

EFFECTS OF SALINITY INTRUSION ON TYPES OF FARMING LAND USE IN VUNG LIEM DISTRICT, VINH LONG PROVINCE

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ABSTRACT

The research was conducted: 1) to assess the salinity intrusion in Vung Liem district, Vinh Long province in 2016, 2) to identify factors that effected on the change of the current land use types, and 3) to find suitable cultivation solutions mitigation of salinization in the future. Data was collected at 09 research sites from January to June, 2016. Which were analyzed by Kriging method in order to edit salinity intrusion map in Vung Liem district in March 2016. Besides, the Participatory Rural Appraisal (PRA) methods such as Key Informant Panel (KIP), structured questionnaire used to interview 96 households; field surveys and workshops were applied to collect and analyze information. Descriptive statistics were also used to describe the result of the study data. These data were compared and evaluated based on Cross-tabulation analysis and Binary Logistic regression.

The results showed that salinity intrusion in the dry season in 2016 in Vung Liem occurred early in the middle of December 2015, get the highest salinity peak in middle of February 2016. A map of salinity intrusion in March 2016 in Vung Liem district was edited with a 95% confidence interval (CI) and the correlation coefficient $r^2 = 0.657$. The area of agricultural land that was affected salinity intrusion at 4 - 6‰ is 5,878.4 ha and at 2 - 4‰ is 6,848.6 ha. The results of the household surveys showed that 26/96 households changed their land use types. The three factors influencing the change of land use types including: cost, profit and labor respectively. Salinity intrusion factor affected on the change of land use types but this effect was not statistically significant. The study also proposed solutions to cope with salinization such as the construction of a sluice gate in Vung Liem rivulet and irrigation infrastructure in the district and adaptation solutions such as announcement of salinity monitoring results, change of seasonal calendar, selection of suitable crop varieties.

Keywords: Land use type, Salinity intrusion, Vung Liem district

1. INTRODUCTION

The climate change direct effect to agriculture production. Salinity intrusion will representative impact to land use in Vinh Long province in next time. (Vinh Long Department of Agriculture and Rural Development, 2016). Besides, the Hydrography is effected by a difference diurnal tide cycle which has fluctuation between 3 to 3.5 meter from the East sea or 0.8 to 1.2 meter from the West sea (MRC, 2005; Tuan et al., 2007). Addition to, there are many small system rivers along Hau river and Tien river which are an easy condition to pervade salinity into the farm river and the soil (Hung, et al., 2001; Tuan et al., 2007). Specially, Vung Liem is a district from the South East of Vinh Long province so it will be effected by salinity intrusion (Vung Liem Office of Agriculture and Rural Development, 2010).

2. DATA USED

The case study was researched along Co Chien river (from Nang Am drain to Mang

Thit confluence) and the river branch along Co Chien river inside 10km. Because this places could be effected by salinity more than another places.

Almost data was collected from books, magazines, science articles or the reports in Vinh Long Department of Agriculture and Rural Development and the other ways. It contains salinity intrusion forecast, the location, the natural conditions, the economic potential, and the salinity intrusion process of Vung Liem district in many years.

The data was collected at nine research sites (from January to June, 2016): outside Nang Am drain, Vung Liem confluence, Mang Thit confluence, Vung Liem Market, Trung Hiep bridge, Mai Phon bridge, Huynh Mai drain, Phong Thoi channel, in side Nang Am drain (Hydro-Meteorological Forecasting in Vinh Long province, 2015).

3. METHODOLOGY

3.1 Analyze and solve data

The solve data: Check and import data into the Excel và SPSS software. Then using Kriging method and GIS established salinity intrusion map.

Table 1: Comment variable: Salinity, cost, agriculture profit, education, labor, gender

Variable	Code name' Variable	Unit	Content	Basis choose variable
X ₁	Salinity	1= Yes 0= No	1: Famer's household is effected by salinity intrusion 0: Famer's household is not effected by salinity intrusion.	Lam Van Tan, 2015
X ₂	Cost	Million dong	The production's cost in a year of 0.1 hectare	Le Xuan Thai, 2014
X ₃	Agriculture Profit	Million dong	The production's profit in a year of 0.1 hectare	Le Xuan Thai, 2014
X ₄	Education	1= Primary 2= Secondary 3= High school 4= Middle level, College, University	The level of education	Nguyen Quoc Nghi & Bui Van Trinh, 2011
X ₅	Labor	People	Element of labor	Nguyen Quoc Nghi & Bui Van Trinh, 2011
X ₆	Gender	1=Man 0=Woman	Gender of host household	Nguyen Tien Dung, 2014

According analyze Cross-tabulation check "Yes or No" relationship between two elements of total. This is an independent accreditation. It is suitable with two research factor which are disjointed qualitative variable or quantitative variable. In case study, this method uses to check "Yes or No" relationship between salinity intrusion and land use change of farmer. For example, H₀ is not relationship between salinity intrusion and land use change of farmer and H₁ is relationship with them. So, when we accept or not accept H₀, we should use suitable check.

Using P value (sig) conclude agreement or disagreement H₀. If P value (sig) ≤ α (significant level), it will disagreement H₀. It is mean there a relationship between salinity intrusion and land use change of farmer. In the other hand, if P value (sig) > α (significant

level), it will agreement H_0 . It is mean without a relationship.

4. RESULTS AND DISCUSSION

4.1 Assessment present land use and effect of salinity intrusion to agriculture production in Vung Liem District, Vinh Long province in 2016

The results of survey showed that in this area, the average famer's age was 54 years old. The average member of household was four. There was not different quantity between man and woman in famer's household. (Table 2). Moreover, in this region, the main jobs were agriculture production and their acreage was about 0.6 hectare/household. Besides, the human resource was enough to use (averaged 3 people/household).

Table 2: The feature of famer's household

Feature	Everage	SE	Maximum	Minimum
The age of host household (Year)	47	10.74	86	30
Member people	4.18	1.41	9	1
Labor	2.78	1.22	6	1
Area (ha)	0.599	0.447	2	0.2

n = 96

Effect of salinity intrusion to agriculture production in Vung Liem District is able to show in figure one. The figure shows highest salinity level in dry season 2016. It appeared in mid - February 2016 (from 05/02/2016 to 13/02/2016), same time with higher level water (the thirtieth December 2016 in lunar calendar which was a Tet holidays). The top of salinity from the points was more over than the top of salinity was recorded in the dry season 2012 – 2013. In the Co Chien river, the salinity was approximated 8‰ - 10‰. Specially, in Mang Thit confluence it was recorded at 5.3 ‰. It has never seen the high salinity.

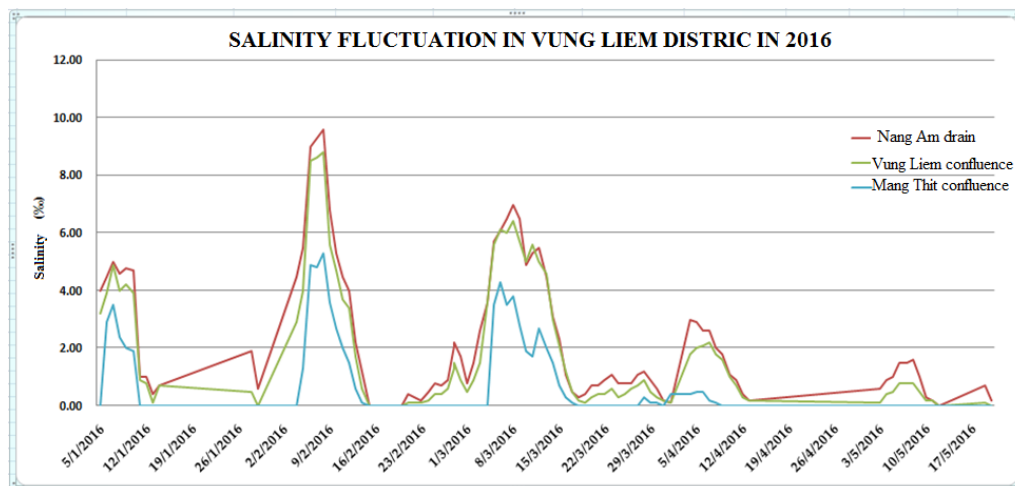


Figure 1. The salinity fluctuation in Vung Liem, Vinh Long 2016.

4.2. Using GIS establish the salinity intrusion map

The map was established by using GIS and Kriging method. The location data and salinity of nine points were collected in the mid - March 2016. Then, using GS Plus widened area survey

and building the salinity intrusion map in March 2016. Addition to, using the GIS stool communed two maps (land use map and salinity map). Finally, the map could show the location of agriculture production which could be salinity (figure 2)

THE SALINITY INTRUSION MAP IN MARCH 2016 OF VUNG LIEM DISTRICT, VINH LONG PROVINCE

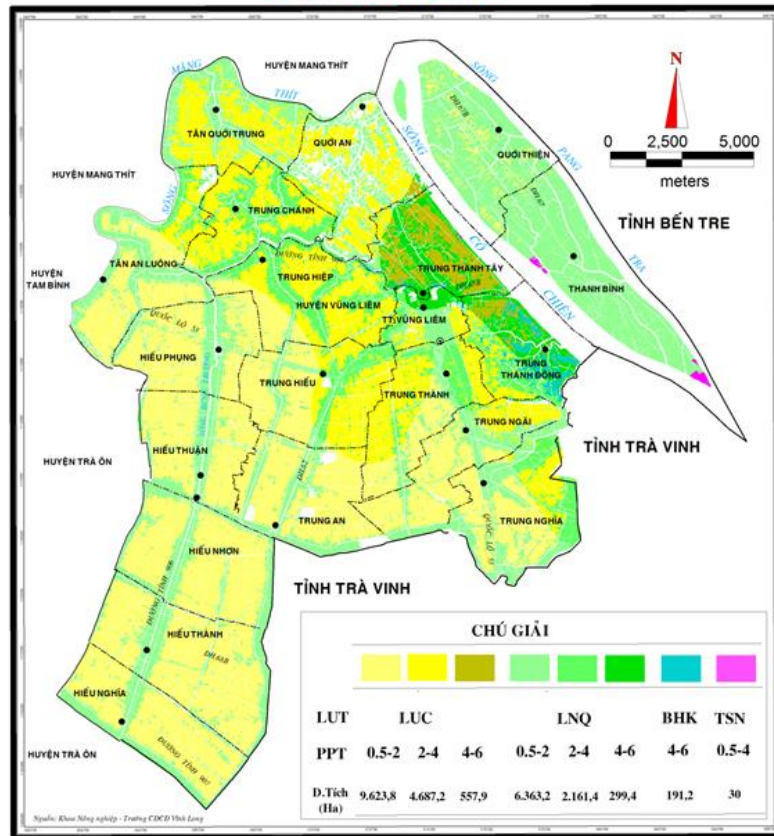


Figure 2. The salinity intrusion map in March 2016 of Vung Liem district, Vinh Long province

The figure two showed that the communes will be effected by salinity intrusion. They were Trung Thanh Dong, TT Vung Liem and Trung Thanh Tay. In this area, the water was pervaded salinity at 4‰ - 6‰ so the famers can't use this water for agriculture production. It made decrease effective of crop (Pham Thanh Vu, 2015). In the other hand, the Vung Liem confluence was higher salinity than Nang Am drain because Vung Liem confluence didn't has the drain. Contraction, Nang Am area has a drain so it could prevent pervading salinity. There were many communes which were effected by line salinity at 2‰ - 6‰ such as: Tan Quoi Trung, Quoi An, Trung Chanh, Trung Hiep and Trung Thanh, Trung Ngai, Trung Nghia.

4.3 Assessment the factors effected on the change of the current land use types

There were many factors influence to the land use types of household. The result analyzed 96 famer's survey showed that there were 70 households not change their land use type and 26 household change their land use type. Include: Firstly, in the area practice rice, there were 29 famers not change their crop and three famers not change. Secondly, in the area grow the trees fruit, there was the big change in land use type (13/31 famers) so this was a new trend in the developing agriculture. Finally, rush – Fruit land use type had two famer's survey. They accepted to change a new type. So the changing land use type in district was happened. However, the causes of this changing came from salinity or another factors. It was necessary to analyze Logistic.

Table 3: The result analyse constant Logistic

Factor	Regression coefficient	Wald value	Scale Odds Exp (B)
Salinity	-0.715 ^{***}	1.288	0.489
Cost	0.013	0.342	1.013
Agriculture Profit	0.017	1.002	1.017
Education	-0.292 ^{***}	0.731	0.747
Labor	0.243	1.365	1.275
Gender	-0.014	0.000	0.986
Log likelihood = 103.803		Prob > Chi ² = 0.000	
Number of obs = 96		LR Chi ² (8) = 57.1%	

(**): Significant difference 5%; (***) : Significant difference 10%;

(ns): non-significant difference

Table 3 showed that the result analyse constant Logistic affected to a changing of land use type. This table had significant with $P = 0.000$. Let's to see, effecting of factors make changing land use type ($Y = 0$: Not change LUT; $Y = 1$: change LUT) showed that the labor affected to a changing LUT at $\alpha = 10\%$. The cost and the Agriculture Profit affected of the changing LUT at $\alpha = 5\%$. In the other hand, the result demonstrated 57,1% choosing LUT of household.

Frist of all, the cost affected to a changing land use type of famer with scale Odds was 1.013 times (fluctuation space from 0.969 to 1.059). There was the same trend between the changing of the cost and the agriculture production model. Secondly, the agriculture profit affected to a changing land use type of famer. There was the same trend between the changing of the agriculture profit and the agriculture production model. Thirdly, the changing land use type was affected by the labor. If the labor increased one person, a capacity changing land use type could increase 1.275 times. Summary, creasing the labor made enhancing capacity changing land use. This result same with the research of Nguyen Quoc Nghi (2011) and Le Xuan Thai (2014). Finally, the scale Odds was 0.489. So it was same with the hypothesis ($\text{Exp} - B = 0.489 < 1$). This case, the salinity did not effect to a changing land use type of famer. Because, the changing was affected of many factors such as: natural condition, social economic and environment. Salinity was one of the factors which effected to environment. So, only there were 26 famers accepted changing LUT among 96 famers in this area while seventy famers did not change LUT. They wanted to find a new solution so that they would continue the current LUT. Besides, the survey result showed that almost household accepted changing LUT who lived near river because of salinity intrusion (Phan Minh Quang, 2009)

4.4 The solutions mitigation of salinization in the future

After the conference was organized in Vung Liem. There were two solutions mitigation of salinization in the future: Response solutions: building brain system, dams and dike system around Vung Liem confluence. It could prevent salinity intrusion.

Adaptation solution: agriculture officer usually monitor salinity in the main river so that they can forecast salinity intrusion for famers in this region. Addition to, the famers need changing the crop time early two weeks. If the areas increase capacity salinity intrusion from 2 ‰, the famers should not grow crop. In the other hand, the local government should interconnect with university, central, institute so that they are able to research many new seedlings which can live in salinity intrusion condition. Finally, the local government often organizes conference, training about mitigation technology for famers in the dry season.

5. CONCLUSION

The salinity intrusion appeared in mid - February 201. It approximated 8‰ - 10‰. Specially, a new level was recorded in Mang Thit confluence at 5.3 ‰.

Using GIS and GS Plus have established the salinity intrusion map in Vung Liem district in 2016. It showed that Trung Thanh Dong, TT Vung Liem and Trung Thanh Tay communes were pervaded salinity at 4‰ - 6‰ and there were seven communes which were effected by line salinity at 2‰ - 6‰ such as: Tan Quoi Trung, Quoi An, Trung Chanh, Trung Hiep and a part of Trung Thanh, Trung Ngai, Trung Nghia.

There were three factors influence to the land use types of household. The cost and the Agriculture Profit affected of the changing LUT at $\alpha = 5\%$ while the labor has $\alpha = 10\%$. In the other hand, this case study was demonstrated that the salinity did not effect to a changing land use type of famer. Besides, the topic also showed that almost household accepted changing LUT who lived near river.

There are two solutions mitigation of salinization in the future such as: response solutions and adaptation solution

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