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Vulnerability assessment of rural livelihoods under multiple stressors. The case study of Bosnia and Herzegovina

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Date: 13.03.2018.

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Abstract

Almost half of the population in Bosnia and Herzegovina lives in rural areas, in the conditions around the poverty line. The causes for the difficult living conditions are mainly found in the complex political situation, as well as the war period that has implicitly influenced the livelihoods of the poor. Climate change is posing additional threat to already endangered livelihoods. Under the pressure of these multiple stressors, livelihoods of the poor are not able to adequately respond to these changes, and therefore they tend to become vulnerable. Livelihood vulnerability can be defined as the extent to which household livelihoods are susceptible or are able to cope with various socio-economic, political and environmental stresses. This study explored how multiple stressors (socio-economic and environmental) affect the vulnerability of livelihood assets for the northern, central and southern region of Bosnia and Herzegovina, using descriptive statistics, Livelihood Vulnerability Index (LVI) and Sustainable livelihood approach (SLA). The results showed that households in all three regions ranked main stressors on their livelihoods by following order: political instability (4.5), agrarian policy (4.5), market access and prices (3.5), climate change (3.0) and weak infrastructure (2.8). Furthermore, the overall LVI value (49.2) showed that livelihoods of all three regions are moderately vulnerable to multiple stressors. The main components which influence overall household livelihood vulnerability of observed regions under multiple stressors were financial capital with LVI value of 66.7 and natural capital (62.6), followed by human (44.8), social (37.9) and physical (33.7) capital. Certain differences found among regions in terms of differential vulnerability levels and households perceptions were discussed in details. Based on the results, it was concluded that low income levels, poor access to arable land, lack of forests, insufficiently irrigated land, low trust in local government, low involvement in social organizations and the lack of labour are the main causes of marked vulnerability levels under multiple effects of the stressors. The results clearly indicate the need to establish institutions and enabling policies that would help rural livelihoods recover from stresses in terms of providing sustained access to capitals. The obtained results are also useful, since they can facilitate better decision-making and strategic planning in order to enhance resilience to various stressors.

Key words: Livelihood, Vulnerability, Livelihood vulnerability index (LVI), Bosnia and Herzegovina

List of Abbreviations

BH - Bosnia and Herzegovina

AFSBH - Agency for Statistics of Bosnia and Herzegovina

BAM - The Bosnia and Herzegovina convertible mark

DFID - The Department for International Development

EBRD - The European Bank for Reconstruction and Development

FIPA – Foreign Investment Promotion Agency

FMAWF - Federal Ministry for Agriculture, Water-management and Forestry

IFAD - International Fund for Agricultural Development

IISD - The International Institute for Sustainable Development

IPCC - Intergovernmental Panel on Climate Change

LVI - The Livelihood Vulnerability Index

MoFTER - Ministry of Foreign Trade and Economic Relations

SLA - The Sustainable Livelihood Approach

UNDP - United Nations Development Programme

UNEP - The United Nations Environment Programme

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1. Introduction

According to IPCC (2014a) almost half of world's population lives in rural areas, while 90 % of them live in developing countries. Rural regions in developing countries are portrayed by its reliance on farming and natural resources, as well as high poverty, low human development rates, marginality and confinement (IPCC, 2014a). Moreover, exposure to various stressors, especially in developing countries is disturbing, because economic, political, social and climate change conditions genuinely affect the food security (Leichenko and O'Brien, 2002). Rural population in developing countries is facing effects of multiple climatic and non-climatic stressors, including inadequate land and natural resource policy, environmental degradation and insufficient amount of investment in agriculture. Cases in Tanzania, Ghana, Malawi, Kenya, India and some other developing countries have shown that climate change and variability interact with other stressors (economic policy, globalization, environmental degradation) as an additional pressure on livelihoods in rural areas (IPCC, 2014b). The livelihoods of the poor are vulnerable to various shocks and stresses in many developing countries (Ribot, 2009). For example, climate change and extreme weather events erode basic needs, particularly for those who are poor (Quinn et al., 2011). Household diversification in terms of farm and household size, crop choices and input use are significant in determining impacts of climate change (Claessens, 2012). Therefore, the concept of vulnerability is a significant analytical instrument for depicting conditions of sensitivity to harm, frailty, and minimalness of both physical and social frameworks, and for managing regulating investigation of activities to upgrade prosperity through diminishment of risk (IPCC, 2014a).

The uncertainties of future exposure, vulnerability and responses are substantial, especially under current global conditions (IPCC, 2014a). In this respect, there is a lack of information for Balkan countries, especially when it comes to Western Balkans. Hence, it is important to do more research on this topic. Recent study carried out on vulnerability assessment to climate change at the subnational level in Bosnia and Herzegovina (Žurovec et al., 2017), was a motivation for more detailed vulnerability risk assessment on the micro level, while including other stressors with the main focus on livelihood assets in Bosnia and Herzegovina. Therefore, the present research is a continuation of first research of its kind done by Žurovec et al., (2017).

Vulnerability can be defined in many different ways. In the context of climate change, IPCC (2001), explains vulnerability as "the degree to which a system is susceptible to, or unable to cope with adverse effects of climate change". The intension of this study is to extend the scope of previous definition including socio-economic and political dimensions. Since human activities to a large extent contribute to vulnerability, there is a need for context-specific approaches to address it (Adger, 2006). In this context, vulnerability is the degree to which a household is sensitive, or unable to overcome multiple effects of social, political, economic, cultural, environmental and technological processes of change (IPCC, 2012a). Rural households with limited access to assets tend to be vulnerable because they lack capabilities necessary to respond to multiple stresses induced by adverse impacts of natural and social changes (Dulal et al., 2010). The population in developing countries is often vulnerable because of their dependence on agriculture (Panthi et al., 2015). Additionally, livelihood vulnerability due to natural and socio-economic stresses limit their ability to secure and sustain their livelihoods. Building resilience to stresses and increasing sustainability of livelihoods could be seen as possible options of reducing vulnerability. Resilience can be achieved through better access to assets (Moser, 1998). Furthermore, better access particularly to infrastructural and technological resources, more diversified assets and activities, as well as, social support can also improve livelihood development (Reed et al. 2013).

Livelihoods encompass set of capabilities, assets and activities that are necessary to make a living (Chambers and Conway, 1992; Ellis et al., 2003). The nature of livelihood is dynamic and people change and adapt their livelihoods due to internal and external stressors. Synergic relationship between climate and other environmental, political, social and economic stressors affect livelihoods, often adversely. These multiple stressors shape livelihood dynamics due to diverse vulnerabilities within or between households. Consequently, some households might be able to manage stresses, while poorer households might be forced to erode their assets. Thus, the more assets households have, the less they are vulnerable and more resilient to multiple stressors (Ellis, 2000). For example, extreme weather events may affect agricultural production and activities, shifts in terms of trade may influence local production and labour migration may erode livelihood options (Scoones, 2009; IPCC, 2014b). Vulnerable households tend to expend their limited resources in order to respond to these stressors (Mortimire and Adams, 2001).

Bosnia and Herzegovina (BH) is mainly a rural country and, therefore, most of the population lives in rural areas, approximately 61 % (MoFTER, 2012). This part of the population highly depends on agriculture (EBRD, 2013). As a country in transition, especially after post-war period, BH has faced severe socio-economic, political and other challenges. Additionally, the climatic stressors in form of extreme weather events, including droughts, floods and other, represent added pressure resulting in serious economic losses (Žurovec et al., 2015). After the four-year war period, most of the farmers lost their jobs, approximately 50-60 % of their assets, 90 % of their livestock and infrastructural, water and electrical power facilities were destroyed (IFAD, 2017). Reconstruction activities were mostly directed to urban areas, while rural areas remained neglected. Furthermore, a large part of rural population got engaged in agriculture as a main and/or additional source of income (Žurovec et al., 2015). Sensitivity of agricultural sector, particularly on climate stressors, makes livelihoods of many households in BH, undoubtedly vulnerable to climatic stresses (Žurovec et al., 2017). It has been estimated that more than 31% of total households in BH are employed in agricultural sector (AFSBIH, 2013). Therefore, agricultural sector has become essential in providing food security, as well as reducing poverty and providing mitigation for the social weight of economic reforms (Bojnec, 2005). Recent findings demonstrated that only half of arable land was under cultivation (state-owned land is awaiting privatization or most of the arable land is poorly irrigated, lacks flood protection or is infested with land mines). Furthermore, good agricultural land is scarce due to mountainous topography and shallow soils (IFAD, 2017). Agricultural sector is characterized by limited farm holdings, low productivity and low incomes. Poor infrastructure, lack of access to support services and finances and limited access to processing industries are the main constraints of agricultural development (Žurovec et al., 2015). Nevertheless, poverty in BH is caused by social exclusion and limited access to basic services, rather than lack of food (IFAD, 2017).

In addition, recent war events, economic crisis and inadequate governance were the main reasons for the poorly developed social and economic infrastructure (Žurovec et al., 2015). Poverty has become the main issue the territory of BH is dealing with. Furthermore, this is the result of difficult transition from former communist state to a market economy, but also the result of limited resource base (IFAD, 2017).

The vulnerability assessment studies utilize different methods in order to examine interactions between humans and their physical and social surroundings (Hahn et al., 2009). This study uses

descriptive statistics, Sustainable livelihood approach (SLA) and Livelihood Vulnerability Index (LVI) as main tools in vulnerability risk assessment with the focus on livelihood assets.

The main objectives of this study were a) to address people's perceptions of main stressors contributing to vulnerability and b) to quantitative assess level of vulnerability in three different agro-environmental regions in BH. These objectives were accomplished by addressing the following questions:

1. What are the main stressors affecting vulnerability of rural households' livelihood in northern, central and southern region?
2. What are the vulnerability levels of livelihood assets in northern, central and southern region?

2. Study area

BH is a South-eastern European country, situated in Western Balkan region, and has a surface area of 51,209.2 km^2, of which 51,197 km^2 is land and only 12.2 km^2 of coast. The land is predominantly hilly to mountainous, where 5% is lowlands, 24% hills, 42% mountains, and 29% is the karst region (AFSBIH, 2013). Furthermore, northern and central region are characterized by humid continental climate, unlike the southern region where semi-arid conditions are predominant. As shown in figure 1, the sites used in this study are divided into three groups by regions: the northern (lowland), central (hilly-mountainous) and southern region (Mediterranean) (FMAWF, 2013).
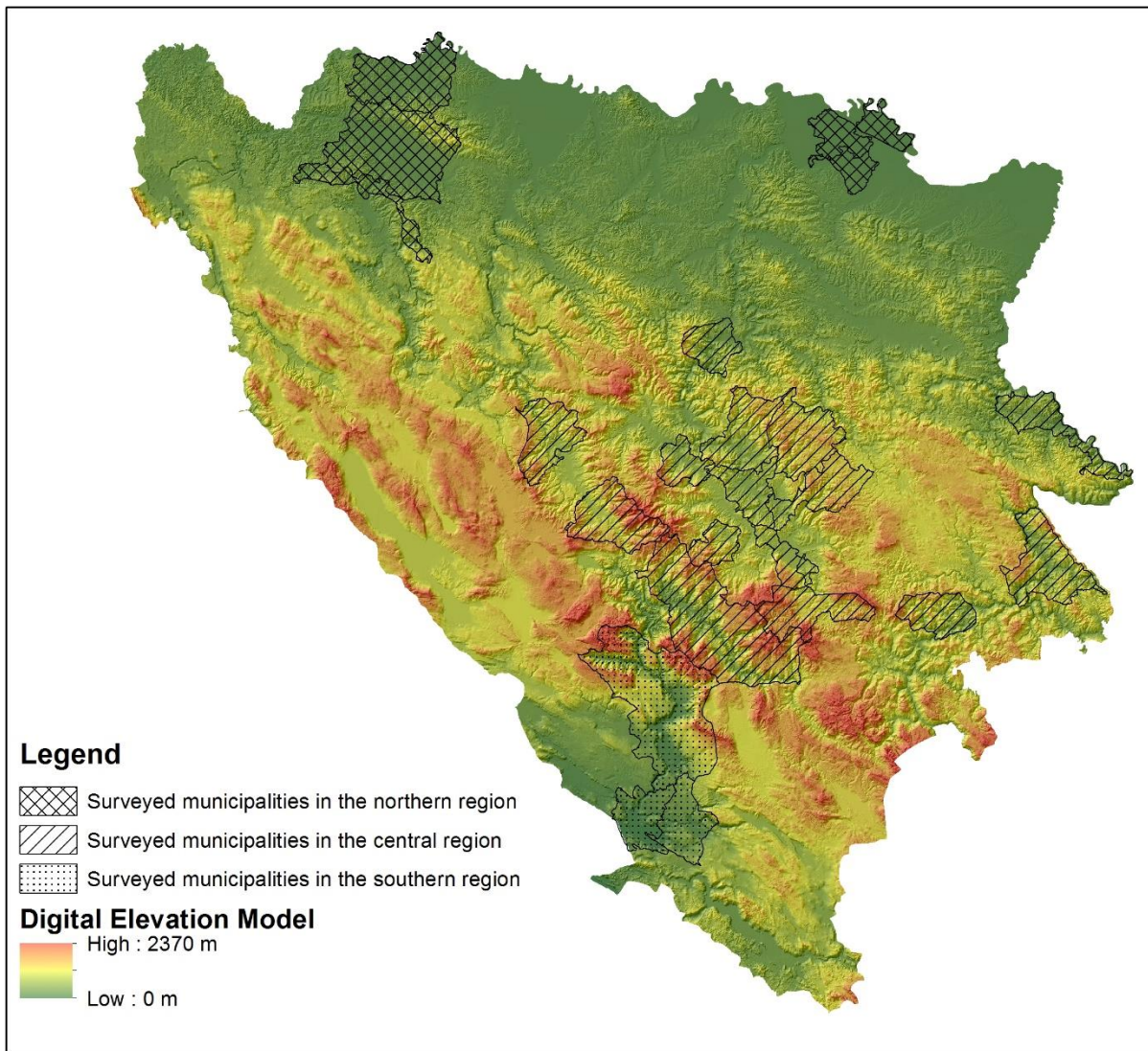
Figure 1. A map of BH showing northern, central and southern region

The *north lowland region* consists of the region of Peri-pannonian Bosnia in the northern part of the country. This region, situated in humid continental climate, is mainly flat, with the presence of hilly landscapes towards the south, where the altitude step by step increments experiencing significant change in the central, hilly-mountainous area. Over 60% of the total population in BH lives in this region, so it represents the most populated region in the country. Agriculture covers a big part of livelihoods for most people, with the exception of few larger cities and business centres. Climatic and geographical conditions in this region are good for many different types of agricultural production. The heft of the nation's crop production is situated in the prolific plains along the rivers, cultivating predominantly maize, than many different cereals and legumes (soybean), while the crucial part of dairy and meat production,

together with the corresponding pastures and fodder production, are performed in the more hilly areas. Furthermore, heavy soils, the need for productive drainage, the expanding recurrence of floods, droughts and other extreme weather conditions, are the main physically constraining variables of agricultural production in this area (Žurovec, 2018).

The *central hilly-mountainous region* covers about 60% of the total surface of BH. The mountain chain of the Dinaric Alps extends from the north-west toward the east and the southeast of BH. Moreover, geographically, it includes the region of central Bosnia, together with the so-called high (tall)-karst areas in the northwest and south-east. Furthermore, this area is abundant in natural resources, particularly water, coal and ores. The areas with high mountains have many forests and they are not very populated. As for the terrain it is mostly rugged, a large portion of the land is on slopes of different heights, and the land is prevalently eroded, shallow and not very fertile. Therefore, the agricultural production is quite limited, as well as the use of mechanization and the choice of crops. Areas located 800 meters above sea level are for the most part unsuitable for intensive crop production because of the harsh climatic conditions. Some of the largest rivers have formed valleys where the most part of the population in this region lives and forms some of the biggest economic and industrial centres in BH, including the capital, Sarajevo. The climate conditions in the valleys are similar to the continental climate of the northern BH. Livestock production is prevailing in this area, but fruit and vegetable are also produced (Žurovec, 2018).

The *south Mediterranean region* is situated at the southern part of the country and it includes the majority of the area of Herzegovina. It represents the smallest region that is being researched, yet remarkable in its natural, climatic and geographical characteristics. Firstly, it is generally a karst territory located in the hinterland of the Adriatic Sea, that progressively increases in altitude in the direction of the Dinaric Alps which are located in the north. This region is partitioned, by altitude, into the region of low Herzegovina (up to 700 m) and high Herzegovina (more than 700 m). Prolonged, dry summers, mild autumns, as well as springs with infrequent rain and brief winters with long periods with rain are the primary attributes of the Mediterranean climate in low Herzegovina. The zones on a higher altitude have colder climatic conditions, yet at the same time generally milder contrasted with the climate in the other parts of the country. The territories that are the most fertile and the most populated ones are located in the south, situated in the few fertile karst fields. The remaining territory is mostly under karst, with its unique surface and subsurface characteristic, like sinkholes, vertical shafts,

sinking rivers and streams, underground drainage systems and caves. These regions are sparsely populated and do not have noteworthy potential for any sort of production, because they are for the most part eroded or barren, as well as scarce vegetation. The natural resources in this area are unexceptional, but the most significant source is the hydro-energy capability of rivers and aquifers, that were useful for building many hydroelectric power plants. Generally, agriculture is dominant in the karst fields and the climatic conditions are favourable for various crops, most eminently vegetables, including tomato, pepper, potato and lettuce. Furthermore, Mediterranean fruits, for example citruses, cherry, figs, peach, and pomegranate are likewise common. Vineyards are found on important parts in the south, while the production of continental fruit is predominant in the territories with higher altitude climate. On the other hand, livestock production is in a constant decline. The primary favourable position of this area is a mild, Mediterranean climate, which gives preference on the local markets for agricultural products, because of prior early ripening of crops, and also the cultivation of some early and late-season fruits that are sought after by consumers and along these lines can command a higher price. There are limited land resources because of the karst and access to irrigation water in some areas, and therefore, they represent the main constraints of agricultural production (Žurovec, 2018).

3. Conceptual Framework

3.1. Livelihoods

Livelihood framework is concerned with people, their strengths (assets) and how people turn them into livelihood outcomes. People need many different assets to accomplish productive livelihood outcomes (Dercon, 2001). Respectively, livelihoods include means and capacities that are required to sustain the basic needs that people have, including food, shelter, clothing, cultural values and social relationships. Furthermore, the capability to fulfil these basic needs depends on assets or capitals (Gaillard, 2015). The assets are the backbone of the livelihood framework within vulnerability context. The livelihood framework identifies five capital categories out of which livelihoods are derived: natural capital, physical capital, human capital, financial capital and social capital (Chambers and Conway, 1992).

Natural capital comprises of "natural resource stocks (land, water and biological resources) from which resource flow and services, that are important to ensure livelihoods (e.g., nutrient cycling, erosion protection) are derived" (DFID, 1999; Goldman, 2000).

Physical capital includes "the basic public goods (infrastructure: roads, housing, electricity) and producer goods (technologies: irrigation works, reticulated equipment) necessary to support livelihoods. Therefore, physical capital is helping people to fulfil their basic needs and to become more productive" (DFID, 1999; Jonathan, 2000).

Human capital denotes "the set of skills, knowledge, capacity to work and well health that all together allow people to invent diverse livelihood strategies in order to accomplish livelihood objectives. Furthermore, at a household level, labour availability is the crucial issue of human capital, that depends on the size of the household, level of skills, leadership potential and health" (DFID, 1999; Roberts and Yang, 2003).

Financial capital consists of "financial resources (flows and stocks) which are used by people in order to accomplish their livelihood objectives. The nature of financial capital is flexible and it can contribute to the consumption, as well as, production. In comparison to other assets, financial capital can be turned into other types of capital. However, this type of asset is usually the least available to the poor population" (DFID, 1999; Lasse, 2001).

Social capital refers to "the social resources (networks, being member of more formal associations, relationships of trust, reciprocity, and exchanges) that people use in order to accomplish livelihood goals" (DFID 1999; Moser, 1998).

Different institutional, cultural, political conditions as well as shocks, seasonality and trends can either affect people`s livelihoods negatively or enhance their wellbeing. Such multiple stressors shape livelihood dynamic due to differential vulnerabilities between and within households (IPCC, 2014d). Furthermore, on a long-term basis, livelihood changes due to dynamic drivers such as demography (Tiffen et al. 1994), regional economic shifts and urbanization (Tiffen 2003), migration (Batterbury 2001), land-use (Fairhead and Leach 1996) and climate (Adger et al. 2003). These circumstances directly influence people's assets and strategy choices they make in order to achieve positive livelihood outcomes. Moreover, these stresses produce diverse levels of vulnerability (UNEP, 2006).

This study focuses on rural households` livelihood, which is usually called "peasant livelihood" in the literature. Peasants are households which pursue their livelihoods to large extent from agriculture, utilize family labour, integrate household production and consumption activities and are partly engaged in input and output markets that are often imperfect and incomplete (Ellis, 1993). This differs them from other types of livelihoods because of their engagement particularly in small – scale agricultural activities (dependent on family labour and low capital

use) and agriculture that is one of the most important sources of rural livelihoods. Moreover, because of its high dependence on agriculture, rural households' livelihood could be recognized as "agricultural livelihood".

The core aim is to achieve sustainability of livelihoods which implies that livelihoods are stable, resilient, resistant and robust when it comes to external and internal stresses (Scoones, 2009). A livelihood is considered to be sustainable when it can handle and recover from stresses and shocks, as well as maintain or improve its capabilities and assets at the present time and in the future, while not endangering the natural resource base (Chambers and Conway, 1992).

3.2. The Sustainable Livelihoods Approach (SLA)

This study uses Sustainable Livelihood Approach (SLA) as conceptual tool used to support vulnerability assessment of rural livelihoods to climatic, as well as non-climatic stressors and to put the focus on the livelihood capital as its fundamental component. SLA identifies five major livelihood assets (capitals): natural, human, physical, financial and social that are essential to achieve livelihood sustainability in a given structure and process context (Chambers and Conway, 1992; DFID 1999).

As presented in figure below (Figure 2), this approach involves *vulnerability context* viewed through shocks, trends and seasonality that affect five *livelihood assets* and the influence of *polices, institutions and processes* on *livelihood strategies* and their *outcomes*. SLA views assets as inputs, livelihood strategies as outputs that in return shape outcomes (Scoones, 2009).
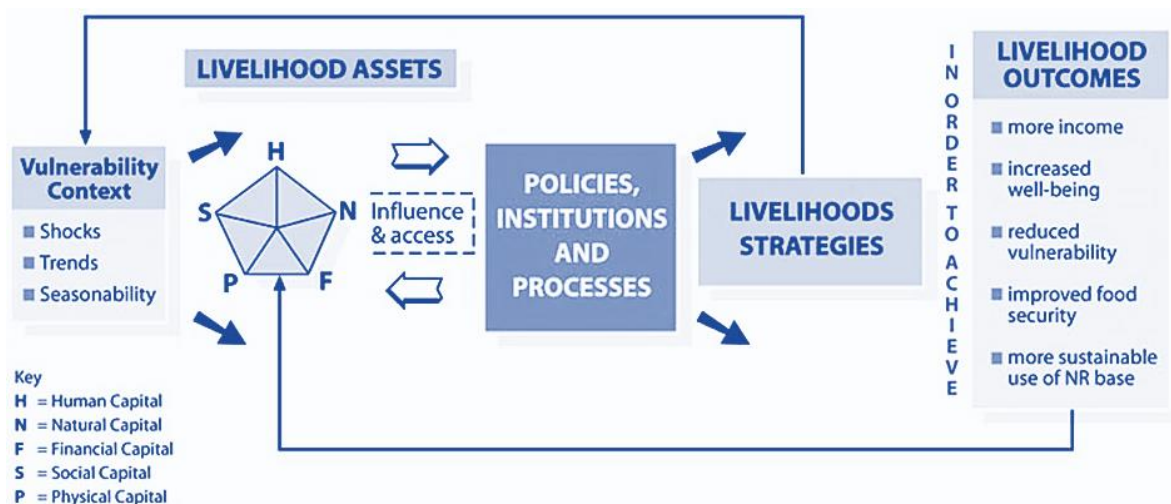
Figure 2. Sustainable livelihood analytical framework. Adapted from DFID (1999).

As it is stated by Kollmair (2002) "this framework shows that stakeholders are operating within the context of vulnerability, because they have access to certain assets. Furthermore, assets attain value through the overall social, institutional and organizational environment. The context of vulnerability shapes livelihood strategies that are available to people in the quest for their self-defined beneficial livelihood outcomes."

The central objective of the SLA is to provide assistance to poor population in order to accomplish enduring upgrades against the pointers of poverty which they identified (DFID, 2001). According to Stirrat (2004) poverty and vulnerability reduction in rural households could be achieved through helping people to build up their assets (facilitating people`s access to assets) and ensuring that people have an adequate support by critical organizations and institutions (DFID,1999).

However, the possibilities for applications of the SLA are complex and not limited just to livelihoods, because the approach incorporates concepts of many other theoretical approaches. Its adaptable outline and receptiveness to changes makes it versatile, so it can be applied to various researches and projects with different objectives. In this study the emphasis is on the vulnerability context within the SLA, which shows the nature of shocks, trends and seasonality, as well as, the capacity of the poor to withstand their effect. Institutions that enable poor households easier access to resources necessary for their livelihood pursuits, might contribute to sustainable livelihood objectives, as well as poverty reduction, asset formation and adaptation

options to climate change (Goldman et al., 2000; Wang et al., 2016). In this context, the role of institutions is important, as they determine access to assets and vulnerability to various stressors, what in return affects livelihood options in achieving positive outcomes (Agrawal, 2010).

3.3. Vulnerability

The concept of vulnerability has met its broad application in livelihood systems (Hahn et al., 2009). When considering the context of livelihood approach with primary spotlight on assets, vulnerability incorporates the exposure of household assets to shocks (e.g., conflict, floods, drought) and seasonality such as prices, employment conditions, demographical, environmental, technological and changes in governance and economy (Malone, 2009). These occasions are generally unpredictable and may impact livelihoods and assets availability, that can sometimes help, and sometimes limit them in creating constructive livelihood outcomes. On the one hand, the impacts of these stresses may have positive influence on livelihoods, for instance by strengthening them through technological change and on the other hand, negative influence by weakening them in some respects (Ellis, 2000). Positive effects, therefore decrease, while negative ones increase livelihood vulnerability.

There are several approaches that are created in order to better understand the concept of vulnerability. O´Brien et al. (2007) identifies two main approaches to vulnerability: outcome and contextual vulnerability. *Outcome vulnerability* is portrayed as a negative effect of a stressor(s) on a biophysical or social exposure unit after adaptation responses have been applied. In order to understand vulnerability in the terms of climate-society interactions the framework of contextual vulnerability could be seen as a process-based and multidimensional approach. Within this contextual framework, "climate change and variability" happen in the context of technological, political, social, cultural, economic and other change processes as presented in figure below (Figure 3).
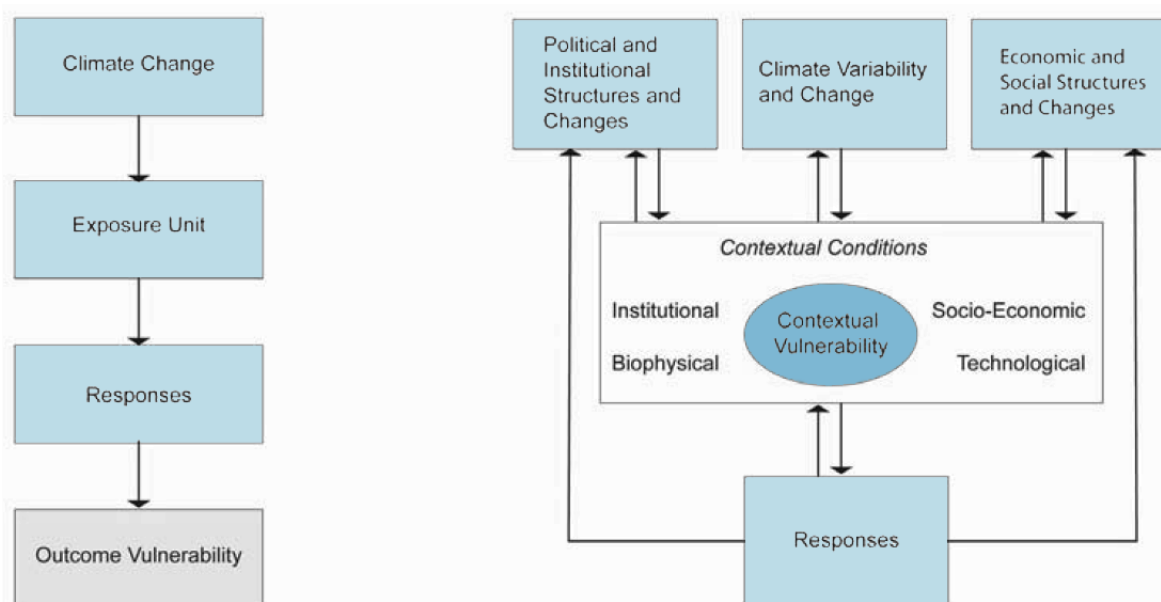
Figure 3. Vulnerability framework: outcome and contextual vulnerability. Adapted from Füssel (2009) and O'Brien, K. L. et al. (2007).

These contextual conditions influence people, at the national, group and individual level, in the terms of subjection to climate change, and their ability to react to these changes (O'Brien et al., 2007). With a specific goal to adequately oversee the risk, it is crucial to see how vulnerability is developed and generated (O'Brien et al., 2004b). That could be done by using various vulnerability assessment techniques.

3.4. Vulnerability assessment

According to Barsley et al. (2013), the vulnerability assessment has to include various techniques from various disciplines. The most widely used approaches to analyse the causes of vulnerability include the concepts of entitlements or livelihoods in assessing the factors shaping people's assets, as well as their adaptive capacity to hazards and stressors (IPCC, 2014a).

The significance of vulnerability assessment is primarily found in facilitation of decision-making information and their several adaptation and planning levels. Multilateral institutions are progressively embracing and developing them as an effective policy framework to address poverty and vulnerability, consistent with expanding growth and development goals. Furthermore, they provide the necessary help to national social development and environmental protection agencies, with the creation of particular community plans that adjust to

environmental, socio-economic and socio-cultural needs and rights of rural population, whose livelihoods are dependent upon natural resources (Arvai et al., 2006).

Additionally, an indicator approach based on vulnerability indicators can give a possibly useful method of monitoring vulnerability over time and space, recognizing processes that add to vulnerability, organizing strategies for reducing vulnerability, and assessing their adequacy in diverse social and ecological settings (Adger et al., 2009). Numerous approaches utilize indicators to describe and quantify multidimensional issues, frequently joining different indicators into a single composite index of vulnerability. Vulnerability indices are created for three basic purposes. To begin with, they offer a reference point for assessing frameworks for development policy (Eriksen and Kelly, 2007). Also, they can convey essential data for creating adaptation and mitigation plans (Gbetibouo et al., 2010). Lastly, they can provide methods for standardizing vulnerability measurement, because of that a correlation of various contexts can be achieved. Progressively, this can give the necessary techniques for setting priorities in resource allocations for adaptation and mitigation (Preston et al., 2011). While indices give helpful methods for comparing and evaluating different units of analysis (e.g. households, geographic regions), they should likewise have the capacity to include local, context-specific variables (Eakin and Bojorquez-Tapia, 2008). Moreover, if they do not have such flexibility, assessments can be affected by the absence of particular, local indicators that might be utilized to make a division between vulnerability assessments that are based on the best quality information that is obtainable and based on the limited resources and expertise that are available (Shah and Rivera, 2007).

Overall, at the household level, an index assessing livelihood vulnerability has an obligation to provide explicit indication of the capabilities, assets, and activities, that are required for a sustainable living conditions of the household (Chambers and Conway, 1992).

4. Research methods

4.1. Data collection and analysis

This study employed quantitative methods in collecting the data from three regions in BH as described in details by Žurovec (2018).

Quantitative research is based on collecting numerical data that are analysed by using mathematically based methods, especially statistics (Aliaga & Gunderson, 2003). Method used in data collection was household survey consisting of closed-ended questions. The aim of a survey is to describe basic characteristics or experiences of the sample of population (Dillman, 2011).

The study was carried out in three regions (northern, central and southern) in Bosnia and Herzegovina. In order to assess households' livelihood vulnerability under multiple stressors, the questionnaire survey was conducted with 104 households in total. The composition of surveyed households divided by the regions was: 35 in northern region, 33 in central region and 36 in southern region. The data collected was based on the main constraints to rural households' livelihood (Table 3) and on main components, sub-components and indicators of vulnerability (Table 1).

Data analysis was carried out through descriptive statistics, by using the Livelihood Vulnerability Index (LVI), as well as by using analytical approaches. First question was addressed by using descriptive statistics based on households' perceptions of the main constraints to their livelihoods. Participation is the backbone of livelihood approach. It gives opportunity to the poor to express their opinions about priorities, opportunities and eventual constraints to livelihoods (Ellis, 2000).

In order to answer the second question, the Livelihood Vulnerability Index (LVI) was used.

Using quantitative method in this research seems to be the most reliable, because it gives clear answers, it is objective and it can express the overall extent of vulnerability. It offers us a possibility to analyse the collected data in a structural and clear way (Field, 2009). Therefore, this study uses quantitative methods in order to examine the level of households' livelihood vulnerability under multiple stressors.

4.2. Constructing and calculating LVI

Based on sustainable livelihood framework and the choice of indicator approach, this study constitutes indicators of livelihood vulnerability which further develop LVI, in order to quantitatively assess the level of livelihood vulnerability of rural households under multiple stressors in BH regions. The purpose of indicator approach is to characterize and quantify the different dimensions of vulnerability and combine such indicators into a single composite index on one hand, and to quantitatively characterize system dynamics, on the other hand (Hahn et al., 2009; Barsley et al., 2013). Balanced weighted average approach was used in order to calculate the LVI. In order to calculate the LVI, sub-component indicators of area vulnerability to multiple stressors were grouped into 11 sub-components as presented in Table 1. These sub-components were classified under 5 different livelihood assets of households in the SLA: natural, physical, human, financial, and social capital.

Table 1. Major components (capitals), sub-components and indicators comprising the livelihood vulnerability index (LVI)

Major components (capitals)	Sub-components	Indicators	Functional Relationship with vulnerability
Natural capital	Agricultural land	Area of owned arable land (ha) Area of leased arable land (ha)	-
	Forests Water	Area under forests (ha) Access to irrigation water (%)	- -
Physical capital	Infrastructure	House ownership (%) Number of other objects on farm (barn, storage)	**-** -
	Technologies	Tractor index (derived from tractor ownership and age of tractor) Irrigation index (derived from ownership of irrigation system and % of irrigated area)	* **
Human capital	Access to labor Education	Number of household members Dependency ratio (%) Education, head of household (years) Education, highest in household (years)	- + - -

Financial capital	Income diversification	Agricultural diversification (number of crops and/or livestock)	-
		Number of HH members with off-farm employment	-
	Total income	Annual household income (BAM)	-
		Annual household income per household member (BAM)	-
Social capital	Networks	Access to internet (%)	-
		Membership in some social organization (%)	-
	Trust	Degree of trust in the local government (average ranking)	-
		Opinion about the neighbours (average ranking)	-

*Subindicators "tractor ownership" and "age of tractor" had negative and positive functional relationship with vulnerability, respectively

** Both subindicators (ownership of irrigation system and % of irrigated area) had negative functional relationship with vulnerability

There were four steps in computing the LVI index. *First*, the chosen indicators were normalized since they were measured in different units. All indicators were normalized to values between 0 and 100, where 0 denotes least vulnerable and 100 most vulnerable. Normalization of indicators was computed by using equation in Human Development Life Expectancy Index as the difference of actual value and minimum value divided by the range of maximum and minimum value (UNDP, 2015). This equation in the case of LVI was used to assess risks (Hahn et.al.,2009). Depending on functional relationship or correlation (positive/negative) between vulnerability and chosen indicator, the following equations were used while computing normalization of sub-component indicators.

If vulnerability increases with increase in the value of the indicator (positive correlation), following equation was used:

$$X_{ij} = \frac{X_i - MinX_j}{MaxX_j - MinX_j}$$

where X_{ij} is the normalized value of indicator (j) with respect to region (i), X_i is the actual value of the indicator with respect to region (i), $MinX_j$ and $MaxX_j$ are the minimum and maximum values respectively of indicator (j) among all the regions.

If vulnerability decreases with increase in the value of the indicator (negative correlation), the following equation was used:

$$X_{ij} = \frac{MaxX_j - X_i}{MaxX_j - MinX_j}$$

It should be noted that minimum value and the difference between minimum and maximum values were obtained from total sample for each individual indicator and for each region. *Second*, the average of normalized scores of each sub-component indicator was calculated.

These sub – component indicators, grouped into several sub-components are based on available data collected through household surveys on socio-economic and environmental impacts in northern, central and southern region of BH.

Third, the average of each sub-component was computed and therefore the total index of each main component was obtained as an average of each sub-component. Each sub-component contributes equally (i.e. balanced weight) to the overall index, even though each sub-component comprises of different numbers of sub-component indicators (Sullivan et.al., 2002).

After computing for all the main components was to average them, in order to get overall LVI of each region and in total average. LVI value ranges from 0 to 100, where the values from 0 - 20 denote the lowest level of vulnerability, 20 – 40 low level of vulnerability, 40 – 60 moderate level of vulnerability, 60 – 80 high level of vulnerability and 80 – 100 the highest level of vulnerability.

5. Results

The overview of results obtained through households` survey and vulnerability assessment are presented in each section in general and in more detail through the listed capitals. Firstly, the data collected through survey in their averages are presented in section 5.1. Secondly, household opinions about stressors on their livelihoods in their averages in section 5.2. Thirdly, quantitative livelihood vulnerability assessment is presented in section 5.3.

5.1. General findings

Table 2. shows general households` characteristics of studied regions in Bosnia and Herzegovina.

Surveyed households reported to have relatively small owned and leased land areas 4.1 ha and 3.6 ha, on average, but they were also scarce in terms of forest resources, the average value of 1 ha showed that. The biggest part of studied households had access to irrigation water, as well as their own irrigation system, however, greater part of the land was not irrigated, 54.9 %, on average. Almost all households owned their own house, but they reported to have lack of other on-farm objects, which was 1.6, on average. Even though high number of households possessed on-farm technologies, such as tractor, findings showed use of relatively old machinery, which was 14.4, on average. Number of household members was 4.6 on average and dependency ratio showed to be relatively high, 34.2 %, on average. More than 50 % of the households were employed in off-farm activities and they generated average annual income on 32,639.3. They also had high access to internet sources, but were less prone to become a member of some social institutions, the average of 57.2 % showed that. Furthermore, relatively low degree of trust in local government was found among households, which was 1.9 on average. As far as the relations with the neighbours are concerned, they proved to be satisfactory.

Table 2. General households' characteristics in the studied regions of Bosnia and Herzegovina

Assets (Capitals)	Indicators	North (average)	Central (average)	South (average)	Average values
Natural capital	Area of owned arable land (ha)	5.1	4.1	3.1	4.1
	Area of leased arable land (ha)	9.3	0.8	0.8	3.6
	Area under forests (ha)	0.6	1	1.3	1.0
	Access to irrigation water (%)	94.3	81.8	97.2	91.1
Physical capital	House ownership (%)	97.1	97	88.9	94.3
	Number of other objects on farm (e.g. barn, storage)	1.4	1.8	1.6	1.6
	Possession of tractor	91.4	60.6	97.2	83.1
	Age of tractor	10	15.2	18	14.4
	Irrigation system	74.3	60.6	88.9	74.6
	Percentage of irrigated land	59.2	46.4	59.1	54.9
Human capital	Number of household members	4.2	4,5	5	4.6
	Education, head of household (years)	10.8	12.3	11.2	11.4
	Education, highest in household (years)	12.3	14	12.9	13.1
	Dependency ratio (%)	32.4	23.1	47.2	34.2

Financial capital	Agricultural diversification (number of crops and/or livestock)	**5.3**	**4.2**	**4.0**	**4.5**
	Number of HH members with off-farm employment	**65.7**	**66.7**	**38.9**	**57.1**
	Annual household income (BAM)	**22302.9**	**27381.8**	**48233.3**	**32639.3**
	Annual household income per household member (BAM)	**5554.3**	**5949.7**	**11226.3**	**7576.8**
Social capital	Access to internet (%)	**94.3**	**66.7**	**94.4**	**85.1**
	Membership in some social organization (%)	**37.1**	**45.5**	**88.9**	**57.2**
	Degree of trust in the local government (average ranking)	**1.5**	**1.9**	**2.3**	**1.9**
	Opinion about the neighbours (average ranking)	**4.5**	**4.3**	**4.7**	**4.5**

5.1.1. Natural capital

According to the survey, households in the northern region reported to have the largest area of both owned and leased arable land, with 5.1 and 9.3 ha respectively, which was above the total average value of 4.1 ha for owned and 3.6 ha for leased arable land. It is worth to notice that southern and central region possess less than 1 ha of leased arable land. In terms of forest resources, this area was the lowest in the northern region (0.6 ha) and the highest in the southern region (1.3 ha). Almost all households had access to water resources in southern region, 93% in northern region and 81.8% in central region.

5.1.2. Physical capital

Most of the households owned their own homes, however this varies from 88.9 % in the southern region to 97.1 % in the northern region. Additionally, all regions owned, on average, 1.6 other infrastructural units. Central region lacked on-farm technologies, such as tractors and irrigation systems in comparison with other two regions. Even though almost every southern household owns a tractor (97.2 %), on average they are 18 years old, which is above the total average of 14.4 years old.

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5.1.3. Human and financial capital

Southern region had the highest number of household members which is 5 on average, but also the highest dependency ratio (47,2 %). In comparison with other two regions households in south generated the highest annual household income (48,233.3 BAM), as well as income per member (11,226.3 BAM), even though they possessed the lowest diversified agricultural production of all three regions. Central region had the most educated house members and the highest number of members employed in off-farm activities in comparison with other two regions.

5.1.4. Social capital

More than 94 % of households in northern and southern region had access to internet, while the number in central region is way below the average with 66,7 %. Generally, all three regions had very low degree of trust in the local government, with an average of 1.9 on scale from 1 to 5. The 88,9 % of households in the southern region were engaged in some social organizations, which is not the case with other two regions, that were less involved in these activities. However, all three regions ranked neighbour relations to be on a high level.

5.2. Main perceived stressors

Stressors were defined in five categories by order: political instability, agrarian policy, market access and prices, weak infrastructure and climate change. Main perceived stressors and their average values are presented in table 3. Results shown in the table 3 were scaled from one to five, with five having the biggest effect on household livelihoods. Political instability and agrarian policy were recognized to have on average the highest impact on household livelihoods of all observed stressors. However, southern region recognized agrarian policy to be the biggest obstacle of all stressors. Weak infrastructure was on average, the stressor of the lowest impact, however compared with climate change it has the similar importance in northern and central region, though climate change in southern region has been recognized as a stressor of greater influence. Market access and prices were similar in all three regions with the average value of 3.5.

Table 3. Average values of the biggest perceived stressors on household livelihoods by region

Main stressors on household livelihoods	Northern region	Central region	Southern region	Average
Political instability	4.9	4.6	3.8	4.5
Agrarian policy	4.8	4.4	4.3	4.5
Market access and prices	3.5	3.6	3.5	3.5
Weak infrastructure	2.7	2.9	2.9	2.8
Climate change	2.7	2.8	3.6	3.0

5.3. Livelihoods vulnerability

In this section, vulnerability assessments for all 5 capitals, respective sub-components and sub-component indicators are described in more detail. LVI values based on 5 major components (capitals), 11 sub-components and 20 indicators are presented in table 4.

The overall LVI value (49.2) shows that livelihoods of all three regions are moderately vulnerable to socio-economic and environmental stressors. No marked differences were found among regions, but despite that, the overall LVI was the highest in the central region and the lowest in southern region.

The main components which influence overall household livelihood vulnerability of observed regions under multiple stressors were financial capital with LVI value of 66.7 and natural capital (62.6), followed by human (44.8), social (37.9) and physical (33.7) capital, on average for all regions.

Even though vulnerability assessment of capitals did not show the highest vulnerability levels, some of sub – component indicators showed very high vulnerability levels (above 80), on average, as well as among regions, contributing greatly to capital`s vulnerability and overall households' livelihood vulnerability under multiple stressors.

Table 4. Indicator based LVI values for all major components and sub - components derived from household data in studied households in Bosnia and Herzegovina.

Overall LVI			Average (total)	Main component	Regions				Subcomponents	Regions				Indicators	Regions			
North	Central	South			North	Central	South	Average (total)		North	Central	South	Average (total)		North	Central	South	Average (total)
48.2	51.3	45.5	49.2	Natural capital	58.3	67.2	62.5	62.6	Agricultural land	71.8	88.3	90.9	83.7	Owned arable land (ha)	74.6	79.3	84.4	79.5
														Leased arable land (ha)	68.9	97.3	97.3	87.8
									Forest	97.3	95.2	93.9	95.5	Forests (ha)	97.3	95.2	93.9	95.5
									Water	5.7	18.2	2.8	8.9	Access to irrigation water (%)	5.7	18.2	2.8	8.9
				Physical capital	31.3	39.9	30.0	33.7	Infrastructure	33.9	28.4	35.8	32.7	House ownership (%)	2.9	3.0	11.1	5.7
														Number of other objects on farm	65.0	53.8	60.4	59.7
									Technologies	28.6	51.4	24.2	34.7	Tractor index	16.2	47.7	19.0	27.6
														Irrigation index	41.0	55.1	29.5	41.9
				Human capital	48.7	38.1	47.5	44.8	Access to labour	58.1	51.9	60.5	56.8	Number of household members	78.0	74.5	69.7	74.1
														Dependency ratio (%)	38.2	29.2	51.4	39.6
									Education	39.4	24.2	34.5	32.7	Education, head of household (years)	32.7	23.1	29.9	28.6
														Education, highest in household (years)	46.1	25.4	39.2	36.9
				Financial capital	63.9	67.0	69.3	66.7	Income diversification	36.1	44,2	59.3	46.5	Agricultural diversification	38.0	55.0	57.5	50.2
														Number of HH members with off-farm	34.3	33.3	61.1	42.9
									Total income	91.6	89.8	79.3	86.9	Annual household income (BAM)	90.6	87.7	75.7	84.7
														Annual households` income per household member (BAM)	92.6	91.9	82.9	89.1
				Social capital	43.1	46.9	23.7	37.9	Networks	34,3	43.9	8.3	28.8	Access to internet (%)	5.7	33.3	5.6	14.9
														Membership in some social organization (%)	62.9	54.5	11.1	42.8
									Trust	51.9	49.9	39.1	47.0	Degree of trust in the local government (average)	88.6	76.5	68.1	77.7
														Opinion about the neighbours	15.2	23.2	10.2	16.2

5.3.1. Natural capital vulnerability

The weighted average of the three sub-components indices, i.e., the vulnerability index of *natural capital* of all three regions was on a high level with value of 62.6. However, the value of this capital index was the lowest in northern region (58.3), followed by southern (62.5) and central (67.2). Sub-components such as forest and agricultural land contribute mostly to these higher indexes. Extremely high values were found in terms of forest resources, with slight differences among regions, 95.5 on total average. Central region had slightly lower agricultural land index (88.3) than southern region (90.9), but the value of this index was found to be the lowest in northern region (71.8). The indicators contributing to this higher index were the owned and leased arable land, with extremely high value of leased arable land index which showed to be the same in central and southern region (97.3). Low index levels on water resources were found in all three regions, with some greater value in central region (18.2).

5.3.2. Physical capital vulnerability

Low level of *physical capital* vulnerability index was found in all three regions on total average with value of 33.7. However, central region (39.9) contributes greatly to the value of this index compared to northern (31.3) and southern region (30.0). The details indicated that the higher value in central region is mainly from these three sub-component indicators: number of other objects on the farm, tractor and irrigation index. The major sub-component indicator contributing with its highest value to vulnerability of this type of capital, on total average with 59.7, was the number of other objects on the farm with slight differences among regions Other sub-component indicators that also make a small contribution to the index were house ownership in all three regions and tractor index in northern and southern region. In terms of irrigation index, northern region (41.0) had higher index than southern region (29.5).

5.3.3. Human capital vulnerability

On average, the vulnerability index of *human capital* in the observed regions was on a moderate level (44.8), while central region had the value below the average (38.1), making this region less vulnerable when it comes to this type of capital, compared to the other two regions. Higher values of sub-component such as access to labor, contributes mostly to human capital vulnerability index. The indicators contributing to these high values were the number of

household members but also dependency ratio to some lesser extent. Relatively high values of number of household members index were showed in northern region (78.0), followed by central (74.5) and southern (69.7) region. Dependency ratio was shown to be the highest in southern region and the lowest in central region. Northern and southern regions had greater education index (39.4 vs 34.5) in comparison with central region (24.2). This is caused by higher index of the highest educated member in household and head of household education index in these two regions.

5.3.4. Financial capital vulnerability

The vulnerability index of *financial capital* showed the highest value in comparison with other four capitals, contributing the most to the value of total LVI in each region. The value of this capital index was on total average 66.7. The sub-component total income in all three regions, contributes mostly to this higher index. However, southern region had the lowest total income index (79.3) and the highest was in northern region (91.6), followed by slight difference in central region (89.8). On the other hand, sub-component income diversification in southern region (59.3) showed relatively high variance of total average value which was on 46.5. The indicators contributing to this variance and therefore, to this higher index were agricultural diversification and the number of household members with off - farm employment. When it comes to other two regions, income diversification index was higher in central region (44.2) than the one in northern region (36.1). Sub-component indicator agricultural diversification with its value contributes mostly to higher income diversification index in central region.

5.3.5. Social capital vulnerability

The weighted average of networks and trust sub – components, i.e. *social capital* vulnerability index was on a low level, on total average 37.9. Social capital vulnerability index of central (46.9) and northern region (43.1) was much higher than the one in southern region (23.7). The major sub-component indicators contributing to the value of this index were mainly the degree of trust in the local government, in terms of all three regions with average value 77.7 and membership in some social organizations of northern (62.9) and central region (54.5). Other sub-component indicators such as access to internet and opinion about the neighbours, also contribute a small part to the value of this index. However, central region had higher index values of these sub-component indicators in comparison with other two regions.

6. Discussion

Generally, the vulnerability assessment showed that household livelihoods in studied regions were moderately vulnerable under multiple stressors. The main reason for livelihood vulnerability is lack of livelihood assets (capitals). In order to decrease vulnerability, it is necessary to build up assets and sustain access to assets. In that case, and as it was mentioned before, the more assets households have, the less they are prone to the risks (Ellis, 2000). That increases their ability to cope and/or recover from stressors.

Relatively small size of agricultural land, limited access to forest resources, inadequate infrastructure, limited access to technologies, insufficiently irrigated land , deficiency in terms of number of household members, inadequate income diversification, as well as low income levels, limited access to social organizations and relatively low levels of trust in governance are the main features contributing to moderate or high levels of vulnerability of livelihood assets in studied regions and they are the causes of multiple effects of stressors.

Based on the results obtained, the total of 104 households saw political instability and agrarian policy as main stressors that seriously affect their livelihoods. Other three stressors such as market access and prices, climate change and weak infrastructure contributed to the high level as constraints to livelihoods. If we look at the differences among regions, political instability and agrarian policy had the highest impact on livelihoods in northern and central region, while households in central region saw agrarian policy as the main obstacle. Climate change conditions, however, in the opinion of households played more important role in southern region comparing to other two regions. This is most likely due to its high orientation on agricultural crop production, while the other two regions had more diversified agricultural production and were more engaged in off-farm activities which might make them less prone to climatic conditions. Nevertheless, according to Žurovec (2018), damages of extreme weather events have been seen as a serious treat in all three regions, particularly in agricultural production in terms of crop yield reduction and loss of product quality.

Political instability, agrarian policy, market access and prices, as well as weak infrastructure are all features of the same process: recent war events and transition from centrally planned to market economy. These shocks, trends and seasonality, such as rise in unemployment, inflation and migration are usually found in transition economies (Davis, 2006). Climate change is added

to the list of these stressors, as an additional trigger that hinders improved livelihoods. These shocks and trends usually act simultaneously and are often unpredictable and unexpected and that may significantly affect vulnerability of livelihoods of the poor. In such conditions, the question is how to achieve sustainability, considering that sustainability and resilience are not always possible due to extreme vulnerability levels (Scoones, 2009).

Natural capital – Moderate vulnerability levels in northern and high vulnerability levels in central and southern region make this type of capital a significant contributor to overall livelihood vulnerability.

Sub-component indicator forests contribute to its highest level to vulnerability of natural capital. Despite the fact that forest resources in BH are abundant, since 53 % of BH territory is covered by forests (FIPA, 2011), studied households in all three regions lack the access to forest resources. This is because there is a significant gap between households that have a greater share of forest areas and those who do not. However, their importance is substantial, because forests can be used as a source of income (timber, harvesting of forest products etc.).

Land or farm size is one of the determinants that greatly contributed to natural capital vulnerability, since arable farms that are in a small ownership or lease, or even landless, were highly susceptible to various stressors. Small farms were found in all three regions, especially in central and southern region that are much smaller in comparison with the northern region. The BH regions are characterized by relatively small arable land, approximately 4.1 ha on average. According to World Bank (2010), it was estimated that 80% of farms are smaller than 5 ha. The reasons for that are found in the large fragmentation of agricultural land and inefficient land market. In the former socialist state, where the maximum private farm size was 10 ha, the subdivision of farm holdings into equal parts was demanded among all successors, which further led to the fragmentation of private holdings and farms (Mizik, 2012; Žurovec, 2018). In the case of this study, most of the households had farms that are formed from small parcels, that are usually not in the same locations. As a consequence of such situation, agricultural production is becoming less efficient and limits investments in technologies. Also, the lack of investment can be the consequence of the incomplete land registry and rigid land transaction processes. Therefore, those who are willing to expand or consolidate their farms are facing a situation which is cost unbeneficial, as well as time consuming. (World Bank, 2010).

Households in northern region had easier access to leased arable land, because most part of the land is owned by the state, which rents out the land to the farmers through concession agreements. In contrast to northern region, the private land was the one that goes under lease in the other two regions (Žurovec, 2018). Rural households in northern region had easier access to land, making their agricultural production easier, unlike in the other two regions where agricultural production was more restricted due to their lack, especially of leased arable land.

Even though the political stressor is crucial feature for vulnerability of this type of capital, climate change could be seen as additional treat to livelihoods, when taking into consideration that impact of climate change is higher on natural resources, such as water and forest. According to the literature, climate change will continue to have various impacts on forests and biodiversity, and that will further affect livelihoods (Tran et al., 2010; Walton, 2010).

Physical capital – contributed to overall livelihood vulnerability with low capital vulnerability levels, although there were slight differences among regions. However, all three regions lacked access to on-farm facilities such as storage, barn, greenhouses etc. Central region lacked on-farm technologies, while households in northern and southern region were relatively well equipped with their own machinery. Despite that, usage of relatively obsolete technologies were noticed in all three regions. Due to long depreciation life of agricultural mechanization in BH, this kind of machinery has a tendency to become obsolete (FMAWF, 2015). Even though most of the households possessed their own irrigation system, except the ones in central region, all three regions struggled with insufficiently irrigated land. That has become a general problem at the territory of BH, since many national reports emphasize that less than 1 % of agricultural areas are irrigated in BH (Siebert et al., 2005). Due to the lack of investments and use of obsolete and outdated assets, the farm function is at the level of simple reproduction, lacking financial resources to support extended production (Bernstein, 2010). Inadequate agrarian policy based on low budget allocation could be seen as the main constraint to this type of capital. Additionally, better access to irrigation facility, that is found in northern and southern region, would enable households in those regions to adjust adequately to adverse climatic conditions (O`Brien et al., 2004).

Human capital – Although no major differences were found among the regions, the level of human capital vulnerability was moderate if we look at average level. Household size, as well as relatively high dependency ratio values were the main determinants that mostly affect the access to human capital in the studied regions. Despite the fact that number of household

members was similar on average, there were still differences in the structure of households, which are presented through dependency ratio. Relatively high value of dependency ratio was found on average, especially in southern region compared to the other two regions. Furthermore, inadequate structure of labour in force and high dependence on older family members (due to three generation household structure) made them less capable to cope with various stressors.

Moreover, relatively low average household size, in all three regions, together with high dependency ratio can hinder households to support their livelihoods. Therefore, households with greater number of members, such as the households in southern region were in a better financial situation. However, households with lower dependency ratio such as the ones in northern and central region were less prone to environmental stressors (Vincent, 2004).

The differences were shown in the education among regions. Northern region is characterized by less educated household members, since they are traditionally farmers, compared to other two regions, where household members were mainly skilled workers and were primarily engaged in non-farm activities in the pre-war period. Consequently, the internal events or stressors such as devastation, migration, privatization, bankruptcy, company's restructuration where they used to work, forced most of them to leave their jobs and they started engaging in agricultural activities what became their main source of income. The reason for household commitment to agricultural activities is lack of alternative income sources (Žurovec, 2018). However, it should be taken into consideration that households with higher literacy rate had higher adaptive capacity (Deressa et al., 2008).

Financial capital – Vulnerability of financial capital was the highest contributor to the overall livelihood vulnerability with insignificant differences between regions. Nevertheless, some of the indicators showed marked differences among regions, where households in southern region were found to generate doubled income, both in total and per household member, compared to the other two regions. Financial capital in southern region was mainly stored in crops, unlike other two regions where livestock production prevailed. Also, southern region had the least diversified agriculture and the least number of household members engaged in off-farm activities. Even though most of household members in northern and central region were employed in off-farm activities, income levels in every region were mostly generated through agriculture, although much less in other two regions compared to the southern one (Žurovec, 2018). Nonetheless, it was estimated that relatively high number of households had incomes

below the poverty line, particularly in northern and central region (AFSBIH, 2015). Some of the reasons that make households in southern region wealthier, in terms of their income, were most likely higher number of household members, as well as better access to on – farm technology. Thus, better access to physical capital contributed to the increase in financial and human capital. In terms of climate change, people that had better access to infrastructural resources, were less vulnerable, as they are able to cope and minimize the impact of hazard (Vincent, 2004). Households in southern region that are more dependent on farm income were more sensitive, since agricultural sector is considered to be vulnerable to climate change. However, despite higher income levels generated through agricultural activities in southern region, households in northern and central region had more diversified income, which qualifies them to have a higher adaptive capacity (Eakin et al., 2008). Furthermore, this increases their ability of recovering after disasters (IISD, 2003).

Social capital – Low vulnerability level was shown on average with significantly lower value in southern region. Almost all households had internet access, with some lower degree in central region. Involvement in social organizations was concerning in northern and central region, while trust in the local government was worrying and estimated on very low levels in all three regions. Low levels of trust in local governance were due to significant political instability in the country. In addition, the networks of public and private institutions that should enable efficient transfer of knowledge and information are not established or underdeveloped, which was the case in northern and central region, and that limited their engagement in social organizations (Žurovec et al., 2015).

Social resources determine access to market, governmental services, credits etc. and households that have better social relations and networks have more chances for opportunities (Vincent, 2007; IISD, 2003). In addition, membership in agricultural or other social organizations ensures access of households to knowledge, innovations and technologies that can be used due to changes in climatic conditions (Bryan et al., 2013).

Social capital (or its lack) was both a cause and effect of vulnerability and thus could result in either positive benefit or negative impact; to be a part of a social group and accrue social assets often indicates another exclusion (IPCC, 2012b).

It can be suggested that social capital plays a major role in better access to other capitals. Increased household participation in farming associations indicates their importance in

improving livelihood opportunities and security. They also allow farmers, especially smallholders, improved access to markets in terms of both inputs and outputs, and access to information and technologies through a wide range of services (Stockbridge et al., 2003). However, rise in food prices affects negatively those who have limited access to land and infrastructural resources, lack of modern agricultural inputs and lack of education (IPCC, 2014b).

7. Conclusion

This study aimed to provide a better insight into the main problems faced by the rural households in three regions of BH, under exposure to multiple stressors. On the one hand, vulnerability assessment by using LVI method attempted to better explain vulnerability of rural livelihoods among regions presented through various indicators and components. On the other hand, people perceptions of main stressors to their livelihoods were included for more comprehensive understanding of livelihood vulnerability.

The obtained results through LVI showed that financial and natural capital are the main contributors to overall livelihood vulnerability, with slight differences among regions. However, higher variances were noticed among regions, which were explained through indicators that contribute to the greatest vulnerability of other types of capitals and therefore to overall vulnerability.

Households' perceptions showed that the country has not yet recovered from the turbulent war period and its aftermath, that is reflected through political instability and inadequate agrarian policy, as main perceived stressors. Climate change has been seen as an additional trigger that has a tendency to increase in the future and poses a serious threat to rural households` livelihoods.

Based on the results obtained through LVI, it can be concluded that higher livelihood vulnerability levels under multiple stressors occurred as a cause of limited access to capitals. Limitation in access to some capitals could be seen through a lack of investments and limited access to information in private, public and research institutions regarding innovation in agricultural production. These constraints unable households to achieve sustainable livelihoods.

Overall, the study suggests that a possible way to reduce vulnerability is to sustain access to assets, particularly to social capital, as its increased and sustained access, may have great influence on other assets.

It can be also suggested that establishment and development of institutions and enabling policies would provide the necessary knowledge, technology transfer and other services in form of investments and credits. That would most likely increase trust in local government and increase motivation of households to become members of some social organization and therefore, increase access to social and human capital. Being a part of such organization would enable households to have access to the market, which might increase income and financial capital. Furthermore, there is a critical need for strengthening community networks and local organizations including advisory services in order to enable households to respond to various hazards and secure their livelihoods.

Investments intended for agricultural production are necessary for ensuring access to both physical capital, in terms of purchasing new infrastructural units and technologies and financial capital through more efficient agricultural production. Furthermore, this would enable households to purchase more arable land and secure access to natural capital. In addition, agrarian reforms might particularly help in forms of better budget allocation, directed more towards rural areas, which would help households secure their livelihoods.

The obtained results may contribute to facilitation of better decision-making and strategic planning in terms of securing livelihoods from multiple exposure to stressors, as well as represent a motivation for other studies, that plan to employ similar approaches.

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Appendix

Household survey. Modified from Žurovec (2018).

ASSETS

Natural capital

1. Farm size:_____, under lease_____
2. Area under crops:_____
3. Meadows, pastures: _____
4. Other (forest, lake, unproductive, etc.):_____
5. Is the farm land fragmented a) Yes   b) No
6. Access to irrigation water: a) No b) Yes - River/lake, Well
7. Agricultural practice: Monoculture Crop rotation_____
8. Percentage (area) of fallows _____
9. How long the fallows haven't been used _____ years
10. What is present on fallows _____
11. Are they used for grazing? _____
12. Reason why under fallow _____

Physical capital

1. Ownership of the house: Yes / No
2. Other available and owned objects (e.g. barn, storage…):
   _____
3. Agricultural mechanization (and
   age):_____
4. Irrigation system: No Yes (which
   one):_____
5. Irrigated area (% of total arable land): _____
6. Tools for other on-farm or off-farm activities (if
   applicable):_____

Human capital

1. Number of household members:

2. Age of the household head:

3. Age (all):

4. Gender (all):

5. Level of education of HH members (0-no education, 8-9-elementary, 11-12-skilled worker, 15-16-university, 16+ higher): 1____2___ 3____ 4___ 5____6____7____

6. Work capable HH members/incapable (low health, other): ___/___

7. Where did you/other HH members work before the war?

   _____

   _____

   _____

   _____

Financial capital

1. Main source of income: Agriculture   Other:_____

2. Area utilized for agricultural production (crops, meadows, pastures):_____

3. Number of livestock: Cattle _____; Sheep_____; Pig_____; Poultry_____; Other_____

4. Where does your livestock graze? a) own pastures   b) own homestead c) communal pastures d) other:_____

5. Do you receive any subsidies for your production?_____

   _____

   _____

6. Does any household member has a job outside agriculture?:

   If yes, it: On farm (and what)_____

                   Off farm_____

7. Any HH member(s) that lives in other area or abroad which contributes to the household?

   If yes, are they living: a) in other rural area   b) urban area   c) abroad

8. Average yearly household income (approx.):

9. How would you roughly distribute your income per these categories:

Agriculture _____%

Job on farm outside agriculture_____%

Job outside of farm_____%

Remittances_____%

Other (pension, aid, etc.)_____%

Social capital

1. Access to information: TV, Internet, Phone, Radio

2. Are you a member of any social organization (political, business, cooperative, trade, religious, cultural):

   If yes, do you have any benefit from this organization (knowledge, income, friendship, spiritual,

   other):_____

   _____

   _____

   _____

3. Do you have access to any agricultural extension service (public extension, NGO, cooperative, other)?

4. Are you using agricultural extension services? How often are you using their services?

5. Do you have trust in the national government? (1- lowest – 5 highest) | 1 | 2 | 3 | 4 | 5 |

6. What about the local government? (1- lowest – 5 highest) | 1 | 2 | 3 | 4 | 5 |

7. How do you get on with your neighbours? | 1 | 2 | 3 | 4 | 5 |

8. If some local problem or issue arises, do you think you and your neighbours would join your forces in order to overcome it?

9. Do you think your community could bring change and improve their lives if they all group together and try to do something?

10. What do you think is the biggest obstacle when it comes to your wellbeing and future?

	Highest	High	Medium	Low	Lowest
1. Political instability in the country					
2. Weak and inadequate agrarian policy					
3. Market access and purchase prices					
4. Weak infrastructure in your community					
5. Climate change and its effect on agriculture					
What is the main challenge (presented 1-5)					