The Changing Wealth of Nations 2018

Building a Sustainable Future

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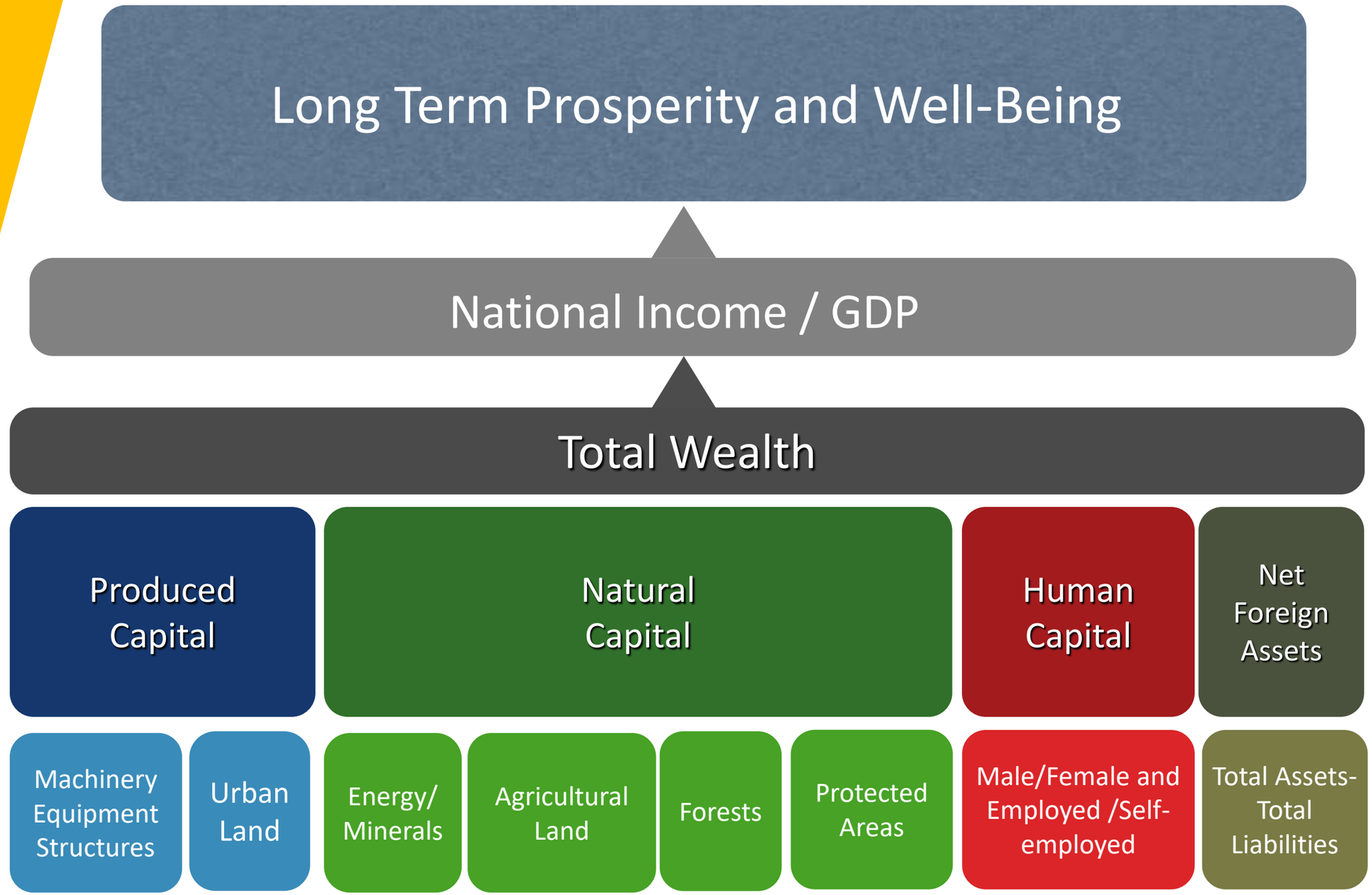
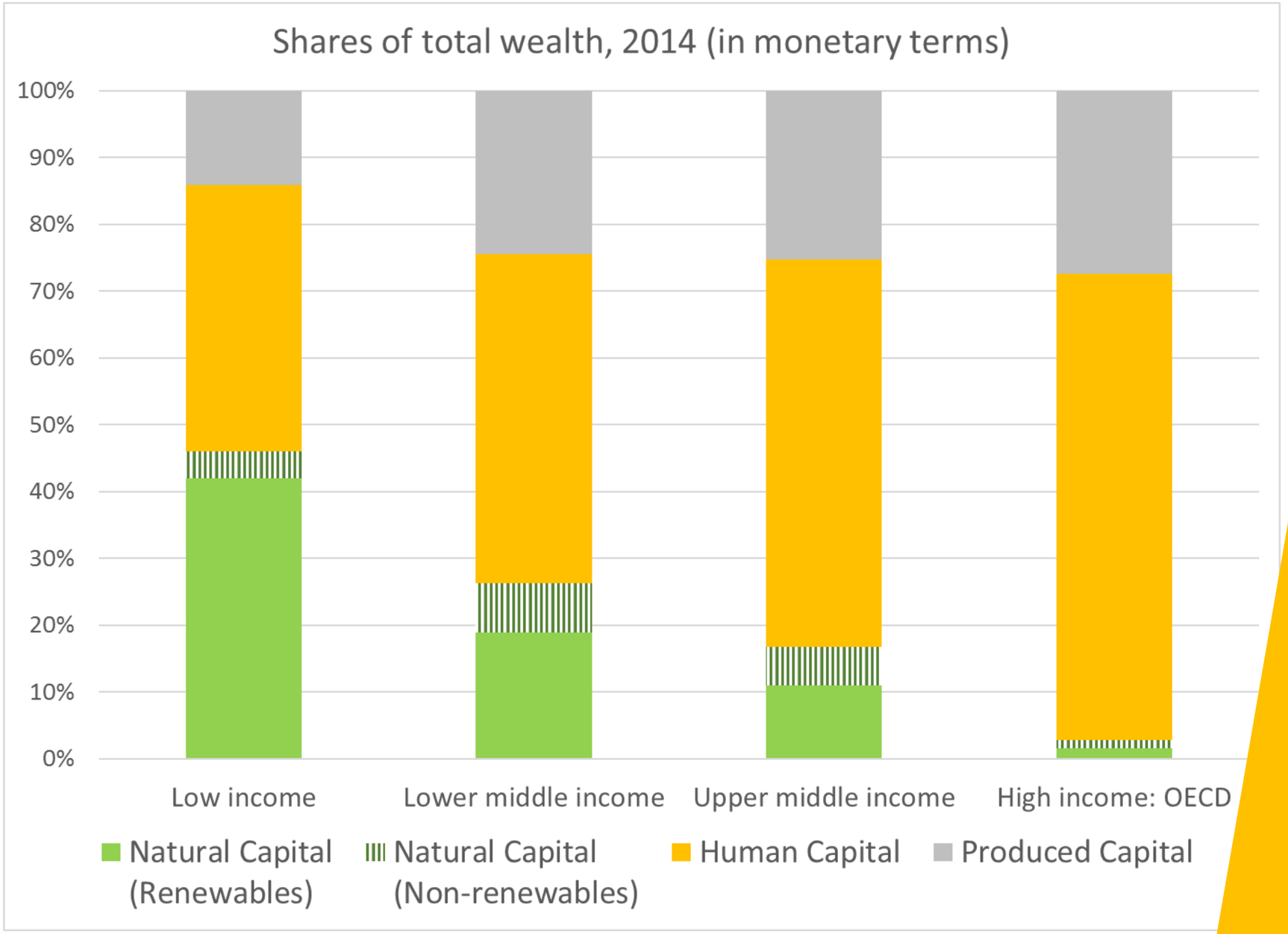
“GDP, the leading economic measurement, is outdated and misleading... It’s like grading a corporation based on one day’s cash flow and forgetting to depreciate assets and other costs.”

Joseph Stiglitz, Nobel Laureate in Economics

The World Bank has developed wealth as an indicator of sustainability for two decades

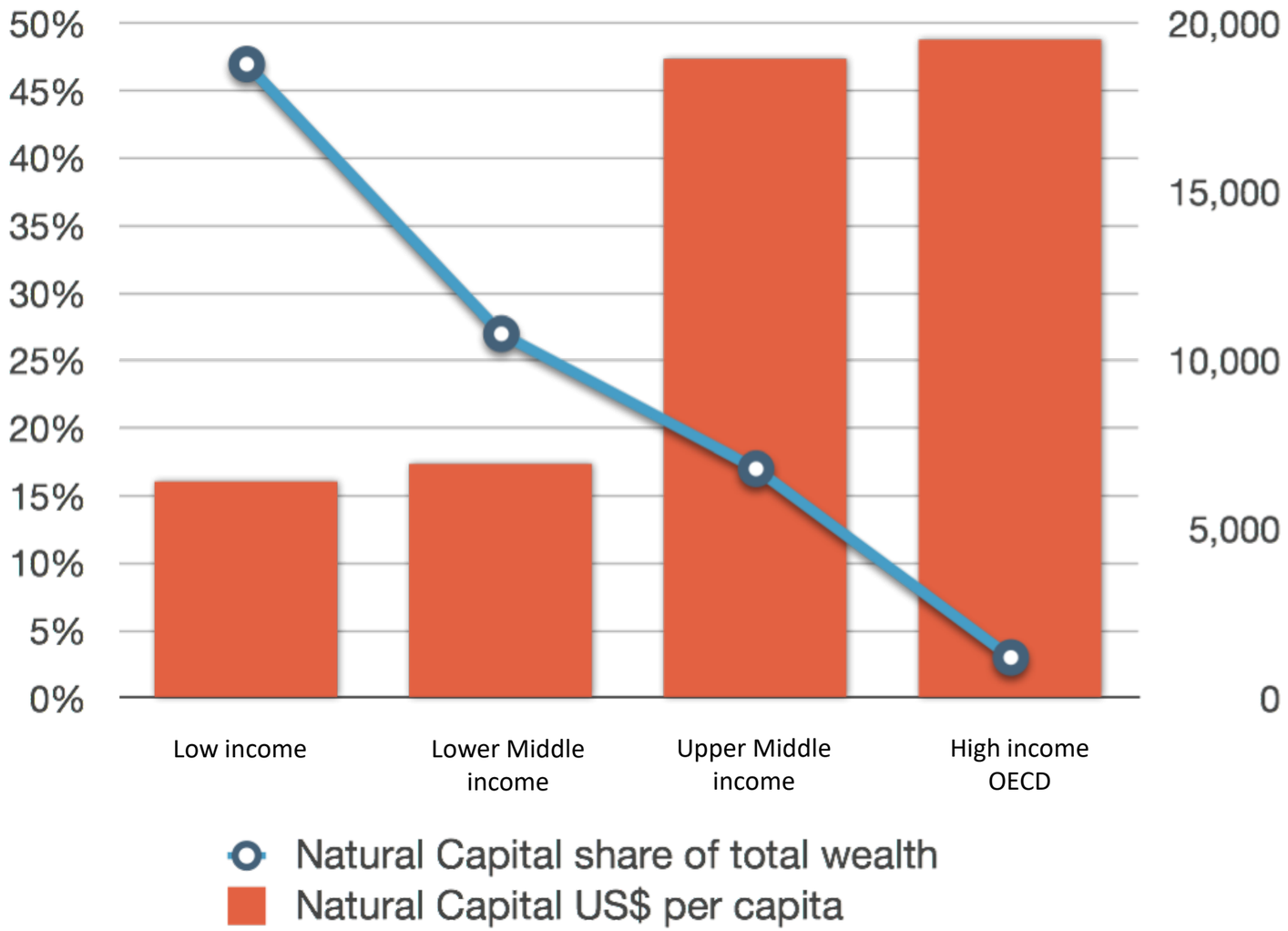
This book tracks wealth in 141 countries, from 1995 to 2014





Natural capital accounts for almost half of total wealth in low income countries, close to 1/3 in developing countries as a whole..

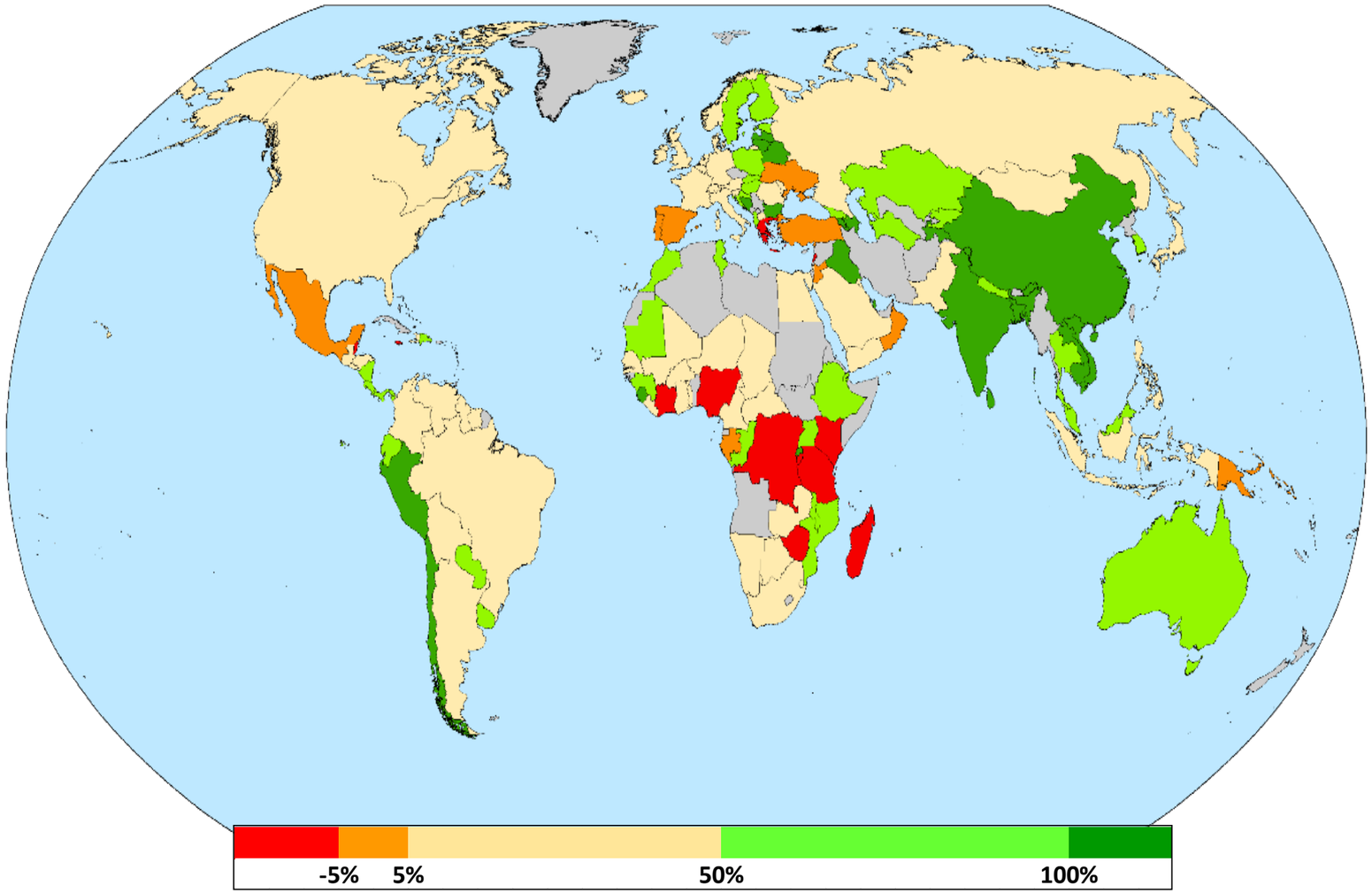
Natural Capital: Share vs Per Capita Value



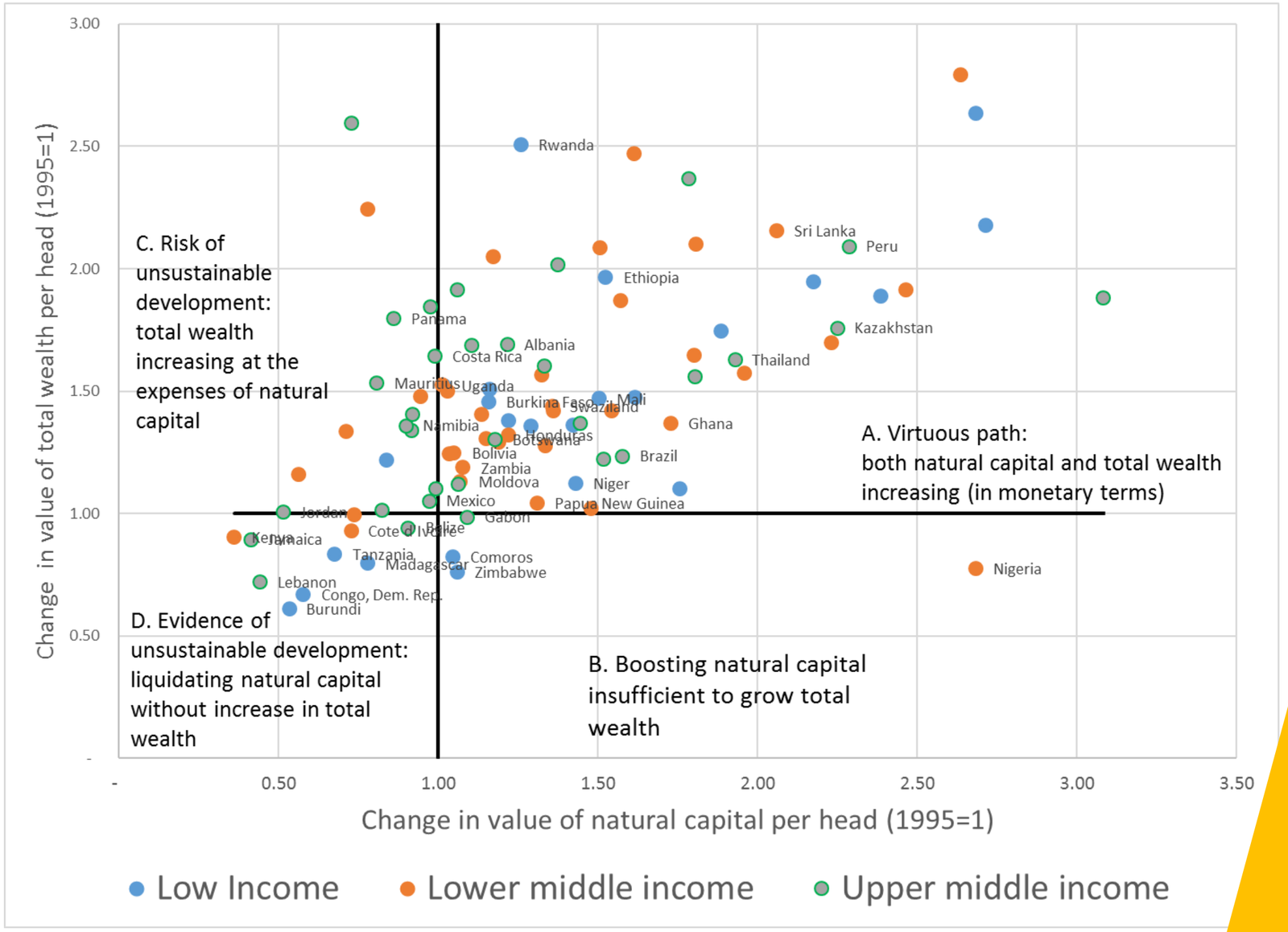
... but growing an economy is not about liquidating natural capital to build other assets

Natural capital per capita is highest in upper middle and high income OECD countries

Percent Change in Wealth Per Capita



Total wealth grew everywhere, but **per capita wealth did not**

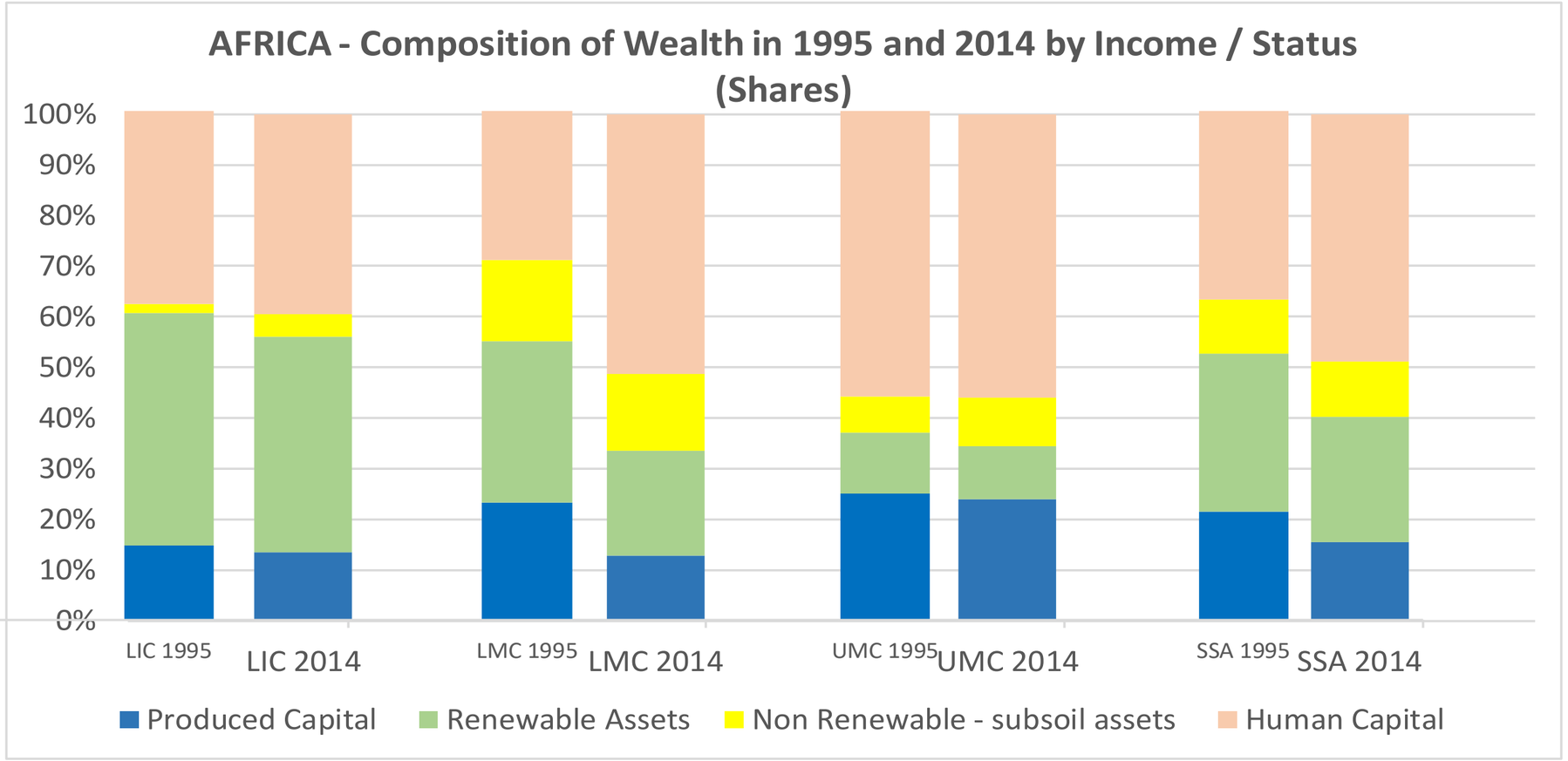


Source: calculated from database of World Bank, The Changing Wealth of Nations 2018

About 1/3 of all developing countries have run down their natural capital per capita (quadrants C and D); of these, 40% without any benefit on total wealth

Many developing countries grow their total assets by depleting their natural capital (a national public good); some, however, do not even build-up their total wealth..

Regional deep dives: the case of Africa



- Physical capital has small and declining share of wealth
- Natural capital, particularly renewable resources has large but declining share
- The share of human capital has been growing—for LMCs, it doubled from 26% to 52%

Approach to evaluate Natural Capital: data caveat

Scope of work constrained by data selection criteria

- publicly available (non proprietary) and credible sources
- 100+ country coverage
- historical time series
- regularly updated

Valuation of Natural Capital

- **Net present value of stream of future rents over resource lifetime**
- Unit is 2014 constant US$
  - Measured at market exchange rates, using country GDP deflator
  - Future work: purchasing power parity (PPP)
- Price volatility addressed by taking lagged five-year average
- In the absence of information on future prices or extraction path, assumes future rent is current and constant
- Discount rate of 4%

Background Scoping Studies

- **To inform *CWON 2018*, scoping studies** assessed wealth methodology and recommended improvements
  - **Forests** (timber and nontimber)
  - **Agricultural land**
  - Subsoil assets
  - Human capital
  - Air pollution damages (for Adjusted Net Saving indicator)

Forest (timber values)

$$V_t = \sum_{i=t}^{t+T-1} \frac{\bar{R}_t}{(1+r)^{i-t}} \qquad R_t = \pi_t Q_t$$

Variable	Meaning	Data source/ estimation
Rt	Rents	Calculated
r	Discount rate	Assumed constant at 4%
πt	Unit rents	FAO data on roundwood export volume, adjusted to reflect difference between domestic stumpage value and export log values
Qt	Volume of production	FAO data (roundwod for industry and fuel)

Limitations

- Forest degradation effects on future returns
- Limited range of ecosystem services
- No evaluations of carbon storage

Forest ecosystem services study methodology

Watershed services, Recreation, hunting, and fishing, Non-wood forest products

1. Review of forest ES valuation studies (over 250)
   - Determine inclusion/exclusion (availability of estimates, methodological consistency)
   - Develop per hectare value estimates, standardize them (USD/ha)
   - Construct ecological and socioeconomic data by study location
2. Developing predictive models of the value of ES
   - Meta-regression approach
   - Model local ecological and socioeconomic characteristics as determinants of ES values
   - Four separate ES models (recreation, habitat/species protection, NWFPs, water)
3. Predicting ES values across all forests
   - Map global forests using a grid (10 km by 10 km)
   - Measure the modeled determinants of ES values at each grid cell
   - Determine “service areas” for specific ES
   - Using meta-regression results, predict values at each grid cell, summarize by country

186 value estimates from 123 studies

Predictor variables used in meta-regressin

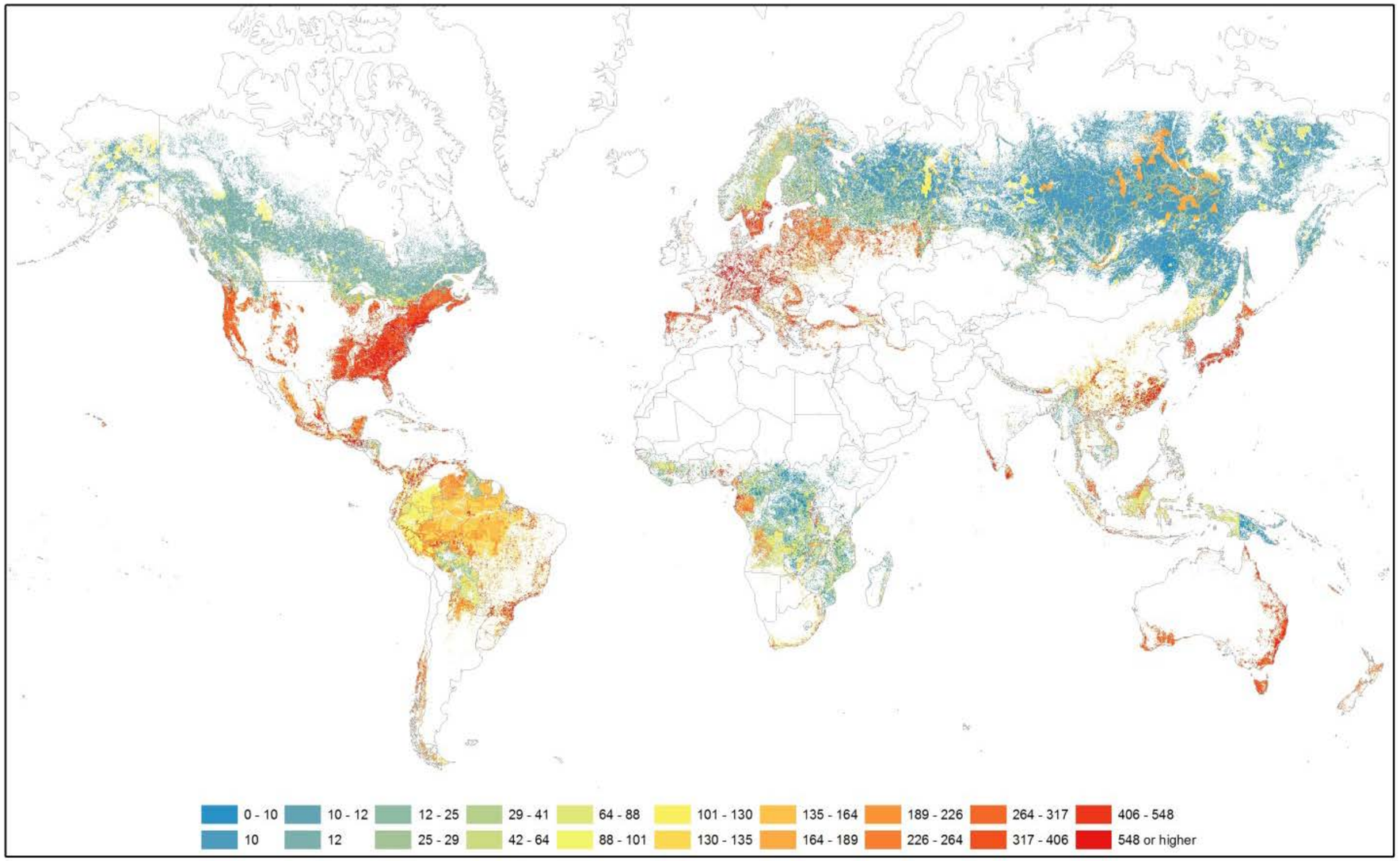
Variable	Mean	Std. Dev.	Min	Max	
Value ($ ha^{-1} year^{-1})	812.0	3097.2	0.01	29,251	
Boreal forest (0/1)	0.220	0.416	0	1	Biome
Temperate forest (0/1)	0.409	0.493	0	1	
Tropical forest (0/1)	0.371	0.484	0	1	
Africa (0/1)	0.075	0.265	0	1	Continent
America (0/1)	0.317	0.467	0	1	
Asia (0/1)	0.167	0.374	0	1	
Europe (0/1)	0.371	0.484	0	1	
Oceania (0/1)	0.070	0.256	0	1	
GDP per capita	16406	11948	297	48,377	Study area - Socioeconomic - Ecological - Forest scarcity - Protection status
Population density	105.7	223.9	0.0	2,444	
Temperature	13.1	9.3	-2.4	26.9	
Precipitation	1364	916	0	4,007	
Distance to urban center (meters)	38302	45157	0	220,164	
Road length	1820	2607	0	16,600	
Forest percentage	35.1	29.8	0.0	97.5	
Wetland percentage	7.6	14.9	0.0	98.6	
Species richness	178.0	144.3	29.0	548	
Latitude	28.5	29.2	-39.7	67.4	
High income country (0/1)	0.624	0.486	0	1	
Middle income country (0/1)	0.323	0.469	0	1	
Protected area (0/1)	0.425	0.496	0	1	
Journal publication (0/1)	0.667	0.473	0	1	Study details

Metaregression Estimation Results

VARIABLE	Recreation	Habitat/species protection	NWFPs	Water services
Ln(population density)	0.562***	0.643**	0.688***	
Ln(GDP per capita)	0.566**	1.655**	-0.919***	13.32*
Temperature	0.0178	-0.234***		
Ln(Species richness)	1.133**	2.145***		
Boreal				-68.74**
Tropics				-65.61*
Temperate				-65.64*
Africa			5.812**	
America			10.87***	
Asia			7.864***	
Europe			10.44***	
Constant	-8.375**	-20.85**		
Observations	86	54	30	16
R-squared	0.480	0.296	0.882	0.712
AIC	338.06	246.30	119.37	80.64
Out of sample RMSE	1.777	2.504	1.729	2.873
Out of sample MAE	1.333	1.920	1.316	2.254

Note: Robust standard errors clustered by study. Weighted estimation using equal weights by study.

Map of Predicted Value of Ecosystem Services: Total All Four Services



Agriculture land (crops and pasture)

$$V_t = \overline{R_t} + \frac{\overline{R_t}}{(r-g)} \qquad R_{c,k,t} = q_{c,k,t} * p_{c,k,t} * a_g$$

Variable	Meaning	Data source/ estimation
Rt	Rents (moving average)	Calculated
r	Discount rate	Assumed constant at 4%
g	annual rate of growth in agricultural productivity	Assumed constant: Crops: 1.94% low- and middle-income countries, 0.97 % is high-income countries. Livestock products: 2.95% for low- and middle-income countries; 0.89% for high-income countries
q_{ctk} and p_{ctk}	Quantity and price of production in country c, time t, crop k	FAO data (for over 100 crops and over 20 livestock products)
a_g	Average rental rate	Assumed constant over each region g; estimates the literature

Limitations

- No assessment of effects of land degradation on future production
- No evaluations of soil carbon storage

Protected areas

$$V_t = \left(\overline{R_t} + \frac{\overline{R_t}}{r} \right) A_t$$

Variable	Meaning	Data source/ estimation
Rt	Rents/ unit area	Calculated (average by country), based on FAO data
r	Discount rate	Assumed constant at 4%
At	Area under protection	World Bank, World Development indicators

Limitations

- Foregone rents from crop/ livestock are a conservative estimate (opportunity costs) of the benefit generated by protected areas: if an area is protected it must generate benefits at least as large as foregone rents from alternative uses. But the value of ecosystem services may be quite larger than the foregone rents

Subsoil Assets

Oil, Natural Gas, Coal, and Minerals

$$V_t = \sum_{i=t}^{t+T-1} \frac{\overline{R_t}}{(1+r)^{i-t}} \qquad R_t = \pi_t q_t$$

- New data sources for **oil** and **gas** (Rystad Energy) and **coal** (Wood MacKenzie)
  - Mine-level information, aggregated to national level
  - Regional prices and rental rates, based on country data
- Areas for further analysis
  - Metals and minerals: production costs and missing commodities

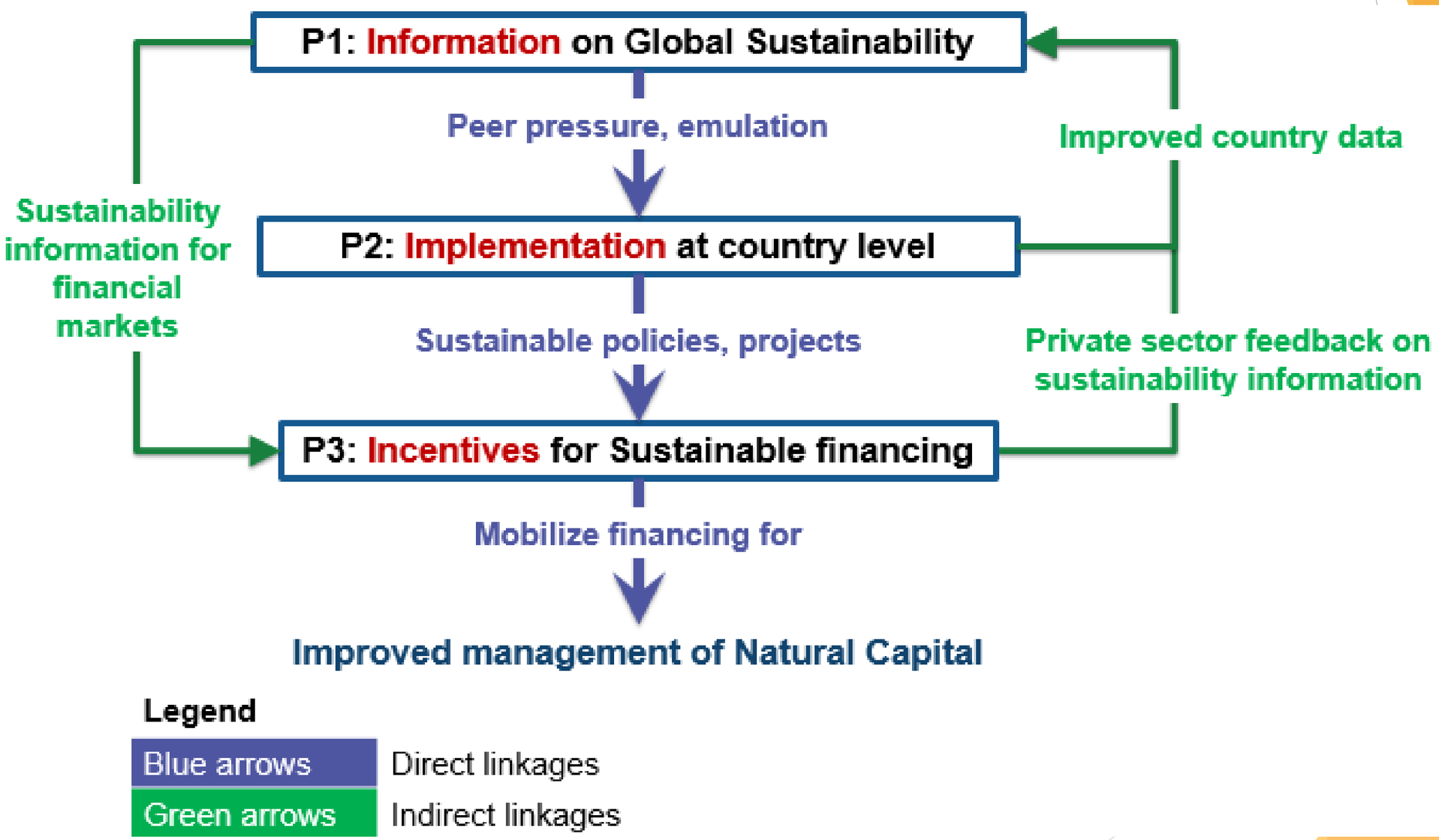
Plans for the future: from WAVES…

Incentives ?

WAVES:
Support to country and regional NCA

Financing for Implementation?

..to a Global Program on Sustainability (GPS)



Pillar 1: components and outputs

Components	Activities/ Outputs
1.1 Measuring sustainability	Broaden the scope of natural capital measurement: Comprehensive platform of improved global data on natural capital and ecosystem services (including new areas e.g. fisheries, land degradation, watershed protection, etc)
	Assessing sustainability a) New valuation database, including economic valuation of natural capital/ ecosystem services. externalities/ environmental health damages, natural resource depletion/ degradation; b) Technical reports on extended multi factor productivity (MFP - including natural capital), decoupling indicators, drivers of change of natural capital and ecosystem services;
1.2 Mainstreaming sustainability	High level publications for the broader development community: • Expanded Changing Wealth of Nations • Sustainability modules in Macro/Poverty Outlooks, Global Economic Prospects
	Integration of sustainability in World Bank products and processes Guidance notes and training for integrating sustainability: • At the planning/ policy level (e.g. SCDs, CPFs, NCDs) • At the project level (e.g. CBA, M/E, ESF)