Anonymous Referee #1

Dear Reviewer:

The authors thank you for the insightful and constructive comments. We have revised the paper to take into account these comments and incorporate your suggestions.
Authors' response is shown in italics, and new text is highlighted in red.

The reviewer's general comments:

The paper titled "Social vulnerability of rural households to flood hazards in western mountainous regions of Henan province, China" provided a data-driven evaluation of the possible influential factors that affect household vulnerability to flood hazards. This is an interesting study that adds to the knowledge towards better understanding this particularly unique group. The methodology employed in the study and the underlying assumptions are generally sound. But the paper could be improved on better presentation and articulation of details. Also, a general assessment of what this group's vulnerability is different from existing literature on flood hazard vulnerability should be discussed in order to put the study outcome in a broader context. The following are a list of suggested the authors can consider:

The reviewer's comment 1:

Abstract needs improvement. The abstract will be more effective if the authors can articulate the significant of the study outcome, rather than restating the conclusion. Potential suggestions of flood mitigation for this region should be clearly stated.

The authors' response:

We have improved abstract following your suggestions. The added texts were marked in red.

Evaluating social vulnerability is a crucial issue in risk and disaster management. In this study, a household social vulnerability index (HSVI) to flood hazards was developed and used to assess the social vulnerability of rural households in western mountainous regions of Henan province, China. Eight key indicators were identified through interactive discussions with expert from different study fields and local farmers, and their weights were determined using principle component analysis (PCA) and expert scoring method. The results showed that (1) the ratio of perennial working in other places, hazard-related training and illiteracy ratio (15+) were the most dominant factors to social vulnerability. (2) The numbers of high, moderate and low vulnerable households were 14, 64 and 16, respectively, which accounted for 14.9, 68.1, and 17.0% of the total interviewed rural households, respectively. (3) The correlation coefficient between household social vulnerability scores and casualties in a storm flood in July 2010 was significant at 0.05 significance level (r =0.248), which indicated that the selected indicators and their weights were valid. (4) Some mitigation strategies to reduce the household social vulnerability to flood hazards were proposed, which included 1) Improving the local residents' income and their disaster related knowledge and evacuation skills. 2) Developing emergency plans and carrying out emergency drills and trainings. 3) Enhancing the accuracy of disaster monitoring and warning systems. 4) Establishing specific emergency management department and comprehensive rescue systems. These results could provide useful information for local governments to prepare, mitigate and response to flood hazards, and the corresponding strategies can help the local households to reduce their social vulnerability and improve their ability to resist flood hazards.

The reviewer's comment 2:

Authors listed a lot of work had been done by other people/studies, however, more details need to be summarized for each paper so that reader had clear understanding of what had been done and their connection to the current study. This will help to answer the question why the authors choose index method to perform the

vulnerable analysis on this particular area, etc.

The authors' response:

We have provided more summarized details about some important papers.

Line 8, Page 6729.

Noriega and Ludwig (2012) assessed the social vulnerability of local earthquake risk in Los Angeles County, and they found that "knowledge of the relationship between earthquake hazard and the demographic characteristics of people in the area at risk is essential to mitigate the local impact from earthquakes". Zebardast (2013) constructed a social vulnerability index to earthquake hazards using a hybrid factor analysis and analytical network process model, and their case study showed that their method was a robust approach to construct a composite SOVI. Using the social vulnerability index approach, Siagian et al. (2014) determined three main driving factors ('socioeconomic status and infrastructure', 'gender, age and population growth' and 'family structure') affecting social vulnerability to natural hazards in Indonesia. They also pointed out that the spatial distribution characteristics of social vulnerability to natural hazards could be easily identified when they were mapped using ARCVIEW GIS. Garbutt et al. (2015) presented an open source vulnerability index and mapped the social vulnerability to flood hazards in Norfolk. They found that "flood affected areas more likely to be composed of elderly, sick and poor", and "high vulnerability areas found to be disproportionately impacted by flooding". All these studies provide a good understanding of the social vulnerability to natural hazards.

The reviewer's comment 3:

Similarly to suggestion above, the assessment method (historical data, scenario data, GIS data, index based data) need to be introduced in detail and justified to some extent in pg. 6730.

The authors' response:

These method were introduced in detail.

Several methods can be used to evaluate the social vulnerability to natural hazards, such as assessment method based on historcial disaster data and scenario-based, GIS-based and index-based assessment methods (Li et al., 2008). Each assessment method has its advantages and disadvantages. The assessment method based on historcial disaster data was using the established disaster database to construct a certain index and assess the disaster risk. For example, the disaster risk index (DRI) can be obtained based on the EM-DAT database, which can show the population loss risk in a catastrophe by using the ratio of the number of deaths and the number of people exposed to a disaster. The advantages of this method are convenient data, simple calculation and accurate results, and the disadvantages is that it is just suitable for the macroscopic spatial scale, such as global or nationla scale, and it is difficult to be used in a small spatial scale, such as community or household scale. The scenario-based method is mainly based on the construction of different disaster scenarios, and then with the help of some models and numerical simulation softwares to show the disaster evolution process and the vulnerability of hazard-prone areas. The advantages of this method is that it can be more intuitional to display the processes and results, and its disadvantages is that the caculation processes is complex and needs computer programming and profound mathematical knowledge. The steps of using GIS-based method are:1) obtaining the data, 2) putting the data into GIS software, 3) running the overlay and spatial analysis function of GIS software, 4) calculating and mapping the results. The advantage of this method is that the results can be showed clearly in the form of maps, and its disvantages is that all the data must be spatial data or can be change to spatial data. The index-based assessment method was used here maily because (1) which can effectively reveal the spatial and temporal patterns, evolution of vulnerability to a natural hazard at different scales, and (2) the assessment results among different regions are comparable due to the use of the same assessment index system (Cutter et al., 2003; Garbutt et al., 2015). There are five steps for using index-based method to assess the household social vulnerability to flood hazards as the

follows:

The reviewer's comment 4:

Need explanation on why the population was chosen. The survey targets are suggested by local officials, what were the criteria used?

The authors' response:

We explained the criteria to choose these households as our survey targets, and the criteria were marked in red.

A door-to-door questionnaire investigation was carried out by the author's research team during the period of April 10-15, 2014. The requirement for participants was that they could answer a questionnaire and have been affected by a flood disaster. One hundred households were chosen according to the local officials' sugestions.The criterias to choose survey targets were: 1) the household had been affected by flood hazard, 2) The flood hazards had resulted in property danage or loss of life, 3) the family characteristics should be as different as possible, and 4) the residences in the households were able to understand and answer a questionnaire clearly. All the 100 copies of the questionnaire were collected on the spot, and 6 copies were eliminated due to the inconsistent and incomplete answers.

The reviewer's comment 5:

For the weight of eight selected indicators, is there a rationale why some factors were weighted more, while others were weighted less. Why the vehicle per capita had such a high weight in rural area in China. Do a large portion of the family surveyed have the income to make private vehicle an option?

The authors' response:

There are several methods to obtain the indicators' weights, and each method has its advantages and disadvantages. In this paper, the principle component analysis (PCA) method was used to achieve this goal. The vehicle per capita had such a high weight is because it is important to evacuate when a flood occurs. And according to the survey, most family do not have ability to buy a private vehicle due to the income problems. So, in the part of "How to reduce social vulnerability", we suggest that the local residents' income should be improved. As for how to improve their income, it is a more comprehensive question and beyond the scope of this paper.

Besides, some papers used the equal weights when they assess the social vulnerability to natural hazards. Because they thought there were no evidence to show which indicator was more important.

The reviewer's comment 6:

There are only 94 survey results been used for the case study, so the review recommend to have a table or chart to present the original survey data (or statistics) for each category so that reader will understand how the author get high, moderate and low vulnerability index for each category.

The authors' response:

The standard data is listed below. The original 94 survey results is a lot of data, which can take up a lot of space. If the journal deems it necessary, please include it in the appendix.

Appendix 1 The standard data and assessment results

	FS	DR	IR	RPW	PCI	AHI	VPC	HRT	Scores	Ranks
1	1.00	0.25	0.42	1.00	0.97	1.00	1.00	1.00	0.87	high
2	1.00	0.25	0.42	1.00	1.00	1.00	1.00	0.50	0.80	high
3	0.57	1.00	1.00	0.63	0.91	0.96	0.53	0.50	0.76	high
4	1.00	0.25	0.42	0.79	0.97	1.00	0.87	0.50	0.75	high
5	0.86	0.19	0.72	0.68	0.91	0.99	1.00	0.50	0.75	high

6	0.43	0.25	0.83	0.79	0.80	0.94	0.67	1.00	0.74	high
7	0.86	0.33	0.23	0.46	0.95	0.99	1.00	1.00	0.74	high
8	0.86	0.33	0.48	0.68	0.95	0.99	1.00	0.50	0.74	high
9	0.86	0.33	0.23	0.46	0.95	0.99	0.86	1.00	0.73	high
10	0.86	0.19	0.72	0.68	0.88	0.91	0.86	0.50	0.72	high
11	0.86	0.19	0.72	0.68	0.91	0.91	0.81	0.50	0.72	high
12	0.86	0.19	0.72	0.68	0.91	0.91	0.81	0.50	0.72	high
13	0.86	0.33	0.23	0.46	0.91	0.99	0.81	1.00	0.71	high
14	1.00	0.25	0.63	0.40	0.97	1.00	0.83	0.50	0.70	high
15	0.57	0.17	0.67	0.32	0.85	0.96	1.00	1.00	0.70	moderate
16	0.43	0.25	0.83	0.79	0.93	0.94	0.67	0.50	0.69	moderate
17	0.71	0.25	0.55	0.52	0.93	0.98	1.00	0.50	0.69	moderate
18	0.71	0.25	0.55	0.52	0.93	0.98	1.00	0.50	0.69	moderate
19	0.71	0.25	0.55	0.52	0.93	0.98	1.00	0.50	0.69	moderate
20	1.00	0.25	0.42	1.00	0.90	0.94	0.75	0.00	0.69	moderate
21	0.86	0.19	0.72	0.68	0.88	0.91	0.53	0.50	0.69	moderate
22	0.71	0.25	0.55	0.52	0.89	0.89	0.45	1.00	0.69	moderate
23	0.43	0.25	0.83	0.79	0.87	0.94	0.67	0.50	0.68	moderate
24	0.71	0.50	0.28	0.27	0.89	0.98	0.78	1.00	0.68	moderate
25	0.71	0.25	0.55	0.52	0.98	0.98	0.78	0.50	0.67	moderate
26	0.57	0.17	0.67	0.32	0.85	0.96	0.73	1.00	0.67	moderate
27	0.71	0.25	0.55	0.52	0.93	0.98	0.78	0.50	0.67	moderate
28	0.86	0.19	0.72	0.68	0.95	0.99	0.81	0.00	0.66	moderate
29	0.71	0.25	0.55	0.52	0.89	0.98	0.78	0.50	0.66	moderate
30	0.71	0.25	0.55	0.52	0.98	0.98	0.61	0.50	0.66	moderate
31	0.71	0.25	0.55	0.52	0.93	0.89	0.78	0.50	0.65	moderate
32	0.71	0.25	0.55	0.52	0.89	0.89	0.78	0.50	0.65	moderate
33	0.71	0.25	0.55	0.52	0.89	0.98	0.67	0.50	0.65	moderate
34	0.71	0.25	0.55	0.27	0.93	0.98	1.00	0.50	0.64	moderate
35	0.71	0.25	0.55	0.52	0.89	0.98	0.61	0.50	0.64	moderate
36	0.71	0.25	0.55	0.52	0.89	0.80	0.78	0.50	0.64	moderate
37	0.57	0.17	0.67	0.32	0.91	0.96	1.00	0.50	0.64	moderate
38	0.86	0.33	0.23	0.46	0.95	0.99	0.67	0.50	0.64	moderate
39	0.71	0.25	0.55	0.27	0.89	0.98	0.78	0.50	0.62	moderate
40	0.57	0.17	0.67	0.32	0.91	0.96	0.80	0.50	0.62	moderate
41	0.71	0.50	0.28	0.27	0.89	0.98	0.83	0.50	0.61	moderate
42	0.71	0.25	0.55	0.27	0.89	0.89	0.83	0.50	0.61	moderate
43	0.71	0.25	0.55	0.27	0.89	0.89	0.83	0.50	0.61	moderate
44	0.57	0.17	0.67	0.32	0.91	0.96	0.73	0.50	0.61	moderate
45	0.57	0.17	0.67	0.32	0.85	0.96	0.80	0.50	0.61	moderate
46	0.71	0.25	0.55	0.27	0.89	0.89	0.78	0.50	0.61	moderate
47	0.57	0.17	0.67	0.32	0.91	0.86	0.80	0.50	0.60	moderate
48	0.43	0.25	0.83	0.79	0.80	0.94	0.67	0.00	0.60	moderate
49	0.57	0.17	0.33	0.32	0.96	0.96	1.00	0.50	0.60	moderate
50	0.43	0.25	0.42	0.40	0.87	0.94	1.00	0.50	0.60	moderate
51	0.71	0.25	0.55	0.27	0.89	0.98	0.61	0.50	0.60	moderate

52	0.71	0.50	0.28	0.27	0.89	0.89	0.78	0.50	0.60	moderate
53	0.57	0.17	0.00	0.32	0.91	0.86	0.80	1.00	0.59	moderate
54	0.57	0.17	0.67	0.32	0.85	0.86	0.73	0.50	0.59	moderate
55	0.86	0.33	0.23	0.46	0.95	0.99	0.86	0.00	0.59	moderate
56	0.86	0.33	0.23	0.46	0.91	0.84	0.38	0.50	0.58	moderate
57	0.57	0.17	0.33	0.63	0.85	0.86	0.53	0.50	0.58	moderate
58	0.71	0.50	0.28	0.27	0.89	0.89	0.61	0.50	0.58	moderate
59	0.43	0.25	0.83	0.79	0.87	0.80	0.41	0.00	0.57	moderate
60	0.57	0.17	0.33	0.32	0.85	0.96	0.80	0.50	0.57	moderate
61	0.57	0.17	0.33	0.32	0.85	0.96	0.80	0.50	0.57	moderate
63	0.43	0.25	0.00	0.79	0.87	0.80	0.67	0.50	0.57	moderate
64	0.86	0.33	0.23	0.46	0.91	0.91	0.67	0.00	0.55	moderate
65	0.57	0.17	0.00	0.32	0.91	0.86	1.00	0.50	0.54	moderate
66	0.43	0.25	0.42	0.40	0.80	0.80	0.67	0.50	0.54	moderate
67	0.71	0.25	0.55	0.27	0.93	0.89	0.78	0.00	0.54	moderate
68	0.57	0.17	0.00	0.32	0.80	0.96	1.00	0.50	0.54	moderate
69	0.57	0.17	0.00	0.32	0.96	0.96	0.73	0.50	0.54	moderate
70	0.57	0.17	0.00	0.32	0.85	0.96	0.80	0.50	0.53	moderate
71	0.57	0.17	0.67	0.32	0.85	0.86	0.73	0.00	0.52	moderate
72	0.57	0.17	0.33	0.63	0.85	0.75	0.73	0.00	0.52	moderate
73	0.57	0.17	0.00	0.32	0.91	0.86	0.73	0.50	0.52	moderate
74	0.57	0.17	0.00	0.32	0.85	0.86	0.73	0.50	0.51	moderate
75	0.57	0.17	0.33	0.00	0.91	0.86	0.73	0.50	0.50	moderate
76	0.57	0.17	0.00	0.00	0.91	0.96	1.00	0.50	0.50	moderate
77	0.43	0.25	0.00	0.40	0.80	0.80	0.67	0.50	0.49	moderate
78	0.57	0.17	0.00	0.32	0.85	0.86	0.53	0.50	0.49	moderate
79	0.57	0.17	0.33	0.32	0.85	0.86	0.80	0.00	0.49	moderate
80	0.57	0.17	0.33	0.32	0.85	0.86	0.73	0.00	0.48	Low
81	0.57	0.17	0.33	0.63	0.85	0.75	0.33	0.00	0.48	Low
82	0.57	0.17	0.00	0.32	0.80	0.75	0.60	0.50	0.48	Low
83	0.43	0.25	0.00	0.00	0.80	0.94	1.00	0.50	0.47	Low
84	0.57	0.17	0.33	0.32	0.85	0.75	0.73	0.00	0.47	Low
85	0.57	0.37	0.67	0.00	0.85	0.86	0.53	0.00	0.46	Low
86	0.43	0.25	0.00	0.00	0.80	0.94	0.67	0.50	0.44	Low
87	0.43	0.25	0.00	0.00	0.80	0.94	0.67	0.50	0.44	Low
88	0.57	0.17	0.33	0.00	0.85	0.96	0.73	0.00	0.44	Low
89	0.57	0.37	0.67	0.00	0.80	0.75	0.33	0.00	0.42	Low
90	0.57	0.17	0.00	0.32	0.85	0.86	0.53	0.00	0.42	Low
91	0.43	0.25	0.00	0.00	0.80	0.80	0.41	0.50	0.40	Low
92	0.43	0.25	0.00	0.00	0.80	0.67	0.75	0.00	0.35	Low
93	0.43	0.25	0.00	0.00	0.80	0.80	0.41	0.00	0.33	Low
94	0.43	0.25	0.00	0.00	0.80	0.94	0.17	0.00	0.32	Low
95	0.14	0.00	0.00	0.00	0.53	0.53	0.50	0.00	0.21	Low

Note: The abbreviation of the indicators. FS: Family size, DR: Dependency ratio, IR: Illiteracy ratio (15+), RPW: Ratio of perennial working in other places, PCI: Per capita income, AHI: Access to hazard-related information, VPC: Vehicles per capita, HRT: Hazard-related training

The reviewer's comment 7:

Need more explanation on the correlation coefficient of HSV score, what does this indicate? (pg. 6734)

The authors' response:

On page 6734, we just showed the results because it is in the results part. We provided more explanation on the discussion part between lines 10-15. on page 6735,

In this study, we calculated the correlation coefficient between socres of household social vulnerability and the casualties of each household in a storm flood in July 2010. The results showed that the correlation coefficient was significant at 0.05 significance level (r=0.248), which indicated that the selected social vulnerability indicators and their weights were valid.

The reviewer's comment 8:

It will be nice to show the regression results graphically in some way.

The authors' response:

We didn't use regression analysis in this study

The reviewer's comment 9:

In conclusion (1), there is no need to describe the weight for each category, it is clearly listed in Table 1, also, this is not appropriate in conclusion part.

The authors' response:

We have deleted the description of the weight for each category according to your suggestions

(1) Through relevant references and interactive discussions with multidisciplinary specialists and local farmers, eight key indicators were identified and used to develop a household social vulnerability index. Their weights were determined using PCA method.

The reviewer's comment:

Technical corrections: 1. Pg. 6730, Line 2, "historcial" typo?

2. Pg. 6731, Line 10, should be "was detailed described"

3. Pg. 6732, Line 3, what does "yr-1" mean?

4. Pg. 6735, Line 25, "strtegies" typo?

5. Pg. 6736, Line 2, should be total, not "totle"

6. Pg. 6737, Line 6, should be "interesting"

Thank you. Changes have been made.