Establishing Community-Based Wildfire Management on Cambodia's Tonle Sap Lake

Conservation International – Cambodia
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Photo Credit: Conservation International | Nick Souter

Introduction

Wildfire is now one of our planet's most destructive environmental issues. And over the last two decades it has grown to become one the major threats to the Tonle Sap Lake's ecosystem.

Dry season wildfire is an increasing threat to the biodiversity of the Tonle Sap Lake. And it presents a largely unmanaged risk to the integrity of the remaining flooded forest (Ashwell 2017). The prevailing fire regime has been in place since at least 2003 (Ashwell 2017), when extensive fire seasons have occurred on average every second year (Ashwell 2017) The 2016 El Niño year was an unprecedented high point[1] during which time a peak of 256 active fires were recorded in one day (Ashwell 2017). The cumulative impact of this fire regime negatively impacts the Tonle Sap ecosystem by reducing biomass and nutrient levels, flowering and seed production, seedling survival, and recruitment to a level that may reduce vegetation cover and make it difficult to restore degraded areas (Ashwell 2017). Beyond the direct effects to vegetation, fire related degradation has wider impacts as the flooded forest provides vital habitat for the lakes fauna, including a variety of IUCN Red list threatened birds and mammals (Campbell et al., 2006) as well as providing vital habitat for the lakes 141 fish species (Ngor et al., 2018) which form the basis to one of the world's largest inland fisheries, upon which thousands of people rely on for their daily survival.

In 2019 Conservation International began supporting the Kampong Prak and Ou Ta Prok fishing communities manage wildfire by providing them with basic fire suppression equipment. Since then, we have developed and implemented Community Based Fire Management (CBFiM), in part of full, with 15 additional communities comprising twelve Community Fisheries organizations (CFi's), two Villages and a Community Protected area. This document provides guidance on implementing CBFiM in partnership with communities on the Tonle Sap Lake. We believe that this approach must be widely adopted if wildfire is to be managed and the lake's unique ecosystem and fishery preserved.

Community Based Fire Management - CBFiM

Community Based Fire Management (CBFiM) is a wholistic approach to fire management in which local communities are actively engaged in the developing and implementing fire management strategies that prevent and control fire, and improve their livelihoods, health, security, and biodiversity conservation. CBFiM is a global community of practice which has been implemented by the FAO and others for several decades. CBFiM is based around the 5R's approach (Moore, 2019) which is consistent with the Sendai Framework for Disaster Risk Reduction 2015-2030.

The 5Rs Community Based Fire Management:

- Review - fire issue analysis and identification of options for positive change
- Risk Reduction – prevent fires from starting.
- Readiness – help communities be prepared to fight fire.

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[1] https://www.iucn.org/news/cambodia/201607/flooded-forest-fires-major-threat-tonle-sap
https://www.nasa.gov/content/goddard/fires-surround-tonle-sap-lake-in-cambodia/
https://www.phnompenhpost.com/national/tonle-sap-forests-razed-fire

- Response – control and extinguish wildfire.
- Recovery – restore fire damaged areas.

We have based our implementation of CBFiM on the Tonle Sap Lake around the 5R's and this is reflected below as we describe our approach.

Work with the local community

The first step in implementing CBFiM is to identify a suitable community – one that is threatened by fire, has the will to address the problem, has adequate land tenure, and can see a direct link between their involvement in fire management and improvements to their livelihoods, health, and security. On the Tonle Sap Lake we have worked with Community Fishery Organizations (CFi's), Community Protected Area Organizations (CPA's), and Villages to implement CBFiM. Engaging a formal community organization with a recognized structure to undertake fire management has several advantages, including recognized community leadership, management capacity, financial resources such as bank accounts, and recognition by the local authorities.

Land tenure and management of the Tonle Sap Lake

Understanding and working within the constraints of tenure is an important part of implementing CBFiM. The Tonle Sap Lake has a complex zoning regime with overlapping governance responsibilities. The Tonle Sap Authority (TSA) is responsible for managing the Tonle Sap Lake as a whole and oversees the three-part zonation of the floodplain under Royal Decree which comprises the outer Zone 1, largely converted rice fields and human settlements; middle Zone 2, a multiple use area comprising cleared rice fields, natural flooded shrublands and ponds – most of the land is state owned and zoned for agricultural development. Land ownership is generally prohibited but can be approved by the local administration. And the inner Zone 3, state owned land that is primarily flooded forest and shrubland's which is protected by a sub-decree prohibiting all destructive human activities. It is within Zone 3 that CI's CBFiM activities have occurred.

The Tonle Sap is also managed as a Biosphere Reserve under the authority of the Biosphere Reserve Secretariat. The Tonle Sap Biosphere Reserve covers the whole lake including the permanently flooded parts and is categorized into three zones: transitional, buffer and core, the latter of which comprises the areas of highest biodiversity. The Ministry of Environment is responsible for managing the biosphere reserve and has an on-ground presence in the three core zones: Preak Toal, Boeng Chhmar and Stung Sen. The Fisheries Administration is responsible for managing the Lake's commercial fishing areas and Community Fishery Areas. The Ministry of Water Resources and Meteorology, UNESCO and local and Provincial Government are also involved in managing the Tonle Sap Lake and its floodplain.

Community Fishery Organizations

Community Fishery Organizations (CFi's) are local community groups who manage a section of aquatic habitat, comprising either open water, flooded forests, rice fields, grasslands, and small water bodies for the benefit of their fish resources. CFi's are governed by an elected committee of local members which implements a management plan. Each CFi and its management plan are recognized by the Royal Cambodian Government through the Fisheries Administration.

Thus, CFi's can exert control over areas of flooded forest that are threatened by wildfire, and they are made up of community members who rely on the Tonle Sap's wild caught fishery for their livelihoods. In our experience these communities recognize the flooded forest and shrubland's importance as vital fish habitat, and in providing floating villages with protection from storms. CFi's can also link community fire management to relevant government agencies, as they are officially recognized bodies and can work through the Fisheries Coordination Team mechanism, which links fishing communities with government officials at the District and Provincial levels to solve fisheries issues.

Community Protected Areas

Community Protected Areas (CPA's) are local community groups who live within or nearby to Protected Areas. These local communities work with the government to conserve biodiversity, protect natural resources and the environment. The Ministry of Environment has the authority to allocate part or parts of sustainable use zones to communities residing within or adjacent to a protected area as a CPA. Once a CPA is organized, a community management committee is elected with participation from the community and institutions involved including the local authority, provincial department of environment, and other stakeholders. The community management committee establishes by-laws for their members regarding the use and management of the CPA. The CPA management plan is developed by the community management committee, and it is approved by the Ministry of Environment (MoE).

Villages

To engage a village in combating forest fire, it is important to include the head of commune, village chief, and other community leaders in the fire management group. These community, and also religious, leaders play a vital role in mobilizing the community to combat forest fire. The community leaders can do this by:

1. Raise awareness about the dangers of forest fire and the importance of prevention and suppression efforts. They do this by talking to community members, holding meetings, and distributing educational materials.
2. Mobilizing the community to combat forest fire. They organize firefighting groups, coordinate fire prevention and suppression efforts, and provide support to firefighters.
3. Working with the government to develop and implement forest fire prevention and suppression policies and programs. They can also advocate for resources to support community-based fire management initiatives.

The inclusion of community leaders in firefighters' groups can help to ensure that forest fire prevention and suppression efforts are coordinated and effective. They also help to build trust and cooperation between the community and the government.

Establish a community wildfire management team

Working with established community groups brings the advantage of existing management structures that can be adapted to manage wildfire. We recommend engaging with the management committees of existing organizations such as the CFi or CPA Committee. When organizing village level fire management, the Village Chief and Head of the Commune should be approached and included. We recommend that our community wildfire management team is

integrated with both the Village and Commune authorities. The Commune Council supervises and oversees the Village Chief, Community Fishery, and Women's Saving Group in wildfire management (Figure 1). The village chief works with the Community Fisheries Committee and Women's Saving Group to select 7-9 active people as the core Community Wildfire Management Team. The Women's Saving Group oversees and manages the CBFiM Fund for the Wildfire Management Team (see details below).
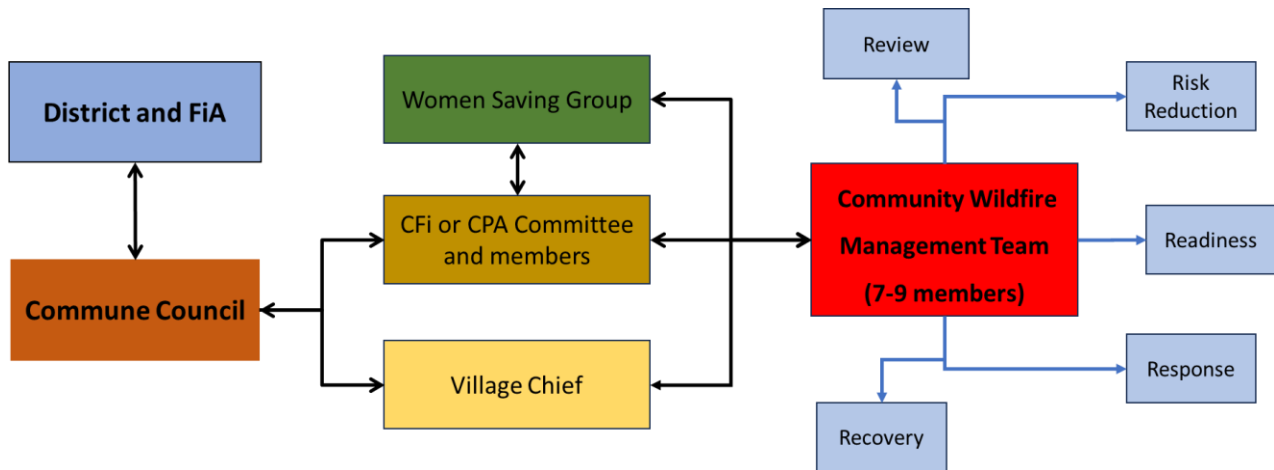

Figure 1. Relationship between the commune, village, CFi, Women's Saving Group and Community Wildfire Management Team.

The establishment of each Community Wildfire Management Team is formalized at the Commune level through written documentation signed by the CFi Chief, Village Chief, Commune Head and - if fire management funds are being provided by the local Women's Saving Group (see below) – the Women's Saving Group Chief. Example documents are provided in Appendix 1.

We have yet to formalize a structure for Village level Wildfire Management Teams but suggest adapting the CFi/CPA approach retaining strong links to local authorities.

Roles and responsibilities in all aspects of fire management need to be clearly defined, as should the identity of stakeholders the communities need to engage with in fire management.

- District and Commune level officials are responsible for overseeing the development and implementation of fire prevention and suppression plans. They also report on ground developments to Provincial and National level Government agencies.
- The Community Wildfire Management Team is responsible for implementing CBFiM within their local community as detailed in this document. They should work with other groups including local Women Saving Groups and youth groups to help with public awareness raising and providing additional support including additional personnel, food, water, funding, and fire suppression materials.
- Individual members of the Community Wildfire Management Team need to assume responsibility for:
    - External communications with local government and NGO partners;
    - Organizing education and awareness sessions;
    - Internal communications;

- o Leading and reporting patrolling activities;
- o Receiving fire alerts;
- o Deciding on when to respond to a fire and organizing the response;
- o Leading the fire suppression efforts;
- o Safety;
- o Finance;
- o Equipment maintenance and replacement; and
- o Restoration.

This list of responsibilities is not necessarily complete as other activities will arise that require attention and oversight.

Community leaders such as CFi and CPA Committee members tend to be older men and diversifying the Community Wildfire Management Team is encouraged through engaging younger people and women. Members of the Pov Veuy CFi Committee suggested that more women be involved in fire prevention work due to their traditional financial management role, and as they can remind the fire management group about fire season preparedness. Younger members bring greater energy to the hard physical work of fire suppression.

Practical example

In establishing community wildfire management teams in Kampong Thom Province we built on the existing CFi Committee management structure by adding extra CFi members and representatives from the FiA and local authorities (Figure 2). Building on the existing CFi management structure provides long term stability for the wildfire suppression team and helps them obtain funds from the CFi's sustainable financial mechanisms. A similar approach can be taken when working with a CPA adopting their management structure and including Ministry of Environment officials.

The community wildfire management team (Red boxes in Figure 2) comprises the existing CFi management structure including District, Commune and Village authorities, with the Sangkat FiA representative acting as the team leader. This team sits under the District Unit Task Force and is directed by the Sangkat FiA. The Commune, Village and CFi are responsible for on-ground implementation.
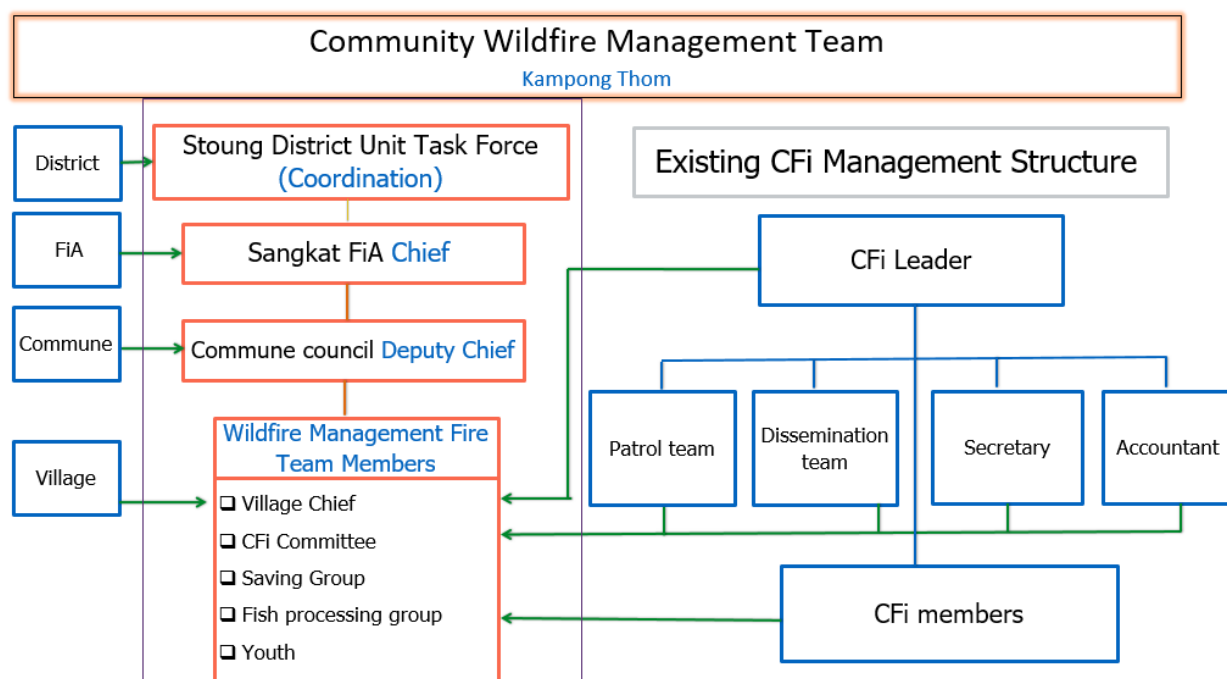
Figure 2. Community wildfire management team management structure for Stoung District in Kampong Thom Province.

Community Based Fire Management Fund

Providing a ready source of funds is a vital component of CBFiM. We do this by integrating Women's Saving Group's into the Community Wildfire Management Team and providing them with a US$1,000 Community Based Fire Management Grant (see Appendix 2 for Terms and Conditions). The Saving Group lends this money to their members and 90% of the interest is made available to the Community Wildfire Management Team to fund fire management activities. These funds allow the wildfire management team to respond rapidly to wildfire.

This mechanism has provided most of the financial support, with local community members also providing smaller amounts, needed to suppress wildfire in our partner communities. Pov Veuy CFi reported that "this fire fund not only helped preventing fire, but also helps community members reduce outside loans to improve their business activities". Whilst Doun Sdaeung mentioned that "as the CFi doesn't have its own money to combat wildfire, the CBFiM fund plays an important role in fire prevention". The CFi's stated that without funding, they cannot pay for gasoline to travel to a fire or buy essential supplies such as drinking water.

We recommended that management groups apply for funds prior to the fire season using the forms provided in Appendix 2. A high level of financial literacy is required both on the part of the Women's Saving Group and Wildfire Management team as problems have occurred with management team members submitting incomplete forms, not providing adequate documentation of their expenses to seek reimbursement, or not submitting or following a detailed plan of proposed expenditure. Thus, for this mechanism to work effectively, a wider programme of financial capacity building and support is needed.

To improve this process CI staff will simplify the required paperwork and assist the CFi's and Saving Groups in managing these funds (Appendix 2). This includes helping the CFC members understand the challenges the Saving Groups have in managing their funds.

Spean Krong CFi has effectively used this mechanism as they followed the correct financial procedures and interacted well with their Saving Group. Spean Krong CFi also received financial support from their local commune and preferred this source of funds to the CBFiM fund, as this left the Saving Group with more money to lend to their members and thus generate more income for their CFi and local community.

As a financing mechanism the Saving Group Managed CBFiM fund can be effective, but requires:

- A high level of administrative and financial management capacity both within the Saving Group and wildfire Management Team;
- Mutual understanding of the roles of responsibilities of both the Saving Group and Wildfire Management Team; and
- Forward planning by both groups so that funds can be used during the fire season.

Partner communities also felt that increased support, both financial and through supply of equipment, from both National and Subnational (Province, District and Commune) Government agencies is crucial for long term operation of their wildfire management teams.

Review

Participatory Rapid Appraisal

Once we have established a Community Wildfire Management Team we review their local issues with fire and identify options for change using a participatory rapid appraisal approach (FAO 2011). Our approach comprises a ranking and scoring matrix that builds an understanding of how and why fires start within each community and the relative importance of each reason (Appendix 3). We also build analysis and impact tables to help us understand the positive and negative impacts of fires started for different reasons, and in different areas. We also ask a series of questions to further build our collective knowledge of each community's issues and problems with wildfire. To compile this information, we recommend interviewing a range of stakeholders including the members of the Community Wildfire Management Team, other village leaders and elders, women, youth, and local authorities.

Our experience in conducting participatory rapid appraisal in five communities in Kampong Thom Province (Doun Sdaeung, Pov Veuy, Boeng Prasan, Peachakrey and Balot) identified nine causes of wildfire:

1. Wildlife hunting (turtles and honey collection);
2. Clearing vegetation for fishing gear;
3. Paddy rice field expansion;
4. Clearing land for vegetable growing;
5. Land conversion to grassland for grazing;
6. Herding buffalo;
7. Road access;

8. Cooking (herders and fishers); and
9. Cigarettes.

All were caused by people and the first seven were deliberate. Context is important as the causes of fire varied between communities. The season occurred from March to June, with April and May the peak months for fire activity.

All five communities identified hot and dry weather as a significant driver of wildfire, wind was a major factor in fire spreading, whilst rainfall was the main factor in extinguishing fires. When asked to describe the positive or negative effects of fire on their local ecology, environment, social wellbeing, safety, health, economy (subsistence and livelihoods) and politics, all impacts were negative.

Community wildfire mapping

Once the causes and impact of wildfire are understood we conduct community mapping to determine spatially:

- where fires are most likely to be lit and why;
- potential firebreaks or control lines within the landscape;
- location of water sources;
- location of access roads and tracks;
- priority areas for protection (e.g. high value forest and restoration areas); and
- the ability of local community members to control fires both through pre-suppression and suppression measures.

These fire maps helped each community implement measures to prevent, detect, and effectively respond to wildfire (Figure 3). Further information on conducting community mapping can be found in
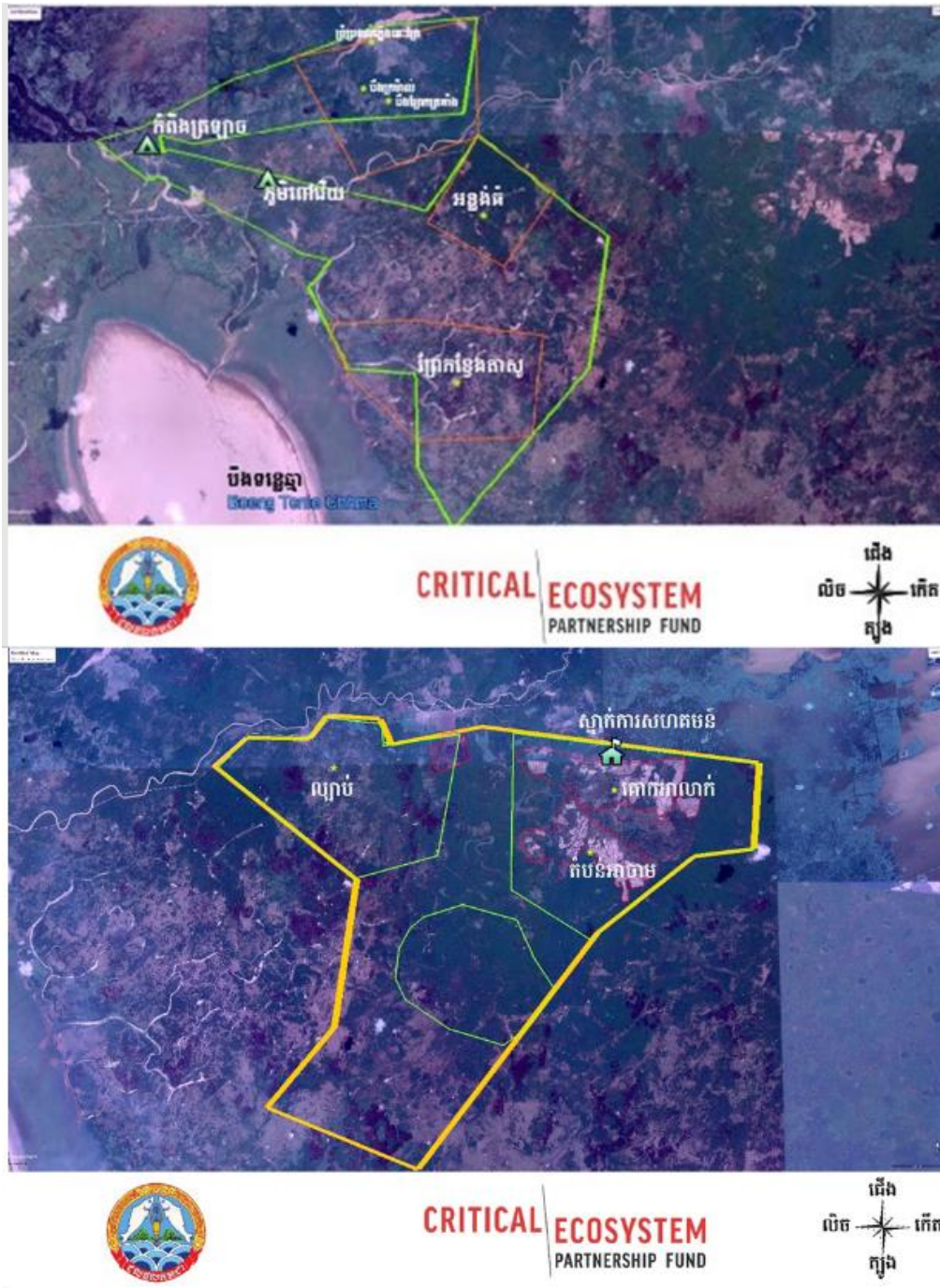
Appendix 4.

Figure 3. Example community wildfire maps.

Wildfire management activity planning

Using the knowledge gained from the participatory rapid appraisal and community wildfire mapping exercise we then work with communities to develop a wildfire fire management action plan, primarily focusing on high fire risk and high value areas (Table 1).

Table 1: Example fire management activity plan

No	Activity Plan	Month					Detail
		Feb	Mar	Apr	May	Jun	
1	Monitor community wildfire management team function	X	X	X	X	X	Ensure that the community wildfire management team is functioning and implementing their management plan.
2	Install warning and information signs at priority areas		X		X		Install and maintain warning and information signs at high risk and high value areas as defined on the fire risk map.
3	Education and raising awareness to relevant stakeholders		X	X	X		Raise community awareness of wildfire delivering education to both local people and seasonal migrants.
4	Undertake fire training		X				Participate in wildfire training when offered before the fire season.
5	Patrol priority areas		X	X	X	X	Undertake regular patrols (at least 2 times/month) around high fire risk and high value areas.
6	Fire suppression readiness	X	X	X	X	X	Ensure that fire suppression equipment is working and available before and during the fire season.
7	Fire response and suppression		X	X	X	X	Community firefighters will suppress wildfires within their management area through cooperation with local authority and other community members.
8	Post fire season review					X	The wildfire management team reviews the fire season and adjusts their management plan to account for lessons learned.
9	Recovery planning					X	Plan for the recovery of fire damaged areas.

Although these plans have been developed our communities frequently reported that they did not follow their plans through the fire season – hence the importance of Activity 1 – monitoring the function of the wildfire management team. They also noted that pre-fire season preparations need extra attention (Activity 6), and frequent review of the plan is also recommended during the fire season.

We recommend printing the plan in large format and prominently displaying it within the community so that it serves as a constant reminder of wildfire management and planned activities (Figure 4).

Figure 4. Wildfire activity management plan on display in the Pov Veuy CFi station.

Risk Reduction

With risk reduction we work with communities to prevent wildfires — focusing resources on their underlying causes. As almost all fires on the Tonle Sap are caused by human activities, prevention is the most effective control measure. Our partner communities identified four wildfire risk reduction strategies:

- Conduct wildfire education and awareness sessions with local community members and seasonal migrants;
- Install fire information and warning signboards at high fire risk and high conservation value areas;
- Conduct joint fire suppression patrols with, local authorities, and FiA officials;
- Identify (name and photograph) of outsiders who visit the community managed area for fishing and buffalo grazing. And explain to them that in the event of a forest fire they will be investigated. This will ensure that visitors will be responsible for fire safety and inform other outsiders of their responsibilities.
- Punish those who destroy the flooded forest by applying the Fishery law, which can result in 3-5 years imprisonment.

Villagers from Pov Veuy believe that women play an important role in fire prevention work due to their traditional financial management role, and they can help remind the wildfire management team to prepare for the coming fire season.

Fire information and warning signboards

Posting signboards at high fire risk areas and high value sites is an effective risk reduction tool as they discourage people from lighting fires and promote responsible behaviour (Figure 5), particularly signboards that depicted the penalties associated with lighting fires (Figure 6). Example fire information and warning signboards are presented in Appendix 3. We recommend obtaining approval from local authorities before using these signboards and seeking their advice on their deployment locations.

Figure 5. Wildfire prohibition signboard.

Education and Awareness Raising

Community education and awareness raising is an important risk reduction tool. Community wildfire management team members should hold multiple wildfire public education sessions during each year (Figure 6). The first sessions should be held in early March - prior to the fire season - to change people's behaviour and reduce the risk of wildfire. These sessions should continue through the fire season until mid-May to ensure that people remain conscious of the risk of wildfire. As wildfire is caused by people the wildfire management team should focus on educating community members and seasonal migrants whose livelihoods rely on fishing, and thus the flooded forest. Migrant fishermen and cattle grazers should be engaged as they are held responsible for lighting fires in the past. Women are encouraged to join the awareness and education sessions as they are best at reminding their family members and neighbors about the causes and dangers of wildfire. Members of the wildfire management team should share their contact details with the migrant fishermen, so they can inform them if they detect any fires.

Figure 6. Public awareness sessions for seasonal migrant fishers on wildfire prevention conducted by Community Fishery Committee members.

Our partner communities suggested expanding the fire education to kindergartens and schools, educating the next generation on the importance of preventing wildfire.

Community education and awareness raising sessions often used the fire warning and information signboards as presentation tools (Figure 6) and these sessions should address:

- Legal issues around forest fire;
- The importance of forest protection;
- Illegal fishing activities such as destroying vegetation to clear space for nets;
- Developing a code of behavior to prevent forest fire;
- What to do if you detect a wildfire;
- Behavior after detecting a wildfire; and
- Protection of forest regeneration sites.

Working with local authorities
Establishing and developing close working relationships with the local commune authorities can reduce the risk of wildfire. Commune authorities can facilitate temporary residents' participation in wildfire awareness raising and education sessions.

Management of high fire risk areas
Identifying areas of high fire risk is an important part of action planning. The CFC's identified management actions required prior to wildfire occurring. For example, Boeng Prasan suggested:

- constructing access tracks to high fire risk areas that would allow easier transport for pumps and hoses;
- constructing fire breaks to protect high value vegetation; and
- reducing high fuel loads such as dry water hyacinth.

Whilst identified, these management actions were not enacted due to a lack of technical knowledge in constructing firebreaks or efficiently removing high fuel loads, labor to do so, or financial support. Reducing the fuel load in high fire risk areas requires either controlled burning early in the fire season (e.g. to remove dried water hyacinth from paths) or mechanical

slashing, likely followed by controlled burning. Both options need further expert input, funding and government approval to be viable.

Readiness

Despite the best risk reduction efforts - fires will still occur, and partner communities need to be prepared to suppress them. We do this by providing our communities with:

- locally sourced fire suppression equipment;
- fire management training;
- an observation tower; and
- real time satellite-based fire alerts.

Fire suppression equipment

Our practical experience in working with communities on the Tonle Sap Lake and assessment by fire management expert, Mr Joe Tilley, has led us to recommend a package of basic - locally sourced equipment suppression for each Community Wildfire Management Team comprising six members who will actively suppress fires (Table 2). The total cost of this equipment is US$2,097. Further information on this equipment is presented in Appendix 6.

It is important that all protective clothing is made of natural materials such as cotton, as polyester is flammable and highly dangerous when exposed to open fires.

Table 2. Basic Community Wildfire Management Team fire suppression equipment

Equipment	Units	Cost per unit (US$)	Total Cost (US$)
Fire suppression equipment			
Petrol powered water pump -	1	250	250
Plastic hose (250 m long, 2.7 cm diameter)	10	16.50	165
Pump/hose couplings	2	2.50	5
Hose joiners	30	2.50	75
Spray tank with battery engine	6	45	270
Rakes	6	5.50	33
Hoes	6	5.50	33
Bush knife/machete	6	10	60
Safety equipment			
Boots	6	4.00	24
Gloves	6	3.00	18
Hats	6	5.50	33
Protective clothing	6	20	120
First aid kit	1	20	20
Communication equipment			
Radio communication intercom	2	63	126
Smartphone	1	210	210
Monthly phone cards	12	10	120
GPS	1	285	285
Fire warning sign boards	5	50	250

In addition to the basic equipment Community Fire Management Teams can be provided with more advanced equipment which will enhance their fire suppression capabilities. These include:

- Fire observation tower nearby the fire suppression equipment storage location;
- Petrol powered brush cutters for rapid vegetation removal – these will be most useful in grasslands;
- Large water tank mounted on a trailer with mechanical mule hand cart for use in areas that lack water.

Ensuring that the fire suppression equipment works is important for readiness. All equipment needs to be inspected prior to the fire season and faulty equipment repaired or replaced. Monthly inspection and maintenance are required during the fire season. Equipment must also be cleaned and inspected after each fire. At the end of the fire season all equipment must be stored in a safe place as it can be damaged during the wet season by moisture and rodents. Ensuring frequent inspection and maintenance during the fire season has proven to be challenging for many communities. Monthly inspection and maintenance must be included in each Community Wildfire Management Team's action plan, with one team member assuming responsibility.

Fire Management Training

Community Wildfire Management Teams benefit greatly from expert training in wildfire management. At a minimum we recommend a single day course – delivered by an expert – covering the following topics:

Theory of wildfire prevention, safety, and suppression.

- factors that cause and effect wildfire;
- safety;
- wildfire behavior;
- fire suppression techniques and equipment;
- fire suppression team dynamics and communications; and
- fire suppression scenario group exercise.

Outdoor field demonstration and practice of wildfire suppression techniques and fire behaviour.

- using pumps and hoses in wildfire suppression;
- hose lay exercise;
- hand tools and their use in fire suppression;
- team safety; and
- fire behavior on the hessian fire table.

Our community partners suggest that this training be expanded to more community members so they can help the Community Wildfire Management Team respond to and suppress larger fires. Having an experienced fire fighter attend wildfires with the Community Wildfire Management Team and provide guidance and advice is also recommended.

Satellite based fire alerts

Before a wildfire can be suppressed it must be located. Fires can be directly observed by a community member and reported to the Community Wildfire Management Team or detected via satellite. We have used satellite-based wildfire detection services - NASA FIIRMS and Ororatech - to alert our partner communities of potential wildfires. Both proved effective in detecting wildfires before they were discovered on the ground and often lead to rapid suppression by the community fire management teams. However, both systems required coordination by CI staff. NASA FIIRMS required staff to inspect the website each day and locate fires within the CFi boundaries, whilst CI staff received automated fire alerts from Ororatech. These observations and alerts were then passed onto the CFC fire management team for action. Whilst both proved effective, NASA FIIRMS required daily monitoring of their website and gave low spatial resolution alerts. Ororatech provided automated alerts within hours of a satellite having detected a potential fire at higher spatial resolution. Whilst Ororatech provides timely and accurate data it is a subscription-based service the cost of which is more than community groups could fund themselves. Whilst NASA FIIRMS is free it is lower resolution and was labor intensive. However, NASA FIIRMS now offers an automated alert feature, but we have yet to test this. Unfortunately, neither system can provide the community with direct alerts that they can respond to.

We monitored each of the four CFis using the Ororatech satellite fire detection service and alerted each community to potential fires. The four CFis reported that the satellite alerts frequently warned them of fires before they were observed on the ground. Thus, this service was extremely valuable to them as they could respond quickly to these alerts, investigate, and stop these fires before they became large and uncontrollable.

Patrolling

Each CFi reported insufficient capacity and financial resources to undertake frequent extensive patrols. Each CFi's fire action plan recommended patrolling at least twice per month during the fire season. As the bulk of fire management responsibilities rests with the CFC members they often did not have enough time to undertake these patrols due to their other CFi duties and personal circumstances. This should be addressed by recruiting more fire management group members.

Response

Implementing the actions described above in review, risk reduction, and readiness allows communities to respond to wildfire. On receipt of a wildfire alert the Community Wildfire Management Team will either send a team member, or ask a nearby community member, to visit the site and assess the situation. On confirmation of an active fire, the Community Wildfire Management Team will determine if it requires suppression and if so, attend and suppress the fire with the appropriate equipment. Or if the fire is not threatening shrubland or flooded forest they will monitor the situation.

Community wildfire management team members reported that they most often used hand tools such as rakes, hoes and bush knives to remove flammable material and create a bare earth barrier (Figure 7), and backpack water sprayers to suppress wildfire (Figure 8). They reported that whilst water was widely used to suppress wildfire, the larger and heavier water pump and

hoses could often not be used due to difficulty in accessing sites and lack of access to water (e.g. lake, streams or ponds). Community Wildfire Management Teams reported that a clear first description of the fire ground helped them decide on which equipment to deploy. For example, site access and a nearby supply of water is needed before a water pump and hoses are deployed (Figure 9).

Figure 7. The CFC members and fire fighters from Boeng Prasan CFi control a fire using hand tools to create a firebreak, and mobile backpack spray tanks to put out the fire.

Figure 8. A group of firefighters in Peam Bang CFi using backpack water sprayer to suppress wildfire.

Figure 9. Firefighters extinguish a wildfire using a water pump and hose.

For larger fires the Community Wildfire Management Team should seek assistance from the commune or recruit more people from the community to help suppress the fire.

The most common reasons fires cannot be suppressed are:

- inability to access the site;
- a lack of nearby water which reduced the effectiveness of fire suppression efforts; and/or
- too few fire fighters were available to suppress the fire.

This frequently resulted in fires growing too large and dangerous for the communities to control. These fires are often left to burn out. Site inaccessibility can be improved by better mapping access routes around the community and clearing access tracks to high fire danger areas. A lack of water can be overcome using hand tools to suppress fire and provision of large mobile water tanks. More fire fighters can be recruited by training community members as reserve fire fighters and calling on nearby Community Wildfire Management Teams and local authorities to assist. Joint training exercises between neighbouring Wildfire Management Teams and local authorities is recommended to develop lines of communication and management responsibilities within and among these larger groups.

Effective fire suppression requires on-ground planning and clear roles and responsibilities amongst the Wildfire Management Team. It is important that a clear and safe plan is developed and agreed to amongst the team as to how to approach and suppress wildfire and each team member's role in doing so. Advice on how to approach this needs to be provided in the basic training.

Reporting

Recording the details of each fire alert, confirmed wildfire, and action taken to address each fire is important so that we can learn from our experiences and adaptively manage wildfire in the future (Table 3). This information is needed for both the review and recovery components of

the 5R's. First the location and origin of each alert is recorded, i.e. was it observed by a community member or a satellite detection service. And for the latter, if it was as confirmed as a fire or was a false alert. For confirmed fires, we collect a range of data including its fate – e.g. the fire burned itself out, the community suppressed or they monitored it. For suppressed fires details of the suppression efforts are included along with habitat within which it burned damage caused.

Table 3. Information collected for each wildfire alert.

Wildfire information	Explanation
Detection method	Was the fire detected by a community member or satellite (Ororatech or NASA FIIRMS)
Confirmed fire	Was this a real fire personally observed (flames, smoke or newly burned area) by a Wildfire Team or community member. Or not confirmed, as it was either not visited, or the location visited but no evidence of a fire found (give details in additional notes)
Location	Give location as Easting and Northing (EPSG: 32648 WGS84 UTM Zone 48N) or Latitude and Longitude but make sure that coordinate reference system is stated
Additional location information	For example, give the local name of the location if known
Date the fire started	Either the date of first alert from the satellite system or community member observation
Time the fire started	Either time of first alert for satellite alert or estimate for community observation.
Time the fire ended	Either estimate for self-extinguished fires or time fire was finally suppressed by the Wildfire Management Team
Direction the fire was spreading	Direction the fire was travelling e.g. west if moving from east to west.
Cause	Likely or know cause of the fire (e.g. wildlife hunting, buffalo herding, cooking fire etc.)
Legal action	Was any legal action taken over the fire if it was deliberately lit? For example, did the local authority have the perpetrator sign a contract stating responsibility and saying they would not start another fire in future?
Burned area	Estimated area damaged by fire (ha).
Habitat	Vegetation type within which the fire occurred (e.g. gallery forest, shrubland, grassland, ricefield, previously burned area)
Affected fauna	Animals killed by the fire
Affected flora	Plant species killed by the fire
Equipment used	Equipment used for fire suppression
Firefighter identity	Groups or individuals involved in fire suppression efforts, e.g. Community Wildfire Management Team, Village Chief, Women's Saving Group, local villagers
Number of firefighters	Total number of people who helped suppress the fire

To allow communities to efficiently report their activities we have adapted the SMART Mobile app (https://smartconservationtools.org/en-us/) to record and send fire information data to the CI team.

Recovery

Recovery for wildfire concerns looking after community welfare, repairing infrastructure, and restoring fire-damaged landscapes. On the Tonle Sap Lake fire has the greatest impact on the natural environment. Fortunately, direct impacts to the community and infrastructure are rare. Thus, recovery involves the restoration of fire-damaged vegetation. And involves determining which areas can be restored and which are left as they are. Some areas such as paths through thick vegetation are repeatedly burned to clear dried water hyacinth and grass to maintain access, or patches are burned to clear space for fishing nets. Each community must decide whether these areas can be restored or are best left untouched. Other areas can either be left to regrow naturally or be actively restored using techniques such as assisted natural regeneration, transplanting nursery grown seedlings or direct seeding using native species (commonly *Barringtonia acutangula*, *Diospyros cambodiana*, and *Combretum trifoliatum*). This generally requires outside resources and the development of restoration plans with local communities.

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Appendix 1. Community Flooded Forest Wildfire Suppression Team formation document

បញ្ជីរាយនាមក្រុមការងារពន្លត់ភ្លើងឆេះព្រៃសហគមន៍នេសាទពៅវិយសែនជ័យ

ភ្លើងឆេះព្រៃសហគមន៍នេសាទពៅជ័យសែនជ័យ គឺបង្កើតឡើងក្នុងគោលបំណងដើម្បីចូលរួមទប់ស្កាត់បញ្ហាភ្លើង ឆេះព្រៃ ក្នុងសហគមន៍ពៅវិយសែនជ័យអោយមានប្រសិទ្ធភាពខ្ពស់ ពិសេសងាយស្រួលក្នុងការអន្តរាគមន៍ និងប្រើប្រាស់ឧបករណ៍ពន្លត់ភ្លើងឆេះព្រៃ នៅពេលដែលមានភ្លើងឆេះព្រៃកើតឡើងក្នុងដែនសហគមន៍របស់ខ្លួន ម្យ៉ាងវិញទៀត នឹងបង្កភាពងាយស្រួលក្នុងការគ្រប់គ្រង និងប្រើប្រាស់ថវិកាដែលបានបង្កើតរួចហើយ។

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១. លោក មេភូមិពៅវិយ

២. គណៈកម្មការ និងសមាជិកសហគមន៍នេសាទពៅវិយសែនជ័យទាំងអស់គ្នា

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Appendix 2. Community Based Fire Management Fund

COMMUNITY BASED FIRE MANAGEMENT FUND SPECIAL TERMS & CONDITIONS

1. Beneficiary Community

    a. The [Name of] Saving Group (the "Saving Group") linked with the [Name of] Community Fisheries Organization ("CFi") is the beneficiary of the Community Based Fire Management Fund established as set forth in the Agreement. The Saving Group is managed by the elected [Name of] Saving Group Committee.

2. Overview

    a. Conservation International (CI) is implementing Community Based Fire Management (CBFiM) in fishing communities on and around Cambodia's Tonle Sap Lake. The objective of Community Based Fire Management is for local communities to participate in local scale fire management. CI has consulted with community members and stakeholders and found that a sustainable source of funding is needed to support the CFi to implement its Community Based Fire Management Plan.

    b. The Prime Donor has agreed to make the Principal available to endow the Saving Group with a Community Based Fire Management Fund. CI shall transfer the Principal to the Saving Group to establish the Community Based Fire Management Fund pursuant to the Agreement and the Funding Terms and Conditions. The Prime Donor requires that the Community Based Fire Management Fund be managed transparently and accountably as detailed in the Agreement and this Attachment 1.

3. Purpose of Community Based Fire Management Fund

    a. The purpose of the Community Based Fire Management Fund is to generate interest which provides income to the CFi to implement its CBFiM management plan, particularly as it relates to developing the fire management workplan, dissemination of material related to wildfire management, activities that assist the CFi in preventing and suppressing wildfire, within and adjacent to the CFi area ("Purpose").

    b. The Community Based Fire Management Fund will facilitate the Saving Group and CFi to collaboratively promote and implement wild-fire management within the CFi.

    c. To provide capital for the Saving Group to fund members' small business activities.

    d. Contribute to mainstreaming gender in wildfire management and promote CBFiM within the local community.

    e. To advance gender equity and equality in decision-making for wildfire management.

    f. Strengthen Community Fisheries management of wildfire.

4. Creation of Community Based Fire Management Fund

    a. CI shall grant the Saving Group the Principal.

b. The Community Based Fire Management Fund will be managed based on the saving group by-laws using the same policies, procedures, and interest rates as other Saving Group funds.

5. Ownership and Management of Community Based Fire Management Fund

a. The Saving Group shall become the owner of the Community Based Fire Management Fund once the Principal has been deposited and shall use it in accordance with the Purpose, the Agreement and these Community Based Fire Management Fund Special Terms and Conditions.

b. The Saving Groups Chief, Secretary and Treasurer are responsible for managing the Community Based Fire Management Fund in accordance with the Grant Agreement and these Community Based Fire Management Fund Special Terms and Conditions.

c. CI will evaluate the use of the interest generated by the Community Based Fire Management Fund within the first year of the grant agreement being enacted. If either the Saving Group or CFi Committee are not following the rules and purpose listed in this document CI will report this to the [Name of Commune] Commune Chief and call a meeting to either resolve the issue, or restructure, or dissolve the Saving Group.

d. CI staff will closely monitor the operations of the Saving Group for a period of three years to ensure that all funds are being managed correctly and in accordance with the Saving Group by-laws.

e. The Saving Group committee (Key Personnel listed in Article IV) is responsible for managing the Community Based Fire Management Fund and ensuring that it is securely held and used in accordance with Saving Group by-laws. Should the Community Based Fire Management Fund be misused the Saving Group committee will be responsible for refunding it in full to the Saving Group.

f. The Saving Group members are eligible to participate in all Community Fishery activities related to the expenditure of interest generated by the Community Based Fire Management Fund. Saving Group members must be engaged in deciding how to spend these funds and in budgeting their use.

6. Use of Community Based Fire Management Fund interest by the Community Fishery

a. The CFi Committee can apply to the Saving Group to receive interest generated from the Community Based Fire Management Fund to use in managing wildfire as described as priority tasks in the CBFiM plan. Suitable activities can include, but are not limited to, updating the fire management workplan, dissemination of material related to wildfire management, and activities that assist the CFi in preventing and suppressing wildfire.

b. The Community Fisheries Committee must send five committee members (Chief of CFi, Secretary, Treasurer, Head of Patrol Team and Dissemination Officer) to attend quarterly or semester Saving Group meetings and present the progress and outcomes of activities undertaken using the proceeds of the Community Based Fire Management Fund.

7. <u>Interest and Withdrawal</u>

   a. <u>Saving Group</u>

      i. The Community Based Fire Management Fund interest will be withdrawn no earlier than every three months and disbursed as follows: 10 % to be divided between Saving Group members and 90% for the CFi to implement priority wildfire management activities as detailed in the CBFiM Plan.

      ii. The Saving Group Committee presents Community Based Fire Management Fund related revenues, loans, and balance to the attending CFi Committee members at the quarterly or semester Saving Group meetings, as the budget available to CFi's depends on the interest earned each month.

      iii. The Saving Group will consider cooperating with CFi law enforcement and environmental improvement activities upon request from the CFi Committee.

   b. <u>Community Fishery</u>

      i. Every three months, the CFi is eligible to receive 90 percent of the interest generated from Community Based Fire Management Fund loans to Saving Group members.

      ii. CFi's must request funds in writing which details an action plan and budget plan.

      iii. At least five CFi Committee members must attend quarterly Saving Group meetings and present the results of activities implementation using the Community Based Fire Management Fund interest and provide a current statement of expenditure.

8. <u>Use of Funds Special Conditions (supplement to the terms set forth in Section VII of this Agreement)</u>

   a. Saving Group

      i. All Saving Group loans (including the Community Based Fire Management Fund) are to be used for business purposes only.

      ii. All saving group members in receipt of loans will inform the Saving Group of the financial viability of their funded business ventures at each monthly meeting.

      iii. To receive a loan, borrowers must submit a business plan, repayment schedule, and agreement consistent with the Saving Group by-laws.

      iv. Borrowers must provide matching funds to the value of 20% of the total loan amount.

      v. The loan proposal must be endorsed (thumbprints accepted) by the applicant's spouse and endorsed by the Village Chief.

      vi. Non-Saving Group members can receive loans if the Saving Group members are not borrowing the funds. Non-members must be guaranteed by one or more Saving Group members.

vii. Each loan proposal and business plan must be submitted to the Saving Group one week prior to committee review.

viii. The final amount loaned will depend on the evaluation of the business plan and the ability of the applicant to repay the loan.

ix. The Saving Group will participate in CFi Committee activities supported by the Community Based Fire Management Fund, including planning and budgeting of approved management activities. The Saving Group will also provide feedback and monitor the implementation of these activities funded by interest generated by the Community Based Fire Management Fund.

b. Community Fishery

i. The CFi is entitled to receive the interest generated from the Community Based Fire Management Fund to use in natural resource management and conservation.

ii. The CFi Committee shall use the interest generated from the Community Based Fire Management Fund solely to finance the operations and activities of the CFi, provided those actions contribute to the Purpose.

iii. The income provided from the Community Based Fire Management Fund shall only be used to implement the Purpose. Permitted activities related to wildfire management include: patrolling the CFi for illegal activity (recorded using the SMART system), disseminating information on relevant laws, environmental education and improving, maintaining infrastructure (e.g. observation towers, sign boards, and fire suppression equipment), costs associated with suppressing wildfire. All activities must take place within or adjacent to the boundary of the officially recognized CFi. The CFi must respond to comments made by the Saving Group on their proposed wildfire management activities prior to receiving any funding.

iv. The income from the Community Based Fire Management Fund shall not be used to attend meetings organized by other NGO's that are not related to the Purpose and/or if the organizing NGO is covering the cost of participation.

v. The CFi Committee will produce a financial report (at least annually) that details all sources of income received, including the proceeds of the Community Based Fire Management Fund.

vi. The CFi Committee must send at least one representative to each monthly Saving Group meeting so that they understand the functioning of the Saving Group and are able to provide financial reports on Community Based Fire Management Fund activities to quarterly Saving Group meetings.

vii. The CFi Committee must record all expenditure and income to verify expenditure of money granted under the Community Based Fire Management Fund.

viii. The CFi Committee shall account for use of the Community Based Fire Management Fund income in accordance with established CFi rules for the utilization of donor funds, as such rules may be revised from time to time. All expenses must be

supported by adequate documentation. Accounting records shall trace back to source documentation.

c. All CFi Committee and Saving Group members must replant at least ten flooded forest tree seedlings every year within a previously burnt area of the CFi.

9. <u>Monitoring</u>

a. CI has the right to review all savings and investments made by both the Saving Group and CFi Committee.

b. The Saving Group will retain all financial and contractual records related to the agreement separately from any other paperwork related to other funding received by the Saving Group. The Saving Group will keep these records for four (4) years from the performance start date and make them available to CI and the Prime Donor for review at any time.

c. The Saving Group must immediately report to CI any cases of the CFi being in breach of their Community Based Fire Management Fund grant agreement. Non-compliance can include, but is not limited to: using Funds for activities that do not support the Purpose; using Funds without supporting documents, requesting and using Funds without an action plan or failing to keep adequate records (e.g. meeting minutes, budget plans, financial accounts, meeting attendance lists and reports), the expenditure or outcomes have not complied with the agreement.

d. The Saving Group is required to monitor grant related activities of the CFi to ensure proper use of the funds.

e. In cases where the CFi was found to be improperly using proceeds from the Community Based Fire Management Fund, it must pay back all money received under the Community Based Fire Management Fund grant in full to the Saving Group.

f. By [DATE ONE YEAR FROM CONTRACT SIGNING], the Saving Group must produce a written and financial report to CI which describes the status of the Community Based Fire Management Fund.

g. The Saving Group shall ensure timely implementation of recommendations made by CI during the period of the grant. Failure to implement recommendations may result in suspension or termination of the Community Based Fire Management Fund by CI as described below.

10. <u>Suspension or Termination of Community Based Fire Management Fund by CI</u>

a. If non-compliance with the Agreement or the Funding Terms and Conditions cannot be resolved, CI reserves the right to suspend the expenditure of, or terminate, the Community Based Fire Management Fund.

b. CI can suspend the Community Based Fire Management Fund until Saving Group elections are called, and a new Saving Group Committee has been elected. If CI is

satisfied with the composition and competence of the new Saving Group Committee the Community Based Fire Management Fund will be reinstated.

c. In cases of gross misconduct or criminal activity CI may terminate the Community Based Fire Management Fund and recover the Principal. Subsequent expenditure of the Principal shall be negotiated with the Prime Donor.

d. In both cases, CI will notify the Saving Group Committee through the [Name of] Commune Council with a written explanation of the reasons for suspension/termination 30 days in advance to the date of the suspension/termination date. During any period of suspension/termination, the Saving Group will be prohibited from spending the income generated from the Community Based Fire Management Fund.

e. CI will terminate the Community Based Fire Management Fund if the Saving Group dissolves and will recover the Principle. Any remaining interest held by the Saving Group will be disbursed to the CFi or Saving Group members as per Article 7 of these Special Terms & Conditions. CI will monitor expenditure of any funds granted to the CFi.

11. Early Withdrawal of Principal

a. CI retains the right to withdraw all or part of the Community Based Fire Management Fund from the Saving Group if CI finds that the funds are being used in a manner that does not comply with the agreement.

b. If CI decides to withdraw all or part of the Community Based Fire Management Fund from the Saving Group it will call for a General Assembly Meeting comprising the Saving Group, CFi Committee and other stakeholders to reveal the reasons for withdrawing the fund.

12. Conflict Resolution

a. If the members of Saving Group committee cannot agree on the management of the Community Based Fire Management Fund and are unable to resolve their disagreement, issues must be raised with CI and the Local authority (Commune Chief) and resolution sought.

b. If problems cannot be solved, CI retains the right to make decisions on management of the Community Based Fire Management Fund and the interest generated from it.

c. If the Saving Group believes that the CFi is not following the terms of the grant agreement it will call a meeting with the CFi Committee and attempt to resolve the issue. And if the issue remains unresolved CI reserves the right to terminate the grant agreement and arrange for repayment of all Community Based Fire Management Fund grant funds.

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ជាតិ សាសនា ព្រះមហាក្សត្រ

✸✸✸✸✸

កំណត់ហេតុស្តីពី

ការប្រជុំពិភាក្សាអំពី៖...

ទីតាំងប្រជុំ...

ឆ្នាំពីរពាន់............. ខែ........... ថ្ងៃទី.........................

វេលាម៉ោង...................នៅ...

បានរៀបចំកិច្ចប្រជុំស្តី..................................... ក្រោមអធិបតីភាពលោក

.... ជាប្រធានអង្គប្រជុំ ។

សមាស ភាពអញ្ជើញចូលរួមមាន÷

១ - លោក.....................   ....

២ - លោក ....

៣ - លោក.....................   ....

៤ - លោក.....................   ....

៥ - បញ្ជីរឆ្មោះមានអ្នកចូលរួមសរុប ....

ជាកិច្ចចាប់ផ្ដើមលោក................... ....ជា.........................

បានលើកឡើងនូវប្រធានបទទាក់ទងទៅ...

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.... ពីព្រោះ ....៕

បន្ថែមជាងនេះទៅទៀតលោក.........................ក៏មានមតិបន្ថែមទាកទង់ទៅនិង.....................

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យោងតាម លទ្ធផលអង្គប្រជុំ

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កំណត់ហេតុបានបញ្ចប់សព្វគ្រប់នៅវេលាម៉ោង ....នាថ្ងៃខែឆ្នាំដែល ប្រកបដោយភាពល្អន និងទទួលបានលទ្ធផលល្អ។

ធ្វើនៅ.................ថ្ងៃទី.......ខែ..........ឆ្នាំ...............

អ្នកធ្វើកំណត់ហេតុ

បានឃើញនិងឯកភាព

ថ្ងៃទី........ខែ..........ឆ្នាំ...............

ប្រធានអង្គប្រជុំ

Community Based Fire Management Fund Work Plan

<u>ផែនការសកម្មភាព</u>

ល.រ	ផែនការសកម្មភាព	កាលបរិច្ឆេទ	សម្ភារៈ	អ្នកចូលរួម
១	....	ខែ..... ឆ្នាំ............. ខែ..... ឆ្នាំ.............	....	............នាក់
២	....	ខែ..... ឆ្នាំ............. ខែ..... ឆ្នាំ.............	....	............នាក់
៣	....	ខែ..... ឆ្នាំ............. ខែ..... ឆ្នាំ.............	....	............នាក់
៤	....	ខែ.....ដល់ខែ...... ឆ្នាំ........	....	............នាក់

ធ្វើនៅ........ថ្ងៃទី....ខែ..........ឆ្នាំ........

ប្រធានសហគមន៍នេសាទ

ផែនការថវិកា

សម្រាប់សកម្មភាព………………………………………………………… …………

ល.រ	សកម្មភាព	បរិយាយចំណាយ	ចំនួន	តំលៃរាយ	តំលៃសរុប
១					
សរុបចំណាយសកម្មភាពទី ១					
២					
សរុបចំណាយសកម្មភាពទី ២					
៣					
សរុបចំណាយសកម្មភាពទី ៣					
សរុបចំណាយសកម្មភាពទី ៤					
សរុបចំណាយ (១+២+៣+៤)					

ធ្វើនៅ………ថ្ងៃទី……ខែ…………ឆ្នាំ…………

ប្រធានសហគមន៍នេសាទ

បញ្ជីវត្តមាន

ស្ដីអំពី៖...

ភូមិ.........................ឃុំ.....................ស្រុក.......................ខេត្ត...........................

ល.រ	គោត្តនាម និងនាម	ភេទ	តួនាទី	អង្គភាព	ហត្ថលេខា	ផ្សេងៗ

សរុប៖.................ស្រី...............

របាយការណ៍

ស្ដីពី ....

ធ្នាំពីពាន់............... ខែ............... ថ្ងៃទី............... វេលាម៉ោង...............
គណៈកម្មការសហគមន៍នេសាទទ
បានរៀបចំធ្វើការ...ដែលធ្វើនៅក្នុងដែនរប
ស់សហគមន៍ ក្រោមការដឹកនាំរបស់ គណៈកម្មាការសហគមន៍ ....នាក់ និង អធ្ការ ភូមិ
យុំ.........នាក់ និង អ្នកចូលរួមសរុប ....។

លទ្ធផលទទួលបាន: (ហើយក៏ ត្រូវបញ្ជាក់ពីឈ្មោះទីតាំង លេខយូធីអឹម)

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ថវិការចំណាយ

ល.រ	មុខចំណាយ	ឯកត្តា	តំលៃរាយ	តំលៃសរុប
១	....	....	....	....
២	....	....	....	....
៣	....	....		....
សរុប				...............រៀល

សកម្មភាបានបញ្ចប់ នៅវេលាម៉ោង ......។ សូមជូនភ្ជាប់ នូរបញ្ជីវត្ថុមាន និង វិក័យប័ត្រ ថ្លៃចំណាយ ។

...............ថ្ងៃទី........ខែ.........ឆ្នាំ២០...

ហត្ថលេខា អ្នកធ្វើកំណត់ហេតុ

....

បានឃើញ និងឯកភាព ប្រធាណសហគមន៍

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Appendix 3. Participatory Rapid Appraisal

Ranking and scoring matrix

We use a matrix to determine the main causes and timing of wildfire within community boundaries (Table 4). We ask a diversity of stakeholders (e.g. women, fishers, elders, community leaders) to describe wildfire in their area by its causes, who causes fire (Agent), the months fires occur, ranking of which causes are most important (this is a combination of frequency of fires, area burnt and burn severity), and comments including where fires are started. Complete one table for each person or group of people interviewed.

Table 4. Community wildfire ranking and scoring matrix. For ranked importance - rank each cause of fire from most important number one down to least important.

Type of fire (cause)	Agent	Month occurs	Ranked importance	Comments
Land clearance (crop expansion)				
Land clearance (sale)				
Land clearance (fishing)				
Rice field stubble burning				
Burning to encourage grass as feed for livestock (e.g. buffalo)				
Hunting				
Cooking/camp fire				
Natural ignition (lightning)				
Honey collection				
Cigarettes				
Buffalo herding (e.g burning to move buffalo from dense shrubland)				
Unknown				
Other				

Local communities may list all or some of these types of fire, whilst others may also be identified, including the suggestions below:

- lightning – a wildfire caused directly or indirectly by lightning;
- burning vehicle or machine;
- firearms or explosives;
- heating fire;
- electricity transmission;
- domestic waste disposal;
- municipal waste disposal;
- recreation – a wildfire caused by people or equipment engaged in a recreational activity (e.g., vacationing, fishing, picnicking, hiking);

- forest industry – a wildfire caused by people or machines engaged in any activity associated with forest products production; and
- other Industry – a wildfire caused by industrial operations other than forest industry or railroads.
- incendiary – a wildfire willfully started for the purpose of damage, mischief, grudge, or gain.

A list of Agents – people who might have started the fire:

- children;
- householder;
- farmer;
- livestock herder;
- traveler;
- fisherman;
- hunter;
- military personnel;
- forestry staff; and
- government staff.

Analytical and Impact Tables

Once identified, the causes of wildfire are examined using Analytical (Table 5) and Impact (Table 6) tables (from FAO 2009). The most important causes of fire are assessed first. If different types of fire may have the same impacts they can be listed on the same sheet. This exercise is best done as a joint exercise with the Community Wildfire Management Team and local authorities. First complete the Analytical table (Table 5) for each cause of fire. For each category list all the relevant information.

Table 5. Wildfire analytical table. Insider refers to community members; outsider refers to non-community members such as seasonal migrants.

Types of fires being assessed (described as cause): 1. 2.						
Point of origin		Impact (+/-)		Ability to change	Intent to change	Shared objectives
Insider	Outsider	Insider	Outsider			

- Types of Fire Being Assessed (described as cause): The cause of wildfire fire as identified and ranked in the ranking and scoring matrix.
- Point of Origin: give the habitat where these fires are started by either insiders or outsiders. Include the perceptions as to whether this is inside or outside of the control of local people or local authorities. There may be different perspectives on who caused a fire.
  Habitats can include:
  - flooded gallery forest;
  - flooded shrubland;
  - mixed flooded gallery forest and shrubland;

- o previously burned gallery forest shrubland dominated by *Mimosa pigra*
- o primary grassland (e.g. undisturbed native grassland)
- o secondary grassland (e.g. native grassland which has regrown on abandoned agricultural land)
- o rice paddy
- o floating village
- Impact: identifies the positive and negative impacts that the fire may have on the local community and outsiders.
- Ability to change: describe the community's capacity to address, respond to and recover from fire. An honest assessment is needed of the community's capacity to affect change.
- Intent to Change: describe whether the community wants to change the situation and if it can do so given the limits of its capacity.
- Shared Objectives: try and determine if the community can develop shared fire management objectives. Explore the potential for conflicting objectives. For example, buffalo herders burn shrublands to chase out their herd, but local fishers understand that shrublands are important fish habitat that should not be burned. In these cases conflict resolution tools may be needed to reach a consensus.

For each type of wildfire examine whether the fires have positive or negative aspects using an impact table (Table 6). They must be positive for people who light them deliberately – but they may be either positive or negative for the wider community. Describe the nature of the impacts and who they are positive and negative for. There may be multiple positive impacts for each category.

Table 6. Wildfire impact table. Ecological impact refers to direct impact to plants animals and habitat, whilst Environmental impact refers to physical impacts such as smoke haze and water quality.

	Insider		Outsider	
	Positive	Negative	Positive	Negative
Ecological				
Environmental				
Social				
Safety				
Health				
Economic (subsistence and livelihoods)				
Political				

Wildfire impacts, either positive or negative depending on perspective, on the Tonle Sap can include, but are not limited to the following:

- Ecological – flora, fauna and ecological processes including:
  - o forest destruction;
  - o tree death;
  - o destruction of fish habitat;
  - o wildlife loss;
  - o regeneration of grassland vegetation;
  - o control of pests and diseases;
  - o post fire colonization by invasive species (e.g. *Mimosa pigra*)

- Environmental – components including:
    - water quality;
    - loss of forest increases local temperature (as cooler forest microclimate and shade is destroyed);
    - smoke/haze.
- Social – impacts on the community including:
    - social harmony among insiders;
    - managing fire builds community capacity;
    - time spent in managing wildfire;
    - illegal activity;
    - conflict with outsiders.
- Safety – personal injury including:
    - injuries/accidents during and after fire;
    - direct loss of housing and goods due to fire;
    - loss of community protection due increased exposure to storm driven wind and waves.
- Health – impacts to individuals including:
    - smoke/haze;
    - poor water quality.
- Economics (subsistence and livelihoods) –impacts including:
    - increased/decreased agricultural production;
    - fertilized agricultural fields;
    - increased fertility of land;
    - creates more agricultural land;
    - improves grazing for livestock and wild animals;
    - loss of fish habitat leading to decreased fish catch;
    - reduced fishing grounds or increase in damage to fishing nets due to invasion by *Mimosa pigra*;
    - increased/decreased household income;
    - costs of managing fire (labour, fuel, equipment);
    - damage and loss of household goods or livestock.
- Political – at the community level, but with implications for other levels of jurisdiction including:
    - community harmony/disharmony;
    - relationships with neighbouring communities
    - relationships with outsiders;
    - relationships with government officials.

Additional impacts identified through the process can be included with an explanation.

Appendix 4. Community mapping resources

When developing a community map and management plan ask the community the following questions. Explore any spatial differences in their answers which need to be reflected on the map and in the management plan.

Causes

- Who starts the fires in each location?
- Why do they do it?
- Have fires been used traditionally within the flooded forest?
- What are the contributing factors and underlying causes of fire e.g.
    - land tenure issues;
    - illegal land clearance;
    - invasive species;
    - climate change?

Fire behaviour

- What are the different types of fuels in the management area and how do they affect fire behaviour?
- How long does it take for the flood water to recede before a fire can start?
- How long does it take for a fire to become unmanageable?
- Without control by people where and why do fires stop burning?
- Are there areas where fires do not occur? If so why?
- Do people consider environmental conditions when they light fires? For example, people lighting illegal fires to clear land for agriculture may do so on a hot windy day, to create a large destructive fire. Whilst buffalo herders chasing buffalo from the forest may want a smaller less intense fire.

Communications

- Does the community have a phone number that is printed on fire warning boards?
- How and to who does the community communicate:
    - suspicious activity that may cause a fire;
    - illegal activity that may cause a fire;
    - suspicious activity that has caused a fire;
    - illegal activity that has caused a fire;
    - when a fire occurs;
    - the location and status of a fire.

Logistics and organization

- How are fires most often spotted?
- How long does it take to get to a fire once it has been spotted?
- Are there any areas that the wildfire management team cannot access?
- Discuss the role and age and gender diversity in each of the three aspects of the 5R's of CBFiM.

Legal issues

- Are people who illegally light fires caught?
- What happens if they are caught?
- Are there repeat offenders?

Appendix 5. Risk reduction resources

Establishing Community Based Fire Management on the Tonle Sap Lake

Appendix 6. Fire suppression equipment

Locally available pumps suitable for use in fire suppression

Pump showing inlet hose

Pump/hose joiners needed to attach outlet hose

Screw coupling used to attach lengths of outlet hose to one another.

PVC outlet hose which needs to 250 m long so that it can be easily handled in the field.

Battery powered backpack water tank.

Bush knife (without handle) for clearing large woody vegetation.

Hand tools for clearing vegetation

Gloves   Boots

Safety clothing