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# **Sao Francisco Andes**

## **Water food development**

**Observations from the basin focal  
projects of the CGIAR CPWF**

**Simon Cook**

- **Background to the Basin Focal Projects of the CPWF**
  - Water and food crisis
- **A development perspective**
  - How water and food systems interact
  - How they influence development and poverty
- **Sao Francisco**
- **Andes basins**
- **Global trends**

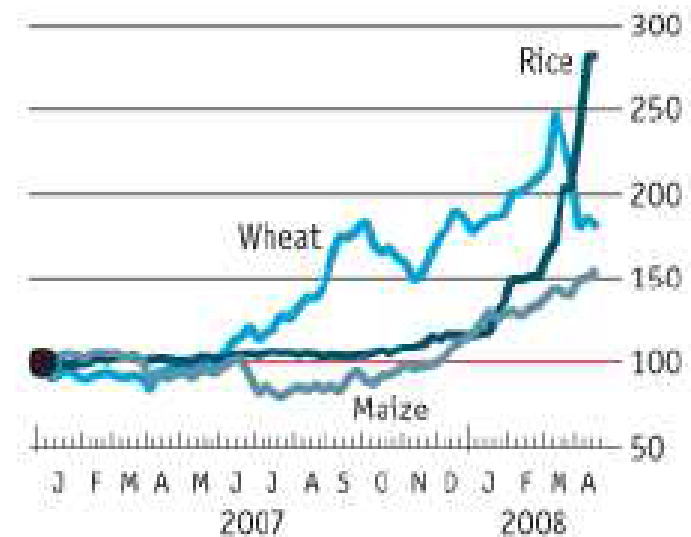
# Background

- **CPWF:**
  - Started in 2001 to help tackle the global food and water crisis
  - About USD 65m in Phase 1
  - Now in phase 2 (roughly the same \$\$)
  - Focussed on research for development
  - Partnerships vital (especially with NARES)
  - Most projects funded through a competitive call
  - Originally intended to help tackle the global food & water crisis through ‘more crop per drop’

# World food crisis

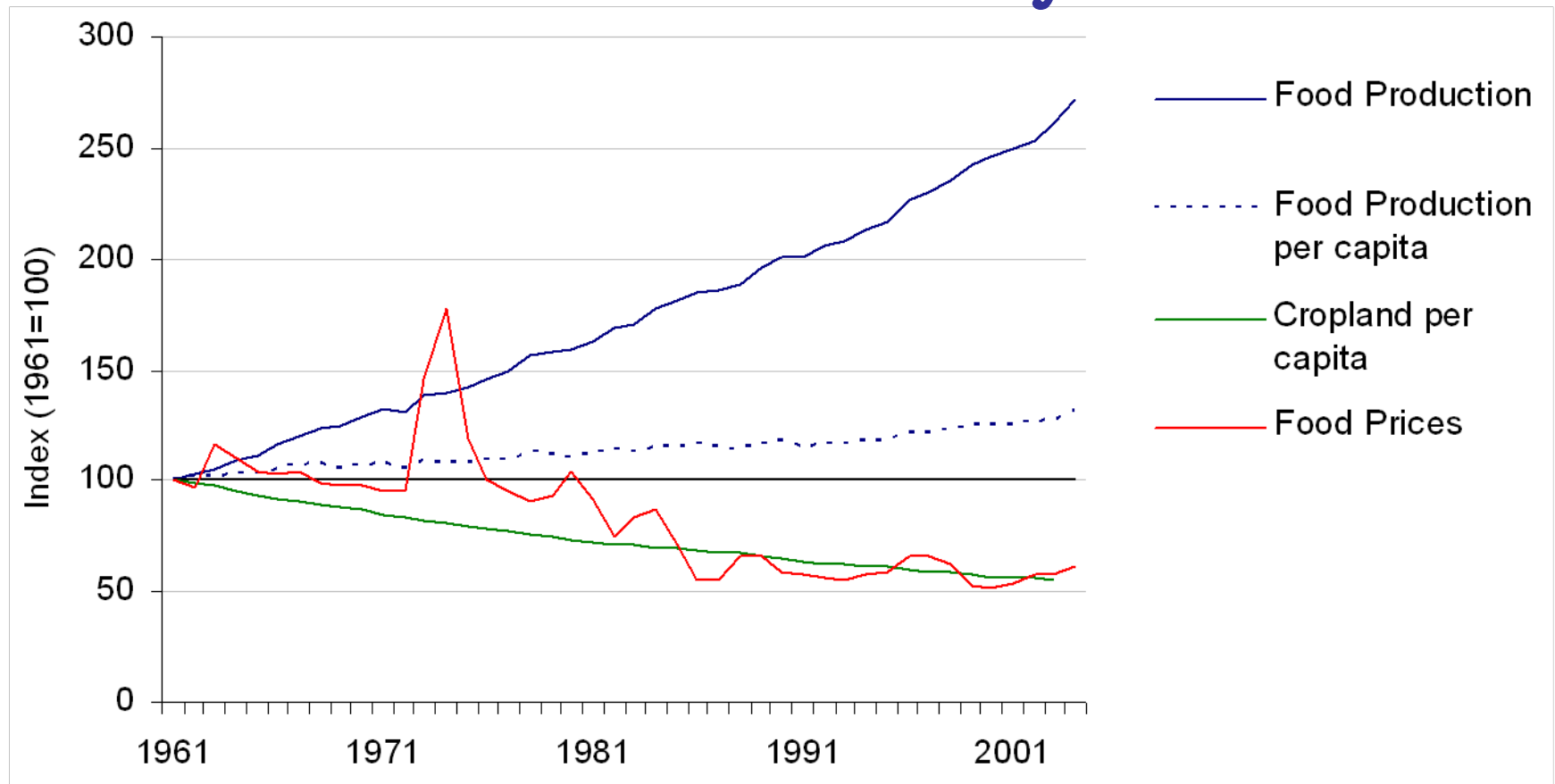
- **‘Spike’ in food prices**
  - Increasing demand
  - Declining supply
  - Biofuels
  - Commodity speculation

Grain prices, \$ terms, January 2nd 2007=100

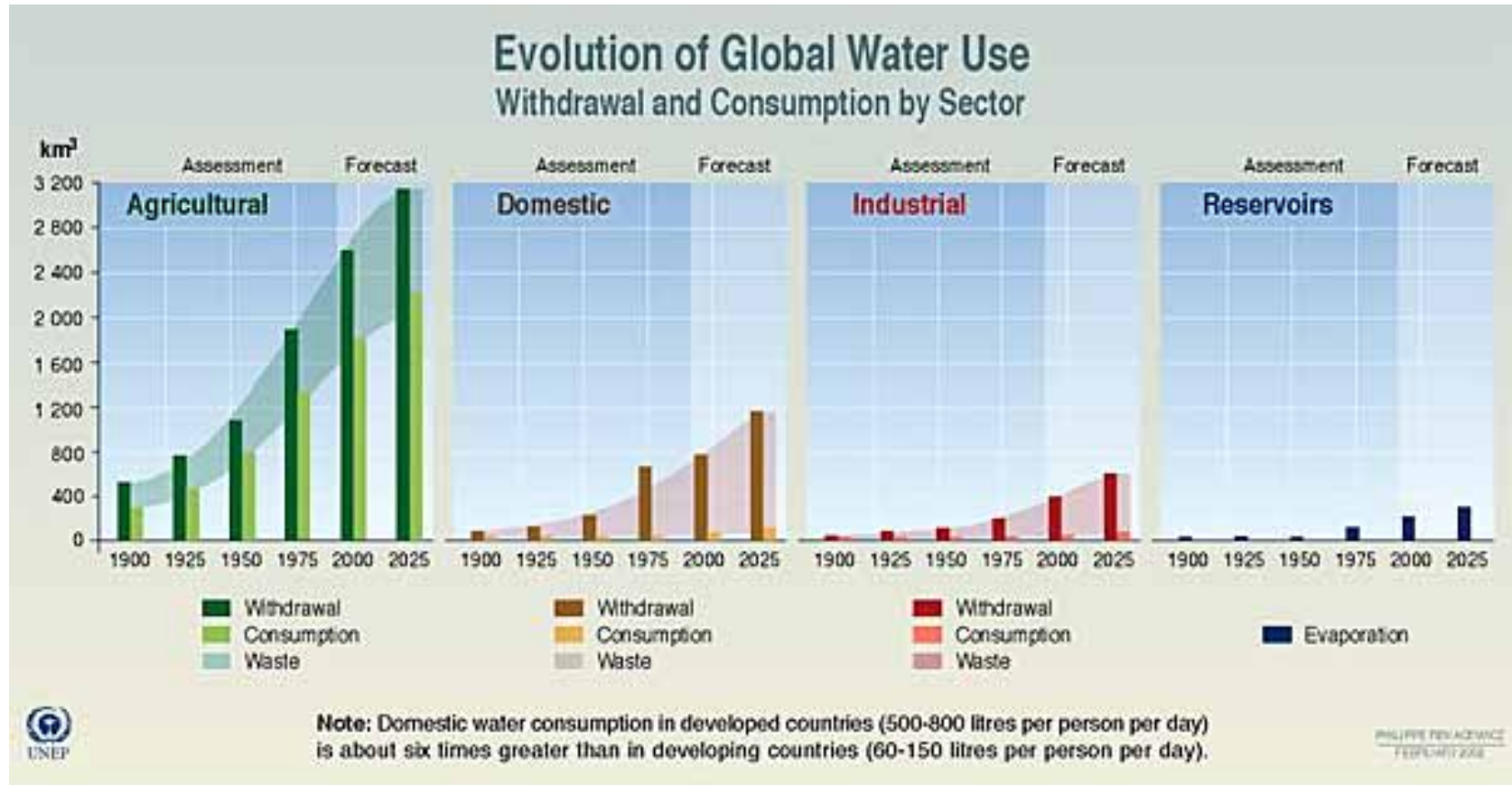


Sources: Chicago Board of Trade; Jacksons

# Global food demand has been met - until recently



## But this leads to increasing conflict with other users



**Agriculture uses > 70% of water**

# Background

- **But what does the ‘crisis’ look like on the ground?**
- **What can be done?**
- **In 2004**
  - **Questions raised re strategy and focus**

# **Basin Focal Projects (BFPS)**

## **To address tough questions**

- **Global food & water crisis:**
  - what does it look like on the ground?
- **Water , food and poverty**
  - What's the connection?
- **River basin livelihood systems**
  - Are basins merely geographical or functional?



# 10 Basins, 30 partners



# Development perspective

- **What's the condition of water systems in river basins?**
- **How do water and food systems interact?**
- **How does this impact development?**

# Workpackage structure

## Background

Demography Rural poverty  
Economic overview Agriculture

What is the overall situation?

## Water availability

Climate Water account  
Water allocation Water hazards

What is the water balance?

## Water productivity

Crop water productivity  $\text{kg}/\text{m}^3$   
Water value-adding  $\$/\text{m}^3$   
Net value / costs

What is the water balance?

## Policies and Institutions

Water

Farming

Water rights Water policies  
Governance Power

Land rights Infrastructure  
Supply chains

Who handles the water?

Who enables farmers to improve productivity?

## Poverty analysis

Rural poverty details  
Water-food related factors  
What links water, food and poverty?

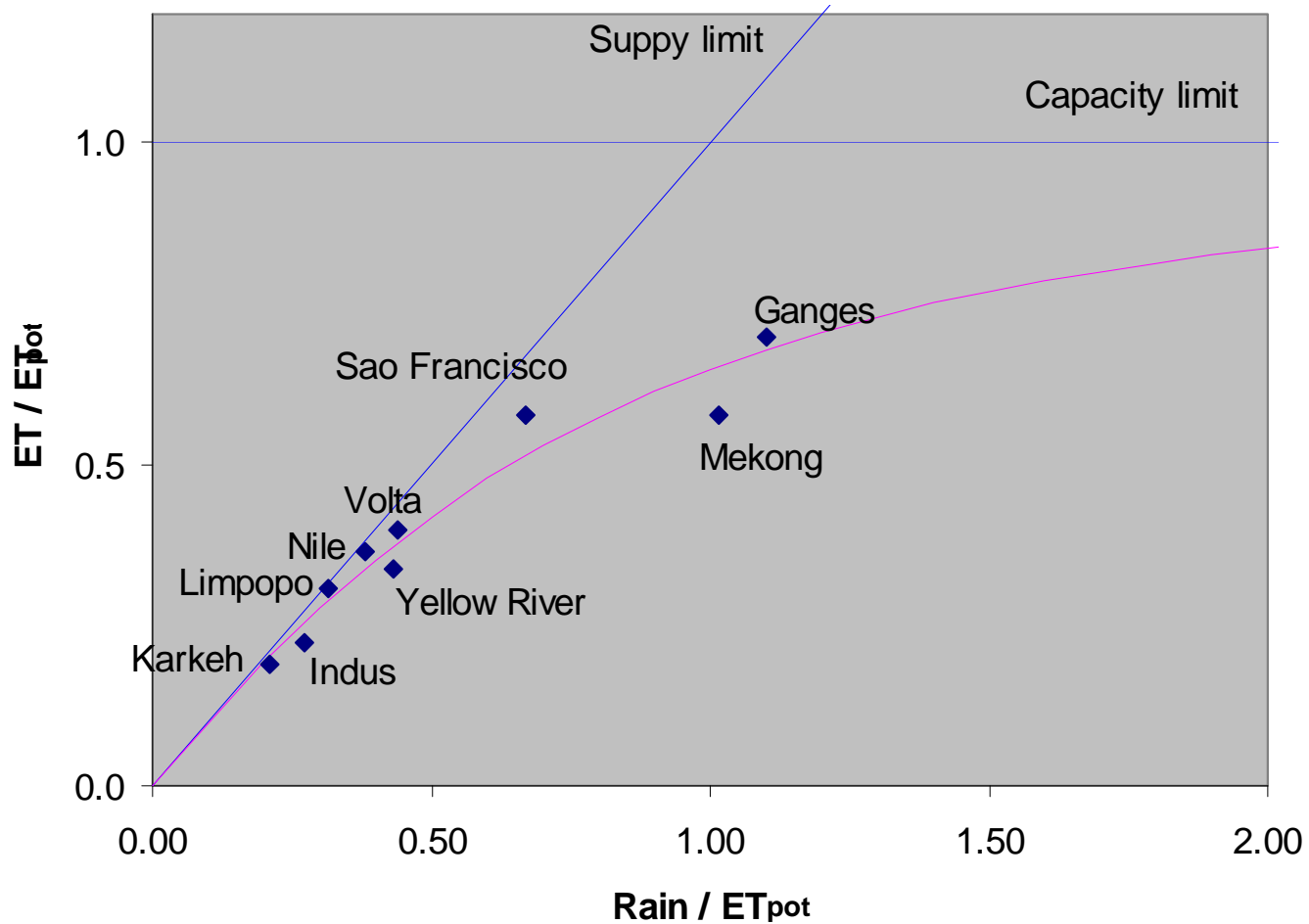
## Interventions

WEAP Trend analysis  
Land use change analysis  
What are foreseeable risks and opportunities for change?

- 
- **Water**
  - **Water productivity**
  - **Poverty**
  - **Institutions**
  - **Relationship to development**

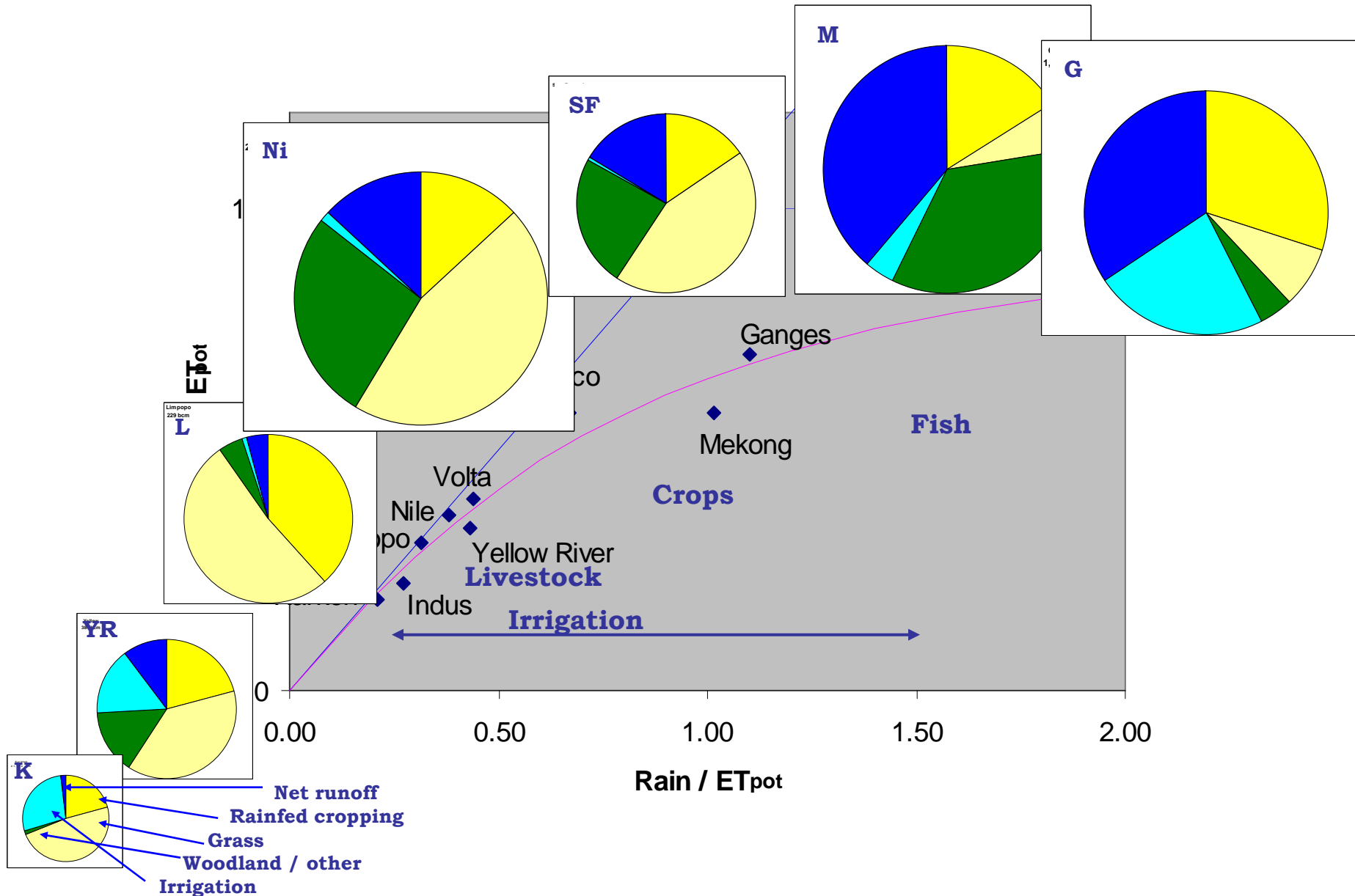
# Water availability

## Basins can be ordered



From Mac Kirby,  
CSIRO

# Water use supports varied livelihoods



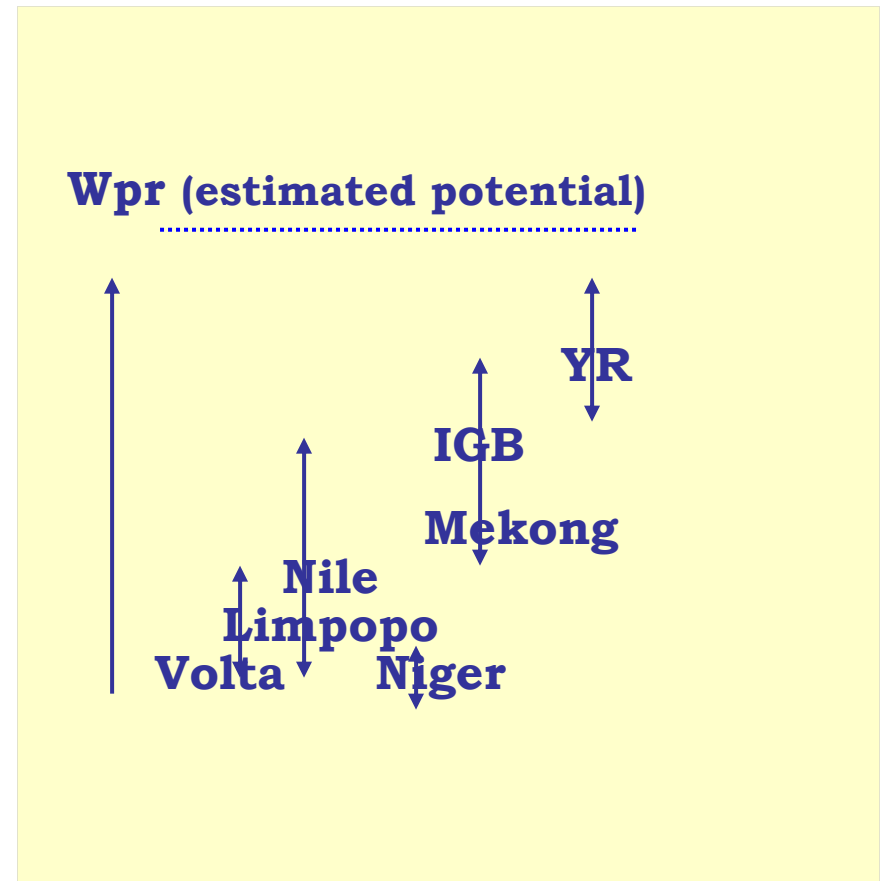
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# Water productivity

- **Benefit per volume of water consumed**
- **A key diagnostic**
- **Applies to irrigated crops, rainfed crops, livestock systems**

# Water productivity: Actual << potential

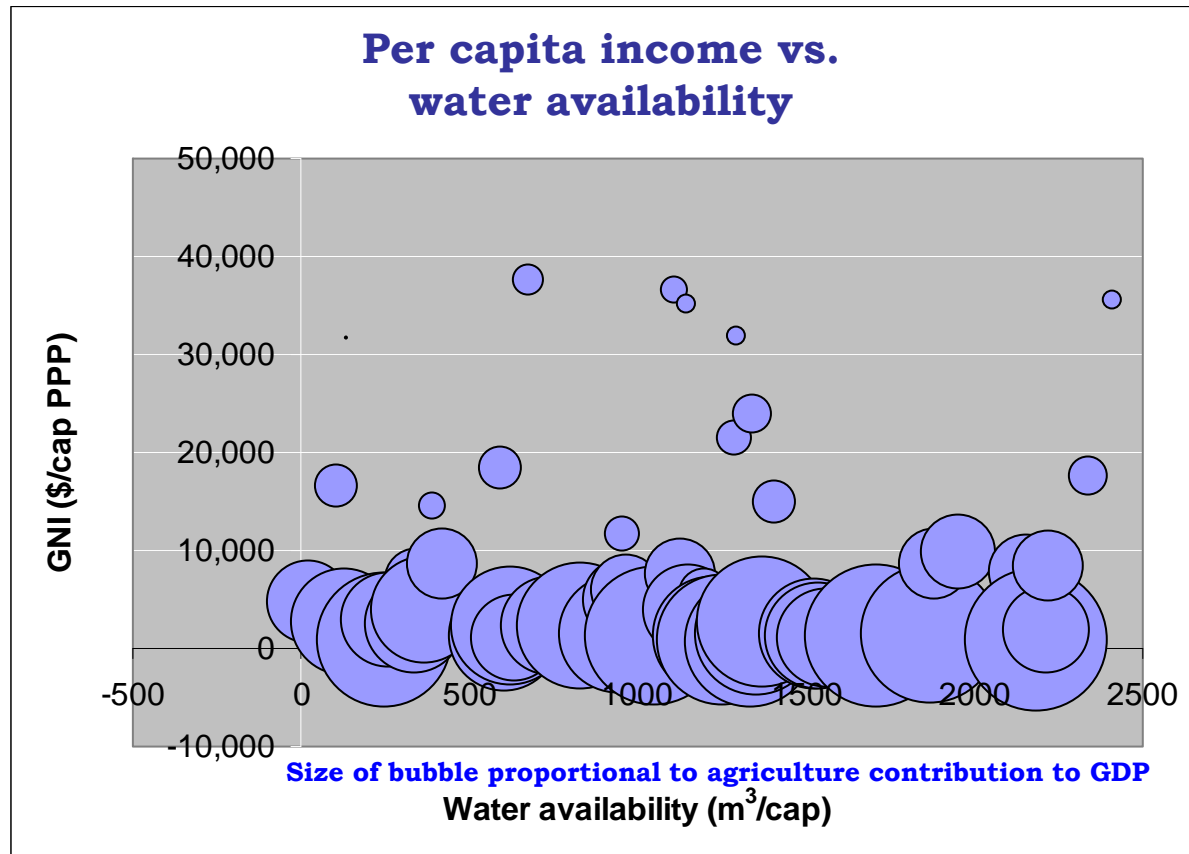
- **Some basins in Asia have responded to pressure...**
- **...but most in Africa are still 'dormant'**
- **Demand in Latin America moderate**





# Poverty:

Water availability less influential than use



World Bank, 2007

# 4 water-related factors

## 1. Availability / Scarcity

How much water is there?

## 2. Access

Who gets water?

How is it shared?

## 3. Hazard:

Are people hit by water-related problems?

Floods, droughts, disease

## 4. Use and abuse

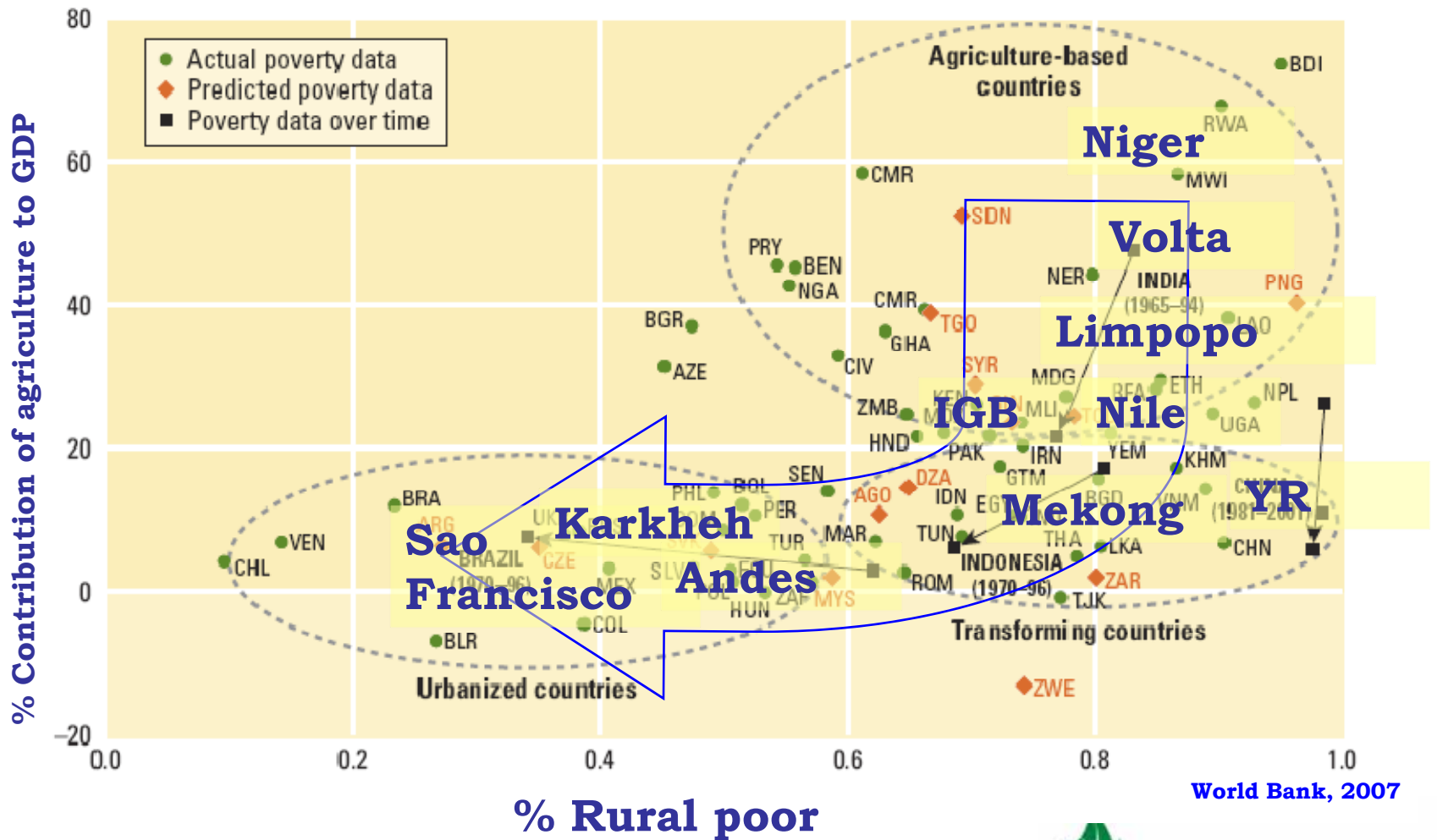
How well do people convert water into benefit?

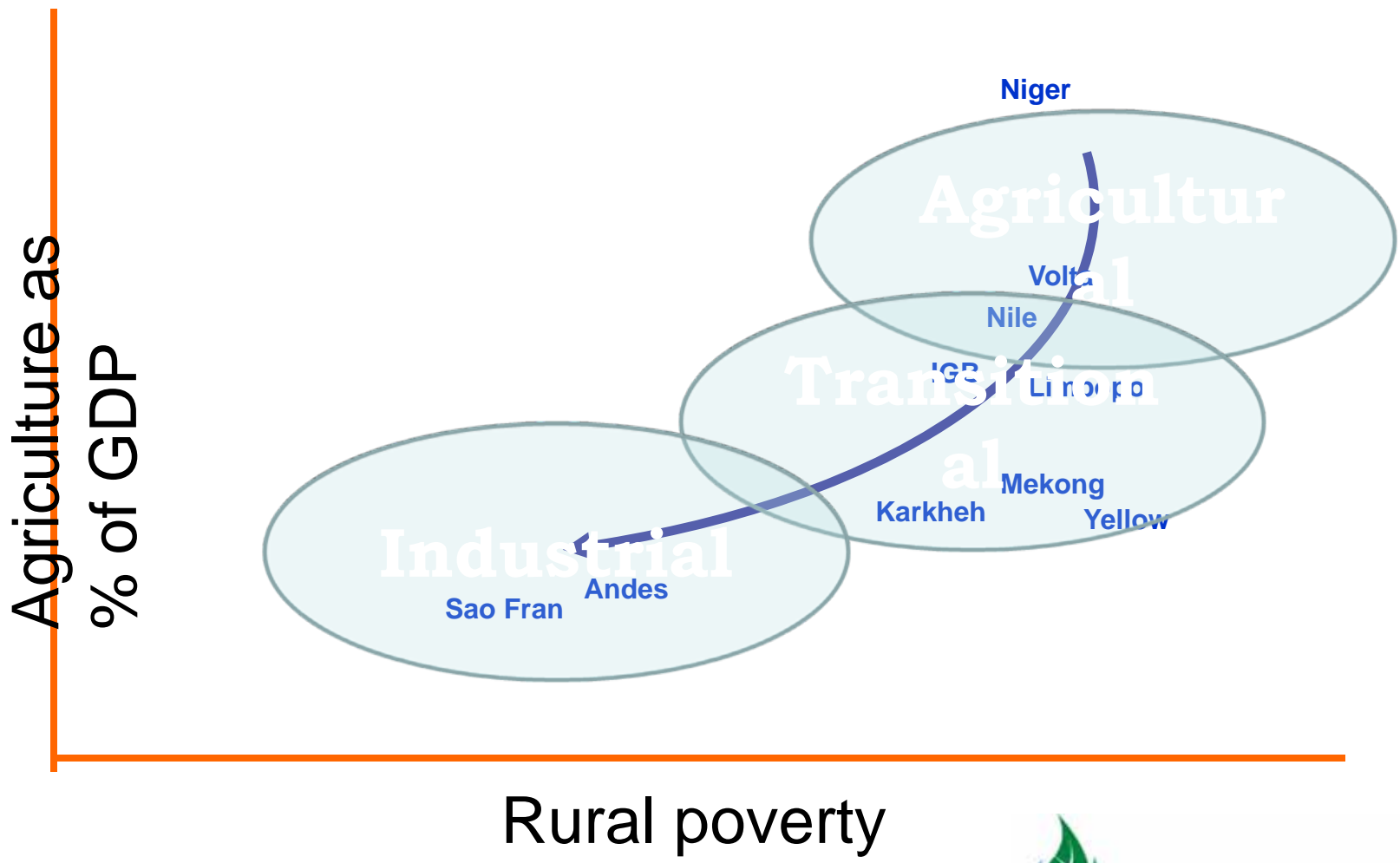
Do they damage the resource?

# Institutions

- **The ‘Cinderella’ subject – always difficult**
  - Goodbye social engineering, hello ‘bricolage’
- **Water, food and development institutions**
  - Generally disconnected at national / basin scale
  - Better connected locally
  - What is their imperative?
- **Lack of instruments**
  - Policy, laws, norms, financials

# Development: basins fall in a trajectory





Select date

# Sao Francisco basin

2 worlds..haves and have-nots

© 2009 Cnes/Spot Image

© 2009 MapLink/Tele Atlas

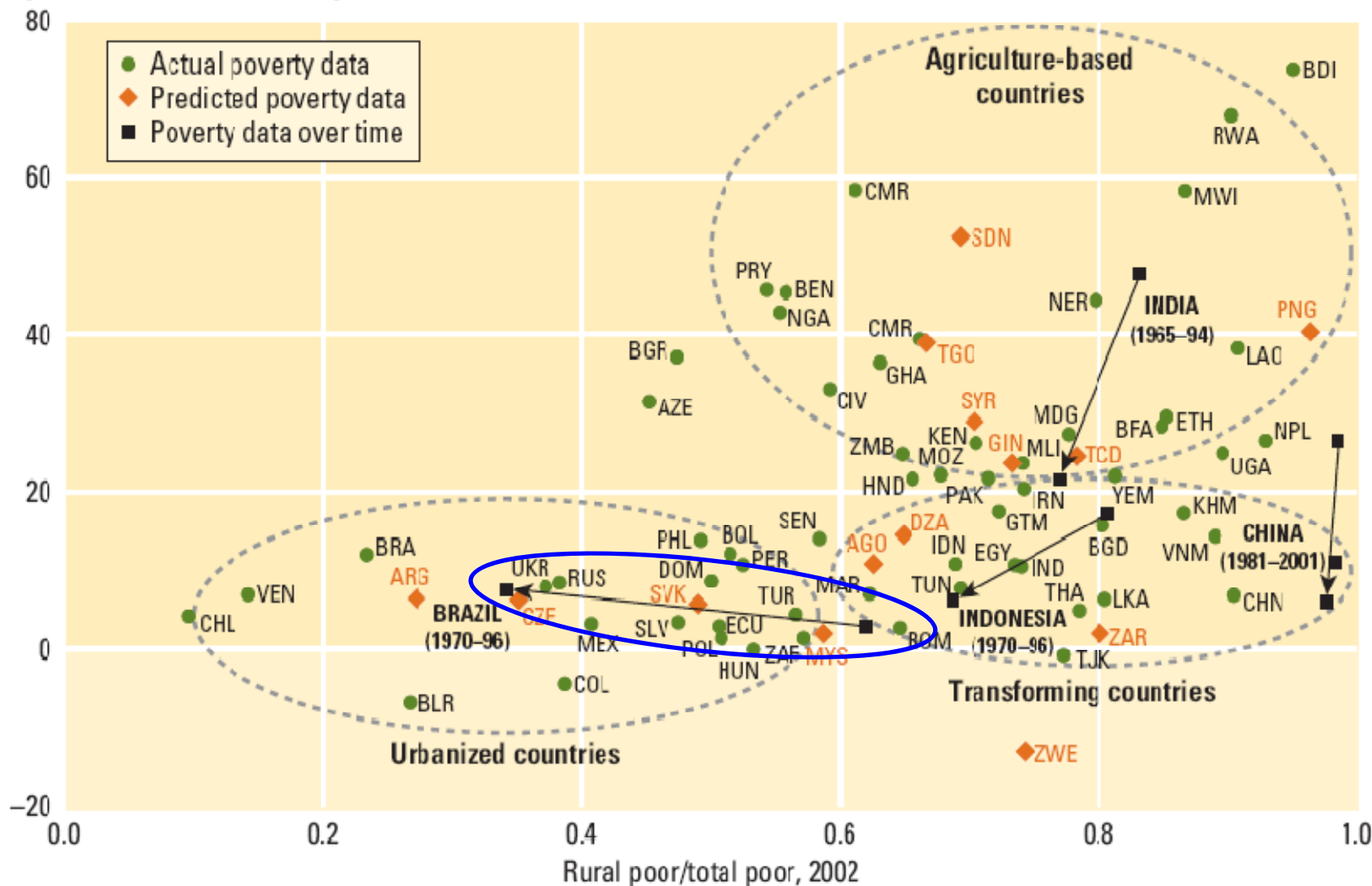
14°48'11.31" S 47°42'20.24" W elev 1000 m



Eye on 12.92

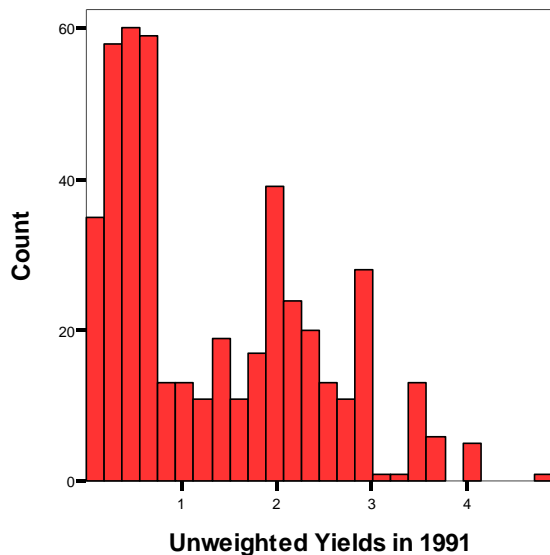
# Agricultural revival in Brazil

Agriculture's contribution to growth, 1990–2005, %



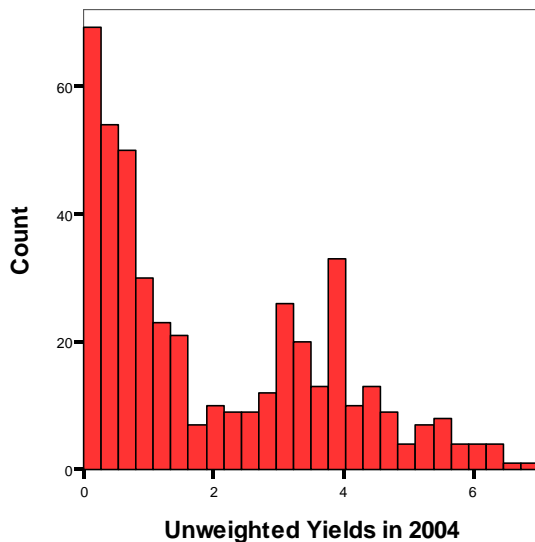
## Frequency Distribution of Corn Production

(in tons/ha)



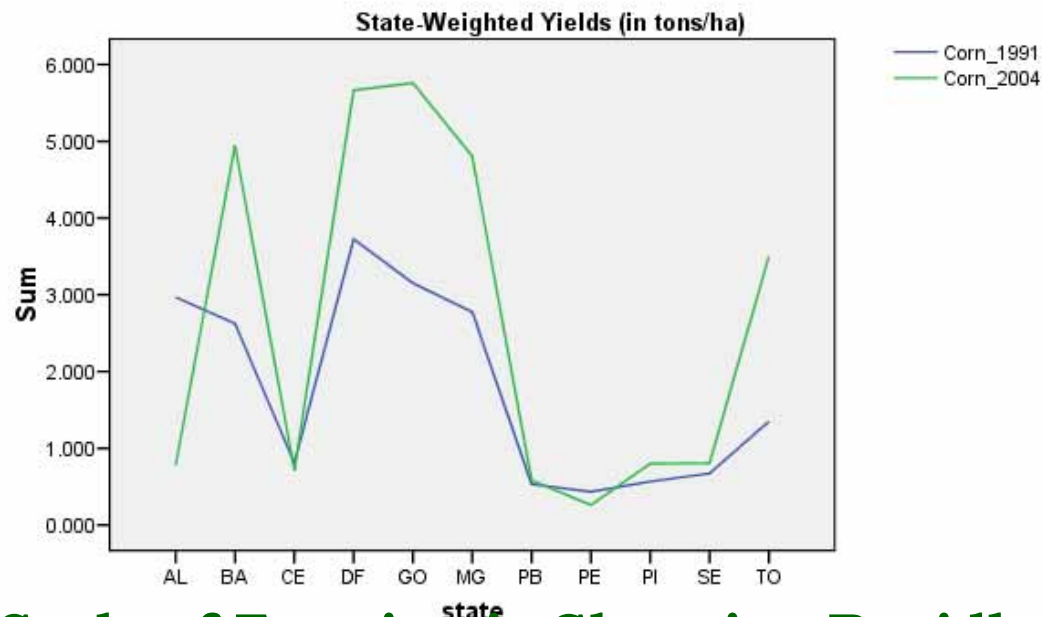
## Frequency Distribution of Corn Production

(in tons/ha)



# Changes in Land Productivity

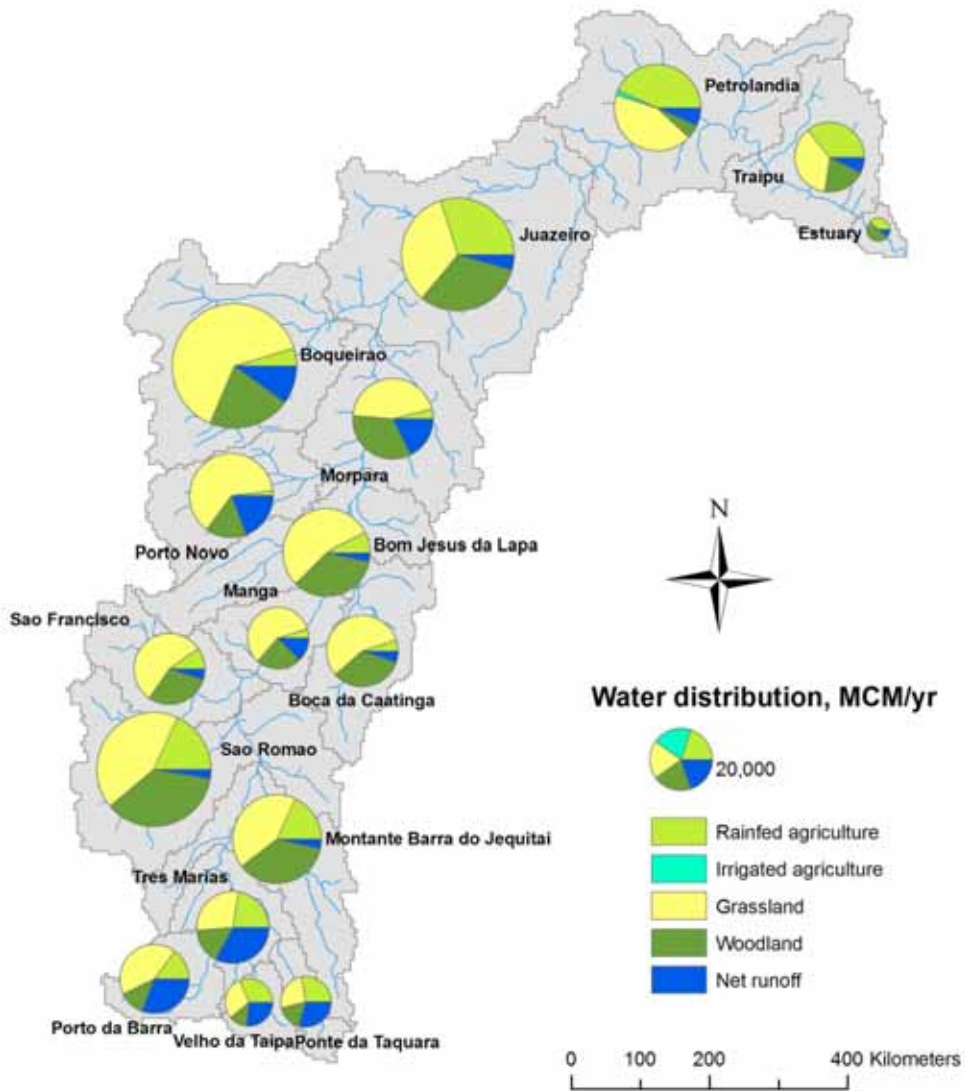
Total Corn Production by State



**Scale of Farming is Changing Rapidly**

- **Vast Majority of Area Expansion is by Large-Scale Enterprises**

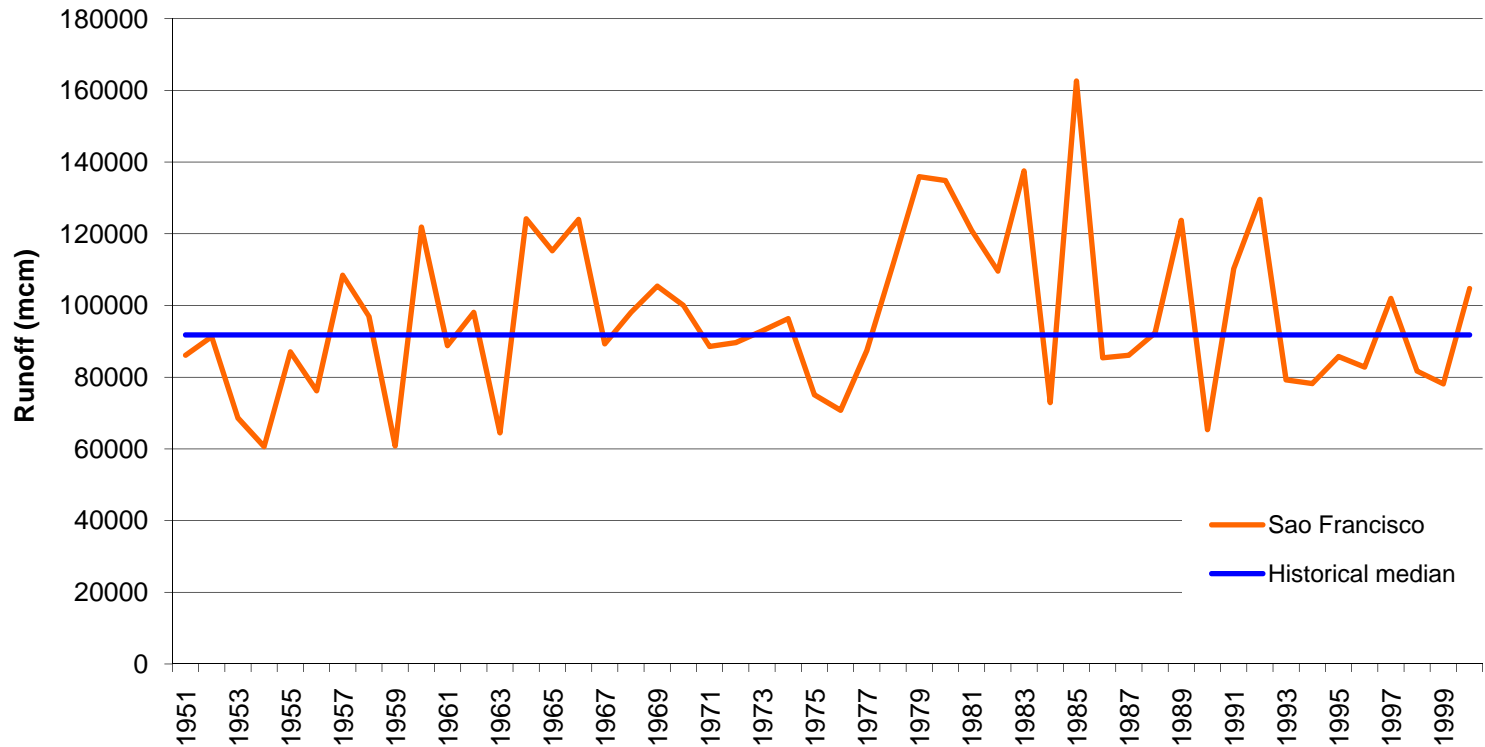




From Eastham *et al*, 2010

# Sao Francisco

## Internal changes dominate



# Andes



# **The human footprint on water : agricultural, industrial, and urban impacts on quality**

## **Global and in the Andean region**

**Mark Mulligan, King's College  
London, UNEP-WCMC**

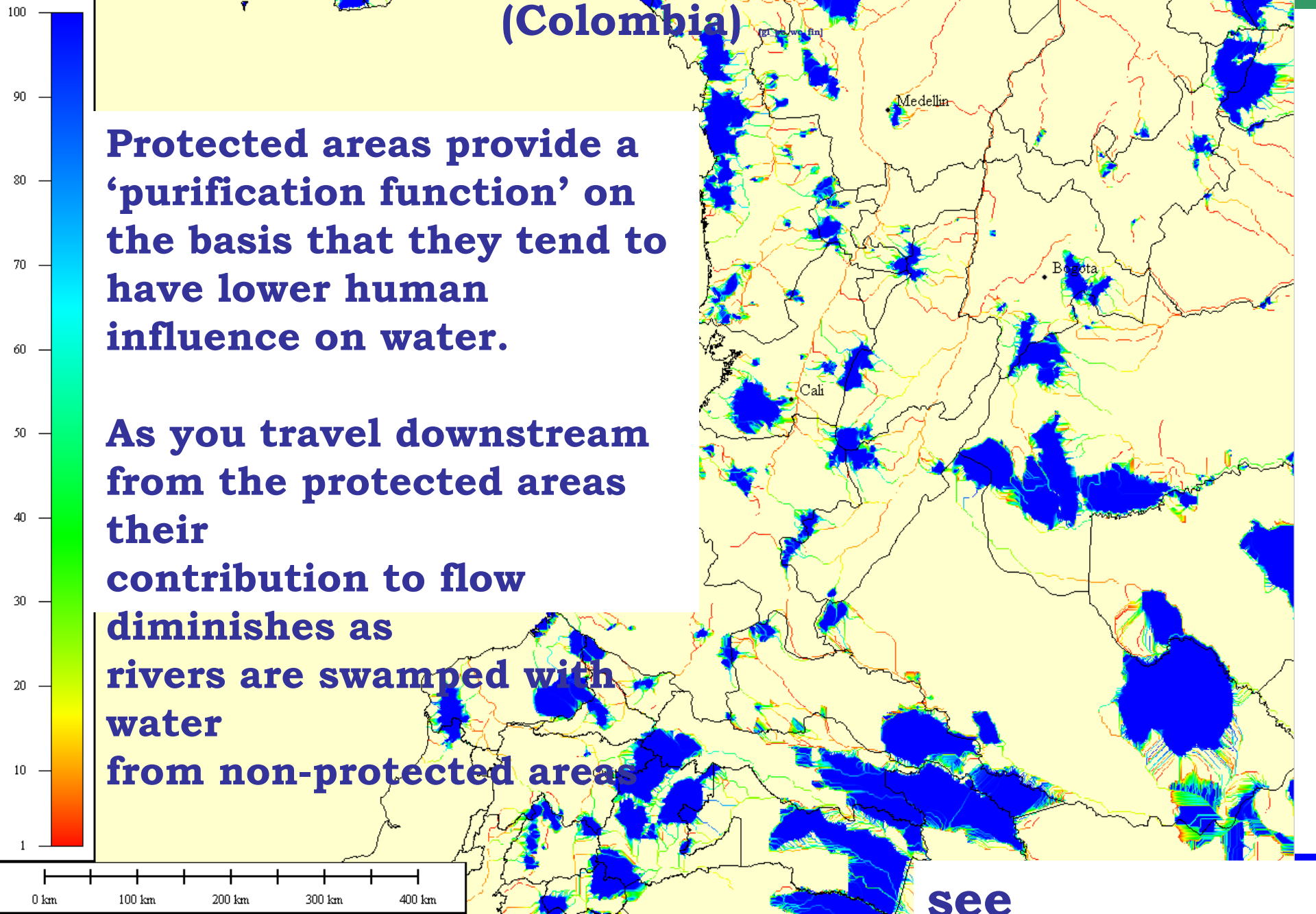
**[mark.mulligan@kcl.ac.uk](mailto:mark.mulligan@kcl.ac.uk)**

# % of water originating in a protected area – WDPA 2009

(Colombia)

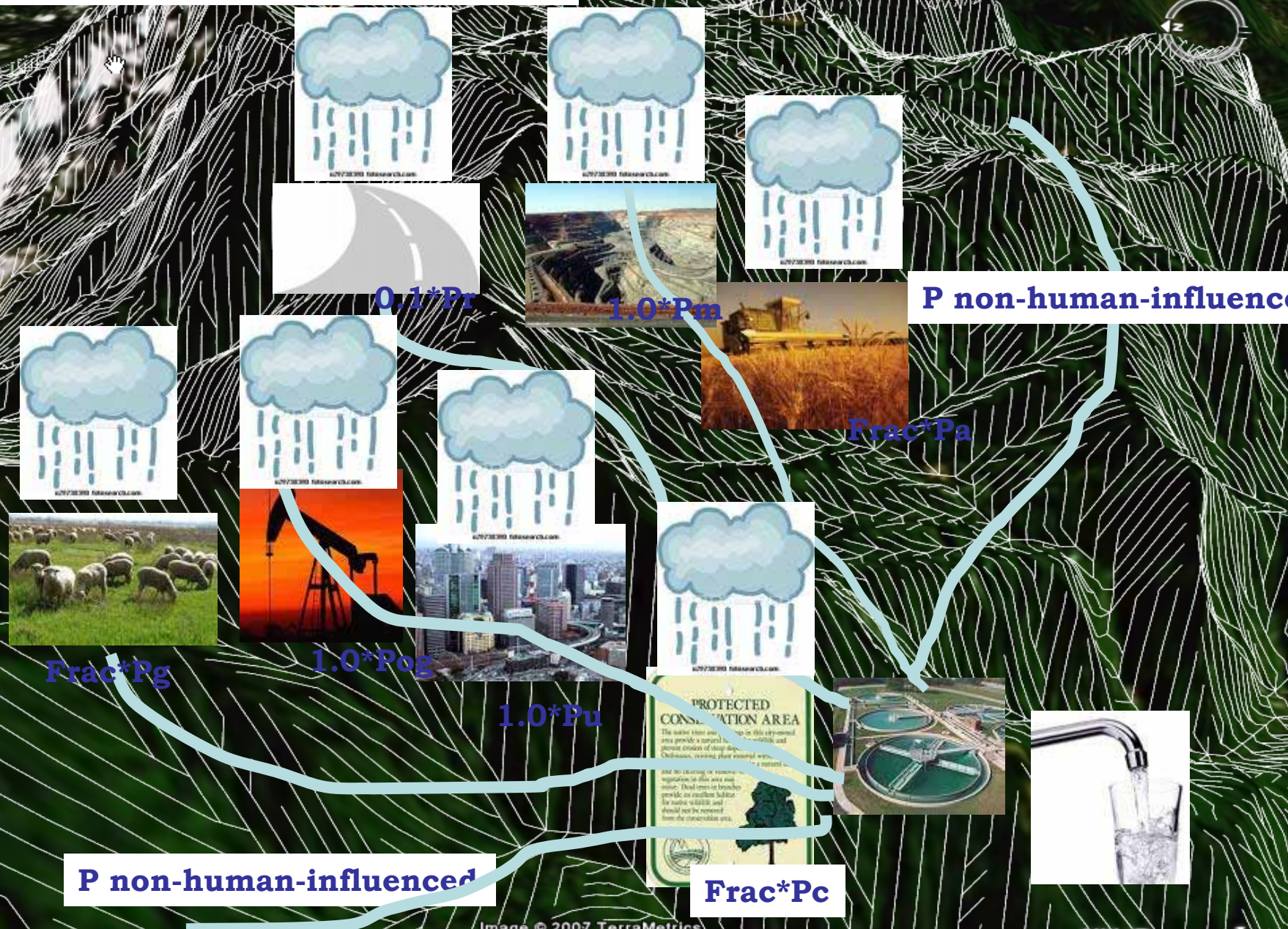
**Protected areas provide a 'purification function' on the basis that they tend to have lower human influence on water.**

**As you travel downstream from the protected areas their contribution to flow diminishes as rivers are swamped with water from non-protected areas**



see

# Modelling the human footprint on water

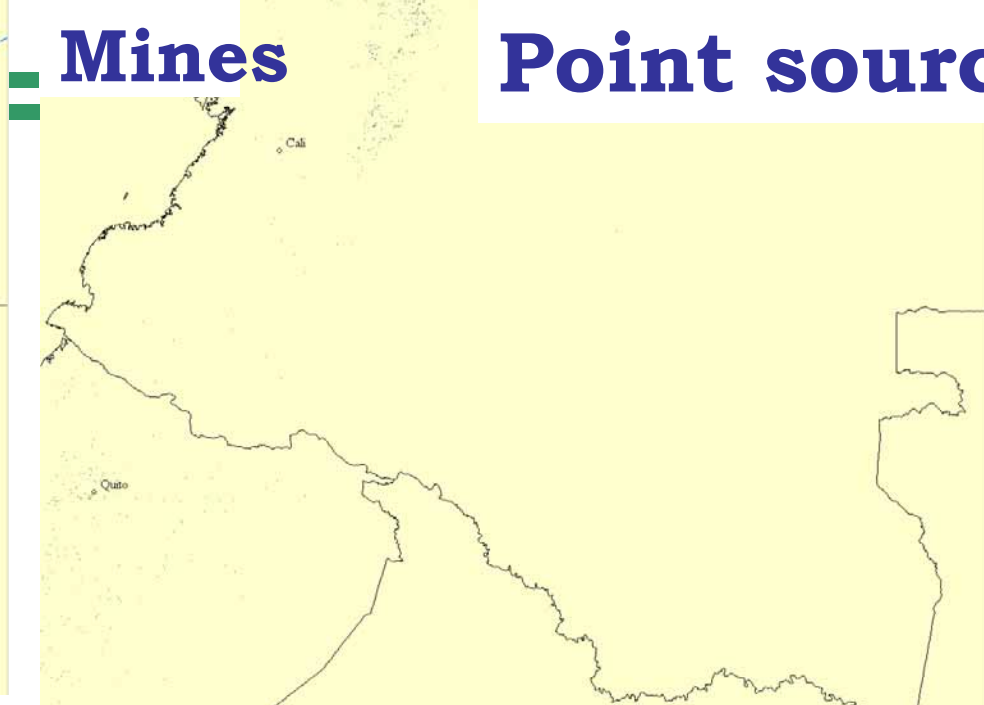


**Human Footprint on Water =  $\frac{\sum P_{polluting}}{\sum P_{total}}$**

# Roads

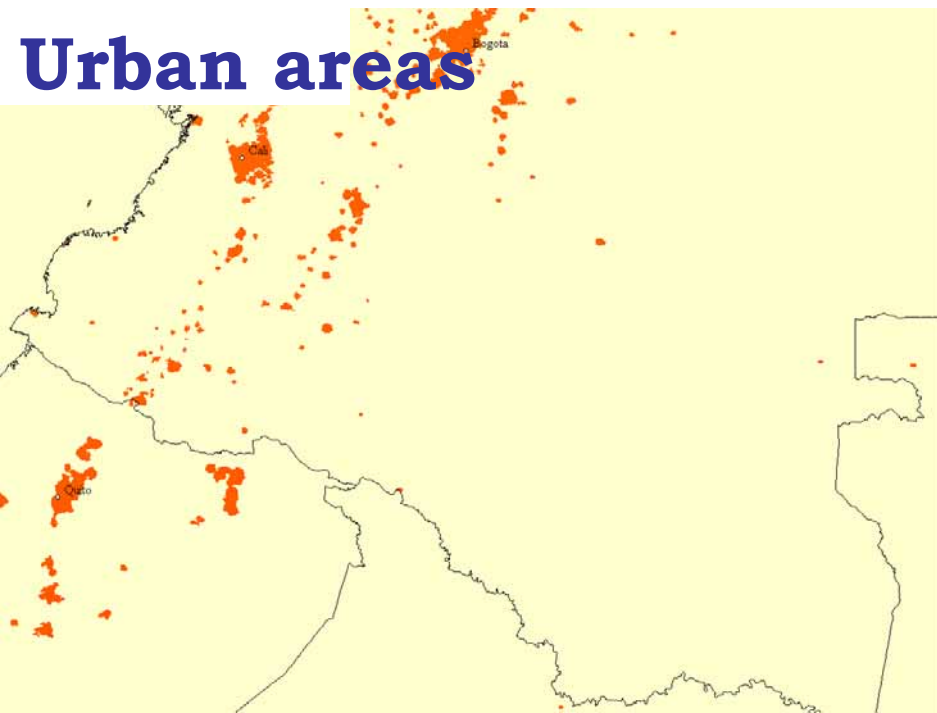


# Mines

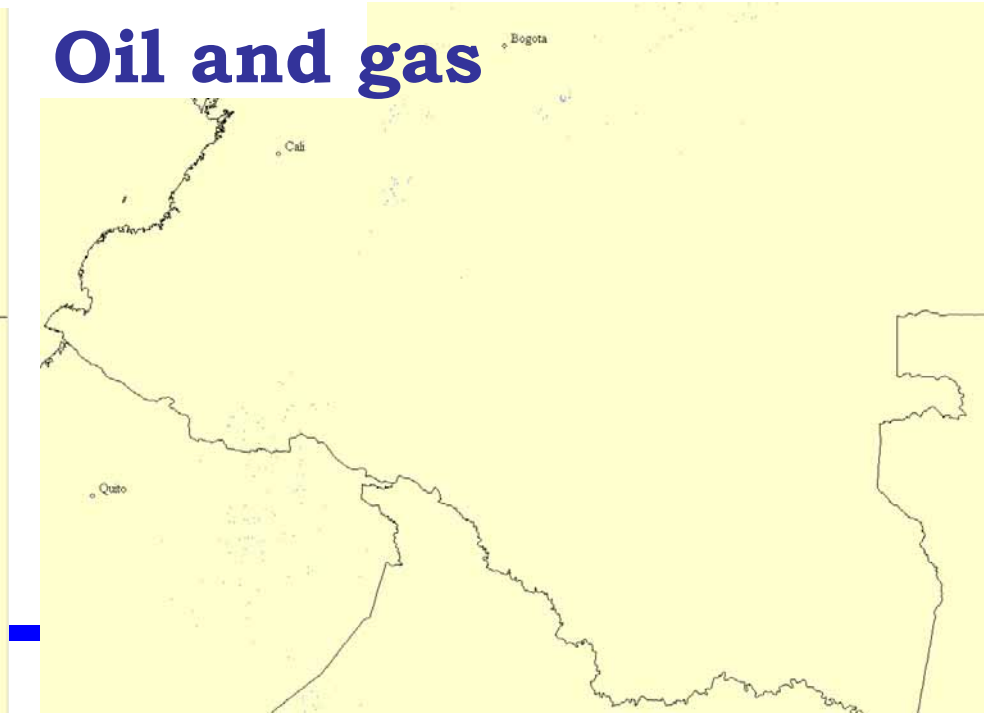


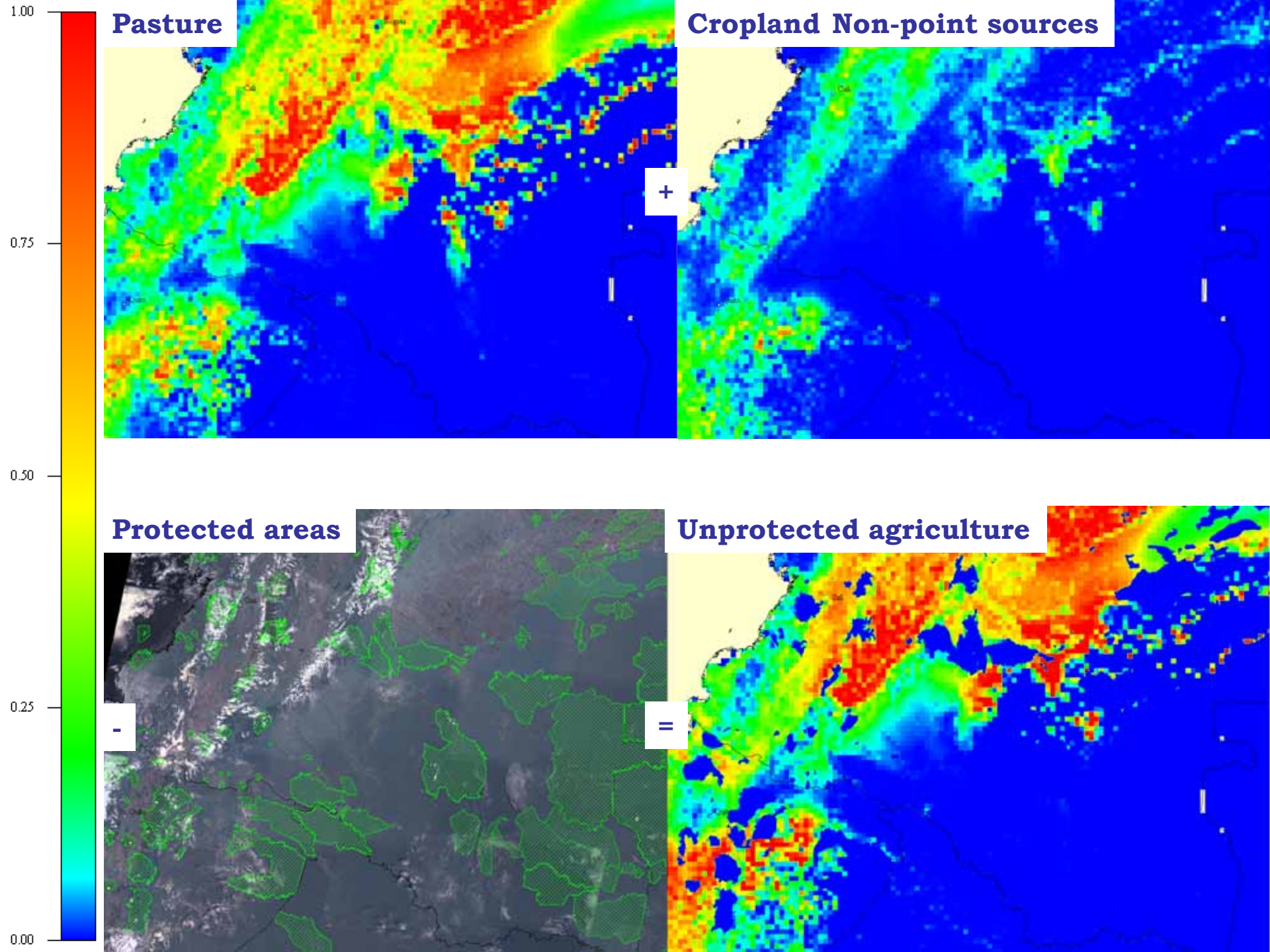
# Point sources

# Urban areas



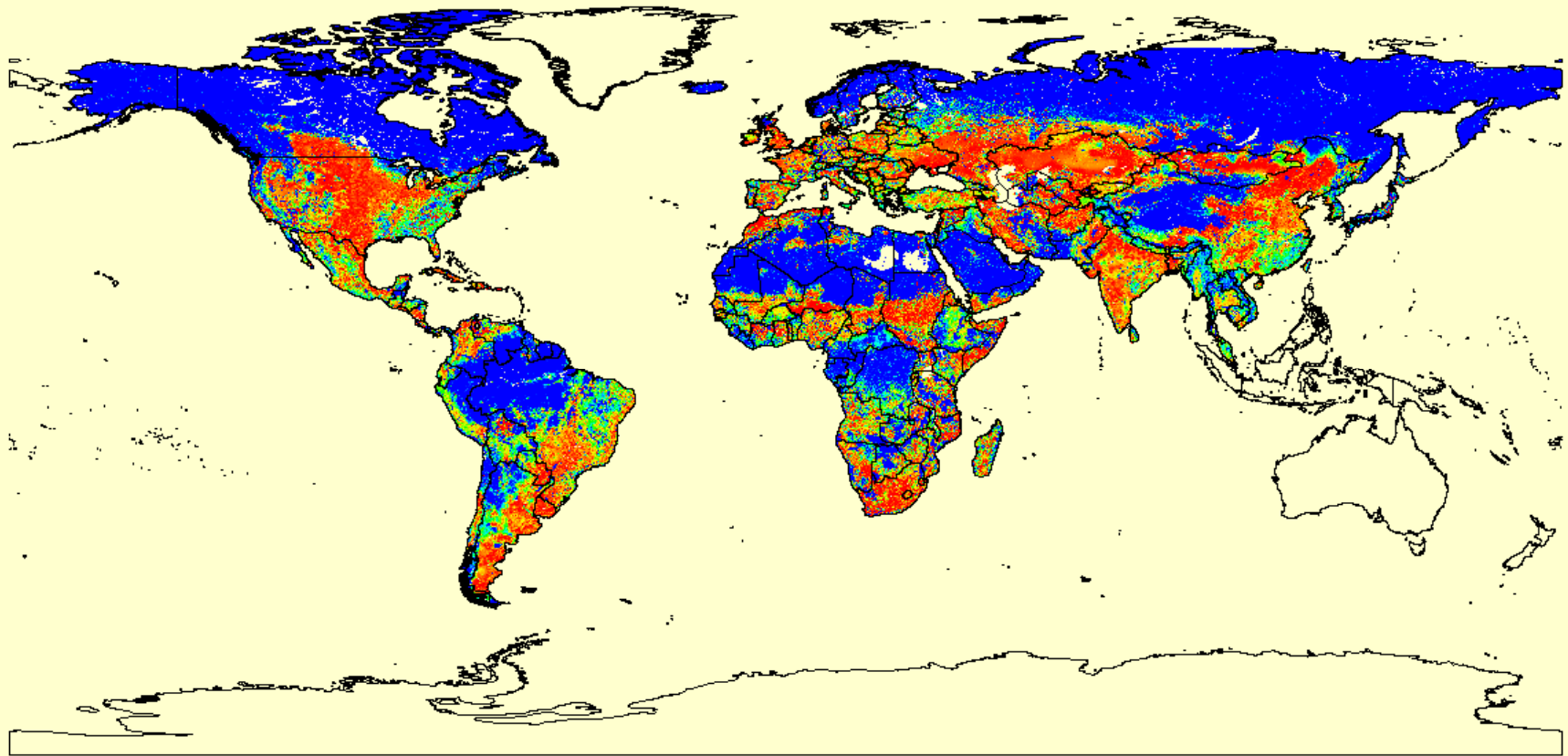
# Oil and gas







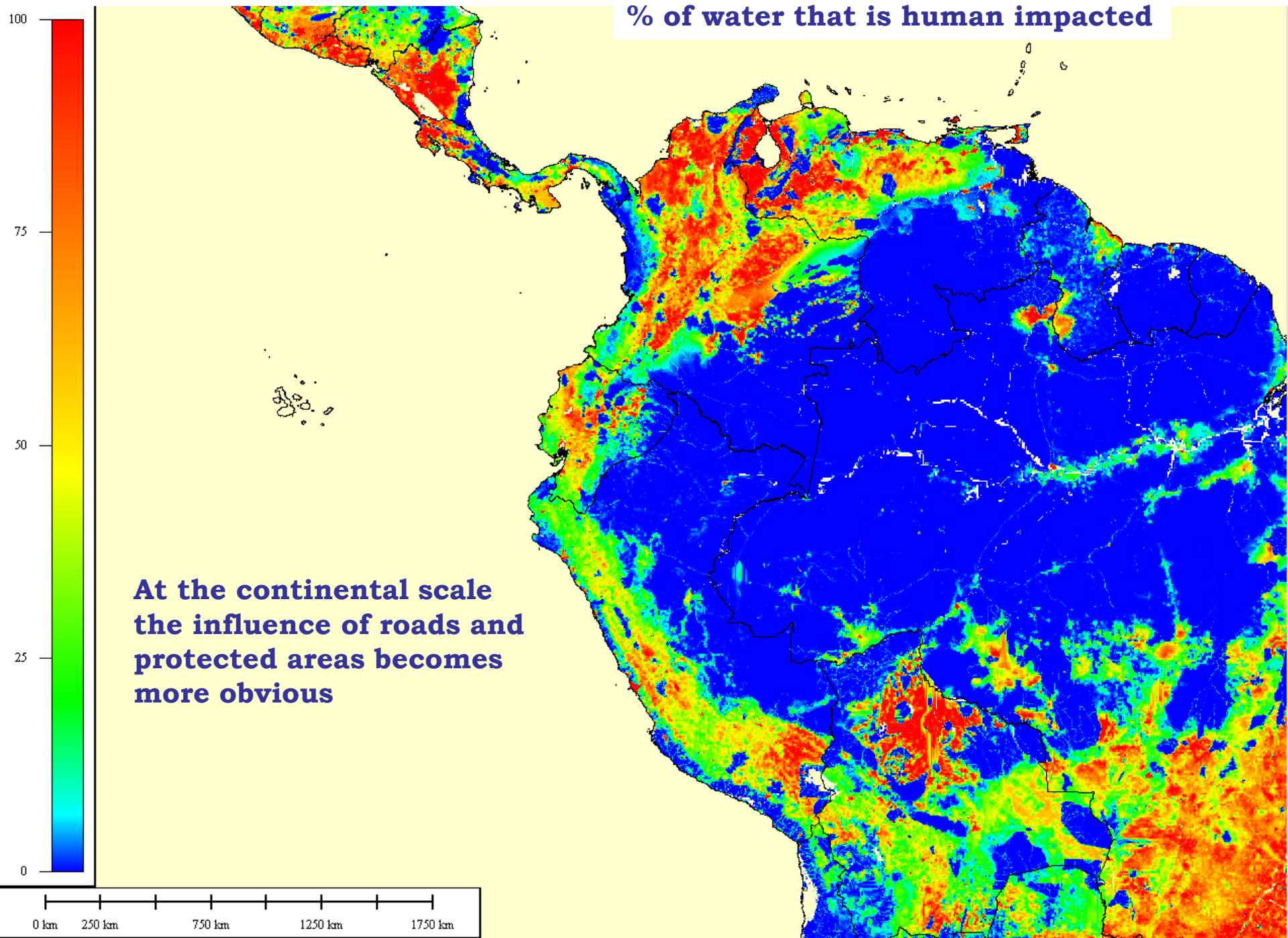
# **% of water that is human impacted**



**At the global scale dominated by the human agricultural footprint**



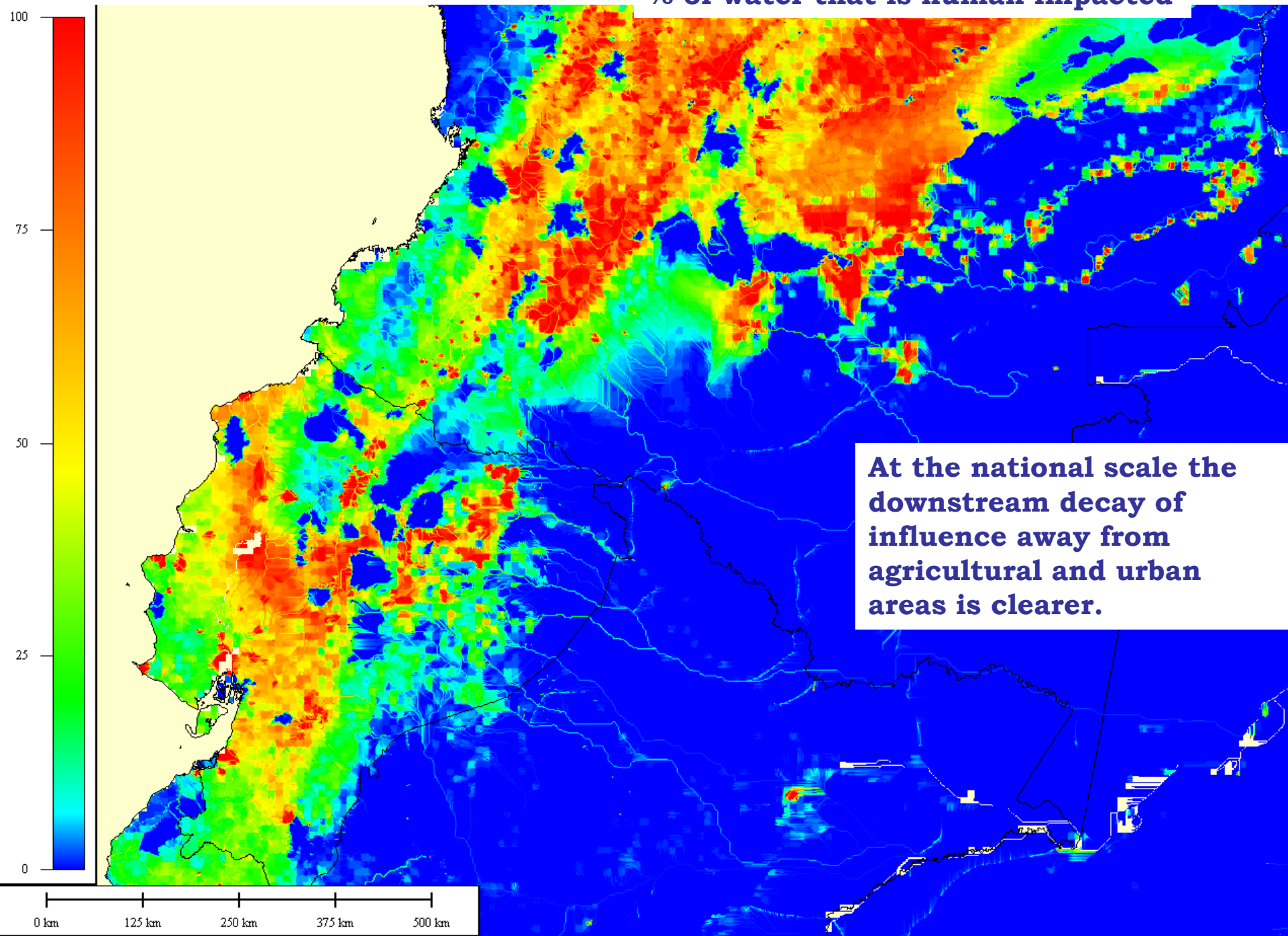
**% of water that is human impacted**



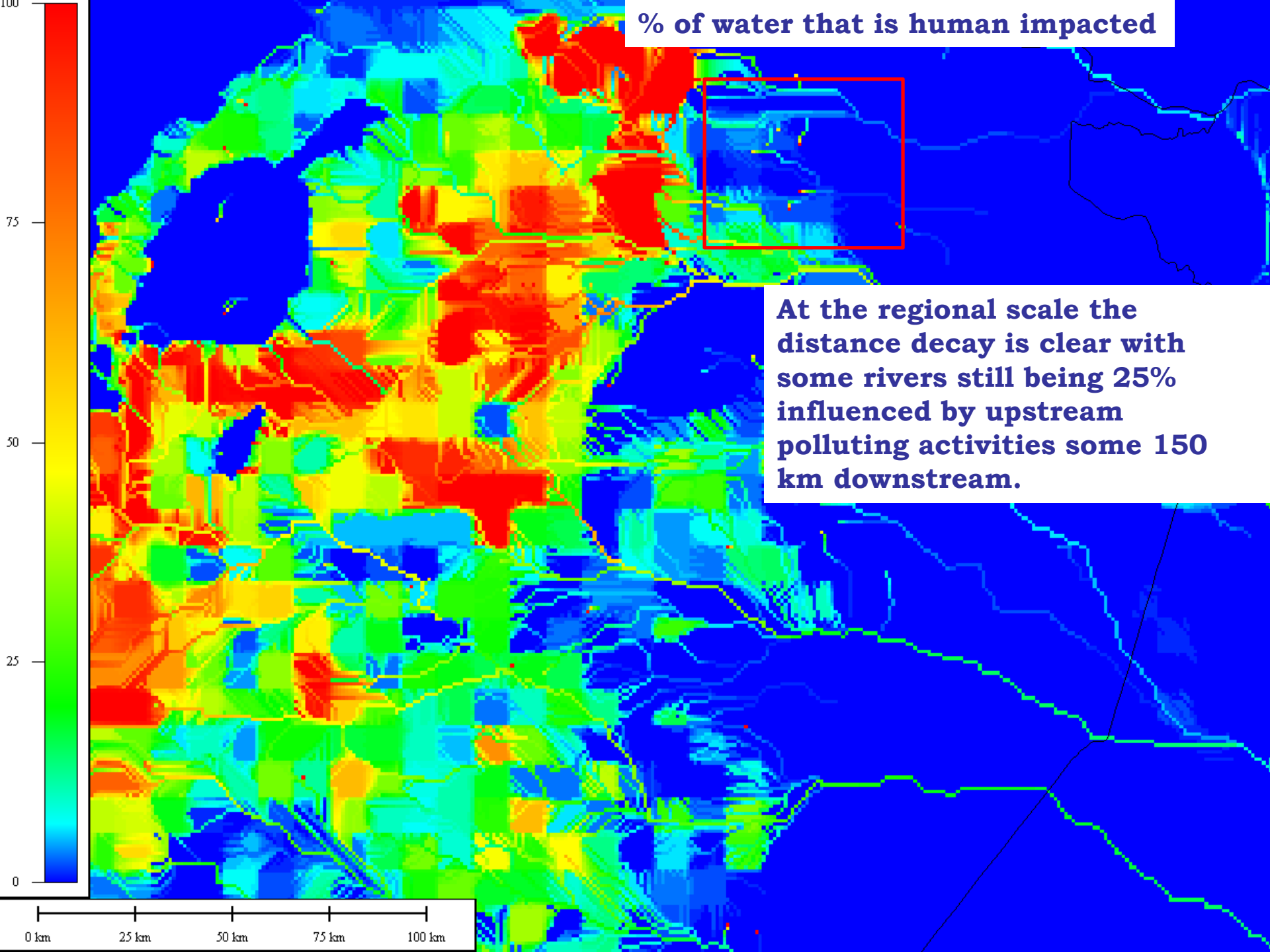
**At the continental scale  
the influence of roads and  
protected areas becomes  
more obvious**

0 km 250 km 750 km 1250 km 1750 km

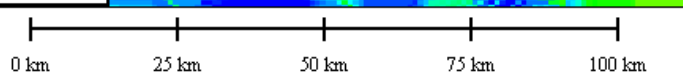
# % of water that is human impacted



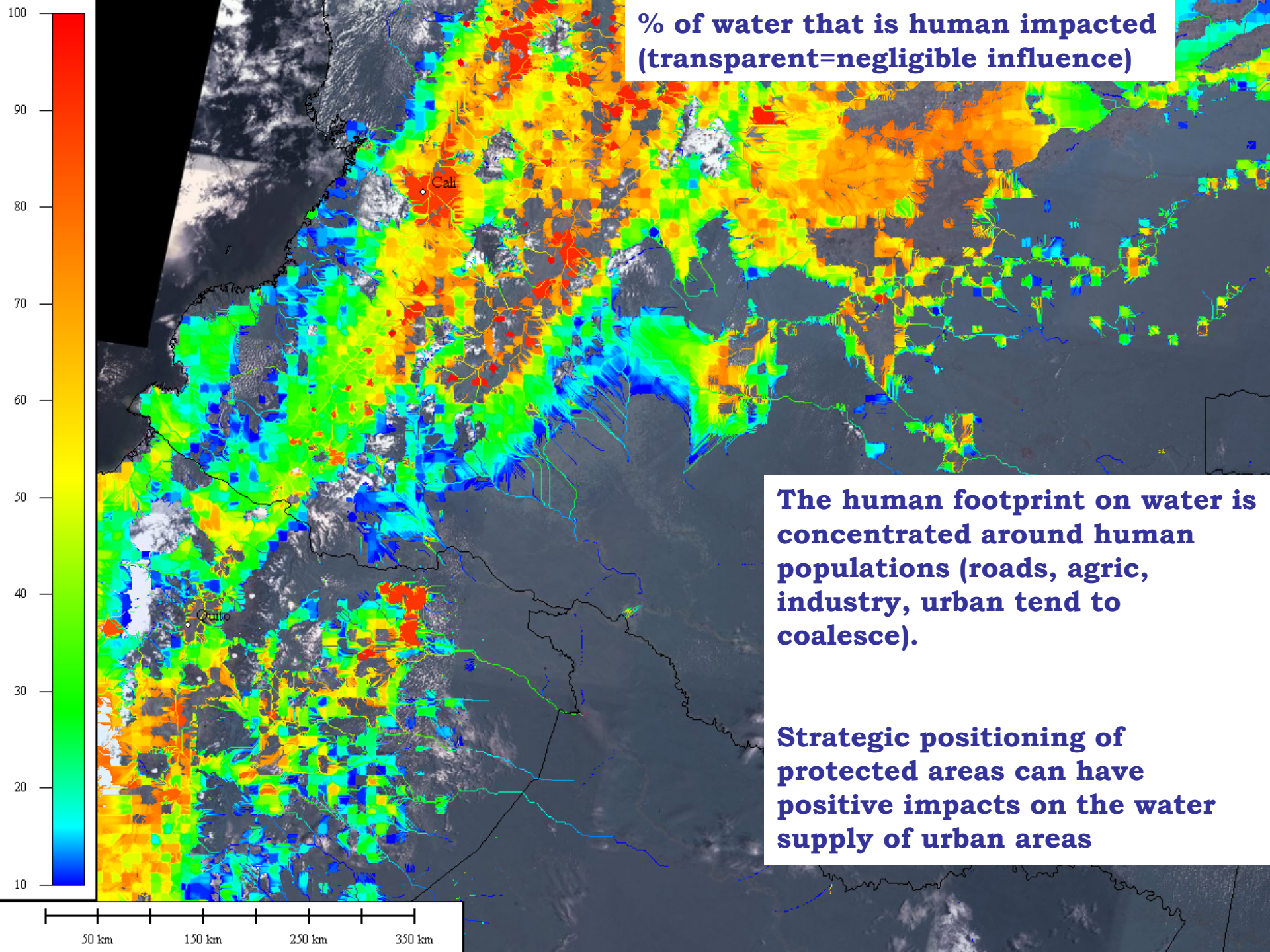
**% of water that is human impacted**



**At the regional scale the distance decay is clear with some rivers still being 25% influenced by upstream polluting activities some 150 km downstream.**



**% of water that is human impacted  
(transparent=negligible influence)**



**The human footprint on water is concentrated around human populations (roads, agric, industry, urban tend to coalesce).**

**Strategic positioning of protected areas can have positive impacts on the water supply of urban areas**

# El ambiente Institucional como un indicador.



Jorge Rubiano<sup>1</sup>, James Garcia<sup>2</sup> y Tatiana  
Gutierrez<sup>3</sup>

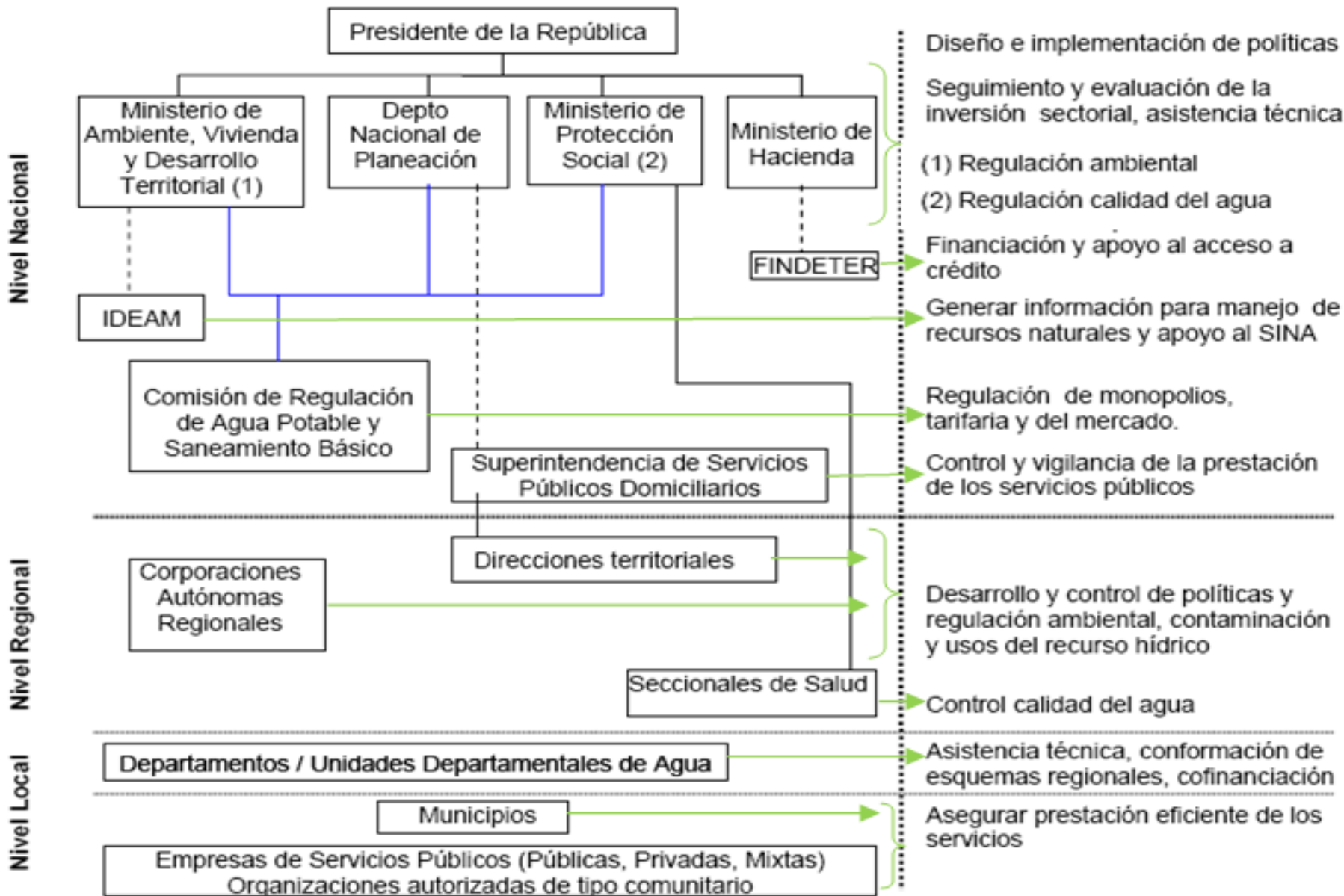
1. Kings College London, [jerubiano@gmail.com](mailto:jerubiano@gmail.com), 2. CIAT, 3. UAO

# Institutions also have observable regional trends



## INSTITUCIONES

## FUNCIONES





# Ecuador

## Instituciones de Orden Nacional

### INSTITUCIONES

Presidencia de La República

Ministerio de Coordinación de Desarrollo Social (1)

Ministerio de Coordinación de Patrimonio y Cultural (1)

Ministerio de Coordinación de la Producción (1)

Ministerio de Coordinación de Sectores Estratégicos (1,3)

Ministerio de Desarrollo Urbano y Vivienda (2)

Secretaría Nacional del Agua SENAGUA (3)

Ministerio de Ambiente MAE (2)

Ministerio de Minas y Petróleos (2)

Ministerio de Agricultura, Ganadería, Acuicultura y Pesca MIAG (2)

Subsecretaría de Agua Potable, Saneamiento y Residuos Sólidos (4)

Subsecretaría de Ordenamiento Territorial (4)

Subsecretaría de Calidad Ambiental (4)

Subsecretaría de Patrimonio Cultural (4)

Instituto Nacional de Riego INAR (4)

Instituto Nacional de Meteorología e Hidrología INAMHI (5)

Contraloría General del Estado Ecuatoriano (6)

Instituciones varias de regulación según Recurso Natural (7)

Consejo Ele

## Organismos Autónomos Regionales y Locales

Consejos Provinciales (7) (8)

Instituto Ecodearrollo Amazónico (8)

Consejos Municipales o Cantonales (7) (8)

Corporaciones de Desarrollo Regional (7) (8)

### FUNCIONES

- (1) Instituciones de orden Nacional encargados de la Coordinación y monitoreo permanente de la política, planes y los programas ejecutados por los ministerios adscritos según su área de gestión.
- (2) Ministerios con competencias, funciones y dependencias de gestión ambiental y recurso hídrico. Encargados de generar normas, políticas, programas y proyectos en el área
- (3) Secretaría dependiente de la Presidencia, encargada de conducir y regir los procesos de gestión del agua de una manera integrada y sustentable en las cuencas
- (4) Instituciones encargadas de la gestión del agua en diferentes

# Peru

## Instituciones de Orden Nacional

### INSTITUCIONES

Gobierno Nacional

Consejo de Ministros (1)

Ministerio Agricultura (2)

Ministerio de Ambiente (3)(2)

Ministerio de Vivienda, Construcción y Saneamiento (2)

Ministerio de Energía y Minas (2)

Autoridad Nacional del Agua ANA (4)

Instituto de Investigaciones de la Amazonía Peruana - IIAP (6)

Programa Nacional de Agua y Saneamiento Rural PROSANAR (5)

Instituto Geológico Minero y Metalúrgico (5)

Instituto Nacional de Desarrollo INADE (5)

Instituto Geofísico del Perú - IGP (6)

Programa Agua Para Todos - PAPT (5)

Proyecto Especial Programa Nacional de Agua Potable PRONAP (5)

Programa Nacional de Manejo de Cuencas Hidrográficas y conservación de suelos (5)

Servicio Nacional de Meteorología e Hidrología del Perú - SENAMHI (6)

El Instituto IMARPE (6)

Organismo Ambiental

## Organismos Autónomos Regionales y Locales

Gobiernos Regionales

Comisión Regional

### FUNCIONES

- (1) Órgano jerárquico superior de coordinación de los Ministerios
- (2) Ministerios con competencias, funciones y dependencias de gestión ambiental y recurso hídrico. Encargados de generar normas, políticas, programas y proyectos en el área
- (3) Ministerio rector del sector ambiental, que desarrolla, dirige, supervisa y ejecuta la política nacional del ambiente, con funciones sancionatorias y técnico normativas.
- (4) Institución autónoma adscrita encargado de realizar las acciones

## Instituciones de Orden Nacional

### INSTITUCIONES

Presidencia de La República

Ministerio de Medio Ambiente y Agua (1)

Ministerio de Hidrocarburos y Energía (2)

Ministerio de Desarrollo Rural y Tierras (2)

Viceministerio General de Agua Potable y Saneamiento (3)

Viceministerio de Recursos Hídricos y Riego (3)

Viceministerio de Medio Ambiente, Biodiversidad y Cambio Climático (3)

Servicio Nacional de Meteorología e Hidrología SENAMHI (4)

Organizaciones No Gubernamentales, Universidades y Organismos Internacionales (5)

Programa de Desarrollo Agropecuario Sostenible GTZ-PROAGRO (6)

Programa Nacional de Riego con Enfoque de Cuencas BID-PRONREC (6)

## Organismos Regionales y Locales

Gobiernos Departamentales (7)

Instituto de Investigación Universidades, Asociaciones Civiles, ONGs Nacionales e Internacionales (9)

Empresas Públicas y Privadas (9)

Gobiernos Provinciales (7)

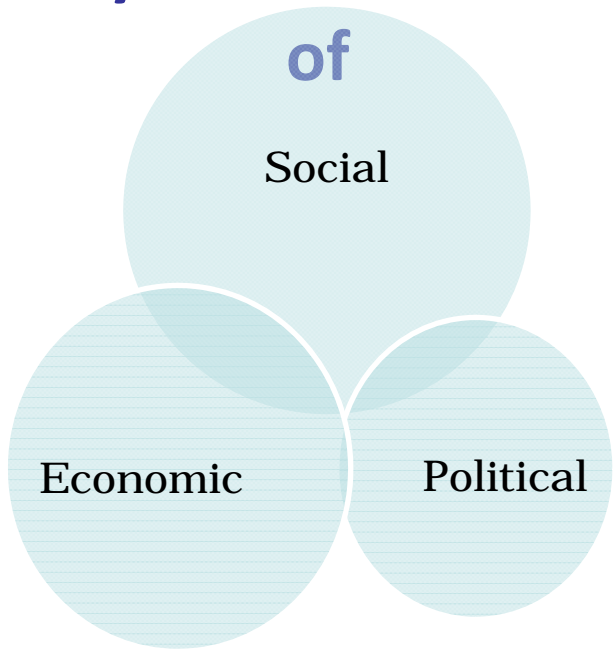
Municipalidades (8)

### FUNCIONES

- (1) Ministerio Rector con competencias, funciones y dependencias de gestión ambiental y recurso hídrico. Encargados de generar normas, políticas, programas y proyectos en el área
- (2) Ministerios de alto impacto para el Recurso Hídrico
- (3) Instituciones encargadas de desarrollar políticas, planes y proyectos del recurso hídrico.
- (4) Institución encargada del monitoreo del recurso hídrico
- (5) Organizaciones No Gubernamentales Nacionales e Internacionales con alta injerencia en las políticas y gestión del agua a nivel Nacional.
- (6) Programas de Cooperación Internacional de gestión del agua.
- (7) Instituciones de carácter Regional con competencias en recursos hídricos.
- (8) Instituciones cobijadas por la ley de Municipalidades que les confiere competencias en la gestión del recurso hídrico.
- (9) Empresas y Organizaciones No Gubernamentales Nacionales e Internacionales de gestión del agua a nivel Regional y Local.

# Bolivia

# Composed representation of key characteristics

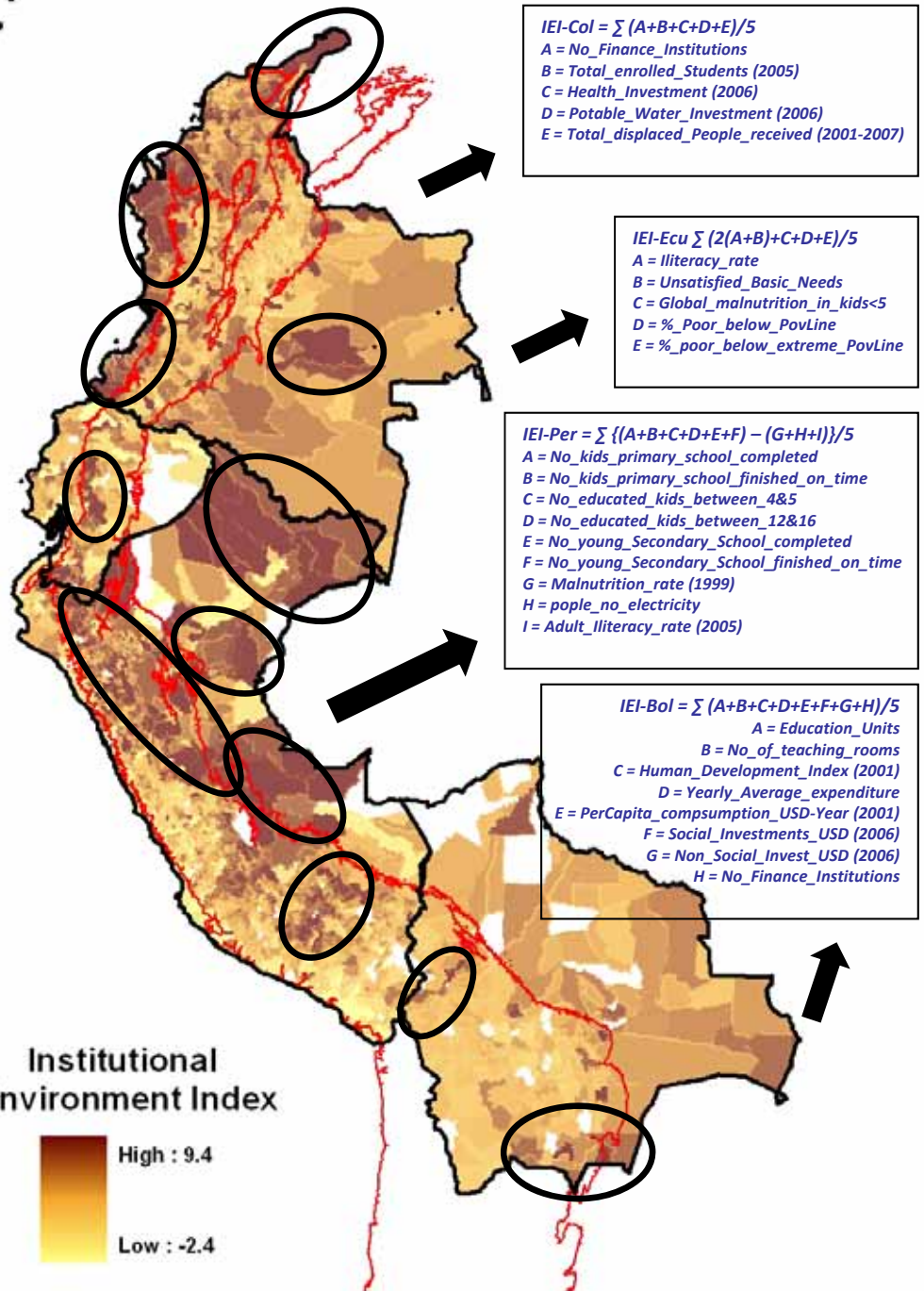


$IEI-Col = \sum (A+B+C+D+E)/5$   
 A = No\_Finance\_Institutions  
 B = Total\_enrolled\_Students (2005)  
 C = Health\_Investment (2006)  
 D = Potable\_Water\_Investment (2006)  
 E = Total\_displaced\_People\_received (2001-2007)

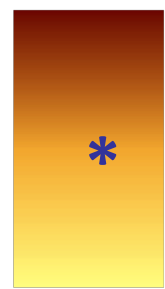
$IEI-Ecu = \sum (2(A+B)+C+D+E)/5$   
 A = Illiteracy\_rate  
 B = Unsatisfied\_Basic\_Needs  
 C = Global\_malnutrition\_in\_kids<5  
 D = %\_Poor\_below\_PovLine  
 E = %\_poor\_below\_extreme\_PovLine

$IEI-Per = \sum \{(A+B+C+D+E+F) - (G+H+I)\}/5$   
 A = No\_kids\_primary\_school\_completed  
 B = No\_kids\_primary\_school\_finished\_on\_time  
 C = No\_educated\_kids\_between\_4&5  
 D = No\_educated\_kids\_between\_12&16  
 E = No\_young\_Secondary\_School\_completed  
 F = No\_young\_Secondary\_School\_finished\_on\_time  
 G = Malnutrition\_rate (1999)  
 H = pople\_no\_electricity  
 I = Adult\_illiteracy\_rate (2005)

$IEI-Bol = \sum (A+B+C+D+E+F+G+H)/5$   
 A = Education\_Units  
 B = No\_of\_teaching\_rooms  
 C = Human\_Development\_Index (2001)  
 D = Yearly\_Average\_expenditure  
 E = PerCapita\_compsumption\_USD-Year (2001)  
 F = Social\_Investments\_USD (2006)  
 G = Non\_Social\_Invest\_USD (2006)  
 H = No\_Finance\_Institutions



**Institutional Environment Index**  
 High : 9.4  
 Low : -2.4



**High :** Tough conditions, bigger effort

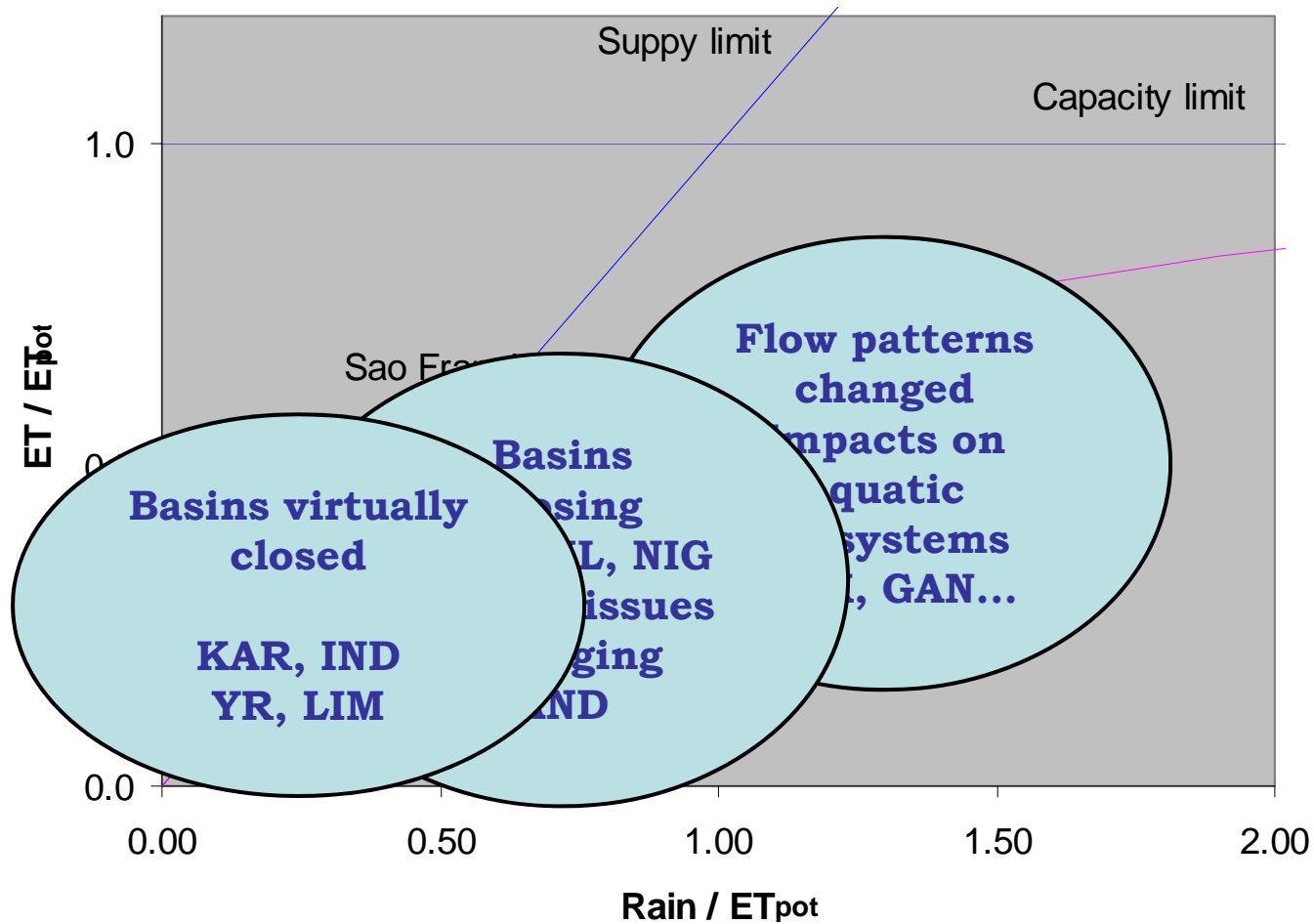
**Low :** Less difficult  
 CGIAR Challenge Program on **WATER & FOOD**

\* Standardize for the four countries, main capitals excluded

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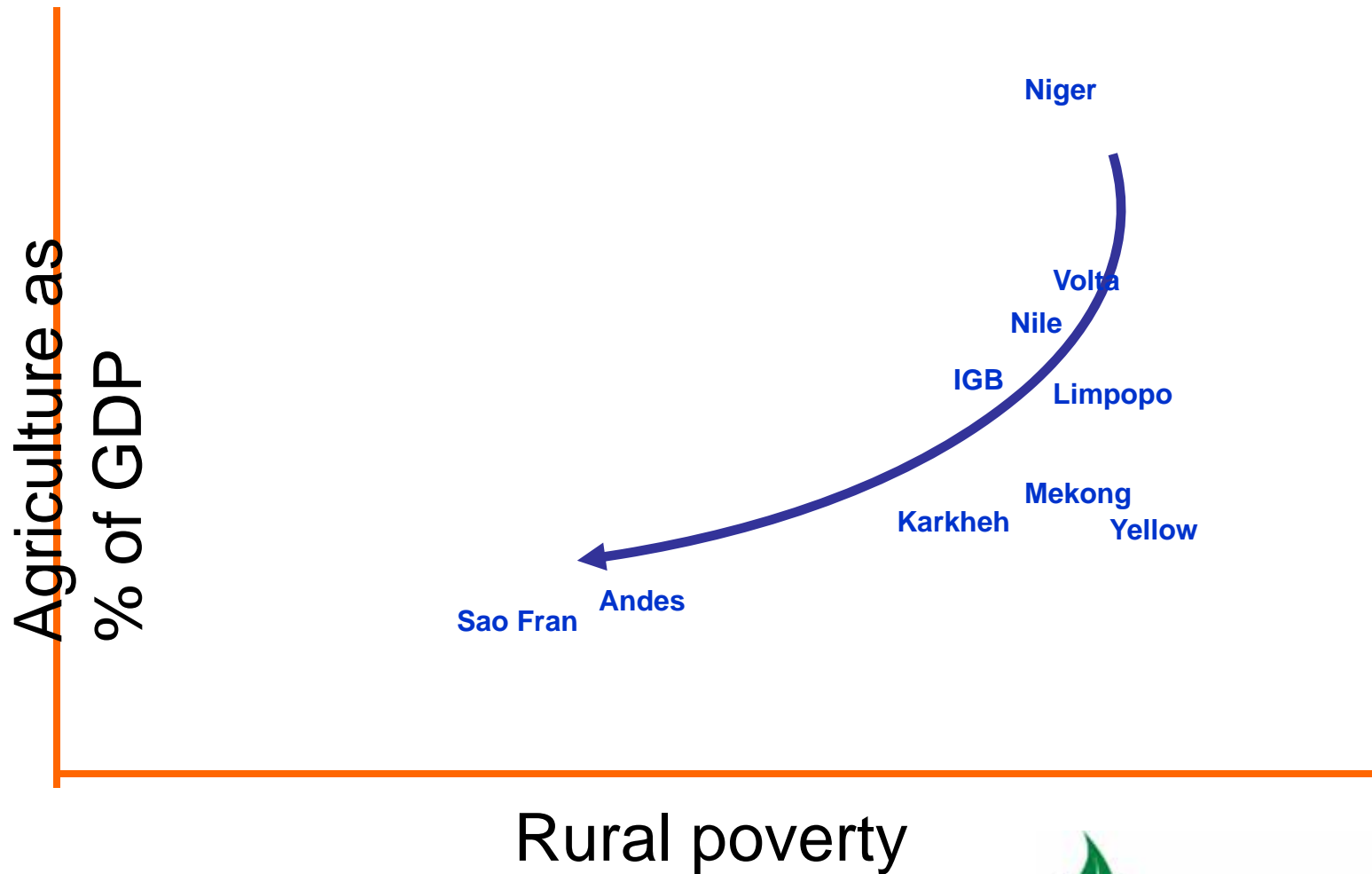
# Global trends

# hydrologic consequences of change

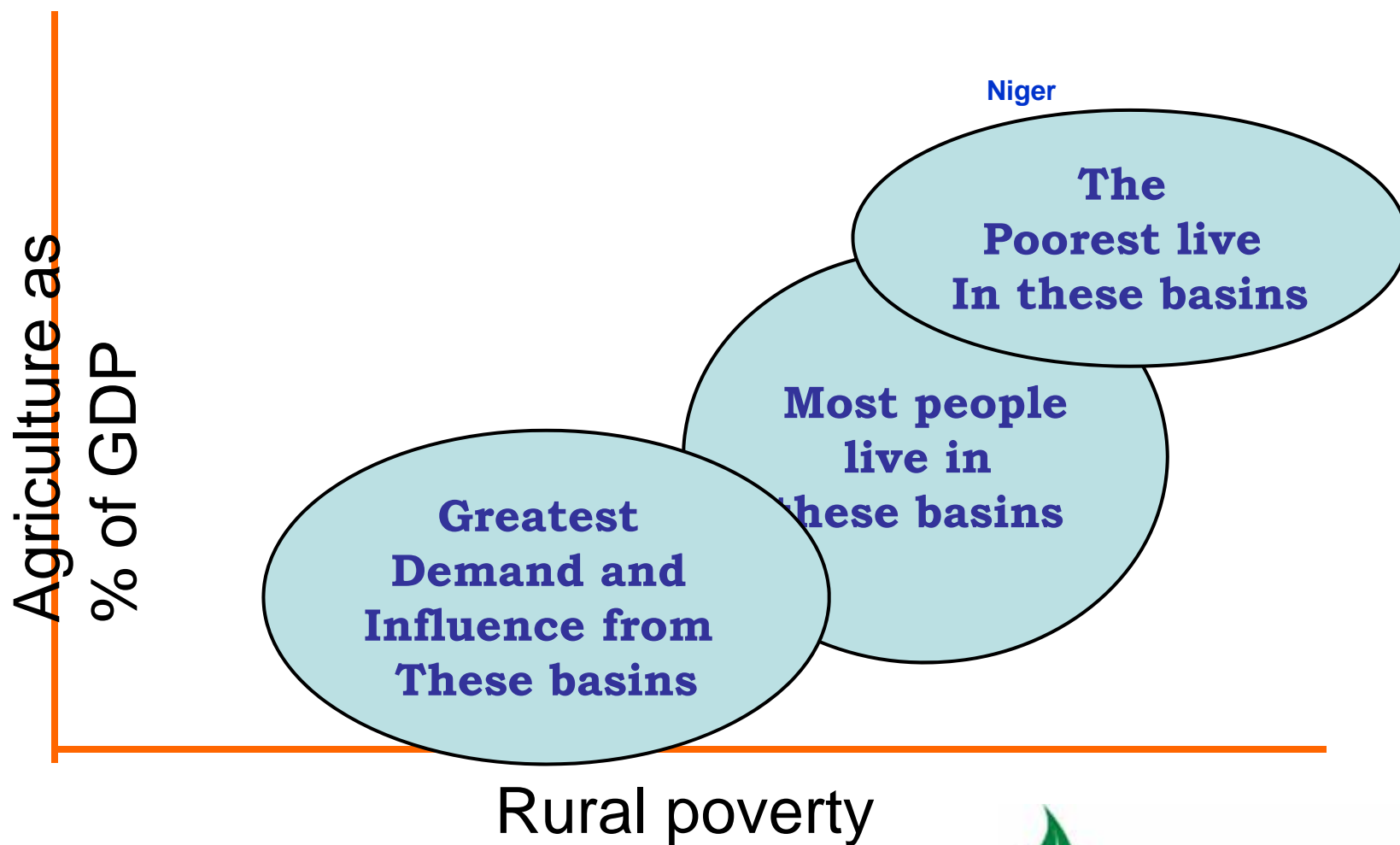


From Mac Kirby,  
CSIRO

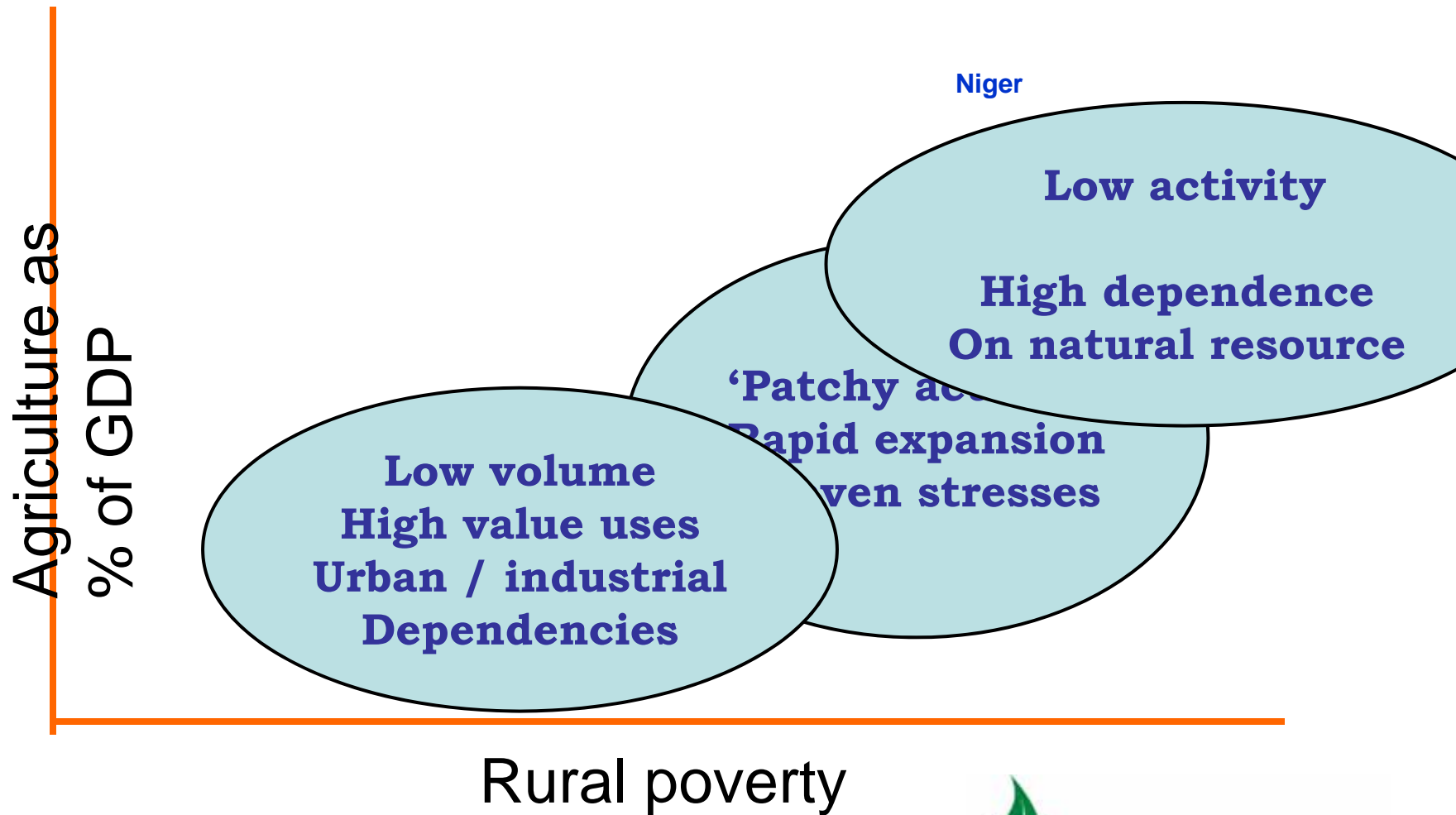
# From the development perspective



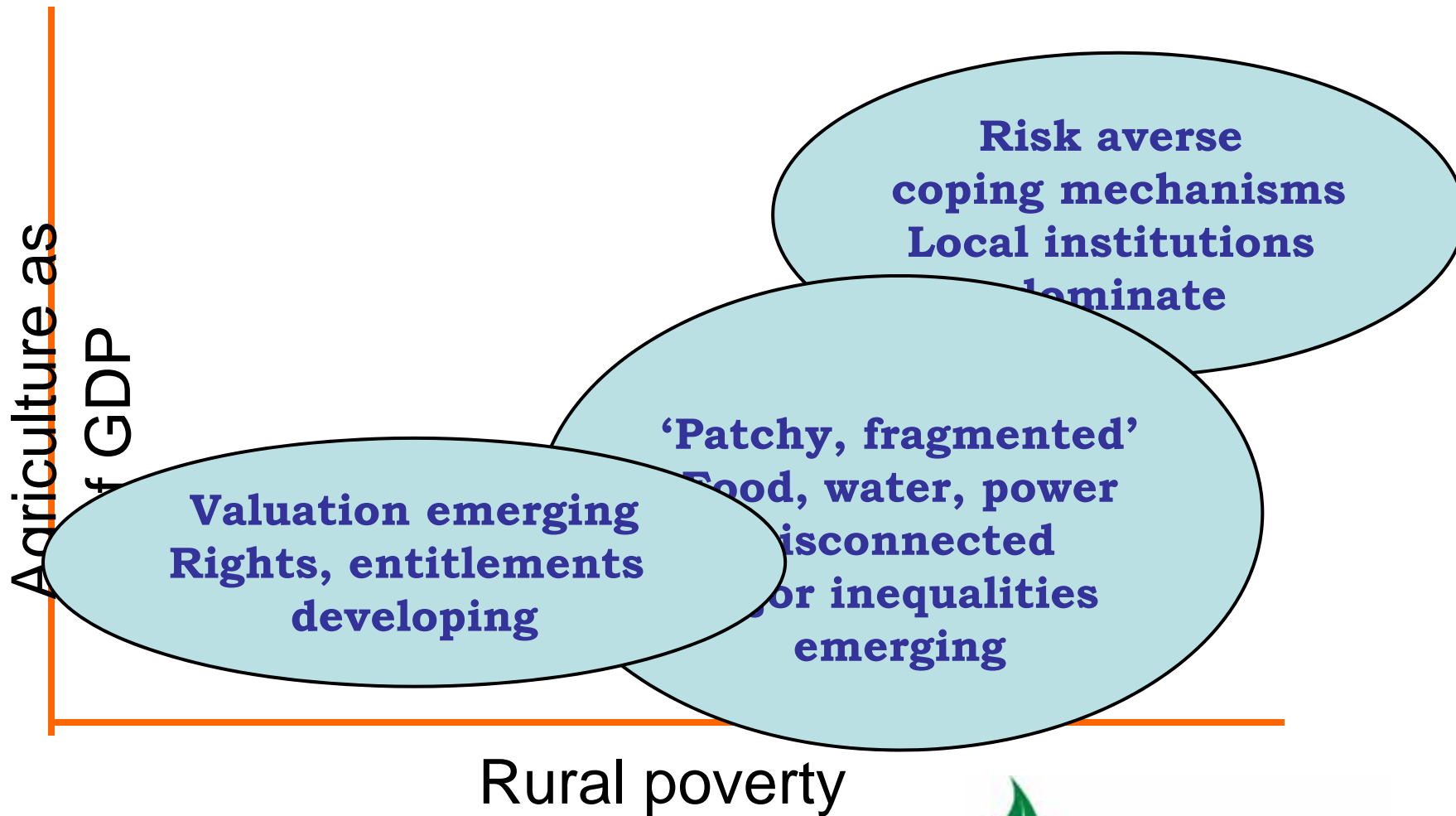
# From the development perspective: drivers



# From the development perspective: changes



# From the development perspective: adaptation





# Summary

- **We have data from 10 basins**
- **...including S Fran and Andes (our most advanced)**
- **Our data is on water, food and poverty**
- **From a development perspective the water acquires slightly different nuances**
- **Global trends are emerging**

**With many thanks**

