ENVIRONMENTAL DEFENDERS

CHAN BER KU FUR
WOMEN GROUP - DEI

FOOD SECURITY IN ALBERTINE REGION

A MODEL FOR SUBSISTENCE FARMERS RESILIENCE

ENVIRONMENTAL DEFENDERS,
CHAN BER KU FUR

Dei-Panyimur, Pakwach district,
West Nile, Uganda, Albertine Region

RIGHT TO FOOD

is defined by *General Comment No. 12* of the *United Nations Committee on Economic, Social and Cultural Rights* (the body in charge of monitoring the implementation of the *International Covenant on Economic, Social and Cultural Rights – ICESCR* in those states which are party to it).

FOOD SECURITY

All people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life

(Food and Agriculture Organization - FAO, 1996)

UNITED NATIONS **E**

Economic and Social Council

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COMMITTEE ON ECONOMIC, SOCIAL
AND CULTURAL RIGHTS
Twentieth session
Geneva, 26 April-14 May 1999
Agenda item 7

SUBSTANTIVE ISSUES ARISING IN THE IMPLEMENTATION OF THE INTERNATIONAL COVENANT ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS:

GENERAL COMMENT 12 (Twentieth session, 1999)

The right to adequate food (art. 11)

Introduction and basic premises

1. The human right to adequate food is recognized in several instruments under international law. The International Covenant on Economic, Social and Cultural Rights deals more comprehensively than any other instrument with this right. Pursuant to article 11.1 of the Covenant, States parties recognize "the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions", while pursuant to article 11.2 they recognize that more immediate and urgent steps may be needed to ensure "the fundamental right to freedom from hunger and malnutrition". The human right to adequate food is of crucial importance for the enjoyment of all rights. It applies to everyone; thus the reference in Article 11.1 to "himself and his family" does not imply any limitation upon the applicability of this right to individuals or to female-headed households.

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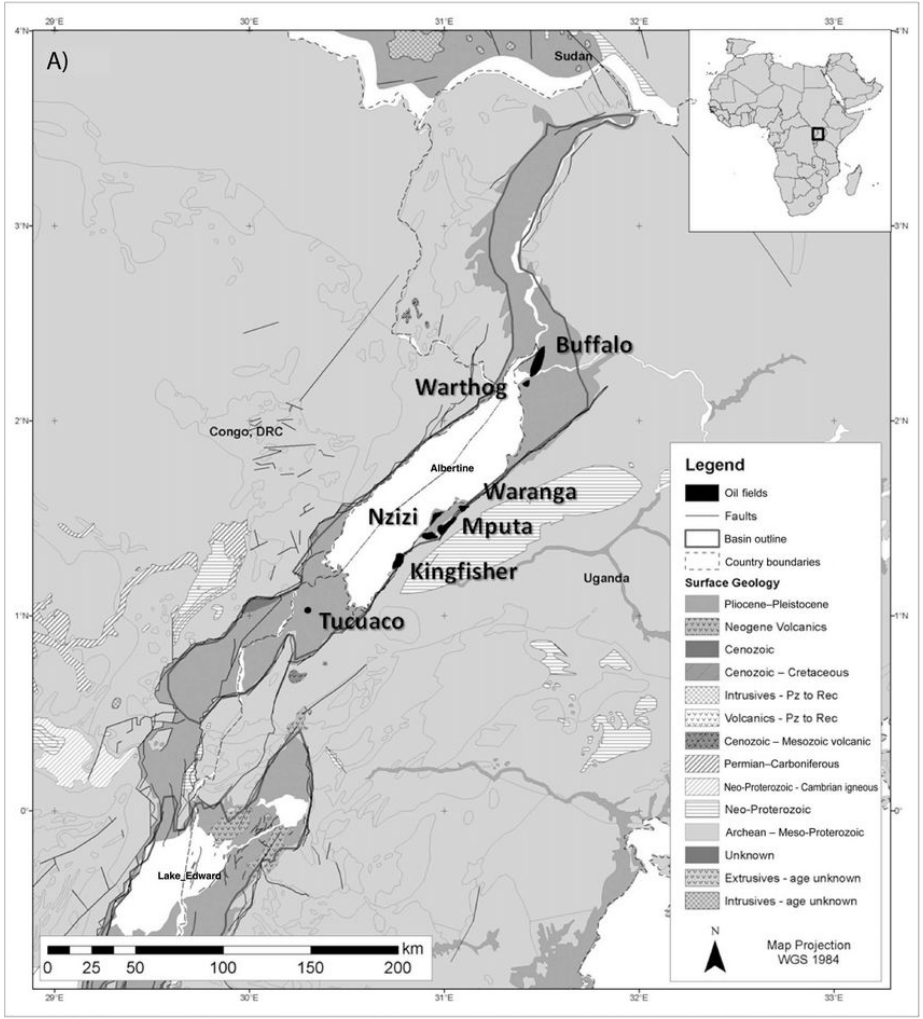


CONTEXT

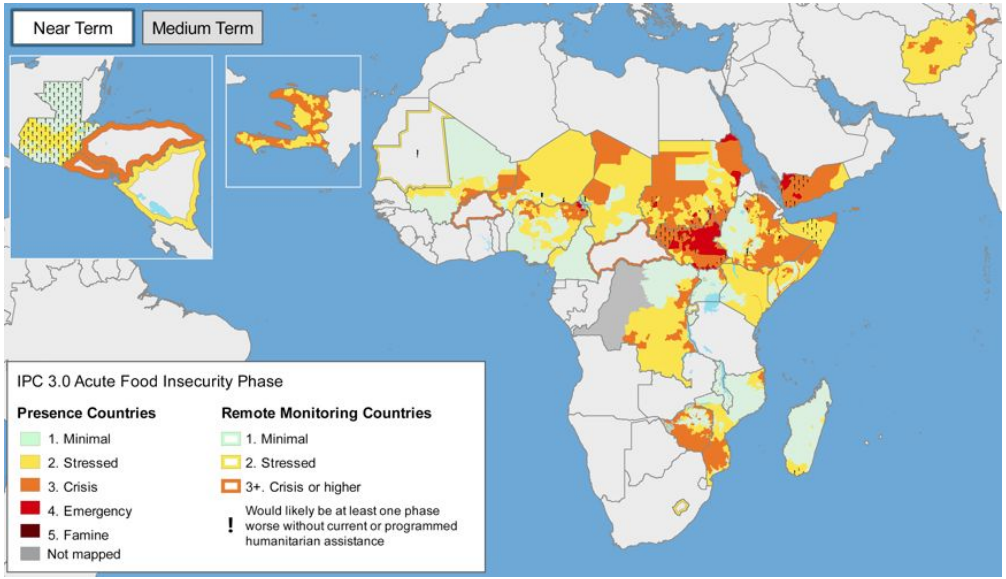
74% of households in northern Uganda suffered **drought/irregular rains** and longtime insurgence which led to a **decline in food production** by about **94%** and **income** by **81%** forcing two fifths of them to **change their dietary patterns.**

Uganda Bureau of Statistics - UBOS, Government of Uganda - GoU, World Food Programme - WFP, 2013

← *Source: Ian Davison, **Tectonics and sedimentation in extensional rifts: Implications for petroleum systems**, 2012*

Country or Region	Reason for Concern	Observations
SOUTH SUDAN	Conflict events have declined, but periodically affect trade, humanitarian access, and livelihoods. The loss of livelihood assets during the conflict has reduced household food and income sources and eroded coping capacity. Very poor macroeconomic conditions constrain household market access.	In Jonglei, floods have displaced tens of thousands of people and damaged crops in Ayod, Twic East, Bor South, and Pochalla counties. Conflict in Akobo and Pibor counties continues to threaten lives and livelihoods.

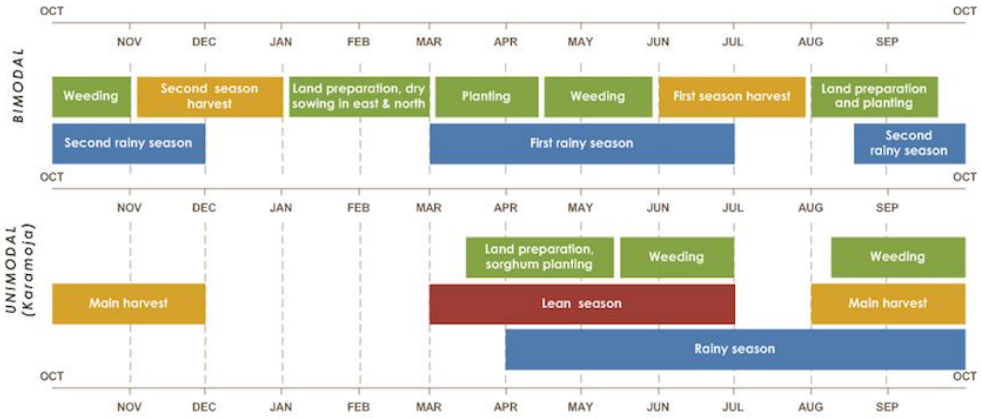
Country or Region	Reason for Concern	Observations
DRC	Ongoing conflicts in the Kasai region, North Kivu, South Kivu, Ituri, Maniema, and Tanganyika Provinces have caused continuing displacement and affected households' abilities to access typical livelihood activities.	The Ebola outbreak in Equateur Province continues to expand, while the country continues to fight COVID-19 and a measles outbreak.



← *ACUTE FOOD INSECURITY: NEAR TERM JULY-SEPTEMBER 2020*

Famine Early Warning Systems Network - FEWS

SEASONAL CALENDAR FOR A TYPICAL YEAR IN UGANDA



KEY MESSAGES FROM *FEWS*

- At the household level, number of people that are Stressed (IPC Phase 2) is higher than average due to reduced income from crop sales and agricultural labor, resulting from below-normal demand for agricultural products;

- The reduced demand for agricultural products is linked to the COVID-19 pandemic. Regionally, the mandatory testing of truck drivers at border crossing points, business uncertainty in destination markets, and the business risks associated with the variations in preventive measures between countries led to higher transportation costs and a decline in exports.

- According to UNHCR/OPM and WFP, the refugee response in Uganda continues to be underfunded. WFP will be able to deliver a 70 percent ration through September and a 60 percent ration beginning in October. As of June 30, Uganda is hosting 1,425,040 refugees and asylum seekers. New refugee arrivals in the first half of 2020 total 21,213, which represents 34 per cent of the expected refugee influx for 2020 according to the Uganda 2019-2020 Refugee Response Plan

DIETARY PATTERNS

A. **Traditional, high-fat, medium environmental impact.** High intakes of nuts/seeds, fats, oils and spreads, fish and boiled vegetables;
B. **Transitioning, processed, low environmental impact.** High intakes of bread and buns, rice and pasta, tea and sugar;
C. **Plant-based, low environmental impact.** High intakes of legumes, boiled roots/tubers, boiled traditional vegetables, fresh fruit and fried traditional cereals;
D. **Animal-based high environmental impact.** High intakes of red/organ meats, chicken, and soups.

ENVIRONMENTAL IMPACT

1. LOW impact. GHGEs <4 $kgCO_2eq$ per kg of product;
2. MEDIUM impact. GHGEs between 4-7 $kgCO_2eq$ per kg of product;
3. HIGH impact. GHGEs >7 $kgCO_2eq$ per kg of product.

What Can Dietary Patterns Tell Us about the Nutrition Transition and Environmental Sustainability of Diets in Uganda?

Carolyn Imelda Auma, Rebecca Pradeilles, Megan K. Blake and Michelle Holdsworth

Nutrients 2019, 11(2), 342
https://doi.org/10.3390/nu11020342

COMPREHENSIVE AFRICA AGRICULTURAL DEVELOPMENT PROGRAMME (CAADP) - 2003

The Comprehensive Africa Agriculture Development Programme (CAADP) is Africa's policy framework for agricultural transformation, wealth creation, food security and nutrition, economic growth and prosperity for all.

African heads of state pledged to devote at least 10% of their national budgets to agriculture in an effort to raise agricultural growth to 6% a year

-

AFRICAN UNION (AU) MALABO DECLARATION ON AGRICULTURE AND POSTHARVEST LOSSES - 2104

The Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods is a set of new goals showing a more targeted approach to achieve the agricultural vision for the continent which is shared prosperity and improved livelihoods.

2017 Country Scorecard for implementing Malabo Declaration - Uganda

Malabo Commitments Areas (T)					Commitments Categories (C)				
No.	Item	Score	Mimimum Score	progress	No.	Item	Score	Mimimum Score	progress
2	Enhancing Investment Finance in Agriculture	3.81	6.67	Not on Track	1	Public Expenditure in Agriculture	3.61	10.00	Not on Track
					2	Enhancing access to finance	4.00	3.33	On Track
3	Ending Hunger by 2025	3.58	3.71	Not on Track	1	Doubling agricultural Productivity	2.78	1.00	On Track
					2	Reduction of Post-Harvest Loss	1.60	1.00	On Track
					3	Strengthening Social Protection	7.05	10.00	Not on Track
					4	Improving Food security and Nutrition	2.51	1.00	On Track
					5	Access to Agriculture inputs and technologies	3.94	5.53	Not on Track
6	Enhancing Resilience to Climate Variability	5.32	6	Not on Track	1	Ensuring Resilience to climate related risks	3.96	2.00	On Track
					2	Investment in resilience building	6.67	10.00	Not on Track

Women play a vital role in Uganda's rural agricultural sector and contribute a higher than average share of crop labor in the region. They also make up more than half of Uganda's agricultural workforce, and a higher proportion of women than men work in farming—76 percent versus 62 percent.

The average plot size is estimated at 0.7 acres, with male managed plots being significantly larger (0.85 acres) than female managed ones (0.54 acres). Soil quality broadly defined as good, fair and poor is by and large similar across male and female managed plots; slightly significantly fewer plots (5.5% vs. 6.9%) of the former are reported to be poor quality than the latter. Almost all of the plots are rain-fed (96.7% of female plots vs. 95% of male plots). Although the proportion of irrigated land is extremely low across the entire sample, the share of male irrigated plots is twice that of female irrigated plots (2.6% vs. 1.3%). Male managed plot are also more likely to be flat (48% vs. 43%) and less likely to be hilly (8% vs. 12%). Distances of plots from the homestead appear to be overall balanced between male and female managed plots. And incidence of plot-level investment in the form of erosion control and water harvesting structures are the same even if slightly more of the male managed plots (83%) are owned by the household than female managed plots (81%).

Given the subsistence nature of crop production, family labor is the main input applied to 96% of both male and female plots. Female managed plots receive more labor days per acre of cultivated land (140 versus 121 days for male managed plots per acre).

GENDER GAP IN FOOD INSECURITY

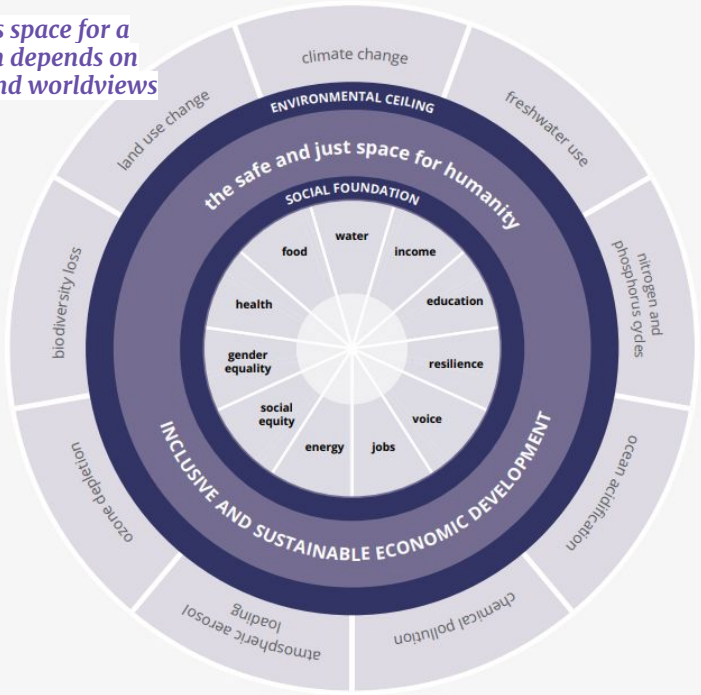
Pic by Felix Warom Okello

Female managers cultivate more roots, pulses and oilseeds, while male managers are involved more in the cultivation of cereals, bananas and cash crops such as coffee. In Northern Uganda, a higher proportion of male managed land is dedicated to the cultivation of pulses and oil than female managed land, while the inverse in true for cereals.

Ali, D., Bowen, D., Deininger, K., Duponchel, M. (2015). Investigating the Gender Gap in Agricultural Productivity. Evidence from Uganda. World Bank Policy Research Working Paper 7262

The Safe and Just Space for Humanity §

Defining this space for a given system depends on the values and worldviews held



§ *Raworth, K. (2012). A safe and just space for humanity: Can We Live Within the Doughnut? Oxfam Discussion Papers.*

Operationalizing safe operating space for regional social-ecological systems *

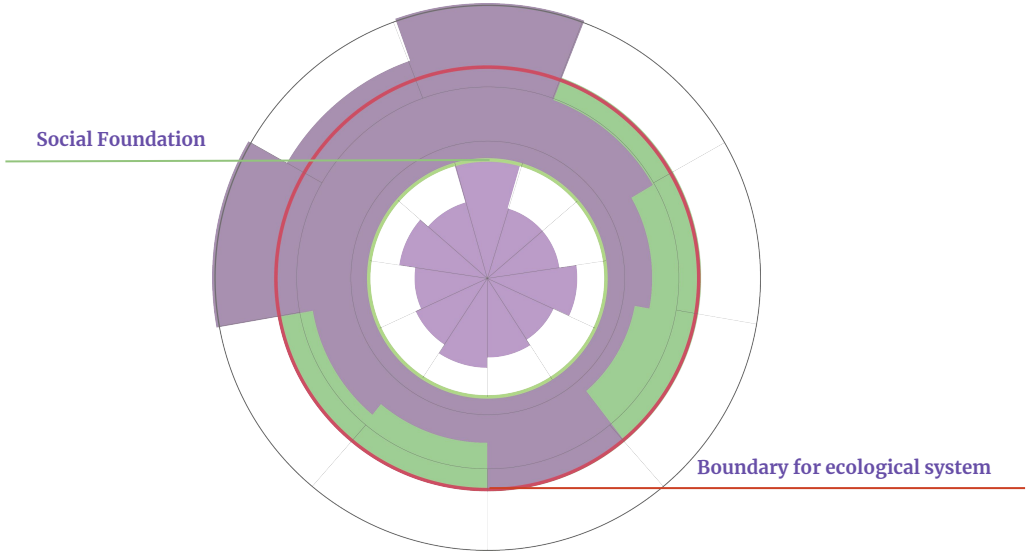
Define the *safe operating space* * at regional level in relation to the envelope of variability, environmental limit and impacts on society, assuming that, outside the envelope of variability for crop production, income and GDP, the society will move out from the safe operating space, posing danger to humanity

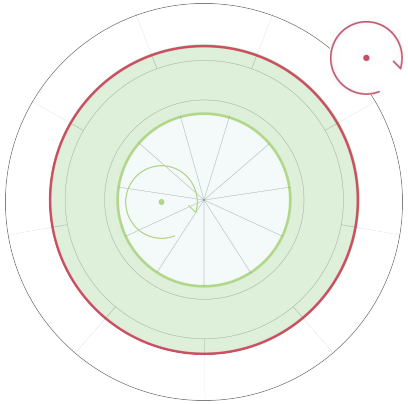
- *analysis and understanding of the co-evolution (drivers, trends, changes points, slow and fast variables) of social-ecological systems involved;*
- *unravelling the dynamic relationships (e.g. interactions, feedbacks and nonlinearity) between social and ecological systems;*
- *simulation and exploration of the social-ecological system dynamics by generating* what if *scenarios based on well-known challenges (e.g. climate change) and current policy debates (e.g. subsidy withdrawal)*

* *Hossain, M.S., Dearing, J.A., Eigenbrod, F. and Jhonson, F.A. (2017) Operationalizing safe operating space for regional social-ecological systems. Science of The Total Environment, 584–585, 673–682.*

FOCUS ON:

- *Feedback between social and ecological system;*
- *Feedback from social system on the boundaries of ecological system*



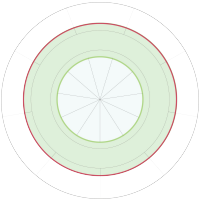


Safe Operating Space

Analysis and understanding of the co-evolution (drivers, trends, changes points, slow and fast variables) of social-ecological systems involved

Unravelling the dynamic relationships (e.g. interactions, feedbacks and nonlinearity) between social and ecological systems

MEASURING THE SAFE OPERATING SPACE



OVERSHOOT OF REGIONAL ECOLOGICAL SYSTEM

SHORTFALL OF THE SOCIAL FOUNDATION

Charcoal bags ready to be sold in the Nebbi district (Uganda) despite the trade ban. Identified the production of charcoal as one of the main causes of deforestation, it remains one of the few income generating options for households and a non-toxic source for cooking.

DEFINE THE BOUNDARIES OF THE ECOLOGICAL SYSTEM

Pic by Patrick Okino Rupiny

Table 1. The updated control variables and their current values, along with the proposed boundaries and zones of uncertainty, for all nine planetary boundaries. In the first column, the name for the Earth-system process used in the original PB publication (R2009, reference 1) is given for comparison.

Earth-system process	Control variable(s)	Planetary boundary (zone of uncertainty)	Current value of control variable
Climate change (R2009: same)	Atmospheric CO_2 concentration, ppm	350 ppm CO_2 (350–450 ppm)	398.5 ppm CO_2
	Energy imbalance at top-of-atmosphere, W m^{-2}	+1.0 W m^{-2} (+1.0–1.5 W m^{-2})	2.3 W m^{-2} (1.1–3.3 W m^{-2})
Change in biosphere integrity (R2009: Rate of biodiversity loss)	*Genetic diversity:* Extinction rate	< 10 E/MSY (10–100 E/MSY) but with an aspirational goal of ca. 1 E/MSY (the background rate of extinction loss). E/MSY = extinctions per million species-years	100–1000 E/MSY
	Functional diversity: Biodiversity Intactness Index (BII) Note: These are interim control variables until more appropriate ones are developed	Maintain BII at 90% (90–30%) or above, assessed geographically by biomes/large regional areas (e.g. southern Africa), major marine ecosystems (e.g., coral reefs) or by large functional groups	84%, applied to southern Africa only
Stratospheric ozone depletion (R2009: same)	Stratospheric O_3 concentration, DU	<5% reduction from pre-industrial level of 290 DU (5%–10%), assessed by latitude	Only transgressed over Antarctica in Austral spring (~200 DU)
Ocean acidification (R2009: same)	Carbonate ion concentration, average global surface ocean saturation state with respect to aragonite (Ω_{arag})	≥80% of the pre-industrial aragonite saturation state of mean surface ocean, including natural diel and seasonal variability (≥80%– ≥70%)	~84% of the pre-industrial aragonite saturation state
Biogeochemical flows: (P and N cycles) (R2009: Biogeochemical flows: (interference with P and N cycles))	*P Global*: P flow from freshwater systems into the ocean	11 Tg P yr^{-1} (11–100 Tg P yr^{-1})	~22 Tg P yr^{-1}
	P Regional: P flow from fertilizers to erodible soils	6.2 Tg yr^{-1} mined and applied to erodible (agricultural) soils (6.2-11.2 Tg yr^{-1}). Boundary is a global average but regional distribution is critical for impacts.	~14 Tg P yr^{-1}
	N Global: Industrial and intentional biological fixation of N	62 Tg N yr^{-1} (62–82 Tg N yr^{-1}). Boundary acts as a global 'valve' limiting introduction of new reactive N to Earth System, but regional distribution of fertilizer N is critical for impacts.	~150 Tg N yr^{-1}
Land-system change (R2009: same)	*Global:* Area of forested land as % of original forest cover	*Global:* 75% (75–54%) Values are a weighted average of the three individual biome boundaries and their uncertainty zones	62%
	Biome: Area of forested land as % of potential forest	*Biome*: Tropical: 85% (85–60%) Temperate: 50% (50–30%) Boreal: 85% (85–60%)	
Freshwater use (R2009: Global freshwater use)	*Global:* Maximum amount of consumptive blue water use ($km^3 yr^{-1}$)	*Global:* 4000 km^3 yr^{-1} (4000–6000 km^3 yr^{-1})	~2600 km^3 yr^{-1}
	Basin: Blue water withdrawal as % of mean monthly river flow	*Basin:* Maximum monthly withdrawal as a percentage of mean monthly river flow. For low-flow months: 25% (25–55%); for intermediate-flow months: 30% (30–60%); for high-flow months: 55% (55–85%)	
Atmospheric aerosol loading (R2009: same)	*Global:* Aerosol Optical Depth (AOD), but much regional variation		
	Regional: AOD as a seasonal average over a region. South Asian Monsoon used as a case study	*Regional*: (South Asian Monsoon as a case study): anthropogenic total (absorbing and scattering) AOD over Indian subcontinent of 0.25 (0.25–0.50); absorbing (warming) AOD less than 10% of total AOD	0.30 AOD, over South Asian region
Introduction of novel entities (R2009: Chemical pollution)	No control variable currently defined	No boundary currently identified, but see boundary for stratospheric ozone for an example of a boundary related to a novel entity (CFCs)	

THE PLANETARY BOUNDARY FRAMEWORK: THRESHOLDS

eve in many regions of the world is increasing (17) [illegible] hav [illegible] wo [illegible] ined mass loss fro [illegible] tic ice sheets is inc [illegible]

Ch [illegible]

We [illegible], addressing [illegible] the Earth system. The first captures the role of genetically unique material as the "information bank" that ultimately determines the potential for life to continue to coevolve with the abiotic component of the Earth system in the most resilient way possible. Genetic diversity provides the long-term capacity of the biosphere to persist under and adapt to abrupt and gradual abiotic change. The second captures the role of the biosphere in Earth-system functioning through the value, range, distribution, and relative abundance of the functional traits of the organisms present in an ecosystem or biota (7).

For the first role, the concept of phylogenetic species variability (PSV) (7, 33, 37) would be an appropriate control variable. However, because global data are not yet available for PSV, we retain the global extinction rate as an interim control variable, although it is measured inaccurately and with a time lag. There may be a considerable risk in using extinction rate as a control variable, because phylogenetic (and functional) diversity may be more sensitive to human pressures than species-level diversity (38). In principle, the boundary should be set at a rate of loss of PSV no greater than the rate of evolution of new PSV during the Holocene. Because that is unknown, we must fall back on the (imperfectly) known extinction rate of well-studied organisms over the past several

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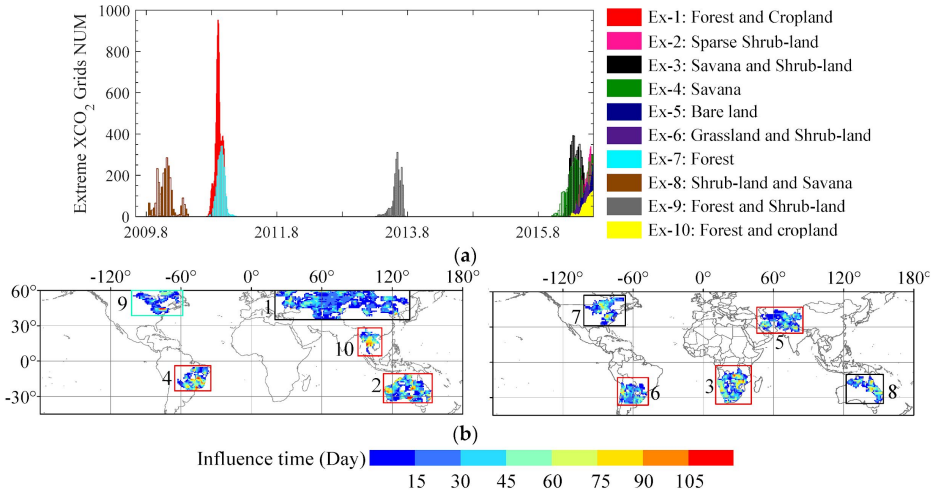
ATMOSPHERIC CO2 CONCENTRATIONS

Atmospheric CO2 concentrations are sensitive to the effects of climate extremes on carbon sources and sinks of the land biosphere. Therefore, extreme changes of atmospheric CO2 can be used to identify anomalous sources and sinks of carbon.

SPATIO-TEMPORAL EXTREME CHANGE DETECTION METHOD FOR ATMOSPHERIC CO2 CONCENTRATIONS using column-averaged CO2 dry air mole fraction (XCO2) retrieved from the Greenhouse gases Observing SATellite (GOSAT)

He, Z., Lei, L., Welp, L. R., Zeng, Z., Bie, N., Yang, S., Liu, L. (2018). Detection of Spatiotemporal Extreme Changes in Atmospheric CO2 Concentration Based on Satellite Observations. Remote Sens. 2018, 10(6), 839



The duration (a) and spatial distribution (b) of the ten largest extreme events (Ex). Those occurring in 2009–2010 are outlined in black (Ex-1, Ex-7, Ex-8), 2013 is in blue (Ex-9) and 2015–2016 are in red (Ex-2, Ex-3, Ex-4, Ex-5, Ex-6, Ex-10). The main land-cover type over the ten selected extreme units was based on MCD12C1 in 2009 from the Moderate Resolution Imaging Spectroradiometer (MODIS). (a) Influenced duration of largest 10 extreme high XCO2 units; (b) Largest 10 extreme high XCO2 units with influenced grids in space.

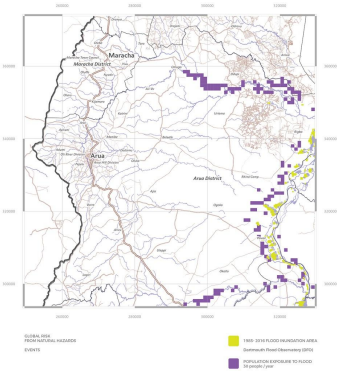
a) 1985-2015 Flood Inundation Area and Population Exposure to Flood

b) 1995-2012 Fires and Solar Radiance

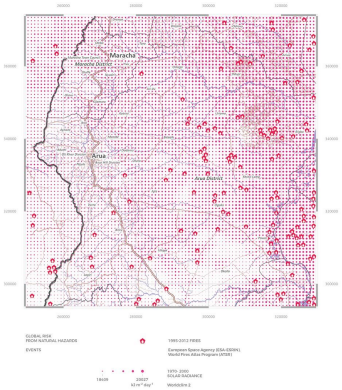
c) Population exposure for landslides triggered by rainfall

d) Population exposure for drought

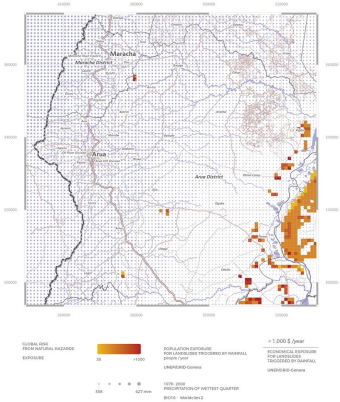
a)



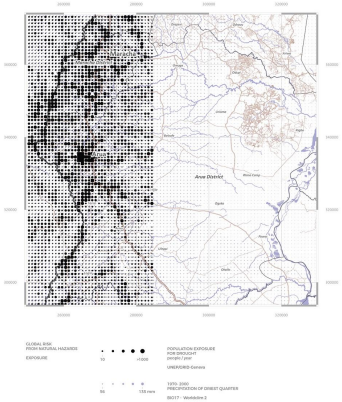
b)



c)



d)



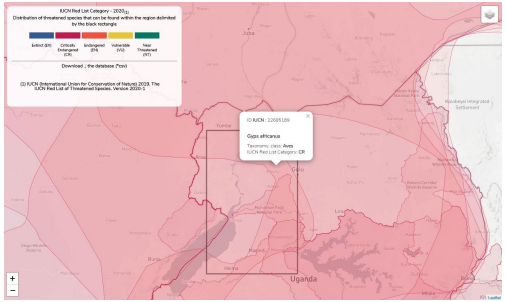
↑ Go to the map

Politecnico di Milano, DAStU, MSLab, Antonella Contin, Alessandro Musetta

GENETIC DIVERSITY / FUNCTIONAL DIVERSITY:

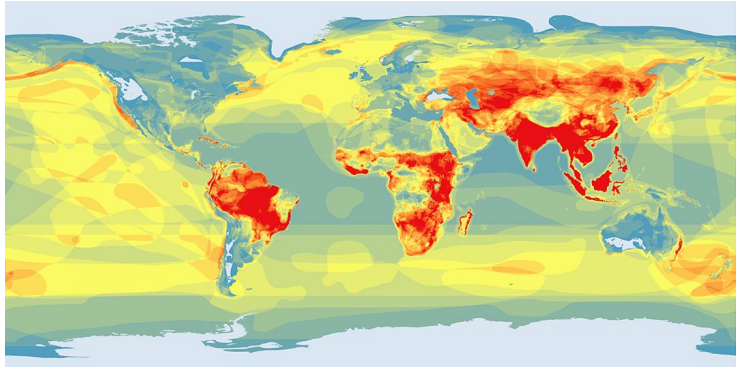
LOCAL SPECIES LEVEL

Species Richness (SR -AOH)[a] and Range-Size Rarity (RWR - AOH)[b] per Area of Habitat

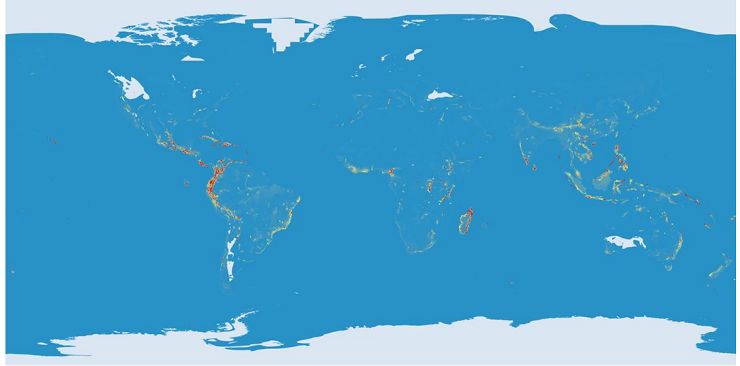


↑ Go to the map for Albertine Region

a) Species richness



a) Range Rarity



Threatened (CR, EN, VU) amphibians, birds and mammals. Only species assessed as CR (Critically Endangered), EN (Endangered) and VU (Vulnerable)

GENETIC DIVERSITY / FUNCTIONAL DIVERSITY:

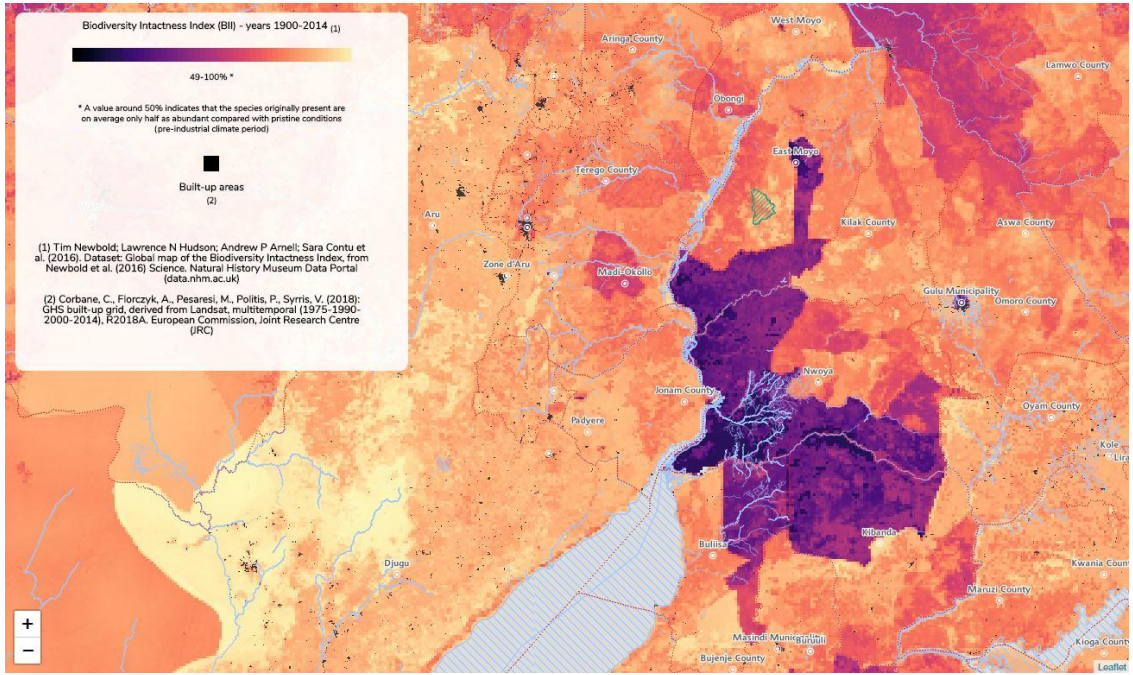
LOCAL ECOSYSTEM INTACTNESS

GLOBIO Mean Species Abudance (MSA)

GLOBIO calculates local terrestrial biodiversity intactness, expressed by the mean species abundance (MSA) indicator, as a function of six human pressures: land use, road disturbance, fragmentation, hunting, atmospheric nitrogen deposition and climate change. The core of the model consists of quantitative pressure-impact relationships that have been established based on extensive terrestrial biodiversity

PREDICTS Biodiversity Intactness Index (BII)

The BII is an indicator of the overall state of biodiversity in a given area, synthesizing land use, ecosystem extent, species richness and population abundance data. It is sensitive to the drivers and changes in the populations of species that typify the process of biodiversity loss, and robust to typical variations in data quality



↑ Go to the map for Albertine Region

GENETIC DIVERSITY / FUNCTIONAL DIVERSITY:

CHANGE IN BIOSPHERE INTEGRITY

REGIONAL HABITAT CONDITION

CSIRO Biodiversity Habitat Index (BHI)

The The Biodiversity Habitat Index (BHI) represents the proportion of biodiversity retained within a given area (such as a country or an ecoregion) in relation to the degree of habitat loss, degradation and fragmentation experienced.

PHOSPHORUS (P) AND NITROGEN (N) CYCLE

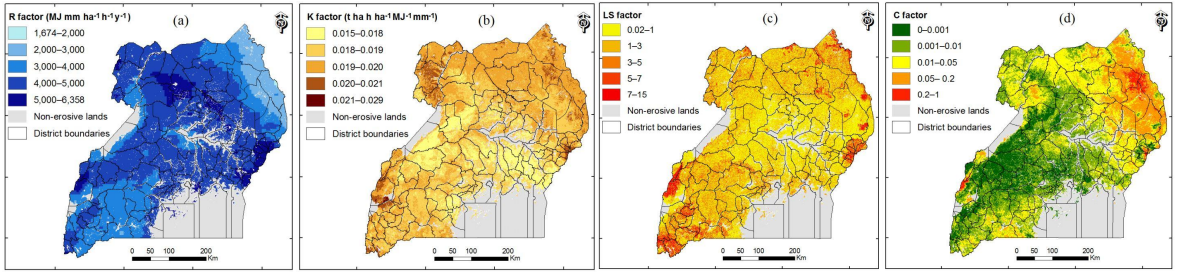
BIOGEOCHEMICAL FLOWS

P REGIONAL - P FLOW FROM FERTILIZERS TO ERODIBLE SOILS

Revised Universal Soil Loss Equation (RUSLE)

RUSLE is an index method having factors that represent how climate, soil, topography, and land use affect rill and interrill soil erosion caused by raindrop impact and surface runoff

Karamage, F.; Zhang, C.; Liu, T.; Maganda, A.; Isabwe, A. (2017) Soil Erosion Risk Assessment in Uganda. Forests, 8, 52



These influences are described in RUSLE with the equation:
A = R × K × LS × C × P

where: **A = annual soil loss** (t·ha−1·y−1); **R = rainfall-runoff erosivity factor** (MJ·mm·ha−1·h−1·y−1); **K = soil erodibility factor** (t·ha·h·ha−1·MJ−1·mm−1); **LS = slope length and slope steepness factor**; **C = cover management factor**; **P = support practice factor**.

BIOME

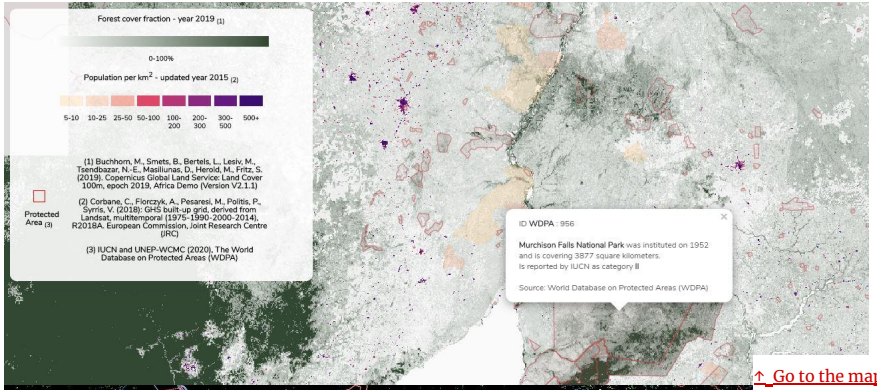
AREA OF FORESTED LAND AS % OF POTENTIAL FOREST

Forest Cover Fraction

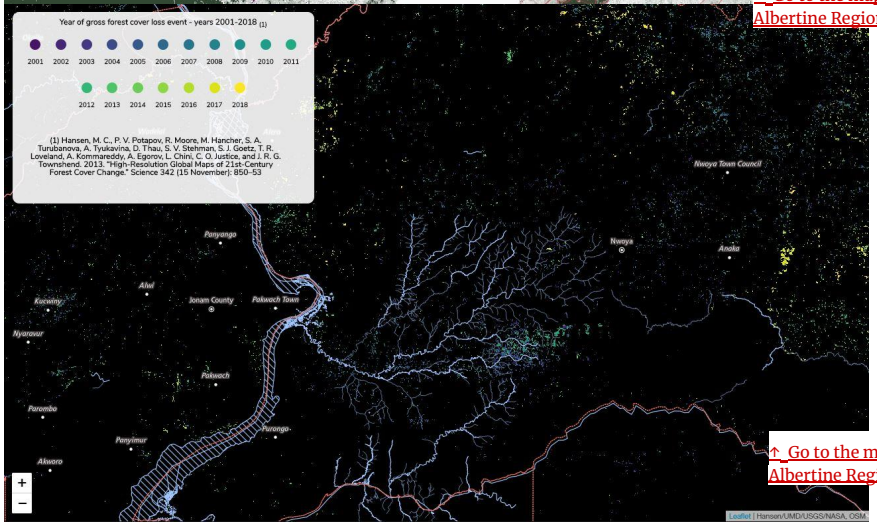
Provide proportional estimates for vegetation cover

Gross Forest Cover Loss (GFCL)

The conversion of forest cover to non-forest cover



↑ Go to the map for Albertine Region



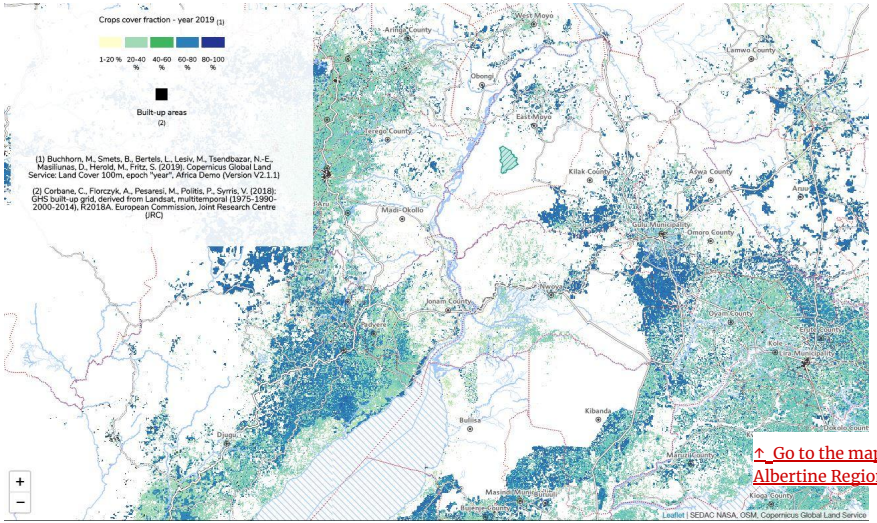
↑ Go to the map for Albertine Region

BIOME

Human Footprint

The ecological footprint represents a set of techniques for estimating the amount of land or sea necessary to support the consumption habits of one individual, population, product, activity, or service. The human footprint represents in some sense the sum total of ecological footprints of the human population.

Human footprint uses four types of data as proxies for human influence: **population density, land transformation, accessibility, and electrical power infrastructure.**

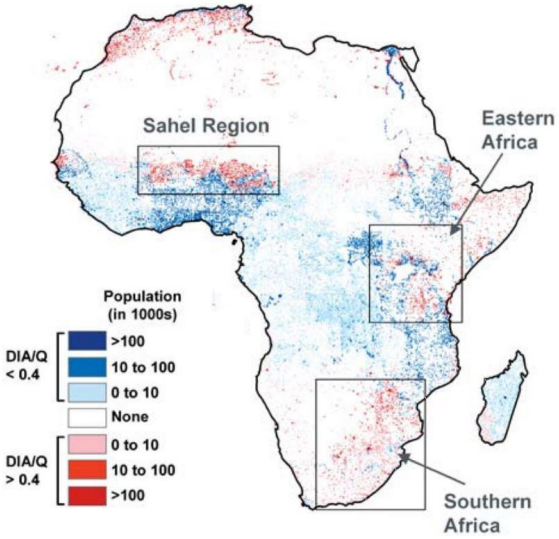


↑ Go to the map for Albertine Region

Sanderson, E. W. et al. (2002)The human footprint and the last of the wild. Bioscience 52, 891–904

Climate Variability and Water Stress

Annual and seasonal means give us one important view of water stress. But a more complete geography of water stress must necessarily consider the inherent variability of the water cycle and its possible changes over time. Of primary concern is a potential acceleration of the hydrologic cycle associated with greenhouse warming, leading to greater frequency and intensity of extreme events like floods and drought



The density of human population living above (red) or below (blue) the relative water use threshold of 40%, presumed to indicate severe stress, under the 30-y recurrence drought. Three examples of the sensitivity in regions located in spatially complex transitional zones between arid/semi-arid and humid climates are shown.

Vörösmarty, C.J., Douglas, E.M., Green, P. A., Revenga, C. (2005). Geospatial Indicators of Emerging Water Stress: An Application to Africa, AMBIO: A Journal of the Human Environment 34(3), 230-236

Evicted families in Rwamutonga village, Bugambe sub county , Hoima district, Uganda, 2019

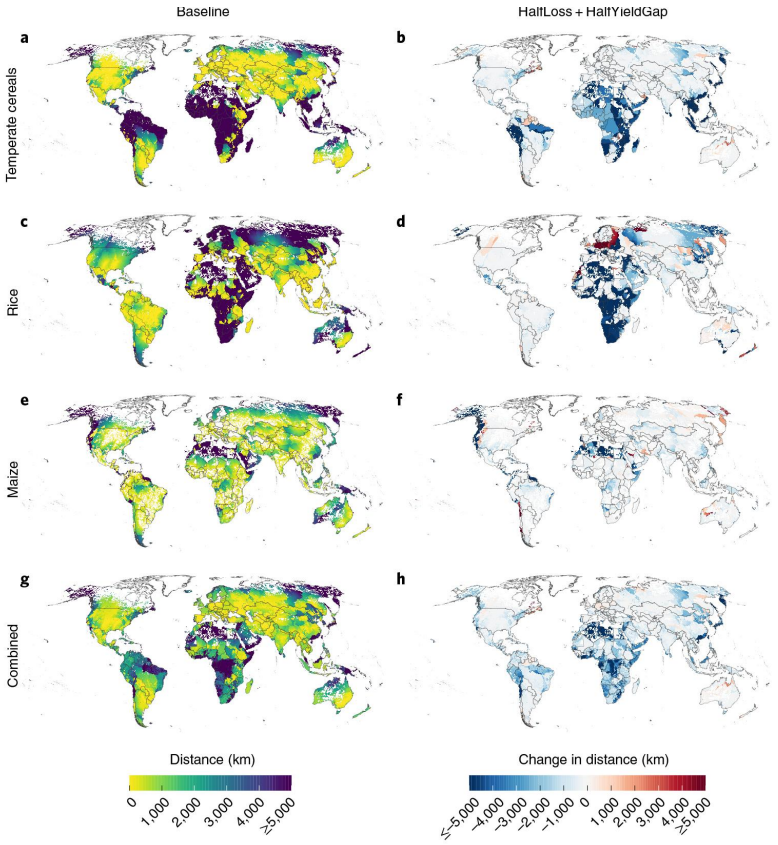
STRENGTH THE SOCIAL FOUNDATION, DEFEND HUMAN RIGHTS

Pic by Winfred Ngabiirwe

Local food crop production can fulfil demand for less than one-third of the population.

FOODSHEDS is a natural unit of analysis, to illustrate the areas that emerge as self-sufficient if the distance between food consumption and production is minimized.

MINIMUM DISTANCE TO CONSUMPTION. In several regions, locally produced crops are insufficient to satisfy the local demand, rendering food flows necessary to balance areas of surplus and deficit. For tropical roots and maize only around 11–16% of the population could meet its demand within 100 km. The geographic distribution of food self-sufficiency is similar for most of the crops analysed, the transport distances needed to satisfy the rest of the demand are both crop- and region-specific



Optimized simulated distance from food production to consumption. a,c,e,g, Distances needed to satisfy food demand under baseline conditions for temperate cereals (a), rice (c) and maize (e), and the mean distance of all six crops weighted by their individual shares of their total usage in each cell(g). **b,d,f,h,** Changes in distances relative to the baseline under the HalfLoss + HalfYieldGap scenario for temperate cereals (b), rice (d) and maize (f), and their weighted mean (h). Food flows are determined by minimizing a friction surface that captures transport travel time costs.

Kinnunen, P., J.H.A. Guillaume, M. Taka, P. D'Odorico, S. Siebert, M.J. Puma, M. Jalava, and M. Kummu, (2020). Local food crop production can fulfil demand for less than one-third of the population. Nat. Food, 1, no. 4, 229-237

INCOME

The main occupation in Nebbi district (Uganda) rural area is agriculture. In particular, it is recorded a regular presence of workers in cassava' life cycle per household.

This activity is largely carried out by women and with an average daily commitment of 3 hours.

Despite that most household members are subsistence farmers, those who are paid for crop farming receive an average cash payment for UGX 5.000 (USD 1,36) per week.

Charcoal selling along the Highway , Arua district, Uganda, 2018

Pic by Alessandro Frigerio

HEALTH

People that suffer due to illness or injury in Nebbi district (Uganda) rural area have access to health facilities. Government hospitals and health centers, community health centers, NGO hospitals and community based distributor, pharmacies/ drug shops are spatially well distributed on the territory (average distance to the place where treatment is seek is 3,5km).

Elaboration from the National Panel Survey 2015-2016 (World Bank / UBOS) data

WATER AND SANITATION

+ HOUSING CONDITIONS

Garbage burning , Arua district, Uganda, 2018

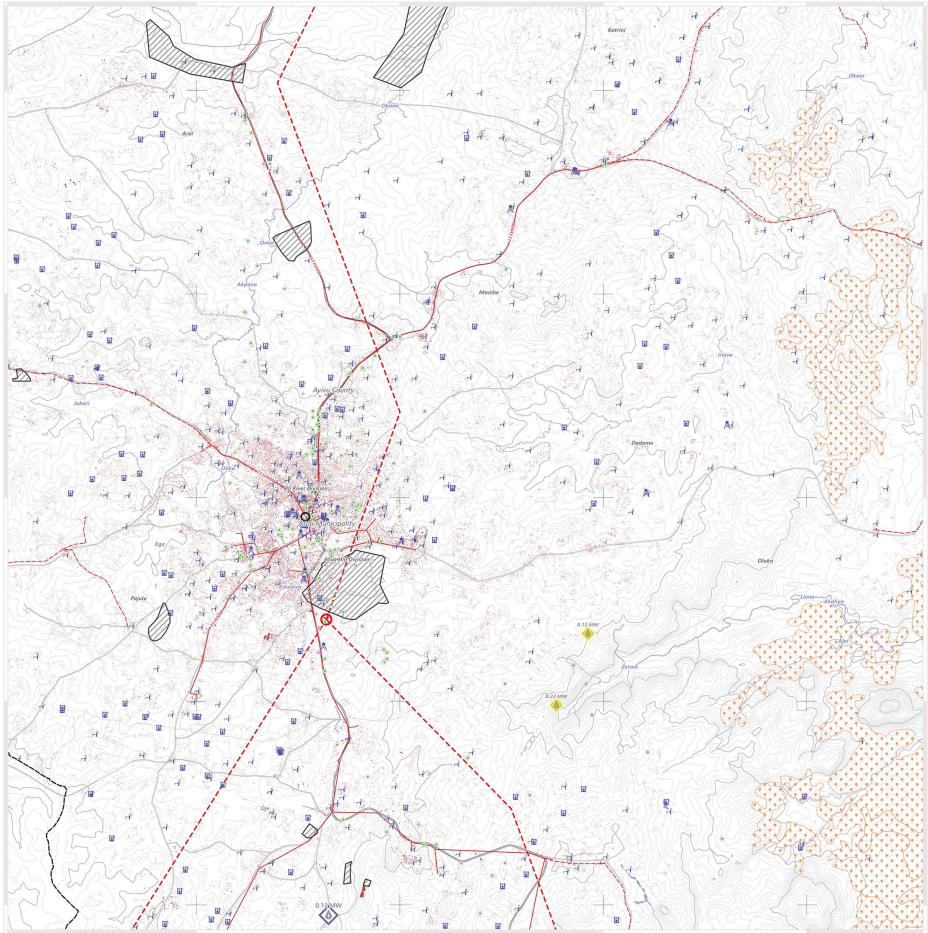
Car washing in river Enyau. The river is also used for collection of household consumption water, Arua district, Uganda, 2018

Pics by Alessandro Frigerio

The most represented buildings typologies in Nebbi district (Uganda) rural area are detached house and hut. For this reason, the most used construction materials are concrete, stones, wood, mud and pole.

The main source of water for drinking for households is the public borehole. It takes on average 25 minutes to carry out water collection operations whose daily consumption is 7 liters per household.

The mainly used type of toiled in household is a covered pit latrine without slab usually shared with other households.



Measuring spatial accessibility to basic services – Arua (Uganda)

Healthcare, water, energy, telecommunication

BORDERS

- Country border

CONTOURS
TOPOGRAPHIC

- index
- intermediate

RIVERS, LAKES, AND CANALS

- river
- stream
- water
- wetland

ROADS AND RELATED FEATURES

- primary
- secondary
- tertiary
- residential
- BUILT UP

VEGETATION

- shrubs
- forest
- natural protected area

WATER POINT

- artificial water
- water tank
- water well
- borehole

ELECTRICITY GRID

- transmission line - operational
- transmission line - at planning stage, under construction
- distribution line - operational
- distribution line - at planning stage, under construction
- transmission/distribution substation

POWER PLANT

operational generation site
- hydroelectric

potential generation site
- hydroelectric

at planning stage generation site
- hydroelectric
- solar

TELECOMMUNICATION TOWER

- GSM
- LTE
- UMTS

Politecnico di Milano, DAStU, MSLab, Antonella Contin, Alessandro Musetta

EDUCATION

In Nebbi district (Uganda) rural area a large percentage have completed their studies at primary school.

Almost all the children reach the school by walking for an average distance of 1,1 km. Households spend an average of UGX 38.000 (USD 10,3) per child/daughter per year, largely supported through education government programs.

Elaboration from the National Panel Survey 2015-2016 (World Bank / UBOS) data

Education facilities , Arua district, Uganda, 2018

Pic by Joy Mutai

Wednesday October 03 2018

BUSINES

DARKNESS!

77% Of Ugandans Have No Access To Electricity

with these is the promotion of efficient utilization of energy resources and reduction in power losses. It should be recalled that in 2013, government put in place the second rural electrification strategy and Plan 2013-2022 which aims at increasing the electrification rate to 26% by 2022. This translates to 1,415,000 new connections on grid and off-grid and also aims at positioning the country to achieve the Government vision of universal access to electricity by 2040.

"As a result, over 9,700km of MV length and 6,500km of LV length have been constructed, 4500km of MV and 3900km of LV is under construction and the rural electrification agency has promoted the use of off-grid renewable energy tech-

Minister Eng. Irene Muloni

ing the implementation of 5 mini-grids," Muloni said. On strategies to increase access, government recently passed the free-connection policy which is intended to increase the number of domestic and commercial consumers on the national grid. Here, the consumer will need to have

inspection fees while the government will provide the necessary infrastructure and the end user will have to pay for the power consumed. "With this policy implemented, access is expected to increase from the current 23% to 28% by the end of the financial year 2018/19," Muloni said.

government through the rur electrification agency has embarked on a program to fast-track rural electrification of the 491 sub counties so as to accelerate access and contribute demand growth. To address the issu of increasing generation capacity, government unde the National Development Plan II is developing and planning to develop severa projects like the construction of the 600MW Karuma Hydropower project which now 80% complete. Isimba Hydropower project (183M is in advanced stages at 9 complete with the first two units expected in Decemb 2018, Agago-Achwa II 42M at 90% complete and othe seventeen (17) small renew able energy projects. 81.7 of these renewable energ

ENERGY

The Ugandan territory of Albertine Region is not connected from the national high voltage grid and is experiencing frequent power cuts, even though different projects are on the way for enhancing the access to electricity.

The most requested energy source for cooking is charcoal, with relevant environmental implications, even though this being a source of income to rural population. Due to its high cost, households are obliged to use toxic energy sources such as kerosene for cooking.

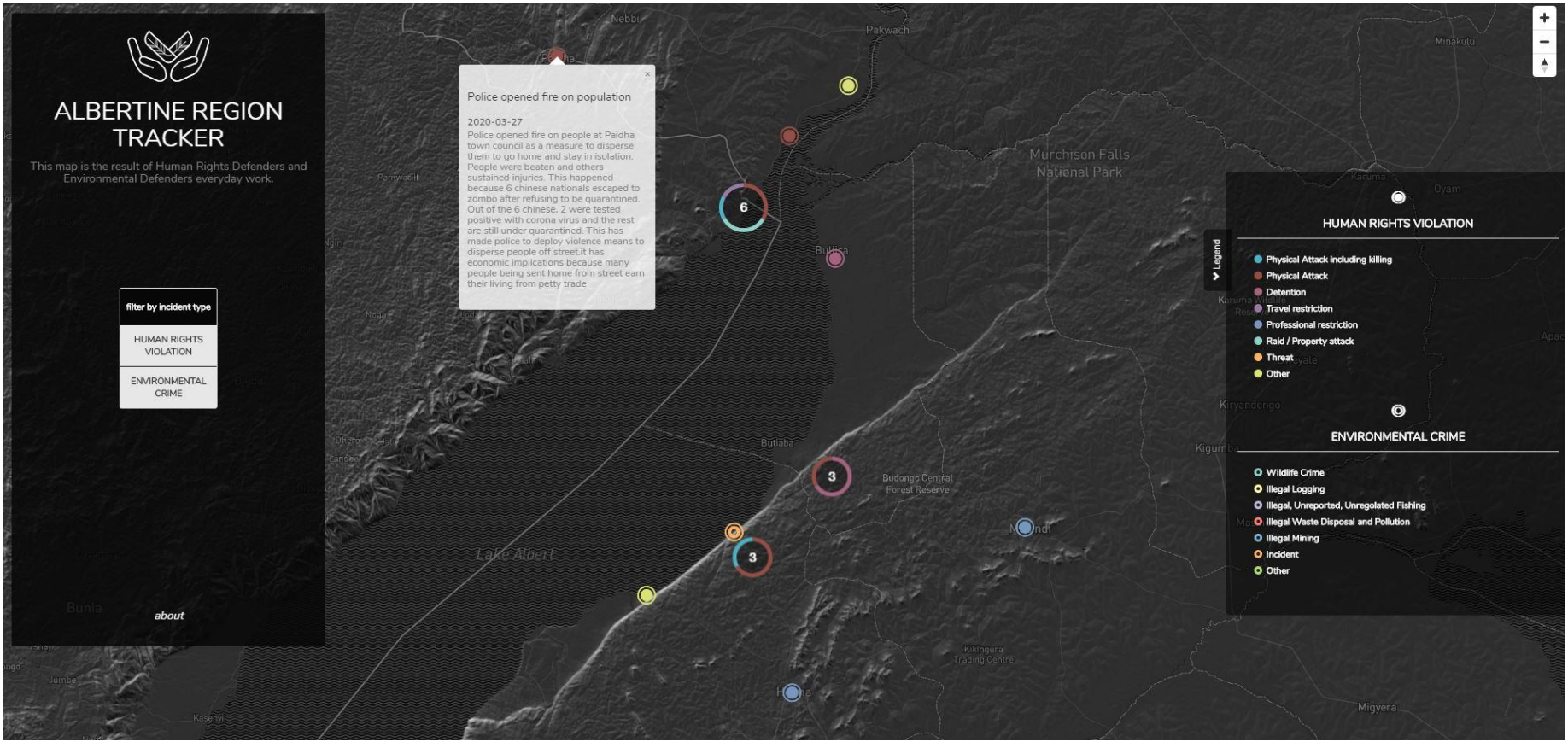
The poetess, academic and LGBT+ rights activist Stella Nyanzi arrested for her support to #WeNeedFood campaign, 2020

Leadership. In Uganda women political leaders have gained access to prominent public political positions in numbers that historically represent a breakthrough. The increase in the number of women at the parliamentary level is attributable to the mandatory district woman MP position, especially with regard to the creation of new districts. Unfortunately, mandatory women representation does not apply to political positions such as district, municipal and subcounty chairpersons, accounting for low women's representation in the latter positions

Agriculture. Women constitute the highest proportion of the labour force in the agriculture sector, they are faced with several challenges, considering that agricultural employment is characterised by low skills, low wages and subsistence, and is generally rain-fed.

Land. According to FAO, in 2011 women owned only 39% of the land, moreover in joint shares with men, while men owned 60% of the land in joint shares with women. Only 14% of the land was owned solely by women, whereas 46% of the land was owned solely by men.

Albertine Region Tracker: reporting platform for Environmental and Human Rights Defenders (EHRDs)



A MODEL FOR SUBSISTENCE FARMERS' FOOD SECURITY, OPERATIONALIZING SAFE OPERATING SPACE.

Pic by Joy Mutai

SYSTEM

A set of elements or parts that is coherently organized and inter- connected in a pattern or structure that produces a characteristic set of behaviors, often classified as its "function" or "purpose."

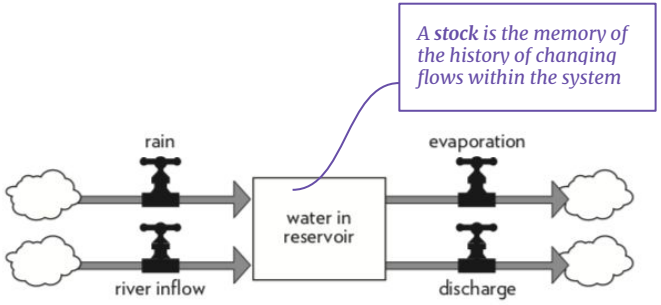


Figure 3. A stock of water in a reservoir with multiple inflows and outflows.

The volume of wood in the living trees in a forest is a stock. Its inflow is the growth of the trees. Its outflows are the natural deaths of trees and the harvest by loggers. The logging harvest flows into another stock, perhaps an inventory of lumber at a mill. Wood flows out of the inventory stock as lumber sold to customers.

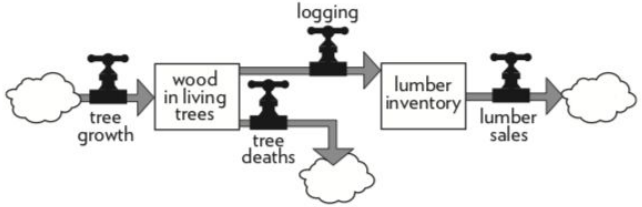


Figure 4. A stock of lumber linked to a stock of trees in a forest.

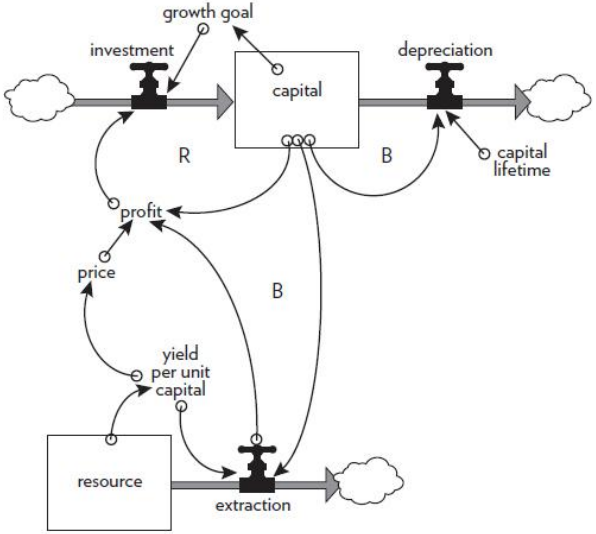
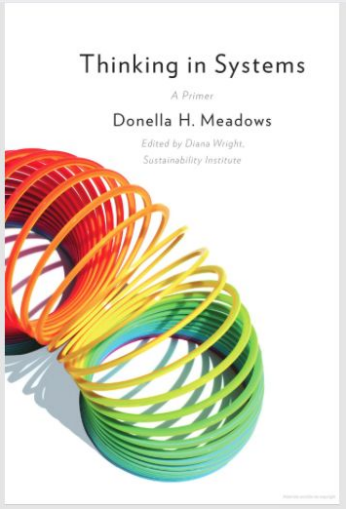


Figure 37. Economic capital, with its reinforcing growth loop constrained by a nonrenewable resource.



Thinking in Systems, Donella Meadows

Springing the System Traps §

Policy Resistance

Trap: When various actors try to pull a system state toward various goals, the result can be policy resistance. Any new policy, especially if it's effective, just pulls the system state farther from the goals of other actors and produces additional resistance, with a result that no one likes, but that everyone expends considerable effort in maintaining.

The Way Out: Let go. Bring in all the actors and use the energy formerly expended on resistance to seek out mutually satisfactory ways for all goals to be realized—or redefinitions of larger and more important goals that everyone can pull toward together.

The Tragedy of the Commons

Trap: When there is a commonly shared resource, every user benefits directly from its use, but shares the costs of its abuse with everyone else. Therefore, there is very weak feedback from the condition of the resource to the decisions of the resource users. The consequence is overuse of the resource, eroding it until it becomes unavailable to anyone.

The Way Out: Educate and exhort the users, so they understand the consequences of abusing the resource.

Drift to Low Performance

Trap: When the state of one stock is determined by trying to surpass the state of another stock—and vice versa—then there is a reinforcing feedback loop carrying the system into an arms race, a wealth race, a smear campaign, escalating loudness, escalating violence. The escalation is exponential and can lead to extremes surprisingly quickly. If nothing is done, the spiral will be stopped by someone's collapse.

The Way Out: The best way out of this trap is to avoid getting in it. If caught in an escalating system, one can refuse to compete (unilaterally disarm), or one can negotiate a new system with balancing loops to control the escalation.

Rule Beating

Trap: Rules to govern a system can lead to rule-beating—perverse behavior that gives the appearance of obeying the rules or achieving the goals, but that actually distorts the system.

The Way Out: Design, or redesign, rules to release creativity not in the direction of beating the rules, but in the direction of achieving the purpose of the rules.

Seeking the Wrong Goal

Trap: System behavior is particularly sensitive to the goals of feedback loops. If the goals—the indicators of satisfaction of the rules—are defined inaccurately or incompletely, the system may obediently work to produce a result that is not really intended or wanted.

The Way Out: Specify indicators and goals that reflect the real welfare of the system. Be especially careful not to confuse effort with result or you will end up with a system that is producing effort, not result.

§ *Thinking in Systems, Donella Meadows*

“ Modellers must not be permitted to project more certainty than their models deserve; and politicians must not be allowed to offload accountability to models of their choosing ”

1. Mind the assumptions

Assess uncertainty and sensitivity. Models are often imported from other applications, ignoring how assumptions that are reasonable in one situation can become nonsensical in another.

2. Mind the hubris

Complexity can be the enemy of relevance. Most modellers are aware that there is a trade-off between the usefulness of a model and the breadth it tries to capture.

3. Mind the framing

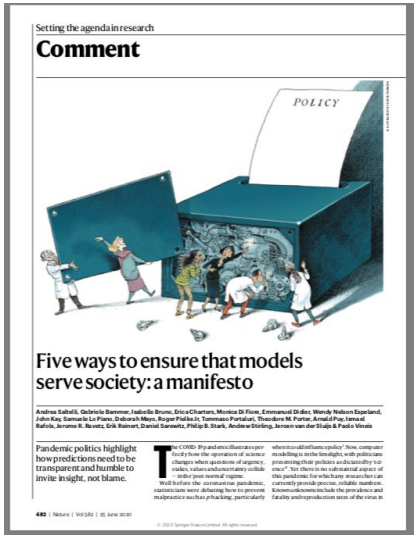
Match purpose and context. Results from models will at least partly reflect the interests, disciplinary orientations and biases of the developers. No one model can serve all purposes.

4. Mind the consequences

Quantification can backfire. Excessive regard for producing numbers can push a discipline away from being roughly right towards being precisely wrong.

5. Mind the unknowns

Acknowledge ignorance.



Setting the agenda in research

Comment

POLICY

Five ways to ensure that models serve society: a manifesto

Andrea Saltelli, Gabriele Bammer, Isabelle Bruno, Erica Charters, Monica Di Fiore, Emmanuel Didier, Wendy Nelson Espeland, John Kay, Samuele Lo Piano, Deborah Mayo, Roger Pielke Jr, Tommaso Portaluri, Theodore M. Porter, Arnald Puy, Ismael Rafols, Jerome R. Ravetz, Erik Reinert, Daniel Sarewitz, Philip B. Stark, Andrew Stirling, Jeroen van der Sluijs & Paolo Vineis

Pandemic politics highlight how predictions need to be transparent and humble to invite insight, not blame.

The COVID-19 pandemic illustrates perfectly how the operation of science changes when questions of urgency, stakes, values and uncertainty collide — in the 'post-normal' regime.

Well before the coronavirus pandemic, statisticians were debating how to prevent malpractice such as p-hacking, particularly when it is called 'science policy'. Now, computer modelling is in the limelight, with politicians presenting their policies as dictated by 'science'. Yet there is no substantial aspect of this pandemic for which any researcher can currently provide precise, reliable numbers. Known unknowns include the prevalence and fatality and reproduction rates of the virus in

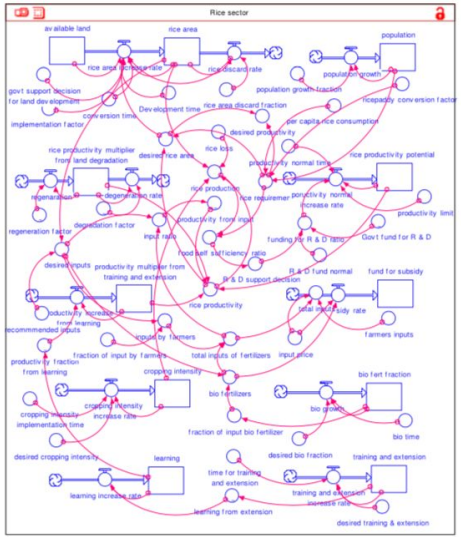
482 | Nature | Vol 582 | 25 June 2020

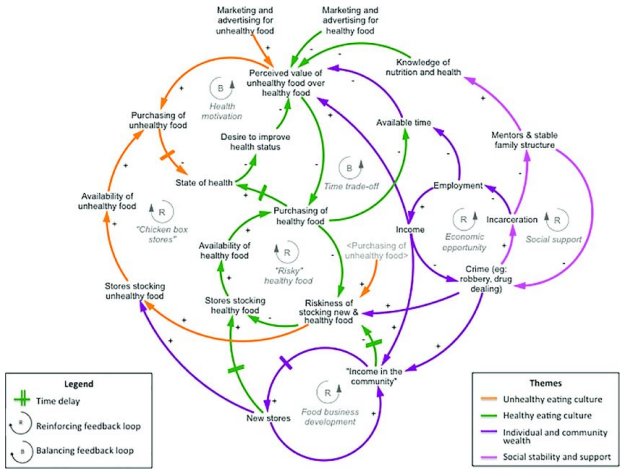
Five ways to ensure that models serve society: a manifesto

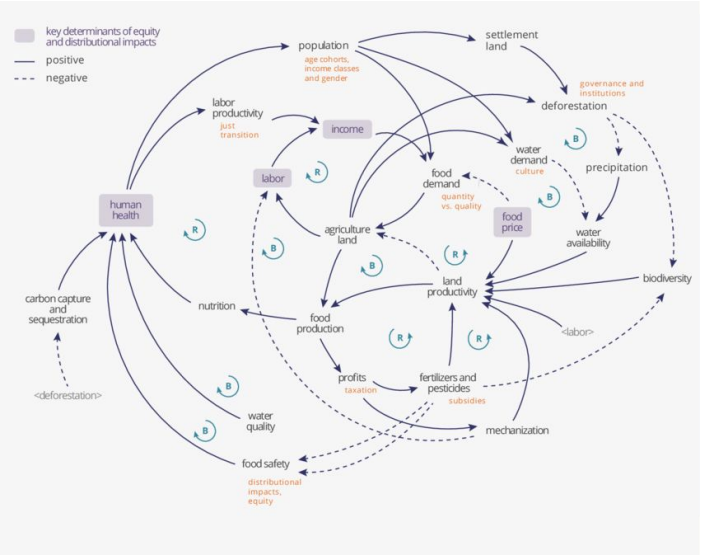
Andrea Saltelli, Gabriele Bammer, Isabelle Bruno, Erica Charters, Monica Di Fiore, Emmanuel Didier, Wendy Nelson Espeland, John Kay, Samuele Lo Piano, Deborah Mayo, Roger Pielke Jr, Tommaso Portaluri, Theodore M. Porter, Arnald Puy, Ismael Rafols, Jerome R. Ravetz, Erik Reinert, Daniel Sarewitz, Philip B. Stark, Andrew Stirling, Jeroen van der Sluijs & Paolo Vineis

Nature 582, 482-484 (2020)
doi: 10.1038/d41586-020-01812-9

MODELS FROM SYSTEM DYNAMICS





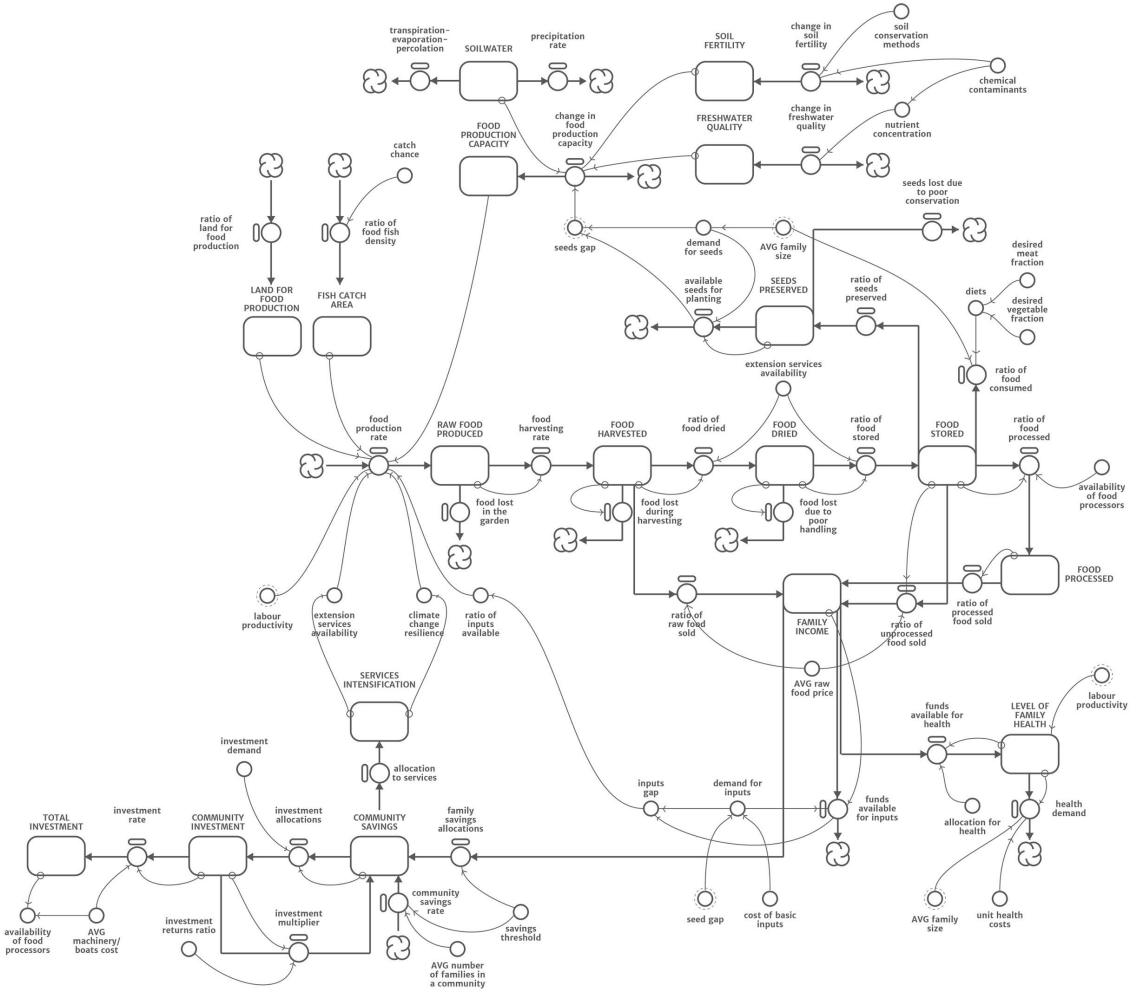


https://doi.org/10.1016/j.simpat.2014.06.001
FOOD SECURITY

https://doi.org/10.1371/journal.pone.0216985
HEALTHY FOOD ACCESS

http://teebweb.org/agrifood/wp-content/uploads/2018/11/Ch2.pdf
ECO-AGRI-FOOD

A MODEL FOR SUBSISTENCE FARMERS' FOOD SECURITY *

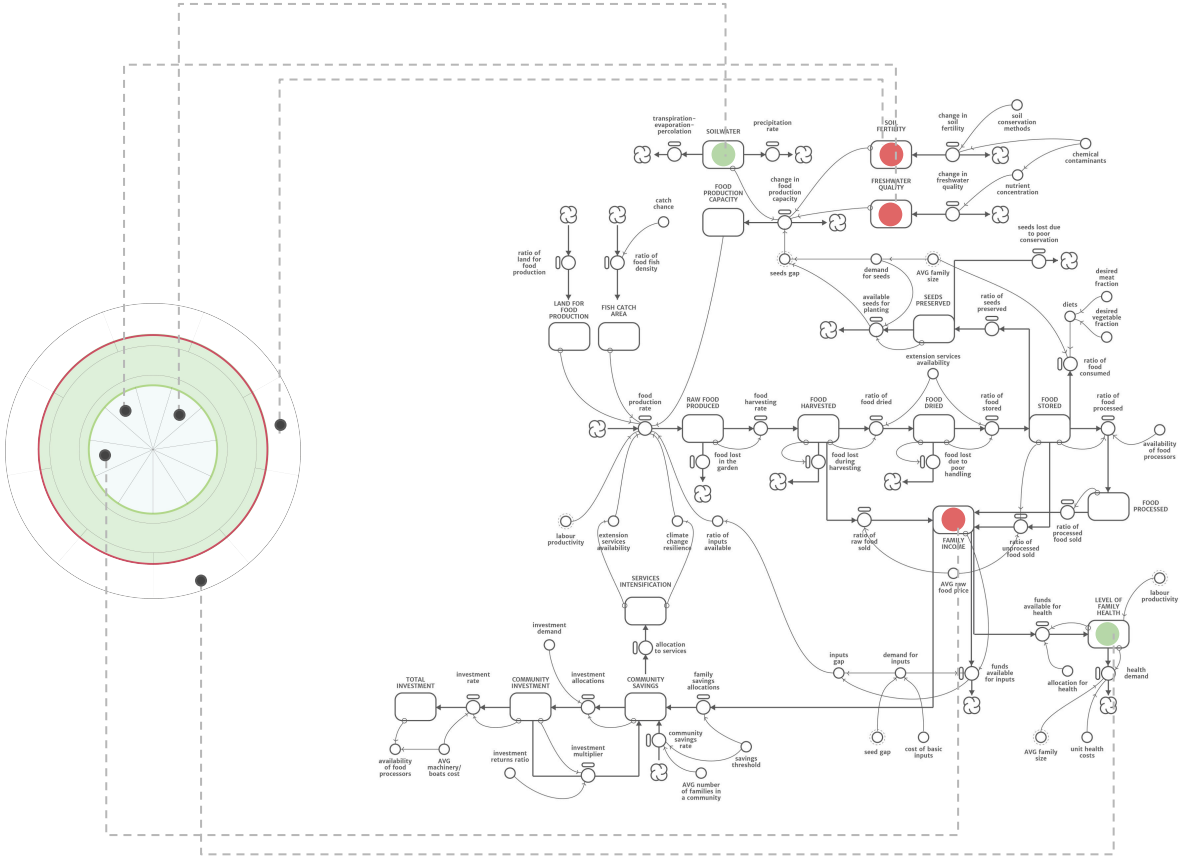


** Implementation and adaptation to Albertine Region socio-ecological system from DOI 10.4018/978-1-5225-8063-8.ch014, Oyo, B., Kalema, B.M., (2016), A System Dynamics Model for Subsistence Farmers' Food Security Resilience in Sub-Saharan Africa, International Journal of System Dynamics Applications (IJSDA), 5, issue 1, p. 17-30.*

Send a request to contato@comunidados.org for high resolution image

OPERATIONALIZE THE SAFE OPERATING SPACE THROUGH THE MODEL

In order to operationalize the model, each of the stocks of the system must fall within the safe operating space of Albertine Region social-ecological systems



FOOD SECURITY VERSUS FOOD SOVEREIGNTY

The term *food sovereignty*, coined with the aim to politicize the food and agricultural debates from below, refers to the *right of nations and peoples to control their own food systems, including their won markets, production modes, food cultures and environments.*

Food Sovereignty as a Weapon of the Weak? Rethinking the Food Question in Uganda

Giuliano Martiniello

Food Sovereignty: A Critical Dialogue International Conference September 14-15, 2013

For Miguel Altieri *, the concept of *food sovereignty* is indissolubly linked to agro-ecologically based production systems in which *ecological interactions and synergisms between biological components provide mechanisms for the system to sponsor soil fertility, productivity and crop protection.*

This approach in his view creates wider socio-cultural and ecological synergies by promoting principles of diversity, recycling, integration and re-embedding food within social processes and eco-systemic dynamics.

* *Altieri, M. (2010). Scaling Up Agro-Ecological Approaches for Food Sovereignty in Latin America. In Wittman H., Desmarais, A. & Wiebe, N. 2010 Food Sovereignty: Reconnecting Food, Nature and Community. Oakland, CA: Food First. pp.120-133.*

SUBSISTENCE FARMING AND FOOD SOVEREIGNTY

Are subsistence farming practices need to be strengthened or eradicated?

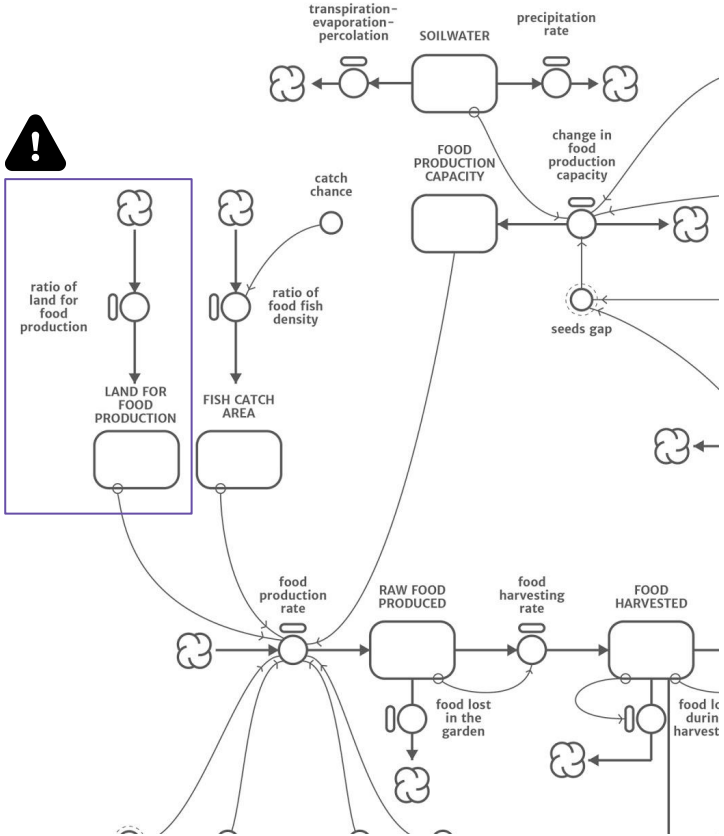
***Food sovereignty* in Uganda requires**

> integration of a nation's agriculture policy with other parallel priority agendas focusing on natural conservation, biodiversity, climate resilience, and efforts to combat rural poverty;
> strengthen farmers' vocational education;
> preserve a wide range of open pollinated seed varieties, which carry high genetic diversity, making them particularly climate resistant, and appropriate for disease resistance breeding.

LAND OWNERSHIP AND TENURESHIP

CRITICALITY FROM THE MODEL

In recent years sensitivity on land ownership and tenureship has grown a lot through: ethnic conflicts that emerged over contentious boundary definitions (such as the Apaa Land Conflict in Adjumani district, Uganda); the deployment of wildlife conservation and economic development rhetoric from Governments, investors and international agencies to justify large-scale land grabs against rural and indigenous communities; large-scale international projects that involve oil extraction and processing and other raw materials mining, excluding communities from the participatory mechanisms and especially by using compensation frameworks that do not directly benefit these communities (such as the Tilenga project in Buliisa district, Uganda); social emergencies and humanitarian crises (such as the construction of refugee camps in Arua, Yumbe, and Adjumani districts, Uganda).
This has led to an increase in land rights abuses resulting in mass evictions, along with human rights abuses (physical attacks including killings, imprisonment, beatings, professional limitation, and so on) and environmental crimes including deforestation in protected areas and trafficking in wild animals. Finally, this results in a land fragmentation that constrains some farmers to leave production looking for alternative income opportunities.



LAND OWNERSHIP AND TENURESHIP

Land title assignment and land right monitoring strategy

Improve the use and application of low-cost geospatial technologies to map accurately land plots and register land rights. Most of the land at the moment is not mapped and there is no land registry. Conflicts arise from the lack of assignment of land titles and from the difficulty of establishing land tenureship (*Mailo*, freehold, leasehold, customary). Environmental and Human Rights Defenders (EHRDs) organizations adopt these processes with an inclusive approach using an emergency criteria and starting from a plan that identifies the most sensitive areas. The goal is to drop below $20 for every land title registered.

EHRDs organizations are equipped with an activation plan. Monitoring land rights in the whole territory, considering its extension and the number of people employed, is not possible. This plan establishes the intervention criteria and in case of a significant incident activates a rapid response mechanism.

Pic by Tom Ogwang

EXTREME EVENTS

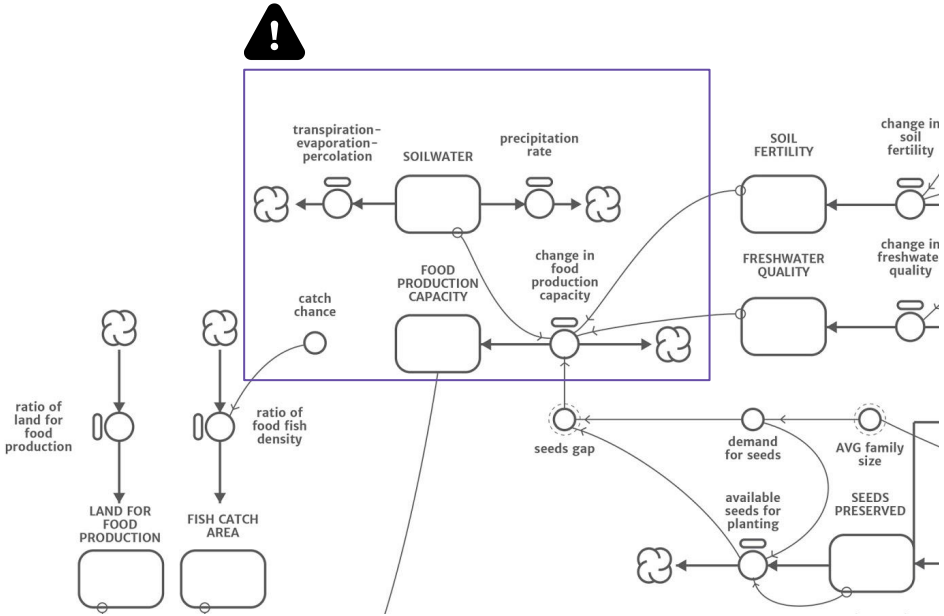
Most natural disasters that occur in Uganda are related to extreme weather events. Ongoing drought and broader problems with rain were raised consistently. The onset of the rains can shift by 15 to 30 days, and season duration by 20 to 40 days. A potential increase in rainfall is possible in the December-February dry season. Such an increase would have an impact on agriculture, especially with post-harvest activities such as drying and storage. In addition, there is a lack of precipitation during planting season and potential for an increase in the frequency of extreme events.

Adaptation mechanism. Urgency on implementing services to support farmers through ICT in order to send seasonal and short-term weather forecasts, agricultural advisories, weekly livestock and crop market information and guidance on low-cost rainwater harvesting techniques and drought and flood coping mechanisms via mobile-phone technology and interactive radio*. As a result, farmers are able to minimize crop loss and damage, making them more resilient to climate change.

* *E.g. The Enabling Farmers to Adapt to Climate Change project, from FHI 360, Healthnet Uganda*

Pic by S. Olupot

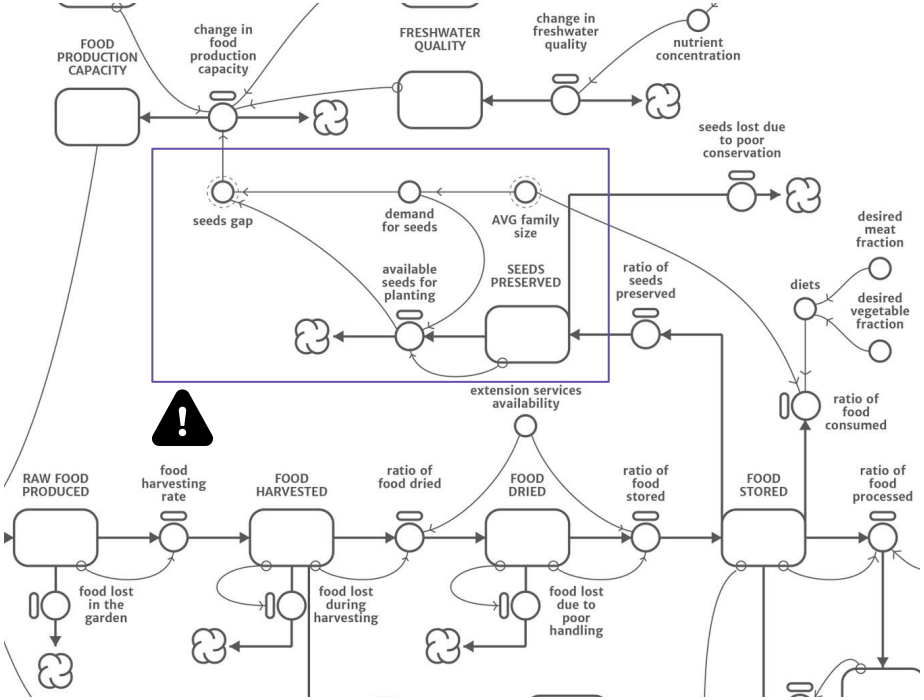
CRITICALITY FROM THE MODEL



SEEDS GAP

It is increasingly becoming difficult for subsistence households to preserve food and seeds for future needs, except for resilient households.

<u>Seed banking</u>. Seed banking services are provided by a seed bank which is a community based organization that also offers agro-processing, agricultural produce marketing and extension services. As such, the seed bank buys harvested crops from farmers at competitive prices, processes them and sells the processed crops for profit, while maintaining a threshold amount of money that is converted into improved seeds and other farm inputs which farmers access during the planting season.



Oyo, B. (2013). A System Dynamics Analysis of seed banking effectiveness for Empowerment of Small Holder Farmers. Paper presented at the IST-Africa Conference. Nairobi, Kenya

Oyo, B., Kalema, B.M. (2016). A System Dynamics Model for Subsistence Farmers' Food Security Resilience in Sub-Saharan Africa. International Journal of System Dynamics Applications (IJSDA), IGI Global, vol. 5(1), pages 17-30, January.

COMMUNITY SELF-EMPOWERMENT PROGRAMMES

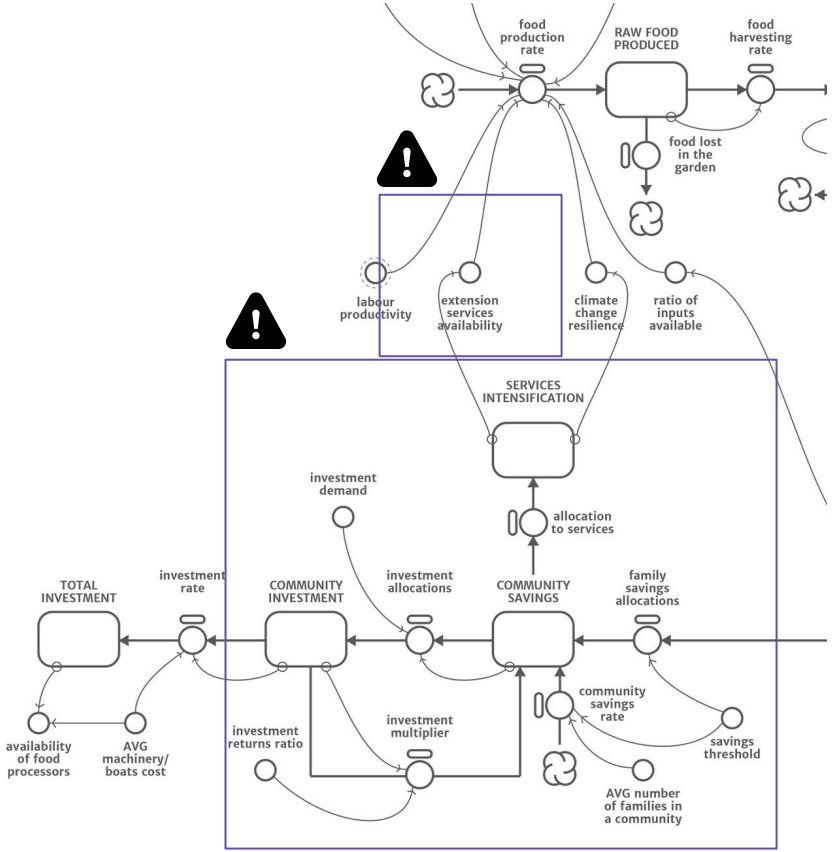
An increase in the number of households belonging to farmer groups is observed within the communities . Farmer groups need to pull resources for self-empowerment through improved seeds, small scale field machinery, and small scale food processing.

EXTENSION SERVICES

In 2015, the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) spearheaded the development of an integrated, coordinated and harmonised public extension system: the *Single Spine* extension service delivery system. This system, which core component is farmer empowerment, is not directly benefiting subsistence farming.

Since the number of farmers seeking agricultural information increased significantly, subsistence farming support programs require promoting peer-to peer learning creating and improving linkages with CSOs and NGOs that are already engaged in the delivery of extension services.

CRITICALITY FROM THE MODEL

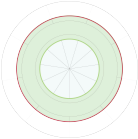


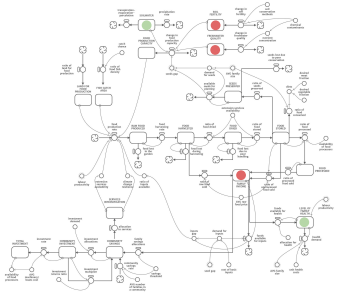
CONCLUSION

Operationalize the *safe operating space* of the Albertine Region socio-ecological system means unravelling the dynamic relationships between social and ecological systems, defining environmental limits and feedback from social system on the boundaries of ecological system.

Using system dynamics, it is possible to model the regional socio-ecological system to generate scenarios and determine whether they fall within the *safe operating space*. This study is focused on the subsistence farming regional system, with the following aims:

- define a rapid response mechanism for food security crisis at regional / district levels;
- evaluate the impact of public and private initiatives that interact with subsistence farming system;
- determine how CSOs and NGOs can implement public policy;
- evaluate the effect of political choices and long-term development strategy (such as food sovereignty).





Environmental Defenders (ED) is a Environmental and Human Rights Defenders (EHRDs) organization that provide capacity-building support to human rights and environmental defenders in Albertine Region. ED focus on protection of the natural environment, people and wildlife that depend upon it, helping marginalized and indigenous communities make a sustainable living and safeguard their resources. ED also provides digital and physical security support, advocacy, legal support, emergency legal action to environmental activists, many of them women activists who continue to be the target of brutalities ranging from forced evictions, land grabbing, extrajudicial surveillance, arrests, and intimidation.

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