

# A Research on the Issues Related to the Development of Forest Carbon Sinks in Heilongjiang Province

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**Abstract:** Heilongjiang is forestry province in China whose rich forestry resources play an important role in developing forest carbon sinks and dealing with global warming. Though Heilongjiang Province has the necessity and the superiorities in the development of forest carbon sinks, it needs to solve the problems of the definition of forest property rights and compensation system of forest carbon sinks to get the better project about the development of forest carbon sinks.

[World Rural Observations 2010;2(1):41-46]. ISSN: 1944-6543 (print); ISSN: 1944-6551 (online)

**Key words:** Forest resources, The forest carbon sinks, The carbon emission right, CDM project

## 1. INTRODUCTION

The climatic change has become one of the global challenges that the world is facing now, which threaten seriously global economic and society's sustainable development and let international society draw unprecedented attention on it. As China is the contracting party of "United Nations Framework Convention on Climate Change" and "the Kyoto Protocol", following the principle that "difference but fulfills the responsibility together", the image of China to be a responsible world power is shown by developing the low-carbon economy positively. Heilongjiang Province as the biggest forestry production area of china, which has superiority and the potential to develop forest carbon sinks.

## 2. THE RELATED KNOWLEDGE OUTLINE OF FOREST CARBON SINKS

### 2.1 The Forest Has the Function of the Absorption and Fixing Carbon Dioxide

The forest plays a unique role in controlling the global warming, which has the main reason that on the land the majority of carbon stores in the forest ecosystem. Dates show that the forest is the biggest carbon storehouse in the world which occupies 60% of the aerial part of carbon storehouse of the terrestrial ecosystem, and occupies 45% of the soil part, between the land ecosystem and the air the CO<sub>2</sub> exchange 90% come from the forest. The trees absorb CO<sub>2</sub> through leaf blade's photosynthesis, release the oxygen, and fix the CO<sub>2</sub> in the plant or the soil, thus take the effect to reduce the density of CO<sub>2</sub> in the atmosphere, this formed the forest function to collect carbon. Moreover,

with tree age increasing, the efficiency to fix CO<sub>2</sub> will be enhanced; long life's trees even can maintain these fixed carbons for several hundred years. From the above, it can be seen that the forest is the absorber, the reservoir and the buffer of CO<sub>2</sub> which plays an important role in balancing between carbon dioxide and the oxygen dynamical and reducing the greenhouse gas density in the atmosphere, slowing the process of global warming.

### 2.2 The Economic Efficiency and the Social Efficiency of the Forest Carbon Sinks Are Obvious

Generally speaking, there are two ways to reduce the withdrawal of CO<sub>2</sub>. Firstly, reduce carbon sources through science and technological means; Secondly, increasing the area of forest to improve the ability to increase carbon sinks. To control or reduce carbon sources, not only will have difficulty in technically implements, but also will involve the economical price, especially for developing countries. There will be a disadvantage impact on the speed of those countries' economy through reducing the use of fossil fuels such as coal, petroleum to limit the emissions of CO<sub>2</sub>. Compared with the former, carbon fixation using the forest has the incomparable cost advantage. It is estimated that using industrial methods to reduce each ton of CO<sub>2</sub> may cost as high as several hundred dollars, however, by afforesting to fix each ton of CO<sub>2</sub> only cost 2.8-5 dollars, and at most 30 dollars. Moreover, the forest carbon fixation has the ecological benefits and the social efficiency of keeping the diversity of the species, water conservation, conservation of water and soil, increasing the green employment, and promoting new rural reconstruction and so on.

### 3. THE NECESSITY OF HEILONGJIANG PROVINCE TO DEVELOP FOREST CARBON SINKS

Heilongjiang Province is one of important Northeast old industrial bases in our country, the economical subject is the secondary industry, which decide the main sector of the energy consumption is the industry. While the backwardness of industrial production technical level aggravated the carbon characteristic of “the development emissions”, then has formed the economic growth pattern as “the high investment, the high depletion, the high emissions, the low efficiency”. In terms of the position, Heilongjiang locates the highest latitude of china and has a relative long winter to warm up, while the primary fuel for Heilongjiang Province is coal, which burns will increase the emissions of greenhouse gas. Statistics indicated that the total withdrawal of both the industry and the waste water in 2008 reached 1, 130,000,000 tons, which include the COD 476,000 tons, the ammonia nitrogen 49,800 tons, the sculpture dioxide 506,400 tons, the mist and dust 469,600 tons, and flour dust 116,900 tons. It can be seen from the data that, Heilongjiang Province is facing serious situation of the greenhouse gas emissions, which makes it necessary for Heilongjiang Province to develop the project of the forest carbon.

### 4. THE ADVANTAGE OF HEILONGJIANG PROVINCE TO DEVELOP FOREST CARBON SINKS

#### 4.1 The Heilongjiang Province Is Rich in Forest Resources

Heilongjiang Province is one of the ecology provinces of china, which is abundant in the forest, the prairie and the wetland, and has huge capacity of the

carbon collects. “Heilongjiang Province Environmental aspect Announcement in 2008” emonstrated that in 2008 the entire province manage the total area of forestry is 31,750,000 hectares which occupies 2/3 of the entire province land area, has 20,070,000 hectares of the wooded area, the forest coverage reaches 43.6%, the quantity of the vigor wooden accumulation is 1,650,000,000 cubic meters. The wooded area and the wooden accumulation and the lumber output occupy the national first place. As the capacity of the forest carbon sinks and the accumulation of the forest resources is proportional, benefit to the rich forest resources, Heilongjiang Province has formed a natural giant carbon storehouse, which makes it have some innate advantages over other places to develop the forest carbon sinks.

#### 4.2 The Tree Seed Is Diverse and Has Strong Ability of Carbon Absorption

The forest of Heilongjiang Province is an important component of the north forest zone of the Eurasia. The north is the cold temperate zone coniferous forest zonal vegetation, the southeast is the temperate zone moist needle broad-leaf mixed forest zonal vegetation, and the west is the temperate zone prairie region. The forest resources mainly distribute in the northwest part Great Khingan Mountain, the northeast part Lesser Khingan as well as southeast area Guangling, Laoyeling and the Wanda Mountain. Particularly the main variety of trees in Great Khingan Mountain is larch, while Lesser Khingan consist of Korean pine broad-leaf pine natural multiple coat different tooth mixed forest. Because of the different growth conditions, different kinds of trees have different ability to absorb the carbon. Some details about the ability that some typical trees to absorb the carbon are shown as follows:

**Table 1. The ability of different kinds of trees to solid carbon and to output the oxygen**

Tree's Type	Absorbs the CO <sub>2</sub> quantity (ton/hectare. Year)	Releases the O <sub>2</sub> quantity (ton/hectare. Year)
Fallen leaf foliage forest	14	10
Chang Lv luo Ye Lin	29	2242
Coniferous forest	22	16

The table shows us obviously that although different kind of trees decide their ability to collect carbon is different, as a whole, the above three kinds have strong ability to attract and absorb the carbon. As the main forest resources of Heilongjiang Province are the three kinds of trees mentioned above, there has great potential to develop the forest carbon sinks.

#### 4.3 The Growth Regularity of Trees Are Benefited to Develop the CDM Project

The CDM project namely clean development mechanism is one of the three kinds of mechanisms which decided by “the Kyoto Protocol” based on various countries’ economic development condition and the reciprocity stipulation. The basic idea goes as: the developed countries cooperates with the developing countries, provide the financial support and transfer the vanguard technology to the developing countries, to reduce the greenhouse gas in the developing countries

development to discharge and to increase the greenhouse gas absorption project, the obtained carbon credit target may use in being set off against the developed countries to reduce a row of duty. This mechanism not only can help developed countries to achieve the task of carbon emission reduction with a low cost, but also can promote the sustainable development of developing countries. It is one of the efficient paths to develop international cooperation and to achieve the goal to solid carbon.

The young growth of vigorous growth period has the strong solid carbon speed and the solid carbon potential, the solid carbon quantity of the mature forest achieves the best, but the ability to continuous to solid the carbon is zero. If the CDM project intends to make the forest carbon sinks function to the fullest, which required the trees pass through a complete vegetal period, and this needs a very long time. Generally speaking, the whole project experiences the time about 50-100 years. Meanwhile, during the project period and after a period of completing the project cut will not allowed. In order to make the forest economic efficiency and the ecological benefits to the furthest, the local trees' vegetal period should be long enough to develop the CDM project and the growth speed is relatively slow, only to do this can ensure that the economic loss is the lowest. The trees' vegetal period of Heilongjiang Province just fit close to the requested forest carbon time, simultaneously this province also has the forestation technology and the experience, based on this superiority, Heilongjiang Province is an ideal region to develop the CDM project.

## 5. THE VALUE ANALYSIS OF DEVELOPING FOREST CARBON SINKS

### 5.1 Ecological Value

Forest resources are different from mineral resources, which are natural resources that renew frequently. Forest resources have ecological functions such as the scavenging air, the self-control water source, the conservation of soil against erosion, the containment land desertification, the maintenance crops health production and the protection biodiversity. The science indicated that the lumbers can become the clean energy instead of many industrial materials and chemistry material. Therefore, the advantages to develop forest carbon sinks and increase forestation are in two main aspects, on the one hand, be good for displaying the functions to attract and solid carbon, on the other hand, to obtain the massive lumbers through afforesting diversely and realize the formidable ecological value of forest.

### 5.2 Economical Value

The economic value of forest carbon sinks can use an economical method to measure. The scientific

research indicated that as the forest grows every 1 cubic meter lumber can absorb 1.83 ton CO<sub>2</sub> and release 1.62 ton O<sub>2</sub> approximately. From a global perspective, for every year each hectare the temperate zone forest absorb approximately 2.5-2.7 ton CO<sub>2</sub>, the cold temperate zone forest absorb 2.9-8.6 ton CO<sub>2</sub>. According to the price of carbon being 12.73 Euro/ton in the European market in May 2009, then for every year each hectare, the temperate zone forest carbon sinks creates economic value 31.825-34.371 Euros, the cold temperate zone forest creates the economic value 36.917-109.478 Euros, (because trees' growth survey is quite troublesome, here is only economic value which brief expression about forest carbon sinks then). Heilongjiang Province is in the temperate zone and the cold temperate zone interactive region, the vegetation mixed by the temperate zone forest and the cold temperate zone forest, especially the cold temperate zone forest-based, which can show the big value from above. According to Heilongjiang Province forest carbon density standard, use each hectare 47 ton carbon to compute, if we use the value of the econometric model of clean-air features similar to measure the economic value of the forest carbon sinks, we can find out the huge economic value which brought by the forest carbon sinks. The econometric model for public welfare forest air purification function is:

$$V = \sum_{i=1}^n (BC_i)$$

Something to say about the pattern:

V: The value of public welfare forest air purification function;

C<sub>i</sub>: The industrial cost of the public welfare forest to release of the ith kind of useful gas;

B<sub>i</sub>: The quantity of public welfare forest release of the ith kind of beneficial gas;

n: The type of public welfare forest release of beneficial gas .

Here we make some slight adjustment for the meaning of the variable to meet our needs, Regard V as the economic value which is created by the forest carbon sinks, B is the quantity of forest carbon sinks; C is the cost to reduce CO<sub>2</sub> in industrial method. Based on the former introduction, assuming the cost to reduce CO<sub>2</sub> with industrial method is C=100 dollars/ton, the total quantity of the forest carbon sinks of Heilongjiang Province in 2008 is B = 47 \* 2007 = 943,290,000 tons. As a result, the total economic value of the existing forest carbon sinks is: V = 100 \* 94329 = 943,290,000,000 dollars. It can be seen by that the economic value of the forest carbon is huge.

### 5.3 Social Value

To afforest forest with science and develop project cooperation with the developed countries positively, it is good for creating more employment posts for the forest regions and absorbing in more surplus-labors of forest regions. By this way, the living standard of forest dwellers will be improved. Through paying more attention to forest carbon sinks, the forest regions' tourism and some related industry will be developed, meanwhile, it also can improve the situation of forest regions effectively, speed new rural reconstruction, improve livelihood of the people, promote economy and the social development harmonious.

## **6. SUGGESTIONS ABOUT THE HEILONGJIANG PROVINCE TO DEVELOP FOREST CARBON SINKS**

### **6.1 Increase the fund and technology input**

The forest carbon sinks play a pivotal role in dealing with the climate warming; through the forest carbon sinks to reduce the withdrawal is also the most economical and the easiest method. However, the investment of our province for forestry production and the forest management is lack for a long time, the forest tending and the forest management is unreasonable, which causes the productive potential and the ecological benefits of the forest land has not obtained the effective display. In future development, the province should attach much attention to the following points: Firstly, enlarge the funds of the forest tending in order to enlarge nurture dynamics to the existing forest, promote its fast growth, enhance the quantity of the forest store and achieve the goal of increasing the forest carbon sinks; Secondly, strengthen the technical support of forest carbon sinks, raise the technical level of the forest carbon sinks, recommend advanced forestry construction and managerial technique from the developed countries and enhance management level of forest; Thirdly, establish early warning mechanism of forest-fire, improve the ability of preventing the forest plant disease effectively.

### **6.2 Expand the Area of the Existing Forest and Increase the Ability of Attracting Carbon**

Continue to strengthen the wildwood protection, Return farmland to forest and "Three North" protection forest systems and some other priority projects constructions, simultaneously, insist afforesting diversely, building the planted forest and the fast-growing bumper crop positively, especially for the planting of fast-growing bumper crop forest. Because Heilongjiang Province has the superiority in climatic resource, the water resources and the soil resource, many fast-growing bumper crops such as larch, the evergreen tree, the poplar tree are suitable growth, the superiority and the potential to plant fast growing bumper crop forest are obvious. These forests not only

grow quickly, but also have a high survival rate and strong solid carbon ability. Expanding the area of the forestation will improve the level of forest carbon sinks of Heilongjiang Province effectively.

As for the funds for forestation, the government must encourage the enterprises to contribute money to afforest in order to increase sinks and be voluntary to reduce the platoon. Massive greenhouse gas is output to the air by the production, the service, the trade and some other economic activities of the enterprises, so enterprises have the duty to reduce the emissions of the greenhouse gas while the forestation might absorb CO<sub>2</sub> by a lower cost. It is necessity to construct one platform for enterprises to contribute money to afforest so that they can store the carbon reputation ahead of time, in this way, the funds to afforest will be increased and enterprise's public welfare image can also be promoted.

### **6.3 Cut the Forest Resources Reasonably and Forbid Deforestation**

There is some phenomenon of deforestation in some forest regions of Heilongjiang Province, for some present economic interest, some people choose to deforestation and occupying the forest land unauthorized, which seriously influenced forest's normal ecological environment and the ability of forest carbon sinks. Research indicates that the destruction or deforestation will increase the CO<sub>2</sub> withdrawal, when the forest is gone, the function to absorb CO<sub>2</sub> will disappear, carbon which fixed in the soil will release to atmosphere through the soil expanding the function as well as other disturbances, especially when the forest transformed to the farmland, as reducing the carbon which input to the soil and with continuous cultivating, the carbon loss will reach as high as 70%. Thus, the price of over-exploitation of arbitrary cutting and deforestation is the CO<sub>2</sub> increasing, the greenhouse effect strengthened which will seriously influence humanity's normal development. Therefore, Heilongjiang Province must consummate the related law about the deforestation, and strengthen the propaganda of the related knowledge in order to let the masses understand that the forest to human is far more important than the economic interests. By this method, let more and more people take active part in the forest conservation and the mutual supervision, and make some contributions to the forest sustainable development.

### **6.4 Define the Property of the Forest Carbon Sinks and Perfect Its Compensation Mechanism**

The forest carbon sinks as the resources property also exists the problem of the property right which is to be the same with other properties. Only to clear about the property right relations, and change resources not produces holds with the free use system, we can establish effective use mechanism of the resources,

promote the progress of resources property work and the marketability work. Because the forest carbon sinks take the forest resources as the carrier, the resources property right of the forest carbon sinks maintains consistent with the forest resources property right, which should belong to the country or the collective.

Perfect the compensation mechanism of the forest carbon sinks, based on evaluating and measuring forest carbon exchange rate value reasonably, according to the principle as “pays expenses leads beneficiary, harming leads compensates”, the suitable and reasonable valuation charge is carried on. Because the forest carbon sinks belongs to the pure public product, with the non-exclusiveness and non-competitiveness characters, once forest is created, the function of the forest carbon sinks also to meet the nature production, each enterprise may enjoy this kind of service freely. While forestation needs funds, this all depends upon national the financial payment shift is insufficient, it needs enterprises' support. However, not all enterprises are willing to pay the funds to support the forest construction; we must take some actions to force the enterprises to make a contribution to the forestation. Reference pollution discharge power transaction system, based on the statistical inquiry of the CO<sub>2</sub> withdrawal of different industries, formulate a more reasonable carbon withdrawal separately in view of the various professions' different situation, and then provide permit. If the CO<sub>2</sub> withdrawal of an enterprise has surpassed the profession request level, the enterprise can invest the purchase carbon emissions permit, and these funds will be used for constructing forest. As for the question how to define the price of the permit, it must be decided according to the ability that how many carbon can be absorbed and soiled for every the unit forest. Through this way, not only the fund for forestation is collected, but also being good for the enterprises to improve the technology and transform structure of energy consumption. With the graph to explain the questions about the optimal price and CO<sub>2</sub> withdrawal, like the figure 1 shows:

MAC: The boundary cost to reduce the pollution, here may regard as the Absorption unit CO<sub>2</sub> must afforest quantity;

MEC: Exterior marginal cost;

When  $MAC=MEC$  obtained  $Q$  is the optimal CO<sub>2</sub> withdrawal of enterprise,  $P$  provides the CO<sub>2</sub> platoon for the related department to release authority optimal price.

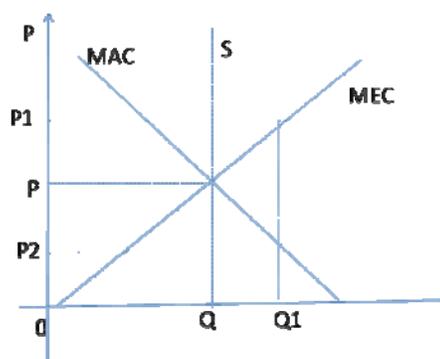


Figure 1 The optimal price

## 7. CONCLUSION

The forest absorbs CO<sub>2</sub> and releases O<sub>2</sub> through its own photosynthesis, which reduces the CO<sub>2</sub> density in the atmosphere, alleviates the global warming tendency, and also provides the possibility for human better survival and development. As being China's forestry big province, Heilongjiang Province is rich in forestry resources, therefore has the congenital superiority on developing forest carbon sinks. We must use this kind of superiority fully, and explore the method to enhance the forest carbon sinks positively, strengthen the international cooperation, develop the CDM project positively with the developed countries, to make the ecological value, the economic value and the social value of the forest carbon sinks to the fullest. Meanwhile, for the questions which exist in the forest regions' construction and development, we should analysis the solutions initiatively, and consummate the related forestry legislation, strengthen the populace supervising mechanism, make Heilongjiang Province become the engine which the Northeast area and even the national development forest carbon sinks.

## REFERENCES

- [1] Yang Hua. The national forest area to develop carbon sinks has bright prospects - diagnose Yichun, Heilongjiang Province how to develop carbon sinks. *China's finance*.2009 (16)
- [2] Luo Wenjun. Decisions about Heilongjiang Province try to construct forestry strong province. *New evening news*.2005
- [3] Duan Xinjun, Gao Yujuan, Li Shunlong. The Heilongjiang forestry's development should pay attention to the question of the forest carbon sinks. *The science and technology information of forestry*.2006 (4):16-17
- [4] Li Youhua. Several questions about developing the carbon sink economy of china. *The academic exchanges*.2008 (3):87-89
- [5] Li Shunlong. Analysis about the potential of Heilongjiang Province forest carbon sinks. *Forest economy question*.2006 (6):521-526

- [6] Wang Keqiang, Zhao Kai. Resources econology. Shanghai Finance and Economics University Publishing House:234-256
- [7] Yu Tianfei. The conception of the carbon platoon releases authority the transaction system. Forest Economics .2007 (5)

10/04/2010