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沙棘林提质增效技术规程

Technical Regulation for Improving Quality and Efficiency of

Seabuckthorn Forests

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Announcement on the approval and release of three association standards such as "Technical Specifications for Seabuckthorn Raw Leaf Powder and its Processing" by the International Seabuckthorn Association

No. 15, 2024 of ISA

The Fifth Office Meeting of the Secretary-General of the International Seabuckthorn Association in 2024 considered and adopted three association standards including the "Technical Specifications for Seabuckthorn Raw Leaf Powder and its Processing"(the following table) on December 24, 2024, which are hereby announced

SER No.	STD No.	Standards name	Date issued	IMP date
1	T/ISAS 014—2024	Technical Specification for Seabuckthorn Raw Leaf Powder and its Processing	2024-12-31	2025-01-30
2	T/ISAS 015—2024	Technical Regulation for Improving Quality and Efficiency of Seabuckthorn Forests	2024-12-31	2025-01-30
3	T/ISAS 016—2024	Technical Regulation for Seabuckthorn Clear Juice Processing	2024-12-31	2025-01-30

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前 言

本标准按照GB/T 1.1—2020《标准化工作导则 第1部分：标准化文件的结构和起草规则》的规定起草。

本标准由国际沙棘协会归口。

本标准起草单位：中国水利水电科学研究院、延安大学、水利部沙棘开发管理中心（水利部水土保持植物开发管理中心）、内蒙古沙漠之花生态产业科技有限公司、新疆松源林果生物科技有限公司

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本标准为首次发布。

Introduction

This standard is drafted in accordance with the provisions of GB/T 1.1-2020 Standardization Work Guidelines Part 1: Rules for the structure and drafting of standardization Documents.

Please note that certain contents of the standard may involve patents. The issuing body of the standard does not assume responsibility for identifying patents.

This standard is compiled by the International Seabuckthorn Association.

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This standard is issued for the first time.

沙棘林提质增效技术规程

Technical Regulation for Improving Quality and Efficiency of Seabuckthorn Forests

1 范围

本标准规定了沙棘林提质增效的适用范围、技术要求和作业设计、林分调查与评价、林分改造、抚育管理、施工验收、监测、评价与档案管理等9部分。

本标准适用于沙棘林改造和提质增效。

1 General Provisions

This standard specifies the scope of application, technical requirements and operation design of seabuckthorn forest quality and efficiency improvement, stand investigation and evaluation, stand transformation, tending management, construction acceptance, monitoring, evaluation and file management, and so on.

This standard is applicable to the transformation and improvement of seabuckthorn forests.

2 规范性引用文件

下列文件中的内容通过文中的规范性引用而构成本标准必不可少的条款。其中，注明日期的引用文件，仅该日期对应的版本适用于本标准；不注日期的引用文件，其最新版本（包括所有修改单）适用于本标准。

- GB 6000 主要造林树种苗木质量分级标准
- GB/T 26424 森林资源规划设计调查技术规程
- GB/T 38582 森林生态系统服务功能评估规范
- GB/T 15776 造林技术规程
- GB/T 15772 水土保持综合治理 规划通则
- GB/T 15773 水土保持综合治理 验收规范
- GB/T 16453.6 水土保持综合治理 技术规范
- SL284 沙棘苗木
- SL350 沙棘生态建设工程技术规程
- LY1690 低效林改造技术规程
- GB/T 11822 科学技术档案案卷构成的一般要求

2 Normative references

The contents of the following documents constitute the essential provisions of this standard through normative references in the text. Among them, dated reference documents, only the version corresponding to that date applies to this standard; Undated references, the most recent version of which includes all amendment orders, are appropriate for use in this standard.

GB 6000 Tree seedling quality grading of major species for afforestation

GB/T 11822 General requirements for the file formation of scientific and technological archives
GB/T 15772 Comprehensive control of soil and water conservation-General rule of planning

GB/T 15773 Comprehensive control of soil and water conservation- Regulation of acceptance
GB/T 15776 Artificial afforestation technical regulations

GB/T 16453.6 Comprehensive control of soil and water conservation- Technical specification- Collapse management technology

GB/T 26424 Technical regulations for inventory for forest management planning and design

GB/T 38582 Specifications for assessment of forest ecosystem services SL284 Seabuckthorn's nursery-stock

SL350 Technical code on seabuckthorn for eco-engineering construction LY1690 Technical regulations on reconstruction of low-function forest

3 术语及定义

3.1 沙棘天然林 natural seabuckthorn forest

沙棘天然林指天然起源的沙棘林，包括自然形成、人工促进天然更新或萌生所形成的沙棘林。沙棘天然林以生态林为主，兼有生态经济林。

3.2 沙棘人工林 seabuckthorn plantation

沙棘人工林指通过人工措施形成的沙棘林；根据经营目的，人工沙棘林划分为生态林、生态经济林、经济林。

3.3 低效沙棘林 low function standing forests of seabuckthorn

受人为因素的直接作用或诱导自然因素的影响，林分结构和稳定性失调，林木生长发育不良或衰竭，系统功能退化或丧失，导致林分生态服务功能，尤其是果叶产量、生物量或生物多样性显著低于同类立地条件下相同林分平均水平的林分总称。

3.4 林分改造 stand transformation or improvement

林分改造是指通过人工措施改造低产、低值的林分，使之成为高产、高值林分。

3.5 带(块)状改造 strip reconstruction or improvement

对低质或低效的沙棘林，根据经营目的、林分状况和立地条件，划出保留带(块)、伐除改造带(块)。

3.6 群团状改造 lumpish reconstruction or improvement

生态经济型沙棘混交林，当有培育前途的目的树种成群团状或块状分布时，主要对非目的树种的地块及林中空隙地，采取林冠下更新、空隙地再造林。

3 Terms and definitions

The following terms and its' definitions apply to the standard.

3.1 Natural seabuckthorn forest

Natural seabuckthorn forests refer to the seabuckthorn forests of natural origin, include the seabuckthorn forests formed by natural formation, artificial promotion of natural regeneration or initiation. The natural forest of seabuckthorn mainly consists of ecological forest and ecological economic forest.

3.2 Seabuckthorn plantation

Seabuckthorn plantation refers to these seabuckthorn forests formed by artificial measures, which can be divided into ecological forest, ecological economic forest and economic forest by the purpose of management.

3.3 Low function standing forests of seabuckthorn

Due to the direct action of human factors or induced natural factors, the structure and stability of stands are disordered, the growth of trees is stunted or decayed, and the system functions are degraded or lost, all of them result in the ecological service functions of stands, especially the fruit leaf yield and biomass or biodiversity, which are significantly lower than the average level of the same stand under similar site conditions.

3.4 Stand transformation or improvement

Stand transformation, improvement or reconstruction means that the stand with low yield and low value can be transformed into high yield and high value by artificial measures.

3.5 Strip reconstruction or improvement

The retention zone (block) and the reduction and transformation zone (block) are designated according to the purpose of management, stand status and site conditions for the low-quality or low-efficiency seabuckthorn forests.

3.6 Lumpish reconstruction or improvement

When the promising target tree species are distributed in clusters or clumps in the ecologically economic mixed forests of seabuckthorn, the plots of non-target tree species and the gaps in the forest are mainly replanted under the canopy and replanted in the gaps.

4 林分调查与评价

林分调查主要包括林分因子、立地因子调查以及生态服务功能调查和评价，按GB/T 26424执行。

4.1 林分因子

主要包括林分起源、树种、初植密度、林龄、雌雄株比例、混交比例、胸（地）径、高度、密度、郁闭度、萌蘖状况、果实产量、叶产量，等。

4.2 立地因子

主要包括土壤因子、地形因子以及地理位置。

4.2.1 土壤因子

主要包括土壤类型、土壤质地、土层厚度、有机质含量，等。

4.2.2 地形因子

主要包括经度、纬度、海拔、坡向、坡度、坡位，等。

4.3 林分评价

4.3.1 总体评价

主要包括沙棘林生长发育状况、林分结构稳定性、立地生产力实现（包括果叶产量）、系统服务功能水平。把是否显著低于同类立地条件下相同林分平均水平作为评价林分质量的基本标准。

4.3.2 评价指标

依据GB/T 38582，确定林分的供给功能（果、叶、生物量等产量），调节功能（保持水土、涵养水源、防风固沙、调节气候等），支持功能（土壤形成、养分循环、固碳释氧、生物多样性维持等），文化功能（休闲娱乐、审美体验、科学研究等）。

4.3.3 指标选择

生态林，优先考虑调节功能，其次是支持功能，兼顾供给功能以及文化功能；生态经济林，优先考虑调节功能，其次是供给功能和支持功能，兼顾文化功能；经济林，优先考虑供给功能，其次是调节功能和支持功能，兼顾文化功能。

4 Stand survey and evaluation

4.1 Stand survey

According to GB/T 26424, the stand survey of seabuckthorn mainly includes stand factor investigation, site factor investigation and ecological service function investigation and evaluation of the seabuckthorn stands.

4.1.1 Stand factors

The stand factors mainly include the origin of stands, tree species, initial plant density, age of stand, ratio of male and female plants, mixing ratio, chest (ground) diameter, height, density, canopy, sprout condition, fruit yield, leaf yield, etc.

4.1.2 Site factors

The site factors mainly include soil factor, topographic factor and geographical location.

A) The soil factors mainly includesoil type, soil texture, soil thickness, organic matter content, etc.

B) The terrain factors mainly include longitude, latitude, elevation, slope direction, slope position, etc.

4.2 Stand evaluation

4.2.1 Overall evaluation

Overall evaluation mainly include the growth and development status of seabuckthorn forests, the stability of stand structure, the realization of site productivity (including fruits and leaf yield), and the level of eco-system service function. Whether it is significantly lower than the

average level of the same stand under similar site conditions is taken as the basic standard to evaluate the quality of the stand.

4.2.2 Evaluation indicators

According to GB/T 38582, the supply function (fruit, leaf, biomass, etc.), regulating function (soil and water conservation, water resources conservation, wind and sand fixation, climate regulation, etc.), supporting function (soil formation, nutrient cycling, carbon fixation and oxygen release, biodiversity maintenance, etc.) and cultural function (recreation, aesthetic experience, scientific research, etc.) of the seabuckthorn stands were determined.

4.2.3 Indicators selected

The ecological seabuckthorn forest gives priority to the regulating function, followed by the supporting function, giving consideration to the supply function and the cultural function. The eco-economic seabuckthorn forest gives priority to the regulation function, followed by the supply function and support function, taking into account the cultural function. The conomic seabuckthorn forest gives priority to the function of supply, followed by the function of regulation and support, taking into account the cultural function.

5 技术要求和作业设计

沙棘林提质增效的总体原则：尊重自然，科学改造；目标导向，生态经济；因地制宜，因林施策；保护生境，保持水土。

5.1 技术要求

5.1.1 技术流程

林分改造技术流程：调查分类、作业设计、查验审批、施工、检查验收，等。

5.1.2 作业面积

根据林分实际情况和评判标准确定改造的作业面积，但更新改造方式一次集中连片作业面积不得大于20 hm²。

5.1.3 布局配置

林分改造应综合考虑改造区域地带性森林群落演替规律、品种在时空上的科学、合理的布局与配置，通过改造实施，达到调整、优化林分结构的效果，进而实现提质增效的目的。

5.2 设计要求

5.2.1 设计单元与单位

林分改造作业设计以小班为基本单元，以乡镇、场所等经营单位为设计文件的申报单位。作业设计需经县级及以上林业主管部门审核批准，并以此作为施工作业和检查验收的主要依据。

5.2.2 设计时限

林分改造作业设计的期限为一个作业年度，在批复后至次年底间实施有效。

5.3 设计过程

5.3.1 资料搜集

改造区域的相关资料，包括自然概况、近期林分经营调查、种植总体规划、沙棘林专项调查及社会经济等文字、图、表材料。

5.3.2 小班调查

对拟改造沙棘林小班面积进行确定。小班面积应分别设置1-3块面积为20.0 m×30.0 m、30.0 m×40.0 m的典型标准地，或宽20.0 m、长50~150.0 m的样带（1 hm²以下设1块、1.01~5 hm²设2块、5 hm²以上设3块）；对拟提质增效改造的林带应设置1-3段长度为20.0 m~50.0 m、宽度为20.0 m的样带，进行林分因子、立地因子等方面的调查。

5.3.3 实施设计

按照林分评判标准，通过对拟改造林地的立地条件和林分现状的评价，确定改造方式及技术要求，在现场进行初步设计的基础上，根据室内计算、分析与整理，完成各项内容、技术措施的设计，编制设计说明书，并绘制设计图件。

5 Technical requirements and operation design

5.1 General principle

The general principle of improving the quality and efficiency of seabuckthorn forests is which respects naturallaws, transforms scientifically, orients by management goal, coordinates ecological and economic benefits, adopts policies according to local conditions, takes policies with seabuckthorn forests, protects habitats and conserves water and soil.

5.2 Technical requirements

5.2.1 Technical Process

Technical process of transformation for improving the quality and efficiency of seabuckthorn forests includes investigation, classification, operation design, examination, approval, construction, inspection and acceptance, etc.

5.2.2 Working area

The working area of transformation for improving the quality and efficiency of seabuckthorn forests is determined according to the actual situation of the stand and the evaluation criteria, but the working area of the stand transformation method in one shot at a time should not be more than 20 hm².

5.2.3 Overall arrangement

It is necessary to comprehensively consider the succession law of zonal forest community, and the scientific and reasonable distribution and collocation of the seabuckthorn varieties in time and space. Through the stand transformation, the effect of adjusting and optimizing the stand structure can be achieved, and then the purpose of improving the quality and efficiency of seabuckthorn forests can be realized.

5.3 Design requirements

5.3.1 Design unit and units

The operation design of stand transformation of seabuckthorn forests takes small compartment as the basic unit, and the management units such as township and forestry station as the reporting units of the design documents. The operation design shall be examined and approved by the forestry authorities at the county level and above, which shall be used as the main basis for construction operations and inspection and acceptance.

5.3.2 Design time-limit

The period of operation design of stand transformation for improving the quality and efficiency of seabuckthorn forests is one operation year, and it shall be effective between the approval and the end of the next year.

5.4 Design process

5.4.1 Data collection

Relevant information of the stand transformation area for improving the quality and efficiency of seabuckthorn forests includes the texts, pictures, and tables such as the natural overview, recent stand management survey, planting overall planning, seabuckthorn forest special survey and social economy, etc.

5.4.2 Small compartment survey

The small Compartment area of seabuckthorn forests to be transformed was determined. The small compartment area should be set 1-3 typical standard areas with an area of 20.0 m×30.0 m and 30.0 m×40.0 m, respectively, or transect belt 20.0 min width and 50 - 150.0 min length (1 piece of area less than 1 hm², 2 pieces of area 1.01 ~ 5 hm², 3 pieces of area more than 5 hm²); To improve the quality and efficiency of the forest belt, 1-3 sections of 20.0 - 50.0 m in length and 20.0 m in width should be setup, and the stand factors and site factors should be investigated.

5.4.3 Implementation design

According to the stand evaluation standards, through the evaluation of the site conditions and the current situation of the seabuckthorn forests to be transformed, the transformation method and technical requirements are determined. On the basis of the preliminary design on the site, the design of various contents and technical measures is completed according to the indoor calculation, analysis and sorting, the design specification is prepared and the design drawings are drawn.

6 林分改造

6.1 改造对象

林龄大且综合功能明显下降的（经济林、生态经济林和生态林林龄分别大于8年、10年、15年以上者）、雌雄比失衡的（经济林、生态经济林和生态林分别低于7:3、6:4和2:8）、萌蘖等使密度过大的（经济林、生态经济林和生态林的密度大于5000、10000和20000株/hm²）、人工作业难以出入的、个体生长显著衰退的、群落结构不稳定的、病虫害危害严重的、果叶产量低于平均水平的（主要指经济林和生态经济林）林分。

6.2 改造目标

根据立地质量，调整雌雄比例及密度，经济林、生态经济林和生态林改造后雌雄比不小于(8:1)、(7:3~8:1)和(5:5~7:3)密度不大于1250、1250-1650和1650-2500株/hm²，最终达到盛果期产果量不低于3000、2250和1200 kg/hm²的目标。生态林或生态经济林改造要兼顾灌乔伴生、常绿落叶混交，且层次明显、密度适中、群落稳定、功能优良。

6.3 改造方法

沙棘林分改造主要有带状间伐、去雄改造、补植补造、平茬复壮、整形修剪和老龄林更新6种方式。

6.3.1 带状间伐

对于面积较大（超过13.33 hm²），或火灾严重的成片沙棘纯林应当采取带状间伐的办法进行林分改造；对于树种组成、林分结构单一，林木分布不均、林下植被覆盖度小于0.4，病虫鼠兔危害严重（病腐木超过20.0%）的沙棘林也可采用群团状改造。

(1) 生态林和生态经济林：根据林分生长的立地沿等高线或地平线，伐带宽度3.0 m，保留带宽度6.0 m~8.0 m。在带内保留两行沙棘，株行距1.0 m×2.0 m。

(2) 经济林：采取“砍2留3，即砍两行留三行，行间距应保证利于正常生产经营，一般为2.0~3.0 m，同时清理病、枯死株，加强水肥管理，调整雌雄比。

6.3.2 去雄改造

生态经济林或经济林：对林分密度大、雌雄比失衡的林分，伐除过密的个体，清除杂灌木和多余雄株；并隔八行雌株栽植一行雄株，混交行内隔八株雌株栽植一株雄株，保持雄雌比1:8。在沙棘园的四周或花期的主风向栽植1-2行雄株，保证雌株充分授粉。

6.3.3 补植补造

(1) 生态林：在干旱阳坡土壤水分较差的立地可以混交耐旱的乡土树种，在山坡底部或沟道内水肥条件较好的立地可混交速生树种，可选择行混、带混和块混。对于补植补造的乡土树种，按照设计要求确定混交方式、造林密度，采用穴状整地，整地规格根据栽植的苗木大小确定，苗木应采用GB 6000规定的I级苗木。

(2) 生态经济林或经济林：对于死亡或枯死株，补植时进行深翻整地，按“品”字形排列，规格40 cm×40 cm×30 cm。补植的沙棘苗木应采用扦插良种苗，苗高30 cm以上、地径0.30 cm以上。每公顷密度1650株，株行距2.0 m×3.0 m，春秋季均可补植，春季萌动前，秋季落叶后。栽植时，应使根系舒展，深浅适宜，适时灌溉保墒。

补植补造时，针对果用型、牧用型（饲料林）、生态型（防护林）、以及兼用型林分经营目标的差异选用不同的沙棘良种实施品种改良。

6.3.4 平茬复壮

根据沙棘萌蘖特性和生长阶段，在造林后8~10年开始，对于生长老化沙棘或萌生沙棘林进行平茬复壮作业。平茬时，可按2.0~3.0 m（根据立地条件也可以放宽到3.0~5.0 m）的宽度沿等高线或作业道

路方向实施带状间伐，并保留同样宽度的沙棘林带，待萌生苗郁闭后，再对保留带实施平茬复壮；平茬时间宜选择在秋季沙棘落叶后至春季树液未流动之前。平茬时应保留茬口平整，避免撕裂现象的发生。

6.3.5 整形修剪

整形修剪对象为沙棘经济林和生态经济林，主要方法有短截、长放、疏除和摘心等。在造林后3~5年开始，适时疏剪，及时将内部过密、病虫害枝条、干枯枝条、不能利用的枝条、徒长枝条、交叉生长的枝条进行适当疏剪，改良冠型，增加林间通风透光率。短截主要是修剪前一年生枝梢的一部分，促进新生枝条萌发，改良树势，抑制徒长枝生长，促进树冠生长发育。摘心处理是在新梢萌发后，将新梢顶端的嫩芽摘除，抑制新梢生长，积累更多营养物质有利于新萌发的枝条木质化，提高沙棘座果率。

6.3.6 老龄林更新

立地条件差的林分一般在造林后8~10年开始，沿坡面等高线或作业道路实行带状改造；立地条件好的在造林后20~25年开始，伐除改造带内老化、退化、弱化的植株，挖除伐除株根结，然后重新栽植目的树种或品种；根据实际情况，也可能同时采取6.3.2去雄改造、6.3.3补植补造（包括品种改良）等措施。改造林分带宽一般为2.0~3.0 m（甚至到3.0~5.0 m）。

6 Stand transformation

6.1 Object transformed

The aged seabuckthorn forests and its' comprehensive function decreased obviously, such as the age of the economic forest, the eco-economic forest and the ecological forest is more than 8 years, 10 years and 15 years, respectively. The gender ratio of male to female in seabuckthorn forests is unbalanced, such as the economic forest, the eco-economic forest and the ecological forest are less than 7:3, 6:4 and 2:8, respectively. The germination of tillers are too high density, such as the economic forests, eco-forests and ecological forests with densities greater than 5000, 10000 and 20000 plants per hectare. Other such difficult to access by artificial operations, significant decline in individual growth, unstable community structure, serious damage by diseases and pests, and lower than average fruit and leaf yield, the seabuckthorn harvest indicators here are mainly economic forests and eco-economic forests.

6.2 Transformation Objectives

According to the site quality of the seabuckthorn forests transformed, the ratio of male to female and the density of ecological forest, eco-economic forest and ecological forest is adjusted, and the ratio of male to female is not less than (8:1), (7:3 ~ 8:1) and (5:5 ~ 7:3), the density of them not more than 1250, 1250 - 1650 and 1650 - 2500 plants per hectare, respectively. The goal of these seabuckthorn fruit yield of not less than 3000, 2250 and 1200 kg per hectare in the full fruit period is reached, respectively. The transformation of ecological forest or eco-economic forest should take into account the combination of shrubs and arbors, evergreen and deciduous trees. Finally, the seabuckthorn forests are transformed into an obvious level, moderate density, stable community and excellent function.

6.3 Transformation method

6.3.1 General provision

The transformation of seabuckthorn stands mainly consists of six methods as strip thinning, de-male transformation, supplementary planting, stumping rejuvenation, shaping and pruning and old forest renewal.

6.3.2 Strip thinning

For the areas greater than 13.33 hm² or the serious fire disaster of pure seabuckthorn forests, the method of strip thinning should be adopted to transform the stand. For the seabuckthorn forests with single tree species composition, single stand structure, uneven tree distribution, understory vegetation coverage less than 0.4, and serious damage more than 20.0 % of diseased plants by diseases and pests and pika, cluster transformation can also be adopted.

- A) Ecological forests and eco-economic forests: according to the stand growth along the contour line or horizon, the width of the cutting zone is 3.0 m and the width of the retention zone is 6.0 - 8.0 m. Two rows of seabuckthorn stands are kept in the belt with the spacing of the rows 1.0 m × 2.0m.
- B) Economic forests: take the method of "cut 2 and leave 3 "in seabuckthorn stands for transformation, that is, cut two lines and leave three lines, the line spacing should ensure that it is conducive to normal production and management, generally 2.0-3.0m, and cleanup diseases and dead plants, strengthen soil water and fertilizer management, and adjust the male-female ratio.

6.3.3 De-male transformation

Ecol-economic forests or economic forests: For transformation of seabuckthorn stands with high stand density and imbalance of male and female ratio, cut down over-dense individuals, remove miscellaneous shrubs and excess male plants. At the sametime, a row of male plants are planted in eight rows of female plants, and a male plant is planted in eight rows of female plants in the mixed row, and the ratio of male to female becomes 1:8. Plant 1 to 2 rows of male plants around the garden or in the main wind direction during flowering to ensure full pollination of female plants.

6.3.4 Planting and replanting

- A) Ecological forests: the drought-tolerant native tree species can be mixed in the site with poor soil moisture on the arid sunny slope, and fast-growing tree species can be mixed in the site with good water and fertilizer conditions at the bottom of the hillside or in the channel. For the local tree species that are planted and replanted, the mixed mode and afforestation density are determined according to the design requirements, and the land preparation is determined according to the size of the planted seedlings, and the seedlings should use the Grade I seedlings specified in GB 6000.
- B) Eco-economic forests or economic forests: for seabuckthorn dead or wither plants, deep tilting is carried out when replanting, arranged in the shape of "品", and the grid is 40 cm×40 cm×30 cm. Cuttings of seabuckthorn seedlings should be used, with a height of more than 30 cm and a diameter of more than 0.30 cm. The density of 1650 plants per hectare, the row spacing of 2.0m × 3.0m, can be replanted in spring and autumn, before sprouting in spring, or after falling leaves in autumn. When planting, the root system should be stretched, the depth is appropriate, and timely irrigation should conserve the soil moisture.

Different seabuckthorn varieties are selected to carry out variety improvement or transformation according to the difference of fruit-using type, grazing type (feed forest), ecological type (shelterbelt) and dual- or multi- use type stand management objectives.

6.3.5 Stumping rejuvenation

According to the sprouting characteristics and growth stages of seabuckthorn, starting from 8 to 10 years after afforestation, the aging or sprouting seabuckthorn forests should be reinvigorated. When the seabuckthorn forest stumping, strip thinning can be carried out along the contour line or the direction of the working road according to the width of 2.0 ~ 3.0 m (it can also be relaxed to 3.0 ~ 5.0 m according to the site conditions), and these seabuckthorn forest belts of the same width can be retained, and then the stubble restoration can be implemented on the retained belt after the sprouting seabuckthorn seedlings are closed. The stumping time should be chosen from autumn after the fall of seabuckthorn leaves to spring before the plant sap does not flow. The stumping should be kept flat to avoid tearing phenomenon.

6.3.6 Shaping and trimming

The shaping and trimming objects are the seabuckthorn economic forests and eco-economic forests, and the main methods are truncation, long-cropping, thinning and core-extraction. Starting from 3 to 5 years after afforestation, timely thinning, timely thinning of internal too dense, disease and insect pests, dried branches, unusable branches, barren branches, cross-growing branches, to improve the crown type, increase the ventilation and light transmission rate between forests. Shorting is mainly to trim part of the top of the previous year's branches, promote the germination of new branches, improve tree potential, inhibit the growth of barren branches, and promote the growth and development of the crown. The core extraction treatment is to remove the buds at the top of new shoots after germination, inhibit the growth of new shoots, accumulate more nutrients, which is conducive to lignification of newly germinated shoots and increase the percentage of seabuckthorn fruit.

6.3.7 Old forest renewal

In the stand with poor site condition, the belt reconstruction along the slope contour or working road is generally implemented from 8 to 10 years after seabuckthorn afforestation. Starting from 20 to 25 years after seabuckthorn afforestation, the aged, degraded and weakened plants in the transformation zone should be cut down, the root knot of the plant should be dug up, and the target trees or varieties should be replanted. According to the actual situation, measures such as 6.3.2 De-male transformation and 6.3.3 Planting and replanting (including varieties improvement) may also be taken at the same time. The reconstructed stand belt width is generally 2.0 ~ 3.0 m (or even 3.0 ~ 5.0 m).

7 抚育管理

抚育管理主要包括林分的草灌调控、水肥管理以及主要病虫害防治等。

7.1 水肥管理

沙棘经济林视土壤墒情适时浇水，一般在春季树液萌动之前和秋季树木休眠之后各灌水一次，土壤湿度保持在田间最大持水量的60 %左右为适宜。萌动前施高氮复合肥，采用条带施肥，深度10 cm ~ 20 cm，施肥量为600 kg/hm² ~ 900 kg/hm²；增施农家肥或菌肥。

7.2 松土除草

沙棘经济林生长期及时进行松土除草，5-9月适时除草，保持土壤疏松，无杂草。

7.3 有害生物防治

7.3.1 病害防治

(1) **沙棘干缩病**：加强土肥水管理，科学增施有机肥料，干旱缺水时及时灌溉，加强松土保墒，合理修剪，及时清除病死株，并集中烧毁。发病初期，结合开沟施肥，根灌70 %甲基硫菌灵500倍液~1000倍液或根腐灵1000倍液等。

(2) **沙棘缩叶病**：加强水肥管理，干旱缺水时及时灌溉，加强松土保墒，合理施肥，提高树势。发现缩卷叶及时进行剪除；发病初期，结合浇水使用0.1 %盐酸四环素液或0.1 %土霉素液，按每株用量200~300 ml灌根，也可使用10g四环素粉剂(25万单位)100倍液喷施树冠。

7.3.2 虫害防治

(1) **沙棘木蠹蛾**：在卵及孵化期，向树干喷施 40 %乐果乳剂 1000 倍液、50 %的辛硫磷 400~500 倍液。每 15~20 d 1 次，毒杀初孵幼虫。用 40 %乐果柴油液（混合比例为 1:1）涂抹蛀孔处。40 %乐果乳油 60 倍注入虫孔，外敷黄泥。

(2) **沙棘蚜虫**：冬季喷石硫合剂清除越冬卵。成蚜、若蚜发生期，用 10 %吡虫啉 1000 倍、10 %氯氰、啉虫脲乳油 1500 倍或 15 %氟啶虫酰胺·联苯菊酯悬浮剂 4000 倍液喷雾灭蚜。增加并保护园内瓢虫等天敌。

(3) **金龟子**：在沙棘林周围高大树上筑巢招鸟；喷施金龟子芽孢杆菌，每亩用 10 亿活孢子/g 菌粉 100 g。幼虫期 50%辛硫磷颗粒剂 1: 10 拌土(2~2.5kg 掺细土 25~50kg)，撒后浅锄 50 %辛硫磷 2000X 按 1: 10 拌种；成虫盛发期喷施 90 %敌百虫、40 %氧化乐果、75 %辛硫磷 500~000X 或 255 西维因粉 1000~1500X。

7 Tending management

7.1 General provision

The tending management of the seabuckthorn stands mainly includes the control of grasses and shrubs, water and fertilizer management, and the prevention and control of major diseases and pests, etc.

7.2 Water and fertilizer management

The economic seabuckthorn forests should be watered according to the soil moisture. It is generally irrigated once before the tree sap sprouting in spring and after the tree dormancy in autumn. It is suitable to keep the soil moisture at about 60 % of the maximum field water capacity. Before sprouting, high-nitrogen compound fertilizer is applied, strip fertilization is

adopted, the depth is 10 cm ~ 20 cm, and the fertilizer amount is 600 kg/hm² ~ 900 kg/hm², and increase the application of farm manure or bacterial manure.

7.3 Loosen the soil and weed control

The growth period of economic seabuckthorn forest should be timely loosened and weeded, and timely weeded from May to September to keep the soil loose and without weeds.

7.4 Pest control

7.4.1 Disease prevention and control

- A) Prevention and control of seabuckthorn dry shrinkage disease: strengthen soil and fertilizer water management, scientific increase of organic fertilizer, timely irrigation when drought and water shortage, strengthen soil conservation, reasonable pruning, timely removal of sick and dead plants, and centralized burning. At the early stage of the disease, combined with trenching fertilization, root irrigation of 70% methylthiobacillam 500 times liquid to 1000 times liquid or root rot 1000 times liquid.
- B) Prevention and control of seabuckthorn leaf shrinkage disease: strengthen water and fertilizer management, timely irrigation when there is drought and water shortage, strengthen soil loosening and moisture retention, reasonable fertilization, and improve tree growth. The coiling leaves are found and cut off in time. At the early stage of the disease, 0.1% tetracycline hydrochloride solution or 0.1% oxytetracycline solution is used in combination with watering, and the roots are be irrigated 200 to 300 ml per plant, or 10gtetracycline powder (250,000 units) could be used to spray the crown with 100 times the liquid.

7.4.2 Pest prevention and control

- A) Prevention and control of seabuckthorn moth: In the egg and incubation period, the trunk is sprayed with 40% Dimethoate emulsion 1000 times liquid, 50% phoxius 400 ~ 500 times liquid. The first hatched larvae are poisoned once every 15 to 20 days. Apply 40% Dimethoate diesel liquid (mix ratio 1:1) to the cavity. 40% Dimethoate emulsified oil is injected 60 times into wormholes and coated with yellow mud.
- B) Prevention and control of seabuckthorn aphids: winter spray sulfur mixture to remove overwintering eggs. In aphid or aphid occurrence stage, use 10% imidacloprid 1000 times, 10% cyanamidine chloride 1500 times or 15% fluridacamide and bifenthrin 4000 times liquid spray to kill aphid. Increase and protect natural enemies such as ladybugs in the park.
- C) Prevention and control of seabuckthorn Chafer: nesting in tall trees around seabuckthorn forests to attract birds; Spray Bacillus scarab, 15 billion live spores bacterial powder 100 g per gram and per hectare. At the larval stage, 50% phoxiphos granules are mixed with soil 1:10 (2~2.5 kg blended with fine soil 25~50 kg), and the seeds are mixed with 50% phoxiphos 2000X at 1:10 after spreading. At the peak of adult growth, 90% trichlorphon, 40% Dimethoate oxide, 75% phoxiphos 500 ~ 1000X or 255 carbaryl powder 1000 ~ 1500X are sprayed.

8 施工验收

8.1 施工过程

8.1.1 施工准备

——经审批的作业设计是施工的主要依据，经营单位应根据设计的改造小班（地段）、施工时间安排，组织施工员进行现场踏勘，核实作业地块、改造方式等技术措施的要求，做好器具、材料的准备，并明确每个改造小班、地段的作业指导员；

——开展施工员的上岗培训，包括作业流程、改造方式、枯死株的采伐、种植（补植）等方面的技术要求；

——采取抚育间伐、择伐作业的改造小班，严格按照设计要求；补植补栽地块，提前明确标定栽植位置。

8.1.2 施工要求

——严格按照作业设计的区域范围、作业面积、改造方式、改造技术等要求开展施工；

——施工员在每个流程开始时进行现场示范和指导，让作业人员掌握有关技术要求；

——改造作业中清除病虫源林木、枝桠，及时就近隔离处理，防止病虫扩散与传播；

——改造过程中采用的苗木均应达到国家标准（GB 6000）规定 I 级的要求；

——做好作业小班、地段的沙棘林地清理，创造有利于保留株、新植沙棘苗的生长环境；

——作业过程中做好护林防火与施工安全工作。

8.2 检查验收

8.2.1 检查验收办法

生态林或生态经济林由省（市、区）林业主管部门组织检查验收；经济林（种植园、丰产园）由经营者组织验收。

8.2.2 检查验收内容

根据设计文件组织检查验收。其内容主要包括：

——作业区的地点、范围、面积；

——改造作业实施情况；

——抚育管理实施情况；

——改造作业综合评价。

8 Construction acceptance

8.1 Construction process

8.1.1 Construction preparations

The construction preparations are as follows:

A) The approved operation design is the main basis for the construction. The business unit shall organize the construction personnel to carry out site survey according to the designed transformation small compartments (lots) and the construction schedule, verify the requirements of technical measures such as the operation plot and transformation method, prepare the equipment and materials, and specify the operation instructor for each transformation small compartment and lot.

- B) Carry out on-the-job training of construction workers which includes the technical requirements of operation process, transformation methods, cutting of dead plants, planting (replanting), etc.;
- C) Adopt the transformed small compartments of tending thinning and selective cutting, strictly in accordance with the design requirements, replanting plots, clearly demarcate the planting position in advance.

8.1.2 Construction requirements

The construction requirements are as follows:

- A) The construction shall be carried out in strict accordance with the requirements of the regional scope, operation area, transformation methods and reconstruction technology of the operation design.
- B) At the beginning of each process, the construction staff conduct on-site demonstration and guidance, so that the operator can grasp the relevant technical requirements.
- C) In the reconstruction operation, the trees and branches infected with the diseases and insects should be removed and treated in a timely manner to prevent the spread and propagation of the diseases and insects.
- D) The seedlings used in the transformation process should meet the requirements of the national standard (GB 6000) level I.
- E) Do a good job in small compartments and sections of the seabuckthorn forest clearing, to create a favorable growth environment for retaining plants and new replanting seabuckthorn seedlings.
- F) Do a good job of forest fire protection and construction safety in the process of these seabuckthorn forests transformation.

8.2 Inspection and acceptance

8.2.1 Inspection and acceptance means

Ecological seabuckthorn forest or eco-economic seabuckthorn forest shall be inspected and accepted by the provincial or municipal or district forestry department; Economic seabuckthorn forests including plantations and high-yield orchards shall be inspected by the operators.

8.2.2 Inspecting the acceptance content

According to design documents, organize inspection and acceptance, the contents mainly as follows:

- A) The location, scope and area of the working area.
- B) The implementation of the transformation operation.
- C) The implementation of nurturing management.
- D) Comprehensive evaluation of transformation operation.

9 监测与档案管理

9.1 监测评价

改造的沙棘林地应纳入沙棘生态工程建设的监测体系，定期进行调查，掌握沙棘资源的动态变化，总结不同改造方式、技术措施的成效与经验。

9.2 档案管理

按GB/T 11822执行。

9 Monitoring and archives management

9.1 Monitoring and evaluation

The transformed seabuckthorn forest land should be included in the monitoring system of seabuckthorn ecological engineering construction, regular investigation should be carried out to grasp the dynamic changes of seabuckthorn resources, and the effectiveness and experience of different transformation methods and technical measures should be summarized.

9.2 Archives management

Archives Management runs with the GB/T 11822.