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Letter to Nova Scotia Forest Practices Review from Art Lynds

Feb 19, 2018.

To Forest Practices Review Panel:

Thank you for permitting me the opportunity to share my expertise and thoughts on this subject.

I am a recently retired ecologist, having worked 43 years with DNR Parks Division and DOE Protected Areas Division. I was a member of DNR's Ecological Technical Committee. I am very familiar with DNR's Ecological Land Classification and developed DOE's Landscape-Ecosystem Classification. As well, my interests lie in plant community assembly processes and old-growth forests (authored and co-authored papers), both subjects having natural disturbance regimes as a prominent theme in their discussion.

Before beginning the review, this: I realize that my next statement is extremely unprofessional but it must be stated. Throughout my career, I met with many professional agencies and individuals but the N. S. DNR's Forestry Division is the most arrogant group of professional I've ever encountered. They believe they are the only legitimate experts of forest ecology. This group seems to, and actually does, contrive to paint worse case scenarios that are aimed to maintain control over the forested landscape in order to meet their economic agenda. This was clearly evident during the short history of the Department's Ecological Technical Committee. Both positive suggestions and criticisms by Wildlife Division's biologist and Parks/Wilderness Areas ecologists members of the Committee were, for the most part, ignored. On top of that, there was an attempts by the Committee's foresters to usurp the mandates of both Wildlife and Parks/Wilderness Areas Divisions (biodiversity and protected areas representation respectively). The Forestry Division has always, and continues to, ignore science information and perspectives presented to them by equally qualified non-DNR ecologists and wildlife biologists.

Bottom line: the authors of the *Natural Disturbance* paper have come up with a scenario – half of the Province forests fashioned by frequent stand initiating natural disturbances – that again meets their consumptive mandate. Other scientific professionals in the Province have major reservations with the outcome of the above paper.

Introduction / Literature Review

There are gradients of natural disturbances, from the inconspicuous endogenous senescence of a single individual to much rarer catastrophic community mortality. Given the right conditions, any forest type will burn or blow down! There are many factors involved - the type, intensity, and size of the disturbance, propagule availability and timing of dispersal, species interactions, etc. - in determining the next vegetation type following a particular disturbance. It must be pointed out that certainly non-catastrophic, and in many cases also catastrophic disturbances, do not necessarily create new ecological communities in terms of species composition.

The scientific literature suggests that at the time of European settlement, we had a forested landscape dominated by our current climatic climax and mid-climax species, much of which was in an older state of community development. Ecological studies throughout the northeastern North America region provide evidence which strongly suggests that catastrophic disturbances were infrequent in the presettlement forest landscape, resulting in large expanses of late successional, old-growth forest ecosystems. The forest-disturbance interrelationships we see today are the result of the transformation of long-lived, disease-resistant, wind-firm, less fire-prone pre-European settlement climax forests to shorter-lived, disease-, wind-, and fire-prone early successional forests as a result of extensive, intensive human intervention.

A major source of information on the condition of the Canadian Maritime Provinces' landscape at the time of European settlement is the historical work of Nicholas Denys. Arriving in the New World in 1632...Denys made 40 notations specific to the vegetation character of the Province's coastline. All notations, except three, describe these coastal forests throughout as " fine and good lands, with an abundance of good woods of all kinds [pines, firs (eastern hemlock, all spruce, and balsam fir), maples, birches, and oak are most often cited]"; "very fine and good woods"; the trees are very fine; etc.". There are two references to Atlantic coastal islands which have "upon them only moss; others have heathers or low shrubs; others have little firs, very low and much branched". The only other area noted by Denys as being of poor quality with respect to forests is the coastline between Cape North and Cheticamp which "is nothing but rocks covered with firs, intermingled with some little birches". Nowhere along the coast does Denys mention the occurrence of fire, windthrow, or barrens. Denys also provides a general statement regarding the inland forests of the Province: "...they [the coastal forests] are as nothing in comparison with those which are inland and on the upper parts of the rivers....The trees [of the inland forests] are very much more beautiful in height and thickness.... The lands there are also much better, and easier to clear than on the margins of the sea, and the country is fine." Denys describes what he thinks the natural disturbance regimes types are: "... the occurrence at times of furious gusts of wind, which overthrow trees, but they are not of long duration."; "...the thunder falls sometimes in fire and strikes the woods, where everything is so dry that it continues there some three weeks or a month. Unless rain falls sufficiently to extinguish it, the fire will burn sometimes ten, twelve, and fifteen leagues of country." These are his only references to natural forest disturbance. It is just as conceivable that some of the fires that Denys

observed, rather than being of natural causes, were simply the result of escaped native campfires or escaped fires from the burning of French outposts/summer fishing/timber settlements by New England raiders.

Titus Smith (1801) made the following observations of his contemporary landscape: “But the great influx of inhabitants in 1783 produced, in the course of a few years, a complete change in the appearance of the forest.... The fires necessary for clearing the land were communicated to the spruce thickets, and spread frequently as far as they extended. The profusion of herbage which followed the fire, for a time furnished a pasture for the cattle. This failed in three to four years. The next dry season the fire was rekindled, for the purpose of renewing it, which it would do in a less degree.”

Original land grant surveys, immediately before and/or during the early period of the European settlement of the North American continent provides actual data on the composition and distribution of tree species that made up the pre-settlement vegetation (Lorimer 1977; Backman 1984;Whitney 1987; Frelich and Lorimer 1991; Marks et al. 1992; Keddy 1993; Frelich 1995; Lutz 1996; Abrams and McCay 1966). These records, detailing local vegetation, many physical attributes of the environment, and forest disturbances, were actually the first empirical ecological baseline data available to modern ecologists and, in most cases, accurately described the pre-European settlement forests. Studies by Lorimer (1977) in Maine and Lutz (1996) in New Brunswick are but a few examples of this important information source. Original land grant information for Cape Chignecto Provincial Park, while sparse, again follows this same trend (Lynds, unpublished data).

Also described, but less frequently, are wood sales studies that indirectly portray the forests at the time of European settlement and leading up through to today=s forests. For example, Simard and Bouchard (1996) used wood sales, recorded in notary deeds, to describe how the presettlement and post-settlement forests of the upper St. Lawrence River region of Quebec changed during the 19th century. The results of their study showed a succession of economically-important climax species being systematically depleted through harvesting over the century, leading eventually to today=s present forests dominated by early successional species.

In comparison, the several draft undertaken by the authors of DNR's *Natural Disturbance* paper relied heavily on Fernow's 1912 *Forest Conditions of N.S.*, depicting a forested landscape that had already endured three centuries of heavy utilization.

Natural Disturbance Regimes

I would suggest the following four natural disturbance regime categories operate within the Acadian Forest Region.

Small-Gap Disturbance - This disturbance type creates forest ecosystems of uneven-aged or multi-storied even-aged with regeneration occurring in small gaps in the canopy created by death of individual trees or small clumps of trees. Long return cycles for

these disturbances are the norm with several to many centuries between catastrophic disturbances. The classic example of the small gap-formed forest type is the sugar maple-yellow birch-American beech [tolerant hardwoods] complex.

Large-Gap Disturbance - Due to extended periods between major catastrophic disturbances such as fire or hurricane, initially even-aged stands tend to become more or less uneven-aged until such time as another catastrophic, stand-replacing disturbance occurs. This disturbance type has been described as an 'infrequent stand initiating disturbance' and the major disturbance type of many coniferous forests types in Nova Scotia (Neily et. al. 2004). However, based on many observations, it is my opinion that most of the climatic climax conifers in the Acadian Forest (ie. the eastern hemlock-red spruce-white pine [tolerant conifers] complex) and relatively stable subclimax (eg. black spruce swamps – see below) coniferous forests are more often than not subjected to frequent smaller disturbances associated with insects infestations and less intense windstorms. Stand initiation is not necessarily the end result but rather a more coarse mottling pattern (ie. larger gaps) than that produced by the small-gap disturbance type. Thus, I believe that most of our climatic climax and stable subclimax coniferous forests are actually part of the gap dynamics disturbance regime and, as such, simply gives the gap disturbance type a broader disturbance size range. Another example of a forest dominated by the large-gap disturbance regime is the tolerant hardwood- tolerant conifer mixwood complex. In summary: with the exception of the spruce budworm devastating the balsam fir of the Cape Breton highlands, insects, a common disturbance of our climax coniferous forests, for the most part, tend to create small- to medium-sized gaps.

Frequent Stand Initiating Disturbances - Disturbances such as fires and spruce budworm outbreaks are generally catastrophic disturbances in nature, sometimes consuming large tracts of forest land. In my view, this type of disturbance is only pertinent to the boreal forests of northern Cape Breton Island plateau and possibly some small isolated areas elsewhere in Nova Scotia. This disturbance type was significantly less frequent in the pEs forest than it is in today's heavily manipulated forested landscape. It brings into question as to whether any attempt to incorporate this disturbance type, being of such limited frequency and irregularity in location and intensity, into ecologically-based forest management systems.

There are only a handful of site types in the Region where geomorphology, soils, climate, etc., combine to create the conditions that permit frequent, stand-replacing disturbance. Some examples in Nova Scotia are: jack pine on Target Hill and a few other prominent granitic knobs in Halifax County; the pines on the sand plains of Annapolis Valley; black spruce-jack pine on the sand plain near Oxford (coincidentally aligned along a railway line); and balsam fir-white birch on exposed spur ends in the steep-sided canyons of northern Cape Breton Island. Basically all other forest types are disturbed by gap dynamics of various sizes. There is virtually no disagreement amongst ecologists that the northern tolerant hardwood forest is subjected to small gap dynamics of the order of <10 sq. m. to 100 sq. m. The debate invariably focuses around our

climax coniferous forests. These forests, I believe, are formed as a result of, again, small gap-forming disturbances, as well as larger gap-forming disturbances, such as windstorms/hurricanes, in the range of 1 to 5 ha. This is based, for the most part, on my own observations (particularly recent events such as Hurricane Juan [2003]) as well as Dwyer's study (1958) of Hurricane Edna (1954) in which he found that 'blowdown was ... confined to patches or areas of 0.1 to 5 acres (2 hectares) in both undisturbed and managed red spruce-eastern hemlock forest of the St. Mary's Bay region of Nova Scotia.

I get the impression throughout the *Natural Disturbance* paper that all imperfectly drained sites are automatically assigned a 'frequent stand initiating disturbance regime' (ie. all forest types on imperfectly drained soils are destined to be windthrown before reaching an older stage of development). The provincial forest cover type mapping shows many imperfectly drained forest lands supporting, in many cases, deep-rooted longer-lived climax and mid-climax species (eg. yellow birch, white ash) in varying amounts. Field observations have verified this condition to be very common. I would therefore challenge this perspective, if that is what's implied.

A debate has recently developed involving our forested wetlands. In some forest regions of the continent, fire is a major structuring agent of black spruce swamps. In my view, black spruce swamps/wetlands are not frequently disturbed by fire as suggested by some (Neily, Steward - personal communications) but rather are gap-disturbed by a variety of disturbances - a limited number of insects, diseases; hydrological fluctuations; and, quite often, simply senescence. As to their fire-caused even-agedness, as pointed out by the above, these ecosystems are the result not of past fires but rather of past harvesting activities. In the earlier days of colonization, spinly, tight-ringed swamp black spruce were used for a numbers of purposes. Titus Smith (1835) tells us that 'Near to the cultivated districts, the wood, in time, becomes scarce; and the swamps are finally attacked by the axe'.

Stand Maintaining - This disturbance type applies particularly to woodland-type forests frequently disturbed by surface fires. It results in the maintenance of the upper tree canopy while destroying/altering the understory tree layer and/or shrub/herb layer. This type of disturbance thus tends to maintain an open, park-like stand structure as well as regulating the amount of ground coarse woody debris. A example of this type of disturbance is reflected in pure pine forest ecosystems on dry, coarse-textured surficial materials (eg. pine sand plains of the Annapolis Valley). This type of disturbance, I believe, is not that common in Nova Scotia.

The above perspective on natural disturbances of the Acadian Foerst is echoed by Seymour and Hunter (1992) who suggests that gap-dynamics natural disturbance regimes in Maine (part of the Acadian Forest Region) were, by far, the dominant structuring force in the forests of the Region: "...fires of natural origin are much rarer here [700-2000-year return intervals; Lorimer 1977]....Unlike fires, these disturbances [insect outbreaks and windstorms] are usually not completely stand replacing, and thus lead to the development of a wider range of age structures".

Agents of Disturbance

Fire

While Denys (1908) acknowledges natural fire on the landscape in the very early days of European settlement, he also points out that escaped native campfires and the burning of French outposts/summer fishing/timber settlements by New England raiders were already prominent on the landscape of the Maritime Provinces: "...not by the fire from the sky, but by the accident of a cannonier, who, drying his powder on Miscou, set it afire in using tobacco, and the fire reduced to cinders a good part of the woods of the island."

Backman (1984), working in both the Acadian Forest Region (Maine) and in the Central Hardwoods Region (Massachusetts) found that charcoal levels were significantly lower in the pEs versus post-European settlement landscape; that the charcoal values were greater in the southern coastal areas than in the coastal sites of Maine; and that inland Maine sites showed almost no fires at all. Backman also attributes many of the coastal fires to indigenous peoples utilizing the coastline.

More recently, soil profiles in the eastern lowlands region of New Brunswick, an area known historically for its regular anthropogenic fires and thus deemed 'fire-prone', showed very little evidence of fire over several thousand years prior to European settlement (Ponomarenko and Ponomarenko 2000).

Wind

Nova Scotia is at the tail-end of major hurricane tracks and thus, generally speaking, only occassionally experience the full force of these disturbances. Major catastrophic windstorms that occur along the eastern seaboard tend to dissipate by the time they reach the northern portion of the Acadian Forest Region.

Dwyer (1958), in documenting two of the Province's most significant hurricanes, Carol (1953) and Edna (1954) states: "Damage was in the form of scattered trees being blown down to areas where practically all trees were down. This damage occurred in both undisturbed forests as well as partially cut areas. 'Carol' of 1953 blew down timber in partially cut areas, especially where the cut exceeded 30% removed by volume. Johnson (1955) states that 'there was some damage in previously undisturbed stands but it was not severe'." This suggests, contrary to the forestry sector's claims, that mature /old-growth forests are no more susceptible to hurricane damage than managed forests and thus do not need to be liquidated.

The majority of the hurricane-disturbed natural forests stands documented in Dwyer (1958) are directly associated with distinct edges - roads, wetlands, previous forest harvesting, etc. These stands were therefore susceptible to windthrow as a result of natural and anthropogenic edge effects. Clearcutting, highgrading, unnatural edge

formations, as a result of land ownership patterns, and road construction can significantly contribute to an altered pattern and intensity of impacts from this disturbance agent. One can, therefore, justifiably argue that hurricane damage would be much less in a landscape free of extensive, intensive human activity.

The pit-and mound topography of the forest floor cannot solely be attributed to catastrophic wind damage. In many cases, windthrow, and subsequent pit-and-mound production, is the result of another anthropogenic influence - the escalation of native organisms due, for the most part, to human manipulations of the forest ecosystem and/or the introduction of alien organisms. For example, Clattenburg (1962) attributes the significant amount of pit-and-mound ground topography in the deciduous forests of Cape Breton Island as the result of beech mortality caused by the beech bark disease. Even native insect species (eg. spruce budworm), which occasionally develop into significant infestations (again, in part, caused by human activities), can produce large amounts of coarse woody debris on the ground.

Insect / Disease

Unlike the natural factors that influenced the pre-European settlement forest, agricultural land abandonment, past and present forest harvesting techniques and fire suppression have significantly increased the frequency and severity of today's insect epidemics (Holling 1978; Blais 1983; Schowalter 1989; Schowalter 1990; Harrington and Sackett 1992; Torgersen 1994; Perry 1994).

The pre-settlement forest contained a spectrum of insect-controlling predators and parasites. Since the coming of the Europeans, the character of the forest has changed dramatically to one of simplicity which has, in turn, had serious consequences with respect to insect impact. As Graham (1938) stated "Clearing, grazing, burning, and logging without thought of the future have all resulted in almost universal retrogression.... These changes have had a profound effect upon insect populations.... This is to the liking of insect pests of these trees." This has resulted in highly stressed, unstable forest ecosystems that become prime host to a variety of chronic/catastrophic insect infestations. Over time we have removed the natural barriers that have kept these insects under control.

Other Disturbances

In most cases, forest damage from freezing rain and snow generally results in limb/twig breakage rather than mortality and therefore no/little change in species composition. As such, it should not be considered a disturbance in the same light as fire, windthrow, and insects.

The 'open seral disturbance regime', to me, makes little sense – it is not a disturbance per se but rather an inherent site condition that, over a longer expanse of time, precludes a forest from developing. It should not be included.

To close: if we, as a society, want to truly achieve sustainability of natural resources, then at least the scientific research, for example natural disturbances, must be undertaken by academics and government agencies not governed by consumptive agendas.

Thank you again

Art Lynds