

Nominated Discussion

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Impact Analysis of Climate Change and Human Activities on Ecosystems in China

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Abstract: Climate change and human activities play an important role in their impacts on ecosystems. This paper analyses the impact of climate change and human activities on typical ecosystems in China.

China is a very large territory of which 70% is highland, mountainous region wilderness. The nature ecosystems in China are very complex. Most of them are fragile and sensitive to climate change and human activities. Although we have taken a lot of effort to protect natural ecosystems, their protection still represents a challenge. Here are some impact analyses of climate change and human activities on natural ecosystems.

1 Lakes in China

There were 2350 lakes in China. In recent years about 543 lakes have disappeared. For example, in the Tibet autonomous region there were 29 lakes but among them 19 lakes have disappeared. This is the result of climate change and human activities. In north/north-west of China the main cause for lakes disappearing is climate change, but in other regions the main reason is human activities or the impact of climate change and human activities together.

2 High mountain glaciers in China

The high mountain glacier ecosystem in China is very sensitive to climate change. Now about 66% of high mountain glacier has vanished. Take Tibet as an example: accumulated snow has decreased by about 11%; melted glacier accumulated snow from the Tibetan autonomous region becomes the main water resource in north-west of China, and represents about 35%- 50% of river runoff amount.

3 Frozen soil in China

The huge region between north-east and qinghai-Tibet highland is a frozen soil ecosystem which takes 22.3% of our territory. The ecosystem can be divided into several types such as highland frozen soil, high mountain frozen soil, north pole stable frozen soil and south non-stable frozen soil. They are very sensitive to climate change and human activities.

According to our estimation, climate change has made the frozen soil layer of qinghai-Tibet highland melt and decrease by about 7-20m. It has also made the low boundary of high mountain frozen soil rise by about 10-200m. Although we made some efforts to protect environment when the qinghai-Tibet road was build, the frozen soil area of qinghai-Tibet highland decreased about 10%. About half of the qinghai-Tibet road and 40% of bridges were damaged to different levels. It costs about 3 billion CN yuan to repair the road and the bridges.

In Qinghai, Gansu and Jilin province, about half of the main irrigation canal was damaged. The depth of melted frozen soil in the Daxingan mountain region of north-east of China increased about 7-40cm, because of forest fires in 1987. The region is located on the temperature increasing area of climate change; it will take about 30-50 years to recover, in our point of view.

4 Wetland in China

There are 205 wetland ecosystems in China, which can be divided into 22 kinds. Some regional wetlands, such as Changbei Mountain, Sanjiang Plateau, and the mountain area of north Xingjiang autonomous region, have very valuable and rich natural plant and animal resources. Wetland areas in China have reduced by about 26-40%. One of the main reasons is climate change and human activities. For example, a lot of lake wetlands in Qinghai-Tibet highland and Inner Mongolia highland have experienced lower water levels and bad water quality; some have disappeared. Some wetlands were destroyed by human activities, such as using wetland to make farmland and wastewater discharging. Fish variety in Dongting lake has reduced from 114 types to 80 types. In Hong lake they have reduced from 90 to 54 types. Some reclamation and cultivation of wetland to farmland has led to serious degradation and decreases in total wetland area.

5 Grassland in China

The variety of grassland in China is very diverse. The total grassland area is about 40% of total territory. Because of climate change, reclamation of wasteland, and lower efficiency of using water resource, some grassland has suffered from wind erosion. The grass producing amount has reduced about 30%. About 460,000 hectare grassland has become retrograded. Every year losses represent about 0.5 billion CN yuan.

6 Desertification in China

Climate change leads to soil erosion and dry weather, reduction in the water level of lakes, rises in the snow line, shrinking back of glaciers, and a reduction in the amount of river runoff. It is one of main causes of desertification.

Every year about 1500-2000 Km² of valuable land are lost, and 4000 Km² of farmland and 48000 Km² of grassland are threatened by desertization. This costs about 1 billion CN yuan every year. Let us take reservoirs as an example. The Library reservoir received 290,000m³ of sand and it will lose its capacity for storing water if we do not do anything. Longyangxia reservoir receives 0.03 billion m³ of sand, and this costs about 0.05 billion CN yuan every year. The Huang river takes 1.6 billion tons of sand into the water supply, of which about 1.2 billion tons of sand come from desertification regions.

7 Forest in China

The impact of climate change on forest ecosystems in China is very obvious, and it leads to changes in forest variety. The precious frigid zone coniferous trees in north-east of China will reduce their growth scope. Over-cutting down of trees in Daxingan mountain region has lead to complex and unique ecosystems in the north-east plateau losing their ecological protective screen. The main reasons for most of desertification, grassland shrinkage, and wetland reduction, are caused by of human activities. Climate change also plays an important role.

8 Coast ecosystem in China

Because of human activities, pollutant discharging, climate change and so on, coastal ecosystems in China will face an increasingly serious situation. The runoff of pollutants into the sea has increased about times 55 every year. Monitoring data shows that in several areas coastal water quality exceed National standard. The air quality monitoring data over the sea shows some items are highly concentrated. Wet and dry sulfur deposition on sea areas will also cause pollution on coastal water. Take April 1993 as an example, sulfur deposition was as follows:

- 1) Bo sea is 4636 tons,
- 2) Huang sea is 18454 tons.
- 3) Dong sea is about 1526 tons.

The comprehensive impact of human activities and climate change on coastal ecosystems is obvious in China.

9 Sulfate aerosols in China

(1) SO₂ concentration distribution in China

In 2020, there are two high SO₂ concentration regions near the ground surface. One is within Sichuan basin and another is in Shangdong province (with lower concentration and higher scope). With increasing height, the high concentration areas become wider and wider. At the height of 5600m, there is a narrow high concentration belt which covers some cities like Nanjing, Shanghai, Hangzhou, and some parts of Human province. In 2050, it is similar but with a larger high concentration scope. The highest concentration area covers some part of Shandong, Anhui, Jiangsu, and Zhejiang provinces; the second high concentration area is in Sichuan basin. In south-west China there is also a high concentration areas. In some parts of Inner Mongolia and Liaoning province there exist a couple of high concentration areas. Above 2400m, a couple of separated high value areas disappear, but there is one high value belt which covers some part of Jiangsu, Zhejiang, Hunan and Guangdong provinces.

(2) Sulfate aerosol distribution in China

The highest Sulfate aerosol concentration area near ground level is in the Sichuan basin. There are several high regions in other provinces such as Shanxi, Shandong and Gongdong province. In Liaoning and Inner Mongolia there is a weakly connected high concentration belt. All high concentration areas are wider, compared with SO₂ distribution. Around 560m the high concentration area disappears from Sichuan basin. But energy production regions such as west of Shanxi and Inner Mongolia, and parts of Shandong, Jiangsu, Guangdong and Anhui provinces, are covered by high concentration. All the east part of China is covered by higher concentration of sulfate aerosols.

(3) Radiation forcing of sulfate aerosol in China

In 2020, the high value scope of radiation forcing of sulfate aerosol in China is located in the Sichuan basin and Yangzi River basin. The high scope clearly spreads in 2050, when compared with 2020.

Conclusion

China is facing a major challenge in relation to the protection of natural ecosystems under threat from climate change and human activities. NEPA is seriously and actively considering this challenge. NEPA has decided to build Integrated Assessment systems with the help of international and domestic experts and institutions, in order to assess the comprehensive impact on ecosystems in China. They will consider various measures focusing the relative strategies to adapt and mitigate climate change.