How fire shaped humans, and forged the modern economy

By Tim Harford

Presenter, 50 Things That Made the Modern Economy

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"The canyons seemed to act as chimneys, through which the wind and fires swept with the roar of 1,000 freight trains. The smoke and heat became so intense that it

was difficult to breathe. The whole world seemed to us men back in those mountains to be aflame. Many thought that it really was the end of the world."

US forest ranger **Ed Pulaski was caught right in the middle of what would become known as the "Big Blowup"** - also known as The Great Fire of 1910. Pulaski realised that his task was no longer to save the forests of northern Idaho, but to protect the firefighters.

"Trees were falling all about us," he said. "And it was almost impossible to see through the smoky darkness. Had it not been for my familiarity with the mountain trails, we would never have come out alive, for we were completely surrounded by raging, whipping fire.

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Image caption

The entrance to the disused mine shaft where Ed Pulaski sheltered with his fire crew

"My one hope was to reach an old mine tunnel which I knew to be not far from us. We reached the mine just in time."

Pulaski passed out. Earlier, with the fire approaching, he had told his wife Emma where to take shelter with their 10-year-old daughter Elsie - and warned her he might not return. The next morning, he could not see, and his hands were burned. But he was alive, and so were all but five of his men.

The Big Blowup had killed 86 people, and consumed enough wood to build 800,000 houses.

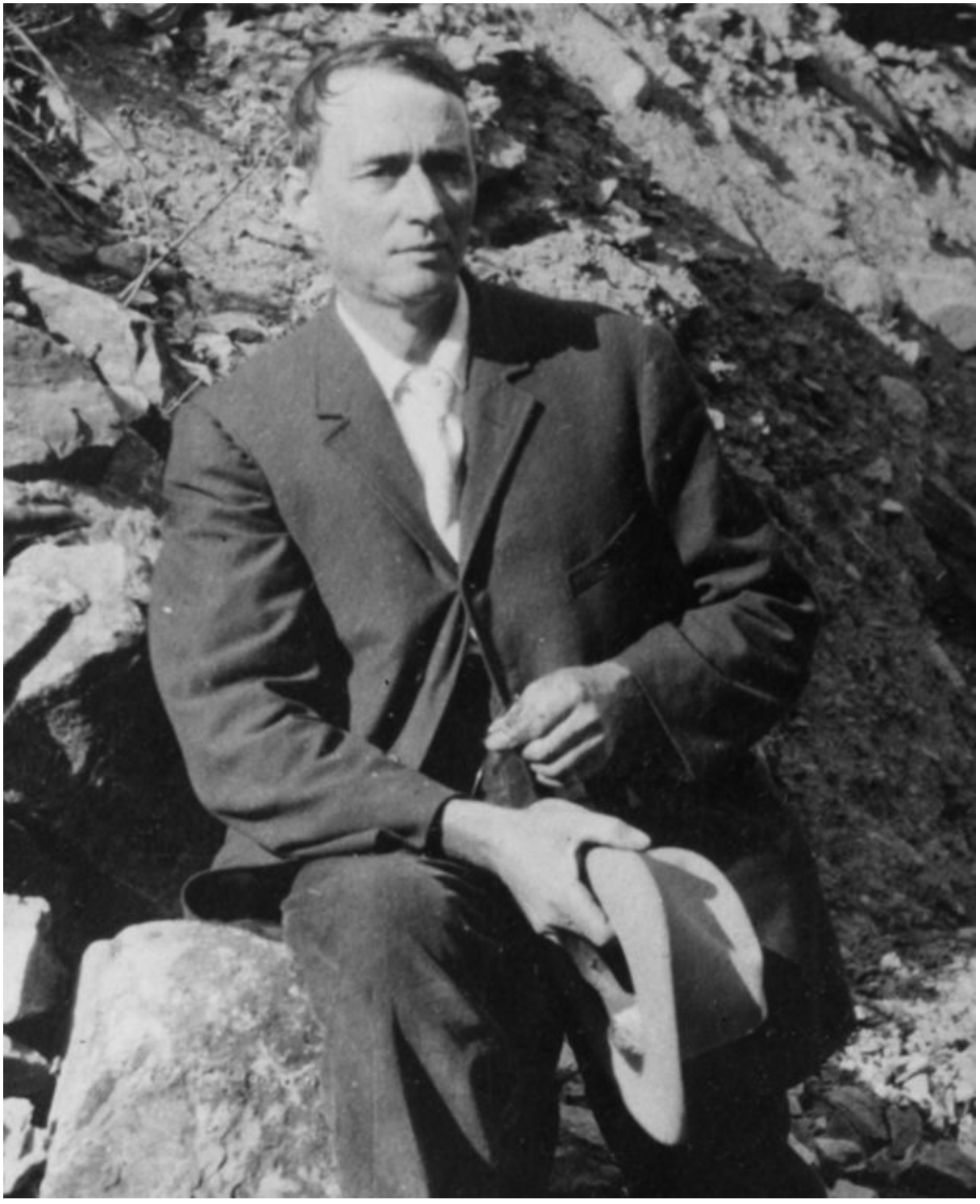

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Image caption

Widely praised for saving his men, Ed Pulaski stayed with the US Forest Service until 1929

It also seared the national consciousness and the US Forest Service promised to douse all wildfires as quickly as it could.

In fact that promise would turn out to be unwise, but you can understand the need to make it. Fire is terrifying, but it is also fundamental to the modern economy.

50 Things That Made the Modern Economy highlights the inventions, ideas and innovations that helped create the economic world.

It is broadcast on the BBC World Service. You can find more information about the programme's sources and listen to all the episodes online or subscribe to the programme podcast.

For the first 90% of Earth's history, there was no fire at all. There were volcanic eruptions - but molten rock is not on fire, because fire is a chemical reaction: the process of combustion.

It is life that creates both the oxygen and the fuel that fires need to burn. Fossil evidence suggests that flammable plant life evolved around 400 million years ago, and periodically went up in smoke, partly because of those volcanoes, but mostly due to lightning.

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In recent years, satellite observations have shown us how surprisingly common lightning is - there are around eight million strikes a day. It is still responsible for more wildfires than ill-advised barbecues or carelessly discarded cigarette butts.

Fire shaped landscapes - and, with it, evolution. It enabled the spread of grasslands, somewhere around 30 million years ago. Without fire, they would have reverted to scrub or forest. And grasslands are thought to have played a role in the emergence of the hominids who evolved into us.

Try to imagine the economy before our ancestors tamed fire.

You can start by discarding any products made with metal, or using metal tools - metal starts life in a furnace. The same goes for glass.

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Now forget anything that involves burning fossil fuels, for transport or electricity; or that uses materials made in the heat of a fire - think plastics - or plants grown with artificial fertilisers, made with the Haber-Bosch process.

No bricks or pottery: they are fired in a kiln. There is not much left. Raw, organic food, cut up with a sharp stone? We can hardly call it an "economy" at all.

Exactly when and how our ancestors learned to control fire is a matter of some debate.

Chimps appear to understand how wildfire will spread pretty well. And other species are reportedly alert to the hunting opportunities it offers. Some birds of prey have even been seen picking up burning sticks, dropping them to start a new fire, and pouncing on the creatures who then make a run for it.

It seems likely that our ancestors similarly harnessed wildfires for hundreds of thousands of years before they figured out how to make sparks from flint. Perhaps they kept the fires alive by adding slow-burning animal dung.

Primatologist Richard Wrangham argues that as cooked food provides more energy, it enabled humans to evolve bigger brains.

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Meanwhile, archaeologist John Gowlett links fire to the "social brain" hypothesis - the idea that we evolved bigger brains to navigate growing social pressures. Evenings around the fire will have given our ancestors more time to socialise.

However much truth is in those speculations, economic development has seen us confine fire to various special chambers - from industrial plants to internal combustion engines to the gas oven in your kitchen. The historian Stephen Pyne calls this the "pyric transition".

And where that has not yet happened, it is a problem: in developing countries, millions of deaths are linked to air pollution caused by cooking on indoor fires. But Pyne argues that this transition increased our fear of wildfires. And with climate change we can expect to see more of those fires.

While satellite observations are helping us to understand them, changing patterns of weather and vegetation are making them harder to predict.

It took half a century after Pulaski's heroics for consensus to form that quickly extinguishing wildfires is not such a great idea.

The problem is that eventually there will be a fire you cannot control - and that fire will be more devastating, because it will burn through all the deadwood that would have been cleared by the small fires if you had not rushed to put them out.

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Image caption

In November 2018, fires spread rapidly across Northern California, destroying the town of Paradise

And in the meantime, complacency sets in: we are increasingly building in or close to wilderness areas where fires will break out sooner or later. When experts advise it might be wise to let those fires burn, you can bet that the people who live nearby are not going to be too keen.

As Andrew Scott argues in his book Burning Planet: "Our increasing scientific understanding of fire in recent years has not translated into greater public awareness."

Some economists think that there is a parallel between handling wildfires and dealing with some entirely man-made crises. The theory is that getting better at handling small problems creates a growing sense of safety, which paradoxically creates the risk of much larger problems.

Take the financial crisis of 2007-2008, the biggest economic "wildfire" of our times.

In his book Foolproof, the Wall Street Journal's chief financial commentator Greg Ip argues that financial policy-makers had got so good at extinguishing minor crises that people became over-confident, and took silly risks - such as betting the ranch on sub-prime mortgages.

It was precisely the success at mitigating previous risk which led to the subsequent misfortune.

"Our efforts to make life safer come into conflict with an equally irrepressible desire to make things bigger and more complicated," he writes. "As our cities, transport systems, and financial markets become more interconnected and complex, so have the opportunities for disaster.

"Successfully preventing one type of risk may simply funnel it elsewhere, to re-emerge, like a mutated bacteria, in more virulent fashion."

And when a financial crisis came along that could not be stamped out, those bad bets fuelled a global conflagration which itself spread like wildfire.

The author writes the Financial Times's Undercover Economist column. 50 Things That Made the Modern Economy is broadcast on the BBC World Service. You can find more information about the programme's sources and listen to all the episodes online or subscribe to the programme podcast.

火是如何塑造人類，如何鑄造出現代的經濟

提姆 哈佛德 - 英國商業時報 “鑄造現代經濟的50個原因” 專欄貢獻作者之一

“整批山谷就像煙囪，風和火掃過，像1，000輛貨運火車呼嘯而至。濃烈的煙和熱氣逼人，讓人難以呼吸。待在這兒的人感覺就像自己就已經著火。多數人都覺得這就是世界末日了”

美國森林巡守員 愛德 普拉斯基 剛巧碰到那名為“大爆裂”事件，這事件也以1910年大火之名著稱。 普拉斯基在當時領悟到的不是去撲滅那在美國愛達荷州北部的森林大火，而是如何讓消防人員保住性命。

普拉斯基說 “樹木不斷在我們周遭倒落，我們的視線在濃濃的煙霧中幾乎沒法發揮作用，要不是我對於山間小路徑熟悉的緣故，我想我們就沒法在熊熊烈火包圍中活著走出來。”

“我的希望是找到離我們不遠的一個礦坑隧道。還好我們及時抵達。”

普拉斯基在抵達時就昏倒了。早先，當山火逼近時，他指導他的太太艾瑪，帶著他們10歲的女兒艾希去找避難所，臨離開前，他警告他太太說自己可能回不來了。普拉斯基第二天早上在礦坑隧道裡醒來，暫時沒了視力，雙手燒傷，但是，除了五人之外，他和他帶的其他所有隊友都保住了性命。

這場“大爆裂”總共燒死了86人，燒毀的樹木數量估計可以用來建造800,000間房屋。

這場大火讓美國大眾，對於美國國家森林局所做的會盡快撲滅森林野火的承諾，削弱了信心。

事實上，美國國家森林局的這項承諾是不智的，但是你們也知道總是有人要做承諾。火會令人懼怕，但火也是現代經濟的基礎。

地球歷史的前90%的時間裏，完全還沒有火，只有火山噴發，但是熔岩本身並不是著火，火本身是化學反應：燃燒的過程。

生命本身產生了氧氣，還有燃料，讓火得以燃燒。從化石中我們找到證據，可以燃燒的植物大約在四億年前演化出來，經常被燒成煙縷，有部分是由火山熔岩導致，但大部分是由閃電所造成。

近年來根據人造衛星的觀測，才讓我們知道地球閃電經常發生，次數的頻繁，每天大約有8百萬次。閃電到如今仍是造成野火的重要原因，遠遠超過人們烤肉不小心，或是亂丟煙蒂所造成的。

火塑造了大地樣貌，因此，也塑造了進化。從30萬年前開始，火讓草原地擴張。如果不是因為火，這些草原地會返回成矮樹叢，或是森林。草原地應該是造成原始人出現，然後進化成現代的人類的原因。

試著想像在我們祖先使用火之前的經濟是怎麼樣的。

我們先從沒有金屬用品，沒有金屬工具之前的時代談起。和金屬相關的物品都是經由熔爐產生，玻璃相關物品也一樣。

我們也忘記燃燒石化燃料來做運輸，或產生電力，或者忘記利用熱來裂解產出塑膠，或是利用哈伯法來生產人造肥料促進經濟作物生長。

沒有磚，沒有陶瓷：這些都是在窯裡面燒出來的。這樣一來，好像這世界就沒啥好談的了。我們可用銳利的石器來切生肉嗎？這情況，連是否算是"經濟"都難說了。

要精確地說出我們的祖先在何時學會運用火，我看還是各有各的說法。

猩猩看起來是十分了解野火如何散佈。有些動物似乎會警覺到因為火帶來的狩獵機會，有些猛禽被觀察到會撿起燃燒的樹枝，扔下，升起新的火，然後撲殺被驚嚇而奔逃的獵物。

我們的祖先有可能在幾十萬年前也是如上述動物般利用野火，或許他們讓火不滅的方式是添加可緩慢燃燒的獸糞，然後才發現可以利用燧石產生火花來生火。

靈長類人類學家 理查蘭厄姆的論點是煮熟的食物能提供更多的熱量，然後讓人類演化出更大的頭腦。

同時，考古學家 約翰高烈認為火促進了 "社交頭腦" 理論，我們人類發展出比較大的頭腦的原因是要處理比較大的社交壓力。晚上一群人聚在營火的四周，讓我們的祖先有更多的時間來互動。

不管上面說的有多大的事實存在，我們人類利用火確實在好幾方面，對經濟發展發生了作用，從工廠，到內燃機，到廚房裡用的瓦斯爐。歷史學家斯蒂芬 派恩 說這現像是 "熱的轉換"

但是，在熱的轉換還沒發生的地方，是會有問題的：在開發中國家中，數以百萬的死亡原因，和在室內生火煮飯所產生的空氣污染有關。但是斯蒂芬 派恩說這種轉換的過程中，讓我們對於野火益生恐懼。而由於氣候變遷的緣故，這種野火發生的機率更會增加。

利用人造衛星的觀測，可以讓我們更了解野火，但是，改變的氣候形態，還有不同的地面植被，會讓野火的發生模式更難預測。

普拉斯基的英勇行為發生後的半世紀，全國終於產生共識，認為迅速撲滅野火不見得是好主意。

問題在於，有些野火你們是無法控制的 - 如果因為有時小野火發生，我們趕著去撲滅，而無法讓一些枯木被清理掉的話，下次發生的大火，所有的東西一起燒，破壞力就非常的強大了。

同時，人類的志得意滿也會是原因：我們的住家不斷的擴建到接近野外，在這兒野火遲早會發生的，但專家說就讓這些野火燒吧，我打賭住在這附近的居民可不會同意的。

安德魯斯考特在他的著作“燃燒的星球”中說：“我們近年來透過科學方法對火的了解，還無法讓社會大眾有更清晰的警覺。”

有些經濟學者覺得處理野火可以比擬為處理人為危機一樣。這種理論是當人類處理小問題的能力日益進步時，會讓安全感增長，但弔詭的是，這在大問題發生時，所產生的危機反而會更大。

我們拿2007-2008年的金融危機來說，這是我們人類史上最大的“經濟野火”。

華爾街日報經濟評論主任 Greg Ip 在他的著作 “萬無一失” 中說美國的財政政策制定者擅長於處理小型危機，讓人們變得過於自信，然後涉入了愚蠢的風險：譬如說在次級房貸中豪博。

這符合了成功解除了之前的危機，反而導致日後的不幸的說法。

Greg Ip 說 “我們讓生活更安全的努力，卻產生了無法抑制的願望去讓事業做的越大，越複雜”，“但我們的城市，交通運輸系統，還有財務市場變得跟交叉相連，更錯綜複雜，發生大災難的機率就跟著大了

”成功阻止一種風險的發生，可能會讓它移轉到別處，然後重新出現，像一種突變的病毒，用更惡毒的方式增生“

但金融危機發生，又無法被遏制的話，之前的錯誤豪賭會形成全球性的危機，就像野火一樣的蔓延。