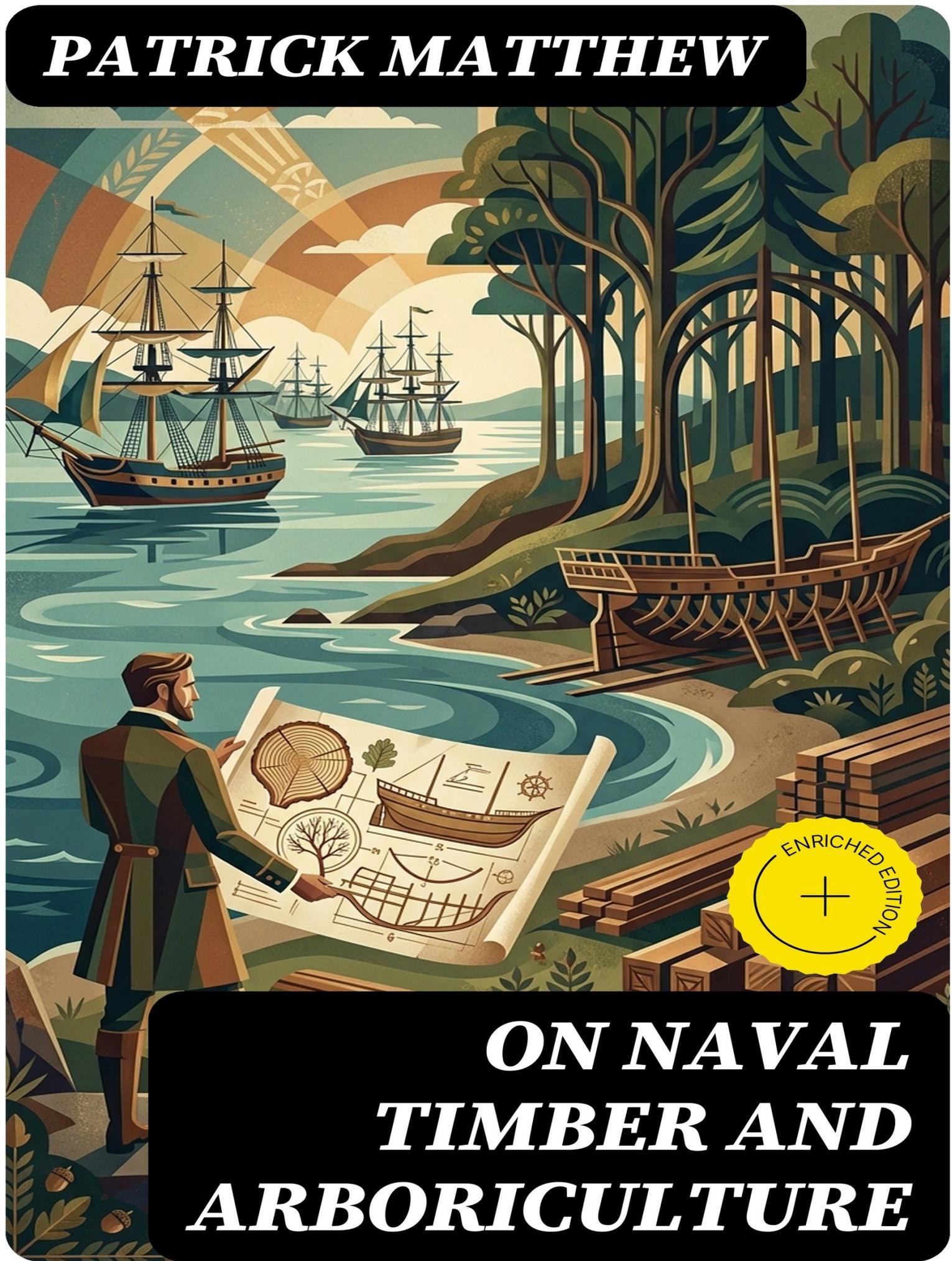


# PATRICK MATTHEW



## ON NAVAL TIMBER AND ARBORICULTURE

**Patrick Matthew**

# **On Naval Timber and Arboriculture**

**Enriched edition. With Critical Notes on Authors who  
have Recently Treated the Subject of Planting**

*Introduction, Studies and Commentaries by Quinn Theodore*

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# Introduction

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At once a manual for shaping forests to human purpose and a meditation on how nature shapes life beyond our designs, *On Naval Timber and Arboriculture* turns the pressure of shipbuilding demands and national resource policy into a stage on which variation, competition, and time quietly act, inviting readers to consider whether careful management can secure predictable outcomes when living organisms respond to climate, soil, and chance, and suggesting that the orderly lines of a plantation and the evolving profusion of the natural world are bound together by processes that reward resilience, economy, and adaptation rather than merely obedience to plan.

First published in 1831, this work belongs to the practical literature of silviculture and rural improvement in early nineteenth-century Britain, written by the Scottish landowner and horticulturalist Patrick Matthew for readers concerned with shipbuilding materials and estate management. Its genre is a technical treatise that mixes instructions, observations from experience, and pointed criticism of other authors on planting. The immediate context is a maritime nation dependent on reliable supplies of strong, well-grown timber for hulls, masts, and spars. Matthew writes within that milieu, aiming to align scientific understanding, husbandry, and public interest in an age when naval strength and commerce rested on wood.

As a reading experience, the book unfolds as a sequence of practical chapters on raising, tending, and selecting trees

for durability and form, punctuated by analytical passages on growth, climate, and soils, and followed by reflective sections that widen into natural history. Matthew's voice is assertive, empirical, and unsparing when judging received wisdom; his style is compact, argumentative, and rich in examples, with a craftsman's attention to detail. The tone combines instruction with controversy, moving from field-tested counsel to broader principles without abandoning the practitioner's vantage. Readers encounter not a textbook alone, but an engaged mind testing methods against outcomes in living systems.

At its core stands the problem of making wood fit for sea: how to cultivate straight, tough, and lasting timber under variable conditions, and how to plan decades ahead for ships that must endure stress and salt. Matthew treats site exposure, spacing, pruning, and rotation as instruments to shape quality, continually relating individual decisions to long-term yield. He links estate economics to public needs by considering how private practice can stabilize national supplies. The recurrent lesson is stewardship across time, where patience, precision, and local knowledge convert planting into infrastructure, and where failure to observe nature's constraints squanders both resources and security.

Alongside this practical program, the book also contains a concise, striking proposal about how species change through the differential survival of varieties under environmental pressures, presented amid discussions of cultivation and improvement rather than as a separate system. That early articulation of a selection principle, delivered years before evolutionary theory became widely debated, appears as an extension of empirical husbandry into the wider economy of nature. Matthew roots it in observable variation and in the culling effects of circumstance. For contemporary readers, this integration

shows how insights about change can emerge from applied work, not only from philosophical speculation.

Modern audiences will find the book relevant for its treatment of sustainability, resilience, and risk in long-lived systems. Its insistence on evidence from practice parallels current emphases on adaptive management, while its concern with continuity of supply anticipates discussions of strategic materials and ecological services. The work models an interdisciplinary habit of mind that moves seamlessly from soil texture to national policy, without losing sight of the tree in front of the planter. It reminds readers that ecological outcomes hinge on cumulative small choices, that feedback loops take decades to reveal themselves, and that prudence is a scientific as well as civic virtue.

To approach *On Naval Timber and Arboriculture* today is to meet a document of craft that doubles as a vantage point on the history of ideas, composed in a period when ships, estates, and sciences were mutually entangled. It rewards close reading for its specific guidance and for the larger implications that guidance carries about limits, opportunity, and change. Without preempting discovery, one can say that the book's enduring power lies in its union of method and imagination: it teaches how to grow trees for purpose, and it suggests how attentive practice can illuminate the patterning of life itself.

# Synopsis

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Published in 1831, Patrick Matthew's *On Naval Timber and Arboriculture* addresses the pressing need for reliable timber suited to shipbuilding and broader rural improvement. Framed as a practical manual grounded in observation and estate experience, the book surveys how to raise, manage, and select trees that meet stringent maritime specifications. Matthew situates timber production within national economic and strategic concerns, arguing that sound silviculture underpins naval readiness and domestic industry. He sets out to replace habit and inherited rules with measured practice, combining notes on soils, climate, and growth with guidance for landowners intent on turning scattered plantings into a sustainable timber resource.

He evaluates the qualities demanded in naval timber—strength, durability, resilience, and, in some cases, naturally curved pieces—and links them to species choice and site. Oak, larch, and various pines receive particular attention, with remarks on local climate, exposure, and soil depth that influence fibre, density, and decay resistance. Matthew emphasizes matching species and provenance to intended use, cautioning that timber soundness depends as much on growth conditions as on nominal species traits. He advises selecting seed and young stock with care, noting how consistent husbandry from nursery to maturity produces wood that better withstands the stresses of construction and sea service.

From nursery practice through final felling, the treatise details techniques to secure form and quality. Matthew discusses sowing, transplanting, spacing, and timely thinning to reduce knots and secure steady increment. He describes pruning and training methods to obtain straight spars and, where required, compass timbers with natural curvature for frames and knees. Protection from wind, grazing, and pests appears as a constant theme. He stresses that early neglect cannot be repaired late in rotation, and that well-planned interventions yield timber that seasons more predictably, works cleanly, and delivers maximal strength-to-weight ratios vital to masts, hulls, and rigging components.

Beyond stand-level practice, Matthew considers estate-scale planning and the economics of rotations. He weighs high forest against coppice and mixed systems, presenting the trade-offs between quicker returns and long-term quality. The book examines costs, market fluctuations, and the risks of relying on uncertain imports, urging measures that strengthen domestic supply. He critiques wasteful felling, injudicious close planting, and misapplied transplanting of overgrown stock, arguing for measured, phased harvests aligned with demand. Interlaced are recommendations on public encouragement and administrative reform to better align private incentives with national needs, so planting schemes yield merchantable timber and strategically valuable material.

Arboriculture in Matthew's sense extends beyond ship timber to shelter, hedgerow structure, and plantation design that serve farms and towns. He outlines how belts and screens temper wind, conserve soil moisture, and protect crops and buildings, while also yielding marketable wood. Species mixtures and edge management receive attention for their effects on microclimate and biodiversity as then

understood. Practical notes on pruning standards, staking, and spacing aim to reduce maintenance and storm damage. Throughout, he treats trees as long-lived infrastructure, advocating arrangements that integrate amenity and utility, and that secure gradual revenue without compromising the structural qualities demanded by skilled trades.

A substantial portion of the volume engages critically with contemporary authorities on planting and transplanting, comparing their prescriptions with results observed in the field. Matthew challenges rigid doctrines where evidence is weak, preferring trials and measured outcomes to prestige. In appendices and addenda, he broadens the discussion to heredity, variation, and adaptation, proposing that environmental pressures can favor certain varieties over others and gradually reshape populations. These reflections, while ancillary to the manual's main purpose, connect silviculture with larger questions about how forms persist or disappear under changing conditions of climate, competition, and land use, extending the book's scope into natural history.

Taken together, the work functions as a practical guide for 19th-century timber producers and a document of policy, economy, and science in transition. Its immediate message champions disciplined, site-appropriate forestry in service of maritime and rural needs. Its lasting resonance lies in the way it unites management detail with a systems view of growth, resource security, and environmental constraint. The methodological insistence on observation and the exploratory notes on variation have invited continued attention, while the core chapters remain instructive about aligning silvicultural practice with end-use performance. The book endures as both a manual and an early, integrative perspective on trees and industry.

# Historical Context

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Published in 1831 in Edinburgh and London, Patrick Matthew's *On Naval Timber and Arboriculture* emerges from early nineteenth-century Britain, when wooden warships still underpinned imperial power. A Perthshire landowner and fruit grower based at Gourdiehill in the Carse of Gowrie, Matthew wrote for landowners, nurserymen, and policymakers concerned with timber supply. Institutions such as the Admiralty, the Navy Board, the Horticultural Society of London, and the Highland and Agricultural Society of Scotland shaped debates over planting and management. Practical handbooks, estate experiments, and agricultural shows disseminated techniques. Matthew's treatise enters this milieu as both a practical manual and an intervention in national resource policy.

Naval strategy set the problem. Britain's Royal Navy, expanded through the French Revolutionary and Napoleonic Wars, depended on vast quantities of oak for hulls and durable conifers for masts and spars. Wartime demand and disrupted European trade exposed vulnerabilities in domestic supply, prompting new plantations and contentious tariff policies to balance Baltic imports with North American timber. Dockyards at Portsmouth, Plymouth, and Chatham needed dependable, seasoned wood resistant to decay. Postwar, debates persisted over reserve planting, procurement standards, and the risks of relying on foreign sources. Matthew frames arboriculture within this strategic calculus, aiming to improve quality and predictability of naval timber.

Arboriculture had an established literature and a vigorous contemporary press. John Evelyn's *Sylva* remained a touchstone, while William Pontey, Thomas Andrew Knight, and John Claudius Loudon advanced techniques in pruning, propagation, and species choice. Loudon's periodicals and encyclopedias popularized experimental results and comparative trials, giving planters guidance grounded in observation. Nurseries expanded catalogues of exotics and improved varieties, while estate reports circulated data on soils, shelter, and rotation. Matthew engages this community explicitly, evaluating authors, disputing prescriptions he considered impractical, and emphasizing methodical planting and thinning. His critical notes situate the book within an ongoing, often polemical conversation about best practice.

Natural history and geology were simultaneously in flux. Ideas of species transformation, extinction, and the tempo of earth history were debated by European savants, from Jean-Baptiste Lamarck's transmutation to Georges Cuvier's catastrophism, while Charles Lyell's *Principles of Geology* (1830–1832) pressed a uniformitarian view. Agricultural breeding and horticulture provided everyday evidence of variation under domestication. In an appendix, Matthew extrapolates from such variation to nature at large, describing a natural process of selection acting through competition and environmental pressures. Though embedded in a technical treatise on timber, these remarks emerged from the same empirical culture that linked husbandry, economy, and natural philosophy.

Scotland offered a distinctive backdrop. The Carse of Gowrie, between Perth and Dundee, was noted for fertile soils, orchards, and access to the River Tay's trading routes. Estate improvement emphasized drainage, shelterbelts, and systematic planting. The Dukes of Atholl's extensive larch

plantations, widely discussed for their speed of growth and potential naval uses, helped make conifer silviculture a national question. Agricultural societies in Edinburgh and across Scotland sponsored premiums, trials, and publications on timber. As a practitioner writing from Gourdiehill, Matthew combined local observation with national concerns, attentive to how site, exposure, and soil chemistry determined both timber quality and economic return.

The treatise surveys species suited to naval architecture and rural economy, notably oak, larch, and various pines, and details propagation, spacing, pruning, and thinning to yield straight, knot-free timber. It addresses seasoning and defects that compromised ship service, including decay often termed 'dry rot,' and argues for preventive management from the nursery onward. Matthew links silviculture to shipwright needs—curved pieces, knees, and mast lengths—so that planting schemes anticipate future demand. He stresses exposure, wind protection, and soil matching as determinants of strength and durability. Throughout, he tests widely repeated claims against estate practice and long-term performance in service.

Matthew's critical notes extend beyond cultivation to policy and institutions. He challenges procurement routines that prized quantity over quality, criticizes wasteful felling and inadequate thinning, and urges reforms to secure reliable supplies decades ahead. He disputes celebrated authorities where their recommendations contradict observed results, insisting on experiments and records rather than reputation. His tone reflects a broader reformist moment in Britain, when scrutiny of administrative systems and calls for public efficiency were common. By juxtaposing silviculture with naval preparedness, he argues that national security

depends on patient, evidence-based management of forests as much as on dockyard workmanship.

On Naval Timber and Arboriculture thus crystallizes several currents of its age: maritime strategy, estate improvement, experimental horticulture, and a widening empirical approach to nature. Its practical chapters seek to align planting with long planning horizons demanded by shipbuilding, while its critiques press institutions to adopt measurable standards. The appendix's brief statement of a natural process of selection links everyday breeding knowledge to broader questions of adaptation and change, exemplifying how technical agriculture fed into contemporary natural history. As a whole, the work mirrors Britain's confidence in improvement and its anxieties about strategic materials, offering both guidance and critique.

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*Castanea* , L.)

B EECH -T REE — *Fagus sylvatica* .

E LM — *Ulmus* . — B ROAD -L EAVED, OR S COTCH, or W YCH  
E LM — *Ulmus montana* .

N ARROW-LEAVED OR E NGLISH E LM — *Ulmus campestris* .

R EDWOOD W ILLOW , or S TAG'S H EAD O ZIER , — *Salix*  
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# INTRODUCTION.

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NAVIGATION is of the first importance to the improvement and perfecting of the species, in spreading, by emigration, the superior varieties of man, and diffusing the arts and sciences over the world; in promoting industry, by facilitating the transfer of commodity through numberless channels from where it is not, to where it is required; and in healing the products of those most fertile but unwholesome portions of the earth, to others more congenial to the existence of the varieties of man susceptible of high improvement: Water being the general medium of action—fluidity or conveyance by water, almost as necessary to civilized life as it is to organic life, in bearing the molecules forward in their vital courses, and in floating the pabulum (the raw material) from the soil through the living canals to the manufactories of assimilated matter, and thence to the points of adaptation. {2}

As civilization progresses under the influence of navigation, and the earth exchanges her straggling hordes of savages for enlightened densely-peopled nations, every climate and country will be more set apart to its appropriate production, and the utility of the *great conduit, the OCEAN*, will more and more be developed, and become the grand theatre of contested dominion—superiority there being almost synonymous with *Universal Empire*—dry land only the footstool of the *Mistress of the Seas*<sup>1</sup>.

In the still hour which has followed the cannon roar of our victories, we seem disposed to sleep secure, almost in

forgetfulness, that we possess this superiority, that we stand forth the Champion of the World, and must give battle to every aspirant to the possession of the *trident sceptre*.

As soon as the recent principles of naval motion and new projectiles, conjoined to shot-proof vessels, shall have been brought to use in naval warfare, marine will have acquired a great comparative preponderance over land batteries, and every shore be still more at the mercy of the Lords of Ocean.

When we consider the tendency of luxurious peace, the effeminacy thence flowing in upon many of our wealthier population—when we view, on the {3} one hand, an entailed aristocracy<sup>2</sup>, whose founders had been gradually thrown uppermost in more stirring times, the boldest and the wisest, but whose progeny, “in a calm world” entailed to listless satiety, have little left of hope or fear to awaken in them the dormant energies of their ancestors, or even to preserve these energies from entirely sinking; and, on the other hand, an overflowing population, chained, from the state of society, to incessant toil, the scope of their mental energies narrowed to a few objects from the division of labour, all tending to that mechanical order and tameness incompatible with liberty; thus, perhaps, equally in danger of deteriorating and sinking into *caste*, both classes yielding to the natural law of restricted adaptation to condition:—when we reflect on this, the conclusion is irresistibly *forced* upon us, that the periodical return of war is indispensable to the heroic chivalrous character and love of freedom which we have so long maintained, and which (Britain being the first in name and power in the family of nations) must be so influential on the *morale* of the civilized world. It is by the jar and struggle of the conflict that the baser alloy and rust of our manners and institutions must be removed and

rubbed away: it is by the {4} ennobling excitement of danger and of hardship that our generous passions must be cherished, and our youth led to emulate the Roman in patriotic thirst for glory—the Spartan in devotion—their own ancestor, the more daring Scandinavian sea-king or rover<sup>3</sup>, in adventurous valour. Without, however, seeking the fight, yet in preparation for the perhaps not distant time, when we shall face another foe, it behoves us, without any sickly sentimentality, to cherish our warlike virtues—above all things to attend to what must constitute “the field of our fame,” *Our MARINE*, and the material of its construction, *Naval Timber*.

## NOTES TO THE INTRODUCTION.

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1. See App. A.
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## PART I. STRUCTURE OF VESSELS.

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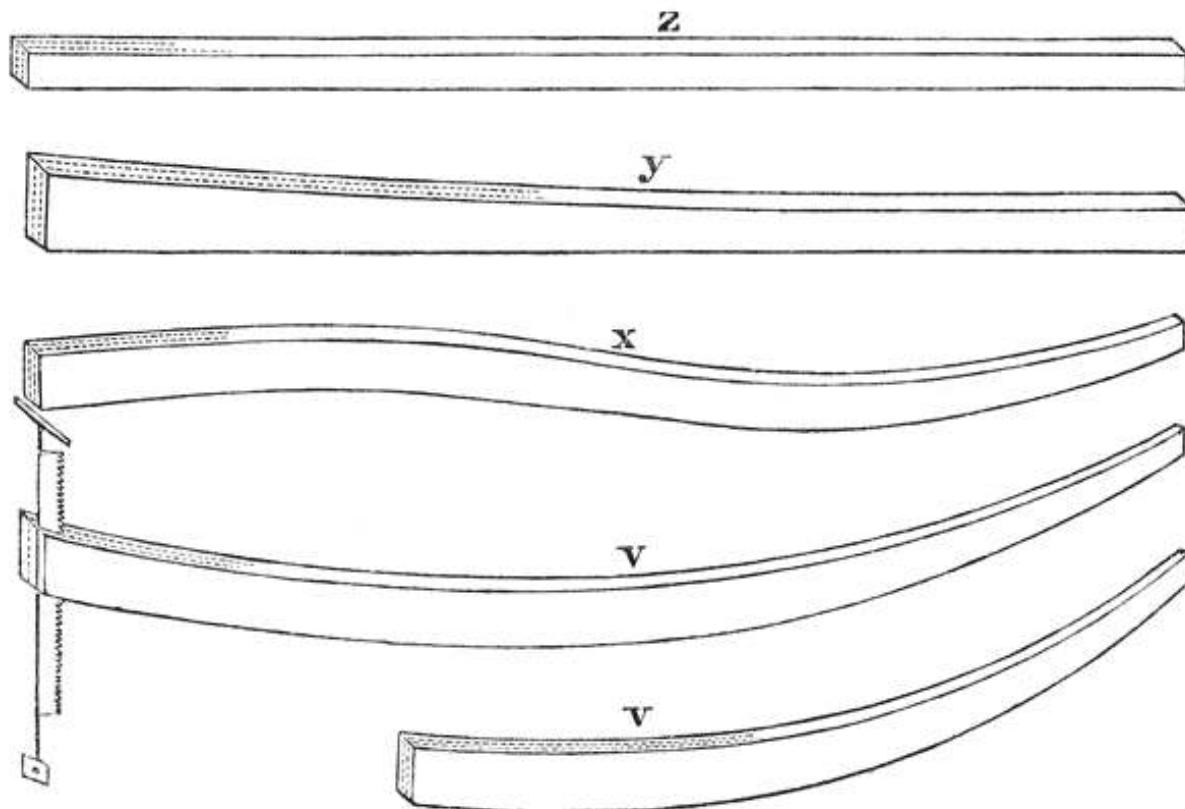
VESSELS are constructed of wood under two forms, *Plank* and *Timbers*; Plank, the out and inside skin of the vessel—Timbers, the ribs or frame which support the plank.

### SECTION I. PLANK.

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Trees intended for plank ought to be reared in close forest, or protected situation, drawn tall and straight, or what is preferable for a part, with a gentle regular bend, technically *sny*[\[1\]](#), Figs. v and x, (next page). It requires to be of clean solid texture, from 12 to 40 feet in length, and at least 8 inches in diameter at small end, or any greater thickness. For the conveniency of transport, oak plank timber is generally squared or planked where grown, and is cut out from 2  $\frac{1}{2}$  to 7 inches in thickness, and from 6 to 18 inches in breadth. Plank is needed of such various dimensions, that any oak tree of clean timber, nearly straight one way, and straight, or with a gentle regular bending, the other, may safely be cut into plank, the section to be in the plane of the [{6}](#) curve. Figs. v, x, y, z, represent the most advantageous forms of logs for cutting into plank. The dotted lines shew the section of the saw in planking: the straighter the log is in the plane of the saw, it is the more suitable, as the planks bend sufficiently *side-way* by steaming; Fig. v, of considerable bend and taper, where the planks, when cut, have a bend *edge-way*, is the most valuable: this form

requires to be very free of knots. In straight planks, Fig. z, cleanliness from knots is not such a desideratum.



Figs. z, y, of any length—best long; x, from 25 to 35 feet; v, v, from 12 to 24 feet.

In the above cut, for distinctness, the saw is drawn entering the butt. In practice it enters the top.

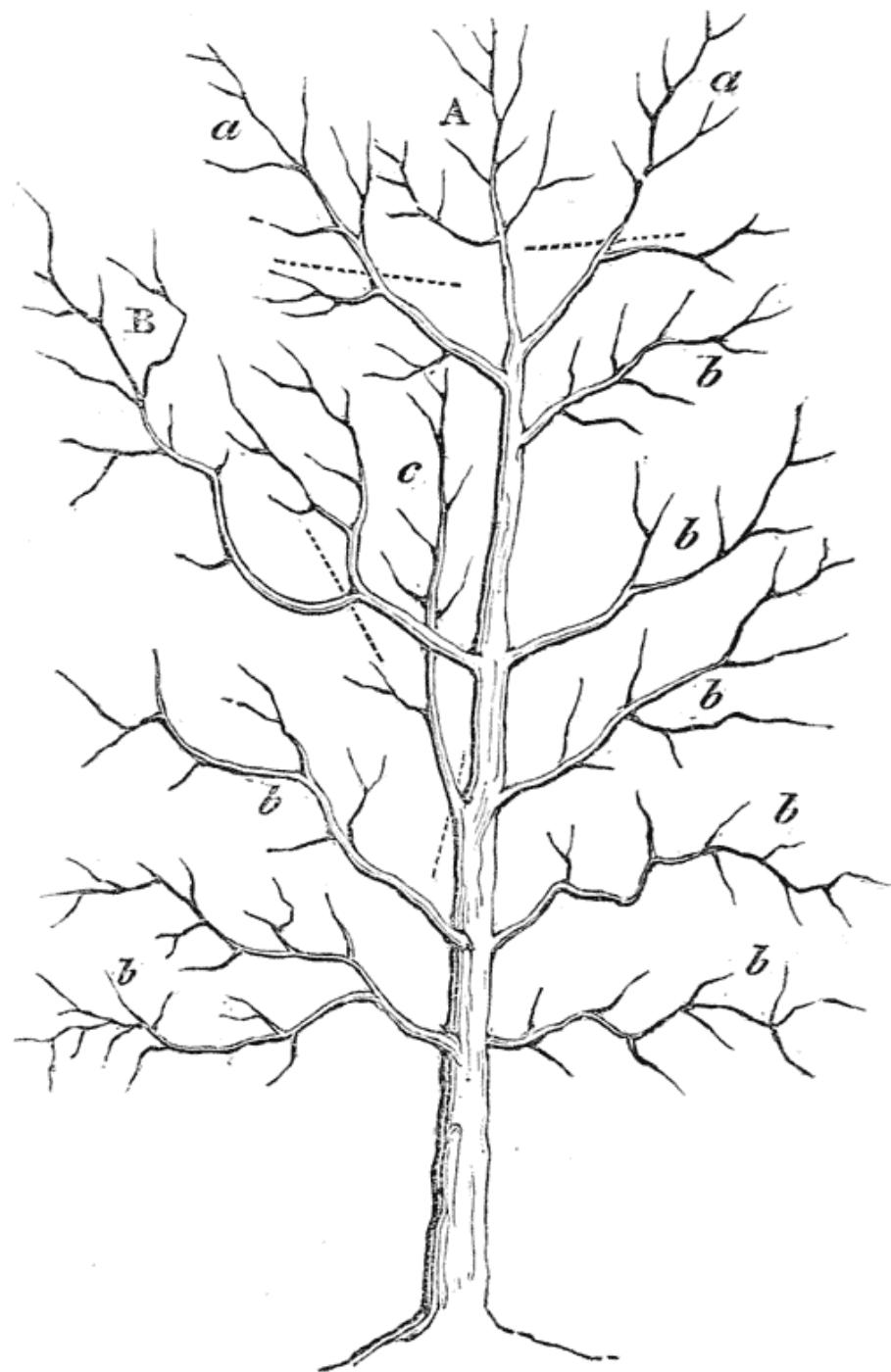
When planks are cut out where grown, they are sawn from the round log immediately after it is {7} felled and barked, which not only prevents injury from drought-cracks, but produces also a considerable saving of timber and labour, as the wood is softer when green; and the centre planks can thus be had much broader than after squaring the log. The outer part of the matured or red wood, which is partly cut away in squaring, is also the cleanest for bending. The sap or not sufficiently matured wood, when left on the side of the plank in the vessel, wherever it is not always soaking in

water, is only useful to the shipwright, as it decays in two or three years, and demands an expensive repair. When plank timber is squared, it is for the conveniency of carriage and stowage, and where timber is of little value.

Of British trees suited for plank, the most valuable are oak, Spanish chesnut, larch, red wood pine, and sometimes beech<sup>4</sup>, elm, plane (*Acer pseudo-platanus*) under water. As no timber decays under water for a considerable length of time, when put in fresh, unless it be devoured by the sea-worm, beech or any other hard tough wood is nearly equally good as oak for outside plank under light water-mark, provided the timber be hastened out of the bush into the vessel, or be kept in pools, either in log or {8} plank, till used, or be planked, and the plank kept dry under cover. One summer on the ground will generally render a beech log in the bark useless.

#### DIRECTIONS<sup>5</sup> FOR TRAINING PLANK TIMBER.

Divide all branches into leaders and feeders; leaders, the main or superior shoots which tend to become stems, A, a, a; feeders, the inferior branches, B, b, b, b.



{9}

Should more than one leader appear from the time of planting the tree till it attain the required height for the plank, shorten all but the most promising one down to the condition of feeders, making the section immediately above

a twig, preferring one which takes a lateral or horizontal direction. *Vide* dotted line crossing *a, a.*

Should any feeder, below the required height, become enlarged beyond its compeers, such as *B*, reduce it to equality (*vide* dotted line), or prune it close off, if this should be necessary to the symmetry of the tree.

Cut off, close by the trunk, all shoots which rise at a very acute angle with the main stem, such as *C*. There is a triple reason for this: they rise up and interfere with the more regular horizontal feeders, tending also to become leaders; they do not form a proper junction with the stem, by reason of the wood, as it swells, not being able to throw up the bark out of the narrow angle; thence the bark of both stem and branch is enclosed in the confined breek, and the wood never unites<sup>6</sup>, thence disease is {10} liable to be generated between them, or the branches are subject to be torn down by the wind; and should they ultimately come to be removed, being then of considerable size, and the section from their perpendicular position being partly horizontal, as the sides of the wound swell up, the rain lodges in the centre, and generates rot. These nearly perpendicular branches generally originate from improper pruning, springing out where a large branch has been cut away.

Lop off all branches, which, by taking an irregular direction, incline to rub upon the more regular; also remove all splintered, twisted, and diseased branches.

Do not cut away any of the lower branches (feeders) till they become sickly or dead. By pruning these prematurely, you destroy the fine balance of nature, and throw too much vigour into the top, which in consequence puts forth a number of leaders. You also diminish the growth of the tree by the loss of healthy feeders; the timber of the tree increasing in proportion to the quantity of healthy branches

to cultivated forms of this willow historically grown in Britain and used for timber, shelterbelts, and basketry.

**15** Refers to ports on the River Tyne in northeast England—North/South Shields and Newcastle upon Tyne—which were major shipbuilding and coal-exporting centres in the 18th and early 19th centuries.

**16** Laburnum (commonly called golden-chain) is a small deciduous tree of the pea family (genus *Laburnum*, historically associated with *Cytisus*); its dense, finely polished wood was prized for small turned or decorative work in the 18th–19th centuries, though it is not a major commercial source of large timber today.

**17** A traditional form of woodland management in which trees (often oak) are cut back periodically to near ground level to produce new shoots for timber, poles, or bark; the practice encourages regrowth and was common in Britain and Europe.

**18** A dark, acetic-containing liquid obtained by the destructive distillation of wood (also called wood vinegar); historically used as an extract or preservative and composed of various volatile organic compounds whose exact composition can vary.

**19** A large naval warship built to take its place in the ‘line of battle’—the linear tactic of fleet actions—commonly referring to ships-of-the-line used from the 17th through early 19th centuries, mounting many guns on broad decks.

**20** An archaic horticultural term (used in 19th-century British gardening) meaning a young shoot or seedling raised from seed; here it refers to the emerging young plant as it pushes up through the husk.

**21** A deliberate pile or layer of seed mixed with sandy earth left to decompose and be turned over (a form of stratification or composting) to break dormancy and prepare certain seeds for sowing the following season.

**22** An archaic or regional English word for ants (insect family Formicidae), often found in older literature and dialect; here it denotes ants that eat seeds and seedlings in the forest.

**23** An 18th-century topical dressing for tree wounds promoted by Forsyth; such 'composition' recipes varied but were intended to cover exposed wood, protect against weather and insects, and encourage healing, though their effectiveness was later disputed by some arborists.

**24** Probably refers to Peter Barlow (1776–1862), an English mathematician and engineer who taught at the Royal Military Academy, Woolwich, and who carried out applied experiments and publications on strength and mechanics known in the early 19th century.

**25** A 19th-century trade name for large Baltic pine timber exported via Memel (the historical name for Klaipėda, now in Lithuania); Memel timber was widely used in British shipbuilding and construction.

**26** Common name for the fungus *Auricularia auricula-judae* (also called 'jelly ear'), which produces ear-shaped, gelatinous fruiting bodies that grow on decaying wood and can bind or cover timber surfaces.

**27** Sir Henry Steuart of Allanton was an early 19th-century Scottish landowner and author who promoted methods of planting and transplanting trees (notably in a work often called *The Planter's Guide*); his practices and theories are the main target of critique in this chapter.

**28** Sir Walter Scott (1771–1832) was a prominent Scottish novelist, poet, and historian; here he is cited for an essay or review on landscape gardening that praised Steuart's methods.

**29** Birnam Wood is the forest named in Shakespeare's Macbeth whose movement to Dunsinane Hill is part of a prophecy; the phrase is used here as a literary allusion to trees literally 'coming' to a place.

**30** The 'Highland Society' likely denotes the Highland Society of Scotland (now the Royal Highland and Agricultural Society of Scotland), an agricultural and improvement body founded in the late 18th century that examined and endorsed rural practices.

**31** The 'Allanton system' refers to the set of transplanting techniques and related landscape practices advocated by Sir Henry Steuart as developed on his Allanton estate.

**32** 'Lazy beds' are a traditional method of cultivation involving raised, narrow ridges or beds (with trenches between) used in Britain and Ireland to improve drainage and produce compact, easily lifted rootballs for transplanting or planting.

**33** 'Carse clay' denotes heavy, adhesive clay soils typical of Scottish low-lying fertile plains (called 'curses', e.g. the Carse of Gowrie), characterised by a shallow vegetable-rich topsoil over dense subsoil.

**34** A Scots term (plural of 'carse') for low-lying alluvial ground or river delta—fertile flat land formed by river deposition, especially at the heads of firths and estuaries.

**35** A submerged reef off the east coast of Scotland, noted here as an example of a former island reduced to near sea

level; it is also the site of the Bell Rock Lighthouse, constructed 1807–1811.

**36** A late 18th–early 19th-century Scottish landowner and writer on planting and estate management (associated with Allanton), cited here for his published views on pruning, planting, and forestry.

**37** A contemporary handbook on tree-planting and forestry practices cited by Patrick Matthew; it is a practical manual aimed at landowners and planters and was published in the late 18th or early 19th century (the exact edition is not specified here).

**38** Common name for the loblolly pine (native to the southeastern United States); 19th-century writers noted some pine species (including loblolly) could leave soils that were difficult for subsequent crops, a property sometimes described as allelopathic or deleterious to following vegetation.

**39** 'Memel fir' was a trade name for high-quality Scots pine (*Pinus sylvestris*) exported from the Memel region (the port of Memel, now Klaipėda in Lithuania); such timber was prized in the 18th–19th-century timber markets for shipbuilding and construction.

**40** A small, hand-held spade-like dibble introduced to speed planting by cutting a notch in turf to receive seedlings; it replaced the earlier two-person spade notch method and allowed a single worker to plant many trees quickly.

**41** A Latin term for gnawing mammals; in 19th-century usage it refers to small rodents or 'gnawers' such as mice and rats (animals largely in what is now the order Rodentia).