ACADEMY COLLOQUIUM

Fire in Human Evolution, Human History, and Human Society

15 – 17 December 2009

Amsterdam, The Netherlands

Program

Tuesday, 15 December 2009

08.30-09.00 Registration and Coffee

09.00-09.15 Opening of the Colloquium by *Robbert Dijkgraaf*, President KNAW

09.15-09.20 General introduction to the theme and conference arrangements
by *Joop Goudsblom*

Section 1. The Original Domestication of Fire

Morning session. Chair: *Peter Westbroek*

09.30-10.15 *Richard Wrangham*
Biological evidence for when fire was first controlled

10.15-11.00 *Frances Burton*
The scenario and the speculation: firelight and its effect on human evolution

11.00-11.15 Coffee

11.15-12.00 *Wil Roebroeks* (and *Paola Villa*)
Quest for fire: on the archaeological evidence for controlled use of fire

12.00-13.00 Discussion

13.00-14.00 Lunch

Afternoon session. Chair: *Henry Hooghiemstra*

14.00-14.45 *Frank Niele*
Energy, engine of evolution, and the pivotal role of fire

14.45-15.30 *Richard Cosgrove*
The fire record from Australia - the last 50,000 years

15.30-15.45 Tea

15.45-16.30 *Corrie Bakels*
Early western European farmers and fire

16.30-17.30 Discussion

17.30-18.30 Reception

Wednesday, 16 December 2009

Section 2. *The role of fire in the history of the agrarian and the industrial world*

Morning session. Chair: *Godfried van Benthem van den Bergh*

09.30-10.15 *Steve Pyne*
Surely fire is what I am: fire in human history

10.15-11.00 *David Christian*
Fire or language? What really made us what we are?

11.00-11.15 Coffee

11.15-12.00 *Floris Cohen* and *Christoph Lüthy*
Destruction and Construction: The Role of Fire in Some Pivotal Episodes in the History of Western Science and Technology

12.00-13.00 Discussion

13.00-14.00 Lunch

Afternoon session. Chair: *Hermann Korte*

14.00-14.45 *Cathy Frierson*
The case of rural Russia or "good" fire gone "bad" in an era of state-sponsored modernization

14.45- 15.30 *Greg Bankoff*
A tale of two cities: the pyro-seismic morphology of 19th Century Manila

15.30-15.45 Tea

15.45-16.30 *Jordan Sand*
The Logic of the Burnable City: Fire and Property in Edo-Tokyo, 1600-1900

16.30-17.30 Discussion

18.30 Colloquium dinner at the Amsterdamse Academische Club
Oudezijds Achterburgwal 235, Amsterdam
Tel.: 020-4210978

Thursday, 17 December 2009

Section 3. *Fire and Fuel in the Contemporary World*

Morning session. Chair: *Abram de Swaan*

09.30-10.15 *Frans Koenraadt*
The tragedy between trauma and triumph. Firesetters: their motives and their mental condition

10.15-11.00 *Randall Collins*
Fire as weapon and symbol in conflict

11.00-11.15 Coffee

11.15-12.00 *Gerrit Haverkamp*
Fire fighting: from external to internal compulsion?

12.00-13.00 Discussion

13.00-14.00 Lunch

Afternoon session. Chair: *Nico Wilterdink*

14.00-14.45 *John McNeill*
Combustion and pollution in modern industry (1900-2050)

14.45-15.30 *Sjaak van der Geest*
Fire, language, and metaphors

15.30-15.45 Tea

15.45-16.30 *Johann Goldammer*
Vegetation fires and global change

16.30-17.30 Discussion

Abstracts

Biological evidence for when fire was first controlled

Richard Wrangham

Evidence that human beings fare poorly on diets of raw food show that uniquely among animals, our species is biologically adapted to a diet that includes substantial amounts of cooked food. This adaptation is explained by the energy advantages of losing unnecessary features of the intestinal system following the acquisition of a predictable cooked diet. Two key features of this adaptation are relatively small molars, and relatively small guts. Both are recognizable in the human fossil record with the origin of Homo erectus, between 1.8 and 1.9 million years ago. Human evolutionary anatomy therefore indicates that fire was first controlled by a habiline (probably Australopithecus/Homo habilis), which as a result of controlling fire, evolved rapidly into Homo erectus. This timing also conforms to the loss of arboreal climbing adaptations by Homo erectus, which was therefore required to sleep on the ground - a safe night location only after fire had been controlled. In sum, the biological evidence indicates clearly that all Homo erectus (including Homo ergaster) controlled fire.
Thanks.

The scenario and the speculation: firelight and its effect on human evolution

Frances Burton

The scenario is known: hominins changed over millions of years to become Homo. The rate of change accelerated with each new change and continues to do so. Some changes were biological; others cultural, but given the nature of the epigenome (the genome viewed as interacting with itself as well as the environment), the repercussions of cultural changes were tantamount to biological ones: genes do not work in absentia. The speculation is that one of these phenomena that affected the rate and direction of hominization was the association with fire. The light from fire entering through the eyes causes a cascade of effects on the hominin body. My talk develops this as detailed in my recent work.

Quest for Fire: On the Archaeological Evidence for Controlled Use of Fire

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The archaeological record starts at around 2,6 million years ago, with the earliest stone tools recovered from several localities in Ethiopia; their association with ungulate remains and observations of cut marks prove that one of their main functions was for butchery (Dominguez-Rodrigo et al. 2005). The record indicates that until recently, i.e. approximately 10,000 years ago, hominins all over the world subsisted as hunters and gatherers, with a generally very mobile life style. Until the final phases of the Palaeolithic, these mobile foragers invested very little in camp layout, in dwelling structures or in the construction of formal hearths. The overwhelming majority of former traces of their presence consists of stone tools and the debris of stone tool production, significantly more prone to survive the ravages of time than the other debris they created, including the traces of their fires. As constructed hearths are virtually absent until the Upper Palaeolithic, these remains consist of various find categories which display traces of having been submitted to heating; the reddened sediments on which a fire was built, burned stone artefacts, charred bone fragments and pieces of charcoal. Other processes than human interference can create such findings too, and much of the debate on the history of human control of fire relates to this equifinality problem.

In our paper, we will give a short (and Eurocentric) review of evidence for the controlled use of fire. The European record displays a very strong signal, in the sense that from at least around 300,000 (and possibly from 400,000) years ago many proxies indicate a ubiquitous and habitual use of fire, which include some cases of Neandertal "High Tech" pyrotechnology in the production of hafting glues (Roebroeks and Villa, in prep.). And there is, importantly, also abundant "negative" evidence. The absence of burnt material from some very rich Lower Palaeolithic sites such as the half a million years old one at Boxgrove (United Kingdom) (Roberts and Parfitt 1999) could be explained away by the very short term occupation nature of these sites. However, some very long and archaeologically prolific karstic sequences, such as the ones from the Caune de l'Arago at Tautavel (France) and from Atapuerca TD (Spain) also did not yield any burnt material before the c. 300ka datum (De Lumley 2006). This does suggest that

controlled use of fire might indeed be a relatively late phenomenon in Europe (Villa et al. 2002). This is a strong archaeological pattern.

However, given the near "invisibility" of fire usage (Sergant et al. 2006), and given the fact that we simply have a larger sample of sites from the second half of the Middle Pleistocene onward, we have to evaluate the strength of this pattern. There are indeed a few claims for earlier fire usage at some Lower Palaeolithic sites in and outside of Europe, with the best case thus far made for the Acheulean site of Gesher Benot Ya'aqov site in Israel, dating to around 780,000 years ago (e.g. Goren-Inbar et al. 2004; Alperson-Afil 2008). Hominins were around in Europe by that time, in its south (Carbonell et al. 2008) and also in more northern latitudes, as shown by recent finds in East Anglia (United Kingdom) (Parfitt et al. 2005; Roebroeks 2005). Given the distinct advantages that control of fire would have conferred upon early hominins (e.g. Wrangham 2009; Wrangham and Conklin-Brittain 2003), it is possible that these range expansions into the north are a biogeographical signal of fire usage. Inventing fire and controlling it should not have been a major problem for hominins who had been hitting stones against each other for already more than two million years before the Boxgrove site was created. The archaeological record however is strikingly silent in this domain.

In our view, the Gesher Benot Ya'aqov "exception" as well as the distinct advantages of systematic use of fire – poignantly discussed in a recent series of papers by Wrangham and colleagues – call for a closer look at the data we archaeologists have and are currently retrieving during excavations. To test the strength of our archaeological signal of fire usage, we need to thoroughly investigate the taphonomic processes that may explain the absence of traces of fire at Lower and early Middle Pleistocene sites in Europe and beyond

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Energy, engine of evolution, and the pivotal role of fire

Frank Niele

An evolutionary energetics approach to the history of planet Earth reveals six energy regimes divided by five energy revolutions, with the domestication of fire seamlessly fusing biological and cultural development. Energy mastery – with fire mastery being its first manifestation – seems the true human advantage.

The latest carbocultural energy regime gained ecological dominancy in record time, but seems unsustainable before it has run its full course. To sustain development a new energy regime needs to be created, consciously this time.

The Staircase of Energy Regimes outlines evolutionary patterns for socio-technological development on the basis of the idea that all development goes by descent with modification. The present paper makes an attempt to extrapolate these patterns by shaping contours of a possible sustainable energy regime.

The fire record from Australia – the last 50,000 years

Richard Cosgrove

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The use of fire in Australian Aboriginal society has been well documented and has been pivotal to arguments about human impact on the Australian biota. Jones (1968) originally coined the term "fire stick farming" that described fire as influential in shaping the ecological systems of Australia. For example, arguments have been mounted to suggest fire had a primary role in the extinction of megafauna (Miller et al. 2005), influenced past and present vegetation patterns (Head 1988; 1989) and had a major effect on the maintenance of biodiversity (Bowman 1998; Gott 2005). Many of the historical observations of Aboriginal fire use have come from extensive ethnographies and observations by settlers and explorers from temperate, arid and northern Australia (Bowman 1998, Head 1988, 1989; Fensham 1997; Dodson et al. 1993; Bowman and Brown 1986; Hallam 1975, 1985; Clark 1983; Plomely 1966; Vigilante 2001). The early ethnographic observations from across the continent reinforced the view that fire was an important and effective device that shaped the continent's flora and fauna, particularly in managing food resources (Murphy and Bowman 2007; Gott 1999; Hallam 1989). The perception has been that fire was instrumental in human adaptation to many different environments, although Bowman (1998) has called for more integrated approaches to understand the effect that humans have had on continental ecology. One of the vital tasks is to unravel the natural and anthropogenic causes of ignition in the past, particularly as recorded from palaeoecological records. Casting the Aborigines as the major determinant of past and present ecosystems through fire does not recognise the complex nature and scales of these interactions and the primacy of any one vector of ignition source over the other. Given the ecological diversity across Australia we can expect variability in both human and natural ignition frequencies and magnitudes.

Understanding how and under what circumstances fire operated in the past is a major issue. This is because in both archaeological and palaeoecological data sets, separating the human from natural ignition sources has been difficult since they have different scales of observation and recording. Indeed, where charcoal has been dated and identified there are no strong links with increased human presence and major fire episodes. For example in the Wet Tropics region of northern Australia when Aboriginal populations are high, charcoal levels are unexpectedly low (Hopkins 1993; Cosgrove et al. 2007). The pollen record is also ambiguous because only minor correlations occur between intensive human occupation and charcoal increases (Haberle 2005). Research has also demonstrated that the magnitude of charcoal concentrations occurring well before human settlement of Australia bear a striking resemblance to those in pollen records that date to periods of human occupation indicating that charcoal is an unreliable measure of human presence (Moss and Kershaw, 2007, Kershaw et al., 2003).

These issues will be examined using archaeological and palaeoecological evidence from various Australian environments.

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Early western European farmers and fire

Corrie Bakels
Faculty of Archaeology, Leiden University

Fire can function as an important tool in the hands of farmers. The practice of slash-and-burn cultivation is a well-known example: burning down woodland and cultivating crops in the ash-enriched soil. Prehistoric farmers in Western Europe did use this method as is proved by investigations in, for instance, Denmark. I will present the Danish research as my first example of the relation early farmers and fire.
But the Danish farmers were not the earliest people to farm land in Western Europe. The people who introduced farming in this part of the continent, an event that took place around 5300 BC, did not use the slash-and-burn technique, but practiced a kind of permanent horticulture. Fire is considered to have played only a minor role in their kind of agriculture.
The early farmers did not only cultivate crops, but also had livestock. Pastureland was probably as important as fields. In the natural, wooded, environment open stretches of land where the animals could browse and graze were scarce. Almost all open space was (and still is) man-made. The heathlands of Western Europe are an example. They date back to at least the third millennium BC and own their existence to a regime of regular burning and grazing. My third example concerns the use of fire by early farmers in relation to the origin of heath.

“Surely Flame is What I Am”: Fire in Human History

Stephen Pyne

Summary (long)

Control over fire is a signature trait of humanity’s ecological agency and a founding source of humanity’s power. There is little humanity does that does not have a fire component. We are truly a uniquely fire creature on a uniquely fire planet.

In simple terms our relationship with the natural world as mediated by fire has three phases: One, aboriginal fire, characterized by control over ignition. Here, the power of fire is limited by its power to spread through the landscape. Two, agricultural fire, characterized by the additional capacity to create fuels out of surface biomass. This expands the range and patterns of burning, but remains limited by the ability to coax combustibles out of the biota. And three, industrial fire, characterized by the ability to burn fossil biomass, which then replaces open burning by processes of technological substitution and active suppression. Its limitations reside not only in the amount of fossil fuels available from the geologic past but amount of effluent the Earth can transfer to the geologic future.

Today the Earth is dividing into two grand combustion realms as distinguished by fuels and the means to burn them. One is founded on surface biomass, and the other, on fossil biomass. The transformation from the first to the second – what might be termed the pyric transition – has shaped human fire history over the past 150 years. In general, there is now too much of the wrong kind of fire and too little of the right kind.

The hazards from wholesale burning make it likely that humanity will have to choose between fire and power, a reconsideration of its original Faustian bargain. Fire will persist under human stewardship where it advances ecological purposes. But combustion will become less prominent within technology generally and the power it conveys.

Summary (short)

Control over fire is a signature trait of humanity’s ecological agency and a founding source of humanity’s power. In simple terms our relationship with the natural world as mediated by fire has three phases: One, aboriginal fire, characterized by control over ignition. Here, the power of fire is limited by its power to spread through the landscape. Two, agricultural fire, characterized by the additional capacity to create fuels from surface biomass. This expands the range and patterns of burning, but remains limited by the ability to coax combustibles out of the biota. And three, industrial fire, characterized by the ability to burn fossil biomass, which then replaces open burning by processes of technological substitution and active suppression. Its limitations reside not only in the amount of fossil fuels available from the geologic past but amount of effluent the Earth can transfer to the geologic future.

Today the Earth is dividing into two grand combustion realms as distinguished by fuels and the means to burn them. One is founded on surface biomass, and the other, on fossil biomass. In general, there is too much of the wrong kind of fire and too little of the right. It appears that humanity will have to choose between fire and power, a reconsideration of its original Faustian bargain.

Fire or Language? What really made us what we are?

David Christian

Macquarie University, Sydney, and Institute of World and Global History, Ewha Womans University, Seoul

I will argue that what makes human beings unique is our capacity for sustained innovation. Unlike all other species, that live and die by a unique set of adaptations, humans continually find new ways of extracting energy and resources from our environment, so that our collective ecological power increases over time. Any attempt to explain what makes us unique must be able to explain this astonishing ecological creativity. Can human use of fire do this? I will argue that control of fire is part of the explanation, but the critical change arises from our linguistic ability, which enables us to share learned knowledge with a power, speed and precision that no other species can match. While most intelligent species function like stand-alone computers, we alone are networked.

Christoph Lüthy & Floris Cohen

Christoph Lüthy shall be concerned to argue the following points:

1. Western scientific theories concerning fire were, for about 2000 years, of little assistance to technology. In the long period in which fire was seen as one of the four (or five) elements, scientific analyses of fire proved inadequate for all purposes of technological advance. The element theory had, however, other advantages.

2. It was in early modern alchemy, or chemistry, that fire was first taken out of the list of elements. In the late Renaissance, chemists began to quarrel over the question whether fire was primarily an analytic, or merely a destructive tool.

Floris Cohen shall go on to make a case for the following points:

3. Not until the switch from machines driven by muscles, air, or water to machines driven by steam, did fire obtain an unambiguously constructive role in the scientific enterprise.

4. It is the fire-driven steam engine that harnessed technology to science and built the bridge from the Scientific to the Industrial Revolution.

5. 'Energy' began to replace 'fire' as a key category in both science and technology in the first half of the 19th century, due to (a) the transformation in the 1760s of Newcomen's fire engine into Watt's steam engine and then the high pressure engine, and (b) to the two-stage development of the principles of thermodynamics that was occasioned thereby.

The Case of Rural Russia or 'Good' Fire Gone 'Bad' in an Era of State-Sponsored Modernization

Cathy A. Frierson, Professor of History

University of New Hampshire, U.S.A.

From the time of Peter the Great's reign (1682-1725), Russian tsars and tsarinas periodically focused on technology, industry, and economic development to "catch up" with western Europe. One consistent agenda in state-sponsored modernization was to control fire by weakening its threat to property and the larger economy. From Peter's reign until the late nineteenth century, the state's regulatory and policing efforts to contain fire focused on cities and towns. Urban spaces were within the state's reach, and the state was able to achieve success in the center of cities and towns by the middle of the nineteenth century. The countryside was another matter, however. The state left the countryside from Peter's reign forward to be managed by members of the serf owning nobility or state administrators of the so-called "state peasants," who were also subject to special restrictions. These persons largely accepted fire as an inevitable feature of the rural landscape.

Only in the middle of the nineteenth century did the Russian state turn its attention fully to the countryside as a determining factor in Russia's future as a modern economy and society. Following the Emancipation legislation of 1861, which freed Russia's proprietary serfs, the so-called Peasant Question loomed large in the official and public imagination. What roles were Russia's peasants to play, and how were they to be integrated as free subjects into the larger enterprise of modernization? Simultaneously and symbiotically in the emergence of an apocalyptic mood, officialdom and educated Russians discovered that fire pervaded rural life, often in destructive ways as accidental fires or arson fires. Uncontrolled peasants and uncontrolled fire alarmed educated Russia. The so-called Fire Question intersected with the Peasant Question to create a flood of research on and regulatory programs directed at fire in the Russian village.

The resulting ethnographic, legal, agricultural, and economic data revealed fire's multiple roles and meanings in late Imperial rural Russia. Researchers discovered the many ways peasants used fire in their daily domestic and farming life. They described its centuries-old contributions to the Russian peasantry's survival in a severe climate, forested landscape, and stingy soil. Yet, educated Russians decried, rather than celebrated, peasants' continued mastery of fire. In the thrall of a fundamentally evolutionary worldview, scholars, civic activists, and officials assigned the special relationships between peasants and fire in late nineteenth century Russia to the category of primitive features of Russia's backward society and economy. At the extreme end of the primitive range of the social evolutionary spectrum were peasant women, who in fact were fire's most frequent practitioners in rural Russia, and who most educated Russians agreed were, as Leo Tolstoy called them, "The Power of Darkness." Controlling fire in the Russian countryside while regulating peasants' relationship, especially female peasants' relationship, with it became a major aspect of state-sponsored modernization and civic activism from 1860-1905.

A Tale of Two Cities: The Pyro-seismic morphology of Nineteenth Century Manila

Greg Bankoff

Colonial Manila, in fact, was two cities: A city of stone and wood largely but not exclusively inhabited by Spaniards, and a city of nipa palm and bamboo where the indigenous peoples of the archipelago mainly lived. These two cities within a city represented not only the socio-economic and ethnic realities of colonial life in the Philippines but a particular cultural adaptation to the twin hazards of earthquake and fire that came to dominate all notions of urban planning in the archipelago. The stone and wood city represented an approach that attempted to manage hazard through legislating an appropriate architecture to suit the dangers of urban living in a seismically active landmass, to express mastery though suitable construction techniques and materials. The palm and bamboo city was an altogether different solution to the frequency of earthquakes by constructing light, flexible structures whose periodic loss was allowed for and accepted. If the first represented a form of adaptive technology, the second was also a technological solution of sorts, a disposable one, long evolved under conditions where fire was never a major threat until the scale of urban living made it so. Since its foundation in 1571, these two cities, the permanent and the ephemeral one, had coevolved together, sometimes coexisting in an uneasy alliance and at other times in open conflict. By the nineteenth century, however, conditions had altered. Earthquakes continued to remain a challenge to both but Manila's growth, the steep rise in its population together with the blurring of boundaries between the two, prompted a renewed attempt by colonial administrators to manage hazard through further architectural adaptation and stricter control over the denizens of the ephemeral city. As fire came to challenge the authority of the state and threaten the wealth of its primary benefactors, foreign and native, its management increasingly became a domain of colonial and even class contestation.

The Logic of the Burnable City: Fire and Property in Edo-Tokyo, 1600-1900

Jordan Sand

Summary: Japan's capital from 1600, the city of Edo grew to be the largest city in the world by 1700. Large areas of the city were destroyed by fire on average every five or six years. How did inhabitants cope with the constant threat of conflagration? What implications did the city's flammability have for governance and the maintenance of property? This presentation will explore the social and political effects of a radically unstable built environment.

The tragedy between trauma and triumph
Firesetters: their motives and their mental condition

Frans Koenraadt, Utrecht University

In an ongoing research project on arson we investigated retrospectively cases of arson. In the Dutch jurisdiction where the focus of special attention in criminal law and criminal procedure is not only on the offense itself but also on the offender as a person we collected data from files of a forensic psychiatric observation hospital in Utrecht, the Netherlands. The sample consists of 75 persons, mainly adults, who were accused of committing arson in the period 2002-2008.
We found that compared to other serious offences like severe maltreatment, homicide and sexual offences arson might be considered as a typical act of revenge. However in the forensic mental health reports there rests a taboo on mentioning the motive as revenge or retaliation. Pyromania, a mental disorder of impulse control, was only rarely diagnosed in these cases of serious arson.

Fire as a Weapon and Symbol in Conflict

Randall Collins

Department of Sociology
University of Pennsylvania

Fire has been a weapon both in ancient war—destroying the enemy "with fire and sword"—and in modern warfare, where fire is used as propulsion and explosion in fire-arms, artillery, and bombs. But even in violent conflict, the use of fire is predominantly socially interactional, emotional, and symbolic. Close examination of how humans behave in violent situations shows that successful violence largely depends upon emotional domination. On the whole, physical violence is incompetent and armies (or smaller groups or individuals) which are not intimidated usually manage to hold up against their opponents. The breakdown of social organization and emotional solidarity typically precedes the successful use of physical violence. Most firing is "bluster"—an attempt to intimidate the enemy, as well as bolster the confidence and aggressiveness of the side doing the firing. The noise of projectiles propelled by fire, and the flash and heat of their impact, have chiefly emotional effects, until these happen to culminate in one side becoming emotionally dominated and socially disorganized, after which most of the physical destruction takes place. The symbolic-emotional use of fire is even more apparent in large-scale civil violence, i.e. riots. "Burn, baby, burn" is a frightening battle cry, but in most riots fire is mainly a symbolic gesture and may take place largely on the rioters' home turf. Prolonged riots resemble forest fires which must move to new locales because they exhaust their materials in one place, but this exhaustion is more emotional than physical. This talk will also address the puzzle as to why the kind of fires differs in riots in the USA, in Europe, and South Asia. Finally, it will consider fire in rituals of domination in more peaceful settings, including the status-enhancing character of Indian *sati*, and the light that this casts on suicide bombing.

Fire Fighting: from external to internal compulsion?

Gerrit Haverkamp

The focus in the paper is on human involvement in preventing and responding to fires. The paper presents an overview of recent and historic trends, interpreted in terms of civilizing processes, up-scaling, and professionalization. Special reference is made to theories of collective action.

Combustion and Pollution in Modern History (1800-2050)

John McNeill

This will consider the role of fossil fuel combustion, and to a small extent wildfire, in the history of air pollution, with a brief look at possibilities for the future. It will include a quick overview of fossil fuels' significance for the environment generally, but focus on local urban), regional, and global scale air pollution trends, the socio-economic reasons for these trends, and the socio-political responses to them.

Fire, language and metaphors

Sjaak van der Geest

The domestication of fire, as we know, has been invaluable in the evolution of humankind. It enabled humans to till the land, keep wild animals at a distance, cook food, warm and lighten homes, melt iron, bake pottery, and destroy enemies; all very useful capabilities. What is generally overlooked, however, is that fire has also enriched the human language. Fire gave us a metaphor with unlimited possibilities. Thanks to fire, people can find words to communicate about experiences, emotions in particular, that are difficult to grasp otherwise. Also for that reason, we would have been different people without fire. This paper will present and discuss various metaphoric applications of 'fire' in – mainly Dutch – language and culture.

Vegetation Fires and Global Change

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Ecosystems throughout the world are undergoing changes in vegetation fire regimes. These changes are primarily induced by humans and aggravated by climate extremes. In the equatorial tropics the use of fire in converting native primary or secondary vegetation, including the conversion of peatlands to biofuel plantations, is a major agent of global vegetation destruction and transfer of terrestrial carbon to the atmosphere. Wildfires spreading from land-use fires in the tropics are favored by dry spells or extended droughts such as those occurring during El Niño-Southern Oscillation (ENSO) events. In many regions of the world regular seasonal smoke pollution caused by wildland fires are aggravated by industrial pollution and other burning activities such as trash burning in the less developed countries. In South Asia the so-called Asian Brown Cloud or the seasonal smoke pollution in Northern Thailand are a consequence of multiple sources of combustion processes consuming fossil, natural and anthropogenic fuels. Vegetation fire smoke emissions are impacting human health and security. In the mountain regions of the world regional warming linked to climate change is predicted to alter the snow and ice regimes in high-altitude ecosystems. Already observed rapidly melting glaciers are impacting not only the drinking water supply but also may effect regional vegetation dryness and fire regimes. In continental regions of the world a trend of regional desiccation as a consequence of climate change is observed. Non-sustainable forestry practices, often illegal, are influencing fire hazard and increase wildfire risk and severity. Besides regional drying wildfires are becoming a major force of steppization of Central Asia. In the northern latitudes that are characterized by continuous or discontinuous permafrost regional warming will affect permafrost, forest cover and fire regimes. In Northeast Asia, notably in the Far East of Russia, mixed forest ecosystems are becoming increasingly vulnerable to fire as a consequence of regional climate, careless fire use and reduced institutional capacities to manage fires.

In North America and Australia human societies are becoming increasingly vulnerable to fire as there is an ex-urban trend of people moving from overcrowded cities to the natural environment, often to highly flammable ecosystems such as the Californian Chaparral or the Australian bush lands. In these ecosystems natural fires are common, and the biota is adapted or at least tolerant to recurrent fires, but human settlements are not. An opposite major trend observed all over the Eurasia is the rapid urbanization of rural populations, which is resulting in the abandonment of the old cultural landscapes. The dramatic reduction of domestic use of biomass allows the recolonization of cultivated lands by vegetation succession, resulting in increasing wildfire hazard and larger and often uncontrollable wildfires.

The accumulating and interacting effects of non-sustainable land use, land-use fires and wildfires on the degradation of those global vegetation resources, which have limited environmental resilience and are fire sensitive, have global implications and negatively affect global land cover and reduce its overall carrying capacity to sustain the Earth's biota and human populations. Collective endeavors are needed to support the existing epistemic community of scientists and fire managers to push towards the development of an informed global political regime.

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