

Drought, desertification, orientations and strategy objectives for preparedness and prevention of Vietnam

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Abstract. This paper mentioned about the current status of drought and desertification of Vietnam and assessment of impacts and consequences of drought inflicted mainly on agricultural production, and recommendation of drought preparedness and prevention in Vietnam. Drought and desertification originate mainly from major climate changes. Drought and desertification may strike any nation and region, cause innumerable environmental, social and economic losses. For various reasons, human influence has also accelerated and exacerbated drought and desertification in each individual area.

1. THE CURRENT STATUS OF DROUGHT AND DESERTIFICATION OF VIETNAM

Vietnam lies in the tropical zone of the Northern - hemisphere. The country extends over 15 latitudes, and has a coastline of approximately 3,000km and a complex topography. With the above- mentioned features, Vietnam is prone to almost all kinds of natural disasters, of which storms, floods and drought rank as the worst and most frequent, inflicting substantial human suffering, massive environmental, social and economic damages, and untold agricultural production losses. Drought ranks third in all natural disasters in Vietnam, after flooding and storms. Vietnam is at risk of drought every year. Regarding agricultural production, only 20% of winter - spring crops over the last three decades have enjoyed relatively safe meteorological and hydrographical conditions or only been affected by slight drought in some areas. All the remaining 80% have suffered from medium or serious drought in many areas or on a large scale.

From 1976 to 2005, serious large - scale drought hit 15 winter - spring crops, accounting for 50% of the years and inflicting catastrophic damages. The drought in 1998 saw serious nation - wide drought, particularly in central part of the country, the central highlands and southern provinces, with damages totaling over VND 5,000 billion. Typical droughts have curred recently in 1992-1993, 1997-1998, 2001- 2002, 2002-2003, 2004-2005.

Drought 2001, 2002, 2003, 2005 occurred on the large areas but less seriously than drought 1998. Drought 2002, in addition to loss of crops, the drought caused widespread forest fires, including the large fire in the Upper and Lower U Minh natural forest. There are a lot of rivers, canal were exhausted completely, many lakes, rising dams had no capacity to provides water.

Desertification is yet to be a common and serious phenomenon in Vietnam. However, initial evidences of desertification have become obviously in coastal sandy areas and in sloping lands in the central highlands and mountainous provinces.

Vietnam's coastal sandy areas extend from the north to the south with total length of over 3,000km. Flying, jumping or flowing sands have made these areas susceptible to desertification in the form of sand burying farmland, with the speed of 2m/year on the average. The province of Quang Tri alone has several hundreds of hectares of its paddy field buried by sand annually. Though all coastal provinces have made plans to plant protective forests against wind and sand, the proceedings remain patchy, inconsistent, irregular and ineffective.

Some 8 million hectares of farmland in Vietnam have the slope of 15⁰ to 30⁰. Under natural and human influence, these areas are at risk of desertification. Results of desertification control have so far been modest, as only traditional methods have been applied, such as using terraced fields, setting up flat barriers to fight runoff and erosion... whereas more effective solutions to maintain soil moisture, reserve water for irrigation, improve the land through promoting upstream reforestation and planting trees along hills and slopes... remain unpopular.

2. CONSEQUENCES OF DROUGHT TO AGRICULTURAL PRODUCTION AND SOCIAL LIFE AND SEVEN ECONOMIC ZONES

2.1. Consequences of Drought to Agricultural production and social life in Vietnam

Some 76% of Vietnam's population work in the agriculture sector. The national economy is essentially based on the stability and development of agricultural production. The stable and gradually increased volume of annual food exports and food average per head is an indicator to evaluate socio- economic development and food security of the country.

When drought has reached its peak, all water sources have likewise become exhausted and social and material damages have been obvious, it is often too late and too money-consuming to fight against drought whatever measures are adopted.

As drought and seawater intrusion deep inside the groundland and in residential areas have a close and cause- and- effect relationship, drought's impacts on production and people's livelihood are exacerbated. During its most critical time, the drought in 1998 made 3.1million people out of household water, and caused massive animals to death and seemingly insurmountable environmental severity.

Drought strike in a gradual manner and through many days; their severity increases step by step and their impacts on the society and people's livelihood augment gradually, coupled with the outbreak of many epidemics and diseases in humans, animals and plants.

2.2. Impact of drought in seven economic zones

Based on each region's specific features of the climate, topography, natural resources, demography, economic potentials and socio- economic development strategies, particularly concerning agricultural production, Vietnam is divided into seven agricultural zones as follows: The northern mountainous and highlands zone; The Northern Delta (Red River Delta); North of the central part of the country; The coastal central part of the country; The central highlands; East of the southern part; The Mekong Delta.

a. The Northern mountainous and highlands zone (14 provinces: Lai Chau, Son La, Hoa Binh, Lao Cai, Yen Bai, Ha Giang, Tuyen Quang, Bac Can, Thai Nguyen, Cao Bang, Lang Son and Quang Ninh, Phu Tho, Bac Giang, Vinh Phuc, Bac Ninh).

Meteorological and hydrographical statistics in the last 30 - 40 years show drought in the northern and northwestern mountainous areas was rarely severe; annual slight drought was most typical, interrupted by medium and partial drought for some years. Drought for two

consecutive years was seldom the case, except the summer crop droughts in 1987, 1988 and winter- spring droughts in 1988, 1989. Drought outbreak follows a 20- 22 year-cycle. The northeastern mountainous areas have to suffer from the most serious drought than other area in the North. In these areas, drought often comes in two consecutive years and does not coincide with drought in other areas. Since 1958, at least three years have seen serious drought, four years have had medium summer crop drought and three others have had medium winter-spring drought. Drought cycle is not stable.

b. The Northern Delta (14 provinces: Hai Duong, Hung Yen, Ha Tay, Ha Nam, Nam Dinh, Ninh Binh, Thai Binh, Hai Phong City and Ha Noi Capital).

According to meteorological- hydrographical documents, the 40 - year period from 1968 to 2007 saw at least seven years affected by serious drought throughout summer crops (1960, 1961, 1963 and 1964, 1997, 1998 and 2004-2005), and many other years suffer from serious and medium drought during winter-spring crops. Drought usually occurred for two or three consecutive years, with a 9 to 10- year cycle.

Drought in these years affected from 30,000 to 140,000 ha and entirely destroyed from 1,000 to over 2,000 ha of croplands each season. During its peak, drought also resulted in certain instability in the social-economic development, price index and local people's daily life, creating a chain reaction to other economic zones of the country.

In 2004 – 2005, since drought, the water level at Hanoi (Red river) go down to 1,72m – the lowest value from 1963 up to 2005.

c. North of the central part of the country (six provinces of Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue).

In this part, summer crop drought has become increasingly more frequent, with shortening cycle from eight years to five years. Winter- spring drought cycle is about 5- 7 years. Drought in the Northern Delta usually expands quickly and has a strong impact on the local ecosystem, most notably of which is the rapid household water exhaustion in high mountainous areas and water shortages in coastal lowlands as a result of seawater intrusion deep inside the farmland and residential areas.

Each crop season, from 12,000 ha to over 50,000 ha of farmland were hit by drought during these years . The disaster entirely destroyed from 1,000 to 13,000 ha of farmland each crop season. The summer-autumn drought in 1998 saw 2.1million of local people out of water.

In 2001, the Quang Binh, Quang Tri provices were hit seriously by droughts. In Jun, July had no rain.

d. The Coastal Central part of the country (Da Nang city and seven provinces of Quang Nam, Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan and Binh Thuan).

From 1948 to 2007, the midlands of the Central Part had severe summer crop drought in 1952, 1969, 1993 and 1998, and winter-spring drought in 1970 and 1984, 1998, 2001, 2004-2005. In general, medium and serious drought during summer crops has become more frequent and severe than winter-spring drought, with 7-10year cycle. Winter- spring drought cycle is unstable; before 1969, it rarely occurred, but then it stroke continuously in 1969-1971, 1977-1978 and 1983 - 1984. The Southern Central Part has the lowest rainfall in the country, with dry season of 9 months and annual downpour of below 1,000mm. For the last ten years, coastal

central part's provinces constantly suffered from drought of all levels, almost all years had at least one drought.

Drought during these years made from 4,000 to 52,000ha of farmland lack of water, and entirely destroyed 1,000 to over 15,000 ha each crop season. The severe drought in summer-autumn of 1998 made 203,000 people short of household water.

In 2001, the Phu Yen, Quang Nam in the south of the Coastal Central Region were hit seriously by droughts. In Jun, July had no rain. Only Phu Yen province, 7,200 ha sugarcane, 500 ha maize and 225 ha paddy rice and 300 ha dry rice were lost.

During the first six months of 2002, Southern Coastal Central was hit seriously by drought .

In 2005, Ninh Thuan and Binh Thuan provinces are drought seriously, the amount of rainfall of 4 months (11/2004 – 2/2005) was about 41% of mean annual rainfall amount. Even many areas in Binh Thuan province had no rain. More than 97,000 people lack of household water. 200,000 cattle were lack of water to drink and food to eat. The total loss caused by drought for Coastal Central parts, Central Highlands about 1,700 billion VN dong.

e. The Central Highlands (four provinces: Kon Tum, Gia Lai, Dak Lac and Lam Dong).

This is a zone of mountains, hills and plateaux, with the average altitude of 500- 800m. Basalt soil area here accounts for 90% that of the whole country, at 1.7million ha. The Central Highlands was regarded as having no serious drought or few droughts for two consecutive crops. Since 1980, by contrast, more and more droughts for two consecutive crops have occurred, such as those in 1983, 1988, 1993, 1995 and 2004-2005. In particular, serious drought for two consecutive crops hit 1997 and 1998.

Drought affected from 2,000ha to over 130,000 ha and entirely destroyed tens to 5,300ha of farmland each crop season. Most seriously, the 1998 drought affected 10,700 ha and totally damaged 5,320 ha of winter - spring wet rice, the figure was 13,320ha and 2,280 ha respectively for the summer crop. Drought withered and caused massive deaths to many industrial plants of high economic value, such as coffee, rubber, tea... By the end of May 1998, some 110,630ha of industrial plants and fruit trees had been affected by drought, 19,290ha had died, in which drought - stricken coffee area accounted for 74,400ha and 13,760ha had died. Drought even caused water shortage to more than 770,000 people.

During the first six months of 2002, drought hit Central highland regions seriously. In 2003, water flow in all rivers and streams were 20 – 50% less than the same period in 2002. water level in the reservoirs was below the dead level. Ground water tables fell by 1.5 – 2m on average (in many places by 3 – 4m), resulting in lack of domestic water supply for 100,000 households. As of April 2003, Kon Tum had 300ha of rice field, Gia Lai province had 3,000 ha rice at, Dak Lac province had 50,000 ha of cultivated lands seriously suffering from the droughts. Only Dak Lac province, the total loss about 250 billion VN dong.

In 2004 – 2005, Drought occurred seriously. There are a lot of rivers, canal were exhausted completely, many lakes, rising dams had no capacity to provide water. Kon Tum, Gia Lai, Dak Lac province had some hundred ha of industrial plants (coffee, rubber trees,...), fruit trees had been affected and died by drought. Some hundred thousand people lack of domestic water to use.

f. East of the southern part (six provinces of Binh Duong, Binh Phuoc, Tay Ninh, Dong Nai, Ba Ria- Vung Tau and Ho Chi Minh City).

In east of the southern part in particular and the whole Delta in general, summer drought, called “ Madame Chang” drought by local people, is normally more severe than winter- spring drought. Summer drought has followed a cycle of 6 to 16 years, in which 1988, 1990 and 1992 experienced very serious drought. Winter- spring drought cycle is 8 to 14 years.

Each crop season, 700 to 2,700 ha of farmland were affected by drought, and 300 to 760 ha were entirely destroyed. Like in many other economic zones, drought is a potential threat in east of the southern part of the country, affecting agricultural production, particularly in dense industrial plant and fruit tree areas. The winter- spring drought in 1998 made 691,000 short of household water.

g. The Mekong Delta (12 provinces of Long An, Dong Thap, An Giang, Tien Giang, Ben Tre, Vinh Long, Tra Vinh, Can Tho, Soc Trang, Kien Giang, Bac Lieu and Ca Mau).

Meteorological- hydrographical documents show that serious drought concentrated from April to June of 1983, 1992, 1998, and from October to December of 1958 and 1992.

Drought during these years affected 4,000 to nearly 230,000ha of farmland, and entirely destroyed 1,000 to 390,000ha each crop season. The winter- spring and summer- autumn drought in 1998 made more than 1,100,000 people in the Mekong Delta out of household water, affected nearly 274,850ha of summer- autumn crop area and entirely destroyed over 32,000 ha.

During the first six months of 2002, drought hit seriously North East of Mekong delta. In addition to loss of crops, the drought caused widespread forest fires, including the large fire in the Upper and Lower U Minh natural forest.

The Government has adopted rational investment policies and guidelines as well as other regulations relating to hydraulic works, with a view to appropriately exploit, protect and develop water resources. Water hydraulics authorities have outlined the overall planning for major river basins, to lay the foundation for the State’s planning of long- term economic development. So far, available water hydraulics works have attained the designed irrigation capacity of 3 million ha, drainage capacity of 1.4million ha, and seawater intrusion prevention capacity of 700,000 ha. 75 medium and small- sized water hydraulics systems have been constructed, consisting of 743 large and medium- sized water reservoirs, over 10,000 small water reservoirs, 1,017 storage dams, 4,716 large water inlets and outlets, 1,796 medium and small- sized electric pumping stations, 854km of major canal lines for water inlet etc. In 1998, 6.321 million ha of rice, 806,530 ha of farm produces and industrial plants were irrigated. Water hydraulics works also supply water for industrial uses and people’s daily needs.

In spite of these efforts, water shortage and drought still occur regularly and have become a challenge, due to global climate changes and shortcomings of structural and non-structural measures.

3. TYPICAL DROUGHTS IN RECENT YEARS

3.1 Drought in 1993

Initial signs of water shortage during the rainy season of late 1992 fore-ran a severe drought to crops and people in 1993. In the Northern Delta and north of the Central Part since August 1992, the rainfall decreased by 30- 70% compared to the average of many years; this

figure was even down to 100% in some places. This condition lasted until the end of November 1992, which is the last month of the rainy season, and cause drought during the end of the summer crop of 1992.

It was clear that by early dry season of 1993, the water level in the soil, rivers, streams and water hydraulics works in these areas had decreased to a very low level. Rainfall in the following months of the 1993 winter-spring crop continued to be smaller by 40- 60% compared with the average of many years. This condition led to winter- spring drought at different scales in almost all the economic zones of the country. Total area of drought affected 176,643 ha of winter-spring rice, in which destroyed 22,590 ha

Approaching the 1993 summer-autumn crop from May to September, the whole Central Part of Viet Nam has very serious drought. Because the 1992 rainy season ended two months earlier than usual, and during the following seven months of early 1993, the total rainfall was 25- 40% of the average of many years, this limited water resource was fully exploited to fight against the winter- spring drought of early 1993. Average water level in major rivers was 0.1- 0.5m lower than the average of many years. This facilitated seawater intrusion inside estuaries, inland and residential areas from 10 - 20km, and invading deeply into the inland at 30 km. By July 1993, water level in all major water reservoirs declined below the death level, and water pumping to cope with drought was still maintained. Exhausted medium and small water reservoirs were no longer operable.

In such an unprecedented waterless condition, agricultural production seemed to be the first and most evident victim of drought. From Thanh Hoa to Binh Thuan provinces, 108,393 ha in 263,317 ha of the 1993 summer- autumn rice crop were affected by drought, of which 24,093 ha died. As drought was less severe in the Mekong Delta, only 27,647 ha in the 1,124,238 ha of summer- autumn rice crop were stricken, of which 8,564 ha died.

3.2. Drought in 1998

The rainy season in late 1997 ended one month earlier than the average of many years. The following six months of early 1998 had the average rainfall decrease down to 30 - 70% that of the same period. There was almost no rain in the Central Highlands, in east of the Central Part of the country and in the Mekong Delta from the last months of the winter-spring crop (March and April 1998) to early summer-autumn crop (May and June 1998). The Central Part had no rain at all from early June to end of August, which was almost the entire summer-autumn crop season of 1998. Meanwhile, temperature during the early months of 1998 was 1- 3⁰C higher than the average of many years. Dry hot sunlight and vigorous vaporization at 5- 7mm/day prolonged from 15- 29 days during March – April - May 1998 in the Mekong Delta and June – July - August of the same year in the Central Part. Temperature sometimes reached up to 38 - 40⁰C. In the Northern Delta, a severely hot period last from 18th to 22nd July 1998, with a temperature of 37 - 39⁰C, causing drought from early summer crop.

The above mentioned climate and water resources situation has posed a great challenge to water hydraulics facilities; meanwhile, it also presents the actual conditions of water hydraulics work in each economic zone. The 1998 drought affected seriously to the production and human life. The drought affected areas of winter-spring rice was 253,988 ha, in which destroyed 30,739 ha, 359,821 ha of summer-autumn rice crop were stricken, of which 68,590 ha died, the summer rice areas were affected 153,072 ha of which 22,689 ha died. About 236,413

ha industrial plant and fruit tree were affected, of which 50,917 ha died. More than 3,100,000 people short of household water. The total loss about 5,000 billion VN dong.

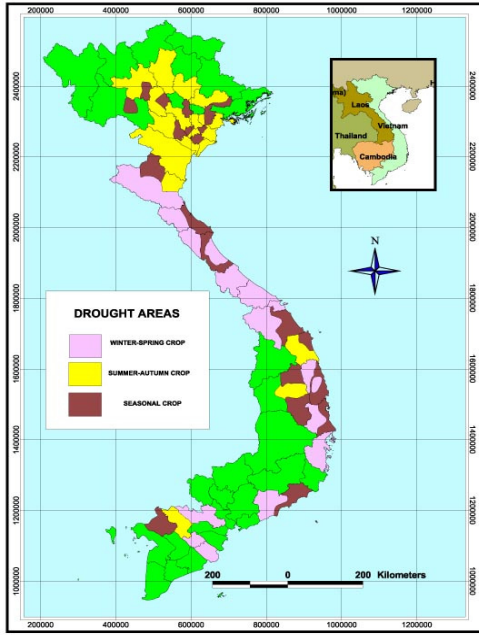


Figure 1: Distribution of drought areas in 1993

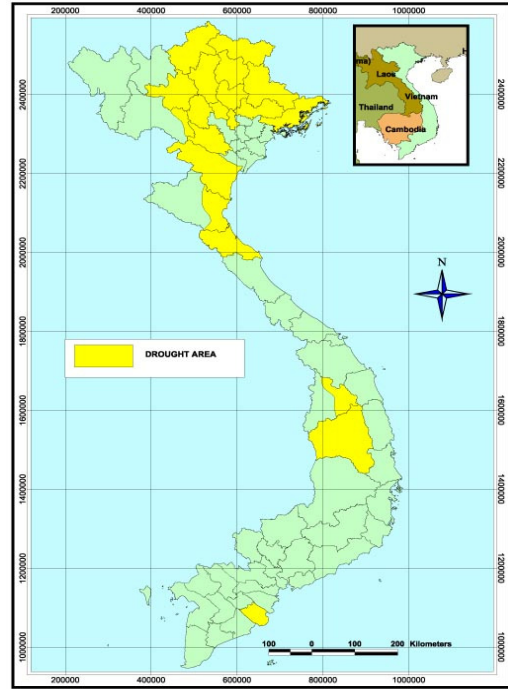


Figure 2: Distribution of Drought areas in winter-spring 1997-1998

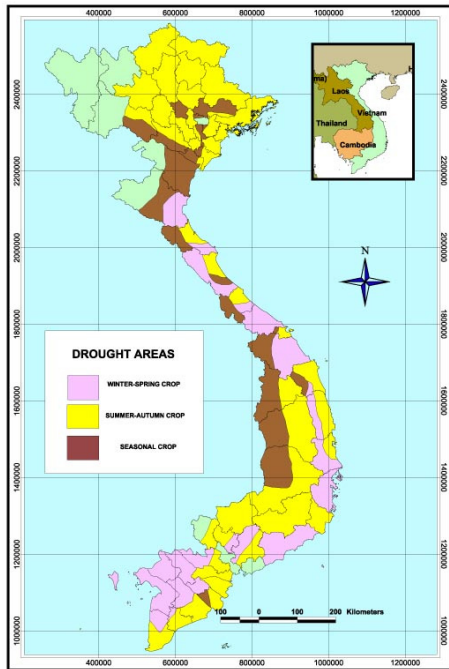


Figure 3: Drought in 1997 – 1998



Picture 1. River was run out water in drought 1998

4. SOME PROPOSED ISSUES FOR WATER RESOURCES MANAGEMENT

- Hydro-Meteorology forecast including short-term, medium-term, and long-term is extremely important;
- Well management for hydraulic structure exploitation and appropriate co-operation for multipurpose reservoir regulation are great significant in drought prevention.
- In responding to disasters, besides long-term solutions, immediate and comprehensive solutions such as technical solutions, mechanisms and policies, social relief, etc. should be prepared for mitigating damage and ensuring production and life.
- Concrete guidance of the Government, ministries and branches, and localities, and the dynamic role of farmers in drought-affected areas should be concerned so that immediate and comprehensive solutions can bring effective results.
- Tensely develop a strategy for national water resources development in the tendency of comprehensive and sustainable development as well as a strategy for comprehensive drought prevention with the co-operation of branches, levels, and localities.
- Check and improve standards for designing hydraulic structures to make supplement plans for the construction of hydraulic structures to ensure sufficient water supply for agriculture and industry production, and water supply for domestic use.
- Needs to be broadly propagated to population to let them respect and follow legal documents on water resources and hydraulic works in order to use water economically and effectively. It is also very necessary to mobilise human force to strengthen canal system, to use economic water irrigation methods such as subsoil irrigation, or evaporation prevention by covering nylon sheets on soil surface, etc., or management for economic water use.
- To mobilise role of farmers in hydraulic work exploitation and management following the spirit of mobilising internal forces to industrialise and modernise agriculture and rural areas.
- Climate changes in a very complicated tendency, material conditions and socio-economic background still encounters lots of difficulties but drought and desertification damage can be mitigated to contribute to sustainable development of the country if we have sufficient and sound knowledge of drought and desertification as well as active-and-effective measures to cope with this kind of disaster. /.

5. ORIENTATIONS AND STRATEGY OBJECTIVES FOR DROUGHT AND DESERTIFICATION PEPAREDNESS AND PREVENTION

To reach a sustainable water resource development in order to prevent drought and desertification, the following principles need to apply:

- The protection, exploitation, and utilisation of water resources as well as the prevention and mitigation damage caused by water disasters must base on river basins, must go with the forest protection and development, the water resource re-creation, and the construction and protection of hydraulic structures, and the prevention of water resources pollution;
- Comprehensive use as well as economic, safe, and effective use of water resources must also be paid much attention;
- The prevention and mitigation the damage caused by water disasters must be actively planned to ensure a harmonious combination of the national benefit and that of the regions, the branches, of the modern technology and traditional experiences and suitable with the national economic potential, must distribute in the socio-economic development and bring some

solutions to ensure the standards of the human life, the national defence, the national security, the national land marks and historical and cultural memorials, and the environment;

The strategic target of preventing drought and desertification up to 2010 is to provide an amount of 124.4 billion m³ water per year to social, economic, and environmental demand, of which 3.1 billion m³ for urban and rural domestic use, 17.3 billion m³ for industry, 10.7 billion m³ for services, 88 billion m³ for agriculture cultivation, 2.8 billion m³ for aquaculture, and 1.6 billion m³ for husbandry. With such water resource, the exploitation of 15,800,000 hectares of agriculture land, of which 10,000,000 hectares are for foods crops, 2,000,000 hectares are for perennial industry crops, 2,000,000 hectares are for short-term industry crops, 1,000,000 hectares are for food-stocks crops, and 800,000 hectares are for fruit crops, will be effective. And fresh water for domestic use of average 150-200 litre per day, of which 100 litre per day is standard for plain area and 80 litre per day is standard for mountainous area, is to be ensured.

6. SOLUTIONS AND STEP OF IMPLEMENTATION FOR DROUGHT AND DESERTIFICATION PREVENTION

6.1. Structure Solutions for drought and desertification prevention

- Effectively exploit existing hydraulic structures and continue to build new hydraulic structures for regulating water resources;
- Invest for large maintenance and upgrading of existing hydraulic structures to fully make-use structure capacity to serve the crop diversification;
- Carry out canal strengthening (lining);
- Apply modern technologies combining with traditional routines to economize water for land and crop conservation, and to keep water in steep-topography areas;
- Continue to invest for multipurpose-and-regulation-structures of water resources in order to serve economic sectors and improve ecological environment.

6.2. Non-structure solutions for drought and desertification prevention

- Maintain and expand upstream-forests to increase 26% of forest-cover in 1998 up to 43% in 2010;
- Strengthen the State management on water resources and hydraulic works. Strengthen institution for water resources and hydraulic works management from Central level to local level. Improve the capacity of national water resources council in order to consult with the Government in water resources management nation-wide. Establish completely big river basin planning and management committees;
- Train skills for labour forces in order to carry out entrusted tasks. Extend studies and researches, and apply modern technologies in management of water resources and hydraulics works. Step-by-step transfer hydraulic works operation and management to match production level and management capacity. Step-by-step socialise the investment and management for hydraulic works exploitation and operation.
- Expand international co-operation in many aspects such as studying to establish institutions and policies, appealing for investment, exploitation and management of water resources and hydraulic works.

6.3. Step of implementation to the end of 2010 and 2015

6.3.1. Steps of implementation up to the end of 2010

Evaluate drought and desertification situation in Viet Nam in past time. Analyse causes, structure, and non-structure measures applied for drought preparedness and prevention. Evaluate effects of measures to find out optimal measures.

Develop strategy for drought and desertification including general strategy and specific strategy for each economic zone. Establish plan for implementing drought and desertification strategy including long-term plan (10 years) and annual plans.

While developing strategy, continue to implement tasks for drought prevention according to plan up to 2010 including structure measures and non-structure measures. Continue to protect and newly plant forests following the program of planting 5 million of hectares of forest. Strengthen capacity of irrigation organisations at low levels. Step-by-step socialise the drought and desertification prevention. Strengthen the State management mechanism and hydraulic-work-exploitation enterprises to meet water requirements for socio-economic development in 2010.

6.3.2. Steps of implementation up to 2015

Develop and strengthen the State management system to organise for implementing and managing the drought and desertification prevention in Viet Nam

Speed up and implement the socialisation of the drought and desertification prevention.

Implement contents of developed and approved strategy for drought and desertification prevention, of which structure and non-structure measures, immediate and long-term solutions must be essentially considered. Material conditions, tools availability, and intellectual standards of population must be synchronous. Among strategic measures, measure of reproducing and newly planting 5 million hectares forest to increase forest-cover percentage to 43% in 2010 should be considered.

Continue to check and supplement appropriate solutions to match with actual conditions, particularly with the rapid development of science and technology, of which the adjustments of production orientation of each economic zone and for the whole country to ensure the sustainable development.

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