

## 6. ЕКОЛОГІЯ ТА ПРИРОДНО-ЗАПОВІДНА СПРАВА



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### To Act or not to Act Białowieża Forest under Conflicting Ecological Paradigms

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*Białowieża, a national treasure to the people of Poland and a unique ecosystem of historical significance, has become a site of intense international debate, following a large scale Bark Beetle (*Ips typographus*) outbreak. The controversy centers around two opposing ecological paradigms: 1) Ecosystems without human interference would eventually reach a climax state that is self-regulating and in equilibrium (The **No Action** paradigm); 2) Trees infected by *Ips typographus* should be salvaged in order to reduce CO<sub>2</sub> emissions, lower the fire risk, and prevent the collapse of healthy tree communities (The **Adaptive Action** paradigm).*

*This contribution analyzes historical evidence and recent issues related to the management of Poland's Białowieża Forest. It presents a proposal towards a negotiated landscape design that allows for small-scale spatial mixing of different land-uses. Białowieża Forest can become a unique example of a continuously evolving forest landscape that is resilient to fluctuating environmental conditions, human values, and societal demands<sup>4</sup>.*

**Key words:** Białowieża; Ecosystem Integrity; Bark Beetle; Nature Conservation; Landscape Model.

**Introduction.** Białowieża Forest, a national treasure to the people of Poland, is of particular interest to the international research and conservation community because of its relatively large area and unique history (Sekowski, 2011). The Polish part of Białowieża Forest comprises four distinct spatial entities: the Białowieża Forest District (12,593 ha), the Białowieża National Park, which is a World Heritage Site, (10,517 ha), the Browsk

Forest District (20,417 ha) and the Hajnówka Forest District (19,654 ha). The Białowieża Forest, Browsk and Hajnówka districts constitute the «Promotional Forest Complex» (the «Puszcza Białowieska») where tree harvesting is allowed, subject to certain limitations imposed by the European NATURA 2000 network, to ensure the long-term survival of Europe's most valuable and threatened species and habitats.

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While the Spruce Bark Beetle (*Ips typographus*) has been present in the Białowieża Forest at least since the early 1800s (Brincken, 1828, Cieszewska and Cieszewski 2019), the dramatic outbreak within the past 25 years is unprecedented. Bark Beetle outbreaks have profound social, economic, and ecological consequences, causing a complete change of the landscape character and deeply affecting the perception of the local communities. The ban on salvaging infected trees has resulted in an explosion in the rate of infestation of healthy spruce trees in Białowieża Forest that threatens to cause a collapse of extensive forest areas. It has also initiated an environmental conflict that has been characteristic after bark beetle proliferations in other regions of Europe (Stadelmann, Bugmann, Meier, Wermelinger, & Bigler, 2013). Two opposing ecological paradigms often cause these conflicts:

a) The No Action paradigm: trees infected by *Ips typographus* should not be salvaged; without human interference, the ecosystem would eventually reach a climax state that is self-regulating and in equilibrium (Worster, 1994). In addition, specific ecosystem dynamics following a natural disaster, such as a Bark Beetle outbreak, are an interesting object of research, and should be left as an «open-air laboratory».

b) The Adaptive Action paradigm: trees infected by *Ips typographus* should be removed timely and continuously in order to reduce CO<sub>2</sub> emissions, lower the fire risk and slow down, and hopefully prevent the further collapse of healthy tree communities. The specific ecosystem dynamics following a Bark Beetle outbreak are well known (Müller, Noss, Bussler, & Brandl, 2010, Nováková, & Edwards-Jonášová, 2015), and there is no justifiable reason to maintain additional «open air laboratories» by protecting uncontrolled bark beetle proliferation given the destructive nature of these outbreaks.

Patch-driven Bark Beetle outbreaks are challenging to control even with active management, but if left untreated can cause significant ecological change (Økland, Nikolov, Krokene, & Vakula, 2016). Attempting to apply a «no action» policy in the forest risks rapid ecological collapse, with a potential for severe ecological disaster for species dependent upon mature conifer forests, as well as significant social and economic consequences for the people living near the forest.

**Methods and Objectives.** We will analyze historical evidence and recent literature in an attempt to contribute facts and logic to the dispute over the National Park and the Dying Forest. A second objective is to develop a landscape model that would satisfy the goals of the Białowieża National Park directorate. The directorate recently emphasized that «Management should always aim at finding a balance between biodiversity conservation, sustaining of ecosystem services and assuring fair distribution of the costs and benefits of conservation, especially to local inhabitants» (Pabian, & Jaroszewicz, 2009). We will develop an integrated approach that allows for diverse values and ecological

services consistent with the history of Białowieża Forest and future vision of the landscape as a whole.

**Results and Discussion.** The management of Białowieża Forest is subject to various national Acts and Regulations as well as a series of international restrictions. The Polish State Forest Administration has a statutory obligation to protect the forest and to ensure its continued existence by preventing its destruction. Item 9 of the UNESCO Directive World Heritage does not allow for human intervention into «natural processes» in certain areas of the forest. The «Habitats» directive of *Natura 2000* specifies the preservation of habitats of importance for the ecological community, which in the case of a large scale Bark Beetle gradation, is impossible to achieve without human intervention. There are areas where tree harvesting is controlled subject to the regulations of *Natura 2000* and the requirements of the Polish-Belarusian UNESCO World heritage site «Białowieża Forest». This includes nature reserves and «reference areas»; special landscape protection areas for certain bird species; protection of «nature monuments» as well as «pioneer» and wetland forests. All these administrative and legal requirements are spatially relevant. Specific restrictions that apply in particular spatial units may be irrelevant in others. The complexity of the somewhat contradictory legal and administrative restrictions complicates planning and policy-making. Any attempt to solve the conflict must, therefore, recognize the spatial relevance of the different legal frameworks.

*The dispute over the National Park and the Dying Forest.* The issue of how to control the beetle outbreak is part of a much larger conflict about how to manage the whole of Białowieża Forest. Three issues, the primeval status of the park, the ecology and health of forests outside of it, and the future management of the forest, are interlinked in public discourse in ways that have obscured how the public understands the forest, its history, and ecology. Activists warned in the Guardian on May 25, 2016, that the harvesting of dead trees will destroy «an ecosystem untouched for 10,000 years». In perhaps one of the most egregious examples, protests were held in Ottawa, London, Edinburgh, and Copenhagen to «prevent the impending destruction of the forest by the local foresters» because of an email sent around by a biology student from Finland who had never visited Białowieża himself (Franklin, 2002). Photographs have been published showing artificial smoke rising among majestic trees to create illusive effects of a «mystic ancient forest». Such visual tricks show the landscape not as it is, but as an illusion (Gutowski et al., 2000, Franklin, 2002).

Activists have selectively used evidence to deny the extent to which the existing National Park is a thoroughly altered landscape that has served, and continues to serve, the needs of its inhabitants. Sensational media reports, which created the myth that Białowieża Forest is a «dying forest destroyed by foresters» is a gross distortion of the truth, because the Białowieża Forests are the result of a long history of forest management and trade in the Baltic (Sunseri, 2012).

*A long History of Human Use.* The Białowieża Forest in Poland is a complex socio-ecological system that has been shaped by active human management that can be traced back at least five hundred years. Białowieża Forest is a remnant of the lowland forests that once covered much of the central European lowland plains (Falinski, 1986). In the 14th century, the forest became the royal hunting ground of the Jagiellonian kings (Samojlik et al., 2013). While sovereignty over Białowieża Forest has shifted many times over the last 600 years, the forest largely remained the reserved hunting grounds of the ruling classes (Schama, 1995). As a result, Białowieża Forest is one of the few lowland forests in Europe that has never been completely cleared of forest cover (Pabian, & Jaroszewicz, 2009). The fact that the forest has for a half-millennia existed as the protected reserve has predominated in nationalist accounts and in contemporary environmentalist discourse about the forest's «primeval» conditions (Schama, 1995, Franklin, 2002, Sunseri, 2012, Blavascunas, 2012).

The argument that Białowieża Forest is primeval or untouched is based on a highly selective reading of history that denies the longstanding human management and use of the forest. One only has to examine the geography of Białowieża Forest to understand humans used and actively shaped the forest for centuries. The existence of navigable rivers through the forest that connect to the Vistula River and the Baltic Sea provided a means of transporting forest products (Brincken, 1828, Hedemann, 1939, Schama, 1995, Cieszewska and Cieszewski 2019). As early as 1410, the rivers of the Białowieża Forest were noted for their transportation use and economic importance (Brincken, 1826, <http://www.historytoday..>). The forest has historically been more open than today (Vera, 2000). Pollen profiles analyzed from peat bogs in the National Park show increases in the charcoal/pollen ratio from around 1430 (Mitchell, & Cole, 1998), which supports evidence that the forest was intensely settled during the 6th to 12th century (Hedemann, 1939, Gorska, 1976)

and that arable farming and animal husbandry were commonly practiced in the forest through the clearing of meadows (Franklin, 2002). Fires were widespread from 1653 to the late 1700s, supporting assumptions of an open, Pine-dominated forest with substantial human influence on the fire regime (Niklasson et al., 2010). Such evidence, painstakingly collected by scientists in Białowieża Forest, is essential to support policy and decision-making.

Historical memoirs provide a detailed description of Białowieża Forest in the early 1800s. Detailed descriptions of the forest conditions, including sizes and volumes by tree species suggest that a reasonably detailed inventory of the forest must have been available. That timber was an essential contributor to the local economy (Brincken, 1828, Cieszewska and Cieszewski 2019). Additional information on the game population, the use and control of fire in the forest, and the detailed description of hunting, all paint a picture of a forest intensively managed by humans. Of particular interest regarding early human activity is a map from 1639, which shows the forest subdivision and the boundaries of forest compartments before the third partitioning of Poland (Hedemann, 1939). Traces of human activity are visible on at least 90% of the present forest boundaries (Falinski, 1986).

One of the most significant human impacts was the maintenance of high populations of large herbivores for royal hunting through the centuries. The last yew trees, a species known to be particularly vulnerable to browsing, disappeared in Białowieża Forest during the 19th century (Wiecko, 1972). Large herbivores, which are protected in the Białowieża National Park, act as a filter by favoring a few species that are capable of withstanding the browsing pressure, thus reducing the natural species diversity (Kuijper et al., 2010, Pommerening, Brzeziecki, & Binkley, 2016). Special control plots for assessing the effects of browsing would complement existing field plots in the Białowieża Park and thus contribute to a better understanding of this crucial issue (Fig.).



Figure. Fenced (left) and unfenced (right) area showing the effect of browsing by large ungulates

Philosophically, the push to maintain «virgin» or «pristine» environments without humans is a product of a long line of Western thought about the separation of humans from nature. This idea has had many negative social and ecological impacts, such as the dispossession of indigenous people from their

traditional lands and the belief that fenced-in protected areas inevitably produce good conservation outcomes (Wapner, 2014, Purdy, 2015). The belief that humans were separate from nature-inspired practical efforts, such as early forestry, to manage nature primarily for human benefit (Barton, 2002). A new preservationist

impulse emerged in the mid-nineteenth century that called for protecting nature in a state of «wilderness», free from humans (Bennett, 2015). Utilitarian and preservationist views have provided justifications for the dispossession of existing local interests (Westoby, 1987, Gibson, Margaret, McKean, & Ostrom, 2000, Blavascunas, 2012, Bennett, 2015).

Frederic Clements (Clements, & John, 1938) popularized the idea that ecosystems without human interference would, through succession, reach a climax community that was self-regulating and in perpetual equilibrium. The idea that «nature» naturally tends towards equilibrium inspired a wave of hands-off management experiments in national parks throughout the world, beginning in the 1950s and 1960s, that continues to this day (Worster, 1994). There has been significant push-back against these policies, because managers recognize now that humans have always been integral parts of the ecosystems, and human action, if removed entirely, can have significant and unexpected ecological consequences in protected areas as seen by efforts to use natural policies for fire and elk in Yellowstone National Park or moose and wolf populations on Isle Royale (Peterson, 1999).

*Landscape Models for Reconciling Diverse Interests.* At least two conditions are required to avoid a major conflict: knowledge of the impending problem and the political will to act (Carment, & Garner, 1999, Woocher, 2001). The Białowieża National Park directorate recently emphasized that «Management should always aim at finding a balance between biodiversity conservation, sustaining of ecosystem services and assuring fair distribution of the costs and benefits of conservation, especially to local inhabitants» (Pabian, & Jaroszewicz, 2009). An integrated approach that allows for diverse values and ecological services is consistent with the history of Białowieża Forest. However, to achieve and maintain such integration is not a trivial task. The practical implementation of that vision requires pragmatic concepts of landscape design.

**Zoning.** The primary purpose of zoning is to assign land use opportunities and restrictions to specific areas, regulating activities, which will be acceptable, and thus preventing land-use conflicts. Zoning has been proposed, for example, as a means to offset the impact on timber production from increased environmental demands (Ontario Ministry, 2000). An advantage of a zoning approach is the spatial segregation of types of land-use based on specific sets of rules and regulations in a simple and straight forward implementation. Thus, zoning may be useful as a very first response to a conservation conflict. A disadvantage is the large scale entrenchment of simple rules and regulations. Zoning usually limits the fine-grained range of spatially relevant options and may thus impede continuous adaptation to changing public demands and environmental conditions.

**Small-Scale Spatial Mixing.** Small-scale spatial mixing of different options, based on new pragmatic theories, is preferable in generating a continuously evolving landscape in response to human demand and changing environmental conditions (Haber, 2004).

Transdisciplinary systems approaches to landscape design have been proposed where the role of humans in the people-landscape interaction proceeds in mutually influencing loops of actions and reactions (Tress, & Tress, 2001). New concepts, such as the «Multiple Path Design», are based on advanced models of ecosystem dynamics and the preferences of *bona fide* stakeholders (Gadow et al., 2007). Many other approaches exist accounting for the sensible Forest Practices Codes allowing for sustainable harvesting and contemporary efficient inventories (e.g. Manning and McDill 2012, Lowe and Cieszewski 2014).

The original subdivision of Białowieża Forest reveals a systematic grid of primary units of landscape design (Brincken, 1826, Hedemann, 1939). The development of each of these primary spatial units through time is affected by a succession of events. Each primary spatial unit follows an *ecological path* that is defined by a particular set of events (including a conscious «No Action» policy or a «protect old habitat trees» policy) within a particular time frame. Each ecological path is associated with a series of outcomes, and new technology allows the simulation of such ecological paths, resulting in a «multiple path design» that provides long-term solutions and spatially explicit solutions for conservation conflicts. The book «Designing Green Landscapes» presents examples of multiple path designs that help generate a continuously evolving landscape in response to human demand and changing environmental conditions (<https://link.springer.com/book/10.1007/978-1-4020-6759-4>).

**Discussion.** Given the largely one-way push to create protected areas, scientists and policy makers need to be careful of embracing a strict and simplistic protected areas' framework, because there is mounting evidence that this can cause problematic and unexpected ecological, social and economic changes. Strict protected areas policies, especially those advocating «no action» or «hands-off» policies, promote the view that humans are not part of nature and have little role to play in ecological functioning.

Over the past few decades, it has become clear, however, that the separation of humans from nature is a cultural construct of relatively recent origin that has negative impacts on people and can cause significant unexpected ecological change (Wapner, 2014). «Nature» does not exist apart from humanity; the world we will inhabit is the one we have made (Purdy, 2015). A significant amount of research has traced the negative social, cultural and economic impacts of people living near protected areas in developing countries. However, less has been focused on developed countries. A study reviewing developments during the past half century based on principles of naturalness, found that, contrary to expectations, managing exclusively for naturalness did not serve to protect all wilderness values and purposes (Bowman et al., 2011). Significant resources and active management are required to preserve ecological values in protected areas because such areas are not self-regulating. Ecological reconstructions show that the world's ecosystems have changed significantly during

the Holocene as a result of interactions between human action, especially from fire and agriculture (Bowman et al., 2011), and environmental conditions, such as natural and human-induced climate change (Parmesan, 2006). A comprehensive investigation into whether it is possible to restore the forests of the American north-east to a historic «natural» condition concluded: «there are no static baseline conditions that exist or have existed for comparison with current conditions or for use as a target for restoration activities» (Foster et al., 2008).

There is a growing concern about the potential of rapid forest decline throughout many of the world's forests as a result of a conjuncture of human and natural processes (Trumbore, Brando, & Hartmann, 2015). The outbreak of Bark Beetle infestations in central Europe is one of the most dramatic of these changes. There is little philosophical, historical or ecological justification for stopping humans from continuing to shape and influence the ecosystems of the Białowieża Forest. A more diverse landscape-including mixed hardwoods and softwoods, remnant old-growth, open woodlands, and commercial forest-would provide the greatest diversity of forest structure with a broader array of ecological services.

Schama (1995) precedes his famous monograph «Landscape and Memory» with a citation of Henry David Thoreau: «It is in vain to dream of a wildness distant from ourselves. There is none such. It is the bog in our brains and bowels, the primitive vigor of Nature in us that inspires that dream». He continues on page 9: «Even the landscapes that we supposed to be most free of our culture may turn out, on closer inspection, to be its product».

**Conclusions.** The argument that Białowieża Forest is primeval or untouched is based on a highly selective reading of history that denies the longstanding human management and use of the forest. One only has to examine the history of Białowieża Forest to understand that humans have actively shaped the forest for centuries. The effects of drought and beetle infestations are causing dramatic ecological changes in central Europe. There is little philosophical, historical or ecological justification for preventing humans from continuing to ensure the sustainability of the basic functioning of the Białowieża ecosystems. A diverse landscape, with uneven-aged, multi-species, and old growth forests, will provide a desirable array of ecological services. This requires effective control of beetle proliferations and the browsing pressure. Small-scale spatial mixing of different land-uses in response to the preferences of *bona fide* stakeholders is possible using advanced models of ecosystem design.

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## Діяти чи не діяти Біловезька Пуща з погляду конфліктних екологічних парадигм

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Біловезька Пуща, національний скарб для населення Польщі, становить особливий інтерес для міжнародної дослідницької та природоохоронної спільноти через його відносно велику площу та унікальну історію.

Ці конфлікти часто зумовлені двома протилежними екологічними парадигмами: а) парадигма «без дій»: дерева, заражені типографом, не потрібно рятувати; без втручання людини екосистема може врятувати-решт досягти кульмінаційного стану, який є саморегулюючим і врівноваженим (Worster, 1994). Крім того, специфічна динаміка екосистеми після стихійного лиха, наприклад, спалаху розвитку короїда, є цікавим об'єктом для дослідження, і його варто залишати як «лабораторію під відкритим небом». б) парадигма адаптивної дії: дерева, заражені типографом, необхідно видаляти своєчасно та постійно, щоб зменшити викиди CO<sub>2</sub>, знизити ризик виникнення пожеж та сповільнити, і, сподіваємось, запобігти подальшій загибелі здорових деревних угруповань.

Специфічна динаміка розвитку екосистеми після спалаху розвитку короїда добре відома (Müller, Noss, Bussler, & Brandl, 2010, Nováková, & Edwards-Jonášová, 2015), і немає вагомих причин підтримувати додаткові «лабораторії під відкритим небом», унеможливаючи таким чином захист від подальшого неконтрольованого розповсюдження короїда, і враховуючи руйнівний характер цих спалахів.

У статті проаналізовано історичні свідчення та новітню літературу, з намаганням внести фактичний матеріал та логічні міркування в суперечку про Національний парк та вмираючий ліс. Інша мета, на яку спрямована робота – розробити ландшафтну модель, яка б відповідала цілям дирекції Національного парку «Біловезька Пуща». Розроблено інтегрований підхід, який дає можливість охопити різноманітні цінності та екологічні послуги, що відповідають історії Біловезької пущі та майбутньому баченню ландшафту в цілому.

Аргумент про те, що Біловезька Пуща є первозданною чи недоторканою, ґрунтується на дуже вибірково читанні історії, яка заперечує історично тривале господарювання та використання лісу людьми. Варто лише вивчити історію Біловезької пущі, щоб зрозуміти, що люди активно формували ліс століттями. Наслідки посухи та зараження шкідниками зумовлюють різкі екологічні зміни в Центральній Європі. Філософське, історичне чи екологічне обґрунтування не дає підстави для того, щоб люди не могли продовжувати забезпечувати стійкість базового функціонування екосистеми Біловежжя. Різноманітний ландшафт з різновіковими, різновидовими та старовинними лісами забезпечить бажаний комплекс екологічних послуг. Для цього потрібен ефективний контроль за поширенням шкідників і рекреаційним навантаженням. Дрібномасштабне просторове змішування різних видів землекористування у відповідь на преференції добросовісних зацікавлених сторін можливе за допомогою використання різних видів землекористування у відповідь на преференції.

**Ключові слова:** Біловежжя; цілісність екосистеми; короїди; охорона природи; пейзажна модель.

## Действовать или бездействовать Беловежская пуща с точки зрения конфликтных экологических парадигм

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охранной общественности из-за его относительно большой площади и уникальной истории.

Эти конфликты часто обусловлены двумя противоположными экологическими парадигмами: а) парадигма «без действий»: деревья, зараженные типографом, не нужно спасать; без вмешательства человека экосистема может в конце концов достичь кульминационного состояния, которое является саморегулируемым и уравновешенным (Worster, 1994). Кроме того, специфическая динамика экосистемы после стихийного бедствия, например, вспышки развития короеда, является интересным объектом для исследования, и ее следует оставить как «лабораторию под открытым небом». б) парадигма адаптивного действия: деревья, зараженные типографом, необходимо удалять своевременно и постоянно, чтобы уменьшить выбросы  $\text{CO}_2$ , снизить риск возникновения пожаров и замедлить, и, надеемся, предотвратить дальнейшую гибель здоровых древесных сообществ.

Специфическая динамика развития экосистемы после вспышки развития короеда хорошо известна (Müller, Noss, Bussler, & Brandl 2010, Nováková, & Edwards-Jonášová, 2015), и нет веских причин поддерживать дополнительные «лаборатории под открытым небом», исключая таким образом защиту от дальнейшего неконтролируемого распространения короеда, и учитывая разрушительный характер этих вспышек.

В статье проанализированы исторические свидетельства и новейшая научная литература с попыткой внести фактический материал и логические рассуждения в спор о Национальном парке и умирающем лесе. Другая цель, на которую направ-

лена работа – разработать ландшафтную модель, соответствующую целям дирекции Национального парка Беловежье. Разработан интегрированный подход, который дает возможность охватить различные ценности и экологические услуги, соответствующие истории Беловежского леса и будущему видению ландшафта в целом.

Аргумент о том, что Беловежская пу́ща является первозданной или нетронутой, основан на очень выборочном чтении истории, которая отрицает исторически длительный менеджмент и использование леса людьми. Стоит только более детально изучить историю Беловежской пуши, чтобы понять, что люди активно формировали лес веками. Последствия засухи и заражения вредителями вызывают резкие экологические изменения в Центральной Европе. Философское, историческое или экологическое обоснование не дает основания для того, чтобы люди не могли продолжать обеспечивать устойчивость базового функционирования экосистемы Беловежья. Разнообразный ландшафт с разновозрастными, разновидовыми и старинными лесами обеспечит желаемый комплекс экологических услуг. Для этого нужен эффективный контроль за распространением вредителей и рекреационными нагрузками. Мелкомасштабное пространственное смешивание различных видов землепользования в ответ на предпочтения добросовестных заинтересованных сторон возможно с помощью применения передовых моделей дизайна экосистем.

**Ключевые слова:** Беловежье; целостность экосистемы; короеды; охрана природы; пейзажная модель.