

DỰ ÁN PHÒNG CHỐNG NHỮNG THIẾT HẠI VỀ NHÀ Ở DO BÃO GÂY RA Ở MIỀN TRUNG VIỆT NAM

PRÉVENTION DES DOMMAGES CAUSÉS À L'HABITAT PAR LES CYCLONES, CENTRE VIET NAM

PREVENT TYPHOON DAMAGE TO HOUSING, CENTRAL VIET NAM



Draft

Survey on indigenous knowledge on disaster prevention and adaptation to climate change



Report
DWF October 2009



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Contents

Introduction	2
Acknowledgements.....	3
A. North area	4
I. Indigenous knowledge in Ban Den hamlet, Ban Ho commune, Sapa	5
B. Central and South-Central area	7
I. Indigenous knowledge in Hung Loc commune, Da Loc, Thanh Hoa province.	8
II. Indigenous knowledge in Duc Giang commune, Vu Quang district, Ha Tinh	11
III. Indigenous knowledge in Hai Quy commune, Hai Lang, Quang Tri	14
IV. Indigenous knowledge in Vinh Hai commune, Phu Loc district, Thua Thien Hue province.....	16
V. Indigenous knowledge in Duc Minh commune, Mo Duc district, Quang Ngai province.....	18
VI. Indigenous knowledge in Phan Ri Cua town, Binh Thuan province.....	22
VII. Indigenous knowledge in Bac Ai district, Ninh Thuan province.....	24
C. South – Highland and Mekong Delta	26
I. Indigenous knowledge in Long Lai village, Mang Ri commune, Tumrong district, Kon Tum province	26
II. Indigenous knowledge in Binh Thanh commune, Chau Thanh district, An Giang province.....	28
Conclusion	30

Survey: June – August 2009

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Introduction

Human being, as well as all living being, is affected by the environmental conditions including the climate factors such as temperature, humidity, atmospheric pressure, wind, rainfall etc. Climate encompasses the statistics is commonly defined as the weather averaged over a long period of time in a given location. The weather is a set of all the phenomena occurring in a given atmosphere at a given time.

Human beings always learn about, discover the nature and weather predict is a manifestation of learning about nature to plan activities around these events, and to plan ahead and survive them.

For millennia people have tried to forecast the weather, discussed the weather forecasting of atmospheric changes and signs from the planetary astral alterations; signs of rain based on observation of the lunar phases; and weather forecasts based on the movement of winds.

Ancient weather forecasting methods usually relied on observed patterns of events, also termed pattern recognition. For example, it might be observed that if the sunset was particularly red, the following day often brought fair weather. This experience accumulated over the generations to produce weather lore. However, not all of these predictions prove reliable, and many of them have since been found not to stand up to rigorous statistical testing.

Viet Nam is located in tropical area at southeast continental Asian region, bounded by East Sea and Pacific Ocean, influenced directly by tropical monsoon type of climate. Viet Nam has 4 main climate areas: the North climate, the South climate, the Central and South of central climate, and East Sea climate. With complicated climate and different between areas and to be an agricultural country, so the Vietnamese has accumulated a huge of knowledge of predicting weather and farmers rely on weather forecasts to decide what work to do on any particular day as well as to organize prevention or warning from extreme conditions.

Great progress was made in the science of meteorology during the 20th century. Even with the accurate weather forecast information updated in time by high technology based early warning systems, numerous local communities worldwide have predict storm, flood, drought using indigenous methods based on observation of the sky, the movement of the wind the water on the sea, the signs of the flora, fauna etc. The communities know a lot about disaster adaptation and the question now, in Vietnam, is to see if this indigenous knowledge is still accurate or not with the climate changing very quickly and if this passed on from one generation to the next.

In August 2009, a team of DWF, under frame of implementing the Joint Advocacy Network Initiative (JANI) project- co-executed by eight partners, funded by DIPHECHO, conducted a survey in 10 locations represented 04 climate areas form the North, Central coastal, Central highland and the South to collect more information about these traditional practices and to evaluate if, with the changing climate, they are less accurate or being modified by rural people. This activity will be shared with other network (like Climate Change Working Group) and will benefit from projects – organisations actives in the field of DRR - CC.

Acknowledgements

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Finally, we owe thanks to a number of families who offered their ideas and support.

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A. North area

This area with tropical monsoon climate includes 4 seasons spring, summer, autumn and winter. However, climate feature in the area is changeable on starting and ending time of each season and temperature. The area divided into 2 main climate areas:

- North East
- North West

The climate in this area is rather temperate, main kinds of disaster are flashflood, landslide. In mountainous provinces, because of being a terrain with many rivers and streams, the water level in streams increases quickly if it rains heavily, that creates much difficulty for local people to travel in landslide-prone areas and threaten the life of people. Thus people in this area have plenty of experiences in forecasting rainfall through animal behaviors, plants and natural phenomenon in general.

I. Indigenous knowledge in Ban Den hamlet, Ban Ho commune, Sapa

1. Natural condition

Lao Cai is an upland area, bordered by Van Nam (China) in the North, Lai Chau province in the west, Ha Giang in the east and Yen Bai, Son La in the south.

Lao Cai has many kinds of terrain including valley, low and high mountainous terrain and some high mountains such as Fansipan Mountain with 3143 meters in height. There are 107 rivers and streams flowing through provinces with 3 main river systems including Hong River (with 120kms in length flowing through province), Nam Mu River (with 122km in length flowing through province), Chay River (with 124km in length flowing through province)



Terraced fields

Lao Cai has a tropical monsoon climate that is specific in mountainous area; dry and cold in winter; hot and much rain in summer. Besides some other kinds of climate are still available in other small-scale areas, Salient feature in Lao Cai is the diversity of biology. In the whole province, there are over 2000 kinds of plants, 442 kinds of birds, animals, reptile and frogs; among these 60 kinds of animal is available in Lao Cai, 9 kinds of plant in Sapa. Lao Cai has a valuable plant system, taking 50% of the whole country.

2. Background:

Sapa is an upland district of Lao Cai province, with natural land area of 67846 ha. The district includes 17 communes and 1 township; main population is Mong people (56%), Dao (26%) and others are King People, Giay, Xa Pho.

Located between the gate of 2 areas North East and West East with the medium height from 1200-1800 and belonging to tropical climate areas in Hoang Lien National Garden, Sapa has a diversity of biology creating a good condition for ecological and cultural tourism. This is one of the key factors to develop social economy of Sapa.

Livelihood activity of Mong people is slash and burn cultivation, corn and rice planting and terraced fields in some areas. Main plants are corn, upland rice and buckwheat. Besides, local people plant flax for taking fibre and medicine tree. Breeding of a Mong family includes buffaloes, horse, and dog, chicken.

Dao people live mainly on planting upland rice tree, irrigated field and farm produce. Main plants are rice, corn and farm produce such as gourd, squash, sweet potato,... They breed buffalo, pig, and chicken; in the medium-high areas people also breed goat, horse. Major foods of Dao people are bamboo shot, vegetable, sometimes meat, fish.

Sapa Township is one of rare place that is sometimes covered by snow. From 1971 to 2008, snow was covered in Sapa 14 times and among these times Sapa was snowed the most on 13 February 1968, continuously from 3 AM to 14 PM in the same day with the snow thickness of 20cm. Snap cold also affects seriously the crop of farmers. As crop is late, following the cultivation custom people do not transplanting rice and vegetable seeding. Particularly people lack of plough as buffalo and cow died for the series of snap cold. Remaining cattle becomes too weaken to plough.

3. Indigenous knowledge

Observation of animals

Buffaloes are tied or grazed in the forest, whenever they shout out or want to escape from shelter. These behaviors inform that the weather will be changed after one or 2 days. If it is sunny, the behavior that buffalo goes home informing it would rain after one or two days and vice versa.

Meng Bom San (Tay language) is an animal with blue body that is similar to locust, but the body size of Meng Bom San is bigger than locust. Behind the body, there is a shape like a knife. This kind of animal shouts in the early evening, if it shouts frequently it would rain tomorrow. The more it shouts the more quickly it will rain. If it shouts just a little, it will rain after several days.

A kind of snake living in the forest called “Giao snake” with 1 meters in length, brown head, yellow stomach and brown back. Snake diameter is as equal as bottom part of small teacup. In the daytime, it is very sunny “Giao snake” often go to the stream or pond for bathing, forecasting that it will rain. This snake just goes to stream or pond in hot weather with sunshine.

The phenomenon that anabases float on the surface of the pond informing that it will rain (fishes put their mouth on the surface of the pond to breath)

Observe the surface of pond's water

With the terrain's feature, this area includes many small natural ponds. Local people use these ponds for fish breeding. Thus based on the pond, people in this community have summarized some experiences on weather forecast as follow:

Normally pond's surface is in the normal state with no color. Whenever the surface of pond is fully covered by a layer of moss, it will rain after 2 or 3 days. As it stops raining the surface of pond become normal state.

Observation of sky

In this area, there are 2 high hills (called husband-wife hill). If there is the phenomenon that these 2 hills are covered by dark clouds (from down to top) informing that it will rain.

In general, the weather in this area is rather stable. In the comparison with other Central provinces, there are few cyclones in this area with mountainous terrain and with coastal line. Thus experiences of local people are about forecasting rain situation in order to have timely preparation for driving the cattle to their cage, food storing. Moreover, people will be more careful in traveling in flashflood-prone areas in mountain slope in order to reduce the losses of human and property.

B. Central and South-Central area

It contains the land in the East of Truong Son Mountain, which stretches from the south of Hoanh Son Mountain to Phan Thiet. This is the transition climate region. This region can be divided into 2 areas:

North-central area, north of Hai Van pass area, sometimes has cold climate and dry periods caused by foehn wind

South-central Coastal area, coastal plain south-center area in the south of Hai Van Pass, is hot all year round.

The important characteristic of this climate area is that rainy and dry season is not the same time with others climate area. In the summer, while the rain quantity of the whole country reaches the highest number. This climate area is the driest one.

Coastal central provinces have the same climate condition; topography and structure of agricultural production are nearly equal. Most of the provinces have the sea. In hard climate circumstance, rain and storms are often, difficult farming conditions, the primitive method of fishing, local people have to adapt and mitigate the risks of natural disasters thanks to experiences communicated from generation to generation. These experiences help adjust crop calendar, select cultivars with traits adapted to weather conditions in order to avoid bad effects caused by natural disaster.

Farmers often observe plants, animals and insects to predict the weather and natural disaster for during the day, month and next year. Through these things, they can guess the flood coming sooner or later, quantity of the rain is more or less they can also predict storms or drought for the year and next year so that they can plan for their agricultural activities. If they realize the signal of flood or the rain is heavier than last year, they do not plant in order to avoid damaging or plant sooner to avoid flooding. Similarly, to winter vegetable in the low land, they will quit that crop.

Many experienced farmers have avoided damages thanks to these traditional ways of predicting the weather. They think that it is effective to forecast weather basing on traditional knowledge and experiences. Now, farmers can access to weather forecast information but it can forecast in the near future (4-5 days). To agriculture, remote weather forecast is very important because the crop last very long, they need to decide in the beginning of the crop.

For fishermen, experiences in observing some phenomena such as clouds, stars, sun to forecast storm, hurricanes are very important to their life. Like other coastal area, seamen in Đức Minh all understand these knowledge and experiences. Although they have weather forecast information, they are in the habit of observing the sky and sea surface before going to the sea. These experiences help them limit the risks when they are in the sea. Especially they can avoid tornadoes that usually occur very quickly that the weather channel cannot predict promptly. If fishermen do not have the experience, the rate of risk is very high.. Thus, the experiences and knowledge are passed from generation to generation. Now, young fishermen can absorb these knowledge from elders and they consider as a facility that exists as a rule of nature.

I. Indigenous knowledge in Hung loc commune, Da loc, Thanh Hoa province.

1. Natural condition

Thanh Hoa, one of the largest provinces of Vietnam, locates in the door of the North, Central and the South area of Vietnam. The North of Thanh Hoa shares border with Sơn La, Hoà Bình, Ninh Bình; The South of Thanh Hoa share border with Nghệ An; the East is near the ocean and the west is near Laos. The topography is quite complicated, low from West to east with mountain, midland, lowland and coast.

This is the transition climate area between North and Central, average annual temperature between 23°C -24°C. Allocating in middle attitude and near the sea so it's not too cold in winter and fresher in summer.



2. Background

Hung Loc is a coastal commune with the total area of 532 ha natural land in which 227 agriculture land, and total population of 12500 people. Farmer mostly live on agriculture with 2 rice crops per years and some live on developing seafood.

In 2008, the area and productivity of crop plants are increasing with 221 ha of the total rice field area of 2 crops, 36-45ha of corn area, 66ha of the area of farm produce. Particularly, the diversity of plant structure in summer crop there are many kinds of plants such as 15ha of soybeans, 40ha of sesame, 10ha of farm produce. In winter crop, there are 45ha of corn, tens of ha of farm produce. Total production is 3520 tons; the average is 360kg for each person per year. Besides that, Hung Loc there is 342 cows, 6000 pigs and 51600 poultry.

Developing seafood reaches good results with total production 450ton of fish per year. The value of exploiting aquatic product and aquaculture is about 10950 millions vnd. Commune continues and enlarges home craft and some others such as carpentry, manufacturing building material and fish sauce, small business,... For that living standard of local people is increasing considerably, the income average is about 5,2 millions dong for each person per year.

3. Indigenous knowledge

Observation of sky

*"Dark cloud in east, red cloud in west
Rain or cyclone occurs"*

This phenomenon is observed from month¹ 6th to 10th. At the time that a mass of dark cloud are appeared in the east while red clouds are appeared in the west is the signal of cyclone in one or two day later.

*"It's no rain in Spring, drought in summer »
Thunder in 9 month, it would be very cold in the next 4 month »"*

At the beginning of spring, from 1st to 15 of January (thuong nguyen) if there is no rain in these day, there will be drought in that spring. Normally there is little thunder in September and October. If in these two months there are thunders informing that it will be very cold in April of next year.

Observation of animals

Chickens are kept in the garden. Normal if chickens go into their cage early the weather is normal, nothing happens. However if it becomes dark, but chickens don't want to go into their cage and go everywhere to find food; This is the signal that it will rain tomorrow.

Dog eat grass is the signal that weather will be changed

Observation of plants

A kind of grass called "Co gung" (Torpedo grass) is normally grown on path at rice field's edge. In 2nd and 3rd month, farmers often count the stumps of Torpedo grass to predict how many flood during the year.

In order to know that whether cyclones are affected seriously to local people, local people see bamboo shoots. If bamboo shoots grow closely with bamboo in the middle of bamboo hedges, there would be big cyclones this years and vice versa

Observation of sky

From 5th to 8th month, a mass of cloud is appeared in the west, down-top direction. Cloud mass with small mountain shape is white and yellowish. If this phenomenon happens, cyclones or sea winds will happen in next days.*

"In 8th month looking out, in 3rd looking in"

In 8th month, people often have a look to the East for forecasting cyclones happening in 6th, 7th and 8th next year. Besides people have a look to the west to forecasting floods, cyclones and winds.

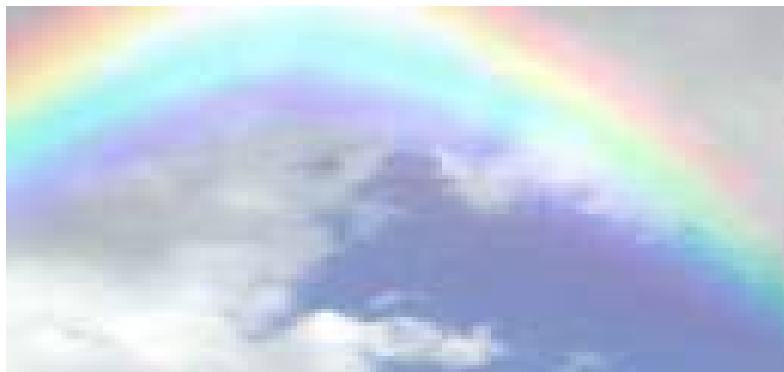
"Yellow clouds, windy; red cloud, rain"

This is the phenomenon of appearing colored-cloud on the sky-line in the short moment before sunrise or sunset. Colored-cloud is formed by reflection and diffuseness of the rays of sun by the speck of dust or steam hanging in mid air. Depending the size of the speck, the cloud has

¹ Lunar calendar

different color (red, orange, yellow etc.). From 6th to 10th month, if red cloud appears in the sea direction it would be rain

"Long rainbow means flood, short rainbow means rain"



A half of rainbow appears informing that it will rain while a full shape of rainbow is the signal of being flood in some next days

Observation of sea surface

Whenever seawater changes its color combining with West-North wind appears informing that weather will be changed and big cyclone will happen in next days. If this phenomenon combines with East wind or south wind, the weather will not change so much, just only wind or waves from the sea. In Phan Ri Cua, this phenomenon called "bubble up water"

The phenomenon called "Dupe water": Boats are laid at anchor, outwardly, although waves push boats on the direction of seashore, boats are pushed out of sea direction. This caused by the action of seawater in the boats make boats ejected into sea direction (in opposing direction of waves). This phenomenon is the signal that weather will change or rough sea, wind or rain.

Yearly weather

"on the 9/9 it rains,
Mother and children prepare plough tools for fields
On the 9/9 it no rain
Mother and children must sell plough tools for other work"

In 9th month, if it rains on the 9th of 9th month, this is the signal of being good weather with an abundant crop. However, if it does not rain in this day even small, farmers have to suffer from bad weather with an unsuccessful.

*"Giving birth in leap year is good
Growing rice in leap year is not favorable"*

Normally farmers have many difficulties for their fieldwork in leap years, as the weather is unpredictable in these years. Farmers having thus experiences in forecasting weather in leap year can change crop calendar or have some solution against bad weather situation.

II. Indigenous knowledge in Duc Giang commune, Vu Quang district, Ha Tinh

1. Natural condition

Ha Tinh is a province with 137km of coastal line stretching in Central Vietnam, sharing its border with Nghe An in the North, Quang Binh in the South, Lao in the West and South China Sea in the East. Its terrain is the diversity of hill, mountainous, plan, midland and sea with 14 small-big rivers. Yearly average temperature is 23,7 °C.



2. Background

Duc Giang is a commune of Vu Quang district, bordering An Phu commune in the north, Duc Linh commune in the south, Huong Son commune in the west. The commune is located in a low sloping area with 3045 people (825 households). Major disasters are flood, cyclone.

2/3 of population lives on agriculture activities. Yearly there are 2 crops (one main crop: rice fields; one auxiliary crop: farm production and rice fields)

3. Indigenous knowledge

Ha Tinh is located in the area with the central north climate. Basically its climate features are nearly the same with coastal central provinces, thus experiences on weather forecast are rather similar and some experiences can be adapted for the whole area of central and central north of Viet Nam.

Observation of sky

“East Lighting occurs, until cock-crow it rains”

This is the phenomenon of lighting from the sky in the East. The lightning occurs near the land surface in 7th, 8th. This phenomenon occurs in nightfall and continuing, until cock-crow it starts to rain. The more lightning occurs with frequency, the more quickly it will rain. Local people from Thanh Hoa to TT hue almost have experiences in observing this phenomenon. These show that this experience is popular and exact. Besides, people also have experience as follows:

“Lighting in the sea, it's rain in the mountain”

Concerned to this phenomenon, if lightning occurs in the east it would rain in the upstream. These kinds of forecast are most accurate and widely practiced by.

“Farming the crop in 5th month, should see the moon on mid of 8th month

If bright moon, it would be good for low land field; if cloudy, it would be good for dry filed”

Rice crop in 5th is normally affected by drought. Thus in order to forecast weather in 5th, people often observe the moon on the night of the fifteenth of 8th (lunar month) so that they can choose suitable solution for their agriculture activities. To grow rice in 5th (lunar calendar) of next year, farmers often observe the moon of the night of fifteenth of 8th (lunar month). If the moon in that night is bright with clear shape, drought in next 5th will occur. The drought weather is not good

for the kind of dry field, but it is good for deep field as in deep field water is enough for rice field. Thus based on forecasting this phenomenon, farmers only plant rice fields in low deep field. In case that the moon in that night is opaque with unclear shape the weather in May of next year will good for deep rice because it will rain a lot because raining a lot in dry areas is favorable for the kind of this rice field.

Observation of plants:

Crimum asiaticum L “Ngai Tuong Quan” plant often flower in 7th and 8th month with the flowering duration of 15 days. During flowering the weather is normal, but when flowers are faded informing that it would rain in next 3 or 4 days.

The top part or body of *Cynodon dactylou* become white informing that it will rain in next 2-3 days

Animal observation

A kind of animal called “*Con sắc sắc*” *mantis*, at nightfall whenever this animal shouts informing that it would rain in 2 or 3 days. The amount of rainfall depends on shouting few or a lot.

Frogs shout a lot informing it will rain

Observation of sky

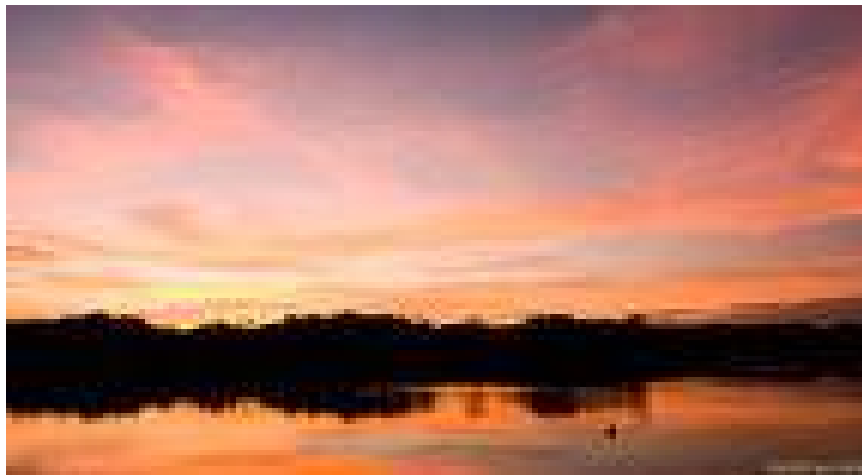
*“Corona moon, drought;
Halo moon, rain”*

*“Colored clouds in East, should run home
Colored clouds in the South, continue the farm work”*

Whenever a colored cloud on the sky-line appears in the east corner, at first it is yellow, around 30 minutes later, it becomes red. This colored cloud combining with lighting in the east informing that it will rain heavily or cyclone will occur quickly. However, these colored clouds appear in the south, the weather is normal. This phenomenon often occurs at the end of 7th, 8th month and end of 3rd or 4th month (lunar calendar).

The phenomenon that a mass of dark cloud under which there is a white cloud mass, and these two cloud masses connect closely. When white cloud mass separates dark clouds one with the distance of 50cm. This phenomenon occurs in a day normally in March and April informing that whirlwind will occur.

*Yellow cloud, strong wind,
Red clouds, rain.
Chicken fat colored clouds, everyone have to reinforce houses”*



Evening clouds

This is the reflection of sun that normally occurs before sunrise and after sunset.

Yearly weather

*"Husband spared but wife did not spared,
5/9 and 23/10 "*

"3 days of 9th month it rains

Father and children prepare plough tools for fields"

"3 days of 9th month it rains

Father and children prepare tools to go to forest"

In lunar 9th month, in 3 days (date of 9, 10, 29) if it rains in these 3 dates this is the signal that the weather of next year will be good and crop will be abundant. Conversely if there is no rain in these 3 dates of September, the weather of next year is bad so farmers should prepare another temporary work.

III. Indigenous knowledge in Hai Quy commune, Hai Lang, Quang Tri

1. Natural Condition

Hai Lang is an agriculture district sharing borders with East sea in the east, DaKrong district in the west, TT Hue province in the South, Quang Tri town and Trieu Phong district in the North. The district is in the south of province, 20 km far from Dong Ha in the north and 40 km far from TT Hue in the south.

There are 3 different areas. In the west there are hills and low mountain, in the middle there are plain and low area, then sea- sand area

2. Background

Hai Qui is a poor coastal commune. Most of people live on agriculture with difficult economic condition. Areas in the commune are often affected by major disasters such as cyclones, floods. Be similar to other central provinces, local people in Hai Qui must have solution to be able to adapt to difficult climate conditions in life. In this condition, they have collected many experiences on forecasting weather.

3. Indigenous knowledge

Observation of Plants

Many Jack-fruits are fruited in the foot of tree informing that there will be big cyclones in year and if they are fruited in high part of tree informing that there will be floods in year.

Observing a bunch of “rock bananas” (chuoï da) is to prepare for winter-spring crop. If the bunch of “rock bananas” is steady, the weather for next winter-spring crop is very favorable with good crop. However if the bunch of “rock bananas” is unsteady (normally the first part of bananas bunch is unsteady), the weather for next crop is not good so farmers have to start their crop later 2 or 3 days. Similarly, farmers observe a bunch of “rock bananas” in May to prepare for Summer Autumn crop.

The Cactus normally flower in 6th, 7th and 8th. At first, they are flower buds, then whenever these buds flower is the signal that it will rain tomorrow. It stops raining when flowers no longer bloom.

“Cynodon dactylou” becomes white is the signal that it will rain.

In 5th and 6th month the Barringtaria Acutangula flower and fruit and will mature in 3 months. If the plant has many fruits, it would have many flood in the very year. Plant flower and fruit sooner, flood would come sooner, because it scatters thank to water flow.

Observation of animal

Cyprinid eggs : Whenever the Cyprinid lay a lot of egg, it would have many flood in the very year and reverse. Regularly, the Cyprinid lay eggs from 8th to 10th month.

Observation of grouper: They disembowel a grouper to see how many grits it has to predict how many floods would come in the year. The Grouper can predict the flood with flow run very fast so, it swallows the grits to make it heavier in order to be sweep away.

Observation of sky

“ Fighting in Eo estuary, would have a lot of water”

This practice is the same in Thua Thien Hue. In this commune they can see to the Eo direction. The Eo estuary (Hoa Duan), is an estuary in Thuan An town of Thua Thien Hue. If the flash of

lighting regularly occurs in 2 and 3 lunar month in the North direction, each 30 minutes a flash from 2 to 3 am and close the sea surface, the strong wind would come at 9 am. People see this sign, they should have the preparedness or not go to the sea.

IV. Indigenous knowledge in Vinh Hai commune, Phu Loc district, Thua Thien Hue province.

1. Natural condition

Thua Thien Hue located in the North Central Coastal, approximately in the center of the country. Its total area is 5,053,99km², population 1,087,579 (2009).

Thua Thien-Hue Province borders the Quang Tri to the North, the city of Da Nang to the east, the Quang Nam province to the south and Laos to the west.

The province has a complex topography. It is made up four different zones: a mountainous area, hills, plains and lagoons separated from the sea by sandbanks. It has 126 km of beaches

The climate is similar to central Vietnam in general: a tropical monsoon climate. The cool season is from November to March with cold northeasterly winds. The lowest average monthly temperature is in January: 20°C. In the cool season temperatures can fall to 12°C. Then follows a warmer period from April to September with average monthly temperatures up to 29°C in July, reaching up to 41°C at times.

The annual precipitation in the province is 3200 mm but there are important variations. Depending on the year the annual average may be 2500 to 3500 mm in the plains and 3000 to 4500 mm in the mountains. The rainy season is from September to December - about 70 percent of the precipitation occurring in those months. Rainfall was often in short heavy bursts which can cause flooding and erosion, with serious social, economic and environmental consequences.

2. Background

Phu Loc is a district of Thua Thien Hue province cover an area of 728 km² along the sea coast with 02 towns of Lang Co and Phu Loc. Vinh hai is a coastal commune. People earn their living by farming and fishing. Locating in North Central Coastal with climate is similar to central Vietnam in general therefore; the indigenous knowledge on prediction of weather is similar to other costal provinces.

3. Indigenous Knowledge

Observation of sky

"Flash of lighting, penis hanging on neck"

Eo estuary (Hoa Duan), is an estuary in Thuan An town of Thua Thien Hue. If the flash of lighting regularly occurs in 2 and 3 lunar month in the North direction, each 30 minutes a flash from 2 to 3 am and close the sea surface, the strong wind would come at 9 am. People see this sign, they should have the preparedness or not go to the sea.

Colored cloud in tile roofing color warning strong wind. Cloud colored as tile roofing occurs in the south at sunset from 6th to 11th month of lunar calendar with size of a sedge mat, if this sign disperse in short time (5 to 10 minutes), the weather should be very dangerous, cyclone would come quickly. In this case, fisherman tries to back to the shore pressingly. In contrary, fishermen feel secure if the cloud still red up to over 30 minutes.

*" Truoi mountain top wear a hat
Heavy rain even in the hell »*

« Truoi mountain top shrouded in dark cloud, heavy rain would come every where even in the hell »

In 2, 3 and 4 month, in Truoi Mountain (30 km from the south of Hue) shrouded in dark cloud, monsoon and lasting rain would come.

"Flash of lighting at Gion Mountain, catch small crap for meal"

Gion Mountain located in southeast. In 6, 7, and 8 month, if the flash of lighting occurs in this area at night and close the water, fisherman would not go to the sea. Lasting flash of lighting until next morning, predict the south wind would come. Weather hot, but choppy sea, so fisherman should not go to the sea.

Observation of plants

Count the stump of *Panicum repens* to predict how many flood during the year.

Torpedograss (*Panicum repens*) is in the family *Poaceae*. It is called torpedograss because of its sharply pointed or torpedo-like growing tips. Torpedograss can grow up to 3 feet tall, with hairy leaf sheaths and hair on the upper margins of the leaves. Leaf blades are stiff, linear, flat or folded.

Cactus blooming: the cactus blooming in 6, 7 and 8 month. Cactus flowering, rain would com in the next day.

Observe of animals

*"Frog cry in July, rain
Frog cry in March, rainstorm or cyclone"*

*Yearly weather
"Husband spared but wife did not spared,
So caused the flooding on 23/10
Husband spared but wife laughed
So caused the cyclone on 10/3 "
(Husband and wife: couple of Sky)*

Yearly, in Central Coastal provinces, by the end of October, people are very worry about the last flood of flooding season. This last flood often fall on 23/10, and for the people who live near the sea, they worry about the cyclone occurs often on 4-10/3.

V. Indigenous knowledge in Duc Minh commune, Mo Duc district, Quang Ngai province.

1. Natural condition

Located on South-Central Vietnam, Quang Ngai borders Quang Nam Province on the north, Binh Dinh Province on the south, Kon Tum Province on the west and East Sea on the east with 135km seaside..



The province is surrounded by Truong Son Mountains on one side and the East Sea on the other. As a result, the topography includes mountains, plains, seaside and offshore islands. The main rivers are Tra Khuc, Tra Bong, Núi Thiên Ân and Ve rivers.

Climate: The rain season lasts from September to December. It is hot between April and August and the weather is cold from January to March. Annual average temperature is 26°C.

Quang Ngai with density river system: besides 4 main rivers: Tra Cau, Ve, Tra Khuc, Tra Bong, there are many small rivers flow from West to East with high slope, short rivers so that flood occurs quickly and high crest. The regular disaster in area: storm, cyclone, flood slash flood, erosion. Disaster more frequently and more serious than before.

2. Background

Mo Duc district located in South coastal of Quang Ngai province, it has 1 town and 12 communes cover an area of 212 km². The mountainous communes of Mo Duc with high slope and lower to the East. Flood comes quickly because of short rivers system.

Duc Minh commune located in low area near the estuary, therefore with the heavy rain, water flow to estuary caused water logging, especially with flood-tide. Average flood time of 5-7 days with average depth of 50-60 cm.

People earn their living by agricultural production. Main crops are the short time crops such as rice, maize, cassava, and watermelon, peanut, sugar can. Livestock is also strength of Duc Minh commune. Farmers raising sow and pigs. Fishing hold 20%.

Watermelon including in crop system of Duc Minh commune. These crops can not resistance with water logging and haevy rain, so that sowing timing is very importance, how to harvesting do not fall in flooding season.

The fishermen in this commune also have many experience of go to the sea. This helped them safer in fishing.

In Duc Minh commune, this indigenous knowledge still passed down to young generation and they practice effectively in agricultural production and fishing to reduce damage caused my natural disaster.

3. Indigenous knowledge



Group discussion

Observation of sky

*“Every evening see the red clouds in the West
Strong waves or strong wind would come”*

In the early evening at sunset, if in the West occur a dark red cloud and then quickly disperse, strong wind or cyclone would come quickly. If fisherman saw this phenomenon they would not go to the sea. The same if they see the red cloud at sunrise.

*“Flash of lighting close the sea surface
Rain would come sooner or later”*

When fishing boat are offshore (small boat), fisherman could not update the weather forecast information so they have to rely on their own experience to survive. They go back to ashore quickly if they see this sign, because cyclone would come soon.

*Yellow cloud, strong wind,
Red clouds, rain.*

*Dense star, sunny sky
Thinly star, rain*

*August look out of the sea
March look on the mountain*

Sunny is favorable to melon, rainy is favorable to rice.

Observation of the sea

Bubble up on water surface, cyclone would come,
Depression beach, strong wind would come.

Observation of plants.

The *Cynodon dactylon*: The blades are a grey-green color and are short, usually 4–15 cm long with rough edges. The erect stems can grow 1–30 cm (rarely to 90 cm) tall. The stems are slightly flattened, often tinged purple in color. The seed heads are produced in a cluster of 3–7 spikes (rarely two) together at the top of the stem, each spike 3–6 cm long. It has a deep root system; in drought situations with penetrable soil, the root system can grow to over 2 m deep, though most of the root mass is less than 60 cm under the surface. The grass creeps along the ground and root wherever a node touches the ground, forming a dense mat. *C. Dactylon* reproduces through seeds, through runners and rhizomes. Growth begins at temperatures above 15°C (59°F) with optimum growth between 24°C to 37°C (75–99°F); in winter the grass becomes dormant and turns brown. Growth is promoted by full sun and retarded by full shade, e.g., close to tree trunks.



Farmers look the *C-dactylon*, if green of leaves become colorless, rain would come soon. This practice is accurate in all coastal provinces and widely know by farmers.

July is the season of sprouting bamboo shot of the bamboo tree. If the bamboo shoots spout outside the bamboo hedges, would have had no serious storm during rainy season. If the bamboo shoot sprouts in middle of cluster or sprouts outside but try to get in the cluster, it's would have had serious storm and heavy rain in rainy season.

Observation of animals

*Black ant bring egg to higher place
To be sure that showery would come.*

The ant makes its nest at the high place, will occurs serious flooding in the year.

*Rumor has it that the largehead hairtail find feed in winter
Husband goes to fish but not come back.*

The largehead hairtail (also beltfish), *Trichiurus lepturus*, is a member of the cutlassfish family, Trichiuridae. It is a long, slender fish found throughout the tropical and temperate waters of the world. The Atlantic and Pacific populations are also known as Atlantic cutlassfish and Pacific cutlassfish, respectively.

Largehead hairtails can grow to over 2 m in length; the largest recorded weight is 5 kg and the oldest recorded age is 15 years. They live in shallow coastal waters, rising to eat planktonic crustaceans during the day and returning to the sea bed at night



Every year, on 4th March of lunar calendar, largehead hairtail appear a lot but in the very day regularly have cyclone. Fishermen call" Beltfish cyclone" and they not go out the sea on this day.

*“Dragonfly flies high, sunny sky
Flies low, rain,
Flies neither high nor low, cloudy sky”*

See river young fish a lot in 3 month predicting first flood would come sooner on 4 month.
Farmers postpone the sowing season to avoid flooding.
Field crab gets out the field predicting serious flood.
Dolphin come to the surface, cyclone would come.

*Yearly weather
“Husband spared but wife did not spared,
So caused the flooding on 23/10 “*

On 9/9 no rain, farmers sell rake for meal,
In 7th month, water jump up the bank.

VI. Indigenous knowledge in Phan Ri Cua town, Binh Thuan province.

1. Natural condition

Binh Thuan Province is located on coast of South Central Vietnam. It shares its border with Ninh Thuan Province to the north-east, Lam Dong Province to the north, Dong Nai Province to the west, Ba Ria - Vung Tau Province to the south-west, East Sea to the east and south-east.

Binh Thuan has three types of topography: mountainous, plain and coastal. The coast longs over 192km with many capes: La Gan, Mui Nho, Mui Rom, Mui Ne, Ke Ga. They create good seaports: La Gan-Phan Ri, Mui Ne - Phan Thiet, La Gi. The Phu Quy District offshore links mainland to Truong Sa Island. The main rivers run through the province are La Ga, Quao, Cong, Dinh.

Climate: The province lies in the monsoon tropical area with two distinct seasons. The rainy season: from May to October and the dry season: from November to April following year. The annual average temperature varies between 27°C and the yearly rainfall is 800mm - 1,500mm

2. Background

Phan Ri Cua town, Tuy Phong district
Tuy Phong has a coastline stretching km that contains a large reserve of seafood. With a wide range of species, Tuy Phong's water territory is one of the largest fishing grounds in Binh Thuan province and in the country as a whole. Along the coastline there are many bays and beaches, and two estuaries suitable for building fishing



50

ports. The coastline also offers great opportunities for developing aquaculture, particularly prawn rising and producing breeding prawns. Aquaculture plays an important role in Tuy Phong district's economy, accounting for 32% of local people's incomes.

As in other coastal provinces, the fishermen in Phan Ri Cua accumulated many of nautical experience, including knowledge of weather prediction to protect their life and property.

3. Indigenous knowledge

Observation of the sea

Neither red cloud no flash of lighting, but water bubble up, strong wind would come in 3-4 days.

In 8th month, flash of lighting close water surface, cyclone would come in following day,

Flow water on surface, strong wind would come.

Observation of sky

In 10th month, at sunrise see dark cloud under the sun, strong wind would come in following day,

From 1st to 7th month, at sunset, see black red cloud, strong wind would come in following day, Hearing thunder, not windy

Observation of animal

Whenever the Dolphin come to the surface and swims against the wind, fisherman knows direction of strong wind is coming.

Methodological phenomenon

Who go any where to do business, don't forget to the 10/8 when buffalo fight wind blow to back home (fight between North- easterly wind and South wind, change season),

Calm in the North, strong wind would come. Softly wind in the South, calm in the South.

VII. Indigenous knowledge in Bac Ai district, Ninh Thuan province.

1. Natural condition

The province of Ninh Thuan is located in South -Central Coast, Ninh Thuan share border with Khanh Hoa province on the North, Lam Dong province on the west, Binh Thuan province on the South and East Sea on the east.

The terrain is mixture of mountain, plain and seaside. Mountains surround three faces.



Ninh Thuận

Climate: The climate is a combination of the tropical monsoon and dry and windy weather. It is hot, dry, windy all of year. Average temperature is 27°C, average rainfall 705 mm and increase by attitude up to 1.100mm in mountainous area. There is two seasons: the rain season lasts from May to November, the dry season lasts from December to April.

2. Background

Bac Ai is one of four poorest district of Viet Nam, The Ra Glai (Rac Lay) ethnic occupies 70% of population of district.

Formerly the Ra Glai simply grew rice and maize using slash-and-burn farming techniques. They also developed wet rice agriculture. Hunting, picking, gathering, and making handicrafts are other forms on income generation. There are two kind of field:

- The field on alluvial soil along the rivers, streams submerged in 9th, 10th month. On this field, farmers cultivate corn or cucurbit in order to harvest before field being submerged.
- The field on high area or hill base where have not been submerged in rainy season. This is the main cultivated land of Raglai. They cultivate rice, corn and tube crop on these fields.

Though farming history, the Raglai people accumulated many knowledge of predicting weather to serve for their farming practice. Whenever the forest tree totally green, the sky cloudy, weather hot and muggy, wind change direction, fruit of Timum tree mature or Pô-ô tree flowering, rain will pour down and Raglai people start to burn, clear the field for sowing at beginning of rainy season.

Recently, with resettlement movement, the RaGlai people begin to cultivate irrigated rice.

Before, when they in old village in mountain base with slash and burn farming practice, cultivator not access with weather forecast information, they mainly based on the sign of animals and plants in forest to predict weather and identify the farming calendar. Recently, they live in the resettlement area so there has been a change in the farming system, but some still practice the traditional farming habitude. Most of them have experience of predicting rain through observation of plants, animals. Listen the song of birds to predict rain is the most practice in this area. This experience passed down generation to generation through narration. Whenever a villager goes to the forest, seeing the sign from plants or animal that predicts the rain, he spread by word of mouth to which he met on the way. Village patriarch often disseminates the knowledge on the village meetings.

Sowing season of Raglai group in Bac Ai begins on 4th month and they call 1st month. Therefore they have to clear the fields on 3rd month and way favorable time to burn and appropriate timing of burning is 10 days before first rain come. If burn early, weed would sprout again but later

after raining comes, then burning would be impossible. For that reason, predict exactly when the first rain comes is very importance and it becomes the most practice of indigenous people.

3. Indigenous knowledge

Observation of animal

The song of the Towao bird: by early of 3rd month, after clearing field, indigenous people listen the song of Towao bird to identify the timing of burning. Whenever the moment between two song is short (5 minute/ song), first rain would come by middle of 3rd month, but longer (7-10 minutes/song), rain would come in 4th month. 01 minute a song rain would come during the day,

An other bird named Pébrik Clao (or laugh bird): whenever the song of this bird is “ pébrik-pébrik- pébrik – he he he” (3-1), rain would come in 1 month but the song is “pébrik-he he he-pébrik-he he he” (1-1), rain would come in 15 days,

Crest Varan changes color from yellow red to green, rain would come in 15 days;

The Varan: The tail Varan with the even yellow spots, favorable weather; many red and yellow spots, drought; more dark than yellow lasting rain during rainy season.

The Gibbon howls constantly on 6th, 7th, It's drought in next dry season

Yellow ant goes in to house, rain;

Black ants goes to a high place; flood;

Bee flies to the East, storm will come (flies low storm comes soon, flies high storm comes later);

Crab digs hole deeper, drought;

It's rain but Moor-hen cry, sunny comes in 3 days.



Observation of plants

In 5th, 6th month, indigenous people cut a bamboo tree in forest, if inside the bamboo section contain a lot of water, it's drought in next dry season;

Grass in the woods has foam on the blade, rain would come in 15 days;

Indigenous people observes plants not only for weather forecast but also for identifying farming calendar.

Observation of sky:

Even star on sky, favorable weather;

Cloud floats low, rain.

Thank to these practices, indigenous people more active in farming activities such as clearance fields, burning, sowing etc. If the song of bird predicts the rain will come in 15 days, farmers would burn the in 10 days. If prediction show that it's would be drought next year, people would have to preserve for cattle etc.

In recent years, especially in 2009, there is a change in weather, more rain and sunny so that it made these practices sometimes no longer accurate. However, the ethnic group who live in mountain base before now move to resettlement area and cultivate on allocated land with irrigation water from Song Sat lake so they no longer depending on rainfeed for farming like before.

Nowadays, the households, those have fields on mountain still predict the weather by these practice. However theses practice still has been passed down to the young.

C. South – Highland and Mekong Delta

This climate area includes the South Central Highland and the Mekong Delta has a tropical monsoon climate with two main seasons: dry and rainy season (lasting from 4-5 to 10-11 month). High temperature in all year round and less fluctuation.

I. Indigenous knowledge in Long Lai village, Măng Ri commune, Tumơrông district, KonTum province

1. Natural condition

Kon Tum Province lies in the Central highland region of and shares borders with Laos and Cambodia. It has an area of 9,934 square km and a population of approximately 330,000. The economy is primarily agricultural. Neighboring provinces are Quang Nam to the north, Quang Ngai to the east and Gia Lai to the south.



Most of Kon Tum area lies behind the west of Truong Son Nam range. With a vast basalt plateau Kon Tum – Pleiku, most of Kon Tum is not directly influenced by northeast monsoon waves. Nature, landscape and people in this area reflect all specific characteristics of highland tropical monsoon climate. It is sunny all year round; trees and plants are harvested every time of the year.

With traditional characters of hard-working, intelligence, bravery, Kon Tum people conquered and defeated many natural disasters. Now they should pay dual consideration into irrigation, make full use of water resources from pools, lakes, streams and rivers, plan to build more artificial lakes, pools to reserve water in dry season, exploit waterfalls and rapids for hydro-electricity.

Kon Tum province with many ethnic groups such as Xedang, Bana, Gia Rai, Gie-Trieng, Brau, Roman, the Kinh and minorities immigrating from the north of Vietnam.

2. Background

Kon Tum is rich not only in natural resources, but also in trees and mountains. In addition, Kon Tum has the area with bazan soil with appropriate to plant rubber, coffee, tea, sugar cane, mulberry etc. and the pastures favorable for cattle raising.

There are many Xo Dang people live in Mang Ri commune. Farming is the main form of income generation. Cattle and poultry raising, hunting, picking, gathering, fishing, basketry, weaving, and blacksmithing are other ways the Xo Dang survive.

In Măng Ri commune, farmer cultivates rice in two crops (6 months/crop). The first rice crop: from 4th to 10th, 11th month (Winter-Spring crop), the second rice crop from 10th to 4th, 5th month (Summer-Autumn crop). Besides, farmer cultivate other crops such as corn, cassava etc. Rainy season lasting from 4th to 11th. Dry season in 1st, 2nd, 3rd and some time lasting to 4th month.

As the RaGlai group in Bac Ai district, Ninh Thuan province, Farming is the main form of income generation of Xo dang people and with the geography is mountainous; therefore their indigenous knowledge of weather forecast is mainly observation of plants and animal in forest to predict the rain serving for preparedness for farming.

3. Indigenous knowledge

Indigenous knowledge of Xo Dang group

Observation of plants

Flower of "Son Toc" tree

"Son Toc" is a shrub plant with height from 1-1,5 m, small stem and has one flower on the top. Flower like lily but bigger and in yellow color and toxic. Flowering season is in 8,9 and 10 month. The "Son Toc" plant flower predicts rain in 01 week.

The highest "Lon Chen" tree attains around 4 m., is a timber tree with small trunk. Its flower is multi-color and each raceme has the many flowers cluster in different color (red, white, yellow). Tree in blossom, it rain during the day and during the lasting of rain and stop flowering when the rain is over.

The Xo Dang group has a custom: the first sowing day they fix a raceme of Lon Chen flower on the field with hoping a bumper crop.

Observation of animals

Tàng Pong bird

Tang Pong bird has the size as the cuckoo with red and white in color... The song is "Tang Pong ha ho" and it sing in 2, 3 and 4 month. Whenever it sings, rain would come in some days. Meaning of "Tang Pong ha ho" is "go to do your farm work". People clear the field and wait until the bird sing to sow rice, maize.

The Út Út bird is in red and black colour lives on the field. This bird sings "ut, ut, ut..." in some minutes and stop, then sing again, rain would come in 3or 4 days. If it sings all day, rain comes soon; sing 02 or 03 times per day, no rain.

The Xo Dang group here has a song:

" People should remind

When Long Chen in flower and Bird sing

In a same cropping season, we has seen fewer and heard the song of bird already,

Village Patriarch urges all villager have to do there farm work "

II. Indigenous knowledge in Binh Thanh commune, Chau Thanh district, An Giang province.

1. Natural condition

Being situated in the southwest Viet nam, in the Cuu Long river delta, in the riverhead of Mekong river where the river of Tien, and Hau are running through, An Giang Province is bounded on the northwest by Cambodia with 97 km borderline, on the southwest by Kien Giang Province, on the southeast by Can Tho Province, and on the northeast by Dong Thap province.



2. Background

Binh Thanh commune, Chau Thanh district located an island of Hau river. Total natural area is 841 h, cultivated land is 432 ha.

Commune made in 4 villages: Thanh Hung, Thanh Nhon, Thanh Hoa and Thanh Phu. Population of 6,547 months. It has two sub- areas surrounded by impoundment with an area of 180 ha. It has 02 resettlement clusters: Thanh Hoa 141 households and Thanh Phu 30 households. The economic is mainly production of vegetable and raising cattle. Natural condition is favorable for crop, livestock and aquaculture production. Commune ha 60, 5 ha of fish raising pond.

The weather in this area is favorable. People here concern only the water levels in flooding season caused by the Mekong River.

Every year by 5/5 water begins flowing to the river system in Mekong Delta ((river level rose high). Before timing of water flow, people observes the sign that can predict the water level, timing of water flow or water stop raising and low. This knowledge is useful to agricultural work. If prediction show that, water level will be high during flooding season, farmers would consider the cultivation on the low fields or outside the impoundment or use the adaptive crops, reinforce impoundment, leave land fallow or use precocious varieties. Farmer wait until having the sign of water stop raising and star lower to prepare seed for sowing.

3. Indigenous knowledge



To know water flow, raising:

Observation of reed: Before water flow, people observe the blade of the reed and measure line on leaf, if distance from axil to the line is long, water level would be high and reverse,

Weigh water before 5/5 and after 5/5, if water after 5/5 more heavy, water would be higher,

Before water flowing (in 3, 4 month), there are a lot of *Daphnia* , water would be high,

Moor-hen cry, water raise,

Hornet nest in high place, water high, low place water low.

To know water:

After mid autumn water is at crest of flood and stop rising at middle of 9 month. Farmer observes the sign to predict low water for starting planting season.

The Reed flower,
The Egrets come back and perch on the river banks to find feed.
Water morning glory flower,

Weather forecast

Field crab, rain,
Frog cry, rain.

Conclusion

Due to approximate climate characteristic of the coastal provinces, the indigenous knowledge on predict weather are similar in region. The farmers in central region have the similar experience of predicting weather but with some different only by dialect. There are many similar folk-songs on weather in region. Farmers predict weather based mainly on plants and animals around them such as grass, bamboo, chicken, dogs, pig etc. depending the flora and fauna of locations.

Vietnam's coastline is 3,260 kilometres long and its inland borderline measures is 3,730 kilometres. In the coastal provinces, the fishers have similar knowledge of weather forecasting based on observation of sky, the sea. The difference of geographical position made the proverbs of weather forecasting called in different way depending on the landmark they used for observation but having the same meaning if it based on direction. These practices are accurate in whole coastal region with observation of colored cloud, rainbow, sea, flash of lighting etc. to predict mainly the storm, cyclone, rain.

The highland area in the North as well as Central highland, the farming system is slash and burn so they mainly observe based on the sign of birds, animal and plants in forest to predict rain. For the farming system based on rain feed, rain timing is very important for sowing season. For the Mekong delta, the weather is rather favorable in this area but flooded by the Mekong. Timing of water flow and edd, and flooding level mostly effect on cropping season. Therefore, experience of farmers in this area is predicting the timing of water flow and level of flooding.

In general, depending on characteristic of climate and nature of each sub-region and farming habitude, people gathered through generations a huge of indigenous knowledge on predicting weather, disaster in each location.

In the surveyed province, people made known that, in recent years, climate has many change. In some area, this change made favorable for farming but some others were unfavorable. In case of Duc Minh commune, Mo Duc district, Quang Ngai province, before it's used to be drought in June, July but recently it's often rain, especially in 2009. This good for plants in area and favorable for crop. But for Phan Ri Cua town, Phan Thiet, Binh Thuan province, a normal rain and cyclone occurred this year was unfavorable to fishers. People in Bac Ai district, Ninh Thuan province made know that, recently the weather have many change heavy rain and baking sun.

Because of changeable weather, made indigenous knowledge on weather forecast some time was less accurate, especially the yearly methodological phenomenon. It's came before or later. For predicting experience based on observation the animals, plants, sky, sea etc. is mostly accurate, because these are the climate phenomenon. The question is that if people try to get this knowledge or not.

Nowadays, even with high technology based early warning systems, but with small scale of agricultural product and the simple mean of fishing, people still practice the indigenous knowledge in prediction, especially the farmers and fisherman. People refer these practices with official weather forecast. The fisherman made know that if want to safe when go out to the sea, should have the experience, knowledge of the sea and of prediction of weather. Although they equipped with high technology equipment of forecast but in case theses equipments were out of work, these experience help them survive. Today, the young with high technology of fishing equipment in the area with large-scale of fishing are very subjective and seem to make light of

elder's experience. However, the fisherman in the areas with small scale of fishing these practices is very importance and passed down from generations.