广东省森林恢复项目对生物多样性保护的潜在贡献

Guangdong Province's forest rehabilitation efforts: Potential for contribution to biodiversity conservation

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广东省一直非常重视退化林地的恢复工作，特别是自50年代以来。针对环境的不断恶化及木材短缺问题，国家和地方相应的制定了相关政策和决定，带动和促进了森林恢复项目的开展。1985年以来，广东在退化森林恢复上取得了较大成绩，森林覆盖率则由19%提高到57%。不同时期，林业恢复项目的范围和性质各不相同，这与政策变化，有利的经济条件，土地权属管理制度改革密切相关。

生物多样性评价通常是在恢复项目实施前和实施后，采用固定样地法进行实地测定，或是通过对不同类型退化与恢复区域的生物多样性的估计来实现。此外，可通过对恢复项目的目标，恢复类型，采用的植被恢复方法和已种上的树种的快速评估获知这类项目在提高和保护生物多样性方面的潜力。

本评价基于广东省八大类恢复项目的22个试验点(市、县、区、林场)的典型分析。这八大类恢复项目为：

1. 国营林场造林项目。到1987年，这类项目已达233个；本文仅以广东省其中一个最大的国营林场(1954-)为例。
2. 广东省省级'五年消灭荒山、十年绿化广东'项目(1985-1995)，选取3个项目县。
3. 世界银行贷款国家造林项目(1990-96)，选取三个项目县。
4. 沿海防护林体系建设工程项目(1991-2010)，选取三个项目县。
5. 市、县生态风景林造林项目(90年代以来)。这类项目较多，从中选取了四个典型项目。
6. 私营企业速生丰产林项目(90年代以来)，选取3个案例。
7. 个体承包造林项目(2000年以来)，选取3个案例。
8. 联合经营造林项目(2000年以来)，选取2个案例。

到2003年，非公有制(包括第6、7、8项)造林实体达54万个。

Guangdong Province has worked continuously to rehabilitate its degraded forest lands since the 1950s. National and regional policy initiatives, and concerns about deteriorating environmental conditions and timber shortages have driven the rehabilitation efforts over the years. The province claims great success in its efforts, particularly since 1985, with forest cover increasing from 19% to 57% of the land area. The extent and nature of these rehabilitation efforts has varied over time, reflecting political changes, evolving economic policies and conditions, and land tenure reform.

The actual biodiversity impacts can only be measured through detailed, on-the-ground studies before and after rehabilitation, or estimated by studying biodiversity across different types of degraded and rehabilitated areas. However, the potential for such projects to enhance and support biodiversity conservation can be seen through a quick assessment of the objectives, kinds of lands rehabilitated, revegetation methods used, and the species planted on different projects.

This assessment is based on 22 samples (counties, cities, or cases) among eight different rehabilitation initiatives in Guangdong Province. The eight initiatives include:

1. State forest farm projects. Some 233 such projects were initiated by 1987; we sampled one of the two largest farms (since 1954).
2. A provincial project called Rehabilitating Degraded Forest Land in Five Years & Greening Guangdong in Ten Years (1985-95). We sampled three counties.
3. The National Afforestation Project, aided by a World Bank loan (1990-96). We sampled three counties.
4. The National Coastal Protective Forest Construction Project (1991-2010). We sampled three counties.
5. Forest landscape rehabilitation projects initiated by local city or county forestry bureaus (from the 1990s). Of the many such projects we sampled the four largest.
6. Afforestation initiatives by private companies (since the 1990s). We sampled three cases.
7. Afforestation initiatives by individual private investors (since 2000). We sampled three cases.
8. Local joint-venture afforestation initiatives (since 2000). We sampled two cases.

森林恢复的贡献

项目目标：惟有一个市（韶关市）的生态风景林造林项目把提高生物多样性列为其具体目标之一。选取的四个生态风景林造林项目和一个县的沿海防护林体系建设项目把改善林分结构，形成多树种混交林，提高蓄积量，提高森林的生态和美学功能为目标。主要由政府组织的10个项目试验点把提高森林的总体生态效益列为项目总目标。

退化地类型：多数是荒山荒地或退化的外来树种人工纯林。22个项目试验点中仅有2个点有天然林覆盖，这些天然林在项目执行期间保存良好。

采用的恢复方法：22个项目试验点主要采用植树造林的恢复方法，半数试验点还兼顾采用天然更新的方法。恢复方式主要有：先种植，然后维持其天然更新或采用天然更新和人工促进天然更新方式。四个政府项目（第二到第五项）和国营林场造林项目以及2个私企的桉树人工林生物防护林带营建，采用了天然更新的方法。中国具悠久历史的‘封山育林’法广泛的应用使得荒山荒地和靠近居民区的森林得以天然更新和恢复。

种植的树种：4个市的生态风景林造林项目因采用多树种（每个立地至少3-6种）混交种植模式，而且采用的树种多是乡土树种，生物多样性最高。私企造林和绿化广东项目因采用长、短轮伐期树种兼顾种植模式，生物多样性次之。私企造林项目一般采用外来树种，一块林地上包含2-5个树种。绿化广东项目采用的树种在3个以上：两个试验点多采用外来树种，另外一个试验点则全部采用乡土树种。

其他项目中，种植树种的多样性比较低。世界银行贷款国家造林项目和国营林场造林项目多采用马尾松和杉木营造长轮伐期用材林，而三个个体承包造林点和两个联合经营造林点多采用外来树种。沿海防护林带建设采用具有抗风、固沙、保持水土功能强的树种，且多为外来树种。然而，总体上，国家沿海防护林体系建设工程除种植特种树种外，在适宜的立地上，如缓坡地和山脚，营建了速生用材林和经济林[1]。在城市生态风景林，国家造林和国营林场造林项目已种植的树种中，乡土树种占50%以上。

结论

广东省森林恢复项目的实施对生物多样性的提高和保护贡献极大。某种程度上，这些项目对生物多样性的贡献已显现出来，随时间的推移，效果会更加明显。尽管一些项目，特别是政府项目并没有明确的把生物多样性指明为项目目标，但实际上采用了

By 2003, the number of non-public entities making investments (initiatives 6, 7 and 8 included) totalled 540,000.

Project objectives

Only one city landscape project (Shaoguan City) specified biodiversity enhancement as a specific objective. However, all four city/county landscape projects sampled and one county in the National Coastal project had the goal of improving forests in terms of stocking, structure, species mix, ecological functions and aesthetics. General environmental improvement was mentioned in ten, mainly government-sector, project sites.

Types of lands rehabilitated

Most areas rehabilitated were initially open grassland, shrubland or barren land, or degraded monoculture plantations of often exotic species. Two of the 22 sites included some natural forest cover which did not decline over the project period.

Revegetation methods used

Tree planting was the dominant method in all samples, although natural regeneration was also allowed in half of the sites. Rehabilitation took different forms: planting and then allowing natural regeneration, or natural regeneration with or without enrichment planting. Natural regeneration took place mainly in the four government projects (initiatives 2 to 5), in the state forest farm and in vegetation belts separating Eucalyptus urophylla plantings in two private-company sites. ‘Mountain closure’ is a common method used since time immemorial in China, whereby barren areas and mountains are closed to the public to enable natural regeneration and forest recovery.

Species planted

The four city landscape projects had the highest diversity with a mix of species planted (3-6 species per site), almost all of which were native. Private company initiatives and the Greening Guangdong project had the next highest diversity with mixed short- and long-rotation timber species. Private company initiatives had 2-5 species planted on each site, mostly exotic timber species. The Greening Guangdong project had three or more species planted: mostly exotic in two sample counties and all native in the third.

Planted species diversity was much lower in other project types. The National Afforestation Project and the state forest farm were dominated by long-rotation native timber species, *Pinus massonianus* (Masson Pine) and *Cunninghamia lanceolata* (Chinese Fir). Mostly exotic species were planted at the two local joint-venture and the three individual private investor sites. In National Coastal Protective shelterbelts, particular species (mostly exotic) were planted for their wind and sand resistance, and ability to hold sand and water. However, in the National Coastal Protective Forest project as a whole, fast-growing timber and economic[1] plantations were developed on suitable slopes and foothills of the coastal mountains. More than 50% native species were planted in the city landscape, National Afforestation and state forest farm initiatives.

Conclusions

Guangdong Provinceís forest rehabilitation efforts have a high potential to contribute to biodiversity enhancement and

[1] 经济林主要指非木质林产品，如水果、食用油、饮料、饲料、工业原材料(橡胶)、药材和香料等

[1] Economic plantations are for non-wood products such as fruits, edible oils, beverages, fodder, industrial use materials (rubber, etc.), medicines and spices for cash income.

多树种造林和天然更新恢复方法，也达到了此目的。两个私企造林项目营建的天然更新缓冲林带以及由个体承包造林项目和当地商品林建设基地中营建的虫害防护缓冲林带可明显的阻止林火蔓延。

为提高森林的生态效益和当地的需要，城市生态风景林造林项目多注重乡土树种的混合种植，相应地提高了生物多样性的潜力。绿化广东、国营林场造林和国家造林项目基地种植的乡土和外来树种均相对较少。为满足环境、商品材和当地的其他多种需求，所有的政府造林项目试验点提倡多样化的种植模式。个体私营、联合经营造林和沿海防护林项目试验点多数因采用种类较少的外来速生树种，生物多样性的潜力较低（一个私企例外）。私企一般考虑长、短轮伐期树种的混合种植，这种方法也可被其他的私人和民营企业所借鉴和发展，以达到获得长、短期产出和减少技术风险（林木病虫害与不良生长）和市场风险的目的。鉴于非公有制造林的迅猛兴起，对采用更多乡土树种和混交种植方式所能对投资者带来的收益有必要进行评价和报道，并支援和鼓励投资者重视这些效益。

多数的造林项目是针对恢复退化的荒草地、灌木林、裸地和退化的人工林而开展的。项目的执行有助于促进荒山荒地植被恢复、丰富和保护生物多样性。为巩固绿化成果，1994年广东省确定了340万公众生态公益林体系建设目标。在这些生态公益林区，通过对严重退化林地采取补植补种、人工促进天然更新及对天然更新林的保护等多项措施，生物多样性必然得到进一步的提高。

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conservation. The efforts are probably already contributing to biodiversity to some extent, and could do even better in the future. Despite biodiversity not appearing as an explicit major objective, natural regeneration is being allowed in many cases, particularly in government projects. The use of naturally regenerated forest buffer belts in two private-company sites suggests there is potential to promote such fire and pest protection buffers in other private and local commercial initiatives.

City landscape rehabilitation projects have high biodiversity potential with a large mix of mostly native species being planted for ecological and local needs. The Greening Guangdong, State forest farm and National Afforestation project sites planted fewer native and exotic species. More diverse planting could be promoted in all government project sites to meet diverse local livelihood needs as well as environmental and commercial timber needs. The private sector, local joint-venture afforestation and National Coastal project sites had the least biodiversity potential, with few, mostly exotic and fast-growing species planted (except for the private company sites which had slightly higher diversity). Private companies planted mixed short- and long-rotation timber species, and this approach could possibly be promoted with other private and civil sector actors to derive short and long-term outputs and reduce technical (disease, pests, poor growth) and market risks. In view of the large number of initiatives in the non-public sector, efforts are needed to assess and document the technical and economic benefits of using mixed-species stands and more native species, and to support and encourage investors to take into account such benefits.

A positive finding is that most rehabilitation efforts took place on open grassland, shrubland or barren land and degraded plantations potentially resulting in net benefits to forest cover and the enhancement and conservation of biodiversity. In Guangdong province, 34,000 km^2 of forest land now has an ecological rather than commercial classification. Biodiversity enhancement could be promoted in these ecological areas through assisted natural regeneration, with planting and protection to catalyse natural regeneration in severely degraded sites.

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