Make Use of Frozen Stagnant Water Instauration Eco-Environmemtal of Northwest Area in China*

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Abstract: The paper analyses the effects of the frozen stagnant water (FSW) on eco-environmental construction of Northwest area on the basis of field observation and simulation in laboratory. The FSW is seasonal solid underground water, formed by freezing effects in winter in the frozen soil layer. It has the feature such as unique forming system, inverting abundant water and independent water-saline dynamic. It has positive and negative effects on eco-environmental construction. The FSW generally increases the amount of water by 8%—25%, the maximum water content is 39.51%, the water content is 300% at frozen lumps on the ground. It is indispensable or even the unique water source for natural forest and manual vegetation live through the winter, vegetation growth in spring, water metabolism, and also is a central factor of ecological balance at Northwest area. When the FSW content is <5%, it bring about decrescence for natural forest and manual vegetation and acceleration of desertification. When the FSW content arrive at immoderate saturated state, it is formed some geological phenomena as the frozen expense on the ground, landslides, dents, salinization and swamplization of soil, thus accelerate the deterioration and imbalance of ecology. It is very important that control the FSW content to built engineering of sustainable developing forestry and improve eco-environment at Northwest area.

Keywords: northwest area, frozen stagnant water, eco-environment

1 Outline

"Our country development of the west" is of great strategic and historical significant, it will bring academic value and benefits of ecological, economical and social at home and abroad. In the rather odious desertification environment, it will picture a prosperous blueprint of "beautiful landscape", it is also a unique hard historical task. Therefore, to fulfil this engineering of ecological system, the solution of water resources is one of the key elements.

In our country average people only own water resources 2,300 m^3, the amount is equal valence to one quarter of the world average amount, our country is one of the thirteen shortest water countries. While Northwest area is the driest area of our country, it is very short of ground water and surface water resources. Under the long- term natural and manual affect, the weak ecological balance was broken seriously. It was lead to 18 provinces, about 400 million people, 2.682 million km^2 ground were harmed deeply by desertification. It spreads 2,600 km^2 every year, it caused economic lost even about 54.8 billion yuan. Species reduced and vanished rapidly, natural disaster frequency increased, the damage power rise. In this day, it is sharpening contradictory between water environment and eco-environment worsening and human being growth with each passing day. Civil and foreign experts are all running after the engineering of sustainable developing forest. Therefore we must resolve the key work—water resources. The useable water resources of Northwest area are very limited. The surface water dispersing, content and time have limitation. Either had been monopolized and extracted to use. The identified ground water (latent water and pressured water) resource was overspent, the water content and quality vary largely. The extractable water is limited. The unidentified water layers need to be exploited. The FSW and the condensation water are new water resources which trees and some plants living through winter and

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growing, it needs to be researched.

2 FSW's formation and feature

The FSW comes from freezing affect of winter causing freezing energy (thermodynamics energy) in freezing soil layer,(Guo-dong, Ch.1995, Ping-shan, N., Shu-lin, X.1996)absorb liquid and gas waters migrate to frozen soil layer and gathered then frozen into ice. It forms the seasonal solid ground water, it has the feature such as unique forming system, inverting abundant water and independent water-saline dynamic. It lies generally in Northwest area, it is water resource of trees and some vegetation living through winter and breeding in spring even the unique water resource. It has deeply meaning of ecological balance. But when the FSW reach the immoderate saturated state, salinization and swamplization of soil are easily formed. If the FSW is too little, forests and some vegetation will decrescent, thus accelerate the desertification. So learning and mastering the theory of FSW water-saline dynamic feature and controlling water amount technical measure will offer science theory and technical measure to fulfil the ecological engineering at Northwest area and also will open a new field of international sharp subjects across research.

2.1 FSW formation system

2.1.1 Hydrogen bond adsorption energy

Under the frozen effect, the water of frozen soil was frozen into ice. The hydrogen bond of ice reach the perfect degree, the stronger the freezing is the thicker the frozen layer is, then ice amount increased, absorption energy of hydrogen bond rise, the absorbed water was frozen into ice and reach the maximum.(Willams P.J. 1984, Xiao-zu,X., *et al*., 1988)

2.1.1 Saturate vapor pressure deficit(Zhi-hai, X., Ping-shan, N. 1982, Xiao-zu,X., *et al*., 1988)

Between frozen soil layer and the lower unfrozen soil layer, it has a large temperature step, and caused saturation vapor pressure deficit. If pick out two point, one is from frozen layer temperature –10℃, the other is from unfrozen layer temperature 10℃, the distance is 96 cm, it is saturation vapor pressure deficit is 0.678 hpa. Under the same temperature, the saturation vapor pressure deficit of water surface is higher than that of soil surface, ice surface and air. The lower capillary curvature's saturation vapor pressure deficit is higher than that of the higher capillary curvature. So that water moves from higher place of saturation vapor pressure deficit to the lower place and then gathered.

2.1.3 Capillary membrane system. (Yue-wei, G., Xue-zu, X. 1989)

With the effect of freezing, the ice of soil added gradually, the poral lacuna diametre contract continually, the capillary water's corrave liquid's curvature rose, the vapor pressure deficit dropped. In addition, the steady and perfect hydrogen bond of ice has stronger adsorption energy to water than to soil particle, moreover the membrane water moves from the thicker place to the lighter place.

Hydrogen bond, Saturate vapor pressure deficit and Capillary membrane absorb the water of capillary and membrane water from the unfrozen layer to the frozen layer.

2.1.4 Saturation vapor belt invert abundant water quality

According to the large observation material of Huhhot suburb, Bayannaoer Huangher river irrigating area, the latent water level lies lower then 200 cm place before the freezing, the saturation vapor belt water distribute again obviously during the freezing, it has three deferent belt with water in it.

2.1.5 FSW abundant belt

Distribute in the frozen layer, the water content added with the frozen thickness increasing. When frozen into 60cm the average water content is 51.45%, the maximum is 65.23%. It rise 20.97% than the frozen into 30cm the average water content, the stored water content added 212 mm. It is equal to that the latent water level dropped 254 cm and offer water content while the water offering content is 0.06. While the frozen thickness reach 100 cm—120 cm, the water content can come up to 70% in 15 cm—70 cm

depth. It normally increase 8%—24% than that of before the freezing, the maximum addition is 39.51%, it gets 300% at the frozen lumps on the ground, so call it is the FSW abundant water belt.

2.1.6 Transfer water lack of water belt

This belt is distribute under the frozen layer thickness about 30 cm—50 cm, the average water content is 23.71%, the minimum point's water content is only 16.52%. The stronger the freezing is the lower the water content, the faster it permeates reduce until the plasticity lowest limit, it promote capillary water and latent water keep gaseous state and moving into frozen belt. So call it the transfer water lack of water belt.

2.1.7 Supporting capillary water vapourization transfer water belt

From the short water belt to the latent water surface, the water content increased downward. But the minimum water content is 12.63% in October 13th, it is only 16.52% in January the 28th. It is far lower than water content (25%) of capillary broken water. It leads to a vast amount of vapourization of the supporting capillary water and move away from the frozen belt. This is the supporting capillary water vapourization transfer water belt.

2.2 FSW compensation and excretion

2.2.1 FSW's compensation source

The main compensation source is the shallow latent water, supporting capillary water and manual supply, the second is the hanged capillary water, the membrane water, the vapourization water and the water from the air. Under the freezing energy, the waters move into frozen layer and gathered as liquid and gaseous state. Then it forms the FSW resource. It supplies trees and some vegetation living through winter and growing in spring to extract, but people can not exploit directly.

2.2.2 FSW's excretion

During the frozen period, the FSW excretes water in evaporation from the earth's surface, and it also needs trees and some plants' living through winter water metabolic equilibrium expenditure. So it cause that the water content reduced at the earth's surface layer about 15cm. During the melting state it mainly melts downward from the soil surface with the reversion of the air temperature. Before the complete melting it block melted water seepage. This period the evaporation from the earth's surface and the transpiration from vegetation are the main excretion means. In the immoderate saturated area, when melted depth is 40 cm—50 cm, the water begins to store. It flows from the higher place to the lower and flood out the earth's surface at low-lying land, then the wet land formed. When the FSW melted completely and turned into saturation vapor belt water to supply plants' extraction and use, the FSW vanished.

3 Analyse the effect on eco-environmental constriction of the FSW

3.1 FSW is the indispensable water resource for plants' living through winter

Till now world experts concerned all consider resting period trees' water metabolic equilibrium is very slender, it can be neglect.(Ping-shan, N., Shu-lin, X. 1998)But the author, after indoors and out-doors experiments, turned out that plants' water metabolic equilibrium balance is the key case for living and growth during winter, it is not neglectable. For example, *Populus*, *salix*, *ulmaceae* and so on, its branches and nursery stocks break off supplying water at the beginning of winter, if lie it as it was no any water serving, its water content is lost 50%—60% at the beginning of spring, it can not grow again any more. The others' water content is lost 6%—10%. The acicular trees' branches and roots break off supplying water until early spring, water losing content is 40%—50%, all died. The others water content is lost 4%—8%. The winter of Northwest area last about half a year, the frozen depth is 80cm—150cm. The trees' roots are always surrounded by the FSW, to live and to grow it has to extract the FSW during winter. The theory research-extract solid the FSW to keep water metabolic equilibrium balance, it has deeply theoretical meaning and academic value. This is a new across research field of geology and biology.

3.2 FSW is usable water resource for spring plants' growth

It is the driest season from March to June at Northwest area. It is also the golden season for plants' germination and growth, it needs enough water. But rainfall of this period is slender even none. Below the frozen layer all kinds of ground water are blocked and can't rise to the earth's surface. Only the melted FSW is the most stable water resource even unique for plants' spring germination and growth. Therefore, controlling the FSW content is the effect technical measure of eco-environment constriction.

3.3 FSW's negative effect to eco-environment

3.3.1 Effect of FSW content to seeds germination

After simulation experiments, made deferent water content original state soil, soil post height is 40cm, diameter is 20cm. After froze 72 hours, melt naturally. When melted depth is 8cm, sow seeds. The seeds of experiment are *Zea mays*, *Triticum aestivum* Spp, *Hedysarum scoparium* Fisch, *Caragana sinica*, *Hedysarum scoparium* Fisch, *Pinus tabuiaeformis*, *Biota orientalis atstivem* etc. It turned out when the average water content is <8% in 0cm—20cm melt layer, the seeds all can't germinate; the water content 18%—20% seeds all can germination, but can't grow well; the water content 22%—35% seeds' germination and rooting rate are all very good. It's the best water content. While the water content rises 40%, the seeds' germination rate is lower than12%, the nursery stocks begin to die after 20 days. So we should control the FSW content among 20%—35% in the eco-environmental constriction.

3.3.2 Analyze relation of sandy area forest eco-environmental worsening and FSW content

In our country, all deserts are used to be widely covered by natural forest, keep the crisp eco-environmental balance in the long history. But with the natural and the manual effect, eco-environment was destroyed badly, until now except preserving area, all had vanished. It is thoroughly caused by worsening of water surrounding.

The Maowusu desert Osier bed distribution range keep drought for five years from 1979 to 1983, the latent water level dropped 2m—8m, the earth's surface water of the forest died up. The FSW content is only 2%—5% at hillock in 1984. Until June the 20th, it is only 4%—6% that the renewing rate of *Artemisia sphaerocephalla* krasch, the renewing rate 20%—30% for Osier bed, no young plant. In dry year migratory bird migrate soon after arrival, man and animals destroy worse, Food chain is imbalance. During 1979—1989 state, the surviving Osier bed is vanished 56%.(Shu-lin, X., Ping-shan, N. 1989, Shu-lin, X., Ping-shan, N. 1989).

In addition, the forest of *Populus euphralica* Oliv. at Ejina and that of *Halaxyion* Bge at Minqin area etc are all died of water lack, because of river dry-up and overspending ground water, the latent water level dropped largely, the FSW and the Saturation vapor belt water reduced rapidly.

3.3.3 Analyses relation between soil salinization and FSW at Northwest area

The soil salinization is very general at Northwest area's dry and semi-dry plain and desert area, especially, the latent water' gathering area's natural distribution with the forest damage salinization developed rapidly and did harm to eco-environment. For instance, Osier bed all distributed over the lower belt at Maowusu desert, the latent water level depth is 0m—1.2m. Spring melted water flood out and formed storing water. It's not only the steady water resource for the Osier bed vegetation living through winter and growth, but also the drinking water resource of birds, wild animals and tamed animals, keeping a good eco-environment. Once the forest was destroyed, evaporation from the earth's surface seriously, the surface water dried up, keep getting bad, accelerated death of trees and vegetation. On the basis of materials of analyses 75 soil samples of 25 soil sections indoor and simulation experiment outdoor shows Osier bed vegetation grow normally at 0cm—20cm soil layer that the salt content is 0.18%—0.58%. When soil salt content is 1%, the nursery stock of *Hippophae rhamnoides* L. living rate is zero, that of *Salix cheilophyla* Schneid and *Salix psammophila* Wang et yang living rate are 10.7% and 11.1%. When the soil salt content is 15%, all nursery stocks can't live. When the soil salt content is 1.25%—2.12%, Osier bed vegetation community all died. It belongs to salt soil to alkali soil transitive type. The change its course or the break its flow of Talimu river are all appeared the similar eco-

environment serious damage. In addition, every sealed plains and basin' river irrigated area in Northwest area, all appeared the soil salinization difficult to preserving and curing. The swamplization of mountain land and forest area all connected with the FSW's immoderate.

4 End words

To carry out "Development of the west" selection, resolving water resource is the key case of the Northwest area eco-environmental constriction. Therefore, we should get experience from the over 40 years desert-control cause and the 70s pastural area's over-sinking machine-well etc eco-environmental constriction. Avoid straight unrealistically optimistic "Rich water resource " appearing in feasible reports and program designs. This day we still use the hydrology geological observation data. We have not recognized enough about the inside relationship of desertification led by water surrounding worsening. We should recognize Northwest areas' water resource lack from the academic theory level, Otherwise it is very unfavourable to the eco-environment constriction.

We should deepen the plexi-across research of the forest ecological system and water resource, set up new research field. Especially the FSW and condensation water research connected tightly with trees and some vegetation.

I suggest set up ecological balance station in desert area to resolve trees and some plants' yearly water metabolic and water resource balance. It can offer scientific proof for eco-environmental constriction.

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