Introduction: What Is Coppice?

There is not a more noble and worthy husbandry than this.

— John Evelyn[1]

The lives of humans and woody plants have been inextricably linked for as long as our species has populated the planet. Even in modern times, when we are so dramatically dissociated from the resources and landscapes that support us, it's remarkably enlightening to reflect on all the ways trees influence our lives and our experience of the world around us.

Trees provide...

- Shelter
- Building materials
- Shade
- Fuel: for heating, cooking, electricity
- Industrial production
- Transportation
- Food: for humans, livestock, mammals, birds, insects, fungi, and microbes
- Craft materials
- Erosion control
- Climate stabilization
- Water cycling
- Wildlife habitat
- Medicine
- Enclosures
- Soil building processes and biomass
- Air filtration
- Beauty and inspiration

It's hard to imagine life on Earth without the myriad benefits proffered by trees. In fact, life as we know it would not be possible without them.

Keeping all this in mind, take a moment to reflect on your relationship (and more broadly, our cultural relations) with the forests that support us. For the vast majority of us in the one-third or "developed" world, that relationship is virtually unconscious. Most of us have no idea where the wood that shelters us, keeps us warm, cleans and oxygenates our air, and stabilizes our soil actually comes from, and even more importantly, how it's produced and managed. Historically, only a privileged few were affluent enough to detach themselves from their relationship with woodlands for anything

FIGURE I.1: Imagine a world without these majestic creatures.

other than hunting and recreation. Industrial culture has enabled this disconnect to become the norm, but today our need to reconnect with our woodlands grows ever clearer.

Coppice forestry is an ancient silvicultural practice that provides one of the best living examples of a symbiotic, cooperative relationship between humans and forest ecosystems. While the modern ecoforestry movement also places humans as active and beneficial participants in the landscape, the longevity of coppice woodlands, stools, and pollards the world over pay testament to the widespread suitability of this land management technique. As we'll explore in later chapters, when well-managed and maintained, coppice woodlands and their biological community are exceedingly healthy, robust, and resilient, host a broad diversity of species, age classes, and forms, and yield an array of forest products for human use.

This book attempts to reconnect our culture with the woodlands that we are part of. While our focus rests primarily on coppice woodland management and other related means of symbiotic silviculture, a much deeper theme underlies the nuts and bolts of system design, establishment, and maintenance. Our real goal is to help initiate and inspire the revival of a woodland lifestyle—a life lived in direct and complementary relationship with the forests that nurture us. This is no small task, but I believe that to bring about the change we wish to see in the world, we first need to envision what it looks like. So please accept this invitation to reconnect, restore, and reinhabit our true home in a way that benefits all beings.

WHAT IS IT?

The term "coppice," both a noun and verb, comes from the Old French word *copeiz,* which today translates to *couper,* meaning "to cut."[2] Additional sources connect the word to the Greek *kolaphos,* "blow," via the Latin verb *colpare,* "to cut with a blow."[3] While etymology can be enlightening, it doesn't offer much in the way of insight into the practice itself.

Coppice management is an ancient silvicultural technology where broad-leaved woody

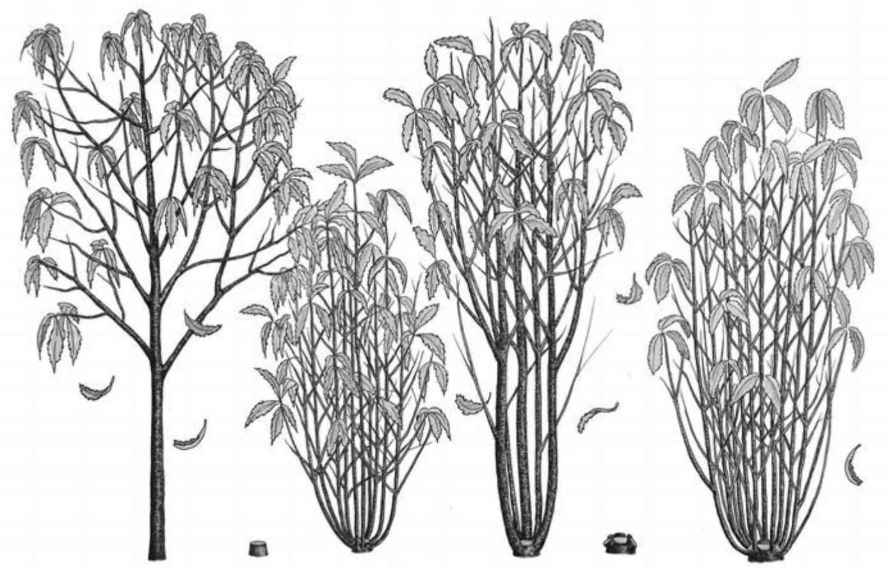


FIGURE I.2: Two harvest rotations in the life of a coppice stool. Starting at the left, we see a young tree, coppiced for the first time, allowed to resprout and grow to a harvestable size, when it's cut back and coppiced once again. The life cycle of a coppiced tree or shrub may theoretically be indefinite.

plants are cut on cycles of 1 to over 40 years during dormancy and allowed to regenerate from the stump. These stump sprouts develop into a new crop of poles harvested during the next felling cycle.

This vegetative regeneration or "stump sprouting" is a common ecological process often found along roadsides and utility lines, where regular clearing by road crews and utility companies establishes "coincidental coppice." Often, for many people, this incredible expression of biological vigor is a nuisance. We were trying to clear the land after all. But only in a culture flooded with cheap energy can we afford to view an abundant self-renewing resource as waste. Yet when we recognize the immense potential of the humble stump sprout, we can develop production systems that are largely self-maintaining, which is the essence of coppice agroforestry.

Dissecting Our Definition

The ability to form a permanent structural stem with perennating organs (buds) well above the ground differentiates most **woody plants** from their herbaceous kin. This adaptation affords woody plants the opportunity to shade out herbaceous competition, avoid many herbivores (especially the big ones), and occupy a vertical niche that extends potentially hundreds of feet skyward. Broadly speaking, the term "woody plants" refers to plants with rigid stems high in compounds called lignin and cellulose. However, plants may be called "woody" even if they don't make actual wood. In this book the term "woody" will refer to tissues made of, or plants that make, actual wood in the strict sense: the secondary xylem lying beneath the bark of a tree or shrub, the hard fibrous material forming the main substance of the trunk or branches of shrubs and trees, composed *primarily* of lignin and cellulose.

Generally speaking, most broad-leaved woody plants (**angiosperms**)—trees and shrubs that have wide leaves as opposed to needles and bear their seeds in fruits instead of cones—will coppice, meaning they respond to cutting during dormancy with vigorous re-sprouting come spring. Some of the best-known examples include maple, ash, oak, linden, hazel, willow, and poplar. The vast majority of broad-leaved woody plants are deciduous, meaning they lose their leaves during the dormant season. Conversely, "evergreens" retain their foliage throughout the year. These trees are typically conifers, which bear cones containing seeds and have needle-like leaves. Most conifers do not coppice in the true sense of the word, although parallel forms of management that we discuss later do allow us to leverage resprouting in conifers.

Table I.1: Top genera/species for coppicing and pollarding

Latin Name	Common Name
Acer spp.	Maple
Castanea spp.	Chestnut
Cornus spp.	Dogwood
Corylus spp.	Hazel
Eucalyptus spp.	Eucalyptus
Fraxinus spp.	Ash
Morus spp.	Mulberry
Platanus spp.	Sycamore
Populus spp.	Poplar/Aspen/ Cottonwood
Prosopis spp.	Mesquite
Quercus spp.	Oak
Robinia pseudoacadia	Black Locust
Salix spp.	Willow
Tilia spp.	Linden/Basswood
Ulmus spp.	Elm

Under coppice management, woody plants are cut on cycles of 1 to 40 or more years. Traditional felling cycles—the frequency of harvest—revolved around the desired size of materials for a particular product and the species being managed. Poles harvested for fence posts 3 to 6 inches (7.5 to 15 cm) in diameter require a longer cycle than shoots used for 1-to-2-inch (2.5 to 5 cm) diameter thatching spars or pea sticks. We generally consider coppice stands harvested on 1-to-5-year cycles "short-rotation" and those exceeding 5 years "long-rotation."

The *timing* of felling operations is critical to the health and vigor of shoot regrowth. While many species will still resprout after cutting during spring and summer, historically, coppicing was carried out during the winter months once trees had gone dormant. Winter felling is desirable for several reasons. During dormancy, trees experience considerably less stress, and insect, fungal, and bacterial populations are quite low, reducing the likelihood of disease and infection. Also, first-year shoots from a freshly felled **stool** (the stump of a coppiced tree that's managed for resprouts) are tender and pithy and benefit from a long growing season to harden off before the arrival of autumnal frosts that can damage or kill young sprouts.

Traditional winter felling and extraction work, especially on frozen ground, dramatically reduces the overall impact on understory vegetation and soil structure while improving extraction routes. The heavy work of tree felling and extraction is well-suited to the cold temperatures of winter, while craft and value-added work was typically performed in spring and summer, creating a varied and seasonally balanced livelihood.

Many coppice sprouts emerge from **preventitious** (dormant) **buds** embedded beneath the bark, capable of prolific new growth following disturbance. Often these buds develop in the spring at the base of a recently felled tree. We call this remnant stump a coppice stool. This contrasts with the suckering tendency of some species, where shoots or suckers emerge from a tree's root system. Cherry, aspen, beech, and black locust (*Prunus* spp., *Populus* spp., *Fagus grandifolia*, and *Robinia pseudoacacia*) are examples of species prone to suckering following disturbance. While the new shoots emerge from a different portion of the tree, we'll discuss both stump-sprouting and suckering species throughout this book. And then of course, there's pollarding—a training system for woody plants that manages sprouts high up on the stem in the crown where they're out of reach of livestock and wildlife—hedgelaying, and shredding. All of these techniques add diversity to our continuum of resprout silvicultural practices.

So, with a basic understanding of what coppicing is, let's now look at why it emerged historically as a widespread silvicultural practice that has benefitted human cultures and how it can best be adapted to meet our needs today.

WHY COPPICE?

To understand the evolution of coppice management, we must begin with some familiarity of the historical context. We'll explore this fascinating history in greater depth in the next chapter, but a moment's worth of historical insight offers many clues about the circumstances that shape the way people manage forests.

Imagine living in the late Stone Age with the same basic needs as modern humans of food, shelter, warmth. Now imagine harvesting and processing the raw materials to provide for these needs using stone tools without any means of transport beyond human power. It's in this context that coppice forest management systems evolved to match the tools and energy available.

Because coppice forestry produces poles of a regular dimension that can be easily processed and used in craft, small-diameter **polewood** was far better suited to the resources available at the time. In British silvicultural lingo, the terms "wood" and "timber" refer to two different forms of forest products. "Wood" describes small-diameter polewood, while "timber" refers to full-size trees, grown for lumber. For Neolithic humans right through to the later peasant class of the Middle Ages, wood was actually a much more valuable and useful material than timber as it could be worked up with simple, readily made tools. In contrast, timber required specialized metal axes for hand-hewing timbers or long, complex metal saws for energy-intensive pit-sawing in which a pair of sawyers worked together, one above and one below the suspended log in an excavated pit to rip it lengthwise into boards.

Countless ancient coppice and pollard specimens exist throughout Europe, having lived for centuries beyond their typical natural life span as a direct result of this management. Research proves that coppicing dramatically increases the life span of woody plants, often by a factor of three or more. This is probably best evidenced by the Greek word *kouri* used to describe a pollarded tree. Essentially describing a process of "keeping young," the super-intensive pruning that is coppicing and pollarding removes most of the mineral- and nutrient-demanding biomass of the plant's aerial parts, stimulating healthy, vigorous new growth. As human management of these ancient trees wanes, many otherwise healthy trees have begun to lose their productive vigor, which is a testament to the critical role humans play in maintaining overall system health.

Coppice and related forms of woodland management formed the backbone of numerous societies around the globe for centuries, that is until humans discovered new and abundant fuel sources: coal and oil. Yet, despite this history, the practice is virtually unknown to North Americans of European descent. Why is this the case?

Pit-sawing

FIGURE I.3: For much of human history, lumber was an exceedingly high-value and labor-intensive product. Here two sawyers are working in tandem, "pit-sawing" a log. Understanding this helps make clear why polewood has been so valuable to human cultures throughout history.

WHY IS IT NONEXISTENT HERE?

We know that sprout-based management was a part of the lives and land management practices of many Indigenous North Americans, but the majority of those traditions were extinguished in the wake of colonization, displacement, and in some cases, genocide.

At the same time, it's difficult to say with certainty why coppicing traditions disappeared from the European silvicultural tool kit as they

The Pollard Cycle

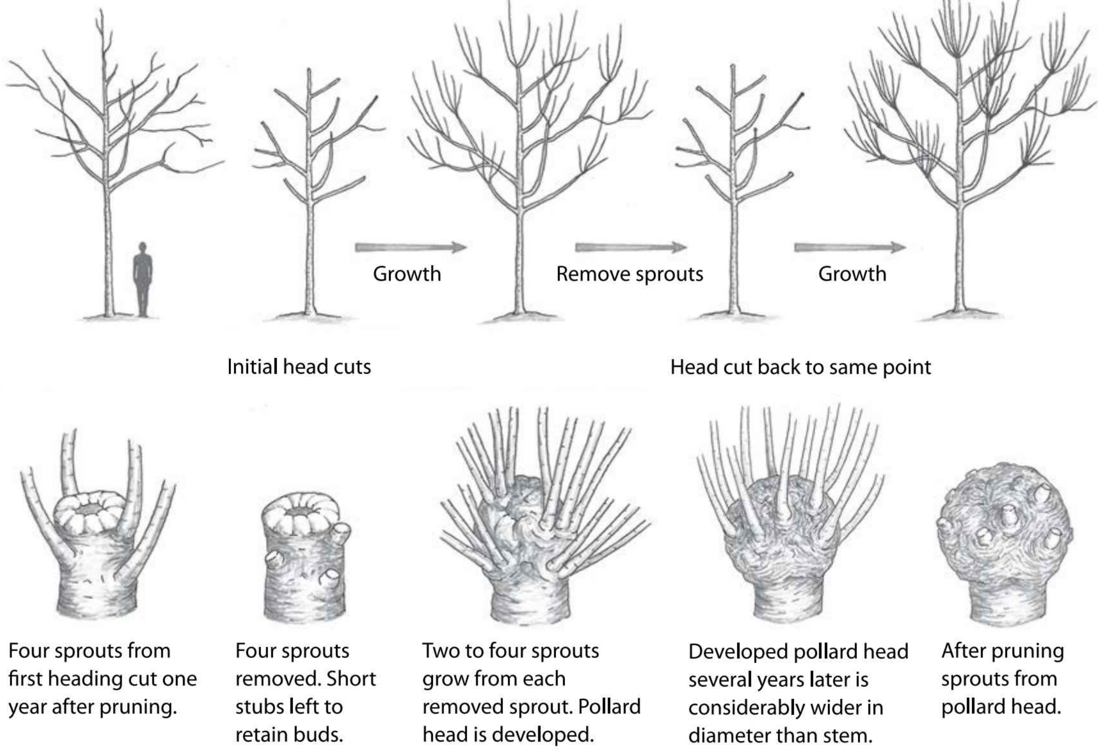


Figure I.4: Like coppicing, pollarding draws on woody plants' ability to sprout following intentional disturbance. In the case of pollarding, the harvest occurs well aboveground, usually out of reach of wildlife and livestock. These trees can be managed for polewood or tree hay. Here we see a young tree that's pruned to shape to optimize plant architecture, followed by the final pollard cuts that initiate the knobs from which new sprouts will originate in future harvest cycles. Adapted from Gilman, 2002, p. 150.

landed on this continent. Given the abundance of mature forest blanketing the landscape, it stands to reason that a resource-conscious system for woody biomass production was probably not on the top of the priority list. Faced with winters far more challenging than much of Western Europe, and little in the way of resources beyond the tools and possessions they brought or made themselves, land clearing, food production, and shelter construction presumably demanded any and all waking hours.

Pioneers struggling to carve out a niche in a landscape dominated by majestic forests likely found the woody resource of eastern North America to be as much of an obstacle as an asset. Most colonists had probably never seen trees of North American size, having lived in the shadow of centuries of resource overextraction and depletion in their native land. These forests must have appeared an inexhaustible resource, with land clearing for agriculture a much more pressing need, and fuel and construction material shortage a rapidly fading memory. There was likely little need to intentionally develop coppice systems as coppice regrowth would have often been a thorn in the side of agricultural development with stump sprouts vigorously reclaiming cleared pastures and farm fields. Somewhere between the struggle for survival and the explosion of industrial culture, European settlers lost the legacy of coppice agroforestry.

Today, with the exception of scattered experiments in short-rotation biomass production, willow harvest for basket materials, and potentially unknown systems managed by homesteaders, foresters, and farmers, coppicing is less than a cultural memory. It has been long forgotten. But as the circumstances that shape our lives and the long-term viability of our civilization rapidly shift, the value of complementary forest management strategies grows ever clearer.

FIGURE I.5: Neatly stacked cordwood piles in a springtime meadow near Limoges, France.

WHY DO IT TODAY?

Reasons for developing coppice woodlands in North America, and the world over, for that matter, are at least as numerous as the staggering number of products that can be produced with coppice wood. Considering the pivotal role coppice played in the stabilization and expansion of many cultures in the face of extensive resource depletion, it would also seem an appropriate response to many of the same problems in our modern world.

The following are some of the benefits of coppice that we'll explore in depth.

Home and Community Scale Energy Security

On a farm/homestead/community scale, intensively managed coppice woodlands could enable individuals to produce small-diameter cordwood to become self-sufficient in home heating. This increases community resilience, reduces or even eliminates the need to import fuel, engages the populace in a direct relationship with the management of their environment, and helps engage them in the understanding and implications of their energy consumption.

Local Livelihoods and a Culture of Craft

Probably one of the most valuable yields coppice woodlands could provide is a renewed local economy based on home-scale production of useful and necessary products. As our current globalized economic system self-destructs before our eyes, we must begin to think about strategies to create a meaningful, right livelihood that enables people to express their skills and creativity and contribute to the renewal of our communities.

It seems clear that we need to build a new modern economy around the production of goods and management of land-use systems that serve the people who use them. In the very same way that coppice sustained a skilled and independent class of craftspeople and land managers historically on the European continent, could we see a similar evolution of a productive community of citizens providing products for neighbors and community members today? I believe so. In fact, I believe it is and will be essential!

While this is no small task to design and implement, human history proves time and again that we cannot separate ecology from economy.

Preserving Native Forests

By concentrating intensive woodland management within coppice **cants** and field edges, we could help reduce the pressure placed on our "natural" forests to provide for our resource needs. By no means do I propose that coppice systems replace modern forestry systems, nor to slight the inspiring, responsible, and cutting-edge forest management strategies that are becoming more and more common. Coppice could provide a valuable complement to conventional forestry management and, in some cases, help to concentrate production in intensively managed systems and protect and preserve our ever-shrinking natural forests.

Leaving a Legacy

Upon establishment, coppice woodlands provide useful materials that will shelter, warm, nurture, and employ us for generations. When I traveled to England to apprentice with Ben Law in his copse of sweet chestnut, I was participating in the harvest of coppice stools that were planted over 160 years ago and that may continue to yield for centuries.

Probably the biggest challenge we face is the considerable investment in time and energy needed to transform fields and forests into silvopasture and coppice cants. But imagine being part of a future generation that inherits a thriving cant of black locust poles that can be used to heat your home and provide a steady supply of one of the world's most rot-resistant woods for building projects. If all we do is lament the resources we lack, we'll never set the stage for the generation that gives thanks each season when they commence the cutting of a cant that their great-great-grandparent nurtured and established.

Why Not?

We know that our planet's life-support systems are in dramatic decline, along with the hydrocarbon economy built on oil and coal. It's up to us to help build a new "carbohydrate economy" equipped with a toolbox stocked with regenerative and productive land-use strategies thousands of years in the making. I believe that we can work to restore our landscapes, build resilience in our communities, and take responsibility for our needs through the intensive design, development, and management of coppice woodlands. And we know that we can have a heck of a lot of fun doing it!

In navigating these waters, we face considerable obstacles, namely, a culture that has forgotten how to provide for its most basic needs and a worldview that expects and demands instant results. While the map is incomplete, we're well acquainted with our destination. I hope that this book will serve as a compass, helping point us in the right direction and inspiring others to dip their oars into the sea alongside us.

PURPOSE OF THIS BOOK

To my knowledge, there is no existing practical handbook on coppice system design and establishment. Of the resources that do at least begin to fill this void, we find a general revisitation of traditional systems that don't necessarily integrate modern ecological thinking and design.

This book strives to inform and inspire a new generation of woodland managers and a renewed experience of "participatory ecology." It draws together much of the existing literature on coppice systems, rural woodland-based economies, ecological design, and projected yields into a single resource that makes a compelling case for the establishment of dynamic,

On the Ethics of Coppice Agroforestry

For most of us, a primary objective in developing resprout silviculture systems lies in meeting our needs though conscious woodland management—a goal that can take many forms. Coppicing is a tool. And it's not always the best tool in all scenarios. The objective of this book isn't so much to promote coppicing, but rather to provide readers with information and tools to make good decisions when considering how to best meet their needs while increasing ecosystem health, diversity, and function.

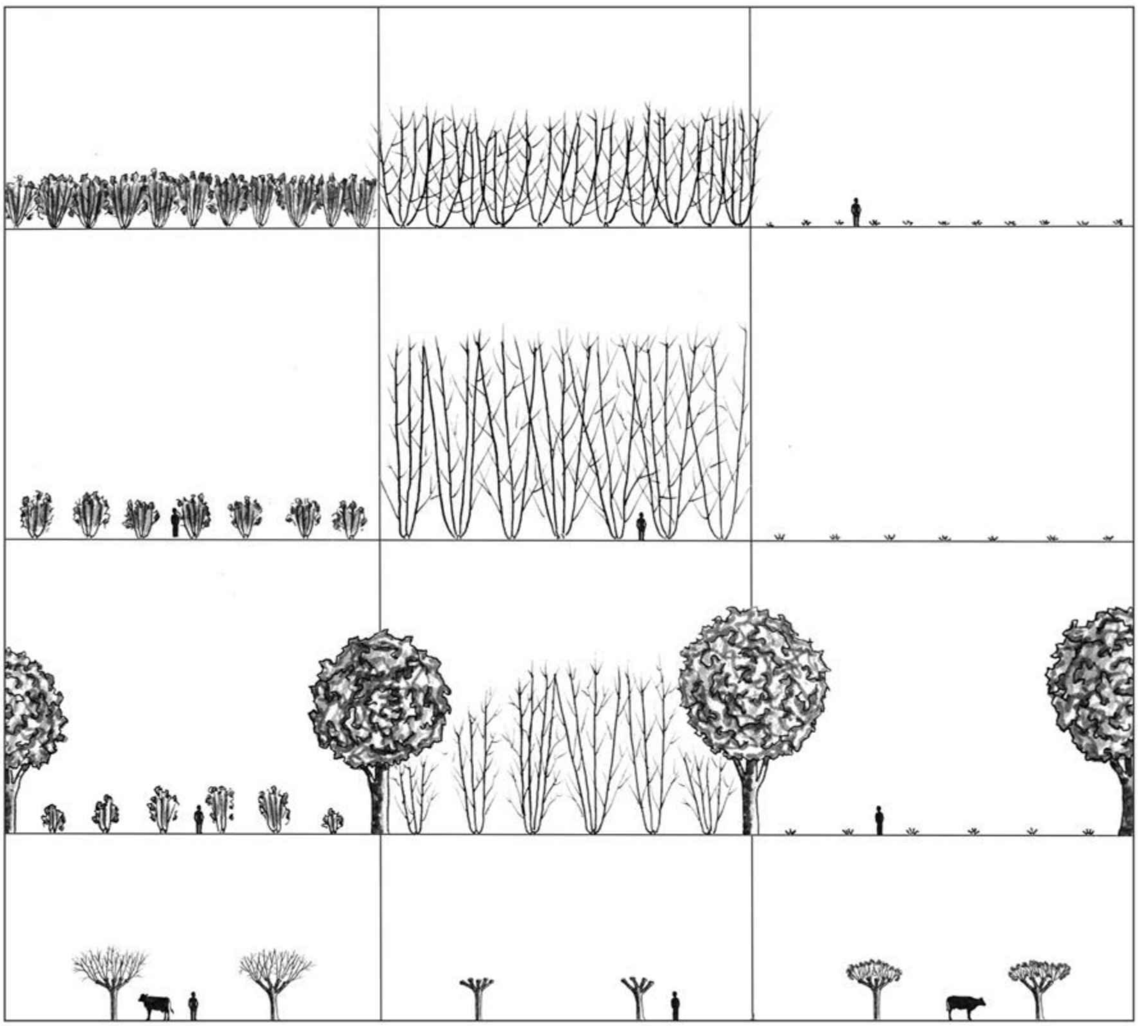
Diverse, healthy, productive, intact forests are often poor candidates for coppice conversion. If our goal is to cultivate productive ecosystems while restoring healthy landscape functions, *disturbed landscapes* are our best places to intervene. If you're looking for tools to manage mature high forest stands, first explore the range of silvicultural practices at your disposal—like uneven-aged selection management, patch cuts, or seed tree treatments (more on this in chapter 4). On the other hand, old fields, backyards, low-grade forests, vacant lots, treeless pastures, farm fields and riparian buffers, and early-successional field edges are the types of landscapes well-suited to coppice woodland and silvopasture conversion. Remember—it's all a matter of context, and universal solutions rarely exist. Silvicultural practices are powerful tools for landscape transformation, and with them comes great responsibility. Apply them with care and forethought.

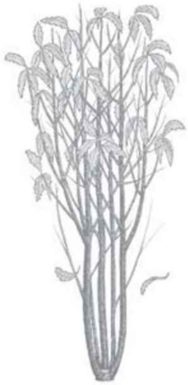
multigenerational, self-regenerating silvicultural systems.

I hope you will use this book to assess the state of forest land for coppice conversion, design your own multifunctional copses and silvopasture systems, develop new ideas for engaging, productive livelihoods, and pave the way for a reinterpretation of this ancient forestry system. I hope this book will serve as a critical tool inspiring the emergence of resprout silviculture systems throughout North America and that you'll share your experiences and research so that we can co-create a culture of educated, skilled practitioners. Let's begin by exploring the reasons why people have used coppicing over the past 8,000 years.

Part I

History, Biology, Ecology, Systems, and Economy





Chapter 1: A Cultural History of Coppice Agroforestry

For there is hope of a tree, if it be cut down, that it will sprout again,
and that the tender branch thereof will not cease.

— The Book of Job, ca. 600 BCE

Once the economic reason supporting it disappears,
no rural pattern survives in a healthy condition for long.

— Roger Miles, *Forestry in the English Landscape*[1]

Many mysteries lie deep in human history and prehistory. Ever wondered about the day-to-day realities of our ancestors from the modern era through prehistory? From clearing land for agriculture; to procuring fuel for warmth, cooking, and industrial production; to creating shelter, tools, and crafts; and weathering the effects of widespread shortage, the story of civilization has often run parallel to the story of their woodlands. While we'll be forever left to ponder much of this story, historical records have left us scattered clues suggesting that the humble stump sprout has played a central role in the development, sustenance, and expansion of human cultures the world over since the Stone Age.

Take, for example, the fact that woody resprouting was once so common that it played a key role in the mythology of the Israelites. In fact, a derivative term, the Hebrew word *netzer,* meaning sprout or shoot, was used to name Nazareth, the childhood home of Jesus Christ, and to signify the Messiah himself. "The prophets, in speaking about the destruction and re-emergence of Israel, used the metaphor of Israel being like a tree that had been cut down, but which would sprout again. Israel would be led by a messianic figure called 'the branch.'"[2] Yet, though coppice was used to symbolize a figure central to much of Western civilization, our culture has largely forgotten about this ancient practice. Remembering this knowledge, and reviving and reinventing these practices for our times, could well play a key role in humanity's future.

Humans have relied on forest resources for thousands, if not millions, of years. Cultures both ancient and modern require adequate wood supplies to meet a range of critical needs, to develop and expand. As civilizations grew, the means by which they met these needs changed as they used their woodlands—or used them up. On every inhabited continent, if human cultures didn't learn to sustainably use forest resources, their civilization didn't last, or they had to buy, beg, borrow, or steal wood from their neighbors. Archaeological work around the world provides evidence of forest management systems built on woody resprouts.

This chapter illustrates how humans have harnessed woody plants' sprouting ability to meet their fundamental needs for millennia and how this relationship has in turn shaped their cultures. We see this relationship expressed in the crafts, buildings, lifestyles, land use and ownership patterns, livelihoods, and economics of societies stretching from prehistory to the modern era.

Yet, coppicing and coppice craft have mostly disappeared in the wake of industrialization. Clearly, Roger Miles is right: as the need and economic demand for woody sprouts declined, the practices vanished, and the rural landscape changed, leaving their legacy shrouded in mystery. Understanding the historical relationships between human civilizations and resprouting trees and shrubs can help us envision how modern coppice management and the polewood economy might find a valued place in our culture, both today and in the future.

This chapter focuses on the coppice history of Europe, especially Britain, and North America. The burgeoning field of **historical ecology** informs this understanding of European landscape and land-use history. The availability of this information, along with the ecological similarities, make this information especially relevant to us here in North America. Most English-language resources describe British resprout silvicultural traditions. While this limits the geographical and cultural extent of our survey, these stories and examples illustrate at least some of the patterns, events, and dynamics that have driven woodland management during the past several thousand years all over the world.

We begin by exploring prehistoric coppice husbandry in Europe and North America, then follow its evolution through Roman and medieval times, primarily in Europe, and conclude with a discussion of coppice in the modern era. What role did resprouts play in human history and cultural evolution? What were the ecological and social milieus within which coppice played a central part, and how did these milieus and resprout management influence each other? Besides the general historical interest, these past realities can teach us about ourselves and our current context and help inform useful design directions.

Remember, however, that even when historical records are available, the information is scant. "It is often quite difficult to discover the nature of many of the traditional practices of woodland management, such as coppicing, pollarding, woodland grazing, making temporary arable fields, and the use of fire. This is partly because their very prevalence and normality meant that authors felt they did not need to comment on them."[3] By presenting even a modest sense of the realities on the ground through history, we can begin to envision wider possibilities.

COPPICE: AN ESSENTIAL PREHISTORIC RESOURCE

We begin with evidence of the use of coppice materials in several parts of very early Europe. Onto this, we enjoy a glimpse of North American land management and coppice use to further flesh out the prehistoric use of resprout silviculture.

The Landscapes of Prehistoric Europe and Early Evidence of Coppice

About 13,000 years ago, at the end of the last Ice Age, glaciers covered most of northern Europe. Tundra or shrub tundra primarily occupied the unglaciated belt south of the ice sheet and north of the Alps, while open, semi-arid woodlands covered the area south of the Alps, containing varying mixtures of oak (*Quercus* spp.) and pine (*Pinus* spp.), along with junipers (*Juniperus* spp.), goosefoots (family *Chenopodiaceae*), and rhododendrons and their allies (order *Ericales*). "Only in the east was forest vegetation extensive; and here various forest types with varying proportions of *Picea, Pinus, Betula,* and *Alnus* were present" (spruce, pine, birch, and alder).[4] A rapidly shifting climate disrupted these vegetation patterns around 8000 BCE (10,000 years ago) as the glaciers melted, marking the end of the Paleolithic Era and the beginning of the Mesolithic.

By 6000 BCE, forests covered the vast majority of mainland Europe,[5] and the British Isles were well into a period of relatively stable **wildwood** (primeval or old-growth forest) dominance.[6] At least, this is what **palynological** evidence (spores, pollen, and certain algae trapped in sediments) has led many to believe. The presence of high percentages of arboreal pollen (from trees) in the pollen record, as compared to grasses and herbs, implies that the Mesolithic landscape was mature **high forest**—what we tend to think of as a "climax" closed canopy forest.[7]

Any peoples living there were probably mostly nomadic, and subsisted by hunting, gathering, trapping, and fishing, like typical Mesolithic cultures. The Mesolithic Era ended, and the Neolithic began, when people started living in long-term settlements, making polished rather than knapped stone tools, and practicing agriculture using cereal grains and domesticated animals. In Europe, that usually involved clearing forests. This is essentially the history as described by Iversen's Landnam Theory (1941). "Landnam" translates to "taking of the land"[8] and suggests that roughly 5,000 years ago humans began to clear the forests of Northwest and Central Europe to make way for agriculture. Their livestock prevented forest regeneration, creating a more open, park-like landscape.[9]

Our survey of coppice history in Europe begins right around this time period, the Late Mesolithic. And since we may only rely on theories to understand what the landscape looked like pre-agriculture, let's also take a brief look at the fascinating work of Dutch ecologist and ornithologist Frans Vera as an alternative to Landnam. In his book *Grazing Ecology and Forest History*, Vera proposes:

> The natural vegetation (of the lowlands of Western and Central Europe—and eastern North America for that matter) consists of a mosaic of large and small grasslands, scrub, solitary trees and groups of trees, in which the indigenous fauna of large herbivores is essential for the regeneration of the characteristic trees and shrubs of Europe. The **wood pasture** can be seen as the closest modern analogy for this landscape.[10]

Framing the foundation of his theory, Vera cites several inconsistencies in the pollen record, namely, the relative abundance of pedunculate oak (*Quercus robur*), sessile oak (*Q. petraea*), and hazel (*Corylus avellana*) in Central and Western Europe over the course of 9,000 years. These three species are unable to survive and reproduce in closed canopy forests. In other words, they do not tolerate shade. So their consistent presence over time would seem to imply that these landscapes must have contained much larger gaps to enable their regeneration.

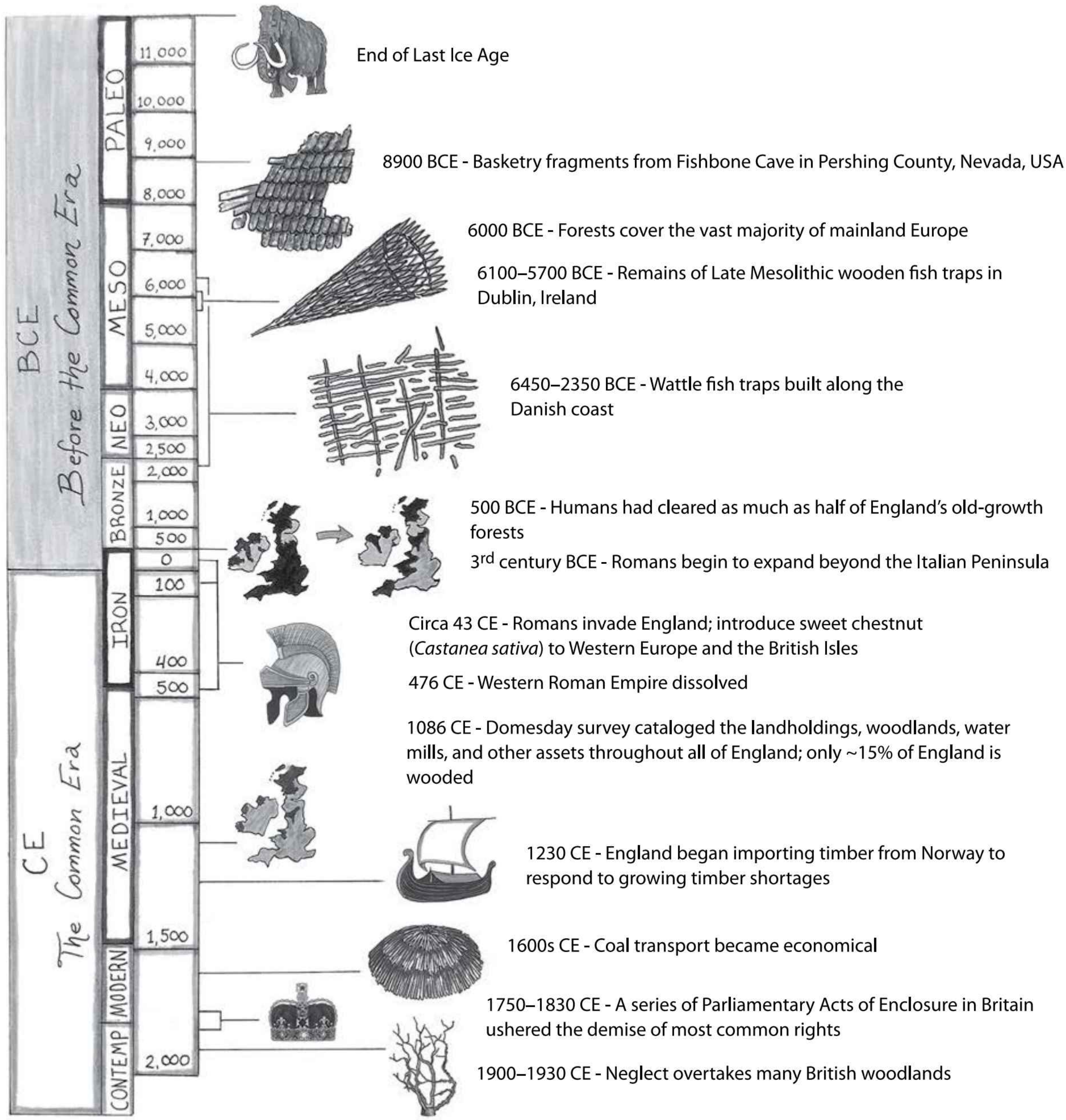
FIGURE 1.1: A modern example of the emerging scrub and mantle vegetation on an overgrazed pasture in Vermont, USA. The thorny shrubby regrowth protects the emergence of longer-lived mast-producing tree species.

In short, Vera suggests that populations of large herbivores including aurochs (*Bos primigenius*), tarpan or European wild horse (*Equus przewalski gmelini*), European bison (*Bison bonasus*), red deer (*Cervus elaphus*), elk (*Alces alces*), roe deer (*Capreolus capreolus*), beaver (*Castor fiber*), and wild boar (*Sus scrofa*) all acted as the primary disturbance agents in these Late- and Postglacial ecosystems. Their impact created a landscape mosaic of "mantle and fringe" vegetation, comprised of grassland, scrub, trees, and groves. These open landscapes enabled light-demanding species like oak and hazel to thrive, sheltered from browsing herbivores by the protective cover of thorny mantle vegetation [blackthorn (*Prunus spinosa*), common hawthorn and English hawthorn (*Crataegus monogyna* and *C. laevigata*), guelder rose (*Viburnum opulus*), common privet (*Ligustrum vulgare*), dogwood (*Cornus sanguinea*), wild apple (*Malus sylvestris*), wild pear (*Pyrus pyraster*), wild cherry (*Prunus avium*), rowan (*Sorbus aucuparia*), and many species of roses (*Rosaceae*)].[11]

So, according to Vera, coppice with standards-type ecosystems were the direct

Figure 1.2

Timeline of the History and Evolution of Coppicing Explored in This Book



result of early humans harvesting the wooded scrub for firewood and allowing seedlings and young trees to grow on to maturity within the protection of the mantle vegetation.[12] This contrasts with the prevailing theory that, as humans created gaps within the dense primeval forest, a shrub layer gradually developed that they later came to manage as coppice.[13]

However history proceeded, these anthropogenic disturbances occurred at different times in different places, but it appears that the use of woody resprouts and their husbandry likely predated the invention of agriculture in the region.

Earliest Coppice Evidence: Hazel Fish Traps in Ireland and Denmark

Some of the first indications of coppice utilization in Europe date to just after post-glacial climates and forest cover appears to have stabilized. In 2004, archaeologists monitoring a development project along the docks of Dublin, Ireland, unearthed the remains of Late Mesolithic wooden fish traps. This passive fishing system consisted of a network of weirs built at low tide to guide fish swimming along the shore at high tide into traps for collection once the tide receded. The archeologists uncovered five well-preserved fish traps, stakes and **wattle** sections—flexible stems horizontally woven between wooden uprights—along an ancient shoreline. These represent some of the earliest-known relics of European fishing culture, dating to as early as 6100 to 5700 BCE (7,700 to 8,100 years ago), at least 1,200 years before agriculture arrived there.[14, 15]

So, what's the relation to coppicing? Well, these fish traps were built using round small-diameter rods, mostly of hazel, though European alder (*Alnus glutinosa*), European ash (*Fraxinus excelsior*), and common dogwood (*Cornus sanguinea*) may also have been used. Most of the stakes were made from similarly sized 8-to-9-year-old coppice growth, cut using small stone axes. The sheer volume of rods and the consistency in their size and growth rate suggests with some confidence that these materials originated as stump sprouts. To fully appreciate this, you must consider the relative difficulty of sourcing a significant volume of straight, flexible weaving material from untended woodland. While one will certainly find quality weavers here and there, you'd be hard-pressed to find thousands upon thousands of consistently sized shoots in one location were it not for some type of sprout-inducing disturbance. Also, the dates of the artifacts spanned 200 years, suggesting sustained coppice usage near this particular fish trap site, and implies sustained husbandry or even planned management of the woodland over a significant period.[16]

Similarly, along the long the Danish coast, researchers have so far uncovered around 1,500 Mesolithic and Neolithic sites both above and below sea level. Key among these are multitudes of fish traps similar to the Dublin finds with an age range of at least 6450 to 2350 BCE, along with larger, more elaborate fishing structures and massive volumes of fish bones.[17]

For example, the Danish Nekselø island site contains "an unusual concentration" of Meso- and Neolithic wooden fishing structures, including the longest Stone Age weir found in Europe. This Neolithic fish trap spanned at least 820 feet (250 m), stood in water 13 to 16 feet (4 to 5 m) deep, and required 6,000 to 7,000 good-quality straight hazel rods up to 13 feet (4 m) long, plus hundreds of longer poles, up to 20 feet (6 m) in length. The production of such huge quantities of material would have been a serious undertaking, and the vastness of the installation implies a considerable organizational capacity and technical skill, with the wattle construction so tight that an adult index finger couldn't fit between the wattle's gaps. This density could only be reached through the use of long, perfectly straight stakes, unlikely to be obtained in any quantity without utilizing coppiced materials.[18]

These tight-knit wattle fences were probably used to catch eel during their autumn migrations, a type of eel trapping that continued in Denmark until the end of the 19th century! These ancient weirs have been found along much of Denmark's coast[19] and, as in Ireland, were probably also used elsewhere.

The high dependence on fish and fish traps strongly implies that these Mesolithic and Neolithic cultures learned early on how to procure coppice, mostly of hazel, to produce the materials they needed to build and maintain the traps as a core part of their sustenance.

Ancient Coppice Husbandry in Britain's Somerset Levels

In the British Isles, evidence points to an intensification of human settlement at around 4000 BCE. These early Neolithic peoples cleared old-growth forests with stone axes to prepare land for cultivation. They probably cultivated among the stumps, later turning the land to grazing.[20] Deforestation continued there through the Neolithic (4000 to 2500 BCE) and Bronze Ages (2500 to 800 BCE), peaking in the first few hundred years of the Iron Age (800 BCE until the Romans invaded circa 43 CE). Historical ecologist Oliver Rackham estimates that humans had cleared as much as half of England's old-growth forests by 500 BCE.[21] Given that many of Britain's tree species resprout after cutting, Neolithic peoples probably had plenty of exposure to coppice material. Similar clearance patterns presumably occurred throughout Europe, though perhaps not as extensively as in Britain. How did coppicing fit into their cultures and ecosystems?

In 1964, archaeological examinations of a wooden trackway buried in lowland peat deposits of southwestern England revealed traces of a highly developed Neolithic settlement. Located in a hydrologically isolated, ecologically rich bottomland landscape known as the Somerset Levels, an ancient human agrarian culture subsisted on the diverse resources available there. Inhabiting and navigating this landscape of elevated hill and island settlements demanded a network of access routes throughout the seasonally inundated lowlands whose foundations remained preserved in peat until modern times. Decades of research into the quality and character of the materials they used to build these ancient trackways reveal a sophisticated culture of active coppice woodcraft and husbandry.[22]

Throughout the Somerset Levels lie the preserved remnants of at least 11 different tracks from the Neolithic and Bronze Ages, all exhibiting the use of coppiced wood in their construction.

Probably the best-known is a wooden access way, discovered by Raymond Sweet, known as the Sweet Track. This linked the Polden Hills with the rock island of Westhay located in the middle of a reed swamp. Radiocarbon dating

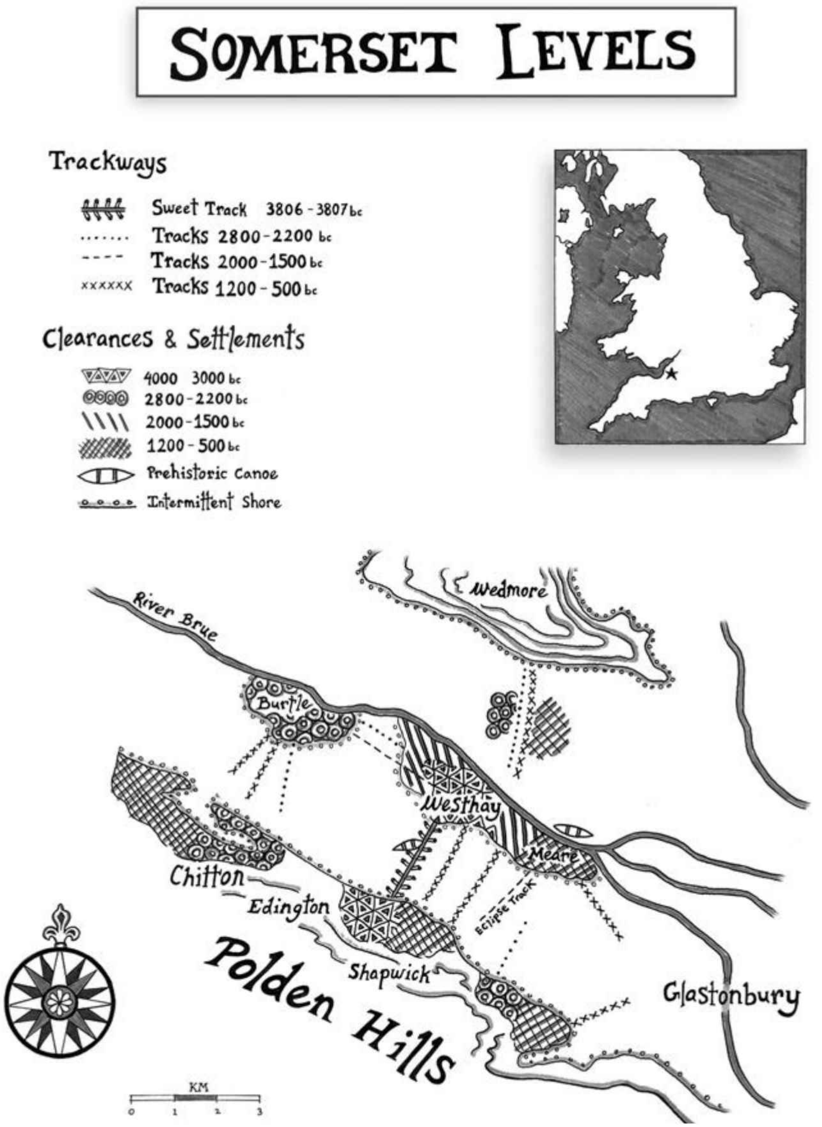


Figure 1.3: The Somerset Levels is a uniquely diverse landscape that hosts some of the earliest archaeological evidence of humans' use of coppiced materials. Here we see the distribution of some of the key archaeological finds in the area, namely a succession of wooden tracks connecting hilltop settlements separated by marsh and seasonally inundated floodplain.

and dendrochronological studies have fixed the date of construction at 3806 or 3807 BCE.[23] Containing almost 6,560 feet (2 km) of split oak planks, longitudinal rails, and 10,000 sharpened pegs, the scale of the Sweet Track suggests the presence of an extensive, interconnected, and cooperative community. The mostly oak, but also ash (*Fraxinus* spp.) and lime (*Tilia* spp.), planks up to 10 feet (3 m) long, 16 inches (40 cm) wide, and 2 inches (5 cm) thick came from trees up to 400 years old and 3.3 feet (1 m) in diameter. These were felled and split radially using only stone axes and wooden mallets and wedges—quite an art. The rails consisted of long straight poles of mostly hazel and alder, up to 20 feet (6.1 m) long, that may have come from secondary growth on tree stumps.[24] The straight sharpened pegs were made of ash, oak, and lime/linden that didn't fork or branch, suggesting they were derived from "deliberately or fortuitously coppiced" material.[25] The construction implies that the builders used coppice as well as **standard** (single-stemmed trees allowed to grow to maturity) trees along the Polden Hills, and that they had been doing so for at least 120 years prior to building the Sweet Track.[26] Numerous other trackways of different lengths, ages, and types of construction have also been discovered in the Levels, including the Post Track, which runs parallel to the Sweet Track, and is 30 years older. However, a track built about 1,000 years after the Sweet Track provides some of the best evidence of intentional coppice silviculture in the Levels.

The Middle Bronze Age Eclipse Track between the Polden Hills and Meare Island was a 1.24-mile (2 km) path made of roughly 1,000 woven hurdles that required at least 45,000 hazel rods to build. A project of this scale would have required an estimated 7 to 11 acres (3 to 4.5 ha) of mature coppice or the annual production of 59 to 88 acres (24 to 36 ha) coppiced on an 8-year rotation.[27]

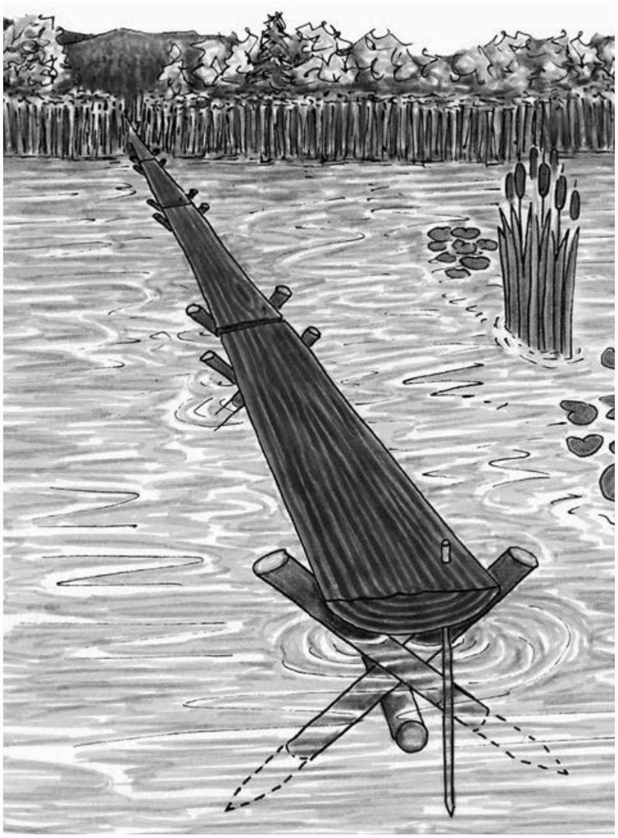


Figure 1.4: The Sweet Track was an elevated walkway fashioned using oak planks and coppice-derived stakes that connected hilltop settlements in this seasonally inundated lowland habitat.

The Walton Heath Track dates to between 2700 and 2300 BCE. It took 5,000 to 6,000 rods 8 feet (2.5 m) long and 0.6 inches (15 mm) in diameter to make about 40 immensely strong woven wooden hurdles to cover the soft peat of a 197-foot (60 m) portion of this route. Made in the traditional Somerset manner, these hurdles were fabricated by weaving long straight shoots of hazel between heavier poles to make panels 6.6 to 9.9 feet (2 to 3 m) long and over 3.3 feet (1 m) wide.[28] The rods bore many signs of having been coppiced: heels at the base of the rod where the shoot was cut or pulled from the stump or stool; narrow growth with no side branches; straight shoots that grew directly upwards to compete for light in a dense stand; rings showing rapid growth aided by an already-developed root system; and the fact that 85% of the rods were from a single species, hazel.[29]

J.M. Coles believes that the Walton Heath hurdle construction demonstrates these people's development of a hazel coppice with oak standards-type system. They did not follow the more modern technique of regular coppice rotations, instead felling the properly sized materials when anywhere from 3 to 8 years old. They would selectively harvest hazel rods from stools when 0.75 to 1 inch in diameter (18 to 26 mm), leaving smaller shoots to grow and mature. Coles also points out that this appears to be the origin of the woven hurdle, which today, 5,000 years later, continues to be a common craft industry in the region![30, 31]

Remember that wood's ability to withstand the ravages of time makes archaeological discoveries of ancient woodwork very rare. Like the undersea conditions in Denmark and Ireland, the Levels' peatlands provided ideal conditions to preserve wooden infrastructure for 5,000 years. Coles points out that archaeologists often fail to acknowledge the role wood plays in prehistoric cultures due to its relative absence in the archaeological record—yet, every human tool of the past for every endeavor from house building to mining to weaving and fiber spinning required wood at some stage.[32] The same was true with Paleolithic and Mesolithic tools, though often only stone or bone parts survive.

Coles calling the Neolithic Somerset woodlands "coppice-with-standards" raises interesting questions. Some authors claim the coppice-with-standards system was not in use as a *system* until the 16th century.[33] Draw-felling stools—harvesting individual rods from stools at need, and leaving widely spaced standard trees up to 300 to 400 years old, differs significantly from a system where entire coppice stands are cut at once in a regular cycle with rotationally managed standard trees. In the end, we don't know exactly what these people were doing, but clearly they were onto something. How advanced and systematic was their husbandry? Did they have long-term intentions, or were they short-term opportunists?

We will probably never fully understand Neolithic peoples' intimacy with their woodlands or the sophistication of their management. But based on their selection and use of different species for different functions in the Sweet Track, and the quality of their craftsmanship, we can at least infer that our prehistoric ancestors had developed considerable knowledge and skill in the art of woodcraft.