Study on Environmental-geological Problem and Ecosystem Re-establishment Countermeasures about Quarry and Damaged Mountain in Peri-urban

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Abstract—The quarry and damaged mountain in peri-urban have an important influence to ecological environment. They have had a series of serious environmental-geological problems to the socio-economic development and urban modernization process, such as increased environmental pollution and soil erosion, destruction of landscape aesthetic, induced geological disasters, and had an impact on groundwater seepage and so on. So it has an important significance to assess the eco-environment-geological disasters about the quarry and damaged mountain, further to do the ecological restoration and reconstruction works in peri-urban. In this paper, the sustainable development theory, land reclamation theory, ecological succession theory and landscape design theory about the quarry ecosystem renewal based on the analysis of the quarry and damaged the mountain environment-geological problems and harmful held on, then the ecosystem re-establishment countermeasures are also analysed, which include plant choice responses and ecological reconstruction technical countermeasures. It will be a reference role to quarry and damaged mountain ecological reconstruction and rehabilitation on the periphery of cities.

Keywords—environmental-geological problem; ecosystem re-establishment; quarry and damaged mountain

I. INTRODUCTION

The quarry with urban rim have made the great contribution to the society economic growth and the development of city modernization construction, also it brings a varieties of serious environment and geology problems, such as vegetation deterioration, water loss and soil erosion, dust and noise pollution, landscape deform, environment smash and so on. Now the area of the destroyed and occupied land in our country has surpassed 4,000,000 square kilometers owing to opencast working, all kinds of waste residue mullock mine stocking. The national land reclamation rate is no higher than 12%. The ecology recovery rate of strip mining is much lower, which makes the mining site the most wrecked region in our country. In the urban rim planning region and along the main communication line, the bequeathal disrepair mountain massif, due to quarry or cutting not only destroy physiognomy and geologic environment but also create huge visual and environment pollution, at the same it reduce the supply from the atmospheric precipitation to underground water. The high and steep side slope formed after the disrepair of the mountain massif also can be induced by geologic hazard, such as collapse, dropping stone, coast, and debris flow. The despair of mountain massif induced by a serious environment geology problems, severely influence growth of production and the safety of people’s lives and property, and the destroyed vegetation’s natural recovery will take about 100 years. Therefore, it has major significance to launch the evaluation of the urban rim quarry and disrepair mountain ecology environment geology disaster, and to carry out ecology recovery and reconstruction researches.

The text probes urban rim quarry and disrepair mountain massif environment and geology problems and harms, on which base the text analyzes the theory and countermeasure of quarry ecosystem reconstruction .And this utilize others wok such as the ecology recovery and reconstruction in urban rim quarry and disrepair mountain massif .

II. THE PROBLEMS AND HARM OF THE QUARRY AND DISREPAIR MOUNTAIN MASSIF TO ENVIRONMENT AND GEOLOGY

A. Seriously polluted environment

Quarry and damaged mountain massif caused great break to environment. Firstly, vegetation and coating should be got rid of before cutting into a mountain to quarry and then fry the pecks. Many quarry hardly have sand-blocking dams or retaining wall or such measures to avoid water loss and soil erosion, nor have they got reclaim and afforestation. Etophia was formed and it is on the rise. Large acreage rotten rocks and sand will produce plentiful raise dust and flour dust which will make local region be hangovering. At the same time, the floating wee dust will fall over the leaves and block the air holes, and it will influence breath and
photosynthesis. This destroyed the local entirment, making the environment pollution more serious, the dust flowing away into the air of the city ,and it became one of the main air contaminant.

B. Making the water loss and soil erosion more serious
Cutting into mountain to quarry, the vegetable layer and topsoil were stripped, which easily leads to water loss and soil erosion. The quarry slash haven’t got vegetation on the surface, and the underlying surface is very special, and doesn’t have common soil that have the water storage and infiltration function. The concieving gravel and dust yielded in the quarry process will become the source of water loss and soil erosion . The influenced and destroyed vegetation area is five times the quarry area, so the result is serious. Great amount of stripped ground aggravated the degree of the water loss and soil erosion.

C. Invoking geologic hazard
Urban rim quarry and the disrepair mountain massif is easy to place a premium on geology hazard .The soil and vegetation are the important parts to constitute terrestrial ecosystem, and the storage vault of the inartificial rainwater. In the mountainous region, after the soil and vegetation were removed ,it will allegro forms flood peak, which will catch the sand rock and soil stuff produced by the surrounding quarry and road construction and pour down , seriously filling up the reservoirs river ways ,reducing the draining water-logged ability ,causing flood disaster. In the rainy season ,it will induce collapse, coast, debris flow ,bringing serious and even truculence infringe to the downriver cities, villages, farms, factories and mines ,roads, people’ lives and properties.

D. Affecting the seepage action of ground water
Urban rim quarry and disrepair mountain massif will influence the seepage action of ground water of the city. As in Jinan, the south mountain part lies in north wing of the Taishan anticline, and it is water source self-restraint of Jinan. The region receive rainfall recharge, infiltrating to form groundwater, portion of which migrate from the photogene’s narrow cranny in limestone into lower base level of erosion as the gravity action..The groundwater conflux to Jinan along the aspects and cranny networks, forming springs to discharge and it repeat erosiding the rock mass again and again finally forming a groundwater cyclical field . Some water crannies are eroded to become water piping $\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \leftrightarrow \text{Ca}^{2+} + 2\text{HCO}_3^-$ networks. The carst motion system is a “$\text{CO}_2 - \text{H}_2\text{O} - \text{Carbonate}$” system which is triphase, lopsided and open.

$$\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \leftrightarrow \text{Ca}^{2+} + 2\text{HCO}_3^-$$

The content of $\text{CO}_2$ is bound to lessen and the upper balance will move to the rightward and the inborn $\text{CaCO}_3$ will block carst pipeline.

E. Wrecking physiognomy aesthetics sight
The quarry process is also the destroying progress. The new rock surface stripped in cutting into a mountain and quarry contrasts tremendously with the surrounding environment hue with the vegetation as background, breaking the completeness of mountain sight. At the same time, the mullock mined stacked any location along the main lines of commutation, causing fearful landscape interfere.

Cutting into a mountain and quarry also destroyed the habitat that the vegetation needed , causing floristic to be rare .community constitute to be simple, coverage and biomass to be much lower than the clean control plot.

III. THE BASIC THEORIES OF QUARRY ECOLOGY SYSTEM RECONSTRUCTION
The ecology system reconstruction is base on ecology principle, by means of certain organism ,ecology, and engineering technology and methods, artificially alter and remove ecology system degeneration leading factor or progress, adjust, deploy, optimize the inner system and exoteric matter, energy, and information flow process ,space time order, making ecosystem structure, function, ecology potential recover the normal level as quickly as possible .The recovery of quarry is a synthesis multidisciplinary issue, which involves physiognomy redevelop, production capacity recovery, ecology synthesis, economic and aesthetics value and such problems .The basic theories of quarry ecology reconstruction mainly involves the under contents.

A. Sustainable development theories
Sustainable development is a new view of development raised in 1980s, which means to satisfy the present needs and not weaken the ability of the springs to satisfy them-selves. The aim that sustainable development pursues is: all kinds of human’s needs should be satisfied, and individuals get abundant development ; conservation and environment should be protected ,not threatening future generation’s survival and development .It specially concerns the ecology rationality of all kinds of economic actives, emphasizing to encourage the economic activities that are good to resource and environment, conversely it should be abandoned . Guiding by the sustainable development theory, each country proposes requirements at a higher level to ecology recovery, including strengthen investigation and research to ecology resources before and after mining, resorting to active safeguard before mining and remedy measures after mining, strengthen protecting to wildlife resources, using landscape ecology principle aesthetic theory, making the new sight and the surrounding introject together harmoniously, having higher economic ecology and aesthetic value and so on.

B. Land reclamation theory
Land reclamation theory means that through mechanical control measure or ecology measure people resume all kinds of lands that were out of date and created by artificial and natural disaster factors into a state that can be utilized, and use them. Base on the different degrees of reclaim, AAS defined reclaim as three popurse types: heal, resume and rebuilding. Australia mine reclaim circles use the word “Rehabilitation”, whose meaning is: make the disturbed soil recover to the prior enactment the earth surface form and production capability ,establish factor, the progress of make the space have a new sustainable different application .Our country define land reclamation as : an active that carry out repair measures in the destroyed land in the construction progress as the reason of damage, sink, divine and so on and make it recover to the state that can be
utilized. The reclamation rate abroad is about 70%-80%, while in China it is lower than 12%.

C. Ecological succession theory

The ecological succession theory is the base of the impaired ecology system recovery theory. Revegetation is the most important work of ecology recovery. The theory considers that only in the extreme conditions, vegetation will always recover according to natural succession discipline after a period without man-made wreck. The natural succession generally needs 100 years to recover to a natural vegetation cover in the disused land. So, according to urban rim quarry recovery aim, guided by ecology succession theory, using artificial method to accelerate recovery in short order is significant to city ecology system optimizing.

D. Landscape design theory

In the quarry ecology reconstruction progress, the thought of geography of landscape and landscape architecture was drew into, mainly researching fusing and coordinate between anthropogenic landscape and rim environment.

IV. QUARRY ECOLOGY SYSTEM RECONSTRUCTION COUNTERMEASURE RESEARCH

A. Vegetation selecting measures

Corresponding measures. Its core is vegetation recovery and on this base to reach system self-maintain, realizing ecosystem virtuous cycle and healthy. The selecting and deployment of floristic are important problems of quarry vegetation reconstruction. It was fixed according to meteorology, soil, hydrology, and expected recovery aim. Floristic selecting generally chooses adaptive, good resistance, quick-grown plantings, simultaneously considering the short-term effect and medium or long development prospect; the following countermeasures can be consulted specifically.

a Selecting nitrogen-fixing planting preferentially

Pant nitrogen-fixing vegetation is a good improvement method of soil matrix which has both economic benefit and ecological benefit. Studies state clearly that nitrogen-fixing plant can fix 50～150 kg nitrogen per year in 1 km².

b Selecting pioneer plant preferentially

Pioneer plant has powerful resistance, being prone to survive and grow, and can improve the soil quality and circumjacent microenvironment, creating conditions for other species’ invasion, promoting the succession of quarry plant community

c Selecting native plant preferentially

No matter from recovery ecology or protecting biosafety angle, in the progress of the quarry vegetation reconstruction, the native species should be selected preferentially and in particular cases outside species can be used.

d Optimizing plant furnishing

In the quarry revegetation, appropriate allocation among different vegetation is equally important. According to ecosystem succession theory, afforestation vegetation matching should accord to their ecological habit and also rests with matching of econiche, considering different terrain, climate, illumination, water, temperature, earthiness, side slope trait and plant characteristic and such factors. It directly relates to the develop of system ecology function and the raise of sight value.

B. Ecology reconstruction technique countermeasures

Currently, home and abroad quarry reconstruction technique mainly use the following countermeasures:

a Slashing afforestation technique

On most quarry surface layer ballast and stone dust, vegetation are unable to grow. Firstly ballast should be replaced by soil, and be aided with other cultivating measures. Big hole and sprout, carrying culture pan can be used when cultivating. During choosing varieties, 3.1 vegetation selecting countermeasures can be referred to, according to various region conditions and landscape requirement to fix. Generally hardy, drought-resistant, fast-growing arbor species.

b Linking Fence and grass-puffed technique

The method strike-off cliff surface firstly, and then fix all kinds of textile networks on the cliff, puff certain thickness vegetation growing base, which contains resolvability cement, organic and inorganic fertilizer, water retention agent. At last mix grass-seed and certain PH indicator clay liquid, and then jet them on the growing base. This method mostly goes for control for cliffs whose grade is below 40 angles.

c Reinforced concrete sash suspension girder technique

The method uses about 60cm high suspension girder and 115mx115m sash, simultaneously welding roof bolt and suspension girder into an entirety, making the force transmit from roof bolt to the cliff. And then add other soil, seeds, fertilizer, geotechnology fiber and such composite material into suspension girder sash. It mostly goes for afforestation of the small range road rock slope.

d Other soil puffing and sowing technique

This method coordinate soil, fiber, agents to prevent erosion, slow, such as fertilizers and seeds with a certain percentage by adding special equipment fully mixed through the pumps, compressed air jet to the surface to form the required thickness of the grass-roots level, and to achieve the purpose of afforestation.

e Hydroseeding technology

The method will mix seeds, fertilizer, seed adhesion agents, soil amendments by a certain percentage of water distribution in a mixed box, by mechanical pressure spray to the slope of a slope planting lawn new technologies. This does not require a linked network, the construction is simple, fast, effective protection, a relatively low cost. This method is more applicable to the slope is less than 45°, rough surface of the rock slope.

f Mixed vegetation spraying technology

Create a porous structure in the rock that satisfies both plant growth and development so that the planting substrate won’t be washed. Rocky slope that is put in barbed wire and
barbed wire anchor will be firmly fixed nail in the rock slope, using special machinery to spray mixed soil, humus, organic matter, security agent, hybrid seeds, cement, such as adding water after the injection to the rock face, the thickness of the formation of the vegetation close to 10cm of concrete. The gap is filled in seed plants, soil, organic matter, security agent and so on, the gap is filled matrix planting space, but also the growth of plant roots in space. The method of construction is difficult, high cost (1,500-2,000 / m²). This method is more applicable to more than 40 ° slope.

g. Landscape reconstruction technology

For cliffs near transport trunk, or close to tourist spots, and oes that have the big visual area of, urban planning or tourist areas can be combined, to consider to establish the landscape that can be used as movement or enjoyment sight spot, such as rock climbing areas, scenic spots, such as water.

V. Conclusions

a. The quarry and damaged mountains around cities influenced the local ecological environment, which bring a series of serious environmental - geological problems to socio-economic development and process of city modernization urbanization, such as increased environmental pollution and soil erosion, destructed of landforms aesthetic landscape, evoked environmental geological disasters, and impacted groundwater seepage field.

b. The ecological reconstruction of quarry and damaged mountains mainly contains two steps, the first is choosing plant, then corresponding measures are adopted, according to the lithological character, slope and surface roughness based on it. The core measure is vegetation restoration, and the ultimately achieving is satisfied with the system self-sustaining, then achieving a virtuous circle of eco-system and health.

c. The reconstruction technique of quarry and damaged mountain include ecological vegetation restoration technology and landscape recycling technology, and the former include mark afforestation technology, drifting network and spurting grass technology, reinforced concrete commits suicide by hanging from a beam the technology, spurting broadcast in imported soil technology, spurting broadcast with hydraulic pressure technology, spurting mixed vegetation spraying technology, and landscape reconstruction technology. The choice should be varieties methods coordinate mutually, to achieve good results in the ecological reconstruction.

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The ecology recovery rate of strip mining is much lower, which makes the mining site the most wrecked region in our country[1]. And the destroyed vegetation’s natural recovery will take about 100 years[2]. This destroyed the local entirment, making the environment pollution more serious, the dust flowing away into the air of the city ,and it became one of the main air contaminant[3]. For instance, the August 26, 1987 rainstorm in Jinan, owing to the serious filling up in the upper reaches, the water reservoir, and 300,000 citizens were besieged by flood[4]. The influenced and destroyed vegetation area is five times the quarry area[5]. The cast motion system is a “CO₂—H₂O—Carbonate” system which is triphase, lopsided and open[6]. The recovery of quarry is a synthesis multidisciplinary issue, which involves physiognomy redevelop, production capacity recovery, ecology synthesis, economic and aesthetics value and such problems[7]. Making the new sight and the surrounding introject together harmoniously, having higher economic ecology and aesthetic value and so on[8]. The theory considers that if only not in extreme conditions, vegetation will always recover according to natural succession discipline after a period without man-made wreak[9]. Actually, these explores to sight concepts reflect that people’s cognition to the relationship between man and nature is deepening[10]. Quarry and disrepair mountain massif ecology reconstruction mainly includes two steps, in the first place, carrying out plant select[11]. Currently, home and abroad quarry reconstruction technique mainly use the following countermeasures[12]:

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