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The Flood Resilience Systems Framework: From Concept to Application

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Appendix A. Flood Resilience Game: Description

The Flood Resilience Game is an educational game that allows players to experience, explore, and learn about the flood risk and resilience of communities in river valleys. The game is designed to help participants - such as NGO staff working on flood-focused programs - to identify novel policies and strategies which improve flood resilience.

The game is set in a community living in an area exposed to floods, occurring with different severity. Players take roles of members of different citizen groups (workers, farmers, entrepreneur, financial services agent), local government and water board officials. Players' decisions and actions focus on what happens before flood, and impact their outcomes following the flood.

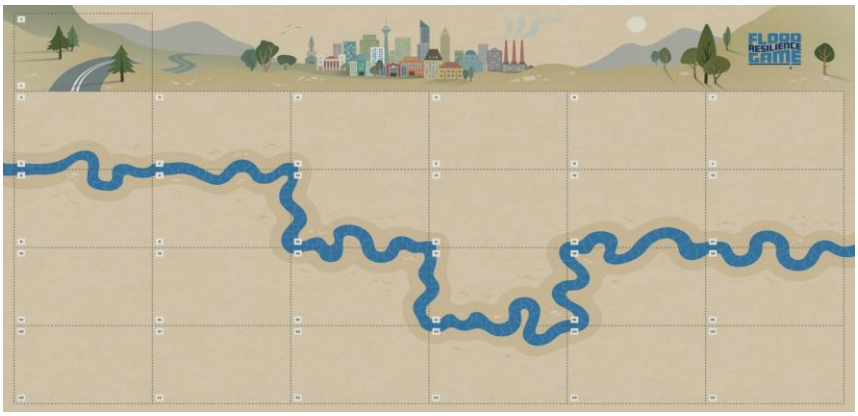

Figure 8. Main board represents the map of the area.

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1 ROAD					
2	3	4 Entrepreneur House	5	6	7
8 Farmer 1 House	9 Worker 1 House	10 Entrepreneur Assets	11 Worker 2 House	12 Food Market	13 Financial Services House
14	15 Farmer 1 Farm	16 Irrigation System	17 Farmer 2 Farm	18 Hospital	19 Power Station
20	21	22 Water Supply	23 Farmer 2 House	24 School	25

Figure 9. Risk map in the game with different risk levels (white parcels - lowest risk, red parcels - highest risk).

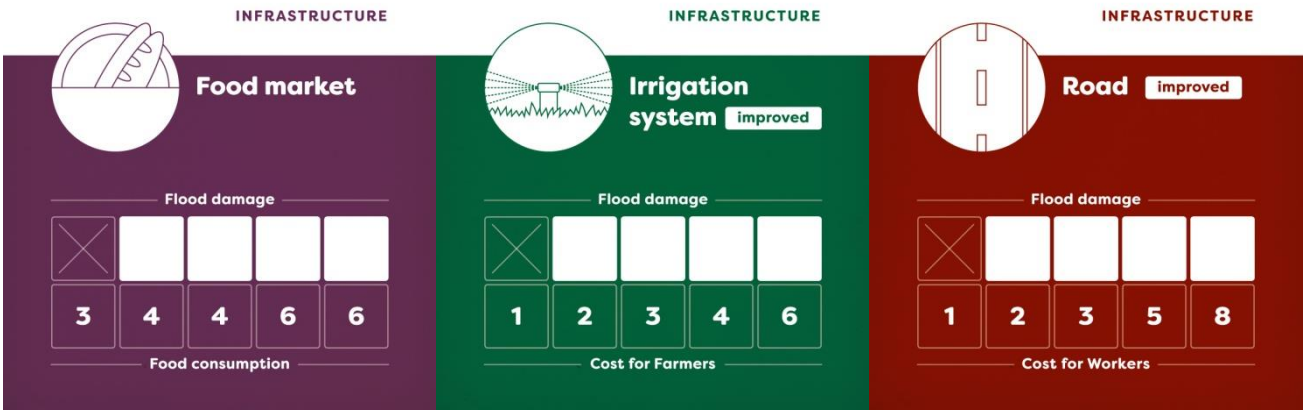

Figure 10. Examples of infrastructure cards.
The condition of particular infrastructure buildings determines the prices of resources and services, and the costs of gaining income.

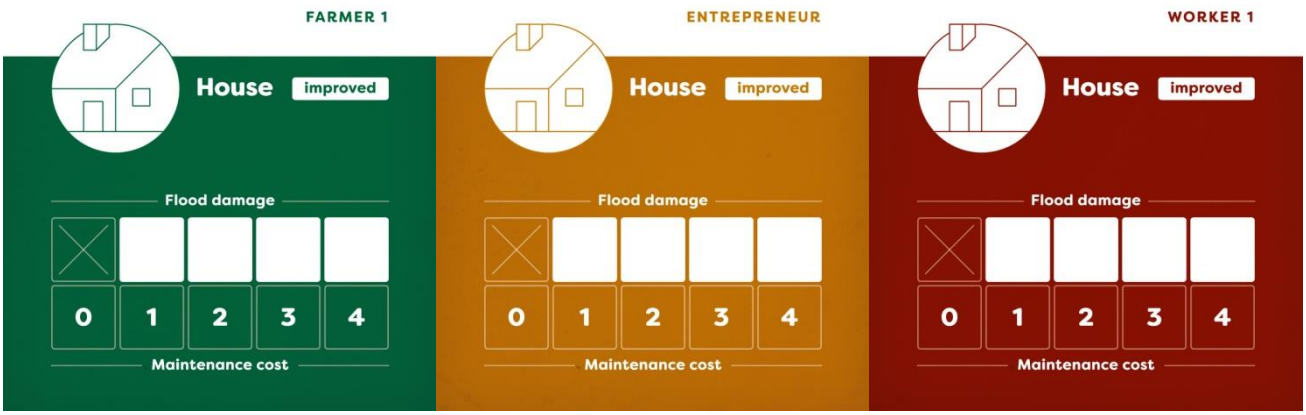

Figure 11. Examples of house cards.
The condition of player's house has impact on her income due to the maintenance costs.

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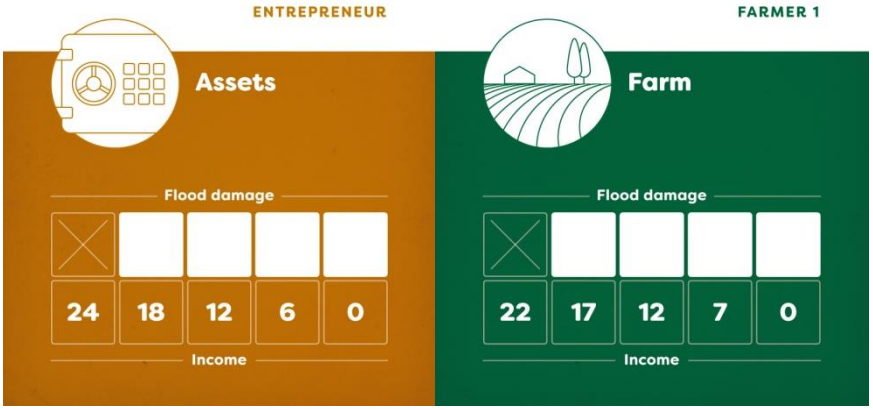

Figure 12. Examples of asset cards. Some players use assets to earn income. The condition of these assets has impact on how much they earn.

Figure 13. Examples of contract cards.
Some players have contracts that guarantee their fixed income.

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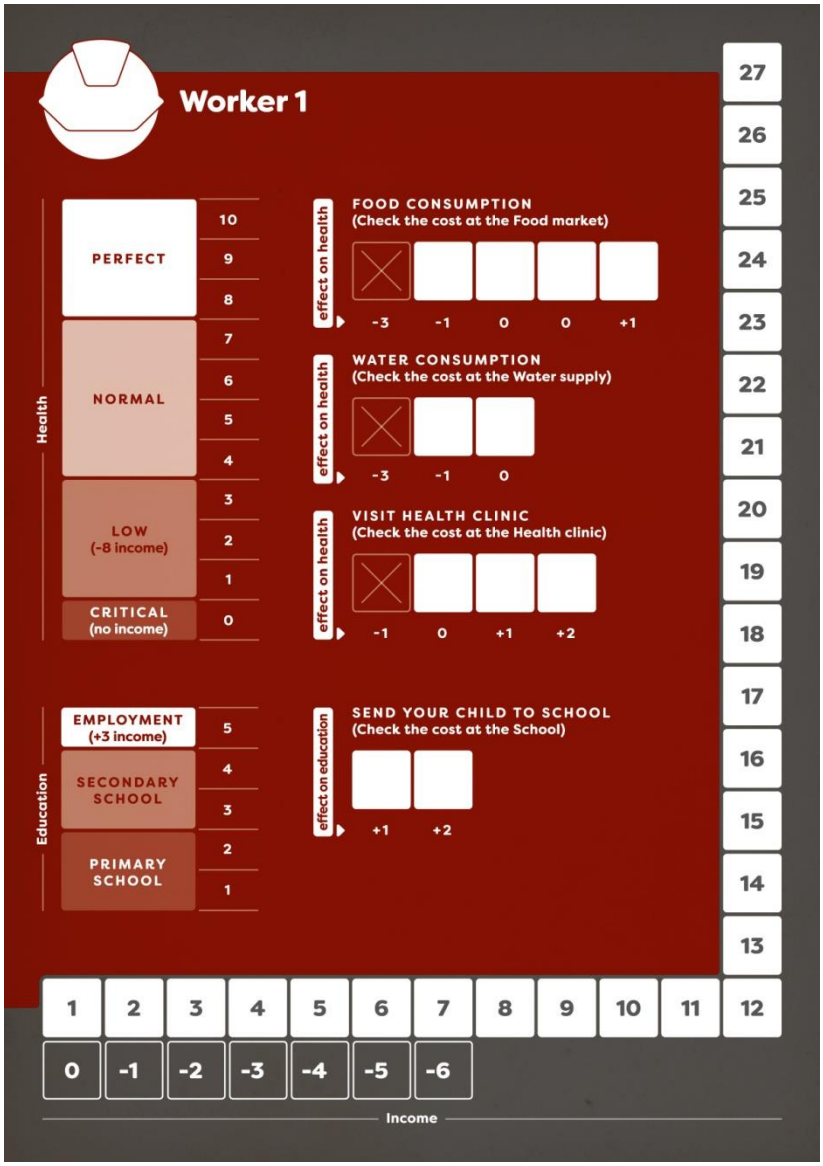

Figure 14. An example of a player board with the indicators (income, health, education) and the needs fulfillment (food & water consumption, health clinic visits, sending child to school).

Figure 15. Diploma cards are granted for completing an education level.

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Figure 16. Examples of flood accident cards. Random citizen players receive them during the flood.

Figure 17. Examples of strike cards. Players who play as Local government and Water board risk strikes when they cut earnings of infrastructure employees.

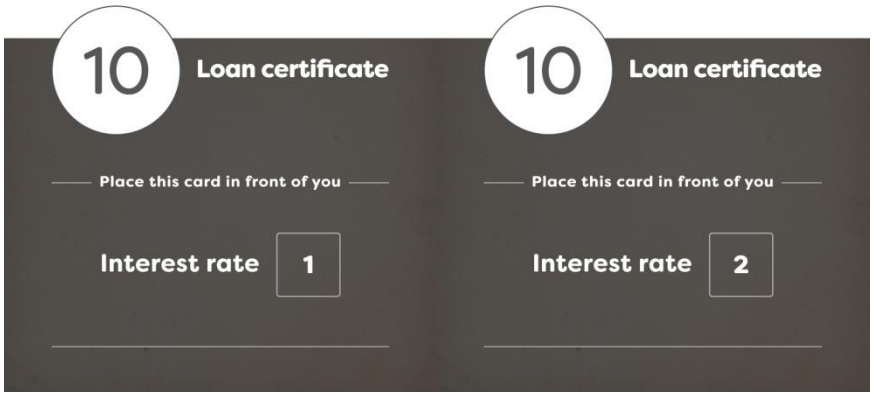

Figure 11. Loan cards that can be obtained from the Financial Services by other players.

Each round the players can learn and perform specific Flood Resilience Actions, based on the Zurich Flood Resilience Measurement tool. Flood Resilience Actions increase flood resilience for specific citizens or the whole community.

Table 1. Actions that can be performed by players. Actions are introduced gradually, with new actions coming each round.

Citizens	
Action in the game	*Description*
Learn emergency response	Citizens who learn emergency response are be partially protected against the impact of flood accidents on their health.
Plan emergency home/asset protection	Performing this action before flood decreases slightly flood damage of private houses or assets. Action has to be repeated each round for its effect to continue.

Remove damage from your house or assets	In the Coping phase of the game, players can repair some part of the damage to avoid losses in the next round. In the next round after the flood, players can repair all the damage done by the disaster to their houses and assets
Save actions units for later	Making savings is highlighted as one of the actions that players can take in order to prepare for upcoming disaster.
Home/asset retrofitting & adaptation	Performing this action before flood decreases flood damage of private houses or assets. Action has to be done only once.
Mutual support	Repairing flood damage costs less when 2 or more citizens work together (pull their action units together to perform action).
Improve your house	Improved houses generate less costs. Damaged house cannot be improved - the damage must be repaired first.
Learn how to use Early Warning System	If Water board has created an Early Warning System (EWS), citizens can learn how to use it. The knowledge of how to use the EWS increases the effectiveness of other actions: emergency response and plan emergency home/asset protection.
Home or business relocation	Players can move their home or assets to another (empty) parcel.
Action in the game	*Description*
Plan emergency infrastructure protection	Performing this action before flood decreases slightly flood damage of public infrastructure. Action has to be repeated each round for its effect to continue.
Remove damage from infrastructure	In the Coping phase of the game, Local government and Water board can repair some part of the infrastructural damage to avoid losses in the next round. In the next round after the flood, players can repair all the damage done by the disaster to the infrastructure.
Save actions units for later	Making savings is highlighted as one of the actions that players can take in order to prepare for upcoming disaster.
Support the citizens	Local government can financially support the citizens in performing actions. The government decides what are the detailed conditions of support.
Inform citizens about risk areas	Water board can use their risk maps to inform citizens about the flood risk on the plots they occupy. The decision on how this information will be given to the citizens is in the Water board's gesture.
Permanent infrastructure protection works	Performing this action before flood decreases flood damage of public infrastructure. Action has to be done only once.
Establish flood reconstruction budget	Local government can establish a special budget that other players can contribute to. Using the funds from this budget decreases the costs of infrastructure repair.

Improve infrastructure	Improved infrastructure makes services cheaper for citizens. Damaged infrastructure cannot be improved - the damage must be repaired first.
Develop Early Warning System	Water board can develop Early Warning System that increases the effectiveness of actions depending on the early access to information about an upcoming flood.
Learn how to use Early Warning System	If Water board has created an Early Warning System (EWS), Local government can learn how to use it. The knowledge of how to use the EWS increases the effectiveness of the plan emergency infrastructure protection action.
Buy insurance	Having insurance covers the full costs of removing infrastructure damage.
Infrastructure relocation	Local government and Water board can move infrastructure cards to another (empty) parcel.
Invest in reforestation upstream	Local government can use upstream parcels for reforestation efforts that decrease the overall flood damage in the area. This action demands relocating some of the citizens' houses or assets.
Create a flood retention pond scheme	Water board can use specific parcels for creating flood retention pond that decrease the overall flood damage in the area. This action demands relocating some of the citizens' houses or assets.

The game is played over 4 rounds. Each round represents a period between floods - one or more years in real life. At the end of each round a flood occurs. Players don't know how severe the flood will be before it occurs. After the flood, they receive information about the flood severity on each parcel on the map. The last round represents a longer period - corresponding to 10-25 years in real life. At the end participants reflect on their final results.

The direct interactions between players create a rich experience that can be discussed, analyzed and lead to concrete conclusions and actions. This allows players to explore vulnerabilities and capacities leading to an advanced understanding of interdependencies and the potential for working together.

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Appendix B. Model Equations

Method

The model was developed using the Berkeley Madonna software (https://www.berkeleymadonna.com/)

Model uses Difference Equations with the following notation:
Setting initial conditions:
INIT x = expression
Updating stock variable to the next time step:
NEXT x = expression
The value of x is replaced by the value of the expression on the right-hand side. Therefore, to implement a typical finite difference equation where some value f(x) is added to the current value of x, the following form is used:
NEXT x = x + f(x)
Although different equations are used the modeling philosophy is based on system dynamics modeling with an emphasis on representing actual decision making processes instead of ideal (optimized) allocations.

Model steps (iteration)

- Household budget allocation
- Calculating basic needs (Survival Threshold): water, food, energy
- Calculating budget necessary for sustaining livelihoods (Livelihoods Protection Threshold)
- Calculating budget allocations for other household priorities:
- Asset damage reconstruction
- Maintain access to human capital services
- Additional water food and energy
- Non-essential goods & services
- Asset protection
- Saving
- Calculating interest cost (in case of debt)
- Updating household budget
- Updating state of protection infrastructure / capacity
- Calculating hazard and damage
- Updating state of income assets
- Updating human capital

Abbreviations

A_ : Agent's (Household) Property (Variable or Parameter)
P : Parameter
Av : Available
UC : Unit Costs
UI: Unit Income
W: Weight
D : Decision, Decided
B : Budget
BP: Budget Priority
FEW: Food, Water, Energy
///// - denotes comments in the model equations below

Variables

Stocks:

A_IncomeAssets

Assets belonging to a household that lead to generating income.

A_Budget

Household budget

A_AssetProtection

The level of protection measures for assets that prevent damage for lower exposures

A_HumanCapital

The level of health and education (including children). Lack of spending in this area leads to long-term negative consequences

Flows:

A_Income

Household income depending on the state of income (livelihood) assets and the extent to which the costs of sustaining livelihoods (e.g. regular purchases of seeds, fertilizer, veterinary drugs, etc. or transport costs for distant jobs) has been covered.

A_Costs

Sum of all expenditure calculated in a specific sequence (starting from basic needs) with a specific spending priorities.

A_AssetDepreciation

Standard way of representing the need for a regular infrastructure maintenance

A_AssetDamage

Damage inflicted by the hazard

A_AssetReconstruction

Improving the state of the asset to increase its income generating capacity. Needed both due to depreciation and asset damage by the hazard

AD_AssetProtection

Increases asset protection from hazards

A_AssetProtectionDepreciation

Decrease in asset protection due to time and wearing out – maintenance needed.

AD_AccessToHCServices

Increase in human capital from using specific services (health, education etc.)

A_HCDissipation

Represents the need for investment in human capital for example when new children are born.

Important Parameters that need to be estimated from the real-world information:

The household budget is allocated first to basic needs (water, food, energy) and then to sustaining income. In the next step it is shared, using relative strength of priority parameters, between the following budget positions:

Asset Reconstruction:

ABP_AssetReconstruction = APBP_AssetReconstruction * AssetDamageEffect

APBP_AssetReconstruction = 1

AP_AssetReconstructionPriority = 1

AssetDamageEffect = 1 + A_AssetDamage * AP_AssetReconstructionPriority

///// The Asset reconstruction priority is calculated as a product of the basic parameter (APBP_AssetReconstruction) and the multiplier (AssetDamageEffect). The multiplier increases the priority

proportional to the current asset damage. The parameter AP_AssetReconstructionPriority further controls the strength of this effect.

Additional food, water and energy (beyond basic needs)
ABP_FWE = 3
///// Budget priority parameter for food, water and energy needs that go beyond the basic needs. It contribute to achieving a minimum locally acceptable standard of living (e.g. purchase of coffee/tea, etc.)

Access to human capital services
ABP_AccessToHCServices = 2
///// Budget priority parameter for maintaining access to basic services (e.g. routine medical and schooling expenses)

Non-essential goods and services
ABP_NonEssentialGS = 2
////// Budget priority parameter for non-essential goods and services. They contribute to achieving a minimum locally acceptable standard of living (e.g. purchase of basic clothing, etc.)

Asset protection measures from hazards
ABP_AssetProtection = APBP_AssetProtection * NeedForProtectionEffect
APBP_AssetProtection = 2
NeedForProtectionEffect = (AP_MaxAssetProtection – A_AssetProtection)/AP_MaxAssetProtection
///// The Asset protection priority is calculated as a product of the basic parameter APBP_AssetProtection and the multiplier NeedForProtectionEffect, that is proportional to the gap between the current state and the possible protection.

Financial Saving
ABP_Saving = 1
///// Budget priority for financial savings.

Sum of priority parameters for normalization
ABP_TOTAL = ABP_AssetReconstruction + ABP_FWE + ABP_AccessToHCServices + ABP_NonEssentialGS + ABP_AssetProtection + ABP_Saving
///// Sum of priority parameters is calculated in order to normalize (i.e. express as percentages of the available budget the remains after covering necessities) the parameters and calculate the actual budget sums for different positions.

Equations

///// Time Bounds
STARTTIME = 0
STOPTIME=20
DT = 1

///// Initial Values for stock variables
INIT A_IncomeAssets = 10
INIT A_Budget = A_IncomeAssets * AUI_Assets
INIT A_AssetProtection = 0
INIT A_HumanCapital = 9

///// Parameters defining ranges for some variables
AP_MaxIncomeAssets = 15
AP_AssetExposure = 2; [1,5]
AP_AssetMaxExposure = 5
AP_MaxAssetProtection = 5

///// Household income calculation
A_Income = IF A_IncomeAssets > 0 THEN A_IncomeAssets * AUI_Assets *
(ADB_SustainingLivelihoods / ADB_SustainingLivelihoods_Needed) ELSE 0
AUI_Assets = 1

////////////////// Household Budget Allocation Start

///// Basic needs: water, energy and food – first priority
AP_FWEBasicNeeds = 3
ADB_FWE1 = AP_FWEBasicNeeds * AUC_FWE
AvBudget1 = MAX(A_Budget – ADB_FWE1, 0)
CreditForBasicNeeds = MAX(ADB_FWE1 – A_Budget, 0)

///// Costs of sustaining livelihoods – second priority
ADB_SustainingLivelihoods_Needed = A_IncomeAssets * A_CostPerIncomeAsset
A_CostPerIncomeAsset = 0.1
;ADB_SustainingLivelihoods = MIN(AvBudget1, ADB_SustainingLivelihoods_Needed)
ADB_SustainingLivelihoods = ADB_SustainingLivelihoods_Needed
AvBudget2 = MAX(AvBudget1 – ADB_SustainingLivelihoods, 0)
CreditForSustainingLivelihoods = MAX(ADB_SustainingLivelihoods – AvBudget1, 0)

///// Partial debt payment – third priority
IndicatedDebtPayment = MAX(A_Debt * DebtPaymentPercentage + AC_Interest, MIN(MinDebtTranche,
A_Debt))
ADB_DebtPayment = MIN(AvBudget2, IndicatedDebtPayment)
AvBudget3 = AvBudget2 – ADB_DebtPayment
DebtPaymentPercentage = 0.05
MinDebtTranche = 0.5
AC_Interest = A_Debt * AP_InterestRate
AP_InterestRate = 0

///// Relative budget priorities for other items on a household budget calculated in parallel using priority parameters (that can be modified)
ABP_AssetReconstruction = APBP_AssetReconstruction * AssetDamageEffect
APBP_AssetReconstruction = 1
CreditForAssetReconstruction = A_AssetDamage * CreditAvailablePerAssetDamage
CreditAvailablePerAssetDamage = 1
AssetDamageEffect = 1 + A_AssetDamage * AP_AssetReconstructionPriority
AP_AssetReconstructionPriority = 1
ABP_FWE = 3
ABP_AccessToHCServices = 2
ABP_NonEssentialGS = 2
ABP_AssetProtection = APBP_AssetProtection * NeedForProtectionEffect
APBP_AssetProtection = 2

NeedForProtectionEffect = (AP_MaxAssetProtection – A_AssetProtection)/AP_MaxAssetProtection
ABP_Saving = IF A_Debt > APBP_Saving THEN 1 ELSE 0
APBP_Saving = 1
ABP_TOTAL = ABP_AssetReconstruction + ABP_FWE + ABP_AccessToHCServices + ABP_NonEssentialGS + ABP_AssetProtection + ABP_Saving

///// Actual budget allocations using the above priorities
ADB_AssetReconstruction = AvBudget3 * ABP_AssetReconstruction/ABP_TOTAL + CreditForAssetRecon-struction
ADB_AccessToHCServices = AvBudget3 * ABP_AccessToHCServices/ABP_TOTAL
ADB_NonEssentialGS = AvBudget3 * ABP_NonEssentialGS/ABP_TOTAL
ADB_AssetProtection = AvBudget3 * ABP_AssetProtection/ABP_TOTAL
ADB_Saving = AvBudget3 * ABP_Saving/ABP_TOTAL
ADB_FWE2 = AvBudget3 * ABP_FWE/ABP_TOTAL
ADB_FWE = ADB_FWE1 + ADB_FWE2

////////////////// Household Budget Allocation End

///// Calculating effects of budget allocation using unit costs for different budget positions
AD_AssetReconstruction = ADB_AssetReconstruction /AUC_AssetReconstruction
AD_AccessToHCServices = ADB_AccessToHCServices/AUC_AccessToHCServices
AD_SustainingLivelihoods = ADB_SustainingLivelihoods/AUC_SustainingLivelihoods
AD_NonEssentialGS = ADB_NonEssentialGS/AUC_NonEssentialGS
AD_AssetProtection = ADB_AssetProtection/AUC_AssetProtection
AD_FWE = ADB_FWE/AUC_FWE
AD_Saving = ADB_Saving

AUC_AccessToHCServices = 2
AUC_AssetReconstruction = 3
AUC_SustainingLivelihoods = 1
AUC_NonEssentialGS = 1
AUC_AssetProtection = 3
AUC_FWE = 1

///// Calculating total costs
A_Costs = ADB_FWE + ADB_DebtPayment + ADB_AssetReconstruction + ADB_SustainingLivelihoods + ADB_AssetProtection + ADB_AccessToHCServices + ADB_NonEssentialGS
A_BudgetDeficit = -MIN(A_Budget + A_Income – A_Costs, 0)

///// Budget and debt stocks update
BudgetChange = MAX(A_Income – A_Costs, 0)
NEXT A_Budget = MAX(A_Budget + A_Income – A_Costs, 0)
NEXT A_Debt = A_Debt + CreditForBasicNeeds + CreditForSustainingLivelihoods + CreditForAssetRecon-struction + AC_Interest – ADB_DebtPayment

///// Asset Protection stock update including depreciation and investments in protection
A_AssetProtectionDepreciation = A_AssetProtection*AP_AssetProtectionDepreciationFraction
AP_AssetProtectionDepreciationFraction = 0.05
NEXT A_AssetProtection = MIN(A_AssetProtection + AD_AssetProtection – A_AssetProtectionDepreciation, AP_MaxAssetProtection)

///// Hazard calculations
Hazard = ABS(NORMAL(0,H_Var)) * HazardEvent
HazardEvent = IF RANDOM(0,1) < H_PROB THEN 1 ELSE 0
H_PROB = 0.1
H_Var = 5
H_dis = 1
HFREQ = 5

///// Asset damage calculations due to the hazard
A_AssetDamage = MIN(MAX(Hazard – (AP_AssetMaxExposure – AP_AssetExposure) – A_AssetProtection, 0), A_IncomeAssets-A_AssetDepreciation)
A_AssetDepreciation = A_IncomeAssets * AP_AssetDepreciationFraction
AP_AssetDepreciationFraction = 0.05
A_AssetReconstruction = AD_AssetReconstruction * (1 – (A_IncomeAssets/AP_MaxIncomeAssets)^AP_IAE)
NEXT A_IncomeAssets = A_IncomeAssets – A_AssetDepreciation – A_AssetDamage + A_AssetReconstruction
AP_IAE = 5

///// Update of the human capital stock
NEXT A_HumanCapital = A_HumanCapital – A_HCDissipation + AD_AccessToHCServices
A_HCDissipation = A_HumanCapital * AP_HCDissipationFraction
AP_HCDissipationFraction = 0.1

///// Living standard
LivingStandard = AD_FWE + AD_NonEssentialGS

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Appendix C. Table listing the variables in *Figure 3. Conceptual model underlying the current and future more detailed models of community flood resilience*

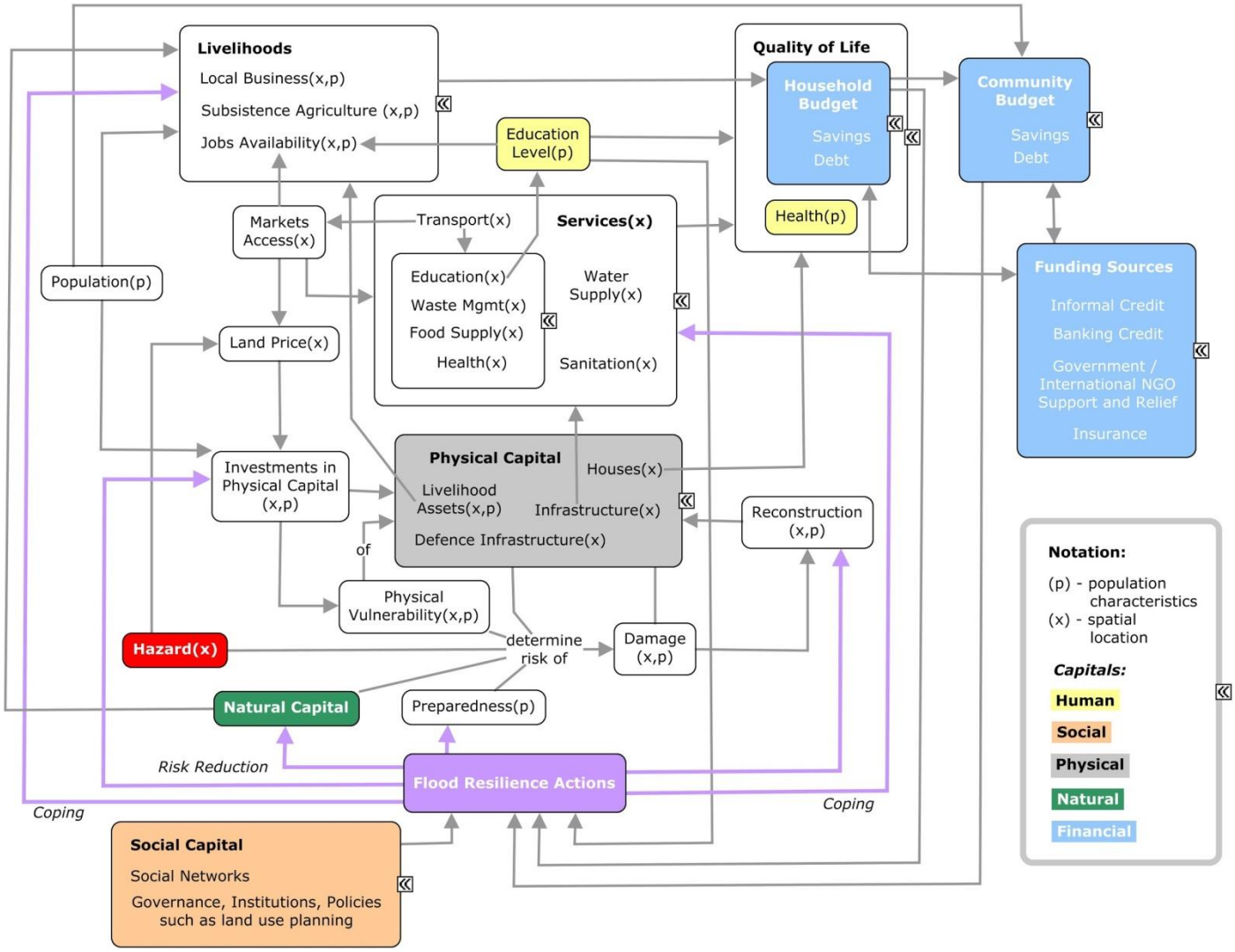

Figure 3. Conceptual model underlying the current and future more detailed models of community flood resilience. Source: authors.

Table 2. Variables in *Figure 3. Conceptual model underlying the current and future more detailed models of community flood resilience.*

Group	**Variable**	**Description**
Livelihoods	Local Business (x,p)	Incoming-generating entrepreneurial venture (formal or informal sector).
	Subsistence Agriculture (x,p)	Contribution of household-produced, non-marketized agricultural products to household well-being.
	Jobs Availability (x,p)	Access to income-generating employment outside the home (formal or informal sector).
Household Budget / Community Budget	Savings	Savings (considered on both household and community level) in different forms: cash, bank accounts, or non-crucial assets that can be quickly sold in time of need (DFID 2001).
	Debt	Debt considered on both household and community level, coming from both formal and informal crediting.
Funding Sources	Informal Credit	Loans between community members that can be used to obtain financial resources when formal options are not available or preferred. It may have liabilities attached, depending on the financial arrangement between the community members.
	Banking Credit Microfinance	Availability and quick access to affordable credits and microcredits for the community members
	Government / International NGO Support and Relief	National-level and international grant and loan programs for resilience focused community development and disaster risk management activities. Post-disaster contingency and reconstruction funds (national-level and international grants and loans). National-level and international post-disaster donations.
	Insurance	Availability of insurance options for both households and public infrastructure
Services	Transport (x)	Availability of transport options (public and private commuting services, private cars)
	Education (x)	Access to different levels of education, the ability of a household to actually send the child to school
	Waste Management (x)	Availability of waste management services
	Food Supply (x)	Access to food markets and convenience stores, supply continuity
	Health (x)	Access to hospitals and health clinics, the quality of health services
	Sanitation (x)	Availability of sanitation services (drinking water and

		sewage treatment)
	Water Supply (x)	Access to water for households, agriculture, industry, and business
Physical Capital	Livelihood Assets (x,p)	Assets used to generate income (cars, agricultural machinery, business equipment, etc.)
	Houses (x)	The condition of buildings and implementation of flood preparedness measures (retrofitting, etc.)
	Infrastructure (x)	The condition and availability of public infrastructure (roads, sewers, pipes, etc.)
	Defense Infrastructure (x)	The presence and condition of defense infrastructure such as levees, retention ponds, dams.
Social Capital	Governance	Different processes of governing at local, regional, and national levels
	Institutions	Formal and informal institutions at the local, regional, and national levels
	Policies	Policies developed and implemented across levels of government
Other variables	Health (p)	Health level of household members, impacting their quality of life and ability to work
	Education Level (p)	The education level of household members
	Market Access (x)	Degree of access to markets for goods and services
	Population (p)	Character of affected population
	Land Price (x)	Cost of access to land
	Investment in Physical Capital (x,p)	Investments in improvement of infrastructure and other physical capital
	Physical Vulnerability (x,p)	Vulnerability of infrastructure and other physical capital
	Damage (x,p)	Direct results of floods, including physical damage to houses and infrastructure
	Preparedness (p)	Degree of preparedness for hazard impacts
	Reconstruction (x,p)	Support for post-disaster recovery and reconstruction
	Hazard (x)	Severity of hazard

	Natural Capital	Availability and condition of ecosystem services
	Flood Resilience Actions	Actions increasing flood resilience for specific citizens or the whole community, based on the Zurich Flood Resilience Measurement tool (Szoenyi et al. 2016)

Appendix D. Comparison of game applications

Table 3. Comparison of game applications.

	Jakarta, Indonesia	*Lima, Peru*	*Valladolid, Spain*
Participants (backgrounds, number)	16 participants playing in pairs, plus moderator and observers. Background: NGO and humanitarian organization staff. The majority were country staff who work directly with communities on flood resilience, a couple of them were from NGO headquarters in donor countries.	33 participants from communities in Peru (Lima, Piura, La Libertad, Cajamarca) and local authorities. All the participants had received at least 1 year of training on DRR related issues. Facilitators: 3, from Practical Action Peru team + 2 "game assistants" For more details, see the video about the game: https://floodresilience.net/resources/item/flood-resilience-game-user-experience	10 participants from various backgrounds: - National, regional and local government representatives (hydrologists, water managers, urban planners, decision makers), - Spanish Meteorological Agency (climate physicist) - Presidents of neighbor associations - Director of the Municipal Archive and Science museum - Journalist from the main regional journal
Workshops' objectives	Test and refine the game, and build participant understanding of the relationships between disasters and development.	Enhance participants' understanding of the complexity of flood resilience, that is to say, the need to coordinate actions among actors with different priorities and constraints, and the need for a long-term vision.	To create awareness of flood risk and strengthen the intercommunication and information pathways amongst the main flood risk management stakeholders and vulnerable groups
Process observations	Limited solidarity between players, who focused on maximizing their individual results. As a result collective actions were not achieved. Due to limited English skills, some players struggled to follow the gameplay.	Due to the high number of participants, there were divided into 8 different tables, each of them representing a different actor. Participants understood the need to: - Take better decisions on what one should invest limited resources - Work as a team - Get a longer term vision when making decisions on	Collective and inclusive decision making leads to more efficient processes and effective results. Lack of awareness and underestimation of the potential of the Natural Capital to buffer flood impacts. Prioritization and overreliance on infrastructural based solutions.

		investments - Understand the other actors' constraints	
Outcomes (observations, evaluation etc.)	Participants reported that the game captured the challenging trade-offs faced by communities quite well. Lack of solidarity was acknowledged in debrief and this stimulated thinking about participant's approach to community development. Participants reported that their perspective on flooding was expanded substantially by playing the game.	The game was very much appreciated by the participants and generated enthusiastic discussions about what should be done for DRR and what has not gone well in real life from a DRR perspective. The game offered a refreshing and fun format to empower communities and make them think about FR, compared with traditional methods such as conferences and training. It helped to strengthen previous knowledge, through decision-making and debates while getting into someone else's shoes. During the first round, participants were confused by the number of rules and instructions, but the following rounds were much more straightforward.	There was a high level of interconnections and interdependency among all actors. The game highlighted the importance and impact of inclusive inter-collaboration and negotiations beyond individual or top-down actions. Participants noticed the tradeoffs between self-protection and life quality. They felt that they had to make difficult decisions and prioritize when making income investments. Such a decision-making process at the individual level is not easy.
Participants recommendations	Simplify the game where possible. Use symbols instead of words where possible. Shorten the game so it can be played more easily with busy colleagues.	We implemented the game within a long-term process, where participants had been trained for at least one year on these issues. It is unsure whether participants would have enjoyed the game as much if they had had no previous knowledge of DRR, since the issues that are tackled through the game are complex.	Usefulness of the game to understand the cycle and process of flood risk management, the roles and influence from a different type of actors and how knowledge and capacities can make a difference, and the range of possible tools and strategies to reduce the vulnerability against flood risks.