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IRREGULAR SHELTERWOOD SYSTEMS IN SOUTHERN ONTARIO

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Silviculture is the science of managing and regenerating forests using silvicultural systems to meet objectives including wood production, wildlife and habitat, recreation, income, carbon storage and other values. In Ontario, foresters and certified tree markers have mostly trained in the single-tree selection (STS), clearcut and shelterwood systems. Hybrid systems include group selection, expanding gap, and irregular shelterwood systems (ISS).

A forest stand is delineated by where conditions (i.e., species, ages, or site conditions) are mostly consistent. Stands can be over 50 or 100 acres in forested landscapes, while developed landscapes like southwestern Ontario may have three or four different smaller stands in a 10-acre woodlot. Stands of any size can be patchy and have “inclusions”, where tree species or sizes vary in different parts of the stand, perhaps because of harvesting history. The ISS approach is useful in managing stands where the patches are not large or different enough to separate and manage as individual stands.

The Ontario Tree Marking Course was developed to train tree markers using the STS to manage deciduous forests and the uniform shelterwood system to regenerate white pine stands, in central Ontario. While the course was developed for Crown land, foresters and technicians in central and southern Ontario also take the training to become certified to mark on private, municipal, and other public lands.

However, the use of STS has many challenges. These can include a lack of desirable regeneration in general, and challenges maintaining the presence

of intermediate-tolerant species like yellow birch, red oak, white pine, and black cherry. Achieving a strict diameter distribution target in STS can also include the premature harvesting of trees with future high-value potential. Many stands are even- or two-aged when first marked using STS, and the conversion of these stands to uneven-aged is slow and potentially challenging. Finally, especially in central Ontario, when planning a second STS harvest, many stands do not meet the minimum Acceptable Growing Stock (AGS) requirements for ongoing STS management.

The alternatives of uniform shelterwood, and group selection also have their challenges. One is stand conditions: mature and formerly managed stands usually have some multi-aged component that would be lost if a by-the-book uniform shelterwood approach was implemented. Another obstacle is aesthetics and competing land uses. Uniform final removal cuts over 1-2m high saplings are visually dramatic and almost impossible to walk through. Formal group selection does not have these challenges but requires a highly specific number and size of the group openings to create.

At a 2023 Canadian Institute of Forestry event in southwestern Ontario, none of the managers present had implemented either uniform shelterwood or group selection on private lands, outside of research programs. ISS presents an opportunity to use elements of these systems in a flexible and scalable manner.

The ISS and other hybrid silvicultural systems blend even- and uneven-aged management concepts to recognize or increase within-stand diversity, manage

for species that require open conditions like oaks or yellow birch to regenerate, improve grade-value of timber, or provide a variety of habitats for wildlife. These hybrid systems include intermediate thinnings, group selection, group or expanding group shelterwood, and two-aged management. The ISS combines many aspects of the other systems in a single stand to meet particular objectives or address existing structures. Implementations of ISS labelled as extended and continuous cover are two approaches that are useful in southern and central Ontario.

ISSs have been used worldwide for many years in the rest of the world, and North America (e.g., Troup, 1928). Raymond et al (2009) reviewed irregular systems describing many applications, suggesting that the group of ISS approaches can be used to restore degraded forests and manage forests with irregular structure. In practice, many elements of ISS have been used here for many years to consider within-stand variability and in plantation management. Two broad variants of ISS that are currently being implemented in Ontario are described below.

The ISS extended system manages an even aged stand that uses regular thinnings, starting as young as economical, optimizing development of the older trees and developing a younger layer of regeneration over a number of thinnings. An excellent example of this is how most plantations are managed. At some point, the regeneration is released by a heavy harvest of the canopy trees. This differs from a standard Shelterwood approach which has two harvests, a regeneration cut to allow regeneration to develop and a release cut to harvest the overstory and





Photos taken side-by-side in the same forest stand showing irregular structure.

release the regeneration. In either case, some dominant trees from the canopy can be retained for structural diversity or wildlife habitat. Historically, foresters have used the ISS extended system, but included repeated thinnings into the shelterwood definition.

The definition of ISS from Raymond et al, 2009 establishes that the canopy is retained for >20% of the rotation length. This contrasts with the description of a shelterwood system in silvicultural guides got a period of 5-15% of the rotation length for the seedcut and release cut. for northern hardwoods. The original canopy may also be managed by thinning periodically, developing regeneration layer or layers over time. However, in either case, the system builds towards a final removal harvest and the release of a well-stocked sapling or polewood layer. This system is well suited where, for whatever reason, the goal is the renewal of

the stand, but horizontal and vertical variation of the mid-canopy is either desired, or already present. It is very well suited to two-aged or multi-aged stands with important components of immature AGS trees that should be managed or retained over time, but not enough immature AGS to recommend the use of STS or the thinning stage of a uniform shelterwood. This is a very common situation in stands formerly managed with STS in central Ontario.

The ISS Continuous Cover (CC) approach is used to manage or create patchy stands, where each “micro-stand” can be treated distinctly, depending on its structure and conditions. This approach may use the ISS Extended approach on each patch, maintaining a continuity of the patchiness where the patches move around over time as they grow older, or younger; as time and management progress over the years.

The CC approach can include thinnings in some patches and group selection in others, or perhaps unregulated group shelterwood, depending on the intensity of removals and the age class structure of the stand. However, the intention is that there is never a final removal treatment for the stand as a whole. The structure of the stand as a whole may show an uneven-aged structure because of the averaging of plot data from diverse even-aged patches.

The CC approach is best suited for good quality stands where there is abundant AGS and few regeneration impediments, to foster the development of high-quality mid-canopy trees and retain individual valuable trees for a long time to maximize tree value. But attempting to conform with strict density targets throughout the stand may compromise patch-by patch opportunities.

In this discussion of ISS, one can see that “irregular”, “continuous” or “extended” are modifiers on the core concept of “shelterwood”. Other shelterwood modifiers are typically so common that they do not appear in a silvicultural prescription. For example, “reserve”, meaning the retention of canopy trees such as crop trees or wildlife trees into the new rotation, creating or maintaining a two-aged or multi-aged condition. These modifiers together establish a continuum of subtly different treatments from uniform shelterwood all the way through to single tree selection, and provide for flexibility to prescribe or describe within-stand opportunities and diversity.

What irregular approaches provide in flexibility, they give up in predictability. While two CC stands will share many features, they are likely to be more different from each other than two stands prescribed single tree selection, or two stands that have recently had a uniform shelterwood final removal cut.

In review, irregular variants of the shelterwood system are excellent methods to regenerate intermediate-tolerant species like yellow birch, black cherry, white pine, oaks, and hickories, which can be challenging to regenerate using STS, and without resort to the careful regulation of group selection, or the visual impact of uniform shelterwood. Irregular methods are also useful in regenerating and releasing young maple in patches, while tending immature maple, all within the same stand: a common condition in lower quality sites which are not suitable for single tree selection.

Publications with more information on ISS systems can be downloaded from the website forestar.ca, publications section.

LITERATURE CITED

Troup, Robert. 1928. *Silvicultural Systems*. Oxford: Clarendon Press. 212 p.

Raymond, Patricia; Bedard, Steve; Ray, Vincent; Larouche, Catherine Tremblay, Stephane. 2009. *The Irregular Shelterwood System: Review, Classification, and Potential Application to Forests Affected by Partial Disturbances*. *Journal of Forestry*. 107(8): 405-413. 



Figure 3e. An example of an irregular shelterwood harvest profile depicting 50 years after partial harvest (c)

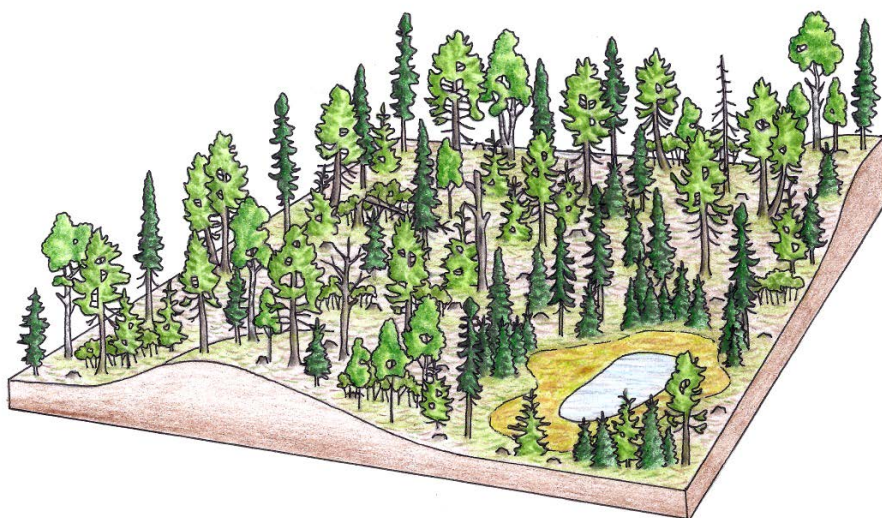


Figure 3f. An aerial view of an irregular shelterwood harvest in a cedar dominated stand 15 years after harvest (a)

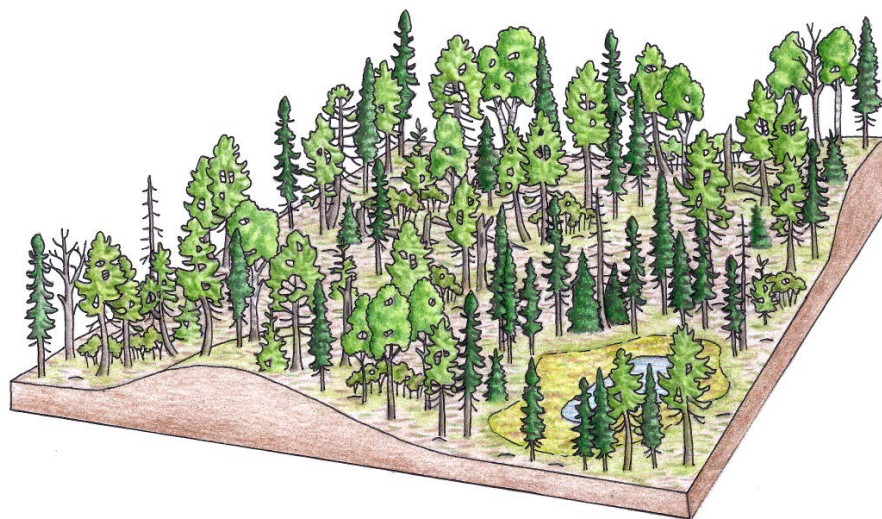


Figure 3f. An aerial view of an irregular shelterwood harvest in a cedar dominated stand 50 years after establishment resulting in a multi-aged stand (b)

The stages of irregular shelterwood from the Ministry of Natural Resources' Great Lakes St Lawrence Silvicultural Guide: <https://www.ontario.ca/page/forest-management-guide-silviculture-great-lakes-st-lawrence-and-boreal-forests-ontario> (Illustrations by Jodi Hall).

