Towards a More Sustainable Coexistence With Wildfire in the Netherlands Through Fire Smart Territory

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Abstract

Climate change will lead to an increased risk of wildfires in the Netherlands in the upcoming decades. The current model to control wildfires is predominantly repression-based, and is expected to become ineffective in the near future. Moreover, the repression-based model increases wildfire vulnerability. This thesis aims to sum up existing measures to mitigate wildfire-risk in the Netherlands, to evaluate these measures via the Fire Smart Territory Concept of Tedim et al.(2016), and to explore the possibility of applying the Fire Smart Territory concept to the Netherlands in an effort to mitigate wildfire risks more sustainably. This research takes an instrumental case study approach to *de Veluwe*. Three policy documents were analysed and eight semi-structured interviews were held with stakeholders. Results indicate that wildfire-risk is briefly mentioned in the analysed governmental policies, and that there are advice documents with FST-related operational advice on wildfire-risk management. The involvement of local communities on *de Veluwe* is limited, although *de Veluwe* does well in adapting its landscaping to sustainable wildfire mitigation. The research concludes that, while mainly the landscaping and fire aspects of the FST-concept would be suited for the Netherlands and/or are already in place, the totality of the concept would not be applicable since few Dutch citizens own- and make extensive use of nature.

Keywords: Wildfires, Fire Smart Territory, Risk mitigation, *De Veluwe*, Wildlife-urban index, Socio-ecological system

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) report of August 2021 had a dreadful conclusion: global warming is increasing at an alarming rate, and faster than we expected (IPCC, 2021). With the risk of an increased global temperature, also comes the increased risk of wildfires: Summers are becoming drier and wind speeds are increasing; ideal factors for large wildfires (Landelijk informatie knooppunt natuurbranden,2012). While the Netherlands currently does not experience many problems with wildfire, there is reason to believe that wildfires will become more common and larger in the near future. Forest fire experts warn that climate change will shift fires occurring in Mediterranean forests towards more temperate climates, meaning that the Netherlands is more at risk for wildfires (Landelijk informatie knooppunt natuurbranden,2012; Ministerie van Landbouw, Natuur en Voedselkwaliteit,2020). Figure 1 presents the situation regarding wildfire sensitivity in the Netherlands and supports the warnings for the increased wildfire-risk.
The Netherlands is densely populated and has a large wildland-urban interface, meaning that wildfires occur closely to populated areas and thus form a large risk to those people and the infrastructure (Landelijk informatie knooppunt natuurbranden,2012).

As recently as 2020, there was a large, uncontrolled wildfire in De Deurnse Peel, which lasted for weeks and burned down 710 acres of wildland. There were substantial costs on extinguishing the fire due to deployment of personnel, several infrastructures were threatened by the fire, there was nuisance from smoke, and several patients form a nursing home needed to be evacuated (Taskforce Natuurbranden,2020). The combination of increased risk of uncontrollable wildfires in the upcoming years and the lack of experience with this type of incident in the Netherlands calls for innovation, preparation and climate adaptation in order to build a sustainable coexistence with fire.

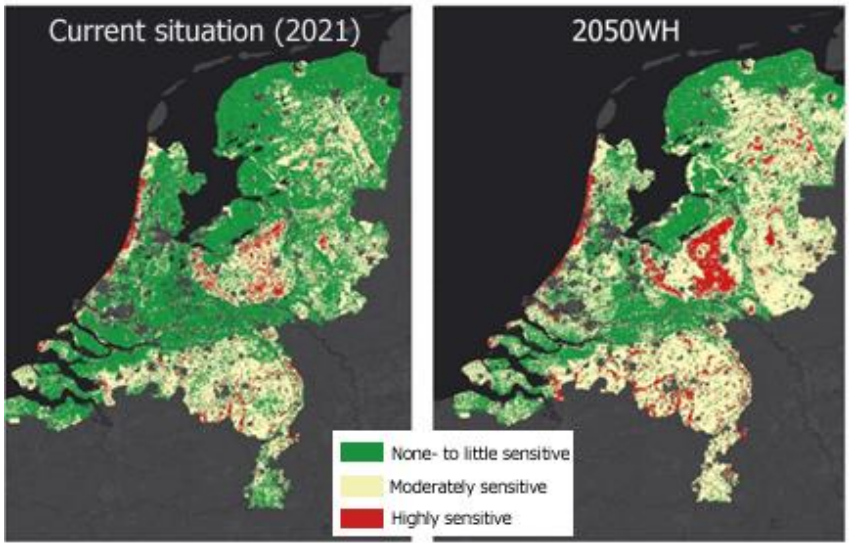

Figure 1: Wildfire sensitivity map of the Netherlands, 2021 vs. expected situation in 2050. Edited by author for translation. Source: Van Marle, M. and Agricola, H.J. (2021) p. 9. Verrijking Klimaateffectatlas Natuurbrandgevoeligheid Huidige situatie en 2050 WH. Deltares. Legend translated by author.

The currently predominant suppression-approach is not sustainable and is actually making forests even more vulnerable to larger and more destructive wildfires in the future, the so-called 'Firefighting trap' (Tedim *et al.*,2016; Hessburg,2017). But spatial interventions in nature areas, choices in terrain management and the attitude of inhabitants of the wildland-urban interface could result into a more sustainable coexistence with fire (Tedim *et al.*,2016).

Researchers describe a strict anti-fire bias in European countries (Tedim *et al.*, 2016), whilst the fundamental role that wildfires can have in sustaining biodiversity and key ecosystem services are neglected (Mortiz *et al.*,2014). Moreover, fire can even be used to prevent unwanted fires (Tedim *et al.,2014)*. This further illustrates that both a societal and operational shift are necessary to achieve a more sustainable adaptation to wildfires. Thus, the goal should not be to suppress all fires, but to holistically prevent them from becoming uncontrolled and endanger humans and ecology (Mortiz *et al.*,2014). An approach that will be explored in this research to achieve this is the Fire Smart Territory concept of Tedim *et al.*(2016); a concept in which wildfire-prone areas are prepared through strategically planned prevention activities in such a way that they become wildfire-resilient with wildfire-resilient inhabitants.

1.1 Scientific relevance

There are little to no scientific studies about the wildfire approach in the Netherlands due to the small occurrence of substantial wildfires in the past. It is relevant to research possibilities for a sustainable coexistence with the living environment in this period of climate change in which wildfires could become a threat to the Netherlands and surrounding countries. Moreover, there are little to no papers that specifically evaluate the Fire Smart territory concept and its possibility to put it into practice.

1.2 Research goals

This thesis looks at the possibility to operationalize a sustainable coexistence with wildfire through the Fire Smart Territory concept of Tedim *et al.(2016)* and aims at answering the following:
How prepared is the Netherlands for wildfires enhanced by climate change, and how can the Netherlands achieve a more sustainable coexistence with wildfires, evaluating through the Fire Smart Territory concept?
Through empirical research, the following will be researched:

1. What official policies are in place to manage wildfires in the Netherlands, and how much do these resonate with the Fire Smart Territory concept?
2. What are measures of different organizations in place to preventively manage wildfires in The Netherlands, and how much do these measures resonate with the Fire Smart Territory concept?
3. What are possibilities for additional Fire Smart Territory measures in the Netherlands?
4. What is being done in the Netherlands to build a sustainable coexistence with wildfires?

These subquestions serve as way to get an overview of the current approach to wildfire in the Netherlands, and ways in which we can achieve a more sustainable coexistence with wildfire, specifically through the FST-concept. Research goals are summarized in table 1.

Table 1: summary of research goals

	Goals of this thesis
1	Know current (preventative) measures and policy documents in place against wildfires
2	Evaluate how much the current measures resonate with Fire Smart Territory (FST)-concept
3	Find out benefits and possibilities for more Fire Smart Territory measures in the Netherlands through participant's opinions
4	Evaluate what the Netherlands is doing to coexist sustainably with wildfires for in the future

2. Theoretical framework

2.1 Wildfire in the Netherlands

Wildfires are fires of which the fuel consists mainly of vegetation; trees but also grass or peat. This includes fires that are (unintentionally) caused by humans, as well as fires caused by natural phenomena (Landelijk informatie knooppunt natuurbranden, 2012). In the Netherlands, hundreds of smaller, insignificant wildfires occur yearly. In the dry summer of 2018, the amount of small wildfires doubled to almost a thousand (CBS, 2020; Deelprojectgroep gebiedsgerichte aanpak natuurbrandbeheersing, 2021). Only ~4% of wildfires in the Netherlands can definitively be attributed to natural causes; wildfires in the European union, including in the Netherlands are mainly caused by human activity, mostly unintentional (Tedim *et al.*,2016; Deelprojectgroep gebiedsgerichte aanpak natuurbrandbeheersing, 2021). About 10% of the Netherlands area has forest-coverage (proBos, n.d.), although there are more nature areas such as heathen fields where wildfires can occur. Uncontrollable wildfires have a higher chance of occurring in the near future, due to increased dry conditions because of climate change, and also due to repression-oriented fire management of the past that left behind sickly trees, unable to withstand fire and dense canopies that easily spread wildfire (Van Marle and Agricola,2021; Tedim *et al.*,2016; Mortiz *et al.*, 2014).

Wildfires are not bad by definition and can have ecological benefits when used for landscape management (Mortiz *et al.*,2014). Wildfires are also effective for fuel reduction, which can prevent future wildfires (Tedim *et al.*,2016). However, when uncontrolled, wildfires can damage human communities - loss of lives and homes, suppression costs, health impacts- and also ecosystems through habitat degradation, loss of ecosystems services and biodiversity (Mortiz *et al.*,2014). This research looks at wildfires from the perspective that they should be prevented from becoming uncontrollable and damaging, rather than being cancelled out altogether.

2.2 Wildlife-urban index (WUI)

In literature, definitions for Wildlife-urban index (WUI) are fairly unanimous. The WUI is described as "the area in which humans intermix with natural vegetation" (Mortiz *et al.*, 2014 pp. 58). Cohen (1999) defines the WUI as "the zone where infrastructures and other man-made systems interact with natural elements, where fire can spread from human assets to vegetation and vice-versa" and Radeloff *et al.*(2018) describe the WUI as the area "where wildfire problems are most pronounced".

This research will look at WUI as areas where fire-prone ecosystems and human communities come together in such a way that fire can spread from vegetation to the infrastructure and vice-versa. The WUI is especially relevant in the Netherlands, since the cause of wildfires are mainly human activity-related, and since forest and urban areas are more spatially mixed, meaning there are many WUI's. This research also considers the WUI as an area where local communities could become active in wildfire risk mitigation.

2.3 Socio-ecological system (SES)

A social-ecological system (SES) can be defined as the connection between social and ecological systems, where the alteration in one subsystem likely leads to changes in the other (Fedele *et al.*,2019). A 'sustainable' socio-ecological system would be a socio-ecological system where vulnerabilities to the system are reduced in the long-run (Fedele *et al.*,2019). In the context of my research, the socio-ecological system is defined as WUI-communities and the nature surrounding them. A sustainable SES would then be a WUI where the communities are prepared for fire hazards and have reduced the risks through Fire Smart (Tedim *et al.*,2016) interventions that will be elaborated below.

2.4 The Fire-smart territory concept (FST-concept)

Both Mortiz *et al.*(2014) and Tedim *et al.*(2016) argue that, instead of focusing only on suppressing wildfires, an effort should be made to adopt a context-specific and proactive approach in an effort to coexist with wildfires in their respective coupled SES (Tedim *et al.*,2016; Mortiz *et al.*,2014). Based on the extensive discussion of Tedim *et al.(2016)* on the FST-concept, this thesis defines FST as the following: A fire-prone SES where individuals, communities, governments and other organizations learn together what they can each do to create a sustainable approach to wildland fire management, in order to prepare that territory and the inhabitants to be less vulnerable and more resilient to wildfire. This is accomplished by aware and well-trained empowered communities, able to decide the objectives and practices for preventing, controlling or utilizing fire.

Tedim *et al.(2016)* extensively discuss the FST-concept and its operationalization. This thesis uses the following explicit, main implications of Fire Smart Territory:

- **Local communities empowered**; they actively participate in forest fire prevention and control and benefit from the forest.
- **Landscape design** and forest management are focused on reducing the risk of large, uncontrollable wildfires
- **Fire.** The use of fire is a pillar of the prevention of unwanted or uncontrolled fires and a primary tool for land and ecological management: prescribed fire. Fire could also be used as suppression fire as a final resort in the case of extreme fires where other repressive techniques fail.
- **Cooperation.** There is interactive cooperation and exchange of resources between stakeholders.

Another less specific aspect to the FST-concept is that it is context-based, and that values of the territory need to be considered to make a trade-off between fire-safety and other end goals. So the wildfire challenge cannot be solved by a check list of theoretically adequate procedures (Tedim *et al.*,2016).

To conclude the theoretical framework, a corresponding conceptual model and operationalization scheme are presented below in figure 2 and figure 3.

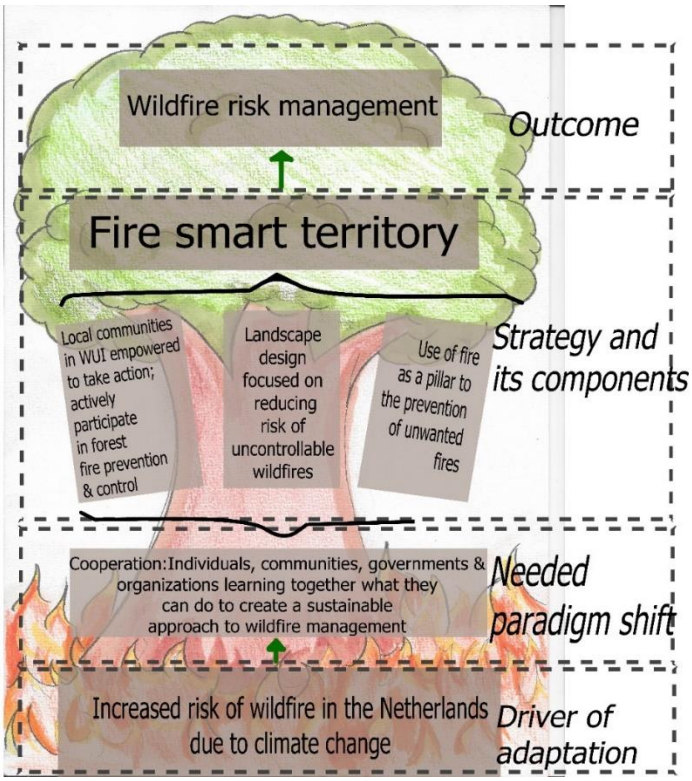

Figure 2: Conceptual model corresponding to the Theoretical framework

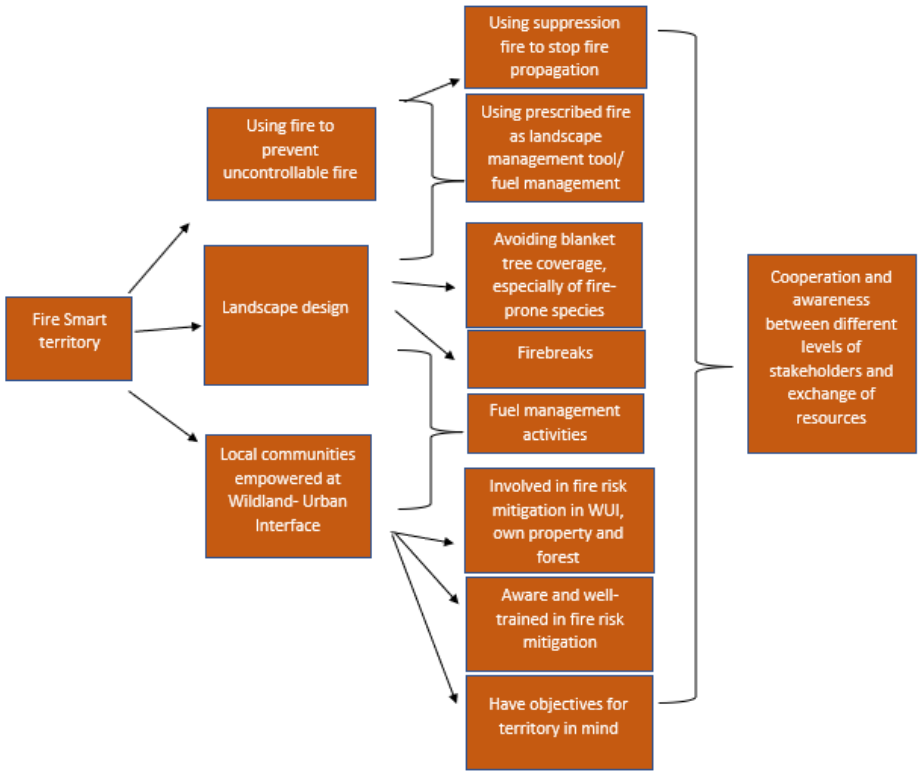

Figure 3: Operationalization scheme corresponding to Fire Smart Territory concept of Tedim et al. (2016). Created by author.

3. Methodology

The following section will elaborate on the chosen research methods and will discuss how the subquestions in this research will be answered. Table 2 contains a summary. This section of the thesis contains tables with details and background information that are not presented in-text.

Table 2: Choice of research methods

Subquestion	Methods used
1. What official policies are in place to manage wildfires in the Netherlands, and how much do these resonate with the Fire Smart Territory concept?	• Policy document analysis
2. What are measures of different organizations in place to preventively manage wildfires in The Netherlands, and how much do these measures resonate with the Fire Smart Territory concept? (Case study *de Veluwe*)	• Policy document analysis • Semi-structured interviews with stakeholders at *de Veluwe*
3. What are possibilities for additional Fire Smart Territory measures in the Netherlands?	• Semi-structured interviews with stakeholders
4. What is being done in the Netherlands to build a sustainable coexistence with wildfires?	• Semi-structured interviews with stakeholders

3.1 Case study approach: *de Veluwe*

For this research, it was chosen to take an instrumental case study approach at *de Veluwe* for some of the subquestions. The general idea of a case study is to develop as full an understanding of a case as possible and to provide understanding of the important aspects of a new research area (Punch, 2014). There is a lack of scientific knowledge on wildfires in the Netherlands, especially in the combination with the FST-concept, making a case-study a valuable method to explore this new subject. The findings of a case study can also be used to form propositions about elements and knowledge that can be transferred to other cases or other research (Punch, 2014). Moreover, the nature of the FST-concept requires understanding of the wildfire problem in a certain area, or community (Tedim *et al.*,2016) , further solidifying the choice for a single-case approach.

It would have been valuable to have done a multiple case study, where the instrumental case study is extended to cover several cases, to learn more about the general population of the Netherlands. However, due to the time-limit of the research and my gradual understanding of the subject, it was chosen to focus on one case. A survey was also considered early in the research, but this would not have given the in-depth answers that I was looking for concerning the subject.

De Veluwe is spatially a suitable area to be researched, as it is the most densely forested area in the Netherlands, high-risk for wildfires and interconnected with society; a SES that would have interests in becoming sustainable. There are not many other areas in the Netherlands with this type of combination of people and nature. Studying *de Veluwe* could also yield valuable data due to past experiences with wildfires. Figure 1 presents *de Veluwe* as an area that is currently highly sensitive to wildfires, and this sensitivity will be increased extremely by 2050. Doing research elsewhere would presumably bring little relevant data, as wildfires are relevant in large nature areas, but not so much outside their perimeters.

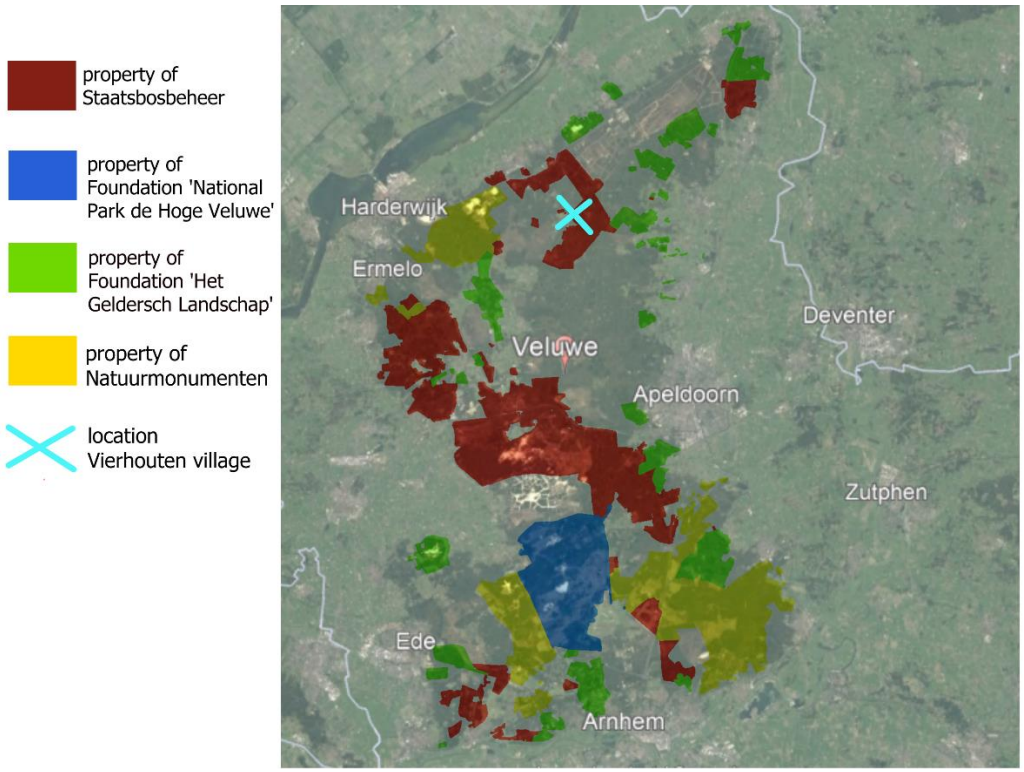

Figure 4: Map of de Veluwe and terrain owners. Screenshot of Google Earth pro overlayed with geodatabase file of Province of Gelderland. Created by author. See Appendix A for details.

De Veluwe (Figure 4) is located in the province of Gelderland. It is an area of mixed function, its main functions are nature preservation, recreation and housing. *De Veluwe* contains a few villages with a total of about 13.000 inhabitants, along with many recreation facilities such as campings and bungalowparks, but also psychiatric facilities. The aggregate of these inhabitants and facilities will be considered 'Local communities' in this research.
Some areas are mostly left alone for nature preservation, although they are often intersected with touristic routes. This means that there is a fair mix of WUI, nature, and recreation on *de Veluwe*, causing there to be both economic and ecological values to the area. As seen in figure 4, there are at least 4 nature organizations that own area in *de Veluwe*, and this figure excludes ground owned by municipalities and private citizens and -organizations.

3.2 Collection of empirical data and choices of research method

The empirical data for this research was collected through a combination of semi-structured interviews and policy-document analyses, as can be seen in table 2. This approach was chosen because policy documents alone would not provide enough data for the reality of situation, and because there are not many official documents on wildfires in the Netherlands. According to Punch (2014) "In conjunction with other data, documents can be important in triangulation, where an intersecting set of different methods and data types is used in a single project." (Punch, 2014, pp. 237).

In order to support and enrich the policy document data and get a better grasp of the subject, eight semi-structured interviews were held with relevant stakeholders in the field of wildfire management in the Netherlands and in *de Veluwe*. Minichiello et al., (1990) paint a continuum of interview styles, ranging from structured to unstructured, with semi-structured being in the middle of the extremities. With a goal of going in-depth with the research, structured interviews were not suitable, as they make use of pre-categorized answers which would have been restrictive. On the other hand, an unstructured interview only uses some general questions and is open-ended. This could have resulted in inequality of responses gained from all the participants, since not every participant would have been asked equally about every subject. Therefore, I chose the semi-structured interview style, though closer to the unstructured style of the continuum than the structured style. During the interview, participants were asked questions from a pre-prepared interview guide, whilst asking some unplanned follow-up questions if the situation called for it. Table 5 gives an overview of the participants.

3.2.1 Policy documents

The policy documents that have been examined for this research are summarized in table 3. Early exploration of the subject through web research and a quick examination of policy documents indicated that the subject of wildfires in the Netherlands makes little formal appearances in policy documents. Ultimately, D1 was selected on suggestion of interviewees. It is relevant to analyze anything related to forest and landscape management from the Dutch government, to see if wildfires are taken into account. D2 was recommended by different participants; terrain keepers play a large role in Fire Smart operationalization, as they have direct responsibility to fuel managing and prescribed fire on their terrain. D3 was found through web research. It contains advice for a wide range of stakeholders; from terrain managers to a regular citizen wanting to protect their property.

Table 3: Policy documents that were analyzed

	Document name	Institution & year of publication	Details	Amount of pages
D1	Bos voor de toekomst: Uitwerking ambities en doelen landelijke Bossenstrategie en beleidsagenda 2030	Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020	Proactive policy: Strategy document on Dutch forest planning and management from the central Dutch government in accordance to climate goals	60
D2	Risicobeheersing en bestrijding van natuurbranden GEZAMENLIJK, GEBIEDSGERICHT, LOKAAL MAATWERK Praktijkadvies voor eigenaren en beheerders van bos- en natuurterreinen	Vereniging van Bos en Natuurterreineigenaren (VBNE), 2018	Practical advice document made by terrain keeper union for terrain keepers on how to mitigate risk and damage of wildfire on their terrain	32
D3	Toolbox Gebiedsgerichte aanpak Natuurbrandbeheersing	Brandweer Nederland, 2021	Advise document on wildfire safety that private organizations can use	83

3.2.2 Interviews

The interview participants (table 5) were selected through my knowledge of who would be relevant. Web searching and suggestions from other students were also used. I started out contacting the national coordinator for wildfire prevention (R1), who suggested other relevant organizations etc. Eventually this developed into a snowballing effect of suggestions from the participants, as well as my own judgement for whom would know more about a subject. The WUI-resident that was interviewed (R6) is a person that was recommended to partake in the research by other residents of the village when I made a call to a local recreational facility for my research. Other stakeholders that were approached, but did not give an interview were: Planbureau voor de Leefomgeving, which indicated to not have enough knowledge on the subject to give an interview, a recreation facility and/or village community centre, which were left out due to time constraints, wildfire experts at the Wageningen University and the municipality of Apeldoorn, who remained unresponsive.

Participants were interviewed via Microsoft Teams. A few days prior to each interview, the participant was sent the "Form of consent" (appendix E) and an "Interview guide" (see table 5 for corresponding appendix). The Interview guide contained questions and a small summary of the FST-concept so that the participant could prepare their answers prior. The interviews were done in semi-structured format, and questions were tailored to each participant, based on their position and knowledge. Yet, the general structure of the interview guide was the same throughout all interviews (table 4). Especially participants in the same stakeholder group (see table 5) were asked similar interview questions (see appendices F-M).

3.3 Data analysis

3.3.1 Policy documents

Policy documents were analyzed by reading through the whole document whilst looking out for key words corresponding to the FST-concept of Tedim *et al.*(2016), as mentioned in Appendix B. I also highlighted relevant passages relating to one of the four main FST-indicators as mentioned in the theoretical framework. All highlighted passages were then divided into categories of the four main FST-indicators for each document. It was done inductively and deductively, as I used the framework of Tedim *et al.* (2016) to find exact matches in the documents, but also summarized some passages that did not exactly match the framework, but were still deemed relevant in my objective. As a control to not miss any relevant passages, some key words of Appendix B were word searched (Ctrl + F).

3.3.2 Interviews

For the interviews, both inductive coding, where codes emerge from the data and deductive coding, where codes are identified prior to analysis and then looked for in the data coding have been performed (Leech and Onwuegbuzie, 2007). Figure 5 presents the exact process of how the interviews of R1 and R2 were analyzed in Atlas ti.9. The codes can be found in appendix D.

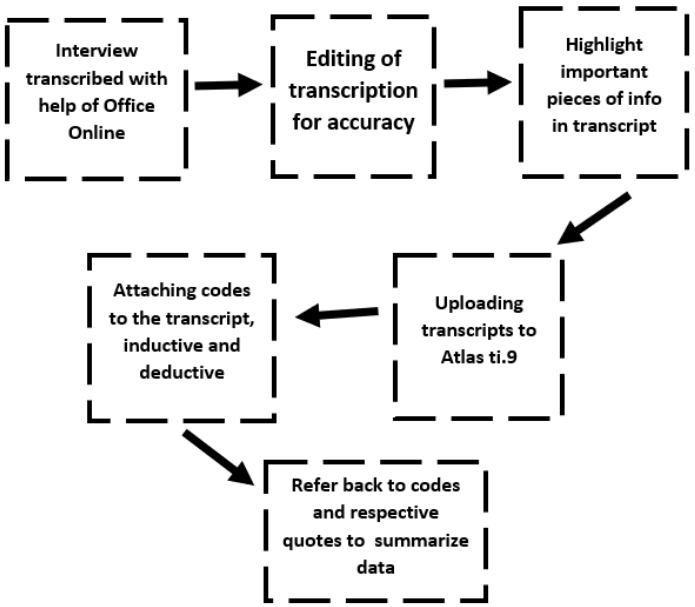

Figure 5: Analysis process of interviews R1+R2. The codes can be found in Appendix D

The process presented in figure 5 was quite time-consuming, had the possibility of overlooking important pieces of information as the coded pieces are easily taken out of context, and was becoming impractical due to time constraints. Therefore, interviews R3 through R8 were analyzed via a different approach (Figure 6): the interview topics ,as presented in table 4, served as a framework to summarize each interview into identical schemes. The interview transcripts were reviewed from beginning till end, and pieces of information relevant to each of the topics were organized accordingly. Quotes or interesting pieces of data were kept in a separate category.

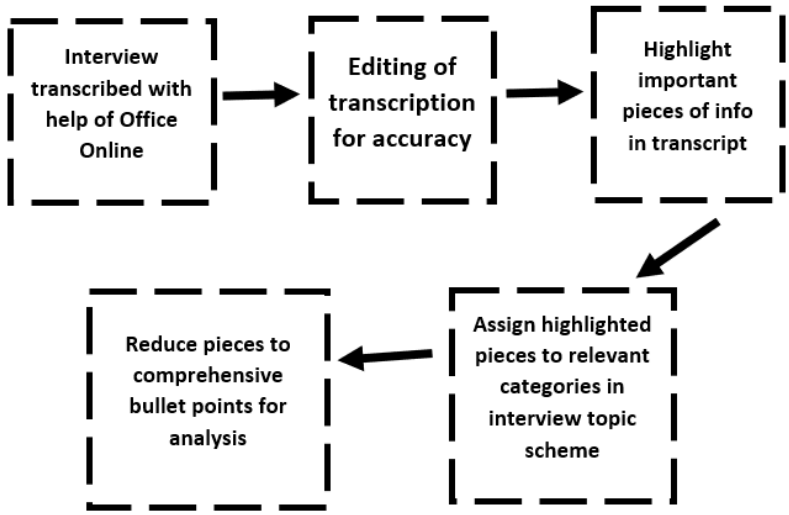

Figure 6: Analysis process of interviews R3-R8.

Table 4: Interview topics & general structure of interview guide

Structure	*Topics*
Introduction	- Organization description and link to wildfires/landscaping - Personal job description
Wildfire mitigation actions of the organization	- Actions of the organization/ area with regards to wildfires - Collaborations with other organizations - Opinion about the wildfire mitigation measures from their organization - Opinion about the involvement of residents and organizations on *de Veluwe* with regards to wildfire
Fire Smart territory introduction	- General opinion of the FST-concept and its suitability for their area of work and/or *de Veluwe* - Opinion on prescribed Fire - Opinion on landscaping - Opinion on involvement of local communities
Fire Smart Territory possibilities for the future	- What are possibilities for more FST approach - Opinion on more prescribed Fire - Opinion on more landscaping - Opinion on more involvement of local communities - How we can ensure more FST measures in the future
Free opinion of participant	- Measures that the participant itself wants to see, related to wildfire - Important things that the participant themselves highlights

3.4 Ethics

This research drew its data mainly from interviews. The interviews contain personal opinions of participants and information on both the person and their organization. Therefore it was important that a mutual agreement was met between the researcher and the participant prior to the interview. Upon agreeing to participate in the interview via email contact, a "form of consent" discussing rights was sent to the participant (appendix E). The form was discussed prior to the start of each interview. Each participant had the option to stay anonymous or to be mentioned in the thesis.

Table 5 : Overview of respondent and details. All interviews were held online, via Microsoft Teams video call

	Stakeholder Group	Organization & profession	Interest	Region of work	Date of interview	Interview Time (min)	Interview guide Appendix
R1	Fire responder	***Jelmer Dam*** National coordinator wildfire management + IFV	Risk mitigation: Preventing harm to humans & animals, being able to control fire	National scale	4 nov 2021	55:52	F
R2	Fire responder	***Anonymous 1*** Employee Veiligheidsregio Gelderland-Midden (VGGM,Fire department)	Risk mitigation: Preventing harm to humans & animals, being able to control fire	Veiligheidsregio Gelderland-Midden	18 nov 2021	55:00	G
R3	Terrain Keepers	***Dirk Goudkuil*** Forester at Staatsbosbeheer	Government organization. Sustaining ecological value of terrain, both flora and fauna. Recreation services and timber harvesting.	Veluwe-Midden	23 nov 2021	37:19	H
R4 a&b	Terrain Keepers	***Remko van Rosmalen & Wijnand Francke*** Forester & Ecological advisor at Natuurmonumenten	Private organization. Sustaining ecological value of terrain, both flora and fauna. Provide quality nature to clients.	Noord-west Veluwe	23 nov 2021	54:14	I
R5	Institution: Local	***Bert Hinderks*** Municipality Nunspeet	Safety for citizens, Accommodating tourists and recreation, Sustaining ecological value in terrain to attract tourists.	Municipality of Nunspeet	30 nov 2021	46:11	J
R6	Private Citizen	***Rinus Keijl*** WUI-inhabitant of Vierhouten, municipality Nunspeet	Keeping themselves and their property safe, sustaining ecological value in terrain	Outskirts of Vierhouten, Gemeente Nunspeet	30 nov 2021	59:35	K
R7	Institution: National	***Frank Tillie*** Ministry of Agriculture, Nature and Food (LNV)	Meet policy goals set by the national government. Facilitate communication between stakeholders to meet goals	National scale	7 dec 2021	57:31	L
R8 a&b	Institution: Regional	***Anonymous 2 & 3*** Province of Gelderland	Preserve biodiversity and recreation	Province of Gelderland	9 dec 2021	57:05	M

4. Results

This section will discuss the main results and is divided into a policy section and interview section. Some figures and tables contain details that are not presented in-text.

4.1 Policies

This section will discuss highlights of the policy documents (see table 3). Please refer to Appendix C for the full analysis and comparison to FST-markers.

4.1.1 "Bossenstrategie 2030": The Dutch government on wildfires

Both web research and the interviews revealed that there are no formal government policies regarding wildfire management in the Netherlands. D1 contains close to no information on wildfire management, but does make small references, which are summarized below. In the chapter "vital forest", there is mention of 6 threats to forest vitality, including climate change and severe drought in sandy soils. Within the subchapter of 'severe drought in sandy soils', the following is said:

"Another possible consequence of drought is the chance of more forest fires in the Netherlands."
-(Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020, pp. 22).

In the same chapter, necessary measures to achieve vital, self-regulating forests in the future are discussed. One of these is:

"Avoiding fire risks by having enough portions of hardwood, and by compartmenting areas with hardwood boulevards"
- (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020, pp. 26).

This describes fire-resistant forest conversion landscape design (Tedim *et al.*, 2016), which is in line with the Fire Smart Territory concept. The interview participants have also confirmed that this is indeed an ongoing process to make the landscape more fire-resilient. Apart from these quotes, there was no explicit mention of wildfires in the document, although there is mention of some measures that would do good towards making forested areas fire-resilient (see Appendix B,C). D1 briefly remarks that monospecific forests are vulnerable to illnesses, and will become more vulnerable as a result of climate change. As a countermeasure, it is planned to intermix tree species more to have genetically diverse forests. Additionally, it is highlighted that the development of a climate-smart forest will lead to a vital forest, further suggesting that climate robustness will be a persuaded goal.
The future vision is to involve society more in forest management. D1 dedicates a chapter to knowledge and involvement of society. According to D1 in order to realize the governments' forest goals, a larger involvement of citizens is necessary. Knowledge and involvement are two fundamentals of the strategy:

"Where possible, we want to -within the existing lawful frames- grow towards a model where terrain keepers take decisions about the forest in the early stadium about the future of the forest, together with residents and users of the forest, on an equal basis."

-(Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020, pp. 54).

More explicitly, it is mentioned that one of the ministries ambitions for 2030 is "Communication, involvement and participation." These plans are to be driven by the central government in collaboration with provinces, municipalities, forest owners and the involvement of residents. Specific agenda points can be viewed in Appendix C.

4.1.2 VBNE

D2 serves as a guide for terrain keepers when they engage in conversation with the fire department, and as a guide to make a wildfire risk management plan. It very briefly mentions measures that terrain keepers can take to prevent uncontrollable wildfires, such as compartmenting areas with fire resilient tree species and contains some info about types of wildfires. The general advice is to integrate fire safety into their regular landscaping activities and terrain goals.

"Often, ecological, economic or scenic values can be combined very well with safety goals by considering -together with the fire department and other involved parties- how safety can be integrated into your terrain management plan. In this case, a good balance is made between [fire]safety and your terrain management goals. Effective risk management and suppression is area-oriented and local customization."

- (VBNE, 2018, pp. 5)

Terrain keepers are encouraged to look risk analyses for their terrain that have been established by other organizations. They can then decide on high-priority areas for fire extinguishing and low-priority areas. An interesting point is that terrain keepers are allowed to appoint locations where fire is not to be extinguished, if they deem that intervention of the fire department would do more damage than the fire itself. This is also reflected on in the interviews by R3 and R4.

4.1.3 Toolbox

D3 is a detailed document aimed at both large- and smaller terrain owners, as well as citizens, healthcare institutes terrain keepers, fire departments and other institutes. It serves to inform about risk reducing measures that can prevent uncontrollable wildfires and their impacts, and encourages institutes in risk areas to make a wildfire risk management plan. As can be seen in Appendix C , operationalizations of fire-safety are extensively discussed, even to the extent of specific measurements that are needed for e.g. a fire corridor. D3 advocates for an area-specific approach due to varying priorities in terrains, such as infrastructure.

"Dependent on the scale, the size of a nature-area, the vegetation that is present and the absence of vulnerable objects and infrastructure, it is necessary to inventory the wildfire risks with the relevant wildlife terrain keepers and to come to area-specific approaches in the case of dilemma's."

- (Deelprojectgroep gebiedsgerichte aanpak natuurbrandbeheersing, 2021, pp. 59)

Notable is that prescribed fires are briefly mentioned as a way to make a fire break. Unlike the detail that is provided to most other measures mentioned, D3 refers to another document for instructions on executing prescription fires.

Out of the three analyzed documents, D3 stands out as it is quite empowering to WUI-inhabitants. There is an extensive list of (landscaping) actions that recreational facilities and healthcare institutions can take around their properties to mitigate wildfire risk. In summary, D3 hits a lot of marks in the FST-concept indicators (see Appendix C). The Fire Responders group has mentioned D3 as providing a handle for to start conversations with wildfire-risk areas on a National scale. D3 was created fairly recently (July 2021) by a group of professionals that saw the need for such a document.

4.2 Interviews

4.2.1 Measures in place against wildfires: Prevention and risk mitigation

Prevention is mainly dependent on landscaping, and is also where the responsibility and powers of the fire department to mitigate fire-risk mainly stops, and many more actors come into play. Most formal institutions on *de Veluwe* are involved with prevention to some degree. A prevalent approach to wildfire risk mitigation on *de Veluwe* is the 'gebiedsgerichte aanpak', where the fire department is called over to large terrains to asses risk factors and give advice about risk mitigation. Several participants involved with large nature areas mentioned that their landscaping activities on *de Veluwe* do take wildfire risk mitigation into account. Especially compartment borders are popular, which serve to prevent uncontrolled fire propagation. Table 5 presents the different interests that participants and their organizations have with regards to wildfire and table 6 the preventative measures taken.

The "Fire responders group" indicated that the main hurdle for a good fire prevention program is the fragmentation of landownership in *de Veluwe*, as fire-safe landscaping is dependent on the terrain owner and individual initiatives. Multiple participants plead for an 'integral prevention plan' for *de Veluwe*, some guideline to enforce that wildfire prevention is taken into account by terrain keepers and organizations.

"The fire department just needs to communicate well with the terrain keepers. We need an overall plan that transcend the subregions(...) We need some kind of masterplan for the whole Veluwe that says which measures need to happen."
-R8a

The interviews pointed out that facilities and inhabitants are not too commonly aware and involved with wildfire prevention. Interviews have indicated as well that measures in the Netherlands are currently more repression-based.

Table 6: wildfire prevention and risk mitigation efforts in place, mentioned in interviews

Respondent	Measures in prevention and risk mitigation of organization
R1 **Instituut Fysieke Veiligheid** **(Fire responders)**	- Meteostations for risk analysis, giving advice on when people can use open fire or not
R2 **Veiligheidsregio Gelderland-Midden - VGGM** **(Fire responders)**	- Meteostations for risk analysis giving advice on when people can use open fire or not - Since 2016: *"Fire Wise pilots"* at WUI village communities and at large recreational facilities - Conversations and risk analysis on terrains with terrain owners about wildfire danger, and measures to make terrain more fire-safe - Conversations with municipalities to take wildfire danger into consideration with policies
R3 **Forester Veluwe/ Staatsbosbeheer** **(Wildlife terrain manager)**	- Regularly working on wildfire-safe terrain management, often in cooperation with VNOG - Tries to use measures that they would do for nature management in such a way that it will also benefit wildfire safety - Have sheep graze along paths of heathland to reduce fuel - Create and maintain compartment borders (fire breaks) at advice of VNOG - Sparser placing of trees along compartment border (fire breaks) - During a fire, they support firemen with advice about where they can drive, which parts could burn off, and which parts should absolutely be protected - Once a year prescribed fire on heathen fields - Support conversion to fire-resilient deciduous trees
R4 **Natuurmonumenten** **(Wildlife terrain manager)**	- Yearly maintenance of fire breaks established by VNOG - Maintain fire-resilient deciduous tree borders throughout terrain - Encourage safe handling of fire of companies on their terrains - 10 year evaluation of each of their terrains to evaluate fire-safety and to possibly take more fire-safe measures when necessary

R5 Municipality of Nunspeet (Institution: Local)	- Establish policy document for wildfire risk management (2020), containing both repressive planning in case of wildfire, and landscape design based prevention methods like separating large nature parcels with fire breaks - Collaboration between different municipalities for wildfire risk management - Establish local plan wildfire prevention - Prescribed fire on heathen fields once or twice a year - Communication with recreational facilities and citizens about fire-safe design of terrain - With VGGM: *Fire Wise* pilots - Drones and airplane for fire detection
R6 Resident of Vierhouten, Nunspeet (Private Citizen)	- Sprinkler installation on roof - 30 metre vegetation reduced space around property as a fuel buffer - Village has 2 water wells for fire department to use - Sent letter to municipality to have conversation about fire-safety concerns
R7 Ministry of Agriculture, Nature and Food (Institution: National)	- Want to pose as a facilitating organization in wildfire prevention - Organize meetings with experts from different disciplines to see what needs to happen in terms of prevention
R8 Province of Gelderland (Institution: Regional)	- Subsidize veiligheidsregio's and terrain keepers in maintenance

On national scale, there is also attention to prevention. The "Bossenstrategie 2030" that came out in 2021, as well as large wildfires in 2020 have prompted the Dutch House of Representatives to start thinking about the issue. This resulted into different stakeholders, such as the Ministry of LNV, several provinces, the IFV, the VBNE and VNOG to have their first interdisciplinary meeting to exchange ideas and to discuss the course of action for wildfire prevention for the upcoming years on December 15th ,2021.

4.2.2 Fire smart territory in *de Veluwe*: What is the general opinion of the participants about it?

Most of the participants were positive about the FST-concept as a means to live more sustainably with wildfires, although a few participants posed objections to one or more of the aspects to the concept. The landscaping aspect was generally accepted, with the condition that a balance should be sought between biodiversity and wildfire prevention. The aspect that was most frowned upon was the use of fire due to the damage it could pose to the ecosystem or infrastructure if it is not executed correctly. Some quotes that illustrate the participants opinions:

"If we leave out the controlled burning part, but just look at the compartmenting and the lay-out with more deciduous wood…I think that FST really gives good handles. But it should be adapted to the Dutch situation. It is different than in America and Canada."

-R3

"I am pro, but just really with the restriction that not all vegetation would be able to handle that [prescribed burning], like I just mentioned. So you really have to pay attention to that"

-R2

In contrast, other participants were less reserved about the prescribed burning, and even encouraged it. R1 went as far as to mention that we need to use more prescribed fire on global scale. Interestingly, R8a pointed out that some aspects of the FST-concept are already being done in the Netherlands, but that the concept as a whole is not suitable for the Netherlands:

"The concept comes from Mediterranean areas, but they have a different spatial design there and a different scale. The area's the [FST-concept] is targeted at, are large areas with lots of joint usage. The largest joint use in de Veluwe is recreation. And the inhabitants of de Veluwe are completely not involved with the use of the area, except for recreation. That is a different situation than forests in Portugal and Spain. (…)there are also communities that have been using the surroundings for a very long time. In the Netherlands, we have abandoned that en masse. (…) so that whole social aspect [of FST], just isn't there in the Netherlands. (…)So if we are talking about making locals adapt their land use and landscaping… that isn't at play. The nature areas belong to nature organizations mostly, and agriculture is completely separated from that."

-R8a

4.2.3 Options to have more FST in the Netherlands

Most participants indicated that "willingness of stakeholders and good communication" are key to have more FST, as well as a better prevention program.

"Due to (…) higher-risk days for fire and less resistant vegetation, we can only manage by adapting landscaping and by reintroducing [prescribed] fires. Which is no different than how we are currently handling water. Water is good ánd bad, and we have developed a very intelligent way to handle this."

-R1

4.2.4 Local communities

Most participants deemed empowerment of local communities as desirable when asked, although most mentioned that local communities are not very involved. Supposedly, they tend to leave the responsibility of wildfire prevention and their own safety during a wildfire to the large terrain owners and fire departments. The empowerment of local communities and recreational facilities is a work in progress nonetheless, as the VGGM has been organizing "Fire Wise" projects in recent years, prompting participants to think about fire-resilient landscaping around their properties, and having evacuation drills. R6 indicated that the Fire Wise project had not reached him yet, despite the Fire Wise pilot being organized by municipality Nunspeet. R6 indicated a lack of communication of the municipality and the VGGM towards WUI-residents in his experience, despite the residents' efforts to reach out. According to him, the residents of the outskirts of his village are quite worried about wildfires, and are observing inaction from the municipality and other institutes when it comes to fire-resilient landscaping around their village and informing inhabitants.

4.2.5 Landscaping

All participants but the Fire Responders Group posted a sidenote to the FST-concept by mentioning that it is important to not be too rigid on fuel reduction during landscaping, since it could damage the ecology and biodiversity. The participants of Natuurmonumenten indicated that they are afraid that their current "nature-following" fire prevention methods will be overruled if a top-down rule for certain fire prevention measures is enforced, pointing out that the fire prevention measures themselves could do more damage to the ecology than wildfire would. Nonetheless, multiple participants indicate a shift from a repressive model towards a more prevention-oriented model, although some landscape interventions like conversion to fire-resilient trees take decades.

4.2.6 Fire

Although the general attitude towards prescribed fires is not negative, and prescribed fires are currently being used -albeit very sparingly and mostly on heathen fields- most participants are quite conservative about the idea of using more prescribed fire. They explicitly mention that the Netherlands is not like Canada or the US, and that prescribed fires could only take place on a small scale in the Netherlands. R2, R3 and R8 remarked that large-scaled prescribed fires could cause ecological damage, and would do more damage than good, due to the Netherlands being dense in biodiversity. Another restriction for using more wildfire are unideal meteorological circumstances and the vulnerability of small animals and insects during these fires, which limits the amount of suitable days for prescribed burning to just a few days per year. Even so, all participants admitted that, generally, wildfires are not negative and could have beneficial effects. R1 indicated that more education and careful practice is necessary, since the Netherlands is densely populated and there is no room for error, but does advocate for more prescribed fire in the Netherlands. R4a and R4b were also quite positive about more prescribed fire.

I find the approach of fire that comes forward in the Fire Smart Territory story a very good thing, in which you don't solely assume that fire is bad per definition and should be extinguished. And you're also going to look at how you can prevent a worse-

case scenario with the help of prescribed burning. Actually, it is a step in the direction of maintenance fires that hasn't been used on heathen fields for some decennia, but used to be commonplace."

- *R4a*

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5. Discussion

5.1 Fire smart territory integration

When evaluating the measures that different organizations have in place or are planning on taking in the near future separately (table 6, Appendix C) and comparing them to the indications for FST as mentioned in the theoretical framework and Appendix B, it would seem that *de Veluwe* and policy documents align quite well with the FST-concept. Even the village resident that was interviewed displayed some actions towards fire-safety, despite indicating to be unsure of what actions are right. However, the unique relation with nature and involvement of local communities that FST assumes is lacking quite severely in the Netherlands, as R8a mentioned, and also in *de Veluwe* in general. Even though there is some awareness of the wildfire risk amongst the public in *de Veluwe,* there seems to be a general lack of empowerment and action from local communities. This could have the following reasons: There are few residents with traditional ecological knowledge, and few communities that truly use their surrounding nature in their daily lives. Moreover, many WUI-inhabitants have municipality property closely to their properties, which could make some fire-smart landscape interventions illegal. Daily fire-safe landscaping activities such as fuel reduction seem to be done solely by terrain keepers like the foresters of Staatsbosbeheer, which further contradicts the idea of Tedim *et al.*(2016) to have local communities involved. Therefore, the totality and the socially transformative idea of the FST-concept does not completely play out as Tedim *et al.*(2016) emphasize in their paper. This could have been expected prior to the research, considering that there is little (agricultural) co-use of *de Veluwe*.

Furthermore, prescribed fire is still considered appropriate for small-scale use only, although it could become more common in the future. Even so, *de Veluwe* does present some of the FST-ideology in the sense that the area is being prepared to become more fire-resilient in a context-specific manner through landscape interventions by large landowners, collaboration of stakeholders and through the 'Fire-Wise pilots, which is perhaps a fitting situation for *de Veluwe*. More research on local communities could elaborate more on the possibility of involvement of WUI-inhabitants.

5.2 Future perspectives and lesson-drawing

By evaluating the policy documents and the interviews of participants working on a national scale, it does seem like the Netherlands in general, including *de Veluwe* are shifting from the repression model towards a more prevention-based model, and are in an early stage towards building a more sustainable coexistence with wildfires. Although awareness about the risk

uncontrollable wildfires had been present by some organizations for quite a few years, we are now beginning to see a more collaborative and nationwide undertaking to manage the problem.

The lack of empowerment amongst local communities on *de Veluwe* could be attributed to the lack of landownership and co-use of locals (see Figure 4), but according to R6, also to a lack of informing and unclear communication from institutes about the subject. Since most participants desire more involvement of local communities, and since R6 illustrated the eagerness of locals to be able to participate in the issue, it seems that that better communication from institutes towards the public could improve this situation and result in more local empowerment and responsible behaviour. Still, it appears that involving the public is a situation that the Netherlands is headed towards, if we consider the "Bossenstrategie 2030".

Stakeholders could still benefit from exchanging resources and knowledge that already exist. Moreover, active education is still ongoing: a small group of fire fighters along with R1 underwent special training in Catalonia in order to learn how to use prescribed fire and suppression fire as a tool against uncontrollable wildfire

5.3 Reflection on research process

5.3.1 Interviews

Although the interviews provided great in-depth answers and obscurities were generally eliminated through follow-up questions, there were some mix-ups: due to the unspecified definition of 'local communities' in the interview questions, there were mixed responses to whom is considered to be the local community in *de Veluwe* in the respondents' answers.
Moreover, I had the idea that there was an unequal understanding of the FST-concept amongst interviewees. Some participants would, for example, pick on one aspect, like the use of fire, and looked less at the aspect of local communities or context-specificness that FST stands for. An explanation could be that some participants took more time to read the interview guide and form of consent that were sent in beforehand than others. Some interviewees went as far as to search up more about the FST-concept. When asked to elaborate more on the FST-concept during interviews, I did not have a standardized answer, which could have issued slightly differing ideas of the definition of FST amongst participants as well.

5.3.2 Research methods

In general coming up with a framework that evaluates 'how much' FST is put into practice is complicated, as it is not quantifiable. It was attempted to take the complete picture into account. Moreover, it is not known whether the current and planned measures really work or not due to the lack of remarkable fires on *de Veluwe* in recent years. Also, despite FST being described as suitable for all EU28 countries, some participants pointed out that the FST-concept is mainly Mediterranean-focused, and perhaps not all of its practices are directly transferrable to the Netherlands.

A weakness of the research is that the focus of interviewing was mostly on institutions, and not as much on the local communities, which is an important pillar of the FST-concept. There could have been different results if there were more interviews with smaller facilities or WUI-residents. Too late in the research it was realized that this would have been valuable. The choice was made to focus more on establishing what measures are in place, instead of the experiences of local communities.
It should also be recognized that, although lessons can be drawn from this research, *de Veluwe* is not a representation of how every SES in the Netherlands operates, although lessons can be drawn from the landscape management and collaboration between stakeholders. Furthermore, it should be noted that participants can be biased in how much is being done about wildfires as compared to reality. R6 indicated himself that he is more involved with the possibility of wildfires than the average resident, so it should be taken into consideration that he does not represent the majority of WUI-inhabitants.

6. Conclusion

To conclude, though there are no governmental wildfire policies, several other organizations do have policy- and advice documents on wildfires. Especially D_3 resonates with the FST-concept due to it being very empowering to local communities, although the other analyzed documents contain passages resonating with the FST-concept as well. In *de Veluwe,* there is attention for wildfire risk mitigation through fuel management and landscape design throughout different layers of stakeholders. Both nationally and on *de Veluwe,* there seems to be a shift to focus more on prevention instead of repression of wildfire. Especially the landscaping on *de Veluwe* follows the FST-concept, but local communities are not very empowered, likely due to locals not owning much of area or having use of it. Fire is used sparingly, and is not the primary tool for fire risk mitigation as of now, due to most organizations not deeming it appropriate for Dutch ecology.
What we can learn from this as spatial planners is that spatial interventions in a natural landscape can contribute to escalation or mitigation of certain powers of nature. It also teaches us that being part of a socio-ecological system brings it risks and responsibilities to shape our living environment. As climate change pushes us to come up with creative solutions to live sustainably in socio-ecological systems and planners and policy makers should realize that the communities in SES play an active role in safety and liveability of their environment. For future research, it would be very interesting to do research about the involvement local communities to wildfire risk management.

References

CBS (2020). *Berm- en natuurbranden in Nederland, 2014-2018 [Dataset]*. [online] Centraal Bureau voor de Statistiek. Available at: https://www.cbs.nl/nl-nl/maatwerk/2019/12/berm-en-natuurbranden-in-nederland-2014-2018 [Accessed 13 Dec. 2021].

Cohen, J., (1999), Reducing the Wildland fire threat to homes: where and how much? USDA *Forest Service gen. Tech. Rep.* PSW-GTR-173, pp. 189–195.

Deelprojectgroep gebiedsgerichte aanpak natuurbrandbeheersing (2021). *Toolbox Gebiedsgerichte aanpak Natuurbrandbeheersing*. *https://www.ifv.nl/kennisplein/natuurbranden-wildfires/publicaties/toolbox-gebiedsgerichte-aanpak-natuurbrandbeheersing*. Instituut fysieke veiligheid - Brandweer Nederland.

Fedele, G., Donatti, C.I., Harvey, C.A., Hannah, L. and Hole, D.G. (2019). Transformative adaptation to climate change for sustainable social-ecological systems. *Environmental Science & Policy*, 101, pp.116–125.

Hessburg, P. (2017). *Why wildfires have gotten worse -- and what we can do about it*. [online] Ted.com. Available at: https://www.ted.com/talks/paul_hessburg_why_wildfires_have_gotten_worse_and_what_we_can_do_about_it.

Landelijk informatie knooppunt natuurbranden, I.V. (2012). *Natuurbranden: de 15 meest gestelde vragen*. Infopunt veiligheid.

Leech, N.L. and Onwuegbuzie, A.J. (2007). An array of qualitative data analysis tools: A call for data analysis triangulation. *School Psychology Quarterly*, 22(4), pp.557–584.

Minichiello, V., Aroni, R., Timewell, E. and Alexander, L. (1990) *In-depth Interviewing: Researching People. Melbourne*: Longman Cheshire

Ministerie van Landbouw, Natuur en Voedselkwaliteit (2020). *Bos voor de toekomst - Uitwerking ambities en doelen landelijke Bossenstrategie en beleidsagenda 2030*. *https://www.rijksoverheid.nl*. Herengracht 23 | 2511 eg Den Haag: Interprovinciaal Overleg.

Moritz, M.A., Batllori, E., Bradstock, R.A., Gill, A.M., Handmer, J., Hessburg, P.F., Leonard, J., McCaffrey, S., Odion, D.C., Schoennagel, T. and Syphard, A.D. (2014). Learning to coexist with wildfire. *Nature*, 515(7525), pp.58–66.

Oswald, B.P., Brennan, A., Williams, P.S., Darville, R. and McCaffrey, S. (2019). Public perceptions towards wildfire preparedness in the Veluwe region of the Netherlands. *International Journal of Wildland Fire*, 28(1), p.25.

proBos (n.d.). *Bos in Nederland – Bos en Hout Cijfers*. [online] www.bosenhoutcijfers.nl. Available at: https://www.bosenhoutcijfers.nl/nederlands-bos/oppervlakte [Accessed 8 Oct. 2021].

Punch, K.F. (2014). *Introduction to Social Research : Quantitative and Qualitative Approaches*. 3rd ed. London: SAGE.

Radeloff, V.C., Helmer, D.P., Kramer, H.A., Mockrin, M.H., Alexandre, P.M., Bar-Massada, A., Butsic, V., Hawbaker, T.J., Martinuzzi, S., Syphard, A.D., Stewart, S.I., 2018. *Rapid growth of the US wildland-urban interface raises wildfire risk*. Proc. Natl. Acad. Sci. U. S. A. 115 (13), 3314–3319.

Stevens-Rumann, C.S., Kemp, K.B., Higuera, P.E., Harvey, B.J., Rother, M.T., Donato, D.C., Morgan, P. and Veblen, T.T. (2017). Evidence for declining forest resilience to wildfires under climate change. *Ecology Letters*, 21(2), pp.243–252.

Stake, R.E. (1994) *'Case studies' , in N.K. Denzin and Y.S. Lincoln (eds), Handbook of Qualitative Research.* Thousand Oaks, CA: SAGE. pp. 236–47.

Taskforce Natuurbranden (2020). *DE PEEL IN BRAND ONDERZOEK AANPAK BRANDPREVENTIE IN DE DEURNESE PEEL*.

Tedim, F., Leone, V. and Xanthopoulos, G. (2016). A wildfire risk management concept based on a social-ecological approach in the European Union: Fire Smart Territory. *International Journal of Disaster Risk Reduction*, 18(2212-4209), pp.138–153.

Van Marle, M. and Agricola, H.J. (2021). *Verrijking Klimaateffectatlas Natuurbrandgevoeligheid Huidige situatie en 2050 WH*. Deltares.

VBNE (2018). *Risicobeheersing en bestrijding van natuurbranden GEZAMENLIJK, GEBIEDSGERICHT, LOKAAL MAATWERK Praktijkadvies voor eigenaren en beheerders van bos- en natuurterreinen*.

Werkgroep Preventie Natuurbranden (2021). *Concept-verslag Werkgroep Preventie Natuurbranden 15 december 2021*.

www.ifv.nl. (n.d.). *Natuurbranden en natuurbrandbeheersing | IFV*. [online] Available at: https://www.ifv.nl/kennisplein/natuurbranden-wildfires [Accessed 28 Sep. 2021].

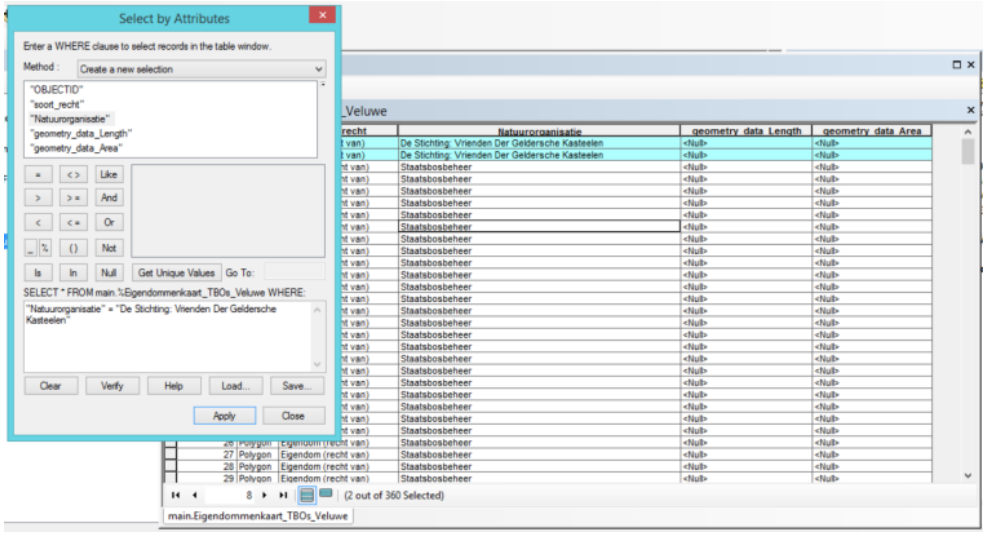
Appendices

Appendix A - GIS analysis steps

Used file Eigendommenkaart_TBOs_Veluwe requested from province of Gelderland

1. *Open* Eigendommenkaart_TBOs_Veluwe.gpkg in ArcGIS Desktop 10.8.1 ArcMap
2. *Open Attributes Table* of layer main.Eigendommenkaart_TBOs_Veluwe.
   Details: Attributes table contains 360 objects with an assigned "Natuurorganisatie" attribute. Areas are allocated based on "Natuurorganisatie". Attributes: OBJECTID, Shape, soort_recht, Natuurorganisatie, geometry_data_Length, geometry_data_Area
3. *Select by attributes*. Specifications:
   Method: *Create a new selection*
   For each nature organization, the following clause was made:
   " SELECT * FROM main.%Eigendommenkaart_TBOs_Veluwe WHERE:
   "Natuurorganisatie" = "**(name of nature organization)**"→ Verify and Apply

Remark: Attribute 'De Stichting vrienden der Geldersche kasteelen' was left out because it was too small to display on map



4. *Select* layer 'Main.Eigendommenkaart_TBOs_Veluwe' → *Selection* → '*Create Layer From Selected Features'* for each Nature organization
5. *Symbol Selector* → assign each layer their own background colour
6. *Add Base map*: Topographic
7. *Export file* as png

Edited in CLIP STUDIO (outside GIS):

8. Png was made transparent and aligned with screenshot of Google Earth Pro
9. Base map was removed
10. Aesthetic edits were made

Appendix B – Policy document analysis key words

Table overview with key words and sentences searched for policy document analysis. Along with key words: Fire, community, stakeholders, community involvement

MEASURES	EFFECTS
In forested areas	
Reducing excessive stock density in even-aged forests	Avoid torching and crown fires, by eliminating fuel ladders and increasing the height to the base of canopies
Favoring, where possible, coppice conversion to high forest	Obtain a more fire resistant stand, with lesser vertical continuity of fuels
Silvicultural tending (thinning from below, pruning)	Reduce fuel ladder and crown fires
Use of harvested biomass for energy	Reduce significant accumulations of surface fuel
Applying prescribed burning	Reduce significant accumulations of surface fuel
Hazard reduction burns	Reduce accumulations of surface fuel
Grazing	Reduce accumulations of surface fuel
Sheep (goats) prescribed grazing to reduce fuel biomass within fuel breaks	Reduce significant accumulations of surface fuel
Avoiding blanket cover and large blocks	Reduce fire propagation and avoid torching and crown fires
Reducing the size of monospecific parcels	Reduce fire propagation and avoid torching and crown fires
Separating parcels through interruption of continuity	Reduce fire propagation
Firebreaks and fuel-breaks	Limit unobstructed fire propagation, rate of spread, intensity and spot fires, by eliminating fuel (fire-break) or reducing its load (fuel-break), and by providing a place for firefighters to work safely and to employ back-firing.
Fuel reduction by manual or mechanical means	Reduce significant accumulations of surface fuel
Slashing, mowing and cleaning in the proximity of railway lines, forest roads and road banks	Avoid that a discarded cigarette or sparks from combustion engines and train brakes can ignite vegetation adjacent to rails or roads.
In wildland-urban interface	
Creating fuel buffers	Reduce the wildfire threat and provide an opportunity for fire-fighters to safely defend the structures by a *lean, clean and green* space with reduced fuel load
Creating a defensible space around homes; width greater on steep slopes.	
Pruning shrubs and trees left within the defensible space around structure	
Spacing trees, increasing separation distances between canopies	Obtain a more fire resistant home
Removing lower tree limbs	
Actively managing vegetation near the home by reducing, maintaining and/or replacing with ignition-resistant components	
Replacing native fire hazardous plants with fire-resistant landscaping	
Reducing dead vegetation	
Maintaining structures free of needles, leaves, and other organic debris from decks, roofs	
Removing flammable materials from beneath structures and decks	
Locating firewood, fuel tanks, and LPG tanks at a safe distance from structures	
In agricultural and pastoral spaces	
Linking patches where agricultural uses of fire is traditionally planned with already burned areas	Reduce fuel load, intensity, rate of spread, and spot fires
Agricultural residues burning	Reduce significant accumulations of surface fuel
Stubble and shrub burning	Reduce accumulations of surface fuel
Pasture regeneration/rejuvenation with fire	Reduce significant accumulations of surface fuel
Shrubs elimination	Reduce significant accumulations of surface fuel
Plowing soon after harvesting cereals	Reduce accumulations of surface fuel
Grazing (sheep, goats)	Reduce significant accumulations of surface fuel
Clearance under powerlines	Avoid that arcing between conductors into accidental contact, can propagate to surface fuels and other ways in which powerlines can start fires
Slashing, mowing and cleaning in the proximity of roads and road banks	Avoid that a discarded cigarette can ignite roadside vegetation
Clearing of grasses in vineyards, olive groves and other tree plantations	Converting these land plots into fire impediments while simultaneously favoring production

Source: Tedim, F., Leone, V. and Xanthopoulos, G. (2016). A wildfire risk management concept based on a social-ecological approach in the European Union: Fire Smart Territory. *International Journal of Disaster Risk Reduction*, 18(2212-4209) pp. 146

Appendix C – Full policy document analysis

Document code	*Mention of wildfire risk mitigation?*	*FST indicator in doc: Use of fire*	*Match with App. B Tedim et al. (2016)*	*FST indicator in doc: Use of landscaping*	*Match with App. B Tedim et al. (2016)*	*FST indicator in doc: empowerment of local communities*	*Match with paper Tedim et al. (2016)*	*FST indicator in doc: Cooperation between stakeholders*
D1	Yes, briefly	No	-	- Compartmenting: Separating parcels through interruption of continuity/ Fire Breaks	Yes	-Plan: Forest keepers have active communication concerning forest management, more transparency	Yes	In general, the national government is the driving force behind the "involvement of citizens" and "Kennisagenda plan". In collaboration with provinces, municipalities, forest owners and involvement of residents
				- Reducing the size of monospecific parcels	Yes	-Develop 'kennisprogramma 'bomen, bos en natuur': Spreading of knowledge and practice-oriented research	No	"Kennisagenda:" Knowledge exchange between Government (working group Bomen, bos en Natuur) and terrainmanagement organizations, OBN, provinces, organizations and scientists
				- Replacing native fire hazardous plants with	Yes	-Support of societal initiatives	Yes	

				fire-resistant landscaping				
				- Agroforestry: Increasing amount of shrubs	Contrary	-Developing a growing model towards a larger involvement of residents and other users of the forest	Yes	
						-Plan: Local residents and users of forests are stimulated to take co-responsibility or to become owners of forests to invest in it, financially or concerning land management and monitoring	Yes	
						-Plan: Better communication of national government and provinces with local communities of forests	Yes	
						- Aiming towards societally-accepted forests, taking societal concerns into account	Yes	
Document code	*Mention of wildfire risk mitigation?*	*FST indicator in doc: Use of fire*	*Match with App. B Tedim et al. (2016)*	*FST indicator in doc: Use of landscaping*	*Match with App. B Tedim et al. (2016)*	*FST indicator in doc: empowerment of local communities*	*Match with paper Tedim et al. (2016)*	*FST indicator in doc: Cooperation between stakeholders*

D2	Yes	- During wildfire, intervention of Fire department is not allowed in some areas so it keeps burning	No	- Spreading dead wood instead of making heaps	No	-Terrain keepers execute landscaping	Yes	-Wildfire risk analyses are done by Veiligheidsregio's and Provinces (RIN-index)
						-Terrain keepers give fire department advice about terrain during fire	Yes	-Together with the Fire department, terrain keepers make a wildfire risk management plan for their area
						-Terrain keepers indicate where the fire fighters should extinguish	Yes	-Facilities in area of terrain keeper are informed about appropriate (daily) actions related to the wildfire risk management plan
				- Compartmenting: Separating parcels through interruption of continuity/Fire Breaks	Yes			-Facilities in the area and terrain keeper exchange calamity plans and possibilities for collaborations for extinguishing water supply

				- Replacing native fire hazardous plants with fire-resistant landscaping	Yes			- Terrain keepers give fire department advice about terrain during fire
Document code	*Mention of wildfire risk mitigation?*	*FST indicator in doc: Use of fire*	*Match <u>with App. B</u> Tedim et al. (2016)*	*FST indicator in doc: Use of landscaping*	*Match <u>with App. B</u> Tedim et al. (2016)*	*FST indicator in doc: empowerment of local communities*	*Match with paper Tedim et al. (2016)*	*FST indicator in doc: Cooperation between stakeholders*
D3	Yes	- Use of Suppression fires is being studied	No	- Separating parcels through interruption of continuity: Compartmenting, Fire breaks, fire corridors, fuel breaks and fuel buffers that make areas accessible for fire fighters	Yes	Terrain keeper can mechanically mow a part of vegetation during fire to embargo fire	Yes	-During fire, cooperation with farmers, terrain keepers and contract workers to help control fire (water supply, manipulation of vegetation)
				-Mowing in the proximity of (forest)roads and road banks	Yes	Specific list of course of action for individual properties and recreation facilities* *see WUI activities*	Yes	
				-Prevent formation of fuel ladders	No	-Natuurbrandrisico.nl: website that informs public about fire risk	Yes	- Terrain keepers give fire department advice about terrain during fire

				-Ensure accessibility for fire fighters with easy-to-move obstacles like levers	No			
				-Crown spacing (3metres) of fire-hazardous conifers	No			-Recreation facilities encouraged to calibrate their course of action during fire
				-Grass sprinkling	Yes			
				-Mowing in the proximity of (forest)roads and road banks	Yes			
				-Prevent formation of fuel ladders	No			
				-Ensure accessibility for fire fighters with easy-to-move obstacles like levers	No			-Terrain keepers collaborate with fire department advisor on taking wildfire prevention methods in landscaping such as creation of fire corridors and compartments
		Prescription fire is mentioned as a way to create fire corridors. Grazing is required as aftercare	Yes	-Grazing	Yes			
				-Mowing	Yes			
				-WUI: Fuel buffers around buildings	Yes			
				-WUI: Actively managing vegetation near buildings	Yes			-Natuurmonumenten has an agreement with power line company Tennet about responsible, fire-preventative landscaping around Tennets' powerlines on in their nature areas
				-WUI: Replacing native fire hazardous plants with fire-resistant species	Yes			
				-WUI: reducing dead vegetation	Yes			

				-WUI: Maintaining structures free of organic debris in roofs	Yes			
				-WUI: Removing flammable materials from beneath structures and decks	No			-Some Veiligheidsregio's collaborate with contract workers and farmers for extinguishing water supply
				-WUI: Remove Propane tanks from vegetation	No			
				-WUI: Install spark arresters on chimney pipes	No			
				-WUI: Tree spacing	Yes			
				-WUI: Location firewood at a safe distance from structures	No			-Strive towards a situation where public authorities supervise the societally responsible wildfire risk management and connect stakeholders by inventorying, analyzing and solving dilemma's; on the basis of legislation and regulations
				-WUI: Use stones or rocks as fuel break	No			
				-WUI: 'Home ignition zone', create defensible space around homes	Yes			
				-WUI: Ensuring extra route for accessibility	No			
				-WUI: Fuel buffers around buildings	Yes			-Proposal of an area-specific approach where a connection is created between risk-holding parties and risk-regulating parties in nature in order to come to an integral wildfire risk management plan

Appendix D – Code book interviews atlas ti.9

Legend:
IP = In Place
PL = On the planning
NO = Lacking/ No
WI = Wish of participant or organization

Theme	IP/PL/NO/WI	Subcode	Inductive or deductive	theory
Cooperation between stakeholders	WI	WI citizen awareness	deductive	Tedim *et al. (2016)*
		WI Cooperation between stakeholders	deductive	Tedim *et al. (2016)*
		WI Integral approach	Inductive	-
		WI National cooperation for prevention	Inductive	-
		WI National cooperation for repression	Inductive	-
	IP	IP cooperation between stakeholders	deductive	Tedim *et al. (2016)*
		IP National cooperation for repression	Inductive	-
		IP public awareness	deductive	Tedim *et al. (2016)*
		IP public involvement	deductive	Tedim *et al. (2016)*
		IP Involvement of nature organizations	Inductive	-
		IP regional cooperation for repression	Inductive	-
	PL	PL Cooperation between stakeholders	deductive	Tedim *et al. (2016)*
		PL public awareness	deductive	Tedim *et al. (2016)*
		PL Cooperation between stakeholders	deductive	Tedim *et al. (2016)*
		PL public awareness	deductive	Tedim *et al. (2016)*
		PL Cooperation between stakeholders	deductive	Tedim *et al. (2016)*
	NO	NO autonomous communities	deductive	Tedim *et al. (2016)*
		NO involvement local communities	deductive	Tedim *et al. (2016)*
		NO national cooperation for repression	Inductive	-
		NO National prevention policies	inductive	-

		NO sufficient repression capacity	Inductive	-
		NO training in fuel interventions	deductive	Tedim *et al. (2016)*
		NO autonomous communities	deductive	Tedim *et al. (2016)*
	-	Involvement of local communities	deductive	Tedim *et al. (2016)*
		Paradigm shift	Inductive	-
		Public awareness	deductive	Tedim *et al. (2016)*
		Responsibility	Inductive	-
Landscape design and upkeep activities	WI	WI Fire smart landscape activities	deductive	Tedim *et al. (2016)*
		WI Fire smart landscape design	deductive	Tedim *et al. (2016)*
		WI more fire for landscape management	deductive	Tedim *et al. (2016)*
	IP	IP fire as landscape management tool	deductive	Tedim *et al. (2016)*
		IP gebiedsgerichte aanpak	Inductive	-
		IP Landscape design	deductive	Tedim *et al. (2016)*
		IP Fire smart landscape activities	dedutive	Tedim *et al. (2016)*
		IP Fuel reduction	deductive	Tedim *et al. (2016)*
		IP grazing	deductive	Tedim *et al. (2016)*
		IP Fire breaks	deductive	Tedim *et al. (2016)*
		IP Fire-resilient conversion	Inductive	-
	PL	PL gebiedsgerichte aanpak	Inductive	-
		PL Landscape design	deductive	Tedim *et al. (2016)*
	NO	NO fire smart landscape design	deductive	Tedim *et al. (2016)*
		NO fire smart landscape management	deductive	Tedim *et al. (2016)*
	-	gebiedsgerichte aanpak	-	-
		Hurdle for Fire as landscape management	Inductive	-
		Hurdle for Landscape design	Inductive	-
Local communities empowered at WUI	WI	WI citizen awareness	deductive	Tedim *et al. (2016)*
		WI public awareness	deductive	Tedim *et al. (2016)*
	IP	IP cooperation between stakeholders	deductive	Tedim *et al. (2016)*
		IP gebiedsgerichte aanpak	Inductive	-
		IP public awareness	deductive	Tedim *et al. (2016)*

		IP public involvement	deductive	Tedim *et al. (2016)*
		IP education to local communities	Inductive	Tedim *et al. (2016)*
	PL	PL autonomous communities	deductive	Tedim *et al. (2016)*
		PL citizen involvement	deductive	Tedim *et al. (2016)*
		PL Cooperation between stakeholders	deductive	Tedim *et al. (2016)*
	NO	NO autonomous communities	deductive	Tedim *et al. (2016)*
		NO involvement local communities	deductive	Tedim *et al. (2016)*
		NO public awareness	deductive	Tedim *et al. (2016)*
	-	Evacuation	inductive	-
		gebiedsgerichte aanpak	inductive	-
		Involvement of local communities	deductive	Tedim *et al. (2016)*
Policies	WI	WI Integral approach	inductive	-
		WI Legal intervention	inductive	-
		WI No legal intervention	inductive	-
	IP	IP policy	inductive	-
	PL	PL Legislation	inductive	-
	NO	NO National prevention policies	inductive	-
	-	Unhappiness with policies	inductive	-
Repression methods	WI	WI National cooperation for repression	deductive	Tedim *et al. (2016)*
	IP	IP National cooperation for repression	deductive	Tedim *et al. (2016)*
		IP regional cooperation for repression	deductive	Tedim *et al. (2016)*
	PL	-	-	-
	NO	NO national cooperation for repression	deductive	Tedim *et al. (2016)*
		NO sufficient repression capacity	inductive	-
	-	Fire fighters control wildfire	inductive	-
		More repression than prevention	inductive	-
		People leave responsibility to fire fighters	inductive	-
Using fire to prevent uncontrollable fire	WI	-	-	-

	IP	IP fire as landscape management tool	deductive	Tedim *et al. (2016)*
	PL	PL More fire as prevention tool	inductive	-
	NO	NO fire smart landscape design	deductive	Tedim *et al. (2016)*
		NO fire smart landscape management	deductive	Tedim *et al. (2016)*
	-	against fire as prevention	inductive	-
		Hurdle for Fire as landscape management	inductive	-
		Hurdle for Fire as prevention	inductive	-
		Opinion on fire in landscape	inductive	-
		Experience with fire	inductive	-
No code group		Opinion on prevention	inductive	-
		Lack of finances	inductive	-
		Education progress	inductive	-
		Interesting	inductive	-
		Opinion on fire smart	inductive	-

Appendix E - English translation of Form of Consent

Agreement of participation – Information form for the participant

Subject of the research: *How prepared is the Netherlands for wildfires enhanced by climate change, evaluating through the Fire Smart Territory concept?*

Researcher: Chayenne van Varsseveld

Thank you for your participation in the research. The interview is about the policies concerning wildfire in the Netherlands, and the possibility of the integration of the Fire Smart Territory concept in the Netherlands. In the Fire Smart Territory concept, these three points stand central:

- The use of prescribed fire is one of the pillars in preventing damaging, uncontrolled wildfires. Wildfire is thus not always bad
- Landscape design and forest management are aimed at reducing the risk of uncontrolled wildfires
- Local communities understand their unique relation to nature and are involved with preventing and controlling wildfires. The Fire Smart Territory concept will lead to a manner of managing wildfires where the local communities develop a kind of resilience, have knowledge and play a role.

Please read through the following:

- I understand that my participation in this research is voluntary
- I understand that the audio of this interview will be recorded for processing goals
- The audio recording and the transcript of this interview will be handled confidentially, and can be stored on an encrypted hard disk
- I understand that I have the right to stay anonymous for this interview
- I understand that some information, like the (kind of) institute I work for, and some of my work activities will be mentioned in the research
- Prior to the interview, I will receive an indication of the questions I can expect
- I understand that I have the right to view the transcript of the interview and to edit it before it is used in the research
- I understand that I have the right to stop or quit at any point during the interview
- I understand that I have the right to not answer a question
- I understand that the information that is collected will only be used for this research
- I understand that this data could also be used in articles, chapters in books, in published and unpublished work and presentations
- I understand that, after the interview, I could possibly be approached for follow-up questions by the researcher

"By considering the above, I agree to participate in this interview":

Signature/ name of the participant: Date:

Please answer the following questions by making the answer **bold**:

1. I wish to remain anonymous for this interview:
   YES/NO

In case Q1 has been answered with YES:

2. My first name can be used in this research: YES/NO
3. A self-chosen pseudonym can be used in this research:
   YES/NO

In case Q3 has been answered with YES (fill in):

4. I will use the following pseudonym for this research:

For the researcher:
"I agree to conform to the wishes of the participant as indicated in this form, and ensure to not hurt any of the participants during this research."

Signature/ name of the researcher: Date:

Appendix F - Interview guide 1 – Jelmer Dam

Generale vragen (doel om algemene relatie van Nederland met vuur en de maatregelen)/ General questions (goal to understand the general relation of the Netherlands with fire and the measures):

1. A. Kunt u een schets geven van het werk dat uw organisatie verricht? /Can you give a description of the work your organization does?
   B. Kunt u een schets geven van het werk wat u doet binnen de organisatie? /Can you give a description of the work you do within the organization?

2. Hoe vaak komen natuurbranden voor in Nederland? En waar vinden deze meestal plaats?/How often do wildfires occur in the Netherlands? And where do these take place most of the time?

3. Wat is dan de respons op zo'n natuurbrand?/ What is then the response to such a wildfire?

4. Wat zijn maatregelen die worden toegepast om natuurbranden te voorkomen?/ What are maeasures that are used to prevent wildfires?

5. En wat zijn maatregelen die worden getroffen als natuurbranden uiteindelijk uitbreken?/ And what are measures that are taken when wildfires do break out?

6. Zijn er speciaal mensen aangewezen die proactief bezig zijn met het voorkomen van bosbranden? Zijn er andere organisaties dan de uwe die zich daarmee bezig houden?/ Are there special people appointed to the prevention of forest fires? Are there other organizations than your organization that is involved in that?

7. Zou u zeggen dat de focus meer ligt op het preventieve of meer op het bestrijden van natuurbranden?/ Would you say the focus lies more on the preventative side, or on the suppression of wildfires?

8. Wat zijn de rollen van andere (hulp)organisaties dan de brandweer in relatie tot natuurbrand?/ What are the roles of other (aid)organizations than the fire department in relation to wildfires?

9. Waarom zijn deze personen/organisaties verantwoordelijk?/ Why are these persons/organizations responsible?

Terreinbeheer (focus op rolverdeling van natuurbrandveiligheid op kleinere schaal): Terrainmagement (focus on division of roles of wildfire safety on a smaller scale):

10. Zijn terreinbeheerders in Nederland over het algemeen getraind op het voorkomen van natuurbranden? /Are terrain keepers in the Netherlands in general trained on preventing wildfires?

11. Komt het voor in *de Veluwe* dat de terreinbeheerders/ lokale gemeenschappen kennis hebben over de omgang met natuurbranden en hier gebiedsgericht mee aan de slag gaan?/ Does it occur on de Veluwe that terrain keepers/ local communities have knowledge about how to go about wildfires and are going about it area-specifically?

12. Hebben mensen die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden?/ Do people that live in nature areas in general have knowledge about things that help to prevent wildfires?

Focus op *de Veluwe* als natuurrijk gebied met hoge kans op natuurbranden/ Focus on de Veluwe as a Nature-rich area with a high chance on wildfires

13. Is er een verschil tussen *de Veluwe* en de rest van Nederland qua preventieve maatregelen voor natuurbranden? Kunt u deze verschillen verklaren?/ Is there a difference between de Veluwe and the rest of the Netherlands in terms of preventative measures for wildfires? Can you explain these differences?

14. Wat kan de rest van Nederland leren van maatregelen die in *de Veluwe* worden getroffen?/ What can the rest of the Netherlands learn of the measures that are taken on de Veluwe?

Focus op Fire Smart Territory applicatie in de Velwue/een bepaald gebied/ Focus on Fire Smart Territory application on de Veluwe/ a certain place

Vooraf aan het interview heb ik u wat verteld over het Fire Smart Territory concept.*
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan./*

Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy*

15. Wat is uw mening over het gebruiken van gecontroleerd vuur om ongewenste of onbeheersbare natuurbranden te voorkomen? Is dit haalbaar voor Nederland en/of wordt het al gebruikt?/ What is your opinion on using controlled fire to prevent

unwanted or uncontrolled wildfires? Is this something the Netherlands could use or already uses?

a. Als niet: waarom niet? Wat zal nodig zijn om dit te verwezenlijken?/ If not, why? What would be needed to in order to be able to use this?
b. Als wel: wordt dit effectief gebruikt in uw mening?/ If so, is it being used, in your opinion, to it's full potential?

16. Denkt u dat landschapsinrichting en bosbeheer gericht zijn op het verminderen van het risico op ongecontroleerde bosbranden?/ Do you think landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires?

17. Vindt u dat lokale gemeenschappen genoeg zijn betrokken bij het voorkomen en controleren van bosbranden?/ Do you think local communities are involved enough with the prevention and controlling of forest fires?

18. A. Wat zijn mogelijkheden in de toekomst om meerdere Fire Smart Territory gemeenschappen te ontwikkelen in Nederland?/ What are the future possibilities for developing multiple Fire Smart Territory communities in the Netherlands?

    B. Hoe zou dit het beste of het snelste worden gerealiseerd?/ How can this be realised most effectively and efficiently?

19. Hebt u misschien aanvullende maatregelen voor zowel *de Veluwe* als voor de rest van Nederland die u ook belangrijk vindt?/ Are there any additional measurements both for de Veluwe as well as for the Netherlands you find important?

20. Is er verder nog iets wat u wilt toevoegen?/ Is there anything else you'd like to add?

Appendix G - interview guide 2 – Veiligheidsregio Gelderland-Midden

Generale vragen (doel om beeld te krijgen van algemene relatie van Nederland met vuur en maatregelen)/ General questions (goal to understand the general relation of the Netherlands with fire and the measures):

1. A. Kunt u een schets geven van het werk dat uw organisatie verricht?/ Could you give a description of what your organisation does?
   B. Kunt u een schets geven van het werk dat u doet binnen de organisatie?/ Could you give a description of your personal job within your organisation?

2. Wat zijn – in uw regio- maatregelen die worden toegepast om natuurbranden te voorkomen?/ What are some of the measurements, in your local area, which prevent against wildfires?

3. Zijn er speciaal mensen aangewezen die proactief bezig zijn met het voorkomen van bosbranden? Zijn er andere organisaties dan de uwe die zich daarmee bezig houden?/ Are there specific persons proactively responsible for the prevention of forest fires? Are there other organisations than your own, who are concerned with preventing forest fires?

4. Zou u zeggen dat- **in het algemeen-** de focus meer ligt op het preventieve, of meer op het bestrijden van natuurbranden **in uw regio?**/ **In general,** does the focus lie on on prevention or on fighting wildfires, **in your local area?**

5. Wat zijn de rollen van andere (hulp)organisaties dan de Brandweer in relatie tot natuurbrand?/ What are the roles of other (help) organisations than the fire department, with regards to wildfires?

6. Waarom zijn deze personen/organisaties verantwoordelijk?/ Why are these persons/organisations responsible?

Terreinbeheer (focus op rolverdeling van natuurbrandveiligheid op kleinere schaal):/ Site Management (focus on the separation of roles of wildfire safety on a smaller scale)

7. Komt het voor op *de Veluwe* dat de terreinbeheerders/ lokale gemeenschappen kennis hebben over de omgang met natuurbranden en hier gebiedsgericht mee aan de slag gaan? **(bijvoorbeeld regelmatig ondergroei weghalen, etc.)**/ Do the land managers/local communities in de Veluwe have knowledge on how to act on wildfires and locally prevent this? **(for instance frequent removal of undergrowth, etc.)**

8. Hebben mensen **of bedrijven** die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden?/ Do locals **or**

companies, residing in nature reserves, in general have a good understanding of actions preventative of wildfires?

Focus op *de Veluwe* als natuurrijk gebied met hoge kans op natuurbranden/ Focus on de Veluwe as nature reserve with a high fire hazard risk

9. Is er -naar uw kennis- een verschil tussen *de Veluwe* en andere gebieden in Nederland qua preventieve maatregelen voor natuurbranden? Kunt u deze verschillen verklaren?/ Is there, according to you, a distinct difference between de Veluwe and other areas in the Netherlands, with regards to preventative measurements against wildfires? Could you explain said difference?

10. Wat voor soort bedrijven/mensen op *de Veluwe* zijn betrokken bij **natuurbrand**veiligheid en welke niet?/ What kind of companies/people on de Veluwe are involved with **wildfire** safety and which are not involved?
11. Wat kan -volgens u- de rest van Nederland leren van maatregelen die in *de Veluwe* worden getroffen?/ What can, according to you, the rest of the Netherlands learn from the measurements which are present in de Veluwe?

Focus op Fire Wise/ Focus on Fire Wise

12. Kunt de "Fire Wise" pilot omschrijven waar u bij betrokken bent?/ Could you describe the "Fire Wise" pilot, which you are involved in?

13. Wat houdt "Fire Wise" in?/ What is "Fire Wise"?

14. Wat is het doel achter deze "Fire Wise" pilot?/ What is the purpose of the "Fire Wise" pilot?

15. Welke organisaties/ gebieden hebben te maken met deze pilot? en waarom zijn deze betrokken?/ Which organisations/ areas are affected by this pilot and why are they involved?

16. Worden beheerbranden ook onderdeel van de Fire Wise projecten, en waarom wel, of niet?/ Are controlled burns a part of the Fire Wise projects? Why are or are they not?

Toolbox gebiedsgerichte aanpak/ Toolbox area-specific approach

17. Ik zag dat de Veiligheidsregio Gelderland-Midden recentelijk ook betrokken was bij het maken van de Toolbox Gebiedsgerichte Aanpak natuurbandbeheersing. Wie bereiken jullie hier mee?/ The safety region Gelderland-Midden has been involved +

Focus op Fire Smart Territory applicatie in de Velwue/ Focus on Fire Smart Territory application in de Veluwe

Vooraf aan het interview heb ik u wat verteld over het Fire Smart Territory concept.*
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan./*

Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy.*

18. Wat is uw mening over het gebruiken van gecontroleerd vuur/**beheerbranden** om ongewenste of onbeheersbare natuurbranden te voorkomen? Is dit haalbaar voor Nederland en/of wordt het al gebruikt? Wordt het gebruikt op *de Veluwe*?/ What is your opinion on using **controlled fires** to prevent unwanted or uncontrolled wildfires? Is this something the Netherlands could use or already uses? Is it being used in de Veluwe?
    a. Als niet: waarom niet? Wat zal nodig zijn om dit te verwezenlijken?/ If not, why? What would be needed to in order to be able to use this?
    b. Als wel: wordt dit effectief gebruikt in uw mening?/ If so, is it being used, in your opinion, to its full potential?

19. Denkt u dat landschapsinrichting en bosbeheer op *de Veluwe* gericht zijn op het verminderen van het risico op ongecontroleerde bosbranden?/ Do you think landscaping and forest management on de Veluwe are aimed at lowering the risk of uncontrolled forest fires?

20. Vindt u dat lokale gemeenschappen op *de Veluwe* genoeg zijn betrokken bij het voorkomen en controleren van bosbranden?/ Do you think local communities on de Veluwe are involved enough with the prevention and controlling of forest fires?

21. A. Wat zijn mogelijkheden in de toekomst om meerdere Fire Smart Territory gemeenschappen te ontwikkelen in Nederland?/ What are the future possibilities for developing multiple Fire Smart Territory communities in the Netherlands?

B. Hoe zou dit het beste of het snelste kunnen worden gerealiseerd?/ How can this be realised most effectively and efficiently?

22. Hebt u misschien aanvullende maatregelen voor zowel *de Veluwe* als voor de rest van Nederland die u ook belangrijk vindt?/ Are there any additional measurements both for de Veluwe as well as for the Netherlands you find important?

23. Is er verder nog iets wat u wilt toevoegen?/ Is there anything else you would like to add?

Appendix H – Interview guide 3 – Dirk Goudkuil Staatsbosbeheer

Generale vragen/ General questions

1. A. Kunt u kort een schets geven van het werk dat uw organisatie verricht?/ Could you give a short description of what your organisation does?
   B. Kunt u kort een schets geven van het werk dat u doet binnen de organisatie?/ Could you give a short description of your personal job within your organisation?

2. Bent u, in het gebied dat u beheert, bezig met brandveiligheid? Voert u zelf, als terreinbeheerder/boswachter, natuurbrandpreventieve maatregelen uit?/ Are you, on the ground you keep, involved with fire hazard? Do you take, as a land manager/ forester, preventative measurements against wildfires?

3. Kunt u mij meer vertellen over wat Staatbosbeheer doet met betrekking tot preventieve maatregelen in natuurbrand in het gebied waar u werkt?/ Could you tell me more about what Staatsbosbeheer does, with regards to preventative measurements against wildfires, in the area you work in?

4. Hoe reageert men op *de Veluwe* op het uitbreken van een natuurbrand? Heeft u ervaringen waarover u kunt vertellen?/ How do people act on a wildfire outbreak in de Veluwe? Do you have any experiences you could talk about?

1. Vindt u dat er genoeg wordt gedaan aan natuurbrandveiligheid? **Ligt de focus meer op het preventieve deel, of op het bestrijden van brand volgens u?**/ Do you think there are enough actions taken against wildfire hazard? **Is the focus more on the prevention of fires or the fighting of fires, according to you?**

5. Hebben mensen of bedrijven die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden?/ Do locals or companies, residing in nature reserves, in general have a good understanding of actions preventative of wildfires?

6. Wat voor soort bedrijven op *de Veluwe* zijn betrokken bij natuurbrandveiligheid en welke niet?/ What kind of companies in de Veluwe are involved with wildfire safety and which are not involved?

Zowel bosbrandexperts als de Veiligheidsregio's in Nederland voorzien dat klimaatverandering ertoe zal leiden dat de kans op ongecontroleerde natuurbranden in Nederland toe zal nemen. Zij pleiten dan ook voor meer en betere maatregelen rondom natuurbrand risicovermindering. In mijn literatuuronderzoek kwam ik het Fire Smart territory concept tegen, een hollistische aanpak voor natuurbranden.
Vooraf aan het interview heb ik u wat verteld over het Fire Smart Territory concept.*

In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan./*

Both the forest fire experts as well as the safety regions in the Netherlands foresee that climate change will lead to an increased risk of uncontrolled forest fires in the Netherlands. They advocate more and better measurements for minimalizing risk of forest fires. In literature, I came across the Fire Smart Territory Concept, a holistic approach for forest fires.
Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy.*

7. Wat is uw mening over het Fire Smart Territory concept? Zou *de Veluwe* zo'n Fire Smart Territory kunnen worden? Waarom wel/niet?/ What is your opinion on the Fire Smart Territory Concept? Can de Veluwe become such a Fire Smart Territory? Why/why not?

8. Wat is uw mening over het gebruiken van gecontroleerd vuur/beheerbranden om ongewenste of onbeheersbare natuurbranden te voorkomen? Is dit haalbaar voor *de Veluwe* en/of wordt het al gebruikt?/ What is your opinion on using controlled fires to prevent unwanted or uncontrolled wildfires? Is this something de Veluwe could use or already uses?
   a. Waarom niet? Wat zou nodig moeten zijn om het te verwezenlijken?/ If not, why? What would be needed to in order to be able to use this?
   b. Zo wel: Wie voert deze uit?/ If so, who excecutes this?

9. Denkt u dat landschapsinrichting en bosbeheer op *de Veluwe* gericht zijn op het verminderen van het risico op ongecontroleerde bosbranden?/ Do you think landscaping and forest management on de Veluwe are aimed at lowering the risk of uncontrolled forest fires?

10. Wat vind u ervan dat de recreatiezonering soms haaks staat op de natuurbrandveiligheid? Als de natuur meer met rust wordt gelaten, kan dat ook betekenen dat brand minder snel gespot wordt en dus groter kan worden./ What is your opinion on the fact that recreation areas sometimes directly undermine the wildfire hazard safety? If nature's being left at peace more, this could result in a decrease in speed of spotting a fire and thus development of bigger fires.

11. Vindt u dat lokale gemeenschappen op *de Veluwe* genoeg zijn betrokken bij het voorkomen en controleren van bosbranden?/ Do you think local communities on de Veluwe are involved enough with the prevention and controlling of forest fires?

12. A. Wat zijn mogelijkheden in de toekomst om meerdere Fire Smart Territory gemeenschappen te ontwikkelen in Nederland?/ What are the future possibilities for developing multiple Fire Smart Territory communities in the Netherlands?
    B. Hoe zou dit het beste of het snelste kunnen worden gerealiseerd?/ How can this be realised most effectively and efficiently?

13. Hebt u misschien aanvullende maatregelen voor zowel *de Veluwe* als voor de rest van Nederland die u ook belangrijk vindt? (Vraag mogelijk over de "integrale"benadering")/ Are there any additional measurements both for de Veluwe as well as for the Netherlands you find important? (Maybe ask about the "integrated" approach)

14. Is er verder nog iets wat u wilt toevoegen?/ Is there anything else you'd like to add?

Appendix I – Interview guide 4 – Natuurmonumenten

1. A. Kunt u kort een schets geven van het werk dat uw organisatie verricht met betrekking tot natuurbeheer?/ Could you give a short description of what your organisation does, with regards to nature management?
   B. Kunt u kort een schets geven van het werk dat u doet binnen de organisatie?/ Could you give a short description of your personal job within your organisation?

2. Bent u, in het gebied dat u beheert, bezig met natuurbrandveiligheid? Voert u zelf als terreinbeheerder/boswachter natuurbrandpreventieve maatregelen uit?/ Are you, on the ground you keep, involved with wildfire hazard? Do you take, as a land manager/ forester, preventative measurements against wildfires?

3. Kunt u mij meer vertellen over wat uw organisatie doet met betrekking tot natuurbrandpreventieve maatregelen?/ Could you tell me more about what your organisation does, with regards to preventative measurements against wildfires?

4. Vindt u dat er genoeg wordt gedaan aan natuurbrandveiligheid? Ligt de focus meer op het preventieve deel, of op het bestrijden van brand volgens u?/ Do you think there are enough actions taken against wildfire hazard? Is the focus more on the prevention of fires or the fighting of fires, according to you?

5. Hoe reageert men op *de Veluwe* op het uitbreken van een natuurbrand? Heeft u ervaringen waarover u kunt vertellen?/ How do people act on a wildfire outbreak in de Veluwe? Do you have any experiences you could talk about?

6. Hebben mensen of bedrijven die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden?/ Do locals or companies, residing in nature reserves, in general have a good understanding of actions preventative of wildfires?

7. Wat voor soort bedrijven op *de Veluwe* zijn betrokken bij natuurbrandveiligheid en welke niet/ What kind of companies in de Veluwe are involved with wildfire safety and which are not involved?

Zowel bosbrandexperts als de Veiligheidsregio's in Nederland voorzien dat klimaatverandering ertoe zal leiden dat de kans op ongecontroleerde natuurbranden in Nederland toe zal nemen. Zij pleiten dan ook voor meer en betere maatregelen rondom natuurbrand risicovermindering. In mijn literatuuronderzoek kwam ik het Fire Smart territory concept tegen, een hollistische aanpak voor natuurbranden.
Vooraf aan het interview heb ik u wat verteld over het Fire Smart Territory concept.*
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*

- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan./*

Both the forest fire experts as well as the safety regions in the Netherlands foresee that climate change will lead to an increased risk of uncontrolled forest fires in the Netherlands. They advocate more and better measurements for minimalizing risk of forest fires. In literature, I came across the Fire Smart Territory Concept, a holistic approach for forest fires.
Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy.*

8. Wat is uw mening over het Fire Smart Territory concept? Is dit geschikt en haalbaar voor Nederland?/ What is your opinion on the Fire Smart Territory Concept? Is this something the Netherlands could use?

9. Zou *de Veluwe* zo'n Fire Smart Territory kunnen worden? Waarom wel/niet? Is *de Veluwe* het al?/ Can de Veluwe become such a Fire Smart Territory? Why/why not? Is de Veluwe already such a territory?

10. Wat is uw mening over het gebruiken van gecontroleerd vuur/beheerbranden om ongewenste of onbeheersbare natuurbranden te voorkomen? Is dit haalbaar voor *de Veluwe* en/of wordt het al gebruikt?/ What is your opinion on using controlled fires to prevent unwanted or uncontrolled wildfires? Is this something de Veluwe could use or already uses?
    a. Waarom niet? Wat zou nodig moeten zijn om het te verwezenlijken?/ If not, why? What would be needed to in order to be able to use this?
    b. Zo wel: Wie voert deze uit?/ If so, who excecutes this?

11. Denkt u dat landschapsinrichting en bosbeheer op *de Veluwe* gericht zijn op het verminderen van het risico op ongecontroleerde bosbranden?/ Do you think landscaping and forest management on de Veluwe are aimed at lowering the risk of uncontrolled forest fires?

12. Wat vind u ervan dat de recreatiezonering soms haaks staat op de natuurbrandveiligheid? Als de natuur meer met rust wordt gelaten, kan dat ook betekenen dat brand minder snel gespot wordt en dus groter kan worden./ What is your opinion on the fact that recreation areas sometimes directly undermine the wildfire hazard safety? If nature's being left at peace more, this could result in a decrease in speed of spotting a fire and thus development of bigger fires.

13. Vindt u dat lokale gemeenschappen op *de Veluwe* genoeg zijn betrokken bij het voorkomen en controleren van bosbranden?/ Do you think local communities on de Veluwe are involved enough with the prevention and controlling of wildfires?

14. A. Wat zijn mogelijkheden in de toekomst om meerdere Fire Smart Territory gemeenschappen te ontwikkelen in Nederland?/ What are the future possibilities for developing multiple Fire Smart Territory communities in the Netherlands?
    B. Hoe zou dit het beste of het snelste kunnen worden gerealiseerd?/ How can this be realised most effectively and efficiently?

15. Hebt u misschien aanvullende maatregelen voor zowel *de Veluwe* als voor de rest van Nederland die u ook belangrijk vindt?/ Are there any additional measurements both for de Veluwe as well as for the Netherlands you find important?

16. Is er verder nog iets wat u wilt toevoegen? / Is there anything else you'd like to add?

Appendix J – Interview guide 5 – Municipality of Nunspeet

1. A. Kunt u kort een schets geven van het werk dat uw organisatie verricht?/ Could you give a short description of what your organisation does?
   B. Kunt u kort een schets geven van het werk dat uw doet binnen de organisatie?/ Could you give a short description of you personal job within your organisation?

2. Kunt u omschrijven wat de interesses zijn van gemeente Nunspeet qua natuurbeheer en natuurbrandveiligheid (als die er zijn)?/ Could you describe what the interests are of the municipalty of Nunspeet for nature management and wildfire safety (if any)?

3. Doet de gemeente iets in relatie met natuurbrandpreventie? Hoe komt u als gemeente uw inwoners en gevestigde bedrijven tegemoet als het gaat om natuurbranden? (mogelijk praten over Fire Wise pilots)/ Is there anything the municipalty does regarding prevention of wildfires? How does the municipalty accommodate citizens and companies with regards to wildfires? (Maybe talk about Fire Wise pilots)

4. Hoe reageert de gemeente op het uitbreken van een natuurbrand binnen het gebied van de gemeente?/ How does the municipalty react to a wildfire outbreak within it's borders?

Opiniërende vragen/ Opinion questions

5. Bent u het eens met de huidige aanpak voor natuurbranden? Wat zou voor u een ideale situatie zijn? Wie zouden hier een rol in spelen?/ Do you agree with the current measurements against wildfires? What would be an ideal situation, according to you? Who would take part in this ideal situation?

6. Vindt u dat er genoeg wordt gedaan aan natuurbrandveiligheid? Ligt de focus meer op het preventieve deel, of op bestrijden van natuurbrand volgens u?/ Do you think there are enough actions taken against wildfire hazard? Is the focus more on the prevention of wildfires or the fighting of wildfires, according to you?

7. Zou de gemeente hier ook een rol in kunnen spelen?/ Could the municipalty play a role in this as well?
   Zo wel: Hoe? Zo niet: Waarom niet? Wie dan wel?/ If so, how? If not, why not and who will instead?

8. Hebben mensen of bedrijven die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden volgens u? / Do locals or companies, residing in nature reserves, in general have a good understanding of actions preventative of wildfires, according to you?

(Vragen om de haalbaarheid van Fire Smart Territory)/ (Questions about the feasibility of Fire Smart Territory)

Zowel bosbrandexperts als de Veiligheidsregio's in Nederland voorzien dat klimaatverandering ertoe zal leiden dat de kans op ongecontroleerde natuurbranden in Nederland toe zal nemen. Zij pleiten dan ook voor meer en betere maatregelen rondom natuurbrand risicovermindering. In mijn literatuuronderzoek kwam ik het Fire Smart territory concept tegen, een hollistische aanpak voor natuurbranden.
Vooraf aan het interview heb ik u wat verteld over het Fire Smart Territory concept.*
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan./*

Both the forest fire experts as well as the safety regions in the Netherlands foresee that climate change will lead to an increased risk of uncontrolled forest fires in the Netherlands. They advocate more and better measurements for minimalizing risk of forest fires. In literature, I came across the Fire Smart Territory Concept, a holistic approach for forest fires.
Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy.*

9. Wat is uw mening over het Fire Smart Territory concept? Is dit geschikt en haalbaar voor Nederland? / What is your opinion on the Fire Smart Territory Concept? Is this something the Netherlands could use?

10. Hoe staat de gemeente tegenover het gebruik van beheerbranden? Zou het een probleem zijn als deze methode vaker gebruikt zou worden?/ What does the municipalty think about using contolled fires? Will this be a problem if this will be used more frequently?

11. Wat vindt u er van om de bewoners/ lokale gemeenschappen meer verantwoordelijkheid te geven? (Denk aan dorpen meer autonomie voor grazers)/ What do you think of giving citizens/ local communities more responsibilities? (Think about giving villages more autonomy for grazers)

12. Ik ben in mijn onderzoek tegengekomen dat het soms niet betaalbaar is voor kleinere grondbezitters in natuurgebieden om natuurbrandpreventieve maatregelen te treffen. Is het aan de gemeente om deze kleine grondbezitters tegemoet te komen hierin? Waarom wel/ niet?/ During my research, I came across the fact that it's not always affordable for smaller land managers in natural areas to take preventative measurements against wildfires. Will the municipalty accomodate these smaller land managers for this? Why or why not?

13. Ik ben ook in mijn onderzoek tegengekomen dat grondbezitters soms geen toestemming hebben van de gemeente om bepaalde handelingen uit te voeren die de kwaliteit en natuurbrandveiligheid van de omgeving ten goede komen (denk aan brandbare conifeerstruiken weghalen, een boom kappen etc.)./ I also came across the fact that land managers not always have permission from the municipalty to take certain measurements which improve quality and wildfire safety of the area (think of removing flammable conifers or cutting a tree, etc.).
A. Wat is uw mening hierover?/ What is your opinion on this?
B. Hoe zou deze situatie in de toekomst misschien gunstiger kunnen worden?/ How can these situations be more favorable in the future?

14. Zou *de Veluwe* zo'n Fire Smart Territory kunnen worden?/ Can de Veluwe become a Fire Smart Territory?

15. Is er verder nog iets wat u wilt toevoegen?/ Is there anything else you'd like to add?

Appendix K – Interview guide 6 – Citizen of Vierhouten

Vierhouten ligt -theoretisch gezien in een WUI (gebied waar natuurbrand veel voorkomt/ voor kan komen en mensen wonen)/ Vierhouten theoretically lies in a WUI (Wildlife Urban Index, an urban area where wildfires are a risk)

1. Kunt u mij kort vertellen waar uw persoonlijke zorgen/ interesse over natuurbranden vandaan komt? Heeft u ervaringen met natuurbranden?/ Could you shortly explain why you are interested in wildfires? Do you have any experience regarding forest fires?

2. Hoe is de relatie van de dorpsbewoners met de natuur, en ook wat betreft bosbranden? Zijn de oorzaken van brand bekend, is er beleid, is er kennis met omgaan met natuurbranden vanuit het dorp?/ What are the local citizens' relations with both nature and wildfires? Are causes of wildfires well known? Are there measurements and knowledge regarding forest fires within your village?

3. Wie beheert de natuur in-en rondom Vierhouten?/ Who administers the natural areas within and surrounding Vierhouten?

4. Kunt u mij vertellen wat er in uw omgeving wordt gedaan aan natuurbrandveiligheid?/ Could you tell me what measurements are being taken in your neighbourhood regarding wildfire safety?

Door wie wordt dat uitgevoerd?/ who takes these measures?

5. Wat doen de inwoners van Vierhouten zelf om zich te bereiden op, of weren tegen natuurbranden?/ How do the locals of Vierhouten prepare themselves against wildfires?

6. Kunt u mij een beeld geven van hoe er wordt gereageerd in het dorp op een natuurbrand?/ Could you describe how the village reacts against a wildfire?

Opiniërende vragen/ Opinion questions

7. Bent u het eens met de huidige aanpak voor natuurbranden? Wat zou voor u een ideale situatie zijn? Wie zouden hier een rol in spelen?/ Do you agree with the current measurements against wildfires? What would be, according to you, an ideal situation? Who will play a role in this?

8. Vindt u dat er genoeg wordt gedaan aan natuurbrandveiligheid? Ligt de focus meer op het preventieve deel, of op het blussen van natuurbrand volgens u?/ Do you think there are enough measurements taken to increase wildfire safety? Is there more of a focus on preventing fires or fighting fires, according to you?

9. Hebben de mensen of bedrijven die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden, volgens u?/ Do locals or companies, residing in nature reserves, in general have a good understanding of actions preventative of wildfires, according to you?

Zowel bosbrandexperts als de Veiligheidsregio's in Nederland voorzien dat klimaatverandering ertoe zal leiden dat de kans op ongecontroleerde natuurbranden in Nederland toe zal nemen. Zij pleiten dan ook voor meer en betere maatregelen rondom natuurbrand risicovermindering. In mijn literatuuronderzoek kwam ik het Fire Smart territory concept tegen, een hollistische aanpak voor natuurbranden.
Vooraf aan het interview heb ik u wat verteld over het Fire Smart Territory concept.*
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan. → Focuspunt van dit interview /*

Both the forest fire experts as well as the safety regions in the Netherlands foresee that climate change will lead to an increased risk of uncontrolled forest fires in the Netherlands. They advocate more and better measurements for minimalizing risk of forest fires. In literature, I came across the Fire Smart Territory Concept, a holistic approach for forest fires.
Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy. → Focus of this interview*

10. Wat vindt u van het Fire Smart Territory concept? Zou *de Veluwe*/ Vierhouten zo'n Fire Smart Territory gemeenschap kunnen worden?/ What is your opinion on the Fire Smart Territory Concept? Can de Veluwe become such a Fire Smart Territory?

11. Vindt u dat lokale gemeenschappen op *de Veluwe* genoeg zijn betrokken bij het voorkomen en controleren van bosbranden?/ Do you think that the local communities on de Veluwe are involved enough with the prevention and control of forest fires?

12. Wat vindt u er van om de bewoners/ lokale gemeenschappen meer verantwoordelijkheid te geven als het gaat om natuurbrandbestendiger worden? (denk aan eigen acties zoals huis en tuin natuurbrandveiliger te maken, maar ook aan lokale experts die beheerbranden kunnen uitvoeren, of boeren met grazers)/ What do you think of giving citizens/ local communities more responsibilities with

regards to being more resiliant to wildfires? (Think about making homes and gardens more wildfire safe, having local experts who can excecute controlled fires or farmers with grazers)

13. Wat zou dit mogelijk kunnen maken?/ What could enable this?

14. Welke obstakels zitten dit in de weg?/ What prevents this?

Afronding van het interview/ Concluding the interview

15. Wilt u verder nog iets toevoegen?/ Is there anything else you'd like to add?

Appendix L – Interview guide 7 – Ministry of LNV

1. A. Kunt u kort een schets geven van het werk dat uw organisatie verricht in relatie tot natuurbranden?/ Could you give a short description of what your organisation does with regards to wildfires?
   B. Kunt u kort een schets geven van het werk dat u doet binnen de organisatie?/ Could you give a short description of your personal job within your organisation?

2. Welk beleid hanteren wij in Nederland als het om natuurbranden gaat? Is er een duidelijk beleid? Wie zijn de verantwoordelijken als het om natuurbrand gaat?/ What measurements are taken in the Netherlands against wildfires? Is there a clear policy? Who are those responsible when it comes to wildfires?

3. Vindt u dat er genoeg wordt gedaan aan natuurbrandveiligheid in Nederland? Ligt de focus meer op het preventieve deel, of op het bestrijden van brand volgens u?/ Do you think there are enough actions taken against wildfire hazard in the Netherlands? Is the focus more on the prevention of fires or the fighting of fires, according to you?

3. Hebben mensen of bedrijven die in natuurgebieden wonen over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden, volgens u? / Do locals or companies, residing in nature reserves, in general have a good understanding of actions preventative of wildfires, according to you?

4. Zijn terreinbeheerders in Nederland over het algemeen getraind op het voorkomen van en omgaan met natuurbranden?/ Are land managers in the Netherlands generally trained to prevent and deal with wildfires?

Zowel bosbrandexperts als de Veiligheidsregio's in Nederland voorzien dat klimaatverandering ertoe zal leiden dat de kans op ongecontroleerde natuurbranden in Nederland toe zal nemen. Zij pleiten dan ook voor meer en betere maatregelen rondom natuurbrand risicovermindering. In mijn literatuuronderzoek kwam ik het Fire Smart territory concept tegen, een hollistische aanpak voor natuurbranden.
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van bosbranden. Het Fire Smart concept zorgt dus voor een natuurbrandbeheerbeleid van onderaan. /*

Both the forest fire experts as well as the safety regions in the Netherlands foresee that climate change will lead to an increased risk of uncontrolled forest fires in the Netherlands. They

advocate more and better measurements for minimalizing risk of forest fires. In literature, I came across the Fire Smart Territory Concept, a holistic approach for forest fires.
Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The FST-concept will thus lead to a bottom-up wildfire management policy.*

5. Wat is uw mening over het Fire Smart Territory concept? Is dit geschikt en haalbaar voor gebieden in Nederland?/ What is your opinion on the Fire Smart Theory Concept? Is it suitable and achievable for areas in the Netherlands?

6. Hoe staat het ministerie tegenover het gebruik van beheerbranden? Zou het een probleem zijn als beheerbranden vaker gebruikt zou worden in het natuurbeheer?/ What's the ministry's standpoint on using controlled fires? Would it be an issue if controlled fires were used more frequently in nature management?

7. Bij wie vindt u dat de verantwoordelijkheid ligt voor een brandresistente landschapsinrichting en beheeractiviteiten die natuurbranden kunnen helpen voorkomen (Fire Smart beheer activiteiten)?/ Who do you think is responsible for having a wildfire resistant landscape management and management activities to help prevent wildfires (Fire Smart management activities)?

8. Hoe staat het ministerie erin om de bewoners/ lokale gemeenschappen in natuurgebieden meer verantwoordelijkheid te geven om natuurbrandbestendiger worden? (denk aan eigen acties zoals huis en tuin natuurbrandveiliger te maken, maar ook aan lokale experts die beheerbranden kunnen uitvoeren, of boeren met grazers, of eventuele andere acties)? Hoe zou dit in zijn werking kunnen worden gebracht? Ik ben in mijn onderzoek tegengekomen dat het soms niet betaalbaar is voor kleinere grondbezitters in natuurgebieden om natuurbrandpreventieve maatregelen te treffen. Wie zou deze grondbezitters tegemoet kunnen komen hierin?/ What's the ministry's standpoint on giving citizens/ local communities in natural areas more responsibilities to become more wildfire resilient? (Think about making homes and gardens more wildfire safe, having local experts who can excecute controlled fires or farmers with grazers, or possibly other actions) How can this be realised? During my research, I came across the fact that it's not always affordable for smaller land managers in natural areas to take preventative measurements against wildfires. Who will accomodate these smaller land managers for this?

9. Denk u dat subsidies en wettelijke interventies een manier zijn om natuurbrandveiligheid te verzekeren?/ Do you think subsidies and legal interventions are a way to ensure wildfire hazard safety?

10. A. Wat zijn mogelijkheden in de toekomst om meerdere Fire Smart Territory gemeenschappen te ontwikkelen in Nederland?/ What are the future possibilities for developing multiple Fire Smart Territory communities in the Netherlands?
    B. Hoe zou dit het beste of het snelste kunnen worden gerealiseerd?/ How can this be realised most effectively and efficiently?
    C. (eventueel) Wat zijn manieren die de Nederlandse samenleving misschien zouden kunnen helpen leven met vuur?/ (possiby) What ways are there to maybe further help the Dutch society live with fire?

11. Hebt u misschien aanvullende maatregelen die u ook belangrijk vindt? Waarom?/ Are there any additional measurements you find important too? Why?

12. Wilt u verder nog iets toevoegen?/ Is there anything else you'd like to add?

Appendix M – Interview guide 8 – Province of Gelderland

1. A. Kunt u kort een schets geven van het werk dat uw organisatie verricht in relatie tot natuurbeheer en natuurbranden?/ Could you give a short description of what your organisation does with regards to nature management and forest fires?
   B. Kunt u kort een schets geven van het werk dat u doet binnen de organisatie?/ Could you give a short description of you personal job within your organisation?

4. Welk beleid hanteert de provincie als het om natuurbranden gaat? Is er een duidelijk beleid? Wie zijn de verantwoordelijken als het om natuurbrand gaat?
   Is er een verschil in natuurbrand beleid nationaal vs. Provinciaal? Waarom?/ What measurements does the province take, regarding wildfires? Is there a clear policy? Who are those responsible regarding wildfires? Is there a difference between national and provincial policy? Why?

5. Vindt u dat er genoeg wordt gedaan aan natuurbrandveiligheid? Ligt de focus meer op het preventieve deel, of op het bestrijden van brand volgens u?/ Do you think there are enough actions taken against wildfire hazard? Is the focus more on the prevention of fires or the fighting of fires, according to you?

6. Hebben mensen of bedrijven die in natuurgebieden wonen binnen de provincie over het algemeen kennis betreft handelingen die helpen bij het voorkomen van natuurbranden, volgens u?/ Do locals or companies, residing in nature reserves within the province, in general have a good understanding of actions preventative of wildfires, according to you?

Zowel bosbrandexperts als de Veiligheidsregio's in Nederland voorzien dat klimaatverandering ertoe zal leiden dat de kans op ongecontroleerde natuurbranden in Nederland toe zal nemen. Zij pleiten dan ook voor meer en betere maatregelen rondom natuurbrand risicovermindering. In mijn literatuuronderzoek kwam ik het Fire Smart territory concept tegen, een hollistische aanpak voor natuurbranden.
In het Fire Smart Territory concept staan deze 3 punten centraal:

- *Het gebruik van gecontroleerd vuur is één van de pilaren voor het voorkomen van ongewenste bosbranden*
- *Landschapsinrichting en bosbeheer zijn gericht op het verminderen van het risico op ongecontroleerde bosbranden*
- *Lokale gemeenschappen begrijpen hun unieke relatie met de natuur en zijn betrokken bij het voorkomen en controleren van natuurbranden. Het Fire Smart concept zorgt dus voor een manier van omgaan met natuurbranden waarbij de lokale gemeenschappen ook een zekere weerbaarheid ontwikkelen, kennis hebben, en een rol spelen. Er vindt communicatie tussen instituten en bewoners plaats over het onderwerp./*

Both the forest fire experts as well as the safety regions in the Netherlands foresee that climate change will lead to an increased risk of uncontrolled forest fires in the Netherlands. They advocate more and better measurements for minimalizing risk of forest fires. In literature, I came across the Fire Smart Territory Concept, a holistic approach for forest fires.
Prior to the interview I told you something about the Fire Smart Territory concept.*
In the Fire Smart Territory Concept, the following 3 points are central:

- *The use of controlled fire is one of the pillars to preventing unwanted forest fires*
- *Landscaping and forest management are aimed at lowering the risk of uncontrolled forest fires*
- *Local communities understand their unique relationship with the nature and are involved with the prevention and controlling of wildfires. The Fire Smart Concept thus enables a way to deal with forest fires, where local communities also develop a resiliance, gain knowledge and play a key role. Institutes and citizens communicate regarding the matter.*

7. Wat is uw mening over het Fire Smart Territory concept? Is dit geschikt en haalbaar voor de natuurgebieden in Gelderland, volgens u?/ What is your opinion on the Fire Smart Theory Concept? Is it suitable and achievable for natural areas in Gelderland?

8. Hoe staat het de provincie tegenover het gebruik van beheerbranden? Zou het een probleem zijn als beheerbranden vaker gebruikt zou worden in het natuurbeheer?/ What's the province's standpoint on using controlled fires? Would it be an issue if controlled fires were used more frequently in nature management?

9. Bij wie vindt u dat de verantwoordelijkheid ligt voor een brandresistente landschapsinrichting en beheeractiviteiten die natuurbranden kunnen helpen voorkomen (Fire Smart beheer activiteiten)?/ Who do you think is responsible for having a wildfire resistant landscape management and management activities to help prevent wildfires (Fire Smart management activities)?

10. A. Hoe staat de provincie erin om de bewoners/ lokale gemeenschappen in natuurgebieden meer verantwoordelijkheid te geven om natuurbrandbestendiger worden? (denk aan eigen acties zoals huis en tuin natuurbrandveiliger te maken, maar ook aan lokale experts die beheerbranden kunnen uitvoeren, of boeren met grazers en/ of andere manieren)/ What's the province's standpoint on giving citizens/ local communities in natural areas more responsibilities to become more wildfire resilient? (Think about making homes and gardens more wildfire safe, having local experts who can execute controlled fires or farmers with grazers, or possibly other actions)

Hoe zou dit in zijn werking kunnen worden gebracht?/ How can this be achieved?

b. Hoe zou de communicatie tussen bewoners en relevante instituten over natuurbranden kunnen verbeteren?/ How can the communication between citizens and relevant institutions regarding wildfires be improved?

11. Ik ben in mijn onderzoek tegengekomen dat het soms niet betaalbaar is voor kleinere grondbezitters in natuurgebieden om natuurbrandpreventieve maatregelen

te treffen. Wie zou deze grondbezitters tegemoet kunnen komen hierin?/ During my research, I came across the fact that it's not always affordable for smaller land managers in natural areas to take preventative measurements against wildfires. Who will accomodate these smaller land managers for this?

12. Denk u dat subsidies en wettelijke interventies een manier zijn om natuurbrandveiligheid te verzekeren?/ Do you think subsidies and legal interventions are a way to ensure wildfire hazard safety?

13. A. Wat zijn mogelijkheden in de toekomst om meerdere Fire Smart Territory gemeenschappen te ontwikkelen in Gelderland?/ What are the future possibilities for developing multiple Fire Smart Territory communities in Gelderland?
    B. Hoe zou dit het beste of het snelste kunnen worden gerealiseerd?/ How can this be realised most effectively and efficiently?
    C. (eventueel) Wat zijn manieren die de bewoners van Gelderland misschien zouden kunnen helpen leven met vuur?/ (possiby) What ways are there to maybe further help the citizens of Gelderland live with fire?
    D. Wat zou de rol van provincie Gelderland hierin kunnen zijn? En de gemeenten?/ What will be the role of the province of Gelderland in this? And the municipalties?

14. Hebt u misschien aanvullende maatregelen die u ook belangrijk vindt? Waarom?/ Are there any additional measurements you find important too? Why?

15. Wilt u verder nog iets toevoegen?/ Is there anything else you'd like to add?