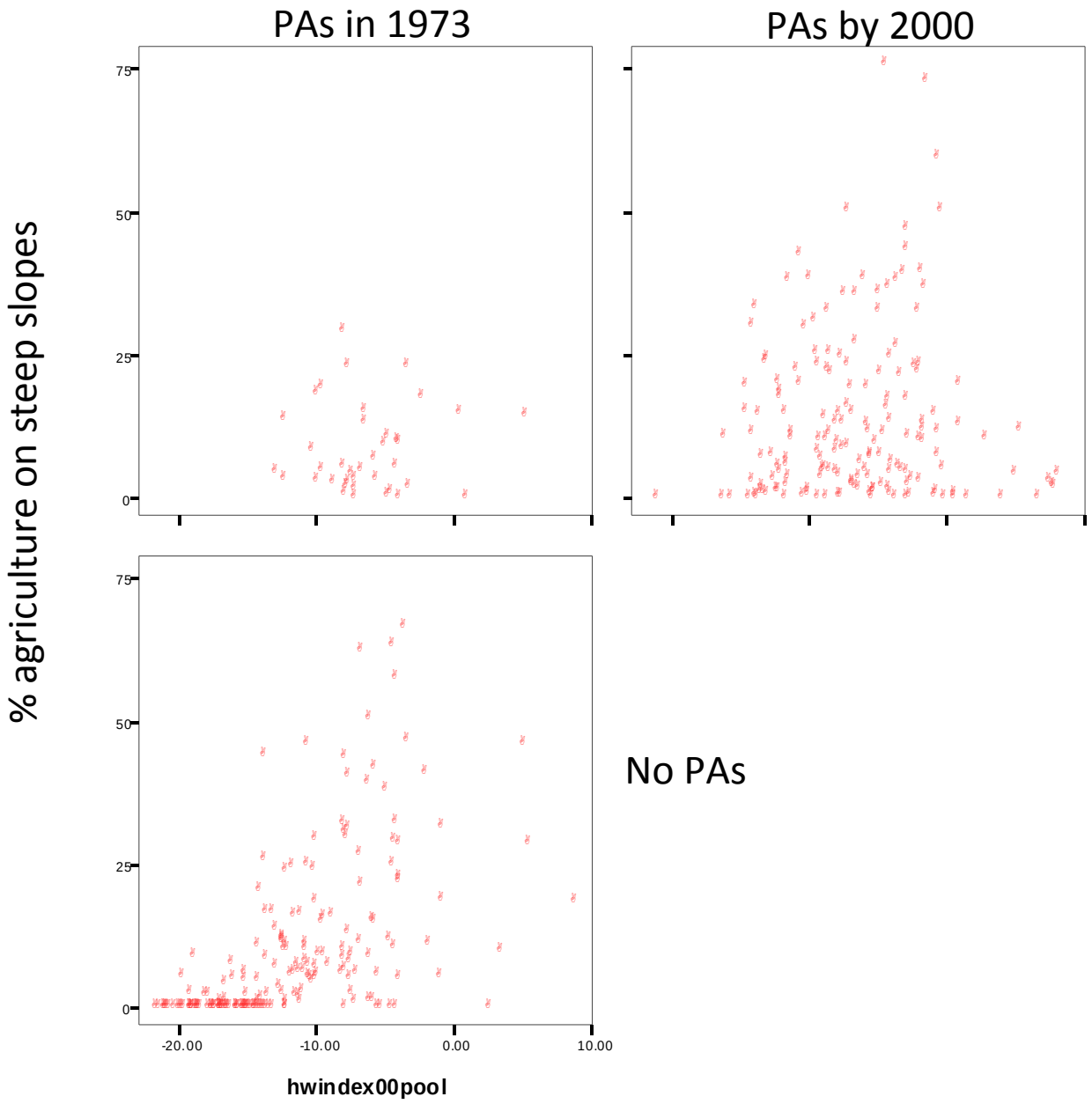
District analysis – ancillary data

Road density →

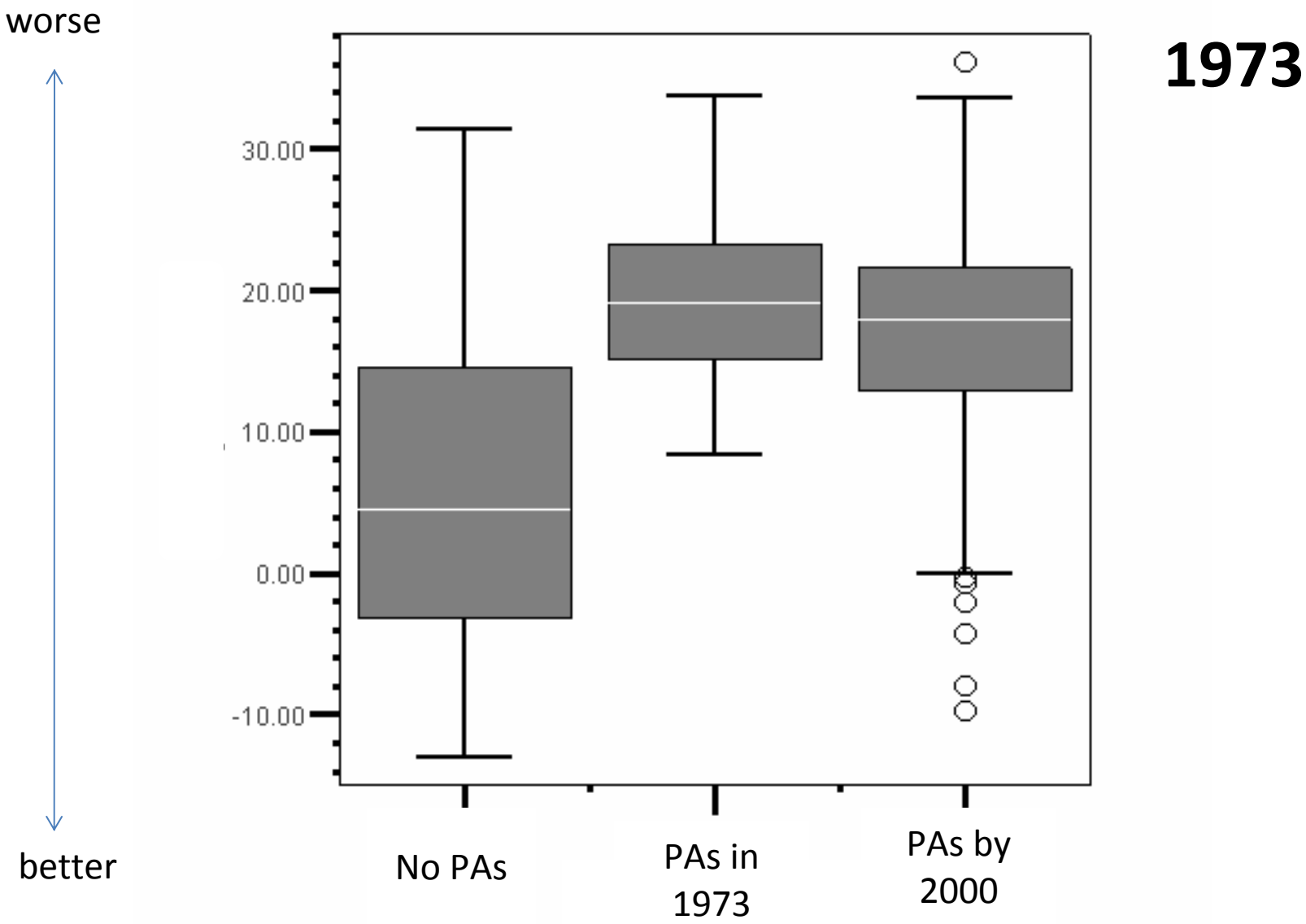


Small → big gains in pov index score

District analysis – ancillary data

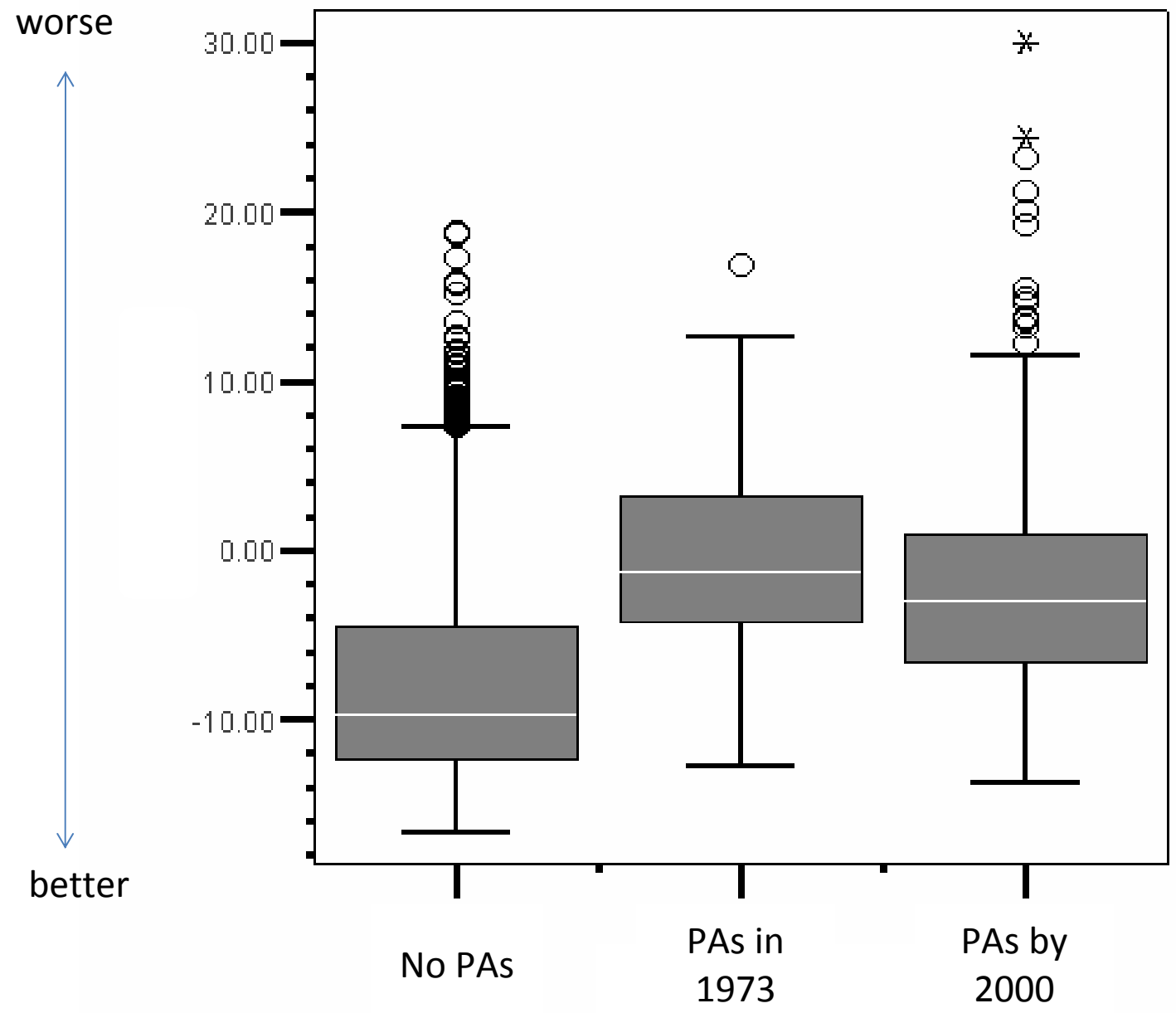


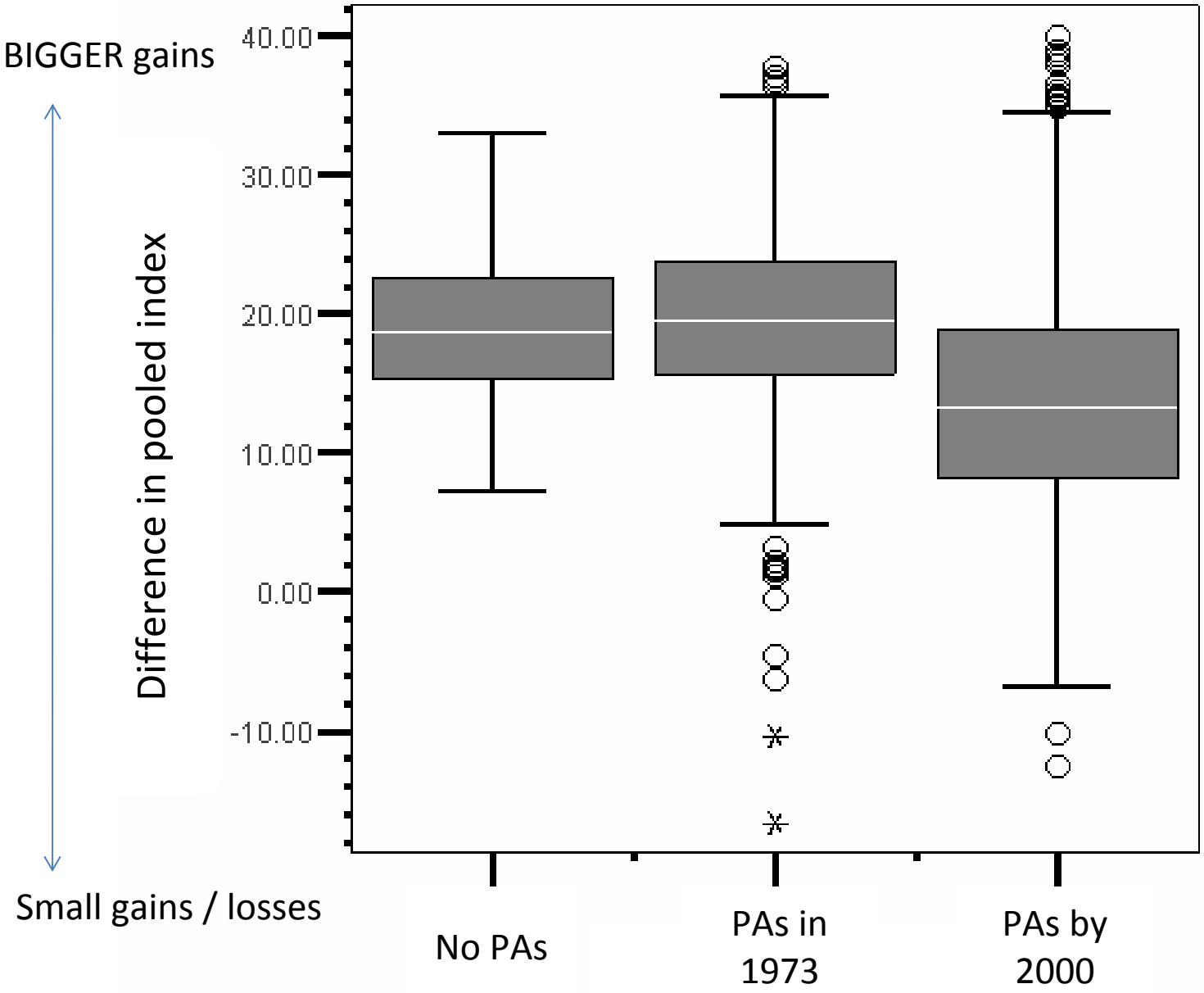
Census segment – static results

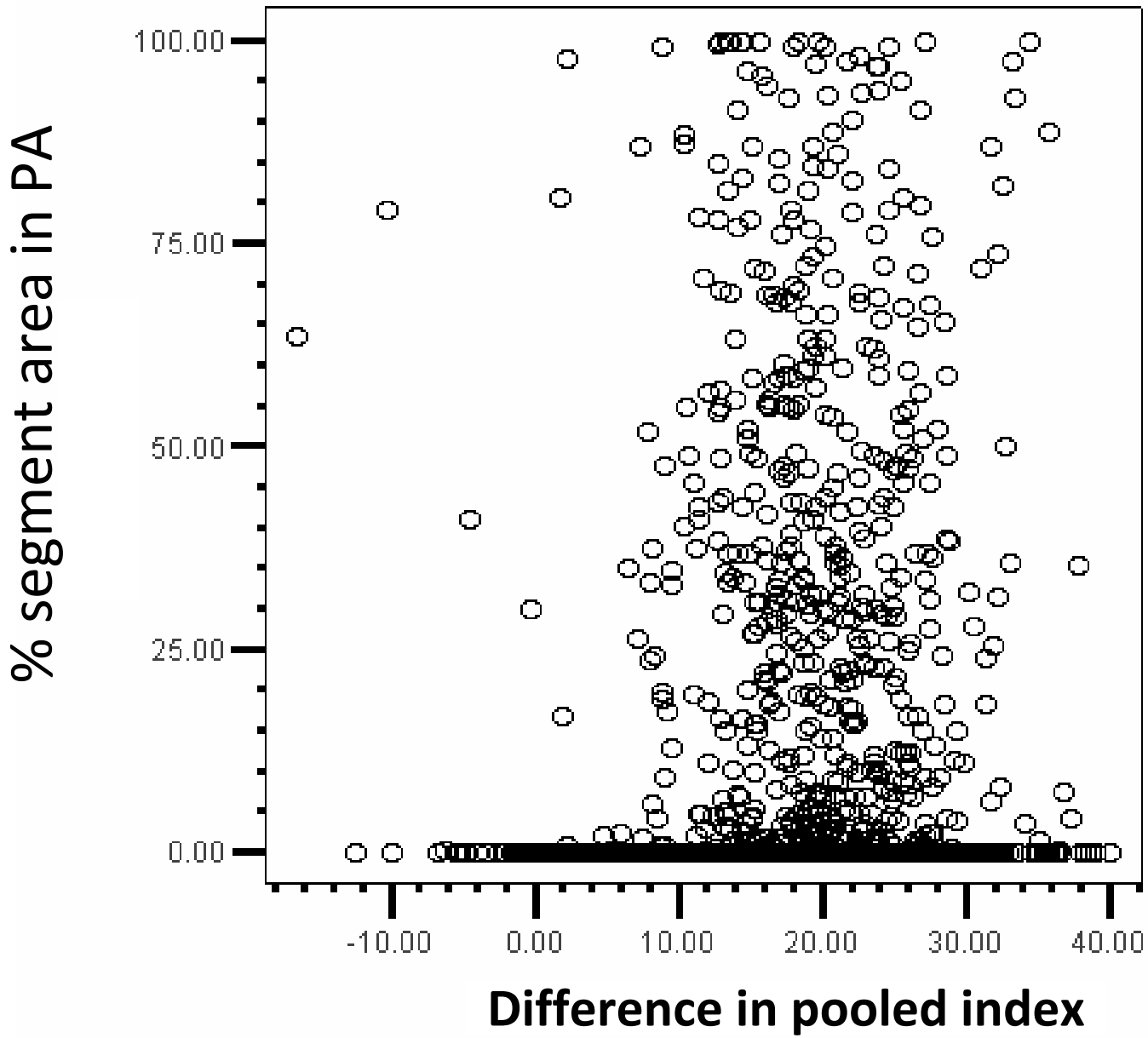


1973

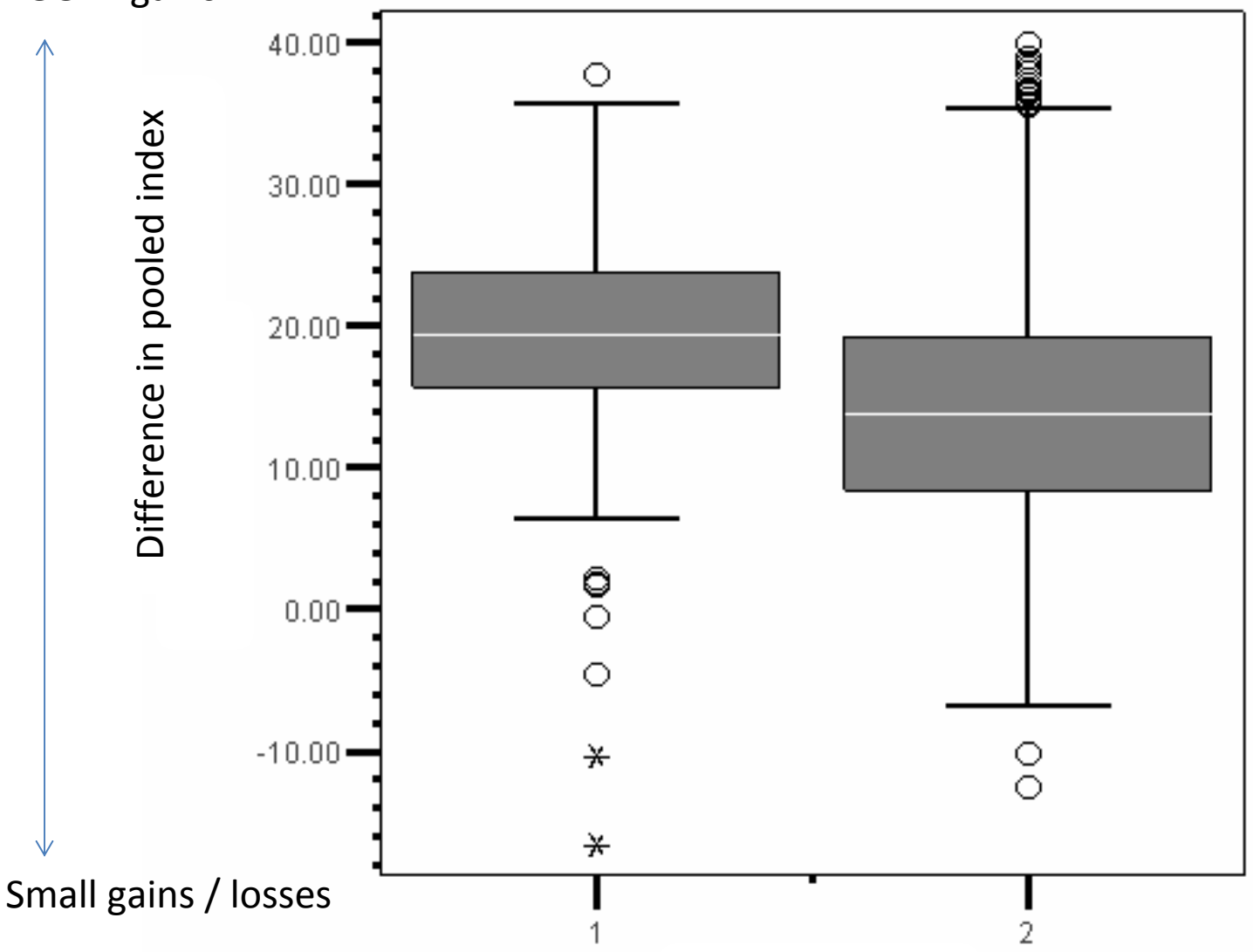
2000


worse
better
30.00
20.00
10.00
0.00
-10.00
No PAs
PAs in 1973
PAs by 2000


BIGGER gains
Small gains / losses
Difference in pooled index
40.00
30.00
20.00
10.00
0.00
-10.00
No PAs
PAs in 1973
PAs by 2000


% segment area in PA
100.00
75.00
50.00
25.00
0.00
-10.00
0.00
10.00
20.00
30.00
40.00
Difference in pooled index

BIGGER gains



Small gains / losses

Segments with > 10% area in PA (1) vs. NO (2)

Preliminary observations - PAs at census segment scale:

- Static glimpse at pov index scores for each year → appear that segments without PAs are better off than those with PAs
- Slight difference between PAs created as of 1973, vs. those where PAs created during 1973-2000
- Looking at change over time, segments with PAs appear to have made bigger gains in welfare index

Moving beyond conventional methods…

- Using program evaluation approach to estimate the effect of PAs on local human welfare
- Establishing the counterfactual: “What would have happened had the PA *not* been established?
- Analysis led by P. Ferraro (GSU) & K. Andam (IFPRI)

Approach

- Estimate impact of PAs established before 1980 on changes in census segment-level poverty index between 1973 and 2000
- Matching methods (difference-in-difference) that allow for selection of control communities that are observationally similar to communities near PAs (establishing the counterfactual)

Matching

- Contrasting differences in socioeconomic outcomes for communities heavily impacted by PAs (20% area) vs. those less affected by PAs
- Treated and control units were similar for observed pre-protection covariates that affect PA location
- Key assumption: in absence of protection, localities with the same baseline would, on average, reach same levels of development by 2000
- By contrasting changes in outcome indicators, approach controls for unobservable, but temporally invariant, differences in outcomes between treated and control units

Results

Average effect. Not saying that "everyone is hurt or everyone benefits".

Result 1: There is no evidence that PAs in Costa Rica had negative effects on the poverty index in our analysis.

Result 2: If anything, PAs have had a net positive effect on indicators of local human welfare.

Result 3: Estimates based on conventional methods that fail to account for non-random assignment of PAs suggest the opposite relationship: protection has negative effects on human welfare

Next steps

- Measure of PA effectiveness in mitigating defor (change detection for 1986 – 2001 using Landsat)
- Incorporate measure of PA “presence” in landscape (mgmt plan, park guards, infrastructure, visitation, funding)
- Examine relationships between PES program & corridor initiatives
- Extend district-level analysis to 4 other Central American countries
- Communicate /disseminate to Costa Ricans

THANK YOU

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