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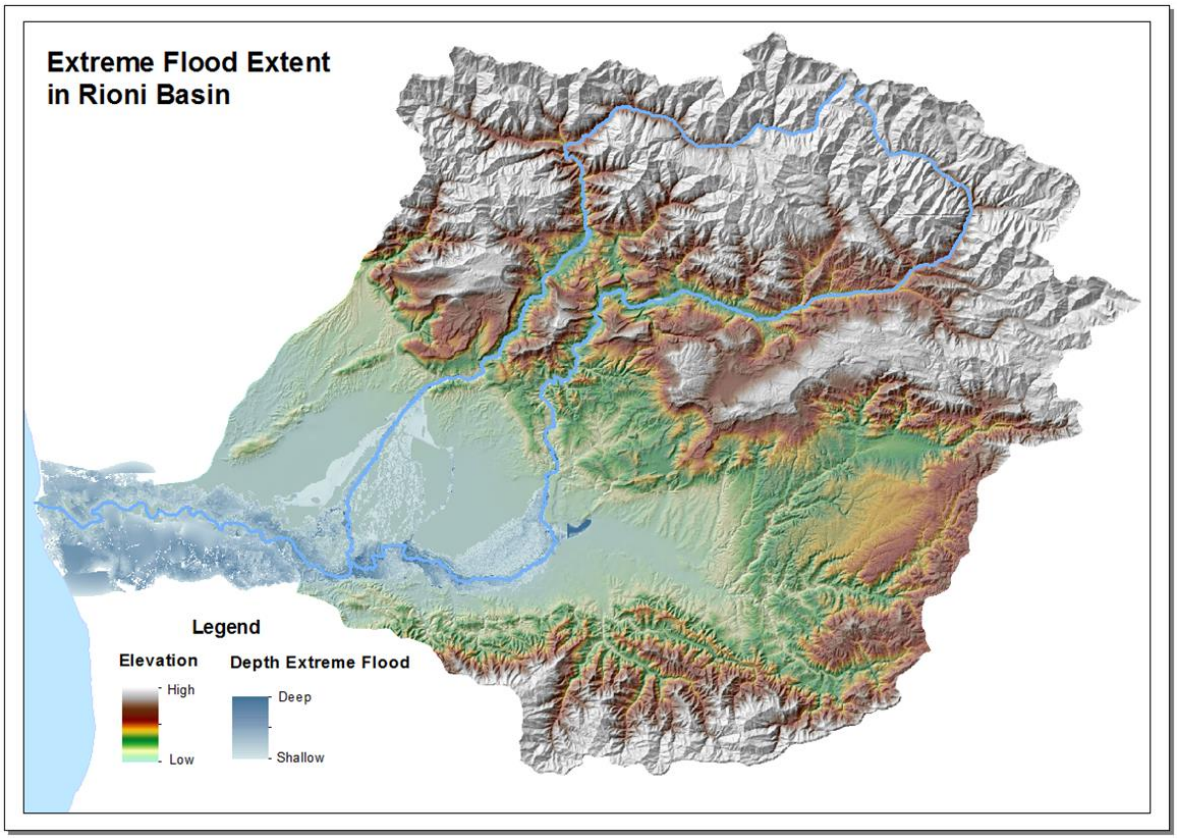
AF/UNDP Project

Developing Climate Resilient Flood and Flash Flood Management Practices to Protect Vulnerable Communities of Georgia

Introducing Index Based Flood Insurance to Municipalities in the Rioni Basin:

A pilot feasibility study



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1 Synopsis and project summary

1.1 Background context

The overall Rioni project objective is to improve resilience of highly exposed regions of Georgia to hydro-meteorological threats that are increasing in frequency and intensity as a result of climate change. The project will help the government and the population of the target region of the Rioni Basin to develop adaptive capacity and embark on climate resilient economic development. The project is comprised of three main components:

1. Floodplain development policy introduced to incentivize long term resilience to flood / flash flood risks;
2. Climate resilient practices of flood management developed and implemented to reduce vulnerability of highly exposed communities;
3. Early warning system in place to improve preparedness and adaptive capacity of population.

The project aims to develop resilience of highly vulnerable communities and regions to climate related hazards, such as floods, and flash floods, and takes an integrated and comprehensive approach by addressing critical gaps in land use policy and regulatory framework, fundamental to climate resilient flood management. The project will implement the Georgian Government's priorities for effective and long term measures for flood prevention and management through the implementation of a balanced combination of policy improvements, early warning and concrete adaptation actions. The Rioni basin is the project geographical area, but many of the project outputs will have national relevance.

One of the key outputs of Component 1 will be a study of the feasibility of introducing an weather index-based flood insurance (WII) scheme to be designed and implemented in the Rioni Basin. In the vast majority of cases, the costs of physical damage and financial losses from river flooding are readily insurable in the commercial market. As such, the widespread expectation of, and reliance upon, the availability of insurance cover can be an important element in the overall approach to flood risk management.

Flood insurance has often been advocated as a long-term non-structural measure for building resilience among flood victims, and is one of a broad scope of risk management approaches that can be used as a financial instrument to help zone development away from high risk areas. However, in developing countries and emerging economies, the use of flood insurance has been unsatisfactory, due to the lack of flood insurance schemes or the limited coverage and negligible impact as a flood mitigation measure. The reasons for this include the reluctance of insurance companies to promote flood insurance because of the high cost of operating and administering them, compared to the revenue to be earned by them. The capacity of flood affected people in developing countries to pay high premiums is limited, and if uniform rates were charged, then insurers would find themselves burdened with an adverse selection of risks because people exposed to higher flood risks are the ones who are most likely to take out such a policy. Alternatively, if rates charged are proportionate to the risks, then the insurance premium might be higher than the paying capacity of the poorer property owners in flood prone areas, thus excluding people who need insurance most. In

addition, flood risk in chronically flood-affected areas can often be widespread and frequent, resulting in insurance companies having to pay out claims for several years in succession, to large parts of the population.

Flood insurance can be an economically viable proposition for insurance companies if governments subsidize such schemes, using a number of measures. For example, if a part of the money normally spent government and aid agencies as post-event flood relief/response is utilized for insurance subsidies this may encourage the poorest to take up insurance. Also, if flood insurance is linked to some reinsurance scheme, then the total pool of money available to the reinsurance companies would be considerably higher making them better able to manage large number of claims. The administrative cost could be reduced by taking the help of local communities and local administrations in the collection, compilation and periodic updating of basic data for working out fair and equitable premiums and pay outs for areas of varying flood risk. Costs can be reduced if local communities are fully involved in the process, and municipalities must play a major role in awareness raising and information dissemination.

One of the interesting developments in recent years has been the emergence of alternative indexed insurance risk-transfer products which use a proxy measurement to pay for significant economic loss. For example, if it is known that extreme rainfall or temperatures is highly correlated with agricultural production losses, then these measures can be used to proxy loss and make payments in case of loss of production. One noteworthy advantage of indexed insurance contracts is that claims management is greatly reduced, since there is no need to validate losses; they are determined by a simple objective measurement. Such an approach helps solve a variety of problems associated with the usual public-sector response to catastrophic risk and to credit constraints in developed countries, namely traditional forms of agricultural insurance and ad hoc disaster aid. However, experience with index based insurance is largely limited to drought risk to agriculture where climatic conditions are largely consistent over large geographical areas. There are few examples of their use in flood risk insurance.

For Georgia, index-based flood insurance could be used to help in the mitigation of flood risk, if it is implemented within a holistic flood risk management framework which has the best balance between the provision of flood protection measures and, assessment and management of the residual risk from which such measures fail to provide protection. Hence if flood protection is provided to an acceptable level, and there is confidence in those protection measures (as will be the outcome of Component 2 of this project), insurance premiums could be set at a reasonable level, as the residual risk would be low, compared to the situation when the standard of protection provided is low, and the residual risk is high. In addition, the requirement for accurate and timely measurements to determine what insurance pay outs needs to be made, will need to be supported by an appropriate monitoring system (as will be the outcome of the improved hydrometric network for the Rioni – Component 3), to provide the rainfall and water level measurements required to verify the flood depths that may be expected to occur during each event. Hence the improved hydrometric network can be used in monitoring the flood indices which will trigger insurance payments.

A further consideration is the willingness/ability of government/donors to provide compensation/relief after flood events. If compensation/relief is traditionally inadequate and highly ineffective (as is the case in the Rioni basin) then the approach of providing a financial framework such as flood insurance, for accessing compensation, which will also act as a means of influencing choices when engaging in economic activities in the floodplain, is appropriate. The combination of an insurance scheme with the development of a robust zoning regulatory framework will improve its chances of success in the long-term. Establishing legally binding flood zones will encourage 'guided growth' of new development and its infrastructure away from the High Risk flood zones.

Part 1 of this report "Socio-economic assessment of flood risk in Rioni basin" has highlighted the communities at greatest flood risk and strategic appraisals in these communities will determine the most satisfactory and sustainable flood mitigation solutions. Where risk is very high during frequent events, as appears to be the case in some of the Rioni communities, the cost of insurance and the risks taken during underwriting these risks, may be unacceptable. However, introducing sound engineering solutions to avoid much of the calculated flood risk, may encourage and incentivise insurance to manage extreme and catastrophic risk that conventional flood risk measures are unable to manage effectively.

1.2 Summary conclusions

Extensive stakeholder consultation has been done prior to advising on the feasibility of the development of a suitable insurance scheme for piloting in the Rioni basin and, ultimately developed for the whole of Georgia. These were mainly with the insurance and micro-finance industry and other Government and non-Government stakeholders, who provided at the October 2014 workshop in Tbilisi an appreciation of the strengths and weaknesses (see section 5 below) of extending the current agri-insurance scheme to property and land within the designated modelled flood zones developed as part of this project (see section 3). Feedback from the workshop and follow-up meetings have further informed the design of the scheme. The main feedback was with respect to the zones that will be covered by insurance (which translates to the size of the events that will be covered under the scheme). The general consensus was that the scheme could impinge on, the current government pilot agri-insurance scheme (section 2.6) if it covered smaller more frequent events, but could benefit it, as it could provide better risk and vulnerability data from the risk model. There was also a second concern that the scheme only covers one hazard when the agri-scheme covers multiple hazards (as do most insurance schemes). Reflecting on the Workshop, the scheme design is now leaning towards catastrophe type insurance (similar to the model to be adopted in the Southeast Europe and Caucasus Catastrophe Risk Insurance Facility GEF Project) rather than individual small premium-based schemes. If this catastrophe insurance approach is taken, consultation will mainly need to be with Government and key players in the insurance and re-insurance market who will be tasked with administering and underwriting the scheme.

The original pilot project within 6 Rioni Municipalities to gauge the appetite and feasibility for weather index-based insurance was extended to evaluate the scale of damages to property and agriculture within all 18 Rioni Municipalities and used GIS-based socio-

economic modelling to inform the likely individual and aggregate premiums necessary to enable an effective insurance scheme.

2 Exploring the potential for a suitable flood insurance model for the Rioni Basin

2.1 The emerging insurance industry in Georgia

The development of insurance products is rapidly expanding in Georgia. Aldagi, with a 26% market share of the industry saw its premiums rise from 8.8 million GEL in the first quarter of 2007 to almost 70 million GEL in 2010. Health insurance is already the predominant insurance sector in Georgia representing 75% of the written premiums, underwritten mainly by the 3 dominant insurance companies in Georgia (Aldagi, GPI Holding and Ardi Group), (Chanturia, January 2014)[1]. The greatest part of loss contribution, paid out by insurers to their clients goes to medical insurance (92 %) and only 4% goes to motor transport insurance. For other types of insurance loss contribution is 1% or less.

Chanturia's study from the information received from Insurance companies concluded that the main part of *Property Insurance* (which typically includes flood insurance coverage) is corporate (plants, factories, sea and airports, power stations) and mortgage property insurance (mainly in Tbilisi and Batumi). Exposure to property insurance is negligible elsewhere. This corporate and 'high end' property insurance represents 7% of the total insurance market.

The Georgian labour force consists of 1.918 million (2007) people. The majority, some 55% (1,055 million) work in the agricultural sector, with 8.9% in the industrial sector and 35.5% in the service sector. Local estimates suggest that 75% of the Georgian labour force is either self-employed or works in the informal agriculture sector. So by contrast to other commercial activities agriculture, which dominates the labour market, is wholly under represented within insurance underwriting, and especially immature for small holdings less than 2 ha. (see Table 5), which reflect the majority of land holdings.

2.2 A micro insurance product for Crystal, Georgia: A review by Dutch consultants

Pension & Development Network (PDN), and the Micro Insurance Association, Netherlands (MIAN) visited Micro Finance Institute Crystal of Georgia to explore the possibilities of developing and implementing insurance products for the Georgian market.[2] Their study focused on health and the newly emergent interest in agriculture (or agri) insurance.

They concluded that financial literacy in Georgia is generally low as a legacy from Soviet rule, during which the state took care of wages, healthcare and pensions. Planning ahead for the (financial) future is not something common amongst Georgians, and it is considered to bring misfortune when one discusses the possibilities of illness, death and other misfortunate events that could occur in the future.

[1] Chantouria, D. Report on the review of current insurance sector in Georgia, its profile and sectors that it covers (Agriculture, property and life insurance). Commissioned by UNDP project January 2014

[2] Report by P&D Network and MIAN

'A micro insurance product for Crystal, Georgia' undated but believed to be last year

From interviews during this project and from an analysis of the Crystal MFI report, a number of factors, co-lateral to poor financial education and endemic poverty (with up to 40% of Georgians living below the poverty line), conspire against an interest in both property and agri-insurance:

- The break-up of Soviet style co-operative agriculture with most farm plots comprising less than 2, often fragmented, hectares.
- Cross Border Remittance from money transfers from family members living abroad represents 8.1%[3] of Georgian GDP or 56% of all remittances coming from the Russian Federation) This provides a financial cushion to low income families but in no way represents a means of strategic sustainable development for a country hoping for membership of the EU.
- A general suspicion (based on the Soviet past) of new co-operatives to manage farming efficiency, including mutual insurance, within largely uneconomic and disparate plots.
- Most farming is subsistence based with any surplus sold on at market stalls or the roadside; money is simply not available for the "luxury" of insurance.
- The lack of specialization amongst Georgian farmers, the large amount of diversification and the small scale of their operations make it hard to design a general agricultural insurance product
- Because farmers are seen as low-income clients, there is limited interest in MFI's providing them with agricultural credit or insurance products.
- Income for farmers is low, and they have difficulty paying the interest rates that come with micro credit loans.
- There is no state taxation with an agricultural turnover below 200,000 GEL, so there is no appetite for efficiencies made with land amalgamation
- There is no state taxation when in possession of less than 5 hectares of land, so again there is no appetite for efficiencies made with land amalgamation

In short, there is little interest for MFI's or insurance companies to market products of small value with comparatively high administrative costs.

According to the Dutch research, although there have been some experiments with agricultural insurance, Georgian insurance companies are (up until now) not very innovative in their approach to new clients or the development of new insurance products. They believe this is due to lack of experience in market research and product development, as well as a narrow focus on specific client groups, which are naturally most profitable.

Even though the quality of local produce is perceived as good 70% of foodstuff in Georgia is imported. This situation will most likely last for some time, as the government has not yet developed a clear vision or programme for the development of agriculture in Georgia. For local produce to be able to compete in price with imported produce, the government would have to provide subsidies for agriculture, but is hesitant to step into "endless rounds of subsidies". Fostering insurance products, especially agri-insurance, heavily subsidised by

[3] Estimating Remittances in the Former Soviet Union: Methodological Complexities and Potential solutions. J Kakhkharov and A Akimov. Griffith University business school, 2014

government is an innovative way of protecting agricultural production until a strategy for whole scale rationalisation of subsistence farming is formulated.

However, setting up an agricultural insurance product is a complex procedure. The break-points in this process are the transaction costs and the sharing of risk. The cost of selling and underwriting insurance and of administering a claim does not decrease in proportion to the value of the policy. Using traditional channels and processes, insurance companies simply cannot write policies with values below a certain floor without pricing them unrealistically. Risk sharing in areas of co-variate risk (i.e. areas at risk from flooding) is one way of blending unaffordable policies with unacceptable institutional risk.

The Dutch consultants to Crystal MFI advised the market to stay away from agri-insurance until government subsidy is agreed. In this eventuality MFI's could combine offering agricultural loans, for example for seeds and fertiliser, with an option for a revenue/crop/livestock insurance.

2.3 Workshop on Agro-insurance March 7, 2014, Tbilisi

The negative attitude of the Dutch conclusions is contrary to the emergent interest in the development of agri-insurance products as reflected in the March 2014 workshop in Tbilisi organised by the Swiss Cooperation Office in South Caucasus (SCO) and Swiss Agency for Development and Cooperation (SDC) and attended by (among others):

- Agrarian committee of Parliament,
- Ministry of Agriculture,
- Ministry of Finance,
- Insurance Companies,
- Georgian Association of Insurance,
- Swiss Re,
- Financial institutions,
- Bi and multilateral donors,
- Farmers' association

The aim was to promote access to affordable financial products for the sustainable growth of around 800,000 smallholders in Georgia, who contribute more than 90% of the agricultural GDP and employ about half of the country's workforce.

After the 2012 elections development of agricultural efficiency has been a prime government objective. Access to affordable loans insured against the plethora of natural hazards is vital to avoid the downward spiral of inefficiencies in the existing rural economy. Insurance was deemed by the workshop as the catalyst to break the vicious cycle of high natural hazard risks, low productivity and lack of access to affordable agricultural working capital and investment loans. Promoting shared, collective risk amongst the micro-finance institutions and insurers will break the disincentive of insurers and lenders to promote what are currently seen as expensive and unprofitable products.

The workshop recognised the underdeveloped framework conditions for setting up insurance, not just the fragmented market and unregistered land ownership but the absence

of weather monitoring infrastructure, information asymmetry[4] and lack of technical knowledge. The UNDP project is a vital player in providing that technical knowledge and investing in hydrometric monitoring.

The pilot programme for agri-insurance set up by the Ministry of Agriculture (section 2.6) is a direct product of this workshop and other similar initiatives. SCO were instrumental in facilitating the process and commissioned a feasibility study to Business & Finance Consulting (BFC), with the objective to make a rapid assessment of the supply and demand of agricultural insurance in Georgia and identify feasible options for the national agricultural insurance scheme.

2.4 Current attitude to supply of Agri-insurance products in Georgia

Currently there is some limited agri-insurance products on the market. For example, Aldagi has policies which operate purely on an indemnity basis, and restricted almost exclusively to farmers, mainly viniculture, with strictly commercial interests. This method demands the time consuming efforts of skilled loss assessors and is probably a further reason why outside the commercial farming sector agri-insurance is poorly developed. A typical structure is given in Box 1:

BOX 1

In Aldagi Insurance Company Agricultural Insurance is a sub-product form (Financial) Loss Insurance. So, based on independent auditor's valuation possible occurrence of damage on affected agricultural land.
Example: If 10 ha vineyard was damaged by insured risk-hail and the independent expert concludes that average damage for 10 ha vineyard is 55%, (negative influence of hail for harvest is 55%)
If the Sum Insured is 70,000 GEL.
And the deductible is 10% or 7,000 GEL,
The loss is 70,000*55%=38,500 GEL
The Compensation Sum (38,500-7,000) = 31,500 GEL
For the calculation of Sum Insured Aldagi uses the following stages
1. Sum Insured = costs spent for 1ha;
2. Sum Insured = potential amount of harvest multiplied for the unit price.

Example: Productivity for 1ha is 7 t. of grape. Unit price: 1 kg =1Gel.
Sum Insured=7t.*1Gel=7000 Gel per ha.
If insurance Rate is 7%, Insurance premium (Price) calculated from Sum Insured
7000 (Sum Insured/ha)*7%=490 GEL per ha"

A number of financial institutions (including Ardi and Aldagi, two of the three market leaders, were interviewed for this project to gauge the mood for supply and demand of insurance products. Their attitudes are summarised here:

Ardi

At the moment a pilot to gauge the appetite for weather index-based insurance products would be futile as the realistic market is tiny. Re-insurers would be reluctant to open a dialogue testing the feasibility of index based insurance as rural communities are poor and assets minimal with no safety net (other than sporadic, and largely ill managed, disaster relief) to ameliorate flood damage and recovery. Coverage to poor house holders and small holders is < 0.01% of their written premiums. Property insurance; between 5% and 8% of policies (which includes flood cover) is largely for commercial entities or wealthier residential clients and largely in Tbilisi and Batumi. To Ardi's knowledge none of the policies

[4] where one party has more or better information than the other

underwritten for property have submitted a claim for flooding. Ardi currently insure no properties in UNDP's targeted 6 pilot municipalities.

With the "known scale of flood damage" (see socio-economic report) demand is potentially high, but development of services should be initiated with Municipal Government/MRDI. Currently insurance underwriters would be wary of getting involved as they do not understand the potential scale of the risk and the technical aspects of risk based premiums that would be set. The main threats to introducing and developing an insurance culture are recognised as:

- Degree of financial literacy especially amongst poor land owners/farmers;
- Suspicion of payment of flood premiums;
- Misunderstanding of output payments (triggers), and premium setting (asymmetry)

In conclusion, the preferred approach is to bundle up flood insurance, managed by municipalities, in accordance to risk formulae set by the UNDP project and outsourced to Insurers (re-insurers) willing to accept and manage this risk.

Aldagi

The company representative summarised their opinion succinctly: The insurance market and culture is young and small, negligible in rural areas both for property and smallholders.

Their main concern was the fragmentation of plots which leads to weak business and corporate incentives with much needed consolidation projects and commercial co-operatives which would take some decades to formalise. Georgia would be better off with a mixed model of government assistance and institutional development. Aldagi liked the index based approach in general as it reduces moral hazard (asymmetry) and administrative costs. Risk is in close correlation with yield reduction due to weather shocks and without careful but proportionate calibration there could be both negative and positive discrepancies in matching pay out to reality with cross compensation an issue. Cross compensation was felt to be bad for business creating high degree of suspicion and criticism of a system where inaccurate pay outs are perceived.

As insurance take up amongst smallholders is tiny, potential households/smallholders are as unfamiliar with an indemnity model as an index based insurance model, though they agreed that the cost of experts for indemnity evaluations is largely avoided and this would significantly reduce administrative costs. However, the Soviet system which engendered an expectation of State support following weather shocks is still prevalent

Their main support for index insurance, as with Ardi, was in the bundling of managed risk creating insurance efficiency. It was acknowledged that municipalities would also benefit from avoidance of expensive and protracted commissions to evaluate, adjudicate and arbitrate over a plethora of small claims.

Aldagi were sceptical of using Geostat data to set crop yields and producer prices as subsistence farming is likely to be more inefficient than commercial farming. Yields will be lower than Regional averages as farming practices are not technologically advanced with an unwillingness to invest in improved seed stock or fertilisers. Optimum yields may be

inappropriate to poorer farmers. Pay outs may therefore be over generous if based on Geostat data.

Aldagi re-iterated the negligible potential market for both property and agricultural insurance products in the project designated pilot municipalities with the main demand for agri-insurance products in Kakheti for vineyards with weather shocks principally hail or rain. Insurance for property is, outside towns and cities, restricted to a limited market in Dachas (small country homes). However, details of their insurance profiles, like in any country, is commercially sensitive.

Aldagi do have some policies for smallholdings, particularly for high value crops like melons. (2 ha of melons is not considered a small plot) but as these are below the 5ha upper limit for paying land tax they are not registered as private entities. Premiums would generally be 9% to 11% of insured value depending on underwriting factors such as history, the crop insured, location etc. This is often added onto the MFI loan agreements but sometimes negotiated separately. In 2012 Aldagi had 1.7 million GEL pay out to the Agri industry (this compares with a 48 million GEL pay out for all products, 2009 data)

2.5 Demand for agri-insurance

A May 2014 study by the Ministry of Agriculture[5] of 6,000 small scale farmers (farming less than 5 ha each) suggested that out of 1600 interviews[6] in municipalities within the Rioni basin study area (covering 3,280 ha of land) only 5 farmers had agri-insurance (1 each in Abasha, Ambolauri, Zestoponi and 2 in Khoni). When asked how many would take out insurance if the state government subsidised premiums by 75% just over half (805) said they would. However willingness to pay surveys are fraught with difficulty when linking theoretical questioning to actual take up.

In the 6 Municipal pilots selected at the outset of the project, willingness to take up insurance given a 75% state subsidy was in stark contrast, with only 4, 7 and 0 interviewees stating they were interested in agri-insurance, in Ambrolauri, Oni, and Lentekhi respectively but 83, 50 and 82 interviewees in Samtredia, Tsgeri and Tskaltubo (Table 1). The negative attitude in Ambrolauri is of particular concern as 77% of the land represented by those interviewed is used for viniculture (Fig 1)

[5] Promotion of agricultural insurance development in Georgia, Draft report by Ministry of Agriculture, May 2014

[6] 6,000 in total across Georgia

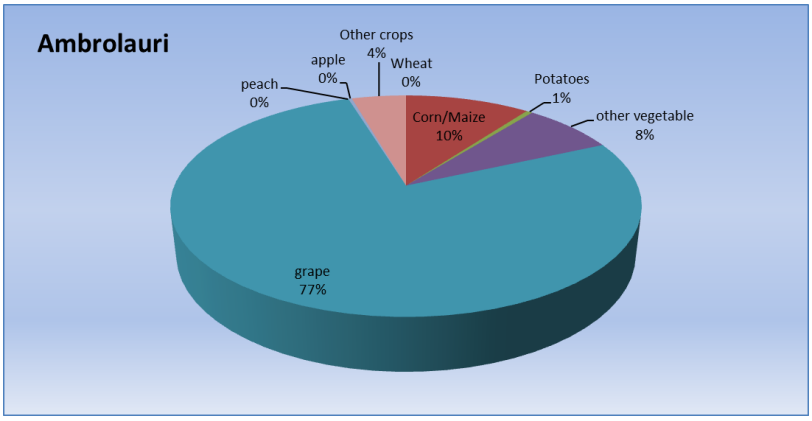

Fig 1: Crop Profile in Ambrolauri Municipality

Municipality	Total agricultural land area (ha)	Areas under crops (ha)	The number of farmers who have used insurance	The number of farmers who would agree to insurance in case of 75% co-funding
Abasha	797.7	652.6	1	81
Ambrolauri	49.6	41.1	1	4
Baghdati	88.6	81.6	0	59
Vani	196.2	196.2	0	71
Zestaponi	74.7	63.4	1	9
Terjola	108.8	96.0	0	13
Lanchkhuti	198.7	181.4	0	80
Lentekhi	63.4	63.4	0	0
Martvili	133.3	105.0	0	77
Oni	21.3	17.1	0	7
Samtredia	507.8	425.8	0	83
Senaki	141.6	135.6	0	37
Tsageri	83.5	63.9	0	50
Tskaltubo	155.5	100.9	0	82
Khobi	217.4	172.7	0	67
Khoni	442.1	173.0	2	85
Total	3,280.3	2,569.7	5	805

Table 1: Attitudes to agri-insurance in Rioni municipalities

The summary analysis in Table1 indicates that signs for piloting an index insurance scheme in Ambrolauri, Oni and Lehtekhi are not encouraging, though piloting such a scheme in Samtredia, Tsgeri and Tskaltubo may show signs of success.

The UNDP weather index-based insurance feasibility study is concentrated on setting premiums and pay outs/compensation (for property and agriculture) within strict flood zoning guidelines to be developed based on flood modelling for one co-variate risk: flooding from the Rioni and its tributaries. However, any insurance product, whether for property or

agriculture will rarely single out just one potential risk. For example, crops need to be insured against hail, drought, frost or excessive rain. Likewise property needs to be insured against more than one hazard.

Flood plain zoning from hydraulic modelling defines spatial and temporal risk for river flood events only. Improved spatial coverage and frequency of hydrometric gauging as part of the UNDP commitment will over time improve this modelling in time. However, agri-insurance but this improved flow data is of little or no value to predicting the intensity and spatial distribution of wind or rain which will affect crop productivity. WII is traditionally applied to homogeneous geography/terrain where predicted climatic conditions are likely to be replicated over wide areas. Given the highly variable terrain in the Rioni basin, it will be important to confirm over time (as more data becomes available) whether the improved hydrometric gauging adequately captures this climatic spatial variability and hence claims variability.

Consequently the UNDP insurance index product should be used to improve the overall development of property and agri-insurance products and maybe not used as a product which insured parties pay into and receive compensation for damage only for flooding. The flood premium/flood pay out formula should be just one component of holistic premium and pay out setting.

However, it is not unprecedented to insure against single or combinations of selected hazards. Since 2000, the Turkish Catastrophe Insurance Pool (TCIP) has been providing stand-alone earthquake risk insurance coverage to millions of Turkish households and SMEs at affordable and actuarially sound rates. The average premium rate is equivalent to US$47 per US$35,000 of insured value with the deductible of 2 percent, or US$1.34 per US$1000 of coverage.

Furthermore, The Romanian Catastrophe Insurance Pool (PAID), which began in July 2010, offers stand-alone flood and earthquake insurance coverage for homeowners and SMEs at the flat rate of €20 per €20,000 of coverage, with no deductible. Although the pool is expected to add a small deductible of 2-3 percent and will increase the premium rate by about 20 percent , Romanian households will be paying only €1.2 per €1000 of insurance coverage.

The above is pertinent as there are 3 other initiatives ongoing in Georgia to develop affordable and sustainable (agri-)insurance products to mitigate against the effects of multiple hazards, not just river flooding:

1. A very recent contract between the Georgian government and KfW group https://www.kfw.de/KfW-Group/ a German banking group.
2. Discussions between the Parliament of Georgia and the Georgian Association of Insurers to resolve any legal barriers by the Autumn to promote non profit organisations to manage insurance activities and set up a commission to manage agri-insurance.
3. The Ministry of Agricultural pilot (mentioned above) working with Ardi and Aldagi, to promote state subsidy for insurance premiums.

2.6 Promotion of agricultural insurance development in Georgia.

This study was commissioned by the Ministry of Agriculture in 2014 to evaluate the demand for agri-insurance and develop a basic indemnity based system common to all farmers across Georgia. The main purpose of this survey was to consider the cost of promoting and subsidising agri-insurance to farmers with less than 5 ha. It is a pragmatic approach to creating a national system of affordable agri-insurance. A pilot has now been completed. The goal was to:

- Develop the insurance market in the agricultural sector
- Support the operations of farmers
- Raise competitiveness of farmers
- Maintenance of stable income for farmers

The main points are summarised as:

- The state funds as an insurance premium 75%
- Farmers and enterprises pay as a premium 25%
- Only accredited insurance companies participate in the project
- Minimum ***insurance premium*** – GEL 150 per hectare per annum (depending on the crop insured)
- The ***insurance amount*** is determined according to average yield of the agricultural crop designed for the specific insurance by a farmer and equals the value of estimated yield.
- ***Insurance re-imbursement*** is paid **only** if losses are greater than 20% of insurance amount (the trigger), less 10% 'franchise', or costs of insurance administration.
- ***Insured risks*** are hail, flooding, wind >15m/sec (and autumn freezing for tangerines and lemons)
- ***Premium tariffs*** (as a % of average yield[7]) are set as follows:
    - 13% cereals
    - 21% potatoes
    - 26% vegetables
    - 20% grapes, pears, apples

Based on the 6,000 farmer interview and normalised for Geostat data (table 2) on actual national crop areas the scheme premium cost would be 17.9 million GEL per annum with the State contributing 13.4 million.

This scheme covers all the risks itemised above but flooding from river sources is not specifically defined in terms of flood frequency and is therefore not risk based. Under this pilot, flooding is defined as:

> "The wash-off and/or inundation of ground surface during excessive precipitation with the soil and/or silt (ground and water) and/or water current that is usually not covered with water. Causes damage and/or destruction of plants by means of mechanical effect on their underground and above-ground parts, tearing them off from soil, washing off or silting of soil. Also causes damming up of water on agricultural lands, and results in damage or destruction of plants by means of the deterioration of physiological processes."

Thus cereals are subject to a premium tariff of 13% to cover all risks. River flooding can be hugely damaging to crops depending on the timing with the growing season. Work on the Danube in Hungary (Fig 2) illustrates this:

[7] There is no discussion as to how these percentages are derived.

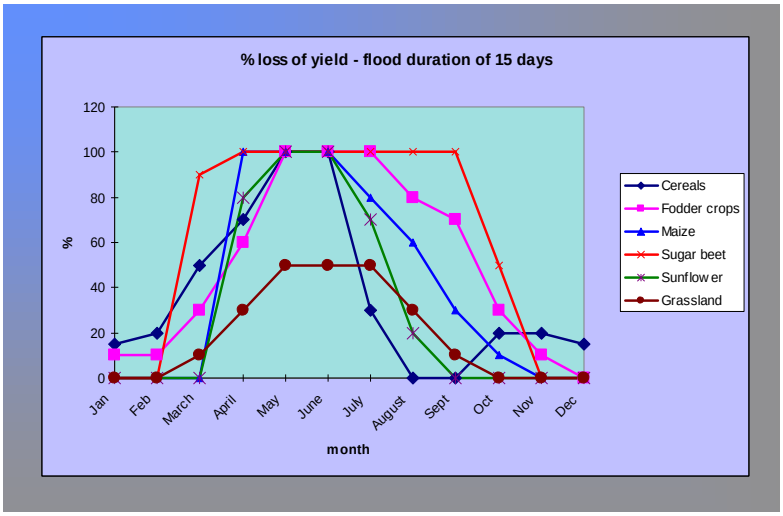

Fig 2: Loss of crop yields through river flooding, River Danube, Hungary

Geostat data 2013	Yield (t/ha)	Producer price (1kg/GEL)	Producer price (GEL/ha) per year
Wheat	1.8	0.50	900
Maize	2.4	0.50	1,200
Potatoes	11.3	0.60	6,780
Other Vegetables	8.3	0.20	1,660
Grapes	5.6	1.00	5.600
Peaches	9.6	0.50	4.800
apples	7.4	0.60	4.440

Table 2: Producer Prices per annum by crop type

The scheme introduced is not index based and the UNDP project can help to improve (reduce) premium tariffs for each crop by using GIS tools to allocate every parcel of flood plain land to the return period of its threshold of flooding. Loss of yield will be ascribed a value based on its probability of seasonal flooding (Table 3).

Wheat	**Probability of Seasonal Flooding (%)**			
900 GEL/Ha Producer Price	Spring	Summer	Autumn	Winter
	34	47	13	5
	Seasonal Yield Loss (%)			
	Spring	Summer	Autumn	Winter
	30	95	35	10
Threshold of parcel flooding (1 in 10 year flood event)				10% (1 in 10 years)
Weighted Loss by season of flooding and season of yield loss				539 GEL per annum
Premium tariff				54 GEL/ha (+ admin)

*Table 3: Premium setting for agricultural crops subject to river flooding (Samtredia) (*as developed for the Rioni basin Project)

The GIS risk model will greatly assist an simplify the calculation of premium setting for each crop, depending on a combination crop type, flood probability, flood seasonality and expected seasonal flood loss. Thus a wheat parcel with a threshold of river flooding of 1 in 10 years (10% probability per year) will have an average annual producer price loss of 90

GEL/ha (900 GEL divided by 10) However depending on the season of flooding the proportion of this annual producer price lost will vary. The probability of seasonal river flooding will also vary and thus the insurance premium will be weighted to reflect seasonal variation of flooding and percentage annual producer price lost. In the case of the example for Samtredia 81% of flooding will occur in either Spring or Summer. An insurance premium, plus administration costs of about 15% would normally be added to the premium

The premium tariff is therefore variable depending on the probability of flooding, the weighted seasonality of flooding and the proportion of the producer price lost, through loss of yield. Premiums based on total risks will generally reflect more realistic losses than blanket premiums per crop as set by the Ministry of Agriculture project

This is potentially much lower than the minimum 150 GEL value used in the Ministry pilot, and could be added to manage flood risk against river flooding for which the Ministry pilot has no trigger context for either setting premiums or compensating after the event, thus bringing a risk and index based approach into insurance.

2.7 The next steps: Dissemination UNDPs technical knowledge to Insurance industry stakeholders

It is clear that there is an appetite for developing insurance products to mitigate against the effects of weather shocks, but the focus of the current insurance scheme is river flooding alone and that any index based product developed as a financial instrument to mitigate against some of the effects of flooding is only one piece of the insurance jig saw.

The current pilot for agri-insurance to small farmers is simple to apply but still indemnity base and (apart from wind/storm with the trigger of 15m/sec) does not have a trigger level for pay out. So, for example, for rain based (pluvial) flooding some technical evaluation of yield loss must be made to determine whether the 20% loss threshold is exceeded.

In October 2014 a workshop session was held (section 5) with a range of stakeholders to explain/indicate:

- The GIS socio-economic and hydraulic models developed for the project to enumerate receptor flood risk and calculate the damages associated with degrees of fluvial flooding to property and agriculture
- For which of 18 municipalities[8], including the 6 pilots and 300 communities within these municipalities, flood risk is greatest for both property (people) and agricultural receptors (and the environment)
- The concept of flood zoning (section 3) and how properties and land within different zones will have different annual average flood risk and how premiums set will be based on this level of flood risk
- The index based insurance concept, where once a trigger level is reached, as measured by UNDP river gauges, then any agricultural land or property ***reported by the owner*** as flooded will receive a standard compensation (pay out) based on the

[8] The flexibility of the GIS model allows the opportunity to develop risk premium analysis for any Municipality not just for the pilots as originally intended.

probability of the flood event. These compensation payments will be agreed in advance.

- That the risk based premiums and compensation set are a subset of the wider indemnity based system on which the May 2014 agricultural pilot and others are based.
- We are working with stakeholders (financial, governmental, agricultural and individuals) in establishing an integrated programme of insurance to the particular benefit of those who currently are suspicious of, or cannot afford, property and agri-insurance.

3 Flood Plain Zoning and its role in Insurance

The hydrodynamic model developed for the project allows zones to be established where property and land can be allocated equal exposure to flood risk. Quite simply, in insurance terms, premiums for insurance will be lower where land and property are exposed to lower risk than adjacent properties where the risk is higher. Flood plain zoning allows for an acknowledgment of risk with strict spatial planning managing this risk. Unfortunately, as flood risk exacerbates, properties and land become exposed to hitherto unacceptable levels of risk. Structural measures to avoid these increased risks may be technically, economically or environmentally unsustainable. Zoning allows the future planning process to impose strict rules on what future development is and is not allowed. It also allows the setting of premiums to insure against flood risk, where this risk is deemed acceptable.

3.1 Spatial Planning and Land Use Planning Policy

Traditional approaches towards managing flooding have focused only on the conflict between rivers and people by employing technical measures that physically separate the two. More holistic views of flooding recognise the role of land as both part of the conflict and also part of the solution. This is demonstrated through the development of new policies such as the Netherlands' "Room for the River" project (Ruimte voor de Rivier) and "Making Space for Water" in the UK (Defra, 2005). These policies increasingly choose to accept flooding as a natural phenomenon to be accommodated rather than prevented. Flood zoning formalises this process.

In the United States Flood plain zones are geographic areas that the United States Federal Emergency Management Administration (FEMA) has determined to be at flood risk to nearby communities and property. FEMA rates these zones for their severity of risk, and designates them as low-to-moderate risks, high risks, coastal areas, and undetermined risks. Each zone reflects the severity or type of flooding in the specified area. UK's policy and planning guidance designates risks in a similar way. Both have legal procedures in place to restrict certain types of development or apply appropriate building regulations to assist with flood proofing and flood resilience. In UK planning guidance applies a "sequential test" for development, with certain development only allowable in flood risk zones if an exception test indicates that benefits of development to the community outweigh flood risk. (Table 4)

Flood Risk Vulnerability classification (see Table D2)	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	X	Exception Test required	✓
Zone 3b 'Functional Floodplain'	Exception Test required	✓	X	X	X

Exception Test

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS12: *Local Development Frameworks* – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;

b) The development should be on developable previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and

c) A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Key:

✓ Development is appropriate

X Development should not be permitted

Table 4: Sequential and Exception Tests within Flood Risk Zones in UK

Adaptation of this testing is appropriate to Rioni Basin flood plains with degrees of property vulnerability as follows:

Essential Infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.

- Wind turbines.

Highly Vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent.

More Vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less Vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-Compatible Development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.

- Docks, marinas and wharves.
- Navigation facilities.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Currently, identification of many of these vulnerability categories is not feasible though the Risk scoring for infrastructure (see socio-economic report) has identified some of these as High, Medium and Low consequence with georeferencing to the 6 Georgian flood zones:

- **Low** if hotels, restaurants, churches
- **Medium** if Municipality buildings ,hospitals (beds), schools (pupils), Large electricity sub stations affected many people, water & sewage treatment works
- **High** if Emergency Services (Fire, Ambulance, Police), Power supply and distribution

This can be a starting point for spatial planning in Rioni Flood Zones

3.2 Insurance and Zoning

In USA most standard homeowner's insurance policies do not include flood insurance. Additionally, most lenders and banking institutions will not loan on a home located within a flood plain if flood insurance is not in effect. In UK Flood Re was introduced in 2015 to enable an insurance industry levy of £180 million per year from low risk properties, defined by flood zoning (18 million properties or £10 per property). High risk properties, up to 500,000 homes (again defined by flood zoning) will pay annual premiums of between £210 and £550 depending on the size of the house. This will fund flood insurance with an excess of £250 on every claim. For floods greater than 1: 200 years (0.05% per annum) a catastrophe fund will be administered by government who will take 'primary responsibility' for allocating any available resources.

The next stage (early to mid 2015) of this project will investigate 'best fit' solutions for the Rioni, including weather index-based products as piloted here, using comparisons with schemes, for example, adopted for UK (Flood Re) and USA (FEMA) or, closer to the region, the model to be adopted in the Southeast Europe and Caucasus Catastrophe Risk Insurance Facility GEF Project.

The rest of this feasibility review of weather index-based insurance will use the GIS and hydraulic model to test the scope of premium setting within defined flood risk zones of the Rioni basin.

4 Methodology for Weather Index-based Insurance feasibility and design

4.1 Summary

Countries with higher private insurance penetration sustain lower economic losses and fiscal costs after natural disasters. Comparing real consequences of natural disasters, a recent study found that countries with relatively low insurance penetration suffer larger output declines after climatic and geological disasters than countries with high insurance penetration[9]

The aims of the feasibility study are:

- To test the viability of introducing WII into communities exposed to flood risk from the Rioni river and its major tributaries
- To co-operate with the insurance industry, MFI's and Government to provide a product that is:
    - Available to all
    - Simple and inexpensive to manage
    - Affordable
    - Adaptable to change
    - Compatible with other agri-insurance initiatives

The literature on weather index based insurance is well advanced and after scrutinising schemes world-wide, our short list of requirements and constraints is as follows:

- Our Weather Index-based insurance (WII) model is wholly reliant on the accurate modelling of river flooding in the Rioni basin
- It will not consider other weather shocks, e.g. hail or drought
- It will develop a method for setting flood premiums and post flood payments for both property and agriculture
- It will help to improve premium setting for the existing agri-insurance scheme. It will not replace it.
- It is based on evaluating risk of flooding in 6 designated flood risk zones
- Payments will be made following trigger levels based on accurate measurement of flood flows, but this will only be possible once the hydrometric gauging is installed and tested
- The scheme will be managed by insurance companies on behalf of MRDI and the Municipalities
- From experience premiums will be heavily subsidised by Government

[9] Melecky, Martin and Raddatz, Claudio. 2010. —Natural Disaster Shocks and Fiscal Stability. World Bank Working Paper.

- Administrative and operational costs will be dramatically reduced compared with indemnity insurance
- The method equates premiums to flood risk exposure from fluvial flood events only, not from rainfall events.
- The method compares annual average anticipated damages (calculated by socio-economic model) with annual premium receipts derived for each Municipality
- Any imbalance is corrected in the form of a risk premium
- Using insurance as a financial instrument to mitigate losses, replaces the need for Government or Donor intervention after flood events
- Community co-operation is vital to success
- Outputs from risk models will be used to raise community awareness of potential flood risk.
- The process of premium setting and payment will be simple and transparent, and based on modelled flood risk
- On-going audit of the method and a review of data input deficiencies and their elimination are essential to success
- WII will work in tandem with new structural measures for flood alleviation, particularly as a hedge against post flood protection residual flooding
- As standards of flood protection improve then residual flood risk will reduce and this will be reflected in lower flood premiums.
- Insurance will not be available in the highly exposed 'floodway' and be more expensive within the 'functional flood plain' to encourage 'guided growth' away from the flood plain or introduction of property resilience measures

The project Terms of Reference were to pilot the WII in 6 municipalities:

- Oni
- Ambrolauri
- Lentekhi
- Tsageri
- Samtredia
- Tskaltubo

taking selections of about 300 plots of land and property at different exposure to risk. However, the sophistication of the GIS risk model has enabled the estimation of potential flood damages and generation of appropriate premiums for all 18 Municipalities for:

- Up to 39,000 properties, (283,000 people), and
- 52,500 hectares of agricultural land

The pilot is now applicable to all 18 Municipalities that are partly in the Rioni's 6 delineated flood zones.

4.2 Introduction

Weather Index-based Insurance is an emerging financial product, popular in the agricultural sector of developing countries, where an insurance policy is linked to the fluctuation of a weather variable index (e.g. rainfall, temperature, wind speed, humidity, soil moisture). Payments are not indemnity based but triggered when the index reaches a predefined threshold that can be expected to result in crop losses. Insurance pay outs are based only on the performance of the weather index and not on actual damage incurred or losses suffered.

Its strengths are summarised:

- WII eliminates most of the asymmetric information problems of traditional insurance products (moral hazard and adverse selection)
- No costly loss post flood assessment is required
- It is objective and transparent
- The claims process is simplified
- It provides timely pay out
- It reduces administrative costs
- It facilitates risk transfer outside of the local community through the potential for international reinsurance

However its weaknesses must be recognised:

- A potential difference (which might be significant) between the loss experienced by the farmer or householder and the pay out triggered by the index.
- Limited perils are covered with the Index insurance only covering one or two weather risks, in this case river flooding.
- Replication is an issue with products needing to be specifically tailored to specific locations and crops, which can require considerable 'up front' technical work if the product is to simulate reality. Geostat data may exaggerate the producer price level to small holders and therefore inflate the pay out per hectare.
- To be acceptable to communities at risk there must be significant investment up front in accurate zonal modelling and improvements to land use cadastres for land and property and spatial data on crop producer prices and property damage and valuation data

Introduction of a successful scheme can assist beneficiaries at 3 levels;

- MICRO-level: Individuals/farmers that need to cover the exposure of their economic activity to weather risk
- MESO-level: "Risk aggregators" that want to cover the exposure of their businesses to weather risk (e.g. micro financial institutions with rural portfolios, agricultural input dealers, supplying farmers with seeds and fertilizers etc.)

- MACRO-level: Institutions, at national or regional level, that want to hedge the exposure to adverse weather. This includes Government and International Aid organisations who currently cover losses exposed to weather shocks.

Following detailed discussions with the targeted six Municipalities, the Georgian insurance and MFI sectors and MRDI an outline Weather Index-based insurance (WII) model has been developed for testing in all 18 Rioni Municipalities exposed to flood risk. Trigger levels for pay outs will not only be developed for the agricultural sector but also for the property sector. The latter application will be far more experimental as this has not been trialled to our knowledge anywhere else in the World.

4.3 Proposed Insurance Model

The proposed Insurance Model Fig 3 is promoted under the headline "planning for a resilient future". The principle premise is 'pooled risk' where funds are made available by all municipalities with mutually agreed formula for calculation of premiums based on risk zones and pay out based on gauging station trigger levels, which if successful, are easier to administer than pay outs post disaster either by Government (MRDI or Ministry of Agriculture and Food) either independently or on behalf of International aid agencies.

However, unlike most weather Index-based insurance schemes it could not be applied to loss of crops through direct rainfall as trigger levels are impossible to correlate with crop locations in such mountainous terrain with spatially very variable micro-climates.

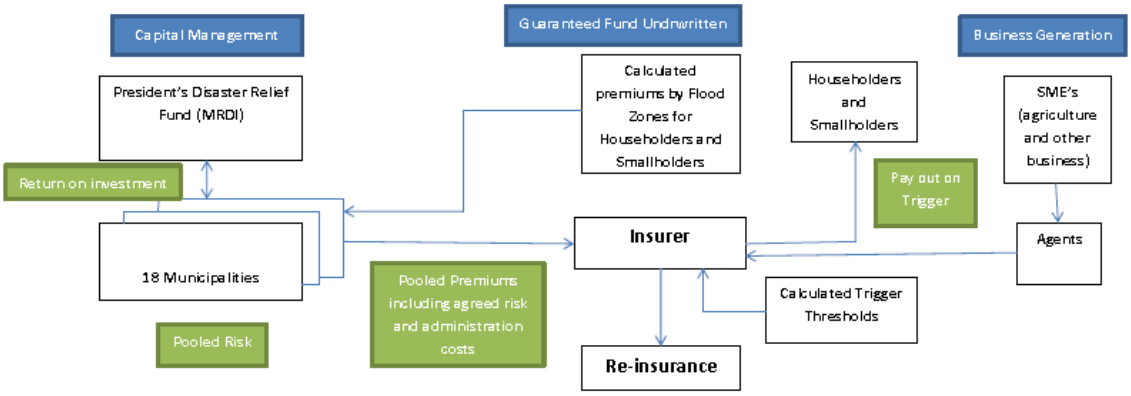

Fig 3: Weather Index-based Insurance business model (Georgia)

Business generation within Small and medium Enterprises is not considered in this pilot.

4.4 Historic Flood Data

There is no evidence of any structured access to insurance or financial assistance following flooding, except for the example of compensation commissions as set up in Samtredia (see below). Most inhabitants of the Municipalities, especially in rural areas, have no access to finance and are of modest income with a poverty rate for the Rioni basin at 40%. Table 5

illustrates the fragmentation of Georgian agriculture, with a mean farm size of less than a hectare:

Farm size	Percent of individual farms
Up to 0.5 ha	22.1
0.5-1 ha	29.7
1-2 ha	43.6
More than 2 ha	4.6
Mean size	0.96 ha

Table 5: Farm size statistics in Georgia[10]

With the exception of Samtredia, data on historic records of flooding or flood damages is sparse or unavailable to the municipality Infrastructure departments interviewed. This is a concern as a web search found that, for example, during the 2005 floods , not only were 'hundreds of properties' either damaged, destroyed or householders evacuated in Lentekhi, Oni and Tsageri but international aid was involved to alleviate the consequences of the disaster. Lentekhi mentioned the 2005 flood event "with up to 12 houses completely destroyed and " many" flooded with only compensation for destruction (5,000 GEL per house). Oni mentioned again 5,000 GEL for 12 houses and interestingly mentioned private sector constructions "in the flood zone" with no planning permission "Naxalovka". Ambrolauri made vague mention of 3 flooded settlements "along tributaries". Samtredia have produced a detailed inventory of specific damages but only those associated with rain damage to crops and landslides but little data on damages caused by flood inundation direct. In the 2005 floods according to CHF, as of April 30, they had counted 61 destroyed houses, 278 damaged houses, and 173 families that required evacuation in these areas. CHF's response included food, hygiene and bed kits to nearly 300 families in Lenteki, Tsageri, and Joneti on Easter Sunday.[11]

The current route for compensation is through Commissions set up to adjudicate on payments but at a very detailed level:

> "Zhuzhuna Meparishvili's melon crops sown on 4,000 sq.m. area owned by her in the Samtredia Municipality village Gomi were entirely ruined in the fruit ripening phase, thus Zhuzhuna Meparishvili was unable to realize her crops, as the harvest was destroyed at 100%. During that period market price for melon was 40-50 Tetri, and the expected amount of Zhuzhuna Meparishvili's crops was 10 tons, hence, the losses incurred by Zhuzhuna Meparishvili amounts to approximately GEL 4-5 thousand".

From this data it can be seen that a Commission deliberates the individual losses and either compensates at market price loss or in some cases compensates indirectly by exempting farmers from land property taxes.

[10] Kan, I., Kimhi, A., and Lerman, Z. (2006). "Farm Output, Non-Farm Income, and Commercialization in Rural Georgia." e-Jade – The Electronic Journal of Agricultural and Development Economics 3(2):276-286

[11] http://www.globalcommunities.org/node/21171

If the WII scheme is to be successful much more detailed data is required on both data on past floods and compensation payments to flood victims. This data requirement crosses over with the socio-economic assessment.

4.5 Defining Flood Zones

If premium setting and trigger levels for pay out are to be plausible then land and property must be assigned within Flood Zones developed following accurate Hydraulic Modelling. Hazard and inundation maps were used to designate flood zones within the Rioni (and selected tributaries). The Flood Zones, based on western European examples are proposed as follows:

1 **Floodway**: Normal course of the River under mean annual flow. No land or property expected

2 **Functional Flood Plain** The functional floodplain is defined as land that would naturally flood with an AEP of 20% (5 years) or greater/more frequent. This is potentially an area of High Agricultural Productivity, valuable for crop production. The presumption is that any properties located in this zone would not be eligible for insurance without property level protection to enhance property resilience. Flood velocities are likely to be high (velocity x depth >1m/sec)

3 **High Flood Hazard Zone (Flood Plain Fringe)** The floodplain fringe is the portion of the floodplain which will be covered by flood waters during the one in 20 year flood, but which will mainly be standing or low velocity water (so hazard here is more likely to be due to the depth of the standing water rather than the velocity of the water).

4 **Medium Flood Hazard (Flood Plain Fringe)** This zone is defined between the limits of the high risk zone and the low risk zone (where the floodplain is the 1 in 50 year flood).

5 **Low Flood Hazard (Flood Plain Fringe)** This zone comprises land assessed to be flooded by the 100 year event

6 **Climate Change Zone** (or buffer). This zone relates to floods rarer than 100 years at present but over time, with climate change could flood more frequently.

These zones are shown in Fig 4.

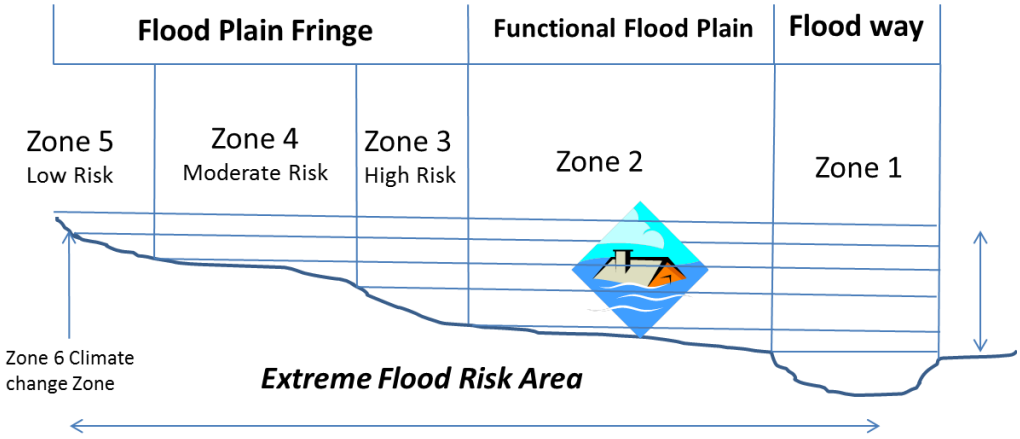

Fig 4: Flood Zones designated in the Rioni

*A distinction is required between where flood plain velocity is high and properties are likely to be destroyed. Empirical research in Australia suggests that when (V * d =1) failure of buildings could begin. This could be a benchmark in Georgia where buildings are often old and building regulations not stringent*.

4.6 Setting Risk Based premiums

Fig 5 sets out the model for developing risk based premiums for property and agricultural land.

PROPERTY		Flood Zones	
Small House (extreme Limit) where V*d>1		No Premiums for Designated floodway	Z1
Small House			
Large House (extreme Limit) where V*d>1	Number of Properties		
Large House			
Apartment (extreme Limit) where V*d>1		Premium for Functional flood plain	Z2
Apartment			
Commercial (extreme Limit) where V*d>1			
COMMERCIAL		Premium for High Risk Zone or floodway fringe	Z3
AGRICULTURE			
Potatoes			
Vegetables			
Corn/maize		Premium for Moderate Risk Zone	Z4
Grapes	Hectares of land		
Peach			
Apple		Premium for Low Risk Zone	Z5 &Z6
Wheat			
Other			

Fig 5: Model for risk based premiums (property and agriculture)[12]

The socio-economic model (see part 1 of this report) calculates the damages to property and crops depending on the return period of the onset of flooding. To refresh, for properties this was calculated from the depth of flooding and the associated damages using a proportional loss approach, converting UK depth damage curves to Georgian equivalent values based on Georgian rather than UK property prices. An annual average damage is calculated relating damage for each return period to the probability of the damage occurring for that return period.

Annual average damage for each property type under average British Flood plain conditions is calculated for each of the 6 Flood Zones and converted to GEL and expressed as a ratio of mean Georgian house price and UK house price (Table 6). Values become smaller for successive flood zones as threshold of flooding becomes less frequent.

Existing AEP	UK AAD No warning (£)	AAD GEL	AAD Premium GEL	Flood Zone		
2 years	4,728	13,238	837	No premiums for Designated Floodway	**Zone 1**	Properties should not be located here
5 years	2,828	7,918	501	Premiun for Funcional Flood plain	**Zone 2**	Properties should relocate or improve property resilience
20 years	612	1,714	108	Premium for High Risk Zone	**Zone 3**	
50 years	261	731	46	Premium for Moderate Risk Zone	**Zone 4**	
100 years	65	182	12	Premium for Low Risk Zone	**Zone 5**	
1000 years	33	92	6	Premium for Climate change zone	**Zone 6**	Future proofing to offset climate change

Table 6: Premiums (GEL) for Mid Range Small House

Thus a small house in Zone 4 (20 year to 50 year threshold of flooding) would have a mid range premium of 46 GEL. A Risk premium and administration percentage is to be added.

Table 7 and Fig 6 compare for each municipality the annual average damage (AAD) – mid range, calculated from the economic model, with the aggregate premiums for small and large houses (mid range). Zone 1 is excluded as properties would be uninsurable if located in the floodway.

[12] Cadastre data was only available to distinguish property between small and large houses

	AAD (Zones 2-6)	Premiums (Zones 2-6)	Premiums as % AAD
Tskaltubo	310,445	66,891	21.5
Kutaisi	869,275	174,271	20.0
Terjola	2,664	619	23.2
Vani	69,106	10,107	14.6
Baghdati	1,880	303	16.1
Zestaponi	1,011	156	15.4
Abasha	3,338,905	2,142,910	64.2
Senaki	107,976	49,658	46.0
Samtredia	3,428,333	1,086,096	31.7
Martvili	50,522	25,337	50.2
Khoni	2,469,180	2,338,786	94.7
Khobi	868,534	230,777	26.6
Lanchkhu	579	97	16.8
Poti	23,770	3,782	15.9
Tsageri	91,981	17,436	19.0
Lentekhi	103,031	4,771	4.6
Oni	27,557	3,134	11.4
Ambrolau	24,583	6,442	26.2
	11,789,330	**6,161,573**	**52.3**

Table 7: AAD compared with aggregate property premiums (GEL)

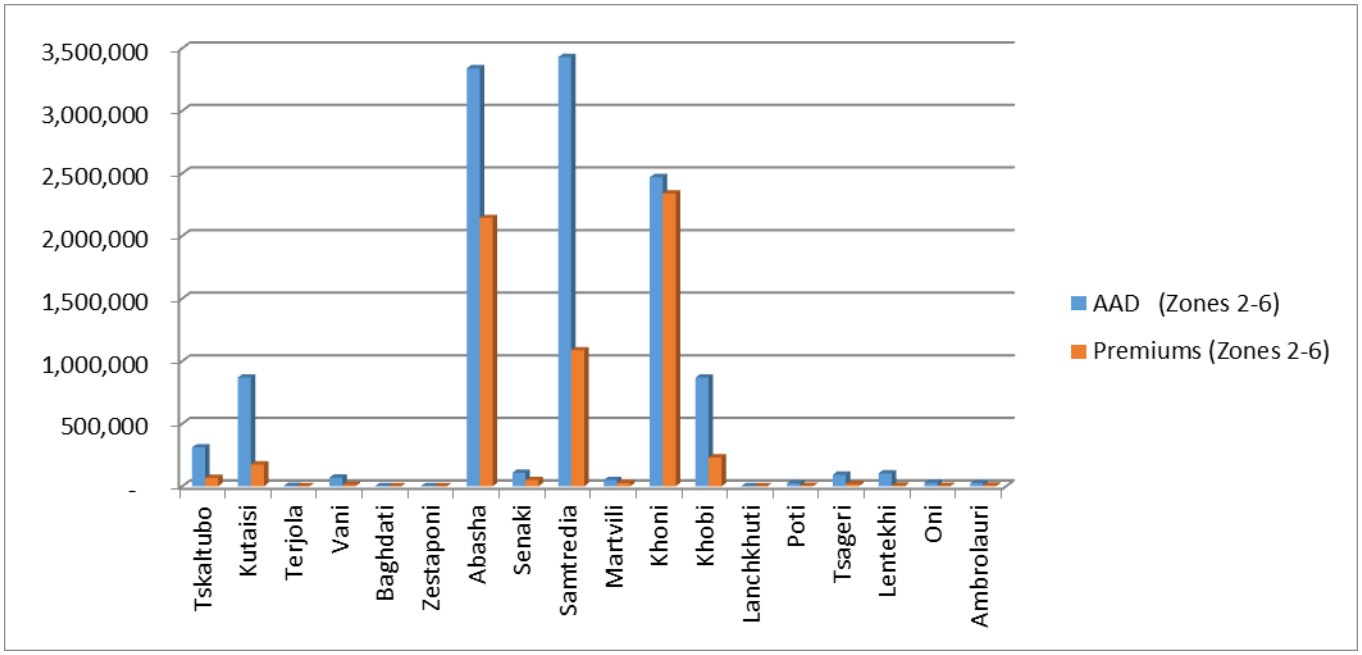

Fig 6: Comparison of AAD with aggregate premiums (GEL) Zones 2-6

AAD for all 18 Municipalities is 11.8 million GEL and aggregate premiums based on UK/Georgia house price comparisons some 6 million GEL. The mean value of percent aggregate premium to AAD is 52% with Khoni in excess of 95%. Some of the difference relates to differences in flood depth characteristics between UK and Georgian flood plains. It would therefore be expedient to allocate 11.7 million GEL per annum for flood coverage (plus a risk premium of, say 10% and an administration fee of 5%). The ratio of premium

contribution between government and householder has to be negotiated. Premium rates in Table 7 relate to the lowest rate set for property within each risk zone. For example, a property in Zone 4 is assumed to have a flooding threshold of 2% per annum whereas in reality the property could be closer to 5% threshold, that is just outside Zone 3. This explains some of the discrepancy between AAD calculations by municipality and aggregate premiums for all zones. It may be prudent that government subsidy is at least the difference between AAD per municipality and aggregate premiums.

Distribution of agricultural land within the Rioni flood zones is illustrated in Fig 7. Something like 50% of all arable and horticultural crops within the Flood Zones are cultivated within the 'floodway' and 'functional floodplain'. This clearly will have an impact on premium setting with no affordable premium set within the 'floodway'.

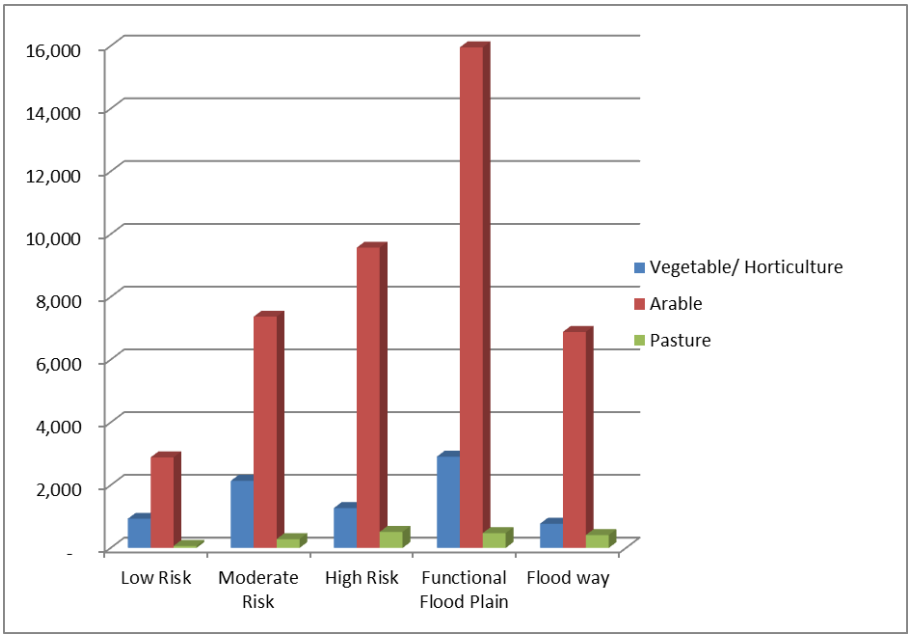

Fig 7:: Distribution of agricultural land use in Rioni Flood Zones

For agricultural crops within the six flood zones the principles used in the example in Table 3 are applied (Table 8)

	Premium GEL/ha (without risk premium and administration costs)					
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
	Flood way	Functional Flood Plain	High Hazard	Moderate hazard	Low hazard	Climate Change Buffer
CROP						
Potatoes		957	239	96	48	24
Vegetables		234	59	23	12	6
Corn/maize	No	113	28	11	6	3
Grapes	Premiums	638	160	64	32	16
peach	Set	547	137	55	27	13
Apple		502	125	50	25	12
Wheat		103	26	10	5	2
Other Crops		480	120	48	24	12

Table 8: Premium setting for agricultural crops in the Rioni basin

The annual average damage for all crops is compared with the premiums as set in Table 8 (see Table 9 and Fig 7)

Municipality	Weighted AAD (GEL)	Total Premium (GEL)	Shortfall (GEL)	% shorfall
Abasha	1,571,065	1,249,967	321,098	20.4
Baghdati	20,520	23,128	- 2,608	- 12.7
Khobi	350,276	227,602	122,674	35.0
Khoni	851,696	544,734	306,962	36.0
Martvili	104,504	119,226	- 14,722	- 14.1
Samtredia	680,865	598,496	82,369	12.1
Senaki	354,734	329,866	24,868	7.0
Terjola	11,340	10,319	1,021	9.0
Tskaltubo	98,166	84,714	13,452	13.7
Vani	92,036	118,658	- 26,622	- 28.9
Total	**4,135,202**	**3,306,710**	**828,492**	**20.0**

Table 9: AAD compared with aggregate premium for 10 municipalities

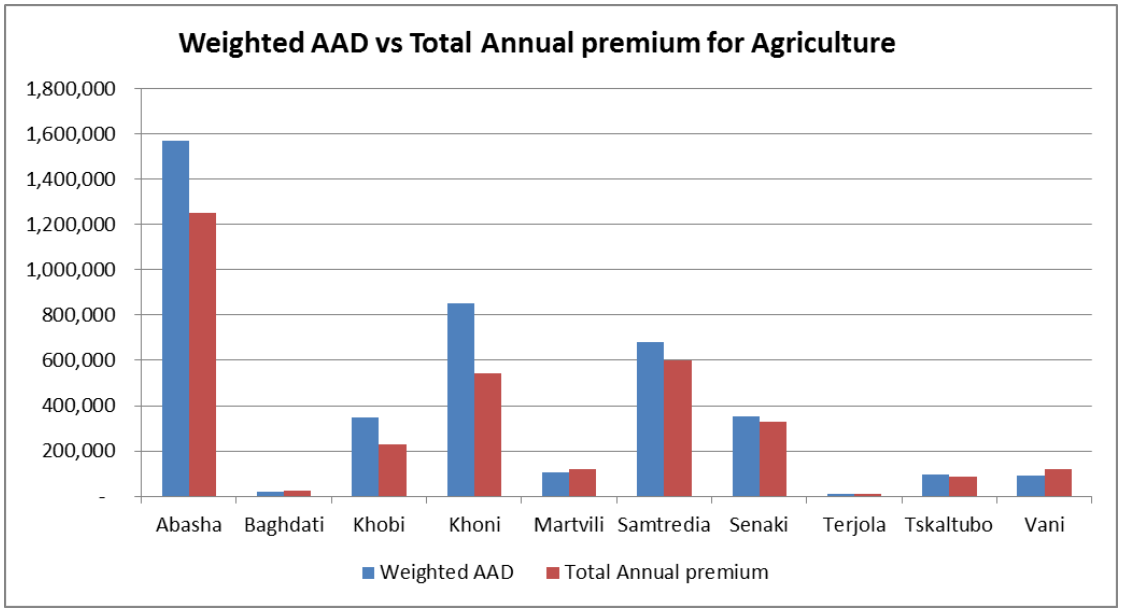

Fig. 7: Shortfall between AAD calculated by GIS model and aggregate premiums for all crops

Some 4.1 million GEL predicted losses on average per year is compared with 3.3 million GEL from an aggregation of projected premiums.

4.7 Principles of pay out

When established, river gauging will monitor the scale of flooding in Zones 2 to 6. Householders and farmers will register their acceptance into the insurance scheme. Their property and land will be georeferenced and allocated a flood zone and an annual premium assigned commensurate with that flood zone and property type. An agreement will be drawn up explaining that they will be paid according to their flood zone location. Those not entering into an agreement will not be entitled to flood compensation

Payments will be paid as follows:

Agricultural damages from fluvial flooding will be paid for each registered crop based on yield loss for the month of the flood (Table 10 – from Socio-economic report)

	Month of year															
	1	2	3	4	5	6	7	8	9	10	11	12	Colours equal seasons			
Aggregate seasonality (%)	5%	0%	3%	20%	18%	22%	7%	5%	0%	11%	6%	2%				
Yield loss by month (%)													Weighted loss, % (seasonality of flood and yield reduction)	Yield t/ha	producer price GEL/Ha	Weighted Flood Loss GEL/ha
Roots (potatoes)	10%	10%	10%	50%	100%	100%	100%	100%	100%	50%	25%	25%	71%	11.3	6780	4786
Vegetables	10%	10%	10%	50%	100%	100%	100%	100%	100%	50%	25%	25%	71%	8.3	1660	1172
Spring cereals (corn/maize)	0%	20%	60%	30%	55%	80%	100%	100%	50%	0%	0%	0%	47%	2.4	1200	566
Grapes	0%	0%	50%	55%	73%	100%	100%	50%	0%	0%	0%	0%	57%	5.6	5,600	3192
Peach	0%	0%	50%	55%	73%	100%	100%	50%	0%	0%	0%	0%	57%	9.6	4,800	2736
Apple	0%	0%	50%	55%	73%	100%	100%	50%	0%	0%	0%	0%	57%	7.4	4,400	2508
Winter cereals (wheat)	10%	10%	10%	28%	50%	80%	100%	100%	0%	100%	10%	10%	57%	1.8	900	514
Other	0%	0%	50%	55%	73%	100%	100%	50%	0%	0%	0%	0%	57%			2402
In red needs yield loss verification																

Table 10: Crop losses weighted by yield loss and seasonality

Property damages from fluvial flooding will be compensated based on depth of flooding experienced for the registered house type. Householders of flooded property will record the depth of flooding with the Municipality. Scale of payment will be based on the Georgian depth damage curve developed within the GIS socio economic model (Fig 8). Should the house be demolished the householder will be entitled to the full market valuation.

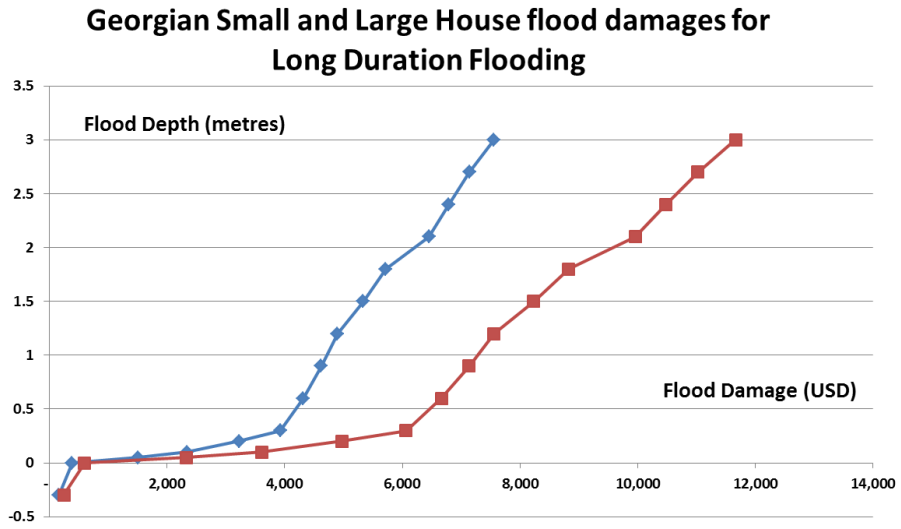

Fig 8: Depth/damage relationships for large and small Georgia Houses

From best available river modelling data and socio-economic data it is expected that an annual sum of 11.8 million GEL should be allocated for residential property insurance through a combination of premiums levied on householder and a negotiated subsidy from government. A further 4.1 million GEL per year should be allocated for small holding crop insurance, again through a combination of premiums levied and a negotiated government subsidy.

These figures represent a global view of property and agricultural risk in the Rioni basin and the method used is easily improved in the GIS model as negotiations to improve input data get under way. This research serves to open the debate regarding further developing flood insurance for flood prone communities, rather than give absolute values as to the scales of investment required in instigating a programme of incentivised insurance.

5 Stakeholder Workshop: 29th October 2014, Tbilisi

A wide range of stakeholders (Table 11) were invited to attend a workshop in Tbilisi on 29th October 2014 to discuss the potential for further developing our formative ideas on Weather Index-based Insurance.

Organization	Name	Position

Ministry for Regional Development and Insfrastructure og Georgia;	Eka Kvirikashvili	Infrastructure Development Dep.
Georgian Insurance Institute	Geroge Gigolashvili .	Director
Georgian Insurance Association;	Devi Khechinashvili	Head
Ministry of Agriculture	Ekaterine Zviadadze	Head of Politics and Analytical department.
nsurance Supervising Service of Georgia;	Maia Tsanava	Leading specialist. Standardization Department
Insurance Supervising Service of Georgia;	Lasha Nikoladze	Head
Agrarian Issues Committee under Parliament of Georgia;	Gigla Abulashvili	Head of Committee
Swiss cooperation Office in the South Caucasus	Teimuraz Khomeriki	National Programme Officer
KFW	Nino Shanidze	
Gras Savoye Georgia http://grassavoye.com.ge/	Ketevan Pavlenishvili	Managing Director;
Gras Savoye Georgia http://grassavoye.com.ge/	Nino Skhiladze	Head of Service Group
Aldagi	Ivane Bujiashvili	Agro-Insurance Manager
Ardi	Mikheil Japaridze	Re-Insurance Manager
Ardi	Lasha Lapachi	Re-Insurance Manager
Representatives of MFI's e.g. Crystal	Archil Bakuradze	Chairman of Supervisory Board
IC Group	Ksenia Ksinioxina	Deputy Director
GPI Holding	Tamar Badashvili:	
Agriculture Projects' management Agency	Archil Bukia	Deputy Director
Agriculture Projects' management Agency	Mariana Morgoshia	Acting Director
Agriculture Projects' management Agency	Levan Maghradze	Agricultural insurance project manager

Table 11: Delegates at Tbilisi Workshop

Out of Workshop participants, 10 persons filled out the distributed questionnaire, which was mainly about determining strengths and weaknesses of the weather index based insurance scheme suggested under the project. The representatives of the following organizations participated in the survey: Insurance Company Aldagi; Georgia Regional Development and Infrastructure Ministry; National Environmental Agency; The Agency for Environment and

Natural Resources; Tskaltubo Municipality Executive Office; Tsageri Municipality Executive Office; Swiss Cooperation Office. A summary of literal translations follows:

1. ***Do you think it is necessary to expand activities in the flood risks insurance?***

The majority of the participants gave a positive answer and think that it is necessary to expand work on flood insurance issues. Specific comments were:

- "It is necessary, because in the process of work the problems and issues related directly to insurance are identified even more precisely. Moreover, in addition to the Rioni Basin, there are the basins of other rivers where the residents are facing similar risks."
- "It is necessary and Poti has to be included later".
- "Yes, because the geographic location of Georgia and diversity of climate conditions necessitates continued work on flood risks."

2. What are the main factors hindering the development of insurance field (agriculture, property, etc.) in flood risk areas?

- "Diversity of risks, concurrence of risks. Furthermore, flood risk can be attributed to the category of disastrous risk given its complex and diversified nature."
- "First of all, for example, social condition of the people living in the mentioned zones in the Tskaltubo municipality has to be noted. Additionally, the issue of awareness raising, for there is very low awareness of residents about insurance procedures and conditions. State should be more involved in the mentioned process."
- "Poverty and the absence of information infrastructure, lack of spatial development plans."
- "Political will of the state, low level of awareness of local residents, low level of economic development in the country."
- "Political will, unregistered land plots, awareness of the residents, lack of legislative framework."
- "At this stage there is no complete model of zoning and relevant legislation".
- "Poverty, availability of data, housing and land usage in high risk zone ".
- "I think that the lack of information from the municipalities about agricultural or other property is the most important factor, which prevents the development of insurance field in this sector."
- "Engineering gap between the insurance carrier and insured company. Maximum involvement from the state in terms of subsidy."

3. What are the advantages of weather index based insurance compared to other approaches?

- "Is easy to administer. A specific insured is unable to manipulate/manage risk. The amounts freed up from administration can be directed towards the reduction of insurance premium rates. It is attractive for reinsurers given its transparency. The risks of fraud and moral harm risks are confined."
- "Weather index based insurance is important for preventive measures. Further, it reduces the feeling of hopelessness in terms of activity in agriculture."
- "Is inexpensive and objective."
- "Weather index based insurance is much cheaper, widely accessible for the population and is much more transparent."
- "It is relatively inexpensive and accessible for the population".
- "Weather index based insurance takes account of trend of climate changes."
- "Easy, Cost effective";
- "Easy, unified integrated system enabling its introduction country-wide in a significantly simpler way."

4. What are the disadvantage of weather index based insurance compared to other approaches?

- "The following cases can be regarded as the drawback of index based insurance: cases when, despite losses, individual insured individuals may not receive compensation. At the same time, the people who have not suffered damages may receive compensation. The development of infrastructure at the initial stage is another drawback. As well as the need for close correlation of insured risks parameters/index in relation to agricultural crops."
- "As for the drawbacks, it can be said that dependence on insurance only should not be the goal; rather, it is necessary to undertake correct measures and procedures preliminarily."
- "Insurance should not be different, main basis should be incurred losses."
- "It is not comprehensive. Can be used only in relation to certain products."
- "The following can be considered as the drawback of the mentioned insurance: accuracy and the presence of the data on which the mentioned insurance system is based for calculating risks."

- "Low density of meteorological network".
- "Single risk in unlimited area it is only one of the risk mitigation measures. If preventive measures and others are not in place there would be problems".

5. Who should be responsible for the development of flood risks insurance field?

- "Largely, it should be the government, represented by the Ministry of Environment. Although, it is necessary to establish an interagency commission and work in an integrated and coordinated manner to ensure effective result."
- "The state, the government, together with private institutions."
- "The central authority – government structures."
- "State together with the private sector."
- "Private and state sector."
- "Government, local authorities. As well as insurance companies."
- "The Ministry of Agriculture together with insurance companies."
- "National Environmental Agency."
- "Central and local governments".

In summary, there was agreement that the development of weather index based insurance should be further developed following response to this project and that a mix of government and insurers should initiate a dialogue to develop the formative ideas addressed. To be successful the correct amount of government subsidy should be explored.

There was a feeling that as exposure to flood risk will be exacerbated by climate change, it is opportune to develop a simple but effective framework for flood insurance. However, some delegates were concerned that poor data (inaccurate modelling, agricultural and cadastre data etc) will hold back the development of a realistic and therefore acceptable product. These deficiencies must be addressed at Ministry level. It is recognised that this pilot project was held back on accurate deliverables by poor cooperation in data collection and availability. This must be redressed as a priority.

The delegates expressed confidence that with an appropriate steer from an insurance-led commission and appropriate stakeholders a simple, inexpensive, transparent, cost effective, and most importantly accessible system could be introduced not only in the Rioni Basin but over the rest of Georgia. Emphasis was placed on political will to develop a comprehensive

flood insurance product in the context of a sound legal framework and community understanding and acceptance.

To conclude, the next phase of the Rioni project needs

a) to promote cost effective and sustainable flood risk mitigation strategies in the communities identified by this project as at greatest risk, and
b) to consider basin wide insurance to help mitigate against residual flood risk which traditional structural flood mitigation, especially in these communities, cannot address
c) to assist stakeholder confidence and buy in at all levels, from government to financial and insurance organisation right down to community level, the modelling and data acquisition and improvement process is of highest priority.