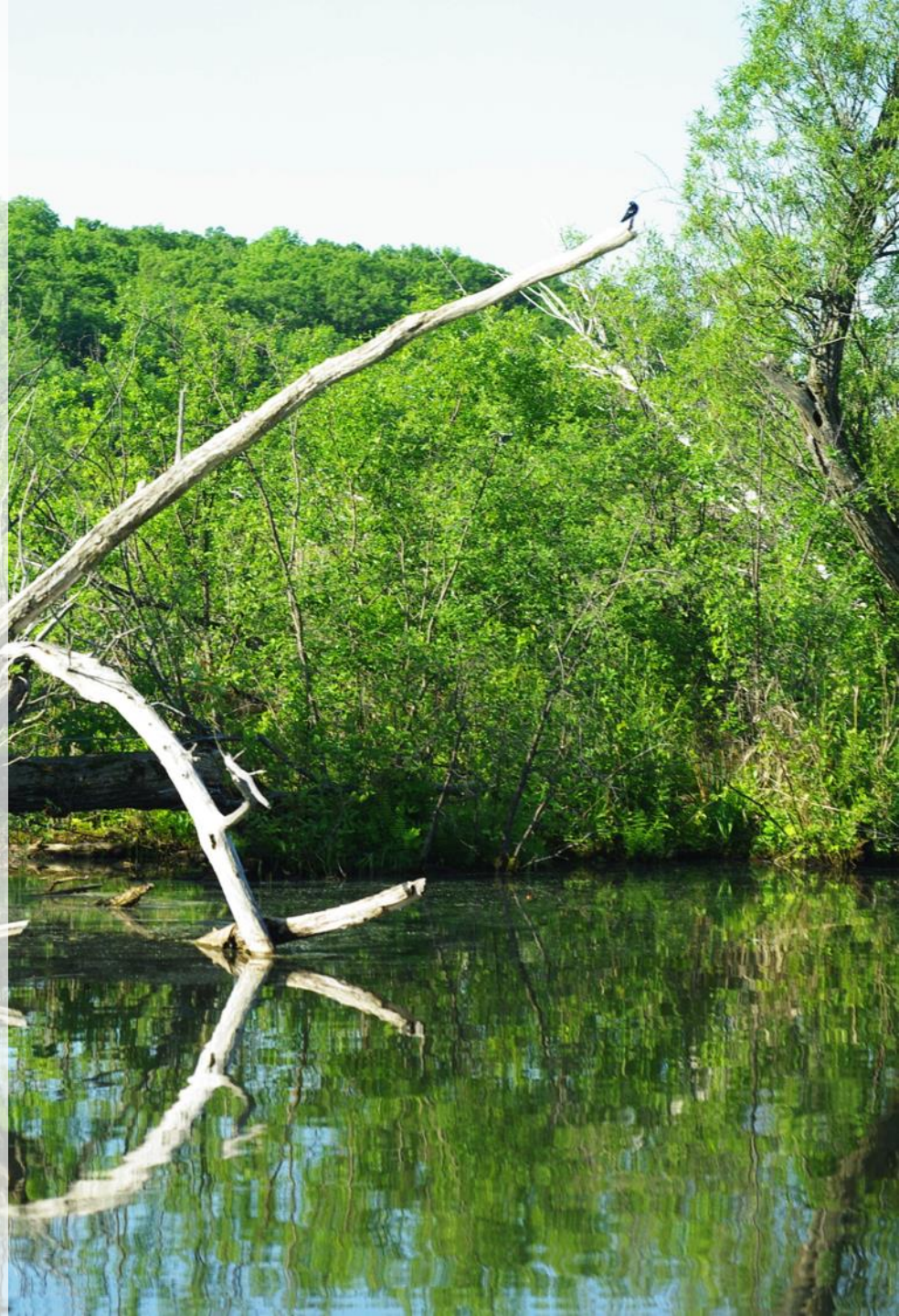
Rethinking Sustainability Indicators

Evidence from the Globe to the Ground

Heather Tallis



Why Sustainability Indicators?

- What are the biggest problems
- What works best to fix them
- Are we making any progress

A Special Challenge: People *AND* Nature

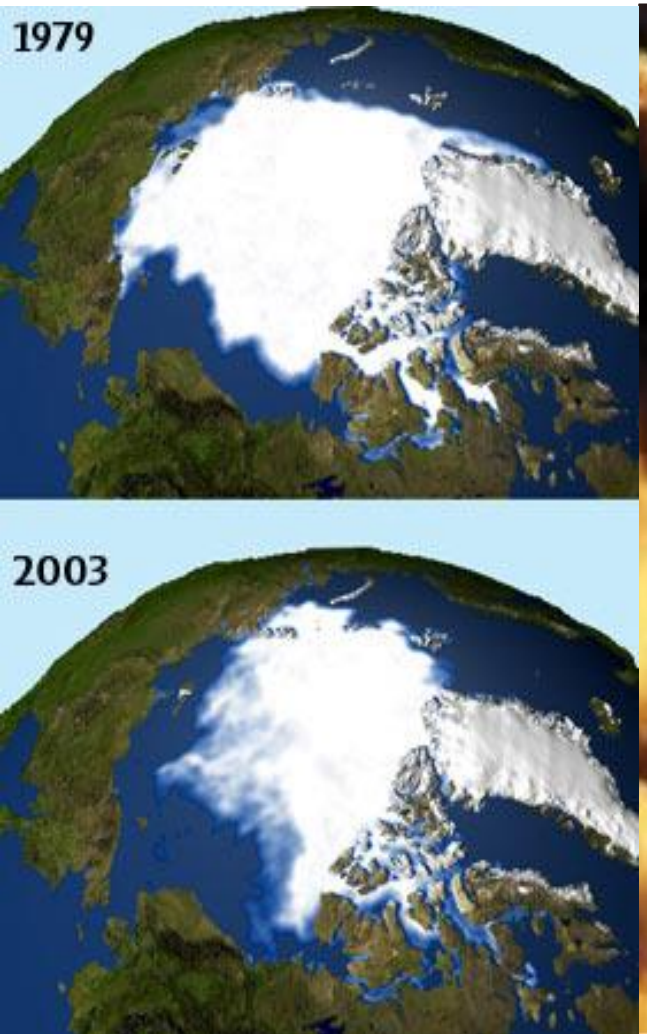
Nature Problem:
Deforestation

Effective Solution:
Protected area

People Problem:
Conservation refugees

A Special Challenge: People *AND* Nature

Nature Problem:
Climate change



Effective Solution:
Fossil fuels

People Problem:
Energy security

Can Our Indicators Catch Up?


What Are The Biggest Problems?
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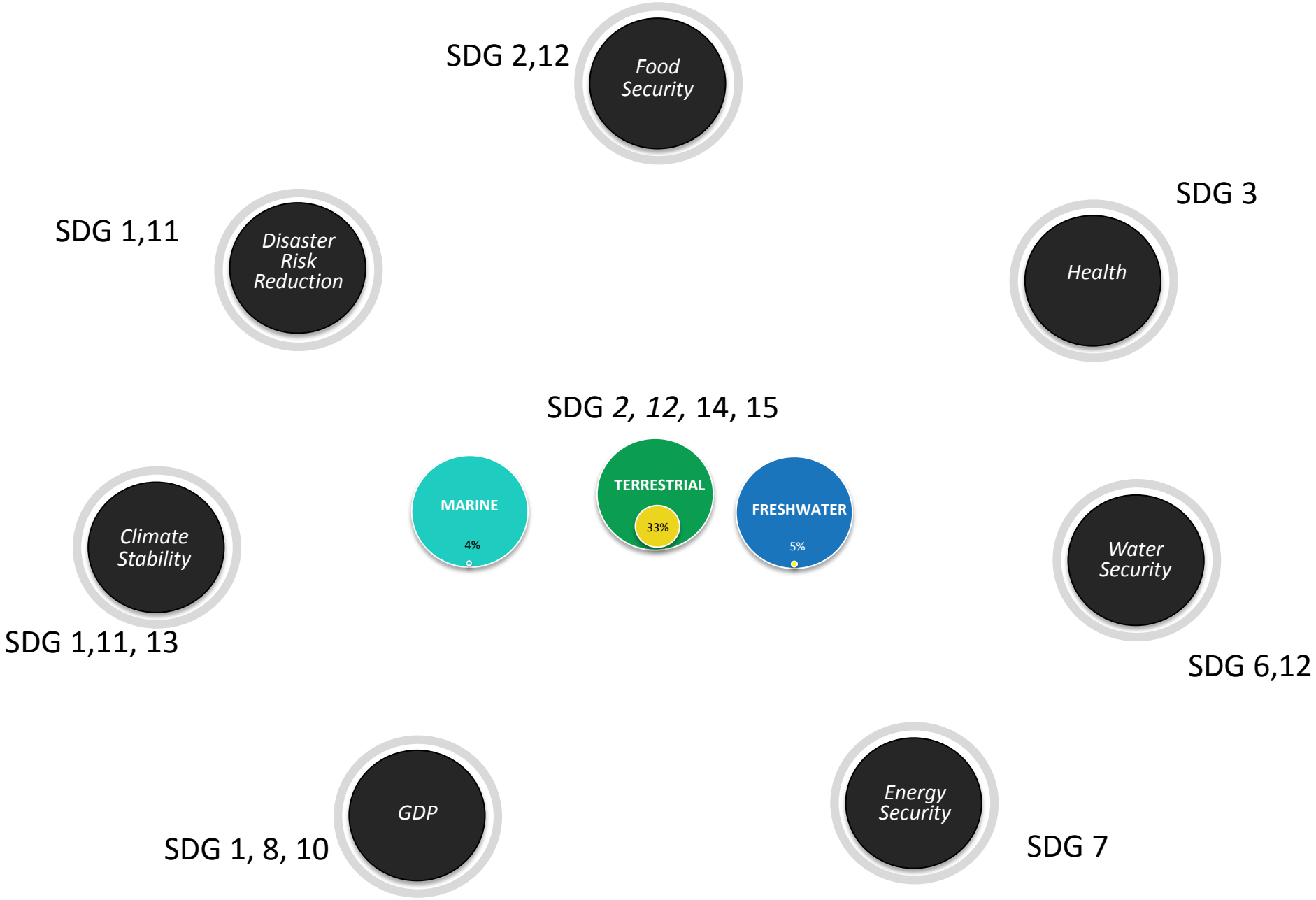
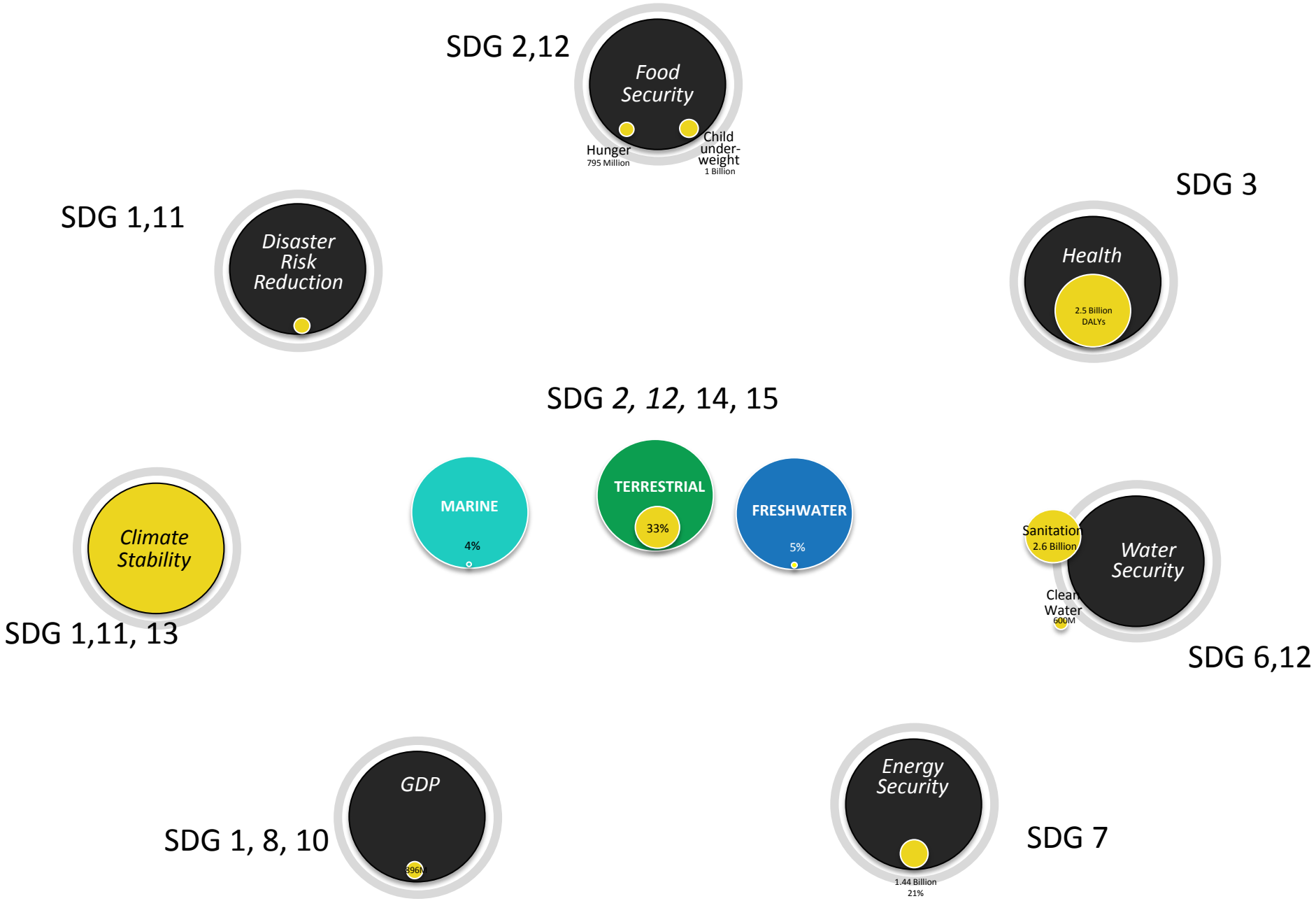
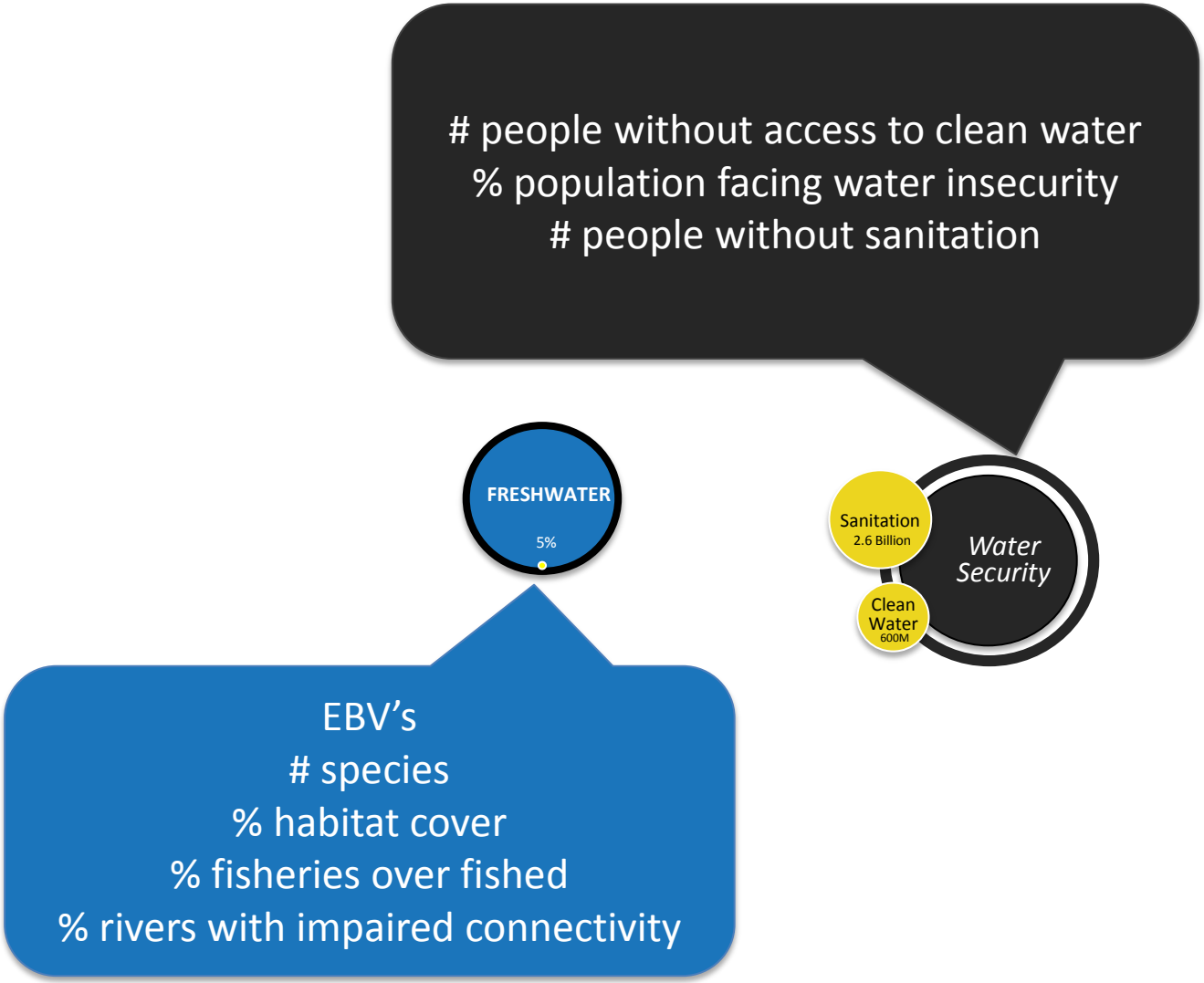
What are the Biggest Problems?

FOR NATURE AND PEOPLE?

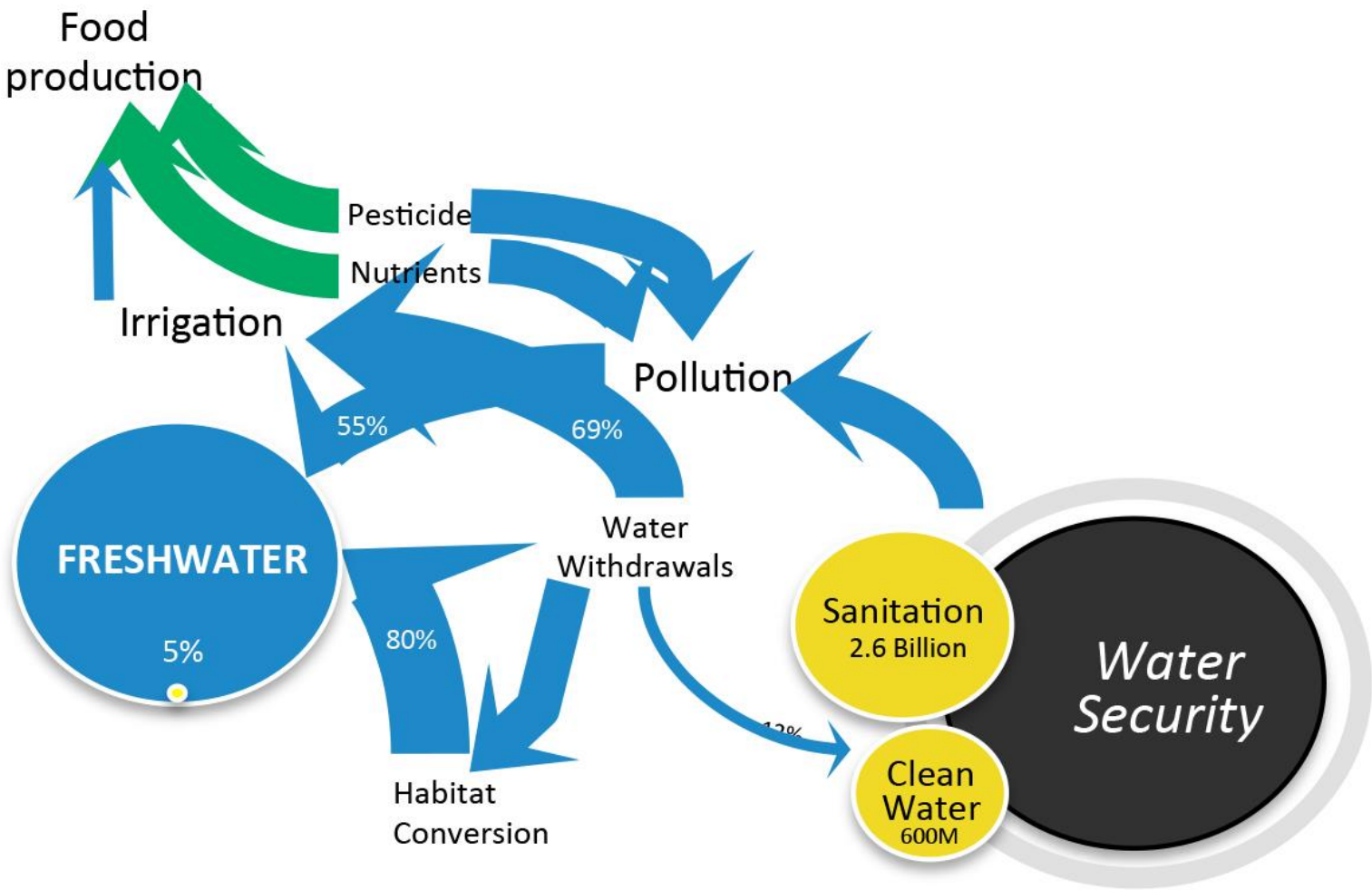

SDG 2,12
Food Security
SDG 1,11
Disaster Risk Reduction
SDG 3
Health
SDG 2, 12, 14, 15
MARINE
4%
TERRESTRIAL
33%
FRESHWATER
5%
Climate Stability
SDG 1,11, 13
Water Security
SDG 6,12
GDP
SDG 1, 8, 10
Energy Security
SDG 7

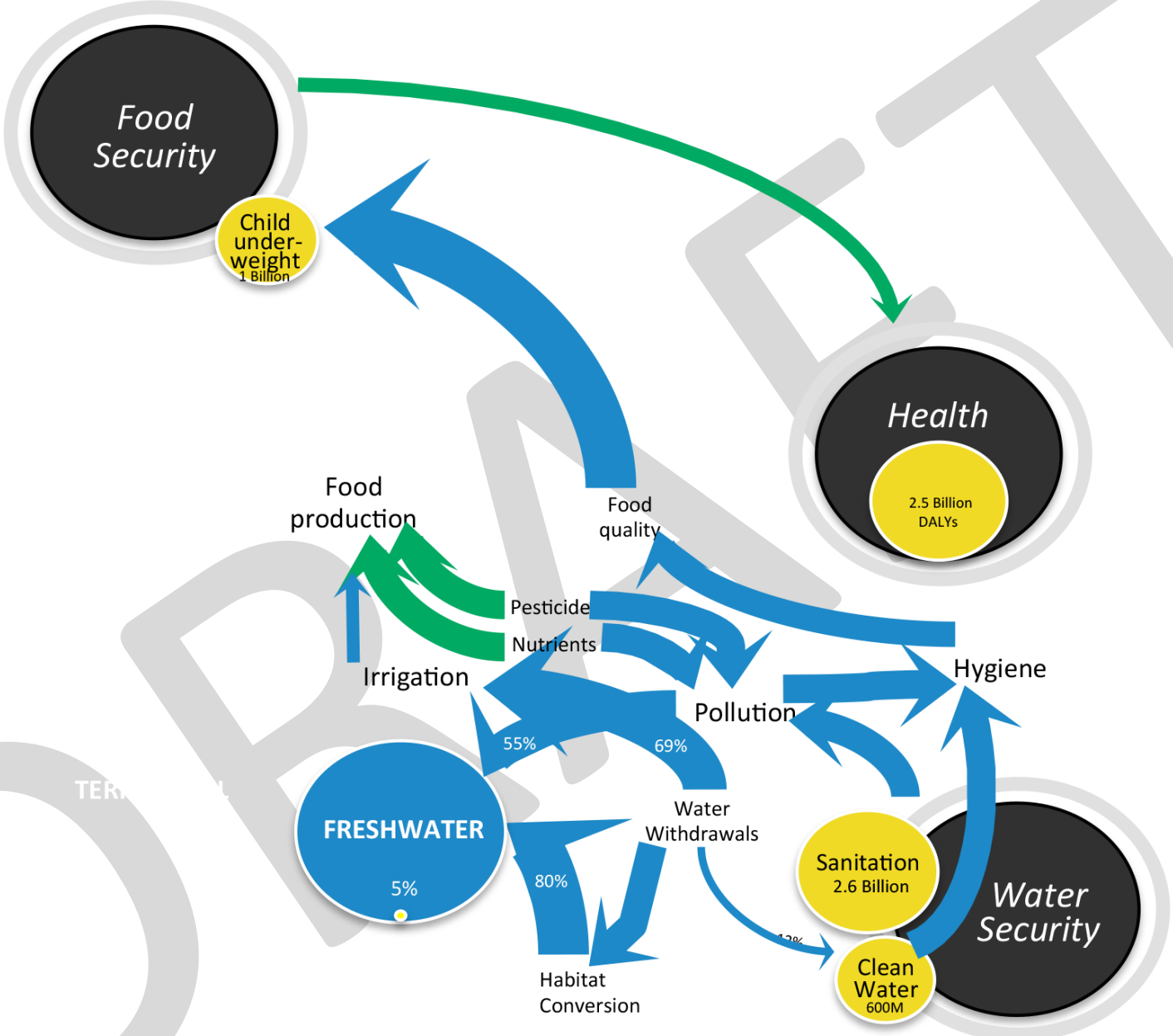

SDG 2,12
Food Security
Hunger
795 Million
Child under-weight
1 Billion
SDG 1,11
Disaster Risk Reduction
SDG 3
Health
2.5 Billion DALYs
SDG 2, 12, 14, 15
MARINE
4%
TERRESTRIAL
33%
FRESHWATER
5%
Climate Stability
SDG 1,11, 13
Sanitation
2.6 Billion
Water Security
Clean Water
600M
SDG 6,12
GDP
SDG 1, 8, 10
Energy Security
1.44 Billion
21%
SDG 7

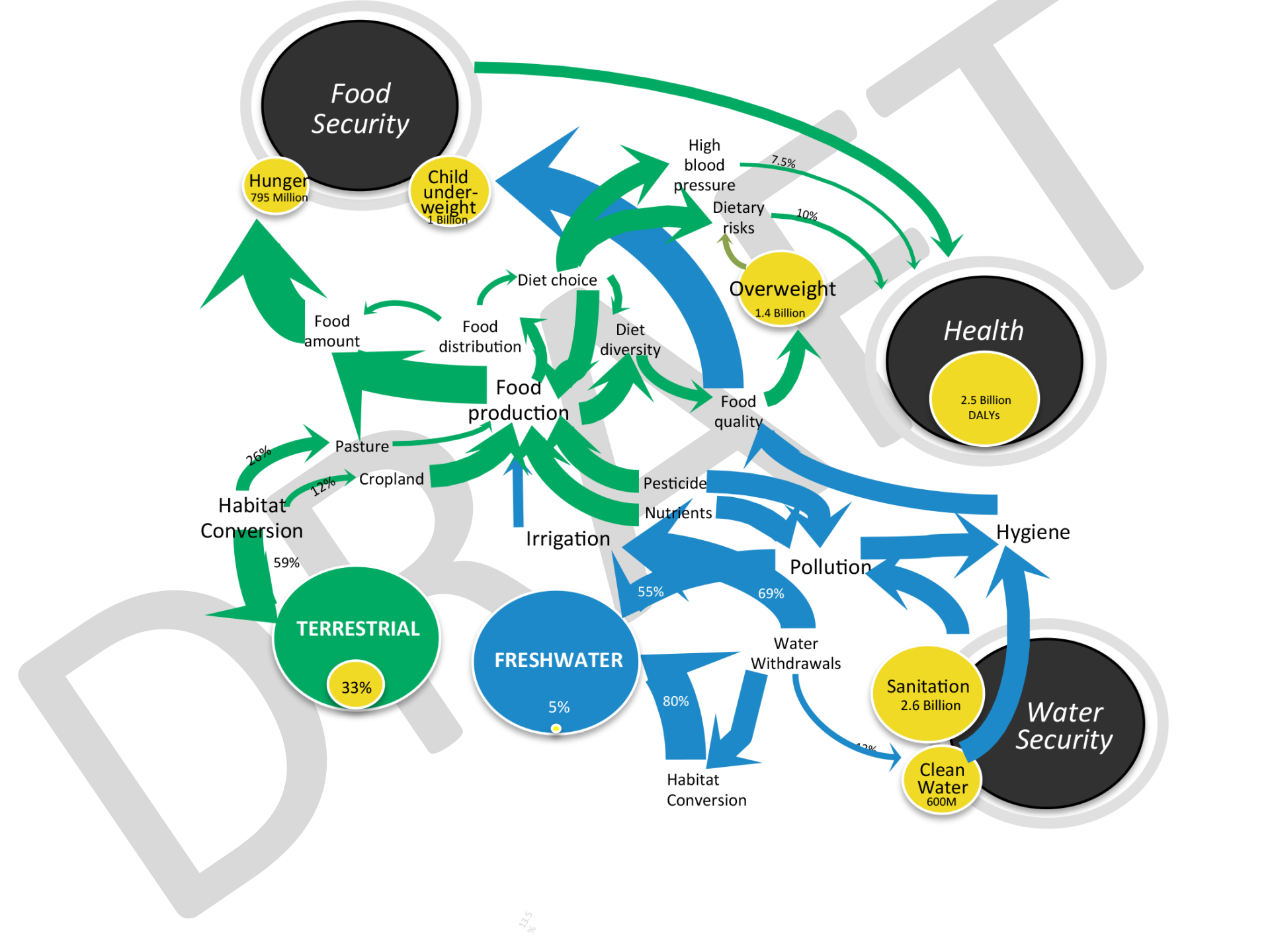
CURRENT INDICATORS



DIG DEEPER: DRIVERS




Food Security
Child under-weight
1 Billion
Health
2.5 Billion DALYs
Food production
Food quality
Pesticide
Nutrients
Irrigation
Pollution
Hygiene
55%
69%
FRESHWATER
5%
Water Withdrawals
80%
Habitat Conversion
Sanitation
2.6 Billion
Clean Water
600M
Water Security


Food Security
Hunger
795 Million
Child under-weight
1 Billion
High blood pressure
7.5%
Dietary risks
10%
Overweight
1.4 Billion
Health
2.5 Billion DALYs
Diet choice
Food amount
Food distribution
Diet diversity
Food production
Food quality
26%
Pasture
12%
Cropland
Habitat Conversion
59%
Irrigation
Pesticide
Nutrients
Pollution
Hygiene
55%
69%
TERRESTRIAL
33%
FRESHWATER
5%
Water Withdrawals
80%
Habitat Conversion
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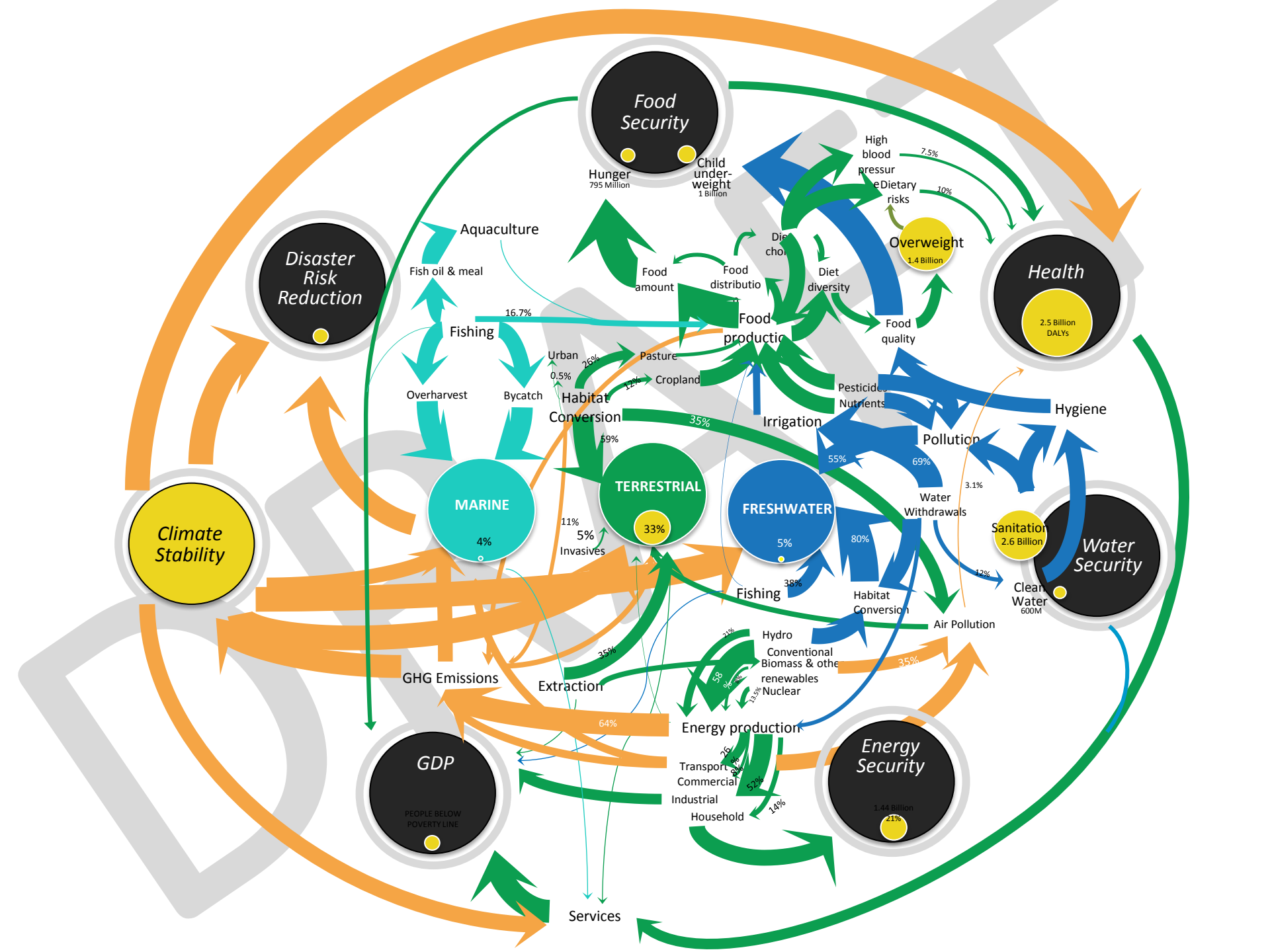
Clean Water
600M
Water Security


Food Security
Hunger
795 Million
Child under-weight
1 Billion
High blood pressur
Dietary risks
7.5%
10%
Overweight
1.4 Billion
Health
2.5 Billion DALYs
Disaster Risk Reduction
Aquaculture
Fish oil & meal
Food amount
Food distributio
Diet diversity
Food quality
Food productio
16.7%
Fishing
Overharvest
Bycatch
Urban
26%
0.5%
Pasture
12%
Cropland
Habitat Conversion
Pesticides
Nutrients
Irrigation
Hygiene
Pollution
35%
59%
55%
69%
Climate Stability
MARINE
4%
TERRESTRIAL
33%
FRESHWATER
5%
11%
5%
Invasives
Water Withdrawals
3.1%
Sanitation
2.6 Billion
Water Security
80%
38%
12%
Fishing
Habitat Conversion
Clean Water
600M
Air Pollution
Hydro
Conventional
Biomass & othe
renewables
Nuclear
GHG Emissions
Extraction
35%
64%
Energy production
Transport
Commercial
Industrial
Household
52%
14%
GDP
PEOPLE BELOW POVERTY LINE
Energy Security
1.44 Billion
21%
Services

There ARE Many Big Joint Challenges

BUT TODAY'S INDICATORS DON'T MAKE THAT EASY TO SEE

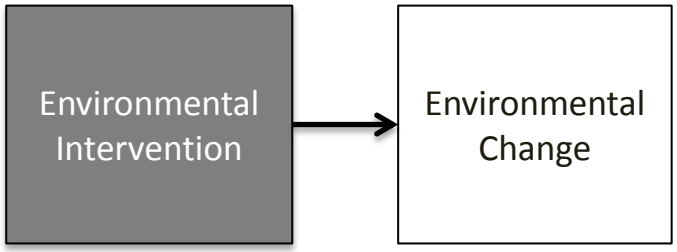
Solving **sanitation access** would solve one of the largest SDGs, and solve major components of freshwater biodiversity decline and child malnutrition

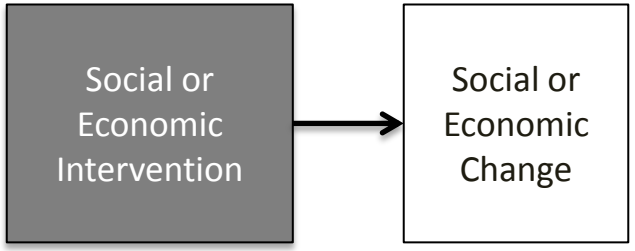
Reducing **agricultural inputs** (land, water, chems) is a connected major challenge for food security, terrestrial and FW biodiversity, child malnutrition and drinking water

Stopping **deforestation** and transitioning households off **biomass fuels** would stop the largest single threat to biodiversity globally, and stop the primary drivers of air pollution and associated respiratory disease.

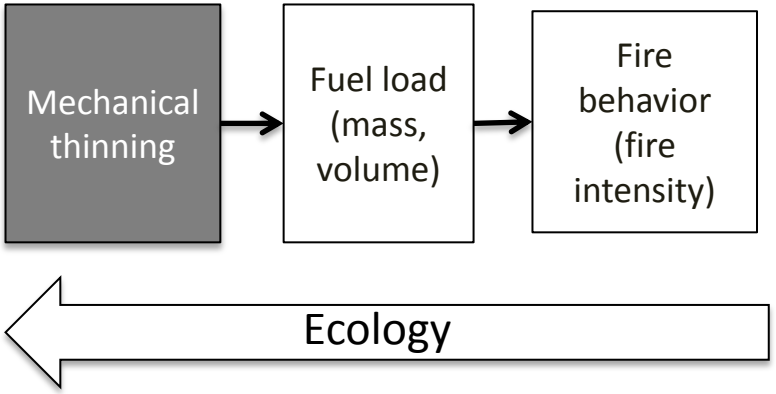
What Works Best?

WHAT WORKS BEST TO FIX THEM?





EXAMPLE: FOREST MANAGEMENT



EXAMPLE: FOREST MANAGEMENT & HEALTH

Mechanical thinning → Fuel load (mass, volume) → Fire behavior (fire intensity)

Ecology

Respiratory treatments → Respiratory health impacts (hospital visits) → Value of reduced illness

Health

EXAMPLE: FOREST MANAGEMENT & HEALTH

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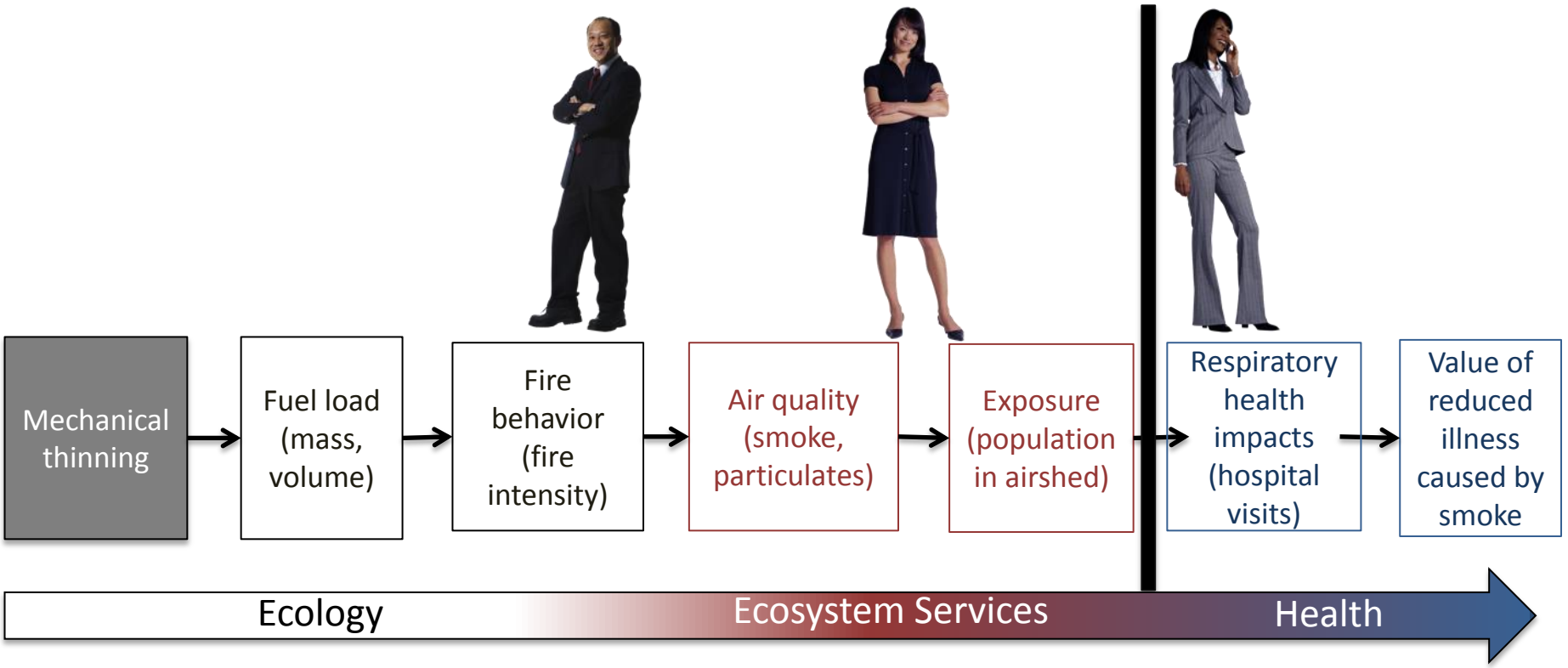
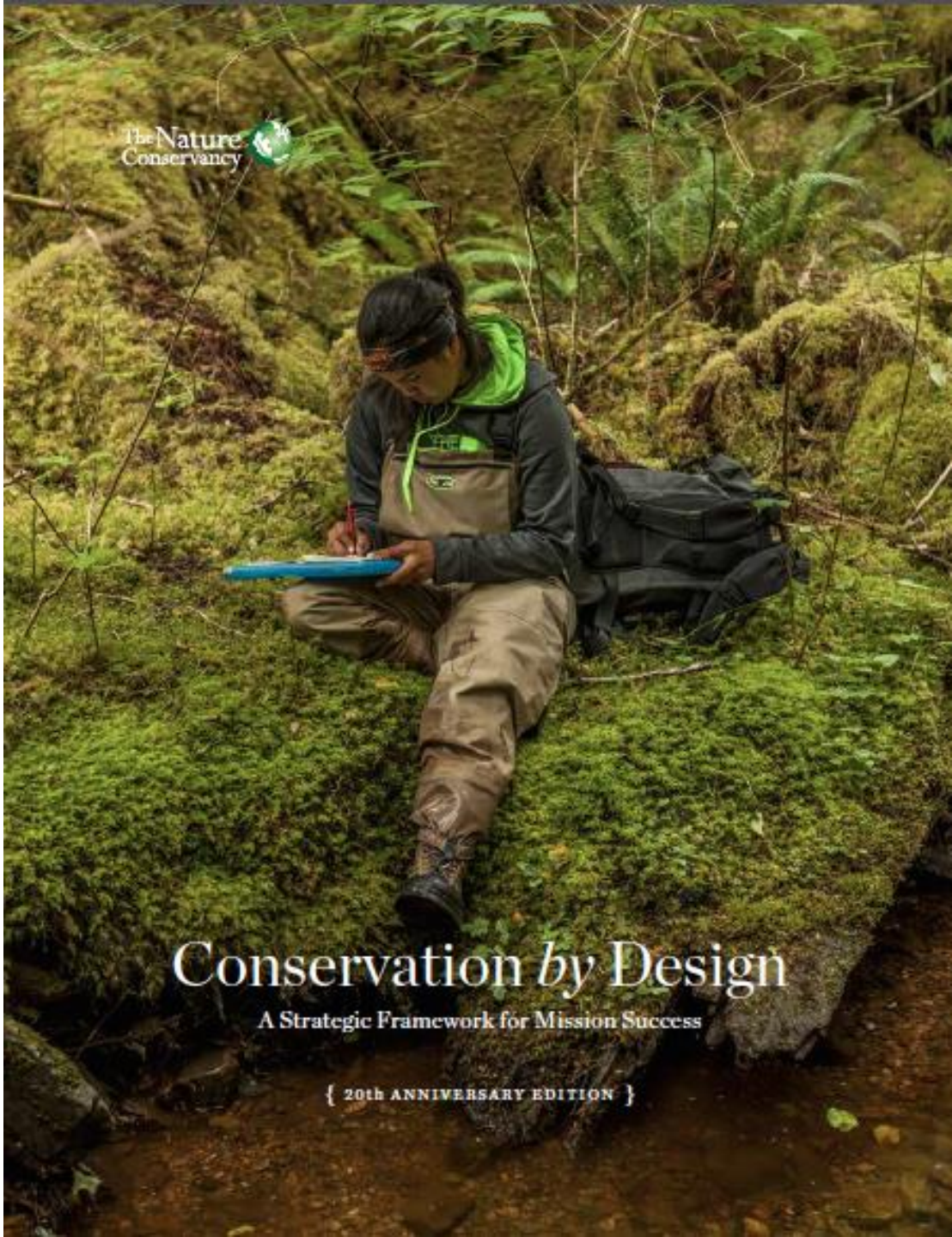


ALIGNING EVIDENCE

Mechanical thinning → Fuel load (mass, volume) → Fire behavior (fire intensity) → Air quality (smoke, particulates) → Exposure (population in airshed) → Respiratory health impacts (hospital visits) → Value of reduced illness caused by smoke

Ecology → Ecosystem Services → Health

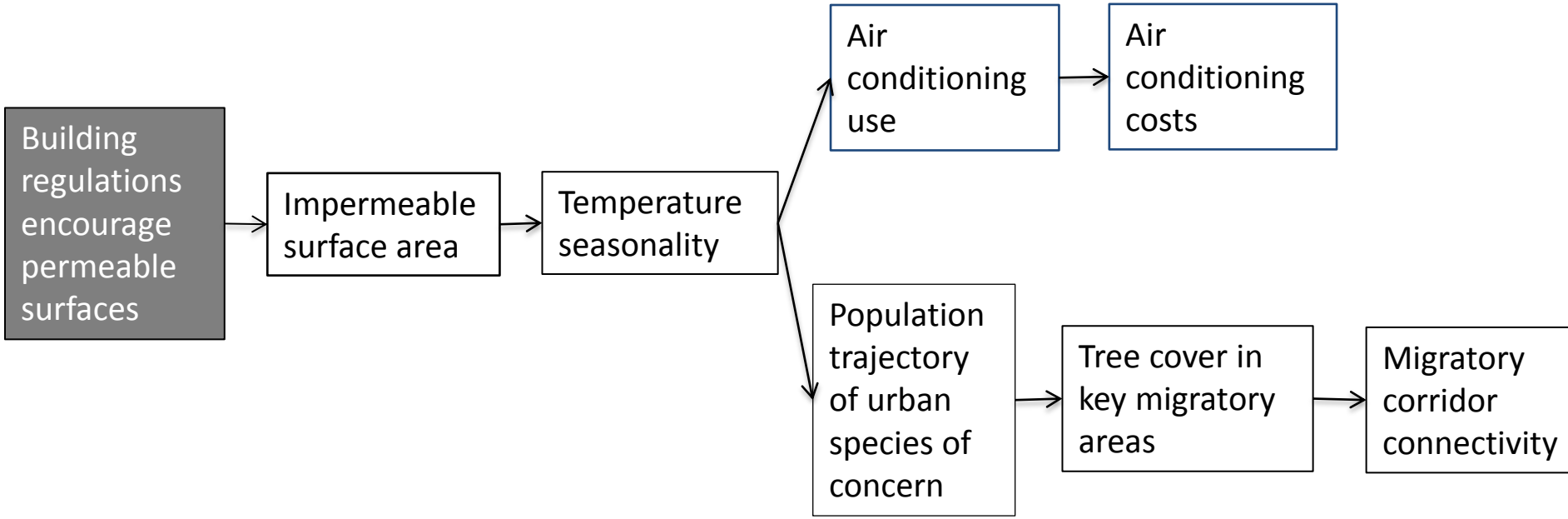
CONSERVATION BY DESIGN



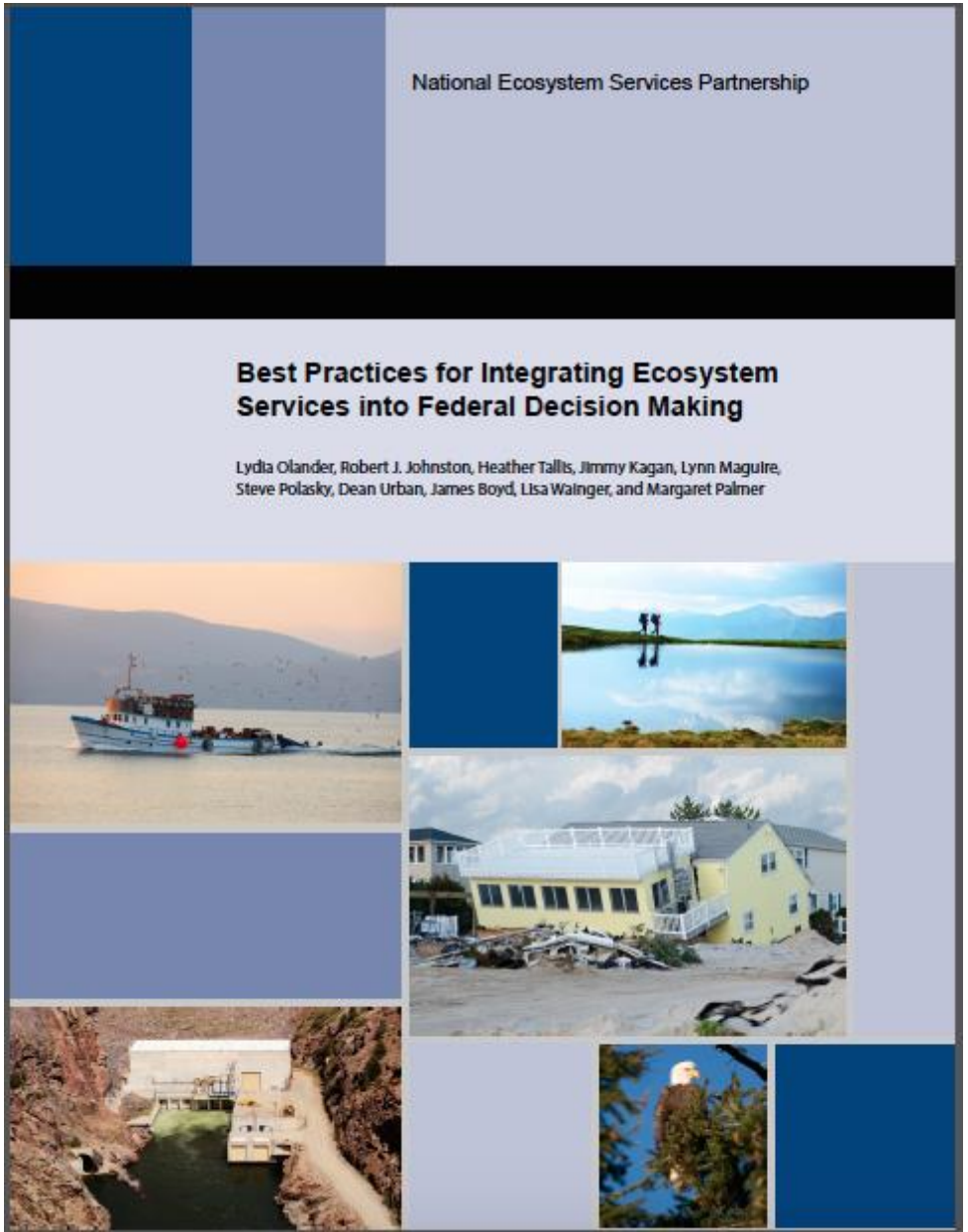
NORTH AMERICA URBAN NETWORK

Problem: Urban heat island effect causing

- increased air conditioning needs and costs
- declines in terrestrial species of concern
- declines in migratory corridor connectivity



Drive Indicators Off Of Shared Logic Models



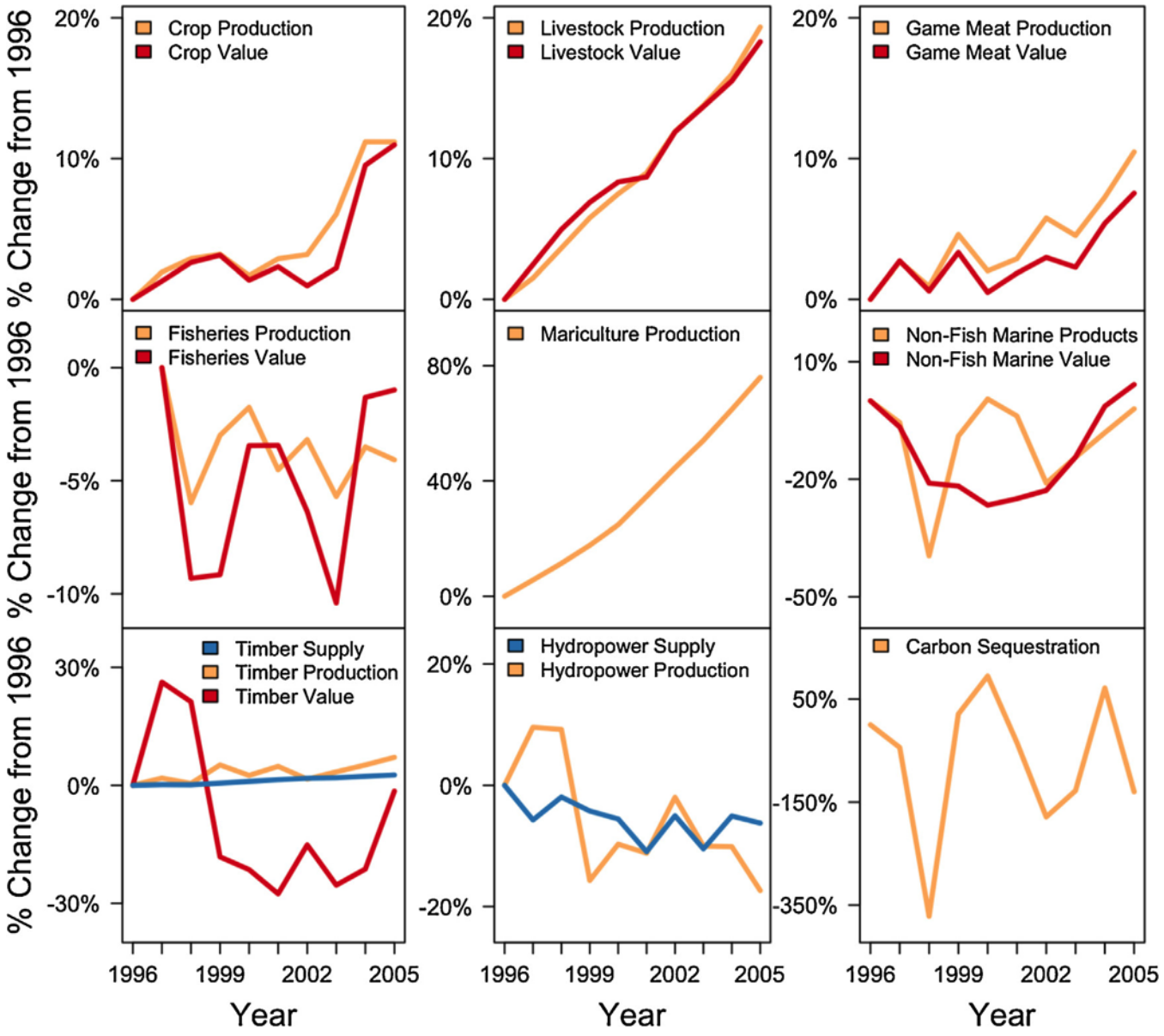
Are We Making Any Progress?

What Can We Track Annually & Globally?

	Type		Metric
Fisheries Production	Supply	Environment	Biomass or abundance of fish
	Service	Handoff	Fish landings Caloric content of landings
	Benefit	Human	Market value of landings Reduced malnutrition from fish

Tallis et al. 2012 BioScience

What Can We Track Annually & Globally?



Karp et al. 2015, Global Enviro Change

What Can We Track Annually & Globally?

Table 2. Examples of emerging services for monitoring.

Ecosystem service	Type	Metric	Source	Available globally	Updated regularly
Fisheries production	Supply	Biomass or abundance of all (commercially) important fishes			
	Service	Landings of (commercially) import species	FAOSTAT	X	X
		Caloric content of those landings			
	Benefit	Market value of the landings			
		Number or percentage of malnourished people			
Biofuel production	Supply	n/a		n/a	n/a
	Service	Production of commercial oil seed crops	FAOSTAT	X	X
	Benefit	Market value of commercial oil seed crops	FAOSTAT	X	X
Water supply for domestic use	Supply	Volume of surface water or groundwater yield	LPJmL, InVEST	X	
	Service	Volume of freshwater withdrawals for domestic use	FAOSTAT		
	Benefit	Percentage of a population with access to clean water	World Bank		
Water supply for irrigation	Supply	Volume of surface water or groundwater yield	LPJmL, InVEST	X	
	Service	Volume of freshwater withdrawals for agriculture	FAOSTAT		
	Benefit	Marginal market value of crops attributable to irrigation			
Nutrient retention for clean drinking water	Supply	Mass of nitrogen or phosphorus retained	InVEST	X	
	Service	Mass of nitrogen or phosphorus retained upstream of the extraction points	InVEST	X	
	Benefit	Avoided water treatment costs	InVEST	X	
Erosion control for reservoir maintenance	Supply	Mass of retained soil	InVEST, SWAT	X	
	Service	Mass of soil retained upstream of reservoirs	InVEST	X	
	Benefit	Avoided dredge costs	InVEST	X	
Flood regulation	Supply	Flood volume regulated by vegetation and soils			
	Service	Area of avoided flood damage due to regulation by vegetation or soil			
	Benefit	Avoided costs due to loss of property or infrastructure			
Nature-based tourism	Supply	Area with attractive natural features or high habitat quality			
	Service	Area with accessible attractive natural features or high quality habitat			
	Benefit	Income from nature-based tourism	IUCN–WCPA		

Tallis et al. 2012 BioScience

Conclusions

Drive indicator development and evidence around shared logic models (everyone face the same idea)

Choose indicators that truly reflect the interaction “the handoff” not just the environmental and socio-economic endpoints