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Definition of silviculture in forestry

Silviculture is a practice of controlling growth, composition/structure and quality of forests in order to meet values and needs, in particular the production of timber. The name comes from Latin silvi- (forest) and culture (growing). The study of forests and forests is said to be silvyology. Silviculture also focuses on the treatment of forest owls being used to preserve and improve their productivity. [1] In general, silviculture is a science and art of cultivation and cultivation of forest crops, based on knowledge of silvik (study of life history and general characteristics of forest trees and stalls, with special attention to local/regional factors). [2] In particular, silviculture is a practice of controlling the establishment and management of forest resources. The difference between forestry and silviculture is that silviculture is applied at stand-level, while forestry is a broader concept. Adaptive management is common in silvikulturia, while forestry can include natural/preserved land without stand-level management and treatment application. Silviculture systems The origin of forestry in German-speaking Europe defined silviculture systems as wide as high forests (Hochwald), standards coppicos (Mittelwald) and complex coppice, short rotary coppice and coppice (Niederwald). There are other systems. These different silviculture systems include several methods of harvesting, which are often mistakenly said to be silvicultural systems, but can also be called a method of rejuvenation or regeneration depending on the purpose. The high forest system is further divided into German:[3] High Forest (Hochwald) Age Class Forest (Altersklassenwald) Even Age Forestry Clean Cutting (Kahlschlag) Shelterwood Cutting (Schir Seed-tree Method Uneven-Age Forestry Femel Selection Cutting (Group Selection Cutting) (Femelschlag) Strip Selection Cutting (Strip-and-Group Logging System) (Saumsch Shelterwood Wedge Cutting (Schirmkeilschlag) Mixed Form Regeneration Methods (Mischformen) Continuous Forestry Cover (Dauerwald) Forest selection of uneven forests (Plenterwald) Target diameter harvest (Zielstärkennutzung) These names give the impression that they are neatly defined systems, but in practice there are variations within these harvesting methods in accordance with local ecology and conditions at the site. Although the location of the archetypal form of the harvesting technique can be identified (all were formed somewhere with a certain forester, and are described in the scientific literature), and broad generalizations can be made, these are only rules, not strict designs on how techniques can be applied. This misunderstanding meant that many older English textbooks did not record the true complexity of silviculture as practiced where it originated in Mitteleuropa. This It was culturally based on wood production in moderate and boreal climate change and did not engage in tropical forestry. The misapp application of this philosophy to these tropical forests was problematic. There is also an alternative silviculturna tradition that developed in Japan and thus created a different biocultural landscape called satoyama. After harvesting comes regeneration, which can be divided into natural and artificial (see below), and nourishing, which includes release treatments, pruning, thinning and intermediate treatments. [4] It is conceivable that any of these 3 phases (harvest, regeneration and nurturing) can occur at the same time inside the stand, depending on the target for that particular stand. Regeneration Regeneration is basic for the continuation of forested, as well as for the a foresting of treeless land. Regeneration can take place through self-sown seeds (natural regeneration), artificially sown seeds or planted seedlings. In any case, the success of regeneration depends on its growth potential and the degree to which its environment allows it to express potential. [5] Seeds, of course, are needed for all ways of regeneration, both for natural or artificial sowing and for raising planting stock in the nursery. Natural regeneration is a human-assisted natural regeneration agent for establishing a forest age class from natural sowing or germination in the area after harvesting in the area through selection cutting, shelter (or seminal) harvesting, soil preparation or limiting the size of a biscuit stand to ensure natural regeneration from surrounding trees. The process of natural regeneration involves the restoration of forests using self-seeded seeds, root suckers or coppicing. In natural forests, conilings rely almost entirely on regeneration through seeds. However, most wide waves can be regenerated using the formation of shoots from stumps (coppice) and broken stems. [6] [full quotation required] Seed requirements Any seed, self-sown or artificially administered, requires seeds suitable for germination assurance. To germinate, seeds require appropriate conditions of temperature, humidity and aeration. For seeds of many species, light is also needed and facilitates seed germination in other species,[7] but spruce trees are not accurate in their light requirements and will germinate without light. White spruce seeds germinate at 35 °F (1.7 °C) and 40 °F (4.4 °C) after continuous disarerment for a year or longer and developed radiuses of less than 6 cm (2.4 in)long in a cold room. [8] When exposed to light, these germinations developed chlorophyll and were usually phototropic with continued permeation. To survive in the short and medium term, germination is required: a constant supply of moisture; freedom from lethal temperature; enough light to generate photosynthate to support breathing and growth, but not enough to create deadly stress in the seedling; freedom from browsers, tingling and pathogens; stable root system. Shade is very important for the survival of young seedlings. [9] [10] In the long term, there must be an adequate supply of essential nutrients and the absence of suffocation. In an undisturbed forest, the decomposed windshield provides the most favorable seeds for germination and survival, the moisture supply is reliable, and the elevation of seedlings slightly above the general level of the forest floor reduces the risk of suffocation with leaves and snow-pressed smaller vegetation; nor is such a microsite likely susceptible to flooding. The benefits given by these microsites include: more light, higher temperatures in the rooting zone and better development of mycorrhizal. [11] [12] [13] In a survey in Porcupine Hills, Manitoba, 90% of all spruce seedlings were rooted in rotting wood. [13] [14] Mineral soil seeds are more receptive than unobstructed forest bottoms and are generally wetter and more readily rewinded than organic forest bottom. However, exposed mineral soil, much more than organic soil, is susceptible to uplifting and collecting frost during drought. Forces formed in the soil by frost or dries are quite enough to break through the roots. [16] The range of microsites occurring on the forest floor may expand and their frequency and distribution may be influenced by site preparation. Each microsite has its own microclimax. Microclimate near the soil is better characterized by a vapede rate deficit and radiation of net incidents, rather than standard measurements of air temperature, precipitation and wind patterns. The aspect is an important component of the microclima, especially in relation to temperature and humid regimes. Germination and seedlings of Engelmann spruce were much better in the north than on the southern aspect of seeds in the Fraser Experimental Forest, Colorado; Seed and seedling ratios of 5 years old were established as 32:1, 76:1 and 72:1 on the northern aspect of the blade shadow, without blades and undisturbed seed. [17] Clearcut opens from 1.2 to 2.0 hectares (3.0 to 4.9 hectares) with the appropriate seed source, and no more than 6 tree heights, it could be expected to provide acceptable regeneration (4,900, 5-year-old trees per hectare), while on undisturbed unsubscribed northern aspects, and on all seed treatments tested on southern aspects, the seed-to-seed ratio would be so high that restocking any opening would be questionable. At least seven variable factors can affect seed germination: seed characteristics, light, oxygen, soil reaction (pH), temperature, humidity and seed enemies. [18] Humidity and temperature are the most influential, both of which are influenced by exposure. The (song) Ensuring the natural regeneration of Norwegian spruce and Scottish pine in northern Europe led to the adoption of various forms of reproduction cuttings that provided partial shade or protection of seedlings from hot sun and wind. [19] The main objective of echelon strips or border cuttings with exposure to the northeast was to protect regeneration from overheating and was created in Germany and successfully deployed by A. Alarik in 1925 and others in Sweden. [20] In exposure to the south and west, direct insolation and heat reflected from tree trunks often result in temperatures deadly to young seedlings,[21] as well as surface soil drying, which inhibits germination. The sun is less harmful on eastern exposures due to lower temperatures in the early morning hours, associated with higher humidity and the presence of dew points. In 1993, Henry Baldwin, after noticing that summer temperatures in North America were often higher than those in places where border cuttings were useful, reported the results of regeneration research at a red spruce stand plus scattered white spruce that was isolated by cleaning from all sides, so equipping the opportunity to observe regeneration at various exposures in this old field stand in Dummer, New Hampshire. [19] Regeneration involved a surprisingly large number of seedlings balm ethers from 5% of the standing component of the species. The maximum density of spruce regeneration, established 4 rods (20 m) inside from the edge of the stand at north 20 ° E exposure, was 600,000/ ha, with nearly 100,000 seedling balm. The prepared seeds remain receptive for a relatively short period, rarely even 5 years, sometimes less than 3 years. The receptivity of seeds in damp, fertile places decreases with a special rate, and especially in such places, the predicted preparation of seeds should be needed in order to take advantage of the good years of seeds. In bad seed years, the preparation of places can be carried out on mesic and drier places with more chance of success, due to the generally longer receptivity of seeds there than those in wetter places. [22] Although an indifferent seed year may suffice if the distribution of seeds is good and environmental conditions are favourable for germination and survival of seedlings,[23] small amounts of seeds are particularly vulnerable to the depredation of small mammals. [24] Significant flexibility is possible in preparing a timing site to coincide with cone crops. Treatment can be administered before any logging, between partial incisions or after check-in. [25] In cut and pantry strips, semen preparation can be carried out as a single operation, pre-scarifying leave strips, post-scary cut strips. [25] Incineration of effusion is not recommended as a method of preparing sites for natural regeneration, as it rarely exposes enough mineral soil to be receptive enough and burned organic are poor seeds for spruce. [26] [27] [28] [29] The watered surface may become too hot for good germination and may delay germination until autumn, with subsequent excessive mortality from unharmed seedlings. [30] Peeling and incineration of logging may, however, leave adequate exposures to mineral soil. [25] Planting season Further information: Tree plantingThis section is empty. You can help by adding to that. (February 2018) Artificial regeneration With the aim of reducing the time it takes to produce planting stocks, experiments were conducted with white spruce and three other coniling species from Wisconsin in the longer frost-free breeding season in Florida, 125 vs. 265 days in central Wisconsin and north Florida respectively. [31] As species adapted to long photoperiods were studied, extended daily lengths of 20 hours were applied in Florida. Other seedlings were bred under extended daily length in Wisconsin and with a natural daily length in both areas. After two growing seasons, white spruce during long days in Florida was about the same as that in Wisconsin, but twice as tall as plants under Wisconsin's natural photoperiodes. On natural days in Florida, with a short local photoperiod, white spruce was heavily dwarfed and had a low survival rate. Black spruce reacted similarly. After two growing seasons, long daily plants of all 4 species in Florida were well balanced, with good root and offshoot development, which equally or exceeded minimum standards for 2+1 and 2+2 outplanting of Lake States species stock. Their survival when it was erected in February and off the plan in Wisconsin is equivalent to that of a 2+2 transplant bred in Wisconsin. The artificial extension of photoperiods in the northern states of the lake greatly increased the height of the increase in white and black spruce in the second growing season. Optimal conditions for the growth of seedlings are determined for the production of containerized planting stock. [32] Alternating day/night temperatures were found more appropriate than the constant temperature; At 400 lumens/m² of light mode, day/night temperatures of 28 °C/20 °C are recommended for white spruce. In 1984, R. Tinus investigated the effects of day and night temperature combinations on height, calibil and dry weight of 4 sources of Engelmann spruce seeds. It seems that 4 semen sources have very similar temperature needs, with a night optima about the same slightly lower than daily optima. [34] The origin of trees is important in artificial regeneration. Good provenance takes into account the appropriate genetics of trees and a good environment suitable for planted / tree seeds in the forest stall. The wrong genotype can lead to failed regeneration or poor trees that are prone to pathogens and undesirable outcomes. Artificial regeneration has a more common method involving planting because it is more reliable than natural regeneration. Planting may include the use of seedlings (from nurseries), (in)rooted cuttings or seeds. [35] Whatever method is chosen, it can also be assisted by nurturing techniques known as mid-stand treatments. The fundamental genetic consideration in artificial regeneration is that seeds and planting stock must be adapted to the planting environment. Most often, the method of managing seeds and introducing stocks is through a system of defined seed zones, within which seeds and stocks can be maued without the risk of climatic irregularity. [36] Ontario adopted a seed zone system in the 1970s based on the G.A. Hills regions of 1952[37] and provincial resource district boundaries, but Ontario's seed zones are now based on homogeneous climatic regions developed with the Ontario climate model. [38] [36] The regulations stipulate that the edlotes identified as the source may be either a general collection, where only the zone of seed of origin is known, or a collection with a certain latitude and longitude. The movement of seeds and stocks of general collection across the boundaries of the seed zone is prohibited, but the use of seeds and stocks in another seed zone is acceptable when the Ontario Climate Model shows that the planting site and place of origin of seeds are climatically similar. Quebec's 12 white spruce seed zones are based mainly on ecological regions, with several modifications for administrative convenience. [39] Semen quality varies with source. Seed orchards produce seeds of the highest quality, followed by, to reduce the quality of seeds produced, seed production areas and seed collection areas, with controlled general collections and uncontrolled general collections producing the least characterized seeds. Seeds Ofoling, extraction When seeds are first separated from cones, it is mixed with a side of the substance, often 2 to 5 times the volume of seeds. More or less tightly attached membrane wings to the seed must be separated before being cleaned by the substance. [40] The test must not cause damage during the cut-off process. Two methods were used, dry and wet. Dry seeds can be slightly rubbed through a sieve that has a net through which only a wingless seed can pass. Large amounts of seeds can be processed in ododle machines, which use cylinders of heavy wire mesh and fast-rotating rigid brushes inside to remove the wings. In the wet process, seeds with attached wings are arranged 10 cm to 15 cm deep on a narrow floor and slightly moistened; light leather butterlashes are used to release seeds from the wings. B. Wang described a unique wet-aged procedure in 1973. The wings of white and Norwegian spruce seeds can be removed so that the seeds are slightly dammested before it Run through the fanning mill for the last time. [40] Any moistened seed must be dried before fermentation or formatting. Seed Sustainability Test biochemical sustainability fluorescein diacetate (FDA) for several types of coniling seeds, including white spruce, estimates the proportion of live semen (sustainability) in seeds, and thus the percentage of seedlot germination. The accuracy of the percentage germination prediction was within +/- 5 for most seedlots. [42] White spruce seeds can be tested for viability by indirect method, such as fluorescein diaceta (FDA) test [42] or Ultra-sound; [25] or by direct germination growth method. White spruce seed samples examined in 1928 [43] 1915 inspection [40] Germinative testing Germinative test results are usually expressed as germination capacity or germination percentage, which is the percentage of seeds germinating over a period of time, ending when germination is practically complete. During extraction and processing, white spruce seeds gradually lost moisture, and overall germination increased. Mittal et al. (1987) [44] Reported that white spruce seeds from Algonquin Park in Ontario received the maximum rate (94% in 6 days) and 99% of total germination in 21 days after a 14-week pre-cold. Previous treatment of 1% sodium hypochlorite increased germination. Encouraged by Russia's success in using ultrasonic waves to improve germination energy and percentage germination of agricultural crop seeds, Thymenine (1966)[45] showed the benefits of white spruce germination after exposure to semen at 1, 2 or 4 minutes of ultrasound generated by an M.S.E. ultrasonic disintegrator with an energy consumption of 280 VA and a power impact of 1.35 amps. [45]:Tables 3.18 and 3.19 However, none of the seeds germinated after 6 minutes of exposure to ultrasound. Seed sleepiness is a dormant complex phenomenon and is not always consistent within species. [46] The cold layering of white spruce seeds to break the bed rest was specified as a condition,[47][48][49][50], but Heit (1961)[51] and Hellum (1968)[52] considered layering unnecessary. The conditions for handling and storing cones affect the rest in this cold, wet storage (5 °C, 75% to 95% relative humidity) of cones before extraction of seemingly eliminated sleep by overcoming the need for sloning. [46] Periods of cold, wet weather during the cone storage period may provide natural cold (stratification) treatment. After the sleepiness was removed in the cone storage, the subsequent drying of the furnace and the storage of seeds did not reactivate the sleep. Haddon and Winston (1982)[46] found a decrease in the viability of snug seeds after 2 years of storage and suggested that stress may have been caused by slodging, e.g. reduced embryo strength, semen aging or actual embryo damage. They further questioned the quality of 2-year-old seeds even though there was high germination in samples that were not stratified. Cold layering Cold layering is a term applied to storing seeds in (and, strictly, in layers with) moist medium, often peat or sand, with the aim of maintaining sustainability and overcoming sleep. Cold slobing is a term that applies to storage at near-freezing temperatures, even if the medium is not used. A common method of cold sloning is soaking seeds in tap water for up to 24 hours, drying it superficially, and then keeping wet for several weeks or even months at temperatures just above freezing. [53] [54] [55] Although Hellum (1968)[52] found that the cold disarling of Alberta seed sources led to irregular germination, While reducing germination with an increase in the length of the layering period, Hocking's (1972)[56] paired test with layered and unstrated Alberta seeds from several sources found no trends in response to layering. Hocking suggested that it is necessary to control seed maturity, handling and storage before identifying the need for shredding. Later, Winston and Haddon (1981)[57] found that storing white cone spruce for 4 weeks at 5 °C before extraction stuned the need for shredding. Seed maturity seed maturity cannot be accurately predicted from the flotation of cones, the content of cone moisture, the specific gravity of the cone; but the province of B.C. found an embryo that occupies 90% + corrosion cavities and megagametophytes that are solid and whitish in color are the best predictors for white spruce in B.C.,[58] and Quebec can predict seed maturity a few weeks in advance by monitoring semen development against heat amounts and phenological progression of firegrass flowering (Epilobium angustifolium L.), a related plant species. [59] A cone collection earlier than a week before seed maturity would reduce seed germination and sustainability during storage. [59] Four stages of maturation are determined by monitoring carbohydrates, polyols, organic acids, breathing and metabolic activity. White spruce seeds require a 6-week ripening period after harvesting in a cone to obtain maximum germination,[60] However, based on the cumulative degrees of the day, seeds from the same trees and stalls showed that 2-week storage of cones was enough. [61] Forest tree nurseries See plant nursery Forest tree plantation Plantations Plantation criteria Plantations can be considered successful when extraplant performance meets certain criteria. The term free-range farming applies in some jurisdictions. The equivalent of Free-to-Grow (FTG) in Ontario refers to a forest stall that meets the minimum stock standard and height requirement and is essentially competition from surrounding vegetation that could interfere with the The FTG concept was introduced with the advent of the Ontario Forest Management Agreement programme in 1980 and was applied to all management units in 1986. The policies, procedures and methodologies readily used by forest unit managers to assess the effectiveness of regeneration programmes were still under development during the environmental assessment hearing. In British Columbia, the Forest Practice Code (1995)[63] governs performance criteria. In order to reduce the subjectivity of the deciduous competition assessment of whether or not a plantation was established, the minimum specifications of number, health, height and competition are set up in British Columbia. However, the minimum specifications remain subjectively set and may need to be fine-tuned to avoid unjustified delays in line with the established plantation status. For example, a powerful white spruce with a strong, multi-sided lead shoot and its crown fully exposed to light on 3 sides would not qualify as freely growing in the current Code of British Columbia, but it would hardly warrant a description as undated. Competition Competition occurs when individual organisms are close enough to each other to create a growth restriction through mutual modification of the local environment. [64] Plants can compete for light, moisture and nutrients, but rarely for space in itself. Vegetation management directs more location resources into usable forest products, rather than just eliminating all competing plants. [65] Ideally, site preparation mitigates competition with levels that mitigate restrictions severe enough to cause lengthy verification. The variety of boreal and sub-boreal stalls of mixed species of broad coniguous trees, commonly referred to as mixed wood, largely excludes the usefulness of generalizations and calls for the development of management practices involving greater inherent complexity of wide conigous mixtures, relative to one-time or mixed types of coniguous. [66] After harvesting or other disturbances, mixed wood stalls usually enter a longer period in which hardwoods over fly over cones, subjecting them to intense competition in sub-competition. It is well established that the regeneration and growth potential of subconscious spruce in mixed timbers correlates with the density of competing hardwoods. [67] In order to assist in the application of free-range regulations in British Columbia and Alberta, guidelines have been developed for management based on distance-dependent relationships within a limited radius of crop trees, no Lieffers et al. (2002)[68] found that free-rising supply standards did not adequately characterise light competition between wide and coniling components on boreal mixed wood stalls, and further noted that appropriate sampling using current approaches would be operational Many promise failed due to lack of care. Young crops are often ill-equipped to combat this with competition revived after initial preparation and planting of the site. Perhaps the most direct assessment of the impact of the competition on the establishment of plantations is ensured by effective herbicide treatment, since it is performed correctly and without contaminating the state's waters. The fact that herbicide treatment does not always produce positive results should not blur the proven potential of herbicides to significantly promote plantation establishment. Factors that may affect the effectiveness of herbicide treatment include: time, especially temperature, before and during administration; weather, especially wind, during application; precipitation, in the 12 to 24 hours after administration; vegetation characteristics, including species, size, shape, phenological phase, vigour and distribution of grass; crop characteristics, including species, phenology and condition; effects of other treatments, such as preliminary weakness, incineration or other prescribed or accidental preparation of the site; and the herbicide used, including dosing, formulation, carrier, shender and method of administration. There is a lot that can go wrong, but herbicide treatment can be just as good or better than any other method of preparing a place. Competition indices The study of competition dynamics requires both a measure of the level of competition and a measure of crop response. Various competition indices were developed, e.g. Arney (1972), Ek and Monserud (1974) and Howard and Newton (1984)[73] based on canopy development, and Daniels (1976), Wagner (1982) and Weiner (1984)[76] with proximity-based models. Studies generally looked at the response of trees to competition in terms of absolute height or basal area, but Zedaker (1982)[77] and Brand (1986)[78] sought to quantify crop size and environmental impacts using relative growth measures. Tending Tending is a term applied to the silviculture treatment of forest crop trees before harvesting at any stage after initial planting or sowing. Treatment can be from the crop itself (e.g. spacing, pruning, thinning and improving cutting) or competitive vegetation (e.g. sedating, cleaning). [2] Planting How many trees per unit area (spacing) to be planted is not easy to answer. Establishment density targets or regeneration standards are usually based on traditional practice, with the implicit goal of quickly gaining a standpoint in the free phase of growth. [79] Money is spent if more trees are planted than is necessary to achieve the desired sock rates, and the chance of establishing other plantations is proportionally reduced. Ingress (natural regeneration) is in place and often becomes surprisingly visible only a few years after the planting has been carried out. The early development of the stall after harvest or other disturbances undoubtedly varies greatly among places, each of which has its own unusual characteristics. For all practical purposes, the total volume produced by the stand at a certain place is constant and optimum for a wide range of density or socks. It can be reduced, but not increased, by changing the amount of growing stock to levels outside that range. [80] The initial density affects the development of the stand in this close distance, leading to the full use of the site faster than the wider gap. [81] Economic operability can be improved by wide spacing even if the overall production is smaller than in a closely spaced location. Outside the founding phase, the ratio of the average tree size and stall density is very important. [79] Various density management diagrams have been developed that conceptualize density-based growth dynamics. [82] [83] Smith and Brand's (1988)[84] diagram has a mean tree volume on a vertical wast and a number of trees/ha on a horizontal wasx: the rack can have many small trees or several large ones. The line of self-thinning shows the largest number of trees of a certain size / ha that can be carried at any given time. However, Willcocks and Bell (1995)[79] caution against using such diagrams unless specific knowledge of the stand's trajectory is known. In Lake State, plantations are made with a gap between trees ranging from 3 to 3 to 10 by 10 meters (0.9 m by 0.9 m to 3.0 m by 3.0 m). [85] Kittredge recommended that no fewer than 600 established trees per hectare (1483/ha) be present during the early life of the plantation. To ensure this, at least 800 trees per hectare (1077/ha) should be planted where 85% survival can be expected and at least 1200/ac (2970/ha) if only half of them can be expected to live. [86] This translates to recommended distances of 5 to 5 to 8 feet (1.5 m from 1.5 m to 2.4 m by 2.4 m) for conifer planting, including white spruce in lake states. Planting enrichment Strategy for improving the economic value of natural forests is to increase their concentration of economically important, native tree species by planting seeds or seedlings for future harvesting, which can be achieved by planting enrichment (EP). [87] This means an increase in the density of planting (i.e. the number of plants per hectare) in an already growing forest stall. [88] Release Weeding treatments: The process of eliminating competition in juices or seedlings by mowing, applying herbicides or other methods of removal from the environment. [89] Cleaning: Release selected juices from competition by overblown trees of comparable age. The treatment favors the trees of the desired species and the quality of the stem. Cutting release: A treatment that releases tree or juice planting removal of older trees. The gap of overcrowded regeneration tends to stagnate. The problem worsens in species that have little self-cutting abilities, such as white spruce. Spacing is thinning (natural regeneration), in which all trees are cut except those selected for retention at fixed intervals. The term juvenile spacing is used when most or all of the felled trees are unmeasured. [90] Spacing can be used to obtain any of the wide range of forest management targets, but is specifically undertaken to reduce the density and control of socks at young stalls and prevent stagnation, and to shorten rotation, i.e. accelerate the production of trees of a certain size. The volume of growth of individual trees and the growth of stalls that can be merchantd is increasing. [91] The primary reason for the spacing is that thinning is a projected drop in the maximum allowed incision. [92] And since wood will be concentrated on smaller, larger and more uniform stems, labour and milling costs will be kept to a minimum. Methods for spacing can be: manual, using a variety of tools, including power saws, brushes and scissors; mechanically, using helicopters and mulch; chemical; or combinations of several methods. One treatment had significant success in the gap of massively overstocked (<100,000 stems/ha) of spruce and eleav regeneration in Maine. Embedded in the helicopter, the Thru-Valve boom emits herbicide spray droplets with a diameter of 1000 μm to 2000 μm[93] at very low pressure. Swaths 1.2 m wide and leave strips 2.4 m wide were obtained by the precision of the blade of the knife when the herbicide was administered by a helicopter flying at an altitude of 21 m at a speed of 40–48 km/h. It seems likely that no other method can be as profitable. Twenty years after a gap of up to 2.5 × 2.5m, the 30-year-old mixed stands of balm eel and white spruce in the Green River basin, New Brunswick, averaged 156.9m3/ha. [94] A study of 3 conilings (white spruce, red pine and jack pine) was established in Moodie, Manitoba, on flat, sandy, nutritionally poor soils with a fresh moisture regime. [95] Twenty years after planting, red pine had the highest average dbh, 15% larger than jack pine, while white spruce dbh was less than half pine. The width of the crown showed a gradual increase with a gap for all 3 conilings. To date, the results have suggested optimal distances between 1.8 m and 2.4 m for both wrinkles; white spruce is not recommended for planting in such places. Comparable data is generated by espacement tests, in which trees are planted on a range of densities. A distance of 1.25 m, 1.50 m, 1.75 m, 2.00 m, 2.50 m and 3.00 m per 4 classes at the site was used in a study in Petawawa, Ontario, in 1922. In the first of 34 old white spruce plantations used to explore the development of the stand in relation to the gap in Petawawa, Ontario, regular queues are planted on razmakima from 4 × 4 to 7 7 feet (1.22 m × 1.22 m to 2.13 m × 2.13 m). [96] A distance of up to 10 × 10 feet (3.05 m × 3.03 m) were subsequently included in the study. Yield tables based on 50 years of data showed: a) In addition to the volumes that can be traders at age 20 and location classes 50 and 60, the closer gap gave higher standing amounts across all age groups than the wider spacing. b) The volume that can be merchanted as a share of total volume increases with age and is higher more broadly than at closer intervals. c) The current annual volume growth culminates rather than at a wider distance. A lesser trial for eprostor, started in 1951, was the first in a long time. The oldest internal trial for spruce espacement in British Columbia was established in 1959 near Houston in the Prince Rupert forest region. [98] A distance of 1.2 m, 2.7 m, 3.7 m and 4.9 m was used and measured 6, 12, 16, 26 and 30 years after planting. On wide areas, the trees developed larger diameters, crowns and branches, but (after 30 years) the basal surface and total volume /ha were the largest in the nearest espacement (Table 6.38). In more recent studies in the Prince George region of British Columbia (Table 6.39) and Manitoba,[99] white spruce planting density had no effect on growth after up to 16 growing seasons, even at intervals of just 1.2 m. The slowness of juvenile growth and closing the crown delays the response to intra-competition. Initially, close spacing can even provide a positive nurse effect to neutralize any negative response to competition. Thinning Thinning Thinning Thinning is an operation that artificially reduces the number of trees growing at the stand with the aim of accelerating the growth of the rest. [100] The aim of thinning is to control the quantity and distribution of available space for growth. By changing the density of the stall, foresters can affect the growth, quality and health of residual trees. It also provides an opportunity to capture mortality and destroy commercially less desirable, usually smaller and deformed trees. Unlike regeneration treatments, thinning is not intended to establish a new tree crop or create permanent openings for canopies. Thinning greatly affects the ecology and micro-meteorology of the stall, lowering among the tree competition for water. Removing any tree from the stall has implications for the remaining trees both above ground and below. Silvicultural thinning is a powerful tool that can be used to influence stall development, stall stability and product characteristics that can be culled. When taking into account the intensive plantations of coniferous products intended for maximum production, it is necessary to remember that the feeding and thinning regimes and damage to wind and snow Related. [101] Previous studies have shown that repeated thinning during forest rotation increases carbon stocks compared to stalls that are clear on short rotations and that the benefits of carbon differ according to the thinning method (e.g. thinning from above below). [102] Thinning of the forethal in the early development of the forest stall, the density of trees remains high and there is competition among the trees for nutrients. When natural regeneration or artificial seeding has resulted in dense, overblown young stalls, natural thinning will in most cases reduce socks over time to silviculture-preferable levels. But while some trees reach a trading size, the second will be overtures and defective, and others will still be insurmountable. In order to reduce this imbalance and obtain higher economic yields, at an early stage a type of cleaning is carried out, which is known as pre-polymer thinning. In general, one or two times the predmercial thinning is done to facilitate the growth of the tree The yield of commercial wood can be greatly increased, and the rotation is shortened by premercial thinning. [103] Mechanical and chemical methods were used, but their cost was militated against their readily adopted. Pruning pruning, as a silviculture practice, refers to the removal of the lower branches of young trees (also giving shape to the tree) so that clear wood without knots can subsequently grow over the branch. Clean wood without knots has a higher value. Pruning has been extensively carried out on Radiat pine plantations in New Zealand and Chile, however the development of finger common technology in the production of timber and mold has led many forestry companies to reconsider their pruning practices. Brashing is an alternative name for the same process. [104] Pruning can be done on all trees, or more cost-effective on a limited number of trees. There are two types of circumcision: natural or self-pruning and artificial pruning. Most cases of self-incision occur when branches do not receive enough sunlight and die. Wind can also participate in natural pruning that can break branches. [105] Artificial circumcision is where people are paid to come and cut branches. Or it can be natural, where trees are planted close enough that the effect is to induce self-cutting of low branches because energy is put into growing up for light reasons, not branches. Booth conversion The term refers to a change from one silviculture system to another and involves converting types (changing from one type (or set of types) to another. [2] Such a change may be spent intentionally by different silviculture means, or accidentally by default, for example, when a high grading removed conilling content from a mixed wood stand, which then becomes exclusively self-sustaining ash. Generally sites because these sites are most likely to be considered for conversion. Growth and yield In the debate over yields that might be expected from Canada's spruce forests, Haddock (1961)[106] noted that Wright's (1959)[107] quote of spruce yield in the British Isles of 220 cubic feet per hectare (15.4 m3/ha) per year and in Germany of 175 cubic feet per hectare (12.25 m3/ha) per year is misleading, at least if it meant such yields could be accessed in the Boreal Forest region of Canada. Haddock felt that Wright's suggestion of 20 to 40 (an average of 30) cubic feet per acre (1.4 m3/ha to 2.8 m3/ha (an average of 2.1 m3/ha) per year was more reasonable, but still somewhat optimistic. The main way forest resource managers influence growth and yield is by manipulating the mixture of species and number (density) and distribution (socks) of individuals forming the canopy of the stall. [108] [109] The composition of species a large part of the boreal forest in North America is already very different from the situation before exploitation. In the forest of second growth there is less spruce and more hardwood than in the original forest; Hearnden et al. (1996) [110] calculated that the spruce cover type decreased from 18% to only 4% of the total wooded area in Ontario. Mixed wood occupies a higher proportion of Ontario's second growth forest (41%) than in the original (36%), but its white spruce component is certainly significantly reduced. The growth performance is certainly influenced by the conditions of the location, and therefore the type and degree of location preparation in relation to the nature of the site. It is important to avoid the assumption that the preparation of the location of a particular designation will have a special silvicultural outcome. Scarification, for example, not only covers a wide range of surgeries that scare, but also any method of intimidation can have significantly different results depending on on-site conditions at the time of treatment. In fact, the term is usually used incorrectly. Scarification is defined as loosening the upper soil of open areas, or breaking the forest floor, in preparation for regeneration by direct sowing or natural seeding, but the term often incorrectly uses practices involving scalping, creaking and mudding, which are paired with low and surface vegetation, along with most roots to expose grassless surfaces, generally in preparation for sowing or planting. It is therefore not surprising that literature can be used to support the view that the growth of seedlings in scarce places is much superior to growth in similar places that are not scarce,[111][112][113], while other evidence supports the contrary view that scarceness can reduce growth. [114] [115] [116] Adverse results can be expected from scars that impoverish the foster zone or exacerbate edaphic or climatic constraints. site preparation has improved the growth of spruce seedlings,[12], but it must be assumed that burning could be harmful if the nutrient capital is significantly depleted. An obvious factor that greatly affects regeneration is competition from other vegetation. For example, in a clean stand of Norwegian spruce, Roussel (1948)[117] found the following relationships: Percentage of coverage (%) Description of vegetation Below 1 No vegetation 1-3 Moss carpet with several seedlings secrete 4-10 Herbaceous plants appear 10-25 Bramble, herbs, fairly powerful spruce seedlings >25 Herbs, brambles very dense, strong, no moss Factor of some importance in solar radiation – reproductive relations is excessive warming of the soil surface by radiation. [118] This is especially important for seedlings, such as spruce, the first leaves of which do not cool the base of the stem on the surface of the soil. Surface temperatures in sandy soils occasionally reach lethal temperatures from 50 °C to 60 °C. The usual methods of harvesting silvicultural methods of regeneration combine both harvesting wood at the stand and re-establishing the forest. The proper practice of sustainable forestry[119] should mitigate the potential negative effects, but all harvest methods will have some impact on land and the rest. [120] The practice of sustainable forestry limits impacts so that forest values are maintained permanently. Silviculture recipes are specific solutions for a specific set of circumstances and management goals. [121] The following are some common methods: Clearcut vintage Conventional clearcut harvest is relatively simple: all the trees on the cutter are cut down and clustered with bunches aligned in the slip direction, and the skidder then pulls the bunches to the nearest log deck. [122] Feller-buncher operators concentrate on the width of the felled swath, the number of trees in the pile and the alignment of the pile. Provided the perimeter limit is cut during the day, night shift operations can continue without the risk of trespassing outside the block. Equipment productivity is maximized because units can operate independently of each other. Clearcutting Even an old method of regeneration that can use natural or artificial regeneration. This includes the complete removal of the forest stall at one time. [123] Clearcutting may be biologically suitable for species that typically regenerate from the stand by replacing fires or other major disturbances, such as Lodgepole Pine (Pinus contorta). Alternatively, clearcutting can change dominant species at the stand by introducing non-native and invasive species as shown in the experimental Blodgett Forest near Georgetown California. In addition, clearcutting can prolong decomposition, expose the soil to erosion, affect the visual appeal of the landscape and remove essential wildlife is especially useful in the regeneration of tree species such as Douglas-fir (Pseudotsuga menziesii) which is intolerance to shade. [verification required]. In addition, the general public's dissatisfaction with even silvikultura, especially clearing up, is likely to result in a greater role for uneven governance in public areas as well. [124] Across Europe, and in parts of North America, even old plantations focused on production and intensively managed plantations are beginning to be considered in the same way as old industrial complexes: something that needs to be abolished or converted into something else. [125] Clearcutting will influence many of the location factors important in their regeneration effect, including air and soil temperatures. Kubin and Kemppainen (1991), for example, measured temperatures in northern Finland from 1974 to 2010. Clear logging had no significant effect on the air temperature at 2 m above sea level, but the daily air temperature maximum at 10 cm was higher in the biscuit cut area than in the unselected forest, while the daily minima at 10 cm was lower. Night frosts were more common in the clear area. Daytime soil temperatures at a depth of 5 cm were 2 °C to 3 °C higher in the sleaze area than in the unseated forest, and temperatures at depths of 50 cm and 100 cm were 3 °C to 5 °C higher. The differences between the listing and the uncut area did not decrease during the 12 years after cutting. Coppicing Method of regeneration that depends on the growth of felled trees. Most hardwoods, coastal redwoods and certain pine trees naturally flow from stumps and can be managed by coppicing. Coppicing is generally used for the production of fuel wood, pulp and other products dependent on small trees. A close relative of coppicing is pollarding. [127] Three coppice forest management systems are generally recognised: simple coppice, coppice with standards and coppice selection system. [128] In a combination of coppicing or coppicing with standards, some of the most high-quality trees are retained for more rotation to obtain larger trees for different purposes. Direct sowing prochnau (1963),[129] 4 years after sowing, revealed that 14% of sustainable white spruce seeds sown on mineral soil produced surviving seedlings, in a seed ratio: seedlings of 7.1:1. With Engelmann's Spruce, Smith and Clark (1960) [130] got average seed ratios in 7th place. Group selection Group selection Method is a method of regeneration of uneven years that can be used when the regeneration of medium-tolerant species is desired. The method of selecting a group can still result in damage to the residual stand in dense stands, however a directional drop can reduce the damage. In addition can select in the range of diameter classes at the stand and maintain a mosaic class of age and diameter. Méthode du contrôle Classical European silviculture has achieved impressive results with systems such as Henri Biolley's méthode du contrôle in Switzerland, in which the number and size of picked trees are determined by reference to data collected from each tree at each stand measured every 7 years. [131] Although not designed for use on boreal mixed timber, the méthode du contrôle is briefly described here to illustrate the degree of sophistication some European foresters apply to the management of their forests. The development of management techniques that enabled monitoring and guiding the development of stalls into sustainable pathways is partly a response to past experience, especially in Central European countries, of the negative effects of clean, uniform racks with species that are often not suitable for the site, which greatly increased the risk of soil degradation and biotic diseases. Increased mortality and decreased growth increased have caused great concern, especially after it has been strengthened by other environmental stresses. On the other hand, more or less uneven, mixed forests of outweighing native species, treated with natural lines, have proven healthier and more resilient to all kinds of external hazards; and in the long run such stands are more productive and easier to protect. However, irregular stalls of this type are definitely more difficult to manage – new methods and techniques should have been sought specifically for the establishment of stocks, as well as for controlling the increase and regulation of yields. In Germany, for example, since the beginning of the nineteenth century under the influence of G.L. Hartig (1764–1837), yield regulation functions almost exclusively through a method of adhesion or a formula based on the origin of a unique normal forest with a regular series of cutting areas. In France, on the other hand, efforts were made to apply another type of forest management, one aimed at permanently bringing all parts of the forest to a state of maximum production capacity. In 1878, the French forester A. Gurnaud (1825–1898) published a description of the méthode du contrôle for determining increase and yield. The method was based on the fact that careful, selective harvesting can improve the productivity of the back stall, as wood is removed as a cultural operation. In this method, the increase of stalls is periodically accurately determined with the aim of gradually converting the forest, through selective management and continuous experimentation, into a state of equilibrium at maximum production capacity. Henri Biolley (1858–1939) was the first to apply Gurnaud's inspired ideas to practical forestry. Since 1890 on, he has managed the forests of his Swiss district these principles, desecration for almost 50 years to the study of the increase and treatment of stalls aimed at the highest production and proving the practicality of the method of verification. In 1920 he published this study giving the theoretical basis of forest management according to the method of verification, describing the procedures that would be applied in practice (which he developed and simplified in part), and evaluating the results. Biolley's pioneering work formed the basis on which most swiss forest management practices were later developed, and his ideas were generally accepted. Today, with the trend of intensifying forest management and productivity in most countries, ideas and applications of careful, continuous treatment of stalls with the help of the method of checking the volume with the growing interest. In Britain and Ireland, for example, the application of the principle of continuous cover forestry has been pursued to create permanently irregular structures in many forests. [132] Patch cut Row and emit seeding Spot and Row cuttings using smaller seeds that emit soil or aerial lightening, but can cause clumping. Red and spot seeding give greater ability to control seed placement than to emit sowing. Also, only a small percentage of a tree field needs to be treated in the row or spot cultivation. It is necessary to treat only a small percentage of the total area. In The Aspen type of the Great Lakes region, direct sowing of coniling seeds usually failed. [133] However, Gardner (1980)[134] after a trial in the Yukon, which included the airing of white spruce seeds at 2.24 kg/ha that provided 66.5% of socks in scarified spring broadcast treatment 3 years after sowing, concluded that the technique held significant promise. Seed-wood Even the old method of regeneration that retains the widely exchanged remaining trees to ensure even dispersion of seeds in the harvested area. In the seed-tree method, 2-12 tree seeds per hectare (5-30/ha) are left standing in order to regenerate the forest. It will be retained until regeneration is in place at which point they can be removed. It may not always be economically viable or biologically desirable to re-enter the stall to remove the remaining seed trees. Cuts on semen can also be viewed as a clearing with natural regeneration and can also have all cleaning problems. This method is most effective for light seed species and those that are not prone to the windshield. Selection systems Selection systems shall be suitable where the uneven structure of the stand is desired, in particular where the need to retain continuous cover noise for aesthetic or environmental reasons outweighs other considerations of the administration. Selection eme has been suggested as greater utility than shelterwood's system in the regeneration of the old Engelmann Spruce Sub-alpine Fir (ESSF) located in southern British Columbia. [135] In most areas of the recording service, more than a lighter demanding spruce. [136] [25] [137] In some areas, selection logging can be expected to favor spruce instead of less tolerant types of hardwood (For now 1972)[138] or lodgepole pine. [25] Shelter spotting sowing Use of shelters to improve germination and survival in spot seeders seeks to capture the benefits of greenhouse culture, albeit miniature. Hakmet Seed Shelter, for example, semi-transparent plastic cone is 8 cm high, with openings 7 cm in diameter with a diameter of 7.5 cm and a diameter of 17 mm in the top with a diameter of 24 mm. [139] This miniature greenhouse increases air humidity, reduces soil drying and raises air and soil temperatures to levels more favorable for germination and growth of seedlings than those offered by unprotected conditions. The shelter is designed to disintegrate after several years of exposure to ultraviolet radiation. Seed shelters and spring sowing have significantly improved supplies compared to seeding bare spots, but the shelter has not significantly improved growth. The stocking of bare seeds was extremely low, probably due to the suffocation of seedlings with abundant broad bread and herbaceous litter, especially from ash and red raspberry, and was exacerbated by strong competition from graminoids and raspberries. Cone shelters (Cerkon™) typically produced greater survival than the unhealed sowing on scars in seed vessels in trials of direct sowing techniques in alaska's interior, and funnel shelters (Cerbel™) typically produced greater survival than unsustened sowing on non-dehucted seeds. [140] Both types of shelters are produced by AB Cerbo in Trollhättan, Sweden. Both are made of lightweight degradable, white, opaque plastic and are 8 cm high when installed. White spruce seeds were sown in Alaska at the burned site in the summer of 1984 and protected by white plastic cone cones on small spots scarred by hand, or white funnels placed directly in the remaining ash and organic material. [141] A group of 6 ravens (Corvus corax) was spotted in the area about 1 week after sowing ended in mid-June. The damage was on average 68% with cones and 50% with funnels in the takeoff area, and 26% with funnels in the floodplains. Raven damage was only 0.13% on unextended but otherwise similar areas. In seeding tests in Manitoba between 1960 [142] Shelterwood Generally speaking, shelterwood's system is a series of partial cuts that remove the trees of an existing stall over several years and eventually culminates in a final cut creating a new steam stand. [143] It is an even regeneration method that removes trees in a series of three harvests: 1) Preparatory cut; 2) Establishment cut; and 3) Removing the incision. Success the shelter system is closely linked to: 1. the length of the regeneration period, i.e. the time from the cutting of cover to the date on which the new generation of trees was established; 2.quality of the new stand with regard to density and growth; and 3.the value of increasing shelter trees. Information on the establishment, survival and growth of seedlings under the influence of shelter tree cover, as well as on the growth of these trees, is needed as a basis for modeling the economic return of practicing the shelter system. [144] The aim of the method is to establish a new reproduction of forests under the shelter of retained trees. Unlike the seed method, the remaining trees change the underlying environmental conditions (i.e. sunlight, temperature and humidity) that affect the growth of tree seedlings. This method can also find a middle with a light ambience by having less light available to competitors, and can still provide enough light to regenerate trees. [145] Therefore, shelter methods are most often chosen for species of places characterised by extreme conditions, in order to create a new generation of trees within a reasonable period of time. These conditions apply primarily at the soil level of places that are either dry and poor or damp and fertile. [146] Shelterwood shelterwood systems include 2, 3 or exceptionally more partial cuttings. The final incision is made after adequate natural regeneration is obtained. The shelter system is most often applied as a 2-cut uniform shelter, the first initial regeneration (seed) cut, the second final cut of the harvest. At stalls less than 100 years old, a light preparatory cut can be useful. [138] A series of intermediate cuts at intervals of 10-20 years has been recommended for intensively managed stands. [136] However, there are shortcomings in the shelter system from operational or economic points of view: harvest costs are higher; trees left for delayed cutting may be damaged during receding or associated extraction operations; increased risk of deflation threatens the source of seeds; damage from bark beetles is likely to increase; regeneration can be damaged during the final incision and associated extraction operations; difficulties in preparing any location would increase; and accidental damage to regeneration can be caused by any site preparation operations. [17] [114] [138] [147] [148] Choosing a single tree The method of selecting a single tree is the method of regeneration of uneven years most appropriate when the regeneration of species tolerant to shade is desired. It is typical for removing older and diseased trees, thereby sheathing the stall and allowing younger, healthy trees to grow. Choosing one tree can be very difficult to carry out in dense or delicate racks and there may be damage to the residual stall. This method also interferes with the canopy layer of all other methods. [149] Spot sowing Spot sowing has been found to be the most common and reliable of direct sowing methods for turning ash and paper birch into spruce and pine. [150] In the Chippewa National Forest (Lake States), sowing seeds of 10 seeds of each white spruce and white pine under a 40-year-old ash tree after varying degrees of cutting gave the results of the second season clearly indicating the need to remove or disturb the forest floor in order to obtain germination of white spruce seeds and white pine. [133] Spot sowing of seed conilings, including white spruce, has had occasional success, but several limiting factors usually limit germination success: drying out the forest floor before the germination root reaches the underlying moisture reserves; and, especially under hardwoods, choking small seedlings with snow pressing leaves and smaller vegetation. Kittredge and Gervorkiantz (1929)[133] found that the removal of the forest bottom of ash increased the percentage of germination after the second season in places of white pine seeds and white spruce, in 4 plots, from 2.5% to 5%, from 8% to 22%, from 1% to 9.5%, and from 0% to 15%. Spot seeding requires fewer seeds than emiting seeding and tends to achieve a more uniform distance, although sometimes with clumping. Devices used in Ontario to seed places manually are oil can sowing, seeding sticks and shakers. [151] A can of oil is a vessel equipped with a long spout through which a predetermined number of seeds are released with each seed movement. Strip cutting Harvest cutblocks where only part of the trees need to be removed is very different from clearcutting. [122] First, paths must be located to provide access to logging and skidding/shedding equipment. These paths must be carefully located to ensure that the remaining trees meet the desired quality criteria and population density. Secondly, the equipment should not damage the rest of the stand. Further desiderata is cited by Sauder (1995); [122] Semen deficiency and lack of receptive seeds were identified as the main reasons for the lack of clearcut harvesting success. One drug tried in British Columbia and Alberta is an alternative comic cutting. [152] A larger source of seeds from uncut trees between felled strips and disturbances in the forest floor within felled strips could be expected to increase the amount of natural regeneration. Trees were cut down to the diameter limit in felled strips, but large trees in leave strips often proved too much of an ordeal and were also cut down,[25] removing those trees that would otherwise have been the main source of seeds. The unfortunate consequence of thinning the tapes was the accumulation of populations of spruceers. Shaded line from initial incision, coupled with an increase in the number of windy trees on leave provided that they are ideal for the beetle. [153] Underplanting DeLong et al. (1991) [154] he proposed underplanting a 30- to 40-year-old aspen standing, based on the success of natural spruce in regeneration under the stalls of such stalls: By planting, the gap can be controlled allowing for easier protection of spruce during entry from harvest stalls as overpenstorey. Variable retention The method of harvesting and regeneration which is a relatively new silviculture system that retains forest structural elements (stumps, logs, snags, trees, undersea species and unobstructed layers of the forest floor) for at least one rotation in order to preserve ecological values associated with structurally complex forests. [155] Uneven and even methods differ in scope and intensity of the disorder. Uneven methods maintain a mixture of tree sizes or ages within the habitat periodically harvest individual or small groups of trees, even old methods harvest most or all of the excessive story and create a fairly uniform habitat stain dominated by trees of the same age. [156] Even age management systems were the main methods to use when studying the effects on birds. [157] Mortality A research in 1955-56 to determine survival, development, and reasons for the success or failure of coniferous pulp plantations (mostly white spruce) in Ontario and Quebec by age 32 found that most of the mortality occurred within the first 4 years of planting, disadvantage and climate were the main causes of failure. [158] The pre-growth of naturally regenerated trees in the subsea before harvesting is a classic case of good news and bad news. Subconscious white spruce is of particular importance in mixed wood dominated by aspen, as in sections B15, B18a and B19a in Manitoba[159] and elsewhere. Until the last part of the last century, the subconscious white spruce was largely seen as money in the bank on a long-term low-interest deposit, with the final yield to be achieved after a slow natural inheritance,[160], but the resource became increasingly threatened by the intensification of the ash harvest. White spruce plantations at mixed wood sites have proved expensive, risky and generally unsuccessful. [160] This has spurred efforts to see what could be done about growing ash and white spruce on the same land base, protecting the existing growth of juniper white spruce, leaving a number of viable crop trees during the first incision and then harvesting both hardwood and spruce in the final cut. Information about the lingerie component is key to planning spruce management. The ability of the current harvest technology at the time and the crews of employees to provide adequate protection for white spruce in the underaded have called into question Brace and Bell. The development may require specialised equipment and training, perhaps with financial incentives which would give the degree of protection necessary for the feasibility of the system. Effective planning of the management of the underling requires more than improved mixed wood inventory. Avoiding damage to the lower building will always be desideratum. Sauder's (1990)[161] paper on harvesting mixed wood describes studies designed to assess methods of reducing non-trivial damage to sub-sub-damage residues that would jeopardize their chance of becoming a future crop tree. Sauder concluded the following: (1) operational measures protecting residual stems may not unduly increase costs, (2) all logging, conilings and hardwoods, it is necessary to carry out in one operation in order to minimize the entry of the pile into the residual stand, (3) several operating procedures can reduce the damage from subconsciousness, some of them at no additional cost, and (4) the successful harvesting of processing blocks depends primarily on the intelligent location of the slip of paths and landings. In short, the key to protecting white spruce underwear without sacrificing logging efficiency is a combination of good planning, good supervision, the use of appropriate equipment and s conscientious, well-trained operators. Even the best plan will not reduce the damage below the level if its implementation is not monitored. [162] New stands need to be established to ensure the future supply of 150,000 ha of commercial white spruce in 4 Rowes (1972)[159] regional forest sections haunting Alberta, Saskatchewan and Manitoba, approximately from the Peace AB River to Brandon MB. [163] In the 1980s, with harvesting using conventional equipment and procedures, a dramatic increase in demand for aspen posed a serious problem for associated dostorey spruce. Previously, white spruce in fundamental theories evolved to a commercial size by natural inheritance under the protection of hardwood. Brace expressed great concern: The need to protect spruce as a component of boreal mixed wood goes beyond concerns about the future commercial supply of timber. Concerns include both fisheries and wildlife habitat, aesthetics and recreation, general dissatisfaction with splitting in mixed forests and strong interest in mixed wood perpetuation, as recently expressed at 41 public meetings on forestry development in northern Alberta.... [163] Based on testing of 3 logging systems in Alberta, Brace (1990)[164] confirmed that significant amounts of sub-damage can be maintained using any of these systems provided sufficient protection efforts are made. Potential benefits would include increased short-term timber supply, improved wildlife habitat and cutblock aesthetics, as well as reduced public criticism of previous logging practices. Stewart and Sur. (2001) [165] have developed statistical models to predict the natural establishment and growth of white spruce trees in alberta's boreal mixed wood forest using data from 148 permanent sample plots and additional information on the growth of white spruce regeneration height and the quantity and type of substrate available. The discriminatory model correctly classified 73% of the site as the presence or absence of the lower part of the white spruce, based on the amount of basal surface of spruce, rotting wood, ecological nutrient regime, soil clay fraction and altitude, although it explained only 30% of the variations in the data. In places with white spruce, the regression model concerned an abundance of regeneration with rotting wood cover, basal surface of spruce, basal surface of pine, soil clay fraction and grass cover ($R^2 = 0.36$). About half of the seedlings tested grew on rotting wood, and only 3% on mineral soil, and seedlings were 10 times more likely to have established themsnded on these substrates than on litter. The exposed mineral soil covered only 0.3% of the observed transect area. Advance growth management Advanced growth management, i.e. the use of repressed tree sneering, can reduce adhesion costs, shorten rotations, avoid propping tree sites, and also reduce adverse impacts on aesthetic, wildlife and catchment values. [166] [167] In order to be valuable, advanced growth must have an acceptable composition and distribution of species, have the potential to grow after redundancies and not be vulnerable to excessive logging damage. The age of advanced growth is difficult to estimate from its size,[168] as white which seems to be a 2- to 3-year-old can be more than 20 years old. [169] However, age does not seem to determine the ability of advanced spruce growth to respond to release,[166][167][170] and trees over 100 years of age showed rapid growth rates after release. There is also no clear link between the size of advanced growth and its growth rate when released. If advanced growth consists of both spruce and e ate, the latter is consistent with the response to release faster than the former, while spruce reacts. [171] [172] If the ratio of e july to spruce is high, however, greater responsiveness to the release of e july may subject the spruce competition seriously enough to negate much of the effect of treatment for release. Even temporary relief from competition from bushes has increased growth rates of white spruce height in northwestern New Brunswick, allowing spruce to be belied to bushes. [173] Site preparation Site preparation is any of the different treatments applied to the site to prepare for soybeans or planting. The purpose is to facilitate the regeneration of this site by the chosen method. Site preparation can be designed to achieve, singly or in any combination: improved access, reducing or rearpping the sloping line and alteration of unfavorable forest floors, soil, vegetation or other biotic factors. Preparing a location to appease himself restrictions that might otherwise thwart management objectives. A valuable bibliography on the effects of soil temperature and site preparation on subalpine and boreal tree species was prepared by McKinnon et al. [174] Site preparation is a work carried out before the regeneration of that site. Some kind of preparation places up there. Incineration Broadcasting is commonly used to prepare clearcut sites for planting, eg, in central British Columbia,[175] and in the temperate region of North America in general. [176] Prescribed incineration is carried out primarily to reduce the risk of cuts and improve conditions at the regeneration site; all or some of the following advantages can be jumped: a) Reducing logging, herbal competition and humus before direct sowing, planting, intimidation or in anticipation of natural sowing in partially cut hideouts or in connection with seed systems. b) Reduce or removing unwanted forest cover before planting or planting or before preliminary scaring c) Reducing humus in cold, wet places to favour regeneration. d) Reduce or remove fuel for cutting, grass or brushing fuel from strategic areas around wooded land to reduce the chances of fire damage. Prescribed incineration to prepare a place for direct seeding was tried on several occasions in Ontario, but none of the burns were hot enough to produce seeds that were adequate without additional mechanical preparation of the site. [151] Changes in soil chemical properties associated with incineration include significantly increased pH, which Macadam (1987)[175] in the sub-boreal zone of spruce central British Columbia found to last more than a year after burns. Average fuel consumption was 20 to 24 t/ha, and forest floor depth decreased by 28% to 36%. The increases correlated well with the amounts of cutouts consumed (≥ and 7 cm in diameter). The change in pH depends on the severity of the burn and the amount spent; increase can be as much as 2 units, 100 times changes. [177] Copper and iron deficiencies in a lilj of white spruce in burned clearings in central British Columbia can be attributed to elevated pH levels. [178] Even airing slash fires in clear does not give the uniform burn throughout the area. Tarrant (1954), for example, found that only 4% of the 140-ha burns burned slightly and 49% were unburned. Burning after cheerleading apparently highlights subsequent heterogeneousness. A significant increase in interchangeable calcium also correlated with the amount of interested consumed at least 7 cm in diameter. [175] Phosphorus availability also increased, both in the forest bottom and in the mineral soil layer from 0 cm to 15 cm, and the increase was still visible, albeit somewhat reduced, 21 months after burning. However, in Study[180] in the same sub-boreal spruce zone found that while it increased immediately after burns, phosphorus availability dropped below pre-combustion levels within 9 months. Nitrogen will be lost from the site by burning,[175][180][181] although concentrations in the remaining forest floor were found by Macadam (1987)[175] to have increased in 2 out of 6 parcels, with the rest showing a decrease. Nutrient losses can be maulting, at least in the short term, by improved soil microclimate through reduced forest floor thickness where low soil temperatures are a limiting factor. The Picea/Abies forests at the foot of Alberta are often characterized by deep clusters of organic matter on the soil surface and cold soil temperatures, both of which make afforestation difficult and result in a general deterioration in location productivity; Endean and Johnstone (1974)[182] describe testing experiments for prescribed incineration as a means of seed preparation and site allocation in representative clear areas of Picea/Abies. The results showed that, in general, the prescribed incineration did not satisfactorily reduce the organic layers, nor did it increase the temperature of the soil, in the places tested. The increase in seedlings, survival and growth in the observed places are likely the result of a slight decrease in the depth of the organic layer, a smaller increase in soil temperature and significant improvements in the efficiency of the planting crew. The results also indicated that the deterioration procedure for the site was not annulled by the incineration treatments used. Ameliorative intervention The weight of the incision (the weight of the dry oven of the entire crown and that part of the stem < 4 inches in diameter) and the size distribution are the main factors influencing the risk of forest fires in the harvested places. [183] To forest managers interested in applying prescribed incineration to reduce hazards and silviculture, Kiil demonstrated a method of quantifying the cutting load (1968). [184] In west-central Alberta, he cut down, measured and weighed 60 white spruces, graphed (a) incision weight by volume of the trader unit in relation to the diameter at breast height (dbh) and (b) the weight of the fine (<1.27 cm) also against dbh, and produced a weight and size distribution table on one hectare of the white spruce hypothetical stand. When the distribution of the diameter of the stand is unknown, the estimate of the weight and size of the incision can be obtained from the average stall diameter, the number of trees per unit and the volume of the cubic foot that can be incurred. The sample trees in Kiil's study had full symmetrical crowns. Densely growing trees with short and often irregular crowns would probably be overpriced; would probably underestimate open trees with long crowns. The need to provide shade for young vanplant Engelmann spruce in the High Rockies is highlighted by the U.S. forest Acceptable planting sites are defined as microsites on the north and east sides a series of logs, stumps or lines, and lie in the shade cast by such material. [185] Where management objectives specify a more uniform distance or higher density than can be obtained from the existing distribution of the material providing shade, redistribution or importation of such material has been undertaken. Preparing a site for access on some sites can be done simply to allow access to planters or to improve access and increase the number of distribution of microsites suitable for planting or sowing. Wang et al. (2000) [186] determines the field performance of white and black spruce 8 and 9 years after it was outplanting at boreal mixedwood sites after preparing sites (Donaren disc trenching versus no trenching) in 2 types of plantations (open compared to protected) in southeastern Manitoba. Donaren trenching slightly reduced black spruce mortality, but significantly increased white spruce mortality. A significant difference in height was found between open and protected plantations for black spruce, but not for white spruce, and the diameter of the root collar in sheltered plantations was significantly higher than on open plantations for black spruce, but not for white spruce. The open black spruce plantation had a significantly smaller volume (97 cm³) compared to a black spruce sheltered (210 cm³), as well as white spruce open (175 cm³) and protected plantations (229 cm³). Open white spruce plantations also had a smaller volume than white spruce protected plantations. For the transplant fund, strip plantations had a significantly higher volume (329 cm³) than open plantations (204 cm³). Wang et al. (2000) [186] recommended that protected plantation preparation be used. Mechanically until 1970, no sophisticated site preparation in Ontario,[187] but the need for more efficient and versatile equipment was increasingly recognized. By this time, improvements had been made to equipment originally developed by field personnel, and field testing of equipment from other sources was increasing. According to J. Hall (1970), at least in Ontario, the most commonly used site preparation technique was mechanical descaration after harvest with equipment mounted on a bulldozer (blade, rake, V-plough or teeth) or dragged behind a tractor (Imsett or S.F.I. scarifier or rolling chopper). Pull-type units designed and built by the Ontario Department of Lands and Forests used anchor chain or tractor pads separately or in combination, or were made with steel drums or barrels of different sizes and used in sets alone or in combination with tractor or anchorage units. J. Hall's report (1970)[187] on the state of preparation of the location in Ontario stated that blades and rakes are suitable for scarfing after incision in tolerant wooden natural regeneration of yellow birch. The snowplows were most effective for treating a dense brush before planting, often in combination with a planting machine. Teeth that scare, e.g. Rolling helicopters found application in the treatment of heavy brush, but could only be used on soils without stone. Finned drums were usually used on jack pine-spruce cutovers in fresh brushy places with a deep duff layer and heavy streak, and needed to be teamed with a heavy blade sure unit to ensure good hairline distribution. The S.F.I. scarifier, after strengthening, has been fairly successful for 2 years, promising trials are underway with a cone scarifier and barrel ring scarifier, and development has begun on a new flail scarifier for use in places with shallow, rocky soils. Recognizing the need to become more efficient and efficient in preparing the site led the Ontario Department of Lands and Forests to adopt a policy of seeking and obtaining new field testing equipment from Scandinavia and elsewhere that seemed to promise conditions in Ontario, primarily in the north. Thus began testing Brackekultivator from Sweden and rotary furrow Vako-Visko from Finland. Treatments for preparing places for spreading that create elevated planting sites have usually improved off-the-plan performance in places subject to low soil temperature and excess soil moisture. Embankment can certainly have a big impact on the temperature of the soil. Draper and Sur. (1985), [188] for example, they documented this, as well as the effect it had on the growth of vanplant root (Table 30). The mounds were the fastest heated, and at soil depths of 0.5 cm and 10 cm respectively, they were on average 10 and 7 °C higher on average than in control. On sunny days, the daytime surface temperature on the mound and organic mat reached 25 °C to 60 °C, depending on soil moisture and shading. Mounds reached mean soil temperatures of 10 °C at a depth of 10 cm 5 days after planting, but the control did not reach this temperature until 58 days after planting. During the first growing season, mounds had 3 times more days with a mean soil temperature of more than 10 °C than control microsites. Mounds of Draper, etc. (1985) received 5 times the amount of photosynthetic active radiation (PAR) compressed on all sampled microsites during the first growing season; control treatment consistently received about 14% of the daily PAR background, while mounds received over 70%. By November, autumn frosts had reduced shading, eliminating differential. In addition to their effect on temperature, incident radiation is also important photosynthetically. The average control microsite was exposed to levels of above the countervailing point for only 3 hours, or one quarter of the daily light period, while the mounds received light above the countervailing point for 11 hours and 86% of the same daily period, respectively. Assuming that the light of the incident in the range of intensity 100-600 μEm.²s.1 is most important for photosynthesis, the mounds received more than 4 times the daily light energy that reached the control microsites. Orientation of linear page preparation, e.g. An experiment with discs in the sub-boreal spruce zone in the interior of British Columbia investigated the effect on the growth of young vanplants (lodgepole pine) in 13 microsite planting positions: berm, hinge and trench; in the north, south, east and west, as well as in untreated places between the grooves. [189] 10-year-old amounts of trees in the south, east and microsites facing west were significantly larger than trees in the north facing and untreated microsites. However, it is believed that choosing a place for planting is generally more important than trench orientation. In a study from Minnesota, N-S lanes accumulated more snow, but snow melted faster than on E-W lanes in the first year after logging. [190] Snowmelt was faster on lanes near the centre of the belt-cut area than on the boundary lanes approaching the pristine stand. The strips, 15.24m wide, alternating with uncut strips 16 feet (4.88m) wide, were cut down on a pinus resinosa stand, aged 90 to 100. See also Trees portal Agroforestry Coppicing Dehesa Ecological Thinning Forest Dynamics Forest Management History of Forests in Central Europe Production of Wood Raw Materials Living Crown Natural Landscape Permaculture Plantation Seeds Choosing to Cut Silvology Sustainable Forest Management World Forestry Congress

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