Low Carbon, Green Growth

PROCEEDINGS

International Symposium
Use of Incident Command Systems in Fire Management

Date

February 3, 2009

Place

Inje Univ. (Kimhae)

산림청
KOREA FOREST SERVICE

KFRI
국립산림과학원
KOREA FOREST RESEARCH INSTITUTE

인제대학교
INJE UNIVERSITY

Opening Address

I wish to welcome you to the International Symposium in Inje University.

Considering the frequent and large-sized forest fires, I believe that the main topic of the symposium would be very timely. By sharing emergency solution systems of East Asia Region, I have no doubt that this is a unique opportunities to contribute to development of domestic crisis solution, anti-forest fire methods, efficient extinguishment system as well as forest fire management.

Through this symposium, it is very meaningful to arouse people's attention to the values of forest and dangers of forest fire. Based on this, business, universities and institutes related to this field will be able to strengthen research organization.

In particular, Gimhae, adjacent to Inje University, has experienced a big-sized forest fire. Therefore, the potential danger of forest fire remains exisiting. I am very honored to hold international symposium, titled "ICS in Asian Region" with 30th anniversary of Inje University.

I deeply appreciate your coming to the International Symposium for the presentation from both domestic and foreign countries. I wish you the best of luck. Thank you.

February 3, 2009

CHOI, Heung Kook

Director General

Industry Academic Cooperation Foundation, Inje University

Congratulatory Address

Honorable Dr. Johann G. Goldammer, Chairman of the Global Fire Monitoring Center (GFMC) under the UN International Strategy for Disaster Reduction (ISDR),
Distinguished delegates from the Northeast Asian countries,
Distinguished guests and representatives from local governments and organizations,
Ladies and gentlemen!

Acknowledging the significance of this international symposium on forest fire with the theme involving ICS at the distinguished Inje University along with exceptional professionals and experts from home and abroad, it gives me great honor to deliver my congratulatory address at this symposium which is held back in Korea, 5 years after the establishment of the Northeast Asia Forest Fire Network.

I hope that we could find better strategies for forest fire control through presentations of the member countries on mitigating forest fire damage and incident command system for early suppression, as well as information sharing on forest fire policies and experiences.

As you know, the Korean government in collaboration with the people has successfully rehabilitated the degraded forest in the 60's and the 70's. This accomplishment has been noted by the FAO as a remarkable success. We have pride in achieving such a significant accomplishment.

However, global warming is expected to worsen forest disease and pests as well as forest fire. Therefore, I believe that there is a need to devise a forest fire control policy that will minimize damage and reduce carbon emission.

Korea has experienced large-scale forest fires several times in the past to remind us the necessity of a systematic scheme. Based on the experiences and studies on the ICS of advanced countries, we were able to develop our own Guidelines on Incident Command System on which we have implemented educational and training programs.

I believe that one of the most important part is regular practice drills. This will enable acting in order in case of an incident.

In this regard, I put much significance in today's symposium. I am looking forward to valuable presentations and open-minded sharing and discussion of experiences in search for more effective forest fire control strategies.

Once again, I would like to extend my sincere appreciation for the distinguished delegates and all those concerned for the preparation of the symposium. I wish all of you good health and good fortune.

Thank you.

HUR, Kyoung Tae
Director General of Forest Protection Bureau
Korea Forest Service

Welcome Address

Dr. Johann G. Goldammer, chair of the Global Fire Monitoring Center (GFMC) under the UN International Strategy for Disaster Reduction (ISDR),
Forest fire control experts from Asian countries and
Distinguished participants,

First, I'd like to thank all of you for attending this symposium despite your busy schedule as forest fire awareness campaigns have started early on due to the dry winter season.

Today, I would like to congratulate the opening of the 'International Symposium on Climate Change and Forest Fire Control'. Also, it's my honor and delight to deliver this welcome address on this special occasion.

As the FAO has acclaimed Korea is a country with abundant forest resources, which was possible after successfully afforesting the once degraded and denuded land in a short period of time. As the ecosystem is adversely affected by global warming, however, the forests are suffering and natural hazards such as insect pests and landslides are making matters worse. Under such circumstances, what is more disturbing is that forest fires are often caused by one minor mistake, resulting in the devastation of forests, damage to property and loss of human lives.

Since 1990, the magnitude of forest fires has become larger and occurred from all over the world simultaneously. This indicates that, unlike in the past, forest fires are no longer a problem of our own, but an international issue. The massive forest fires that swept Greece in 2007 can be a case in point.

Besides, the damage to international cultural assets by forest fires has become a major concern. Moreover, the toxic smoke and fumes from fires spread to

neighboring countries, increasing the likelihood that the vulnerable such as the elderly and children die from respiratory ailments.

Forest fires are mostly man-made disasters in that, according to statistics, they are caused by people's carelessness or negligence. Therefore, if we establish a policy to control and curb forest fires and dedicate ourselves to that initiative constantly, we will be able to reduce the scale of damage.

For the past years, we witnessed several large-scale forest fires here in Korea - in Kosung (1996), in the East Coast region (2000), in Chungyang, Yaesan (2002) and in Yangyang (2005). Since then, we have established a forest control system suited to our situation. On top of that, we are now customizing this system to meet regional needs and circumstances.

Recently forest fire management is considered as one of the solutions to global warming, as the forests act as a sink by absorbing carbon dioxide (CO_2). Accordingly, the Korean government is sparing no effort in achieving its vision, Low-carbon Green Growth. In this regard, this international symposium on the forest fire control and ICS is timely and significant.

Lastly, I expect that we can share and exchange information and experience on forest fire control among countries through presentation and discussion. I believe that this symposium will serve as an opportunity to help countries reduce forest fire damage.

Thank you.

Choi Wan Yong
Director General
Korea Forest Research Institute

Program

3 February(Tue)

Sponsored by Korea Forest Service, Global Fire Monitoring Center

Organized by Korea Forest Research Institute, Inje University

Date	Session	Time	Title	Speakers/Chairs	Affiliation
		09:00 - 09:30	**Registration**		
Feb. 3	**Opening**	09:30 - 09:35	Opening Address	Dr. Heung Kook CHOI, Director General, Industry Academic Cooperation Foundation, Inje University, Korea	
		09:35 - 09:40	Congratulatory Address	Director General, KFS (Kyung Tae HEO, Director of a Bureau, KFS, Korea)	
		09:40 - 09:45	Welcome Address	Director General, KFRI (Dr. Joon Hwan SHIN, Assist. Director General, KFRI, Korea)	
		09:45 - 10:00	Photo time & Coffee Break		
	1	**10:00 - 11:45**		Dr. Myung Bo LEE	Korea Forest Research Institute, Korea
			Improvement of Governance in International Wildfire Dosaster Response: The International Wildfire Incident Management System	Dr. Johann G. Goldammer	The Coordinator of the UN_ISDR / GFMC
			A System Scheme for ICS Efficiency of Korea	Prof. Kwang Il KIM	Inje University, Korea
			Update on the Implementation of the ASEAN Agreement on Transboundary Haze Pollution	Ms. Riena Prasiddha	Association of Southeast Asian Nations, Secretariat

Date	Session	Time	Title	Speakers/Chairs	Affiliation
			Regional South Asia Wildfire Incident Management System:Need for Intervention	Mr. Sundar P. Sharma	Ministry of Water Resources, Nepal
		11:45 - 13:30	**Lunch**		
	2	13:30 - 15:10		Dr. Shu Lifu	Chinese Academy of Forestry, China
			Education for Early Suppresion of Wildlandfire by Utilization of IT in Korea(Case Study)	Dr. Kyo Sang KOO	Korea Forest Research Institute, Korea
			Incident Command System in Fire Management, Thailand Report	Mr. Siri Akaakara	Wildlife and Plant Conservation Department, Thailand
			Use of Incident Command System in Central Asia and Russia	Dr. Leonid Kondrashov	Pacific Forest Forum, Russia
			Wildfire Incident Management System in Mongolia	Dr. Colonel Ganbaatar Jamiyansuren	Fire Department Agency (NEMA), Mongolia
		15:10 - 15:30	Coffee Break		
	3	15:30 - 16:45			
			Construction Plan of Ground Forest Fire Fighter Conduct Manual on Use of Incident Command System in Korea	Prof. Si Young LEE	Kangwon National University, Korea
			Incident Command System in Fire Management, Indonesia Report	Dr. Bambang Hero Saharjo	Bogor Agricultural University, Indonesia
			Forest Fire Suppressions in China	Dr. Wang Mingyu	Chiness Academy of Forestry, China
		16:45 - 17:30	**Discussion and Closing ceremony**		
		17:30 -	**Dinner**		

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Session 1

Improvement of Governance in International Wildfire Disaster Response: The International Wilsfire Incident Management System

국제적 산불 재난 대응 관리 방식 개선 대응
: 국제적인 산불 사건 관리 체계

Goldammer, Johann Georg

Abstract

Increasing vulnerability of societies and the environment to wildfires is noted globally and in particular in the Asian region. The destructivity of wildfire disasters and the transboundary consequences of fires is prompting governments to develop cooperative mutual (reciprocal) agreements on emergency assistance at bilateral and in some cases at multilateral levels. The UNISDR Global Wildland Fire Network (GWFN), a network facilitated by the UNISDR Wildland Fire Advisory Group (WFAG) and the Global Fire Monitoring Center (GFMC), is promoting international cooperation in wildland fire management, notably through capacity building in wildfire prevention, preparedness and suppression, and the development of standardized procedures for use in international wildfire incident response. Long-term GWFN is also aiming at the development of an International Wildland Fire Accord (voluntary or binding under international law), which would be based on the rationale that the protection of global vegetation cover against degradation or destruction by fire will contribute to disaster risk reduction, e.g., fire-generated smoke pollution affecting human health and security, release of greenhouse gases, secondary disasters such as landslides, erosion, and floods. In preparation of the process the international community cooperating under the umbrella of the GWFN and supported by UN agencies and programs (notably UNISDR, FAO, UNEP, OCHA, WMO, WHO, UNFCCC, CBD, CCD) has developed a number of tools, templates and models for improving governance, efficiency and effectiveness of international cooperation in wildfire disaster risk reduction, management and response. These tools will be important for the

development and implementation of cooperative agreements in the Asian region to share resources in wildland fire management and wildfire disaster response. One of the tools, the proposed International Wildfire Incident Management System will be a key prerequisite to improvement of governance in international wildfire disaster response.The UNEP-led *Rosersberg Initiative*, which is aiming at strengthening the international system in environmental emergencies, will be an important partner.

요 약

사회와 환경이 산불에 대한 취약성이 증가하고 있는 상황은 세계적으로, 특히 아시아 지역에서 주목 받고 있다. 산불 재난의 파괴력과 경계를 넘나드는 화재의 결과들은 각 정부들로 하여금 두 나라간에, 혹은 몇몇 경우에는 다국간에 비상사태 지원에 대한 협력적인 상호 협정을 맺도록 자극하고 있다. UNISDR의 산불 자문 그룹 (WFAG)와 지구 산불 모니터링 센터(GFMC)에 의해 촉진된 네트워크인 UNISDR 지구 산불 네트워크(GWFN)는 산불 관리에 있어서 특히 산불 예방, 방어태세, 진화 능력 신장과 국제적 산불 사건 대응에 사용할 표준화된 절차의 개발에 대한 국제적인 협력을 증진시키고 있다. 장기적인 GWFN은 또한 장기적으로 국제 산불 협정(자발적인 혹은 국제법 하에 의무적인)의 개발을 목표로 하고 있다. 이 협정은 화재로 인한 붕괴와 파괴를 막기 위한 전 세계의 식피 보호가 재해 위험, 예를 들면 인간의 건강과 안정에 영향을 미치는 화재로 야기된 연주공해, 온난화 가스들의 배출, 산사태, 침식, 홍수와 같은 이차적인 재난을 줄이는데 기여할 것이라는 생각에 기초한 것이다. 이 과정을 준비함에 있어 GWFN의 비호와 UN 산하 기관과 프로그램 (주로 UNISDR, FAO, UNEP, OCHA, WMO, WHO, UNFCCC, CBD, CCD)의 후원 하에서 국제사회의 협력이 수많은 방법, 기본골격과 모델을 개발하였다. 이들은 산불 재난 위험을 감소시키고, 관리하고 대응하는데 있어 국제적인 협력의 관리방식, 효율성과 유효성을 증진시키기 위한 것들이다. 이 방편들은 아시아 지역에서 산불 관리와 산불 재난 대응에 있어 협력 조약을 맺고 실행하기 위해 중요하다. 여러 방편들 중 하나로 국제 산불 사건 관리 체계는 국제적 산불재난 대응의 관리방식 개선에 있어 핵심적인 선행 조건이 될 것이다. UNEP가 이끌고 있는 Rosersberg 발안은 환경적 비상사태에 있어서 국제적 시스템의 강화를 목표로 하고 있으며, 중요한 협력자가 될 것이다.

Improvement of Governance in International Wildfire Disaster Response: The International Wilsfire Incident Management System

Goldammer, Johann Georg

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Abstract

Increasing vulnerability of societies and the environment to wildfires is noted globally and in particular in the Asian region. The destructivity of wildfire disasters and the transboundary consequences of fires is prompting governments to develop cooperative mutual (reciprocal) agreements on emergency assistance at bilateral and in some cases at multilateral levels. The UNISDR Global Wildland Fire Network (GWFN), a network facilitated by the UNISDR Wildland Fire Advisory Group (WFAG) and the Global Fire Monitoring Center (GFMC), is promoting international cooperation in wildland fire management, notably through capacity building in wildfire prevention, preparedness and suppression, and the development of standardized procedures for use in international wildfire incident response. Long-term GWFN is also aiming at the development of an International Wildland Fire Accord (voluntary or binding under international law), which would be based on the rationale that the protection of global vegetation cover against degradation or destruction by fire will contribute to disaster risk reduction, e.g., fire-generated smoke pollution affecting human health and security, release of greenhouse gases, secondary disasters such as landslides, erosion, and floods. In preparation of the process the international community cooperating under the umbrella of the GWFN and supported by UN agencies and programs (notably UNISDR, FAO, UNEP, OCHA, WMO, WHO, UNFCCC, CBD, CCD)

has developed a number of tools, templates and models for improving governance, efficiency and effectiveness of international cooperation in wildfire disaster risk reduction, management and response. These tools will be important for the development and implementation of cooperative agreements in the Asian region to share resources in wildland fire management and wildfire disaster response. One of the tools, the proposed International Wildfire Incident Management System will be a key prerequisite to improvement of governance in international wildfire disaster response.The UNEP-led *Rosersberg Initiative*, which is aiming at strengthening the international system in environmental emergencies, will be an important partner.

1. INTRODUCTION

Increasing vulnerability of societies and the environment to wildfires is noted globally and in particular in the Asian region. The destructivity of wildfire disasters and the transboundary consequences of fires is prompting governments to develop cooperative mutual (reciprocal) agreements on emergency assistance at bilateral and in some cases at multilateral levels. The UNISDR Global Wildland Fire Network (GWFN), a network facilitated by the UNISDR Wildland Fire Advisory Group (WFAG) and the Global Fire Monitoring Center (GFMC), is promoting international cooperation in wildland fire management, notably through capacity building in wildfire prevention, preparedness and suppression, and the development of standardized procedures for use in international wildfire incident response. Long-term GWFN is also aiming at the development of an International Wildland Fire Accord (voluntary or binding under international law), which would be based on the rationale that the protection of global vegetation cover against degradation or destruction by fire will contribute to disaster risk reduction, e.g., fire-generated smoke pollution affecting human health and security, release of greenhouse gases, secondary disasters such as landslides, erosion, and floods, as well as threats to biodiversity.

In preparation of the process the international community cooperating under the umbrella of the GWFN and supported by UN agencies and programs (notably UNISDR, FAO, UNEP, OCHA, WMO, WHO, UNFCCC, CBD, CCD) has developed a number of tools, templates and models for improving governance, efficiency and effectiveness of international cooperation in wildfire disaster risk

reduction, management and response. These tools will be important for the development and implementation of cooperative agreements in the Asian region to share resources in wildland fire management and wildfire disaster response. The tools include an international wildland fire terminology, wildland fire risk identification at national, regional, and global levels, non-binding guidelines for fire management and smoke management, including dedicated ecozonal fire management guidelines, the use of a standardized, commonly accepted wildland fire incident management system for international cooperation in a disaster situation. The network has also developed a template for international wildland fire management cooperation agreements for the use by countries interested in entering into formal relationships and agreements on reciprocal assistance with other countries facing similar issues. Training in fire disaster management through development of internationally compatible standards and competency, as well as certification of international fire responders, are important elements of improving international cooperation in wildland fire management. One of the tools, the proposed International Wildfire Incident Management System will be a key prerequisite to improvement of governance in international wildfire disaster response.The UNEP-led "Rosersberg Initiative", which is aiming at strengthening the international system in environmental emergencies, will be an important partner.

In the following some key activities are described, which provide the ground for international cooperation in wildland fire management. The proposed International Wildfire Incident Management System must be understood as one of a larger set of tools that provide terms, procedures and products essential to be mastered if entering multinational cooperation in wildland fire management.

2. INTERNATIONAL WILDLAND FIRE TERMINOLOGY

The very basic prerequisite for international cooperation in fire management is a commonly agreed terminology, a language that is understood by all partners intending to develop cooperation in fire management. In a number of countries very useful terminologies have been developed. This includes English-speaking countries in which fire terminologies are becoming increasingly compatible at international level. However, terminologies show some differences in the use and meaning of terms. In some countries specific terms have been developed that are

not in use in other countries. As the English language is becoming the major language used for international cooperation in fire management it has been proven useful to develop a basic English glossary with English explanations of the terms, which would then be useful for translation. The "Global Wildland Fire Management Terminology", first published by FAO in the1980s (FAO, 1986) was updated by the Global Fire Monitoring Center (GFMC) on behalf of FAO in 1999. The glossary has not been printed as it is considered a dynamic document open for any changes considered necessary. The glossary is available on the web (Fig. 1 and 2). In 1986 French, German and Spanish had been included. In the 1999 version, however, the only non-English language updated was German. Countries are encouraged to develop a glossary based on the English version. Any additional language can be added to the online terminology at any time by GFMC. For details see Annex I.

Figure 1 Screenshot of the interactive Global Wildland Fire Management Terminology, available online at: http://www.fire.uni-freiburg.de/literature/glossary.htm

Figure 2 Screenshot of the result of entering the term "fuelbreak"

3. INTERNATIONAL STATISTICAL WILDLAND FIRE DATA COLLECTION

Internationally agreed methodologies and procedures for the establishment of fire databases and formats for national fire reporting are not in place. Both databases and national fire reports (assessments) are important for decision support at national, regional and international levels, as well as for assessment of needs and impacts and for targeted cooperation in fire management.

The FAO "Global Forest Fire Assessment 1990-2000" (an element of the Global Forest Resources Assessment 2000 - FRA-2000)[1] and the reports from the 12 UNISDR Regional Wildland Fire Networks, summarized and evaluated in the "Fire Management Global Assessment 2006"[2], revealed the lack of current, consistent and coherent statistical data sets. The concept of the detailed "Global Wildland Fire Assessment 2004", initiated by the GFMC, was used for a number of national reports submitted to the Regional Wildland Fire Networks.[3] However, the assessment covered only a marginal fraction of countries.

Information flow from national and regional level to an international clearing house for receiving, processing and disseminating fire data as well as other fire information back to countries and other users, connected with a network of national fire management agencies, must be ensured.

It is proposed to establish a Task Force to produce a proposal for a harmonized and coordinated data collection and reporting system that will meet the demands of various user communities as proposed by the UNECE/FAO/ILO in 1996[4] and build on the concept of the "Global Wildland Fire Assessment 2004" (Annex II).

The next step forward to overcome uncertainties and inconsistencies of fire inventories is the development of a global satellite-based vegetation fire inventory. The Global Observations of Forest and Land Cover Dynamics (GOFC/GOLD) project, an element of the Global Terrestrial Observing System (GTOS)

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[1] Global Forest Fire Assessment 1990-2000: http://www.fao.org/docrep/006/ad653e/ad653e00.htm
[2] Fire Management Global Assessment 2006:
   http://www.fao.org/docrep/009/a0969e/a0969e00.htm
[3] Global Wildland Fire Assessment 2004:
   http://www.fire.uni-freiburg.de/inventory/assessment.htm
[4] Initial proposal for a global fire dataset by the ECE/FAO International Conference "Forest, Fire, and Global Change": http://www.fire.uni-freiburg.de/iffn/org/ecefao/ece_3.htm#Appendix%20I

programme, sponsored by the Integrated Global Observing Strategy (IGOS), provides a forum for international information exchange, observation and data coordination, including calibration and validation of sensors and algorithms, and a framework for establishing the necessary long-term monitoring systems. The GOFC/GOLD Fire Mapping and Monitoring Theme is aiming at refining and articulating the international observation requirements and making the best possible use of fire products from the existing and future satellite observing systems, for fire management, policy decision-making and global change research.[5] The global vegetation fire inventory based on a joint satellite and ground-reporting approach will be defined in 2009.

4. INTERNATIONALLY COMPATIBLE TRAINING, STANDARDS AND COMPETENCY, AS WELL AS CERTIFICATION OF INTERNATIONAL FIRE RESPONDERS

Capacity building of human resources is a key prerequisite for efficient planning and implementation of sustainable fire management. Many countries that are in need of developing or reviewing fire policies or upgrading existing fire management methods and / or technologies, however, do not have own resources or expertise in capacity building in fire management. International cooperation in fire management is critical to support those countries. Priority for international cooperation should include advanced capacity building of target groups influential or responsible for developing fire policies, fire management planning and implementation. Multi-stakeholder, inter-sectoral and inter-agency approaches will be a key consideration. Non-government organizations and the private sector are important target groups to be included. Capacity building of instructors / training for trainers will be a key prerequisite for the success of building capacities at local to national level.

Advanced international training courses for fire management specialists working at high-level positions in their home country and in the private sector will support the development of a culture of trans-national cooperation. Experience has been gained by UN interagency training courses conducted by UNU-GFMC in Africa.

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[5] GOFC/GOLD Fire Implementation Team: http://gofc-fire.umd.edu/

In 2005 the United Nation University (UNU) and the Global Fire Monitoring Center (GFMC), in partnership with the UNU Institute for Environment and Human Security (UNU-EHS) and the UNISDR Global Wildland Fire Network, have created an initiative to provide advanced fire management training involving UN inter-agency contributions. A vision is to work through a decentralized worldwide network of training institutions in which donor organizations would collaborate. The development of international training materials is desirable.

In the case of fire suppression these must be based on competency standards that will ensure the smooth cooperation between firefighting units of different nations, i.e. their inter-operability in international missions. The EuroFire project is currently researching and reviewing competency-based wildfire training systems to identify best practice examples from Europe and around the world.[6] This research is informing the production of competency-based basic training materials specifically for use in European countries. The key target end-user groups for the EuroFire project are: fire-fighters, the rural and land-based sector, sectoral organisations and education and training institutions. EuroFire is also working with the parallel EU-sponsored Fire Paradox Project to share resources, support distribution of the material and encourage feedback.

A key context for the development of the competency-based standards is the need to develop criteria for the certification of firefighters deployed in international missions.

5. FIRE MANAGEMENT GUIDELINES

Fire Management Guidelines are needed for the various user levels, ranging from practical guidelines for local fire managers to guidelines for land-use planning and policy development. Guidelines must consider the specific natural (ecological) conditions of vegetation fire, as well as the social, cultural, economic and political environment. Valuable guidelines exist for local to global use. However, in many countries these guidelines are not known or not applied, or need to be adapted for the specific conditions, or need to be translated.

Fire management guidelines for international use have been developed by

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[6] EuroFire project website (coordinated by GFMC): http://www.euro-fire.eu/

international organizations since the 1990s. The main guidelines for international use are described detail in Annex 3 and include:

- International Tropical Timber Organization (ITTO) Guidelines on Fire Management in Tropical Forests (1997)
- The WHO/UNEP/WMO Health Guidelines for Vegetation Fire Events (1999)
- The FAO Guidelines on Fire Management in Temperate and Boreal Forests (2002)
- The Fire Management Voluntary Guidelines (2006)
- Fire management handbooks for international use, e.g.:
    - Wildland Fire Management Handbook for Sub-Sahara Africa
    - Wildland Fire Management: Handbook for Trainers

While guidelines have been developed primarily to serve countries to develop sound, sustainable fire management capacities, including fire management policies and implementation strategies, they are also providing guidance on standard approaches or standards in fire management that have been proven internationally and which will facilitate international cooperation in fire management.

6. INTERNATIONAL SYSTEMS TO BE SHARED: WILDLAND FIRE MONITORING AND EARLY WARNING

There are a number of fire management support tools that are based on international earth observation systems. These systems include spaceborne sensors for fire detection and monitoring, and terrestrial networks of hydrometeorological services for recording and forecasting of fire weather.

The Global Observations of Forest and Land Cover Dynamics (GOFC/GOLD) project, an element of the Global Terrestrial Observing System (GTOS) programme, sponsored by the Integrated Global Observing Strategy (IGOS), provides a forum for international information exchange, observation and data coordination, including calibration and validation of sensors and algorithms, and a framework for establishing the necessary long-term monitoring systems. The GOFC/GOLD Fire Mapping and Monitoring Theme is aimed at refining and

articulating the international observation requirements and making the best possible use of fire products from the existing and future satellite observing systems, for fire management, policy decision-making and global change research.[7] GOFC/GOLD and GFMC are closely interacting with the United Nations Office for Outer Space Affairs (UNOOSA), UNOSAT (Operational Satellite Applications Programme of the United Nations Institute for Training and Research – UNITAR), the International Charter "Space and Major Disasters", and the Group on Earth Observations (GEO) with its Global Earth Observing System of Systems (GEOSS).

In 2005 a global multi-hazard early warning system has been proposed in the Hyogo Framework for Action – an outcome of the World Conference on Disaster Reduction (WCDR), Kobe, Japan, January 2005. A project proposal for the Development for a Global Early Warning System for Wildland Fires submitted by an international consortium has been endorsed by the United Nations and presented at the Third International Conference on Early Warning (EWC-III), March 2006.[8] The Global Early Warning System for Wildland Fires aims at developing:

- Early warning of fire danger, on a global basis, that will provide international agencies, governments and local communities with an opportunity to mitigate fire damage by assessing threat likelihood and possibility of extreme behaviour enabling implementation of appropriate fire prevention, detection, preparedness, and fire response plans before wildfire problems begin.
- A globally robust operational early warning framework with an applied system that will provide the foundation with which to build resource-sharing agreements between nations during times of extreme fire danger.
- Development of local expertise and capacity building in fire management for system sustainability through technology transfer and training.

The initiative is supported by the Group on Earth Observations(GEO) Secretariat and closely cooperate with the UNISDR International Platform for Early Warning (PPEW) and the World Meteorological Organization (WMO).

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[7] GOFC/GOLD Fire Implementation Team: http://gofc-fire.umd.edu/
[8] Website of the Global Early Warning System for Wildland Fires:
   http://www.fire.uni-freiburg.de/fwf/EWS.htm

7. INTERNATIONAL WILDFIRE INCIDENT MANAGEMENT SYSTEM

As a result of severe fires over a number of years, national leaders have demanded a more coordinated approach to the management of wildfires, including receiving from or sending firefighting assistance to other countries. However, the ability to effectively cooperate between countries is still limited by organisation and communication barriers. In the USA, State and Federal legislators, concerned at the lack of uniform emergency management protocols, directed federal, state, and local government to develop a common incident command system that would enable wildland fire protection agencies to effectively coordinate interagency actions and to allocate suppression resources in dynamic, multiple fire situations. The creation of the "Incident Command System" (ICS) enabled emergency response personnel to work together toward common objectives. Australia and New Zealand, faced with similar emergency response issues, evaluated incident management systems around the world, elected to adopt the ICS and modify it to meet their specific needs.

The complexity of incident management, coupled with the growing need for multi-agency and multi-functional involvement at incidents has increased the need for a standard inter-agency incident management system not only within a country/state but increasing internationally. Many countries have adopted similar or common systems of addressing emergencies. In addition a number have developed firefighting agreements based on a common system enabling interoperability when lending support to other countries. In the past this is usually to support adjoining States or Countries within the same geographical region. Since 2000 we have seen examples of this being broadened by support provision occurring from different hemispheres. In 2000 and 2002, Australia and New Zealand sent critically needed incident managers to the USA. Similarly early in 2003 the USA reciprocated sending fire specialists to Australia. Canada and the USA frequently exchange firefighting forces, especially along their borders. New Zealand sent firefighting forces to Australia in 2002 and 2003.[9] ICS was also used during the wildland fire emergency in Ethiopia in 2000.[10]

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[9] See: International Arrangements on the Sharing of Wildland Fire Suppression Resources bet ween the United States of America and Australia and New Zealand: http://www.fire.uni-f reiburg.de/iffn/iffn_29/USA-Australia-NZ-Int-Arrangements.pdf

[10] See: **The Ethiopia Fire Emergency between February and April 2000:** http://www.fire.uni-

The Incident Command System may need to be adapted to suit a particular country's existing political, administrative or cultural systems, customs and values. Where the primary purpose is to enhance emergency management within a country, such adaptations are not only beneficial, but may be essential to have the ICS system adopted. If the purpose of adopting ICS is to enhance cooperation between countries, through the sharing of resources such as fire management teams, it is highly recommended that the sending country and the receiving country both use the same emergency management system.

A strategic paper produced by the International Wildland Fire Summit in Sydney, Australia, 8 October 2003, suggested that such a system should be the ICS. Given that ICS is a proven model in many countries and given that training materials for ICS are freely available, there is considerable benefit to be gained by a country adopting this system.

It is proposed to introduce an International Wildfire Incident Management System (IWFMS) based on the principles of the ICS. This system would not necessarily require that ICS would be the incident management system of the country receiving or providing firefighting assistance. The IWFMS would be activated when two or more countries would cooperate in wildfire emergencies, e.g. as it is increasingly the case within the European Union.

IWFMS would also be considered as a candidate system to be introduced in the UN-driven process to strengthen the international system of responding to environmental emergencies. The UNEP and OCHA have established the international Advisory Group on Environmental Emergencies (AGEE) as their most important cooperation and support mechanism for the response to environmental disasters. The AGEE is an international forum that brings together environmental experts from around the world to share information, expertise and lessons learned for improved response to environmental emergencies worldwide, and in particular in developing countries. In 2007 AGEE founded the "Rosersberg Initiative", which aims at strengthening the global regime that governs environmental emergency response and preparedness.[11] The GFMC on behalf of the Global Wildland Fire Network is currently preparing a procedure for the UN to introduce the IWFMS based on the concept paper for the international use of the ICS (Annex 4).

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freiburg.de/iffn/country/et/et_1.htm
[11] http://ochaonline.un.org/ToolsServices/EmergencyRelief/EnvironmentalEmergenciesandtheJEU/ RosersbergInitiative/tabid/2647/language/en-US/Default.aspx

8. TEMPLATE FOR INTERNATIONAL WILDLAND FIRE MANAGEMENT COOPERATION AGREEMENTS

The International Wildland Fire Summit of 8 October 2003 provided an important forums for discussions of how to manage the future of international wildland fire management and share solutions to global problems. One of the outcomes of the Summit was a paper that offered a template and information on cooperation in wildland fire management to countries interested in entering into formal relationships and agreements with other countries facing similar issues. The paper is intended to enhance current international coordination and cooperation by providing information on the following:

- A Template outlining areas to consider when developing international cooperative agreements;
- Listing of the types of cooperation and assistance that may occur between countries;
- The responsibilities of countries sending assistance and of those receiving assistance;
- Websites containing information and examples of existing cooperative agreements and arrangements.

This paper, which is provided in full length in Annex 5, may serve as a proposal for Asian countries to develop border-crossing agreements for mutual wildfire disaster assistance.

9. CONCLUSIONS: TOWARDS ENHANCING INTERNATIONAL COOPERATION IN WILDLAND FIRE MANAGEMENT

The United Nations International Strategy for Disaster Reduction (UN-ISDR) and its Wildland Fire Advisory Group are working to assist and strengthen the efforts of United Nations bodies, other international organizations, and non-governmental organizations, to reduce the negative impacts of wildland fires. Similarly, the UN-ISDR Global Wildland Fire Network (GWFN), the Global Fire Monitoring Center (GFMC) and the FAO are working systematically to increase the intra- and inter- regional cooperation in wildland fire management in the

world. Consultations of the Regional Wildland Fire Networks in 2003-2004 revealed that the majority of countries worldwide is ready to establish and strengthen regional and international dialogues on cooperation and exchange of information, research and wildland fire management, including through agreements.

Figure 3 Overview of international organizations sharing responsibilities and tasks in global wildland management [12]

At the 4th International Wildland Fire Conference (Sevilla, Spain, May 2007) the representatives of the Regional Wildland Fire Networks and the participants of the joint regional sessions agreed to the need to develop synergies through coordinated and collective action to address the most pressing problems

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[12] Goldammer, J.G., 2006. Fire Management. Review of International Cooperation. FAO Fire Management Working Paper FM18, 45 p. http://www.fao.org/docrep/009/J9406E/J9406E00.htm

related to fire management globally. [13] Further the conference participants recommended that:

- The international wildland fire community pursue the development of a global-scale international resource sharing strategy to assist countries with fire management planning activities (including prescribed fire for ecological purposes and fuels management), and active support during periods of wildland fire;
- The FAO promote the global adoption of Incident Command System (ICS) including the publishing of an annual list of countries which have implemented ICS;
- Regional strategies for fire management be developed and designed to the specific needs of regions;
- An international framework for fire management standards be developed and regional wildland fire training be supported, especially to meet the needs for capacity building in developing countries;
- Scientific research programmes addressing the consequences of changes of climate, land use and land cover, and socio-economic changes on fire regimes, environment and society must be supported at all levels;
- The Strategy to Enhance International Cooperation in Wildland Fire Management and the implementation of the Fire Management Voluntary Guidelines be encouraged and endorsed;
- Agencies and groups be encouraged to participate in the Fire Management Actions Alliance in support of their adoption of the Voluntary Guidelines;
- The UNISDR Global Wildland Fire Network, the Regional Wildland Fire Networks and the Secretariat of the global network, the Global Fire Monitoring Center (GFMC), be supported by national agencies and international donors aimed at fostering international cooperation in fire management, including collecting and disseminating fire information, arranging and enhancing international policy dialogue, and supporting projects;
- A series of Regional Consultations tentatively addressing "Global Change and Wildland Fire: Regional Solutions for Fire Management" – be held

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[13] The results of the 4th International Wildland Fire Conference are documented at:
http://www.fire.uni-freiburg.de/sevilla-2007.html

globally, within the next 1-2 years, to progress the global issues that are impacting people, resources and livelihoods;

▪ The 2nd International Wildland Fire Summit – tentatively addressing "Global Change and Wildland Fire: Fire Management Solutions for Mitigation and Adaptation" – be held within the next 2 to 4 years under the auspices of the United Nations and partners.

The Pan-Asia Forest Fire Consultation, Busan, South Korea, 1-7 February 2009, is a response to these challenges set by the 4th International Wildland Fire Conference.

12. REFERENCES

Note: References have been provided as footnotes or embedded in the text of this paper in order to facilitate online reading. Further search for documents on international cooperation in wildland fire management is facilitated by the search engine on the GFMC homepage (http://www.fire.uni-freiburg.de/). For searching documents only a relevant term (without adding "fire" etc.) needs to be entered.

13. Annexes

Annex 1: Wildland Fire Management Terminologies

Some Remarks concerning the revision of the 1986 FAO Wildland Fire Management Terminology (FAO 1986. Wildland Fire Management Terminology. Food and Agriculture Organization of the United Nations, FAO Forestry Paper 70, 257 p.) by the Global Fire Monitoring Center (GFMC). The terminology is available online at:
http://www.fire.uni-freiburg.de/literature/glossary.htm

In producing this version the GFMC has entered the whole glossary of the 1986 version. GMFC has added, compared and harmonized the English base document with other major national fire management terminologies and some encyclopaedias and websites, such as:

- National Research Council Canada (1987). Glossary of Forest Fire Management Terms. Canadian Committee on Forest Fire Management. Ottawa. 91 p.
- National Wildfire Coordination Group (1985). Smoke Management Glossary. Smoke Management Guide Produced by: Prescribed Fire and Fire Effects Working Team. Boise, Idaho. 28 p.
- National Wildfire Coordination Group (1989). A Guide for Prescribed Fire in Southern Forests. Boise, Idaho. 56 p.
- National Wildfire Coordination Group (1994). Introduction to Wildland fire Behavior S-190. Student Workbook. Boise, Idaho. 66 p.
- National Wildfire Coordination Group (1996). Glossary of Wildland Fire Terminology. Incident Operations Standards Working Team. Boise, Idaho. 162 p.
- International Tropical Timber Organization (ITTO) 1997. ITTO Guidelines on Fire Management in Tropical Forests. ITTO Policy Development Series No.6. ITTO, Yokohama, 40 p. (J.G. Goldammer, senior author)
- Random House Webster's Electronic Dictionary and Thesaurus, College Edition Version 1.0, Software.
- Society of American Foresters (1990). Glossary of Wildland Fire Management Terms Used in the United States. University of Arizona press. Tuscon, Arizona. 138 p.
- NASA (1999). Fire Monitoring Glossary. Responsible NASA Officials: Chris Justice and Yoram Kaufman: http://modarch.gsfc.nasa.gov/fire_ atlas/ glossary.html
- NASA (1999). Glossary of Terms. Atmospheric Sciences NASA Langley Research Center: http://asd-www.larc.nasa.gov/biomass_burn/glossary. html
- DELFI (1999) The DELFI vocabulary. CONCERTED ACTION Definition and Creation of a Common Knowledge Base for Forest Fires ENV4-CT98-0735. http://www.cinar.gr/delfi/
- Encyclopædia Britannica, Britannica.com: http://www.britannica.com/

Other Online Fire Terminologies

Note: Some of the listed terminologies are hosted by various websites. In some cases of the following list the web address is taken from the GFMC portal:

- U.S. Forest Service Online Fire Management Glossary: http://www.fs.fed. us/r2/nfp/glossary.htm
- Glossary of Wildland Fire Terminology (US National Wildfire Coordination Group, Incident Operations Standards Working Team, published in 2006: http://www.fire.uni-freiburg.de/literature/US-NFCG-Fire-Mgmt-Glossary-2006.pdf
- Australasian Fire Authorities Council (AFAC) Updated Wildfire Glossary (2008): http://www.afac.com.au/awsv2/publications/Wildfire_Glossary_ Indexed_2008.pdf
- Tall Timbers Research Station (Florida, USA) offers a library which contains the E. V. Komarek Fire Ecology Thesaurus: http://www. talltimbers.org/research/fethesaurus.htm

Annex 2: International Statistical Wildland Fire Data Collection

(A) Draft Proposal for the Development of a Standardized Fire Inventory System

The following proposal was included in the conclusions and recommendations of the ECE/FAO/ILO Seminar on "Forest, Fire, and Global Change", Shushenskoye (Russian Federation), 4-9 August 1996. <u>Note</u>: The proposal is included in its original version and does not reflect any changes of designations or mechanisms at international level including within the UN system.[14]

I. Preamble
A Vegetation Fire Inventory System at both national and international levels serves a large number of practical needs:

1 Regional - national fire management
a.   budget - resource requirements
b.   daily to annual tracking of activity compared to normal
c.   long-term trends
d.   interagency - intergovernmental assistance
e.   changes in long term trends

2 Regional - national non-fire
a.   integrated assessments - monitoring of fire impacts on other resources
b.   policies and regulations on
    i.   air quality
    ii.   global change
    iii.   biodiversity

3 International use of fire inventory
a.   updated forest inventory; availability of timber; fire integrated in resource availability salvage
b.   market strategies

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[14] Original publication: http://www.fire.uni-freiburg.de/iffn/org/ecefao/ece_3.htm#Annex%20I

c.   import- export policies - strategies
d.   food and fibre availability rangelands
e.   interagency - intergovernmental assistance agreements
f.   national security
    i.   food and fibre assessment grass and fodder
    ii.   water supply and quality
g.   research
    i.   global change
    ii.   integrated assessments monitoring
h.   international treaties, agreements
    i.   UNCED
       -   climate convention
       -   biodiversity
    ii.   CSD, IPF
    iii.   Montreal protocol on ozone
    iv.   IDNDR, others

4 Economic data utility national, but not international compatibility of assumptions

II – Information Requirements

A. Classes of information

1. alpha type
- fire start and end dates
- fire location (lat, long; resolution?)
- fire size
- cause of fire

2. beta type
- fuels - biome classification
- fuel loading forest inventory, age class, size class

3. gamma type
- fire characterization (crown, surface, etc.)
- fuel consumption
- structural involvement (wildland urban interface)

4. delta type (current ECE/FAO)
- number of fires
- area burned (by forest type)
- cause of fires (number)

5. epsilon type
- gas and aerosol emission data

6. eta type
- total expenditure of fire programme
- total fire suppression costs
- total direct losses of merchantable timber, structural losses

B. Decision Space Table

Information use	Information type					Frequency of info
	alpha	beta	gamma	delta	eta	
Regional/National (fire)						
1. Budget resource requirements	X	X			X	A
2. Daily to annual fire activity	X	X	X		X	DWMA
3. Long term trends	X	X	X		X	A
4. Interagency agreements	X				X	DWMA
5. Resource allocation	X	X	X		X	
Regional/National (non fire)						
Assessment monitoring	X	X				A
7. Air quality policy regulations	X	X		X		A
8. Global change policy regulations	X	X	X			A
9. Habitat change						A
International (fire)						
10. Intergovernmental assistance	X	X	X		X	A
International (non-fire)						
Treaties and agreements	X	X	X	X		A
12. National security	X	X	X			DWM
13. Research		X	X	X	X	A
14. Market import/export forecasting	X	X		X	X	A

Frequency of Information: D = daily; W = weekly; M = monthly; A = annual

C. Parsimonious Fire Inventory

Intergovernmental assistance at bilateral or regional level does not require a global database. These agreements are regional and may differ in requirements from one region to another. If we exclude national security, we need only annual data for a global database. The gamma data type is assembled from the alpha data so there is no need to report this separately. The beta data on fuels can be obtained from other inventories, but must be standardized. The gamma data type will also require development of international standards before it can be considered. All vegetation fires must be included in this database.

III – Establishment of Mechanisms to Collect and Distribute Fire Inventory Data on a Global Scale

A. Current State of Fire Inventory

1. Data consisting of individual fire reports are developed by many nations, but many regions of the world are not covered.
2. Only ECE and EU nations have established mechanisms to share data.
3. Current shared data consists of statistics aggregated from individual fire reports.
4. Data from remote sensing is rapidly becoming available, but only for fires that can be defined by either heat signature or by fire scars on the landscape.

B. Issues

1. A large number of uses of an international fire inventory have been identified in fire management, environmental policy and agreements, and in economic growth of nations.
2. A parsimonious inventory has been identified which can be utilized by all nations (see statement on standardized fire inventory).
3. There needs to be international agreement to provide fire inventory (similar to the FAO global forest inventory).

C. Implementation

1. Fire inventory at the global scale should consist of individual fire data of date of fire start and end, location of fire, size of fire, and cause of fire. Fire location from individual fire reports normally report origin of fire. Remote sensed data are more likely to report centre of burned area. Should fire reports contain centre rather than origin, in addition to origin?
2. Two additional forms of data will be needed in the future, biome classification and fire characterization. Standard for these additional information will need to be developed
3. Rapid electronic communication is available for nearly all parts of the globe. Fire inventory data can be made available through World Wide Web. FAO is an appropriate centre to compile and distribute these data.
4. Remote sensed data will need to be placed in the same format as individual fire reports and be made available on World Wide Web (WWW).

Images can also be made available through WWW. Appropriate potential centres for compilation and distribution of these data are Ispra (EU) or NASA's EOS-DIS.

5.   Those nations which cannot provide data in electronic format, should agree upon a hard copy format which can be scanned and readily placed in electronic format

Annex 3: International Fire and Smoke Management Guidelines

(A) International Tropical Timber Organization (ITTO) Guidelines on Fire Management in Tropical Forests (1997)

The ITTO Guidelines on Fire Management in Tropical Forests build on the previously published ITTO Guidelines on Sustainable Management of Natural Tropical Forests, the Establishment and Sustainable Management of Planted Tropical Forests, and the Conservation of Biological Diversity in Tropical Production Forests. These fire management guidelines were designed to provide a base for policy makers and managers at various levels to develop programs and projects in which the specific national, socio-economic, and natural problems related to fire in tropical natural and planted forests will be addressed. The scope of the guidelines is to assist the ITTO producer and consumer countries to develop programs for reducing damage caused by fire; and to help tropical forest managers and rural residents to safely use and take advantage of the beneficial effects of fire in land-use systems. The Guidelines are in accordance with the UN Resolution 44/236 in which the 1990's were designated as the International Decade on Natural Disaster Reduction (IDNDR). One objective of IDNDR was to reduce damage, economic disruption, and loss of life caused by wildfires through concerted international actions, especially in developing countries.

The guidelines recognize that many forest fires originate in the agricultural and pastoral systems; and in degraded vegetation which is outside of forests. Therefore, fire management on former and degraded forest lands may help to re-establish productive forests and to safeguard the success of reforestation programs.

As a follow up of the ITTO-sponsored activities in the rehabilitation of forests destroyed by fires in East Kalimantan, Indonesia, the International Tropical Timber Council (ITTC) embarked upon the development of Guidelines for the protection of tropical forests against fire. Pursuant to a Decision of the Council, an Expert Panel comprising specialists form producer and consumer members was convened in Jakarta from 6-20 March 1995. Draft Guidelines, based on a background paper prepared by Dr. J.G. Goldammer (Germany) and Prof. S. Manan (Indonesia), were formulated and subsequently presented at the Eighteenth Session of the ITTC in Accra, Ghana.

Reference:

International Tropical Timber Organization (ITTO). 1997. ITTO Guidelines on Fire Management in Tropical Forests. ITTO Policy Development Series No.6. ITTO, Yokohama, 40 p.

Online Publication:

http://www.fire.uni-freiburg.de/programmes/itto/itto.htm

(B) WHO/UNEP/WMO Health Guidelines for Vegetation Fire Events (Guideline Document) (1999)

Human-caused and natural wildfires in forests and other vegetation as well as land-use fires occur in many parts of the world. Smoke from vegetation fires consists mainly of fine particulate matter in the respirable range and to a lesser extent, of carbon monoxide and polycyclic aromatic hydrocarbons, which are not generally relevant to the long distance transport of air pollutants. During the episode of smoke in the South East Asian countries, monitoring of particulate matter of mean aerodynamic diameter at or below 10 micrometers has shown that short-term air quality standards of the WHO 1987 Air Quality Guidelines for respirable particulate matter are largely exceeded.

The WHO therefore became active in three major planning meetings aimed to prepare programmes and guidelines which will contribute to prevent and manage disasters caused by smoke from vegetation fires and to mitigate their effects on human health:

Organization of the WHO Bi-Regional Workshop on Health Impacts of Haze-related Air Pollution (Kuala Lumpur, June 1998)
http://www.fire.uni-freiburg.de/programmes/un/who/whwsh.htm

Co-sponsoring of the WMO Regional Workshop on Transboundary Smoke and Haze in Southeast Asia (Singapore, June 1998)
http://www.fire.uni-freiburg.de/programmes/un/wmo/wmorep.htm
Organization of the Workshop on and drafting of WHO Health Guidelines for

Episodic Vegetation Fire Events (Lima, 6-9 October 1998)
http://www.fire.uni-freiburg.de/programmes/un/who/whorep.htm

On 6 November 2001 the WHO and the Max Planck Institute for Chemistry, representing the Global Fire Monitoring Center (GFMC), signed a Letter of Agreement (LoA) on collaboration in joint research and training related to the reduction of vegetation fire smoke impacts on human health.

Bibliographic Information on the Health Guidelines:

WHO/UNEP/WMO 1999a *Health Guidelines for Vegetation Fire Events – Guideline document*. D. Schwela, J.G. Goldammer, L. Morawska, O. Simpson (Eds.) United Nations Environment Programme, Nairobi, World Health Organization, Geneva, World Meteorological Organization, Geneva, Institute of Environmental Epidemiology, WHO Collaborating Centre for Environmental Epidemiology, Ministry of the Environment, Singapore (ISBN 981-04-1460-9)

WHO/UNEP/WMO 1999b *Health Guidelines for Vegetation Fire Events - Background Papers*. Kee-Tai-Goh, D. Schwela, J.G. Goldammer, O. Simpson (Eds.) United Nations Environment Programme, Nairobi, World Health Organization, Geneva, World Meteorological Organization, Geneva, Institute of Environmental Epidemiology, WHO Collaborating Centre for Environmental Epidemiology, Ministry of the Environment, Singapore (ISBN 981-04-1460-9)

WHO/UNEP/WMO 1999c *Health Guidelines for Vegetation Fire Events – Teachers' Guide*. D. Schwela, L. Morawska, Abu Bakar bin Jaafar (Eds.) United Nations Environment Programme, Nairobi, World Health Organization, Geneva, World Meteorological Organization, Geneva, Institute of Environmental Epidemiology, WHO Collaborating Centre for Environmental Epidemiology, Ministry of the Environment, Singapore (ISBN 981-04-1460-9)

Health Guidelines for Vegetation Fire Events (Guideline Document)
http://www.who.int/docstore/peh/Vegetation_fires/vegetation_fires.htm and
http://www.fire.uni-freiburg.de/vfe/WHO%20Health%20Guidelines%20Vegetation
%20Fires-Complete.pdf

Executive Summary published in IFFN No. 22 (January 2000)
http://www.fire.uni-freiburg.de/iffn/org/who/who_1.htm

(C) FAO Guidelines on Fire Management in Temperate and Boreal Forests (2002)

The primary concerns of forest managers and policy makers focus on questions concerning the local to global impacts of excessive and uncontrolled burning, broad-scale trends over time, and the options for instituting protocols that will lead to improved control. Other key questions involve determining in what circumstances fires pose a sufficiently serious problem to require action; what factors govern the incidence and impacts of fires in such cases; and what might be the relative costs and benefits of different options for reducing adverse impacts?

The majority of nations in the temperate and boreal zone have systems in place that permit appropriate fire management actions. However, in some countries there is still a deficiency in systematic approaches to fire management due to a lack of guiding policies or shortcomings in funding. In other places, traditional misconceptions in fire prevention are inefficient or expensive. Unchecked rural human population shifts, urbanization, and civil and frontier wars have also been identified in developing countries as significant contributors to degrading practices and increased fire risk in temperate forests. There are large forest areas in which natural or human-set fires have beneficial effects and improve ecosystem stability and diversity. The exclusion or suppression of fires in these ecosystems may have detrimental consequences, particularly because of a build-up of fuels and an increase in wildfire hazard. As a consequence, high-intensity and high–severity wildfires occur that are often difficult or even impossible to control.

These fire management guidelines are designed to provide a base for policy makers and managers at various levels to develop programs and projects in which the specific national, socio-economic, and natural problems related to fire in temperate and boreal natural and planted forests will be addressed. The scope of the guidelines is to assist countries in developing programs for reducing damage caused by fire; and to help forest managers and rural residents to safely use and take advantage of the beneficial effects of fire in land-use systems. The guidelines are in accordance with the FAO policy and take into account the recommendations of the FAO

Meeting on Public Policies Affecting Forest Fires (FAO 1999) and the FAO/ITTO International Expert Meeting on Forest Fire Management (FAO 2001a) and Legal Frameworks for Forest Fire Management: International Agreements and National Legislation (FAO 2002a).

The guidelines also address the objectives of the United Nations International Strategy for Disaster Reduction (ISDR) that has been established by the UN Economic and Social Council (ECOSOC) and the General Assembly of the United Nations (UN 1999), particularly the ISDR Interagency Task Force on Natural Disaster Reduction, Working Group on Wildland Fire. The Working Group on Wildland Fire supports the UN and other international stakeholders by providing an inter-sectoral and interdisciplinary global platform for policy support.

The guidelines recognize that many forest fires originate in agricultural and pastoral systems; and in degraded vegetation, outside of forest areas. Therefore, fire management on former and degraded forest lands may help to re-establish productive forests and to safeguard the success of reforestation programs.

The FAO Guidelines are complementary to:

- the ITTO Guidelines on Fire Management in Tropical Forests (ITTO 1997)
- the FAO Handbook on Forest Fire Protection as a Technical Guide For The Mediterranean Basin <FAO/Cemagref: Guide technique international Protection des forêts contre l'incendie. Fiches techniques pour les pays du Bassin Méditerranée> (FAO 2002b)
- the WHO/WMO/UNEP Health Guidelines for Vegetation Fire Events (Schwela et al. 1999)

The present paper is based on work carried out by a team of experts working under the overall coordination of FAO and the Global Fire Monitoring Center (GFMC), Germany.

Guidelines available on the internet: http://www.fao.org/forestry/35853/en/ and mirrored at the GFMC portal:
http://www.fire.uni-freiburg.de/programmes/un/fao/FAO%20Fire%20Guidelines%20Temp%20Bor.PDF

(D) **Fire Management Voluntary Guidelines (2006)**

The UNFCCC, UNCCD and UNFF have recognized the critical role of fire - on the one hand in maintaining fire dependent ecosystems, but on the other, causing deforestation, forest degradation and destruction of livelihoods, biodiversity and infrastructure. Following the recommendations of the 3rd International Wildland Fire Summit, Sydney, Australia, October 2003; Ministerial Meeting on Sustainable Forest Management, March 2005, and Committee on Forestry, March 2005, FAO has been coordinating a multi-stakeholder process to prepare voluntary guidelines for fire management to detail the framework of priority principles to provide the policy, legal, regulatory and other enabling conditions and strategic actions for more holistic approaches to fire management.

The fire management guidelines will be a voluntary and non-binding instrument tailored primarily to land-use policy makers, planners and managers in fire management including target users as the State, private sector and non-governmental organizations. The scope of the voluntary guidelines for fire management includes the positive and negative social, cultural, environmental and economic impacts of natural and planned fires in forests, woodlands, rangelands, grasslands, agricultural and rural-urban landscapes.

Technically the fire management coverage includes early warning, prevention, preparedness (international, national, sub-national and community), safe and effective initial attack on incidences of fire and landscape restoration following fire. The voluntary guidelines for fire management provide an international framework, outline the cross-sectoral issues, detail the principles and attributes necessary to balance social, cultural, environmental and economic dimensions of fire management and prescribe key actions necessary for planning and management of fires.

The voluntary guidelines also provide the framework towards achieving the Millennium Development Goals: particularly Goal 1 to eradicate extreme poverty and hunger; Goal 7 to ensure environmental sustainability; and Goal 8 to develop a global partnership for development.

The preparation process has involved core technical group and expert consultations with selected member Governments, private sector associations,

non-governmental organizations and inter-governmental organizations. The voluntary guidelines for fire management were presented to and discussed at the Regional Forestry Commissions and regional wildland fire management meetings in 2006. The voluntary guidelines for fire management (formerly the draft fire management code) were available on the internet from July 2006 and invitations made to all countries for them to conduct meetings to consider the contents and format and provide feedback by 30 October 2006. Based on recommendations and suggestions from these meetings and feedback, a final draft of the voluntary guidelines for fire management have been prepared and available on the FAO forestry website by the end of January 2007 and submitted to the Eighteenth Session of the Committee on Forestry (COFO) in March 2007 for their consideration and appropriate actions for implementation, particularly capacity building to translate the voluntary guidelines into policies and practices and in formalizing responsibilities and procedures for monitoring and reporting. In May 2007 the voluntary guidelines for fire management and an associated needs assessment were be presented at the 4th International Wildland Fire Conference. The attendees, a broad array of stakeholders, will strengthen partnerships and propose implementation strategies through their networks.

FAO's collaborating partners that provided inputs on an "in kind" basis included members of the International Liaison Committee of the 4th International Wildland Fire Conference, Spain, 2007; USDA Forest Service; Global Fire Monitoring Center (GFMC); UNISDR Global Wildland Fire Network; The Nature Conservancy and the Government of Spain. A broad stakeholder group of experts representing Governments, the private sector, IGOs and NGOs also gave of their valuable time.

Available at: http://www.fao.org/forestry/firealliance/en/ and at the GFMC fire management guidelines portal at:
http://www.fire.uni-freiburg.de/programmes/un/fao/FAO-Fire-Management-Voluntary
-Guidelines-2007.pdf
(E) Fire Management Handbooks for International Use

Wildland Fire Management Handbook for Sub-Sahara Africa

This GFMC publication was prepared by a consortium of 43 contributing authors. The 432-pages volume is available for a subsidized price for the African market.

Reference:

Goldammer, J.G., and C. de Ronde (eds.). 2004. Wildland Fire Management Handbook for Sub-Sahara Africa. Global Fire Monitoring Center and Oneworldbooks, Freiburg – Cape Town, 432 p. (ISBN 1- 919833-65-X).

Book orders:

* http://www.fire.uni-freiburg.de/GlobalNetworks/Africa/Flyer-Fire%20book
* %20AI%2022April04.pdf
* Fax-Order Form: http://www.fire.uni-freiburg.de/GlobalNetworks/Africa
* /fire_book_order_form.pdf
* Online-Order: www.oneworldbooks.com

Wildland Fire Management: Handbook for Trainers

The Finnish Ministry of Foreign Affairs (MFA) have supported implementation of the Voluntary Guidelines for Fire Management by financing review of the Handbook on Forest Fire Control, A Guide for Trainers, to incorporate the more holistic approaches. This new Handbook on Wildland Fire Management, for Trainers, will target field trainers/instructors, and thus complement the other recent Wildland Fire Management Handbooks; for Sub-Sahara Africa (2004), for North-East Asia (2006) in Russian, produced by the UNISDR and the Global Fire Monitoring Center (GFMC). This handbook production was supported by GFMC.

Reference:

Heikkilä, T.V., R.Grönqvist, and M. Jurvélius. 2007. Wildland Fire Management: Handbook for Trainers. Ministry for Foreign Affairs of Finland, Development Policy Information Unit. Helsinki, Finland, 236 p. (ISBN-13: 978-951-724-581-4)

Online publication:

* http://www.fire.uni-freiburg.de/literature/Fire-Management-Handbook-2007.pdf (PDF, 12 MB)

Annex 4: Basis for a future International Wildfire Incident Management System (IWFMS)

Outcomes of the International Wildland Fire Summit
Sydney, Australia, 8 October 2003

Strategic Paper
Incident Command System (ICS) [15]

Introduction

As a result of severe fires over a number of years, national leaders have demanded a more coordinated approach to the management of wildfires. There have been many examples over the years of large numbers of fire suppression agencies making gallant attempts to minimize the devastation of uncontrolled wildfires. However, their ability to effectively cooperate with other fire agencies was limited by organisation and communication barriers. In the USA, State and Federal legislators, concerned at the lack of uniform emergency management protocols, directed federal, state, and local government to develop a common incident command system that would make a quantum jump in the capabilities of wildland fire protection agencies to effectively coordinate interagency actions and to allocate suppression resources in dynamic, multiple fire situations. This landmark direction created the beginning of the Incident Command System (ICS), and the ability of emergency response personnel to work together toward common objectives. Australia and New Zealand, faced with similar emergency response issues, evaluated incident management systems around the world, elected to adopt the ICS and modify it to meet their specific needs.

The community expects that emergencies will be dealt with safely, effectively and efficiently by emergency services. Experience has shown that at times parochial attitudes, internal politics, and the lack of communication result in poorly

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[15] Published in: International Forest Fire News (IFFN) No. 29 (July – December 2003), p. 15-19 (http://www.fire.uni-freiburg.de/iffn/iffn_29/content29.htm)

managed emergency operations. Lack of co-ordination between agencies and unclear accountabilities often results in safety issues being overlooked. There is therefore, a professional, social, political and economic demand for the management of emergency incidents to be enhanced wherever possible.

The complexity of incident management, coupled with the growing need for multi-agency and multi-functional involvement at incidents has increased the need for a standard inter-agency incident management system not only within a country/state but increasing internationally. Many countries have adopted similar or common systems of addressing emergencies. In addition a number have developed firefighting agreements based on a common system enabling interoperability when lending support to other countries. In the past this is usually to support adjoining States or Countries within the same geographical region. Since 2000 we have seen examples of this being broadened by support provision occurring from different hemispheres. In 2000 and 2002, Australia and New Zealand sent critically needed incident managers to the USA. Similarly early in 2003 the USA reciprocated sending fire specialists to Australia. Canada and the USA frequently exchange firefighting forces, especially along their borders. New Zealand sent firefighting forces to Australia in 2002 and 2003. ICS was also used during the wildland fire emergency in Ethiopia in 2000.

The Incident Command System may need to be adapted to suit a particular country's existing political, administrative or cultural systems, customs and values. Where the primary purpose is to enhance emergency management within a country, such adaptations are not only beneficial, but may be essential to have the ICS system adopted. If the purpose of adopting ICS is to enhance cooperation between countries, through the sharing of resources such as fire management teams, it is highly recommended that the sending country and the receiving country both use the same emergency management system. This paper suggests that such a system should be the ICS. Given that ICS is a proven model in many countries and given that training materials for ICS are freely available, there is considerable benefit to be gained by a country adopting this system.

Objective

The purpose of this paper is to recommend the adoption of a common

international incident command system by all countries. This action will leverage the domestic capability of emergency response managers by utilizing other trained personnel within the country, will facilitate international training of fire managers, and will enhance the global interoperability of emergency managers. In many countries, emergency responders are periodically faced with overwhelming emergency situations, and additional emergency responders, trained to common operational procedures, are difficult to locate. The global capability to support other countries is often hampered by incompatible operating procedures or organizational incompatibilities.

Background

Incident management systems in one form or another exist in many countries. In most countries, local emergency operating protocols have evolved over the years to meet the specific demands of the jurisdiction. Many have been copied from the military command and control models. Unfortunately, most of these models do not provide consistent procedures or organizations throughout each country. The ICS is the most widely used incident management system. It was specifically designed to address the majority of management problems common to most complex incidents. These problems included:
- Inefficient supervisory span of control.
- Competing organizational structures
- Inconsistent or non-existent incident information
- Incompatible communication systems
- Uncoordinated planning across agency lines
- Unclear lines of authority
- Competing agency incident objectives
- Inconsistent terminology.

It took a considerable investment of time and effort to design an incident management system that could address all of those issues. ICS has a proven record in many countries around the world. ICS has been fully implemented in Australia, New Zealand, Canada, and the USA. Mexico and Costa Rica have interpreted the ICS training course into Spanish, and have begun to teach ICS to wildland firefighters. In addition, Taiwan, Bulgaria, and Mongolia have received

ICS training, and new training programs are starting in India and South East Asia. Recently, the USA has adopted ICS as the national incident management system to manage all domestic emergency threats and responses.

ICS was developed on four basic principles.
1. The system must be organizationally flexible to meet the needs of incidents of any size and kind.
2. Organizations must be able to use the system on a daily basis for routine situations and major emergencies.
3. The system must facilitate a common management structure that integrates personnel from different locations and from a variety of agencies.
4. The system must be cost effective.

ICS Framework

The ICS framework provides an effective forum for interagency emergency management issues to be addressed. By establishing a unified command of the respective agency/jurisdictional representatives together at a single interagency incident command location, the following advantages will be achieved:
- One set of objectives is developed for the entire incident.
- A collective approach is made to developing strategies to achieve incident objectives.
- Information flow and co-ordination is improved between all jurisdictions and agencies involved in the incident.
- All agencies with responsibility for the incident have an understanding of each other's priorities and restrictions.
- No agency's authority or legal requirement will be compromised or neglected.
- Each agency is fully aware of the plan, actions, and constraints of other agencies.
- The combined effects of all agencies are optimised as they perform their respective assignments under a single Incident Action Plan.
- Duplication of effort is reduced or eliminated thus reducing costs and the chance of frustration and/or conflict.

From this unified approach, a single incident action plan is developed. Success in this area requires advance planning, understanding and acceptance within respective agencies. If not fully understood, it can cause confusion or be rejected.

ICS Principles

The ICS structure is based on the following principles:

Common terminology

Common terminology is essential in any emergency management system, especially when diverse or other than first-response agencies are involved in the response. When agencies have slightly different meanings for terms, confusion and inefficiency can result. In ICS, major organisational functions, facilities, and resources are predesignated and given titles. ICS terminology is standard and consistent among all of the agencies involved.

Modular organisation

A modular organisation develops from the top-down organisational structure at any incident. "Top-down" means that, at the very least, the Control/Command function is established by the first-responding officer who becomes the Incident Controller. As the incident warrants, the Incident Controller delegates other functional areas. In approximately 95 percent of all incidents, the organisational structure for operations consists of command and single resources (e.g., one fire truck, an ambulance, or a tow truck). If needed, however, the ICS structure can be scaled up to multiple layers that are implemented to meet the complexity and extent of the incident.

Integrated communications

Integrated communications requires a common communications plan, standard operating procedures, clear text, common frequencies, and common terminology. Several communication networks may be established, depending on the size and complexity of the incident.

Consolidated Incident Action Plans

Incident Action Plans describe response goals, operational objectives, and support

activities. The decision to have a written Incident Action Plan is made by the Incident Controller, dependent on the duration and complexity of the incident. Incident Action Plans should cover all objectives and support activities that are needed during the entire operational period. A written plan is preferable to an oral plan because it clearly articulates responsibilities and provides documentation when requesting assistance. Incident Action Plans that include the measurable objectives to be achieved are always prepared around a timeframe called the operational period.

Manageable span of control
A manageable span of control is defined as the number of individuals or functions one person can manage effectively. In ICS, the span of control for any person falls within a range of three to seven resources, with five being the optimum.

Designated incident facilities
It is important that there are designated incident facilities with clearly defined functions to assist in the effective management of an incident. Every incident requires that control be managed from one identifiable Incident Control location. Additional facilities are designated as the complexity of an incident increases.

Comprehensive resource management
Comprehensive resource management is a means of organising the total resource across all organisations deployed at an incident. This includes:
- maximising personnel safety
- optimising resource use
- consolidating control of single resources
- reducing the communications load
- providing accountability
- reducing freelancing
- assigning all resources to a status condition
- managing day and night shift resources
- enabling sustaining resources during long duration (campaign) incidents.

ICS Organisational Structure

Many incidents – whether major emergencies or disasters (such as cyclones or earthquakes) or more localised incidents (such as accidents, hazardous substance spills or fire incidents) require a response from a number of different agencies. No single agency or department can handle every large-scale emergency situation alone. More usually, several agencies must work together to manage multi-agency emergency response. To co-ordinate the effective use of all the available resources, agencies need a formalised management structure that lends consistency, fosters efficiency, and provides direction during a response.

The ICS organisation is built around four major components:

- **CONTROL** – the management of the incident
- **PLANNING** – the collection and analysis of incident information and planning of response activities
- **OPERATIONS** – the direction of an agency's resources in combating the incident
- **LOGISTICS** – the provision of facilities, services and materials required to combat the incident.

These four major high-level structural components (as further illustrated in Figure 1) are the foundation upon which the ICS organisation is built. They apply during a routine emergency, when preparing for a major event, or when managing a response to a major disaster.
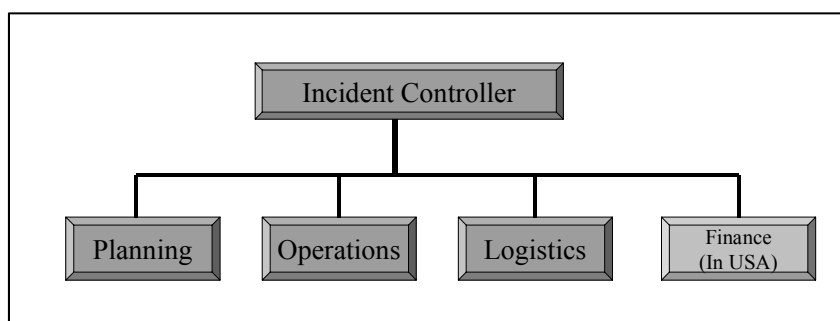
Figure 1. Four high-level structural components

The ICS structure can be expanded or contracted to manage any type and size of incident. The complexity of the incident more than the geographic size is normally the determinant for the Incident Controller establishing additional members of the Incident Management Team to fulfil management functions. ICS requires only one position to be filled – that of the Incident Controller. The Incident Controller carries out all of the management functions and responsibilities until the complexity of the incident determines that he or she assigns someone else responsible for a particular function(s). This is only done when necessary. Figure 2 illustrates a complex organisational ICS structure for managing a complex wildland fire incident.
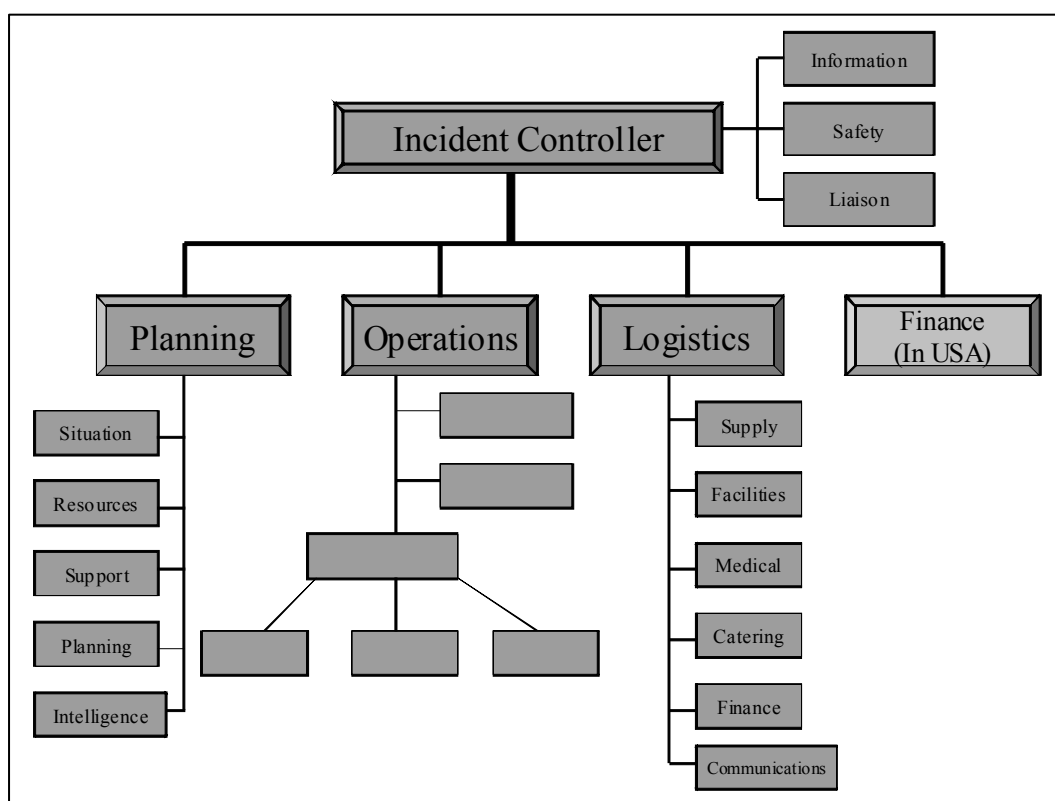
Figure 2. Complex organisational ICS Structure

Incident Management

Incident management can be viewed as a system composed of inter-related components that function together to enable the best possible management of an emergency of any scale. As such, it is necessary to understand the function of individual components, as well as how they fit together.

The Incident Controller is responsible for the overall direction of the response activities in an emergency situation and is the person in charge of an incident. The Incident Controller will carry out all management functions and responsibilities until the incident assumes such a size that it requires additional functional roles to be appointed. It is important to distinguish between Incident Control, which relates to situations and operates horizontally across agencies, and Command, which operates vertically within an agency. Under ICS an incident has only one Incident Controller but a number of line commanders may be required depending on the number of agencies involved.

Conclusions

On a global scale emergency services consume large amounts of funding each year. Safety, effectiveness and efficiency are achievable where a seamless integration of agencies is possible at an emergency. A globally implemented ICS will improve firefighter safety, efficiency and effectiveness in management response. It will also limit damage to property and, most importantly, will save lives. ICS provides the model for command, control and co-ordination of an emergency response. It provides a means of co-ordinating the efforts of agencies as they work towards the common goal of stabilising an incident and protecting life, property, and the environment. Many emergencies, from vehicle accidents to large-scale disasters, require co-ordination across several agencies. It will also reduce the risk of agency overlap and potential confusion at an emergency through poor understanding and inadequate co-ordination.

It is critical that a common global incident management system is adopted that will enable any assistance to quickly function in an effective manner. ICS is that tool which can enable that goal to be achieved.

Annex 5: International Wildland Fire Management Agreements Template

Outcomes of the International Wildland Fire Summit
Sydney, Australia, 8 October 2003

Strategic Paper
International Wildland Fire Management Agreements Template[16]

Introduction

The 3rd International Wildland Fire Conference held in Sydney, Australia 4-6 October 2003 and the subsequent Summit on 8 October 2003 provides important forums for discussions of how to manage the future of international wildland fire management and share solutions to global problems. This paper offers a template and information on cooperation in wildland fire management to countries interested in entering into formal relationships and agreements with other countries facing similar issues.

This paper is intended to enhance current international coordination and cooperation by providing information on the following:

- A Template outlining areas to consider when developing international cooperative agreements;
- Listing of the types of cooperation and assistance that may occur between countries;
- The responsibilities of countries sending assistance and of those receiving assistance;
- Websites containing information and examples of existing cooperative agreements and arrangements.

Template for International Cooperative Agreements

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[16] Published in: International Forest Fire News (IFFN) No. 29 (July – December 2003), p. 10-14 (http://www.fire.uni-freiburg.de/iffn/iffn_29/content29.htm)

The following is an outline for a template of areas that need to be considered when countries are developing international cooperative agreements. There may be other areas that need definition and consideration besides those listed below. This template is drawn from an annex of a UN Food and Agriculture Organization (FAO) document *Legal Frameworks for Forest Fire Management: International Agreements and National Legislation*. This FAO document provides excellent reference materials, which should be reviewed prior to entering into international agreements.

Developing countries will require special consideration because they may not be able to reciprocate in a partnership as fully as a developed country can.

The important role of Non-Government Organisations (NGOs) should be considered as part of any bilateral or regional assistance arrangement.

It is strongly recommended that the parties to a mutual assistance agreement should exercise the agreement through exchanges, field exercises and low-level assistance prior to it being activated at a time of crisis.

Outline for International Cooperative Agreements

1. Parties to the Agreement
   - Includes governmental and non-governmental agencies and organizations at a variety of levels

2. Purpose
   - Defines areas and forms of cooperation
   - Define the scope of the cooperation

3. Definition of Terms
   - Defines terms used in the agreement to insure there is no confusion or misinterpretation as to the meaning of the content of the agreement

5. Expenses and Costs
   - Personnel- Defines how personnel costs will be set such as per person, per

crew, per day or per assignment.

- Equipment - Defines how equipment cost use will be set such as per day or per assignment.
- Reimbursement of costs – Sets the procedures, amount, and criteria for reimbursement. Some agreements call for reimbursement only after a certain threshold of time or level of support has been reached.
- Non-reimbursable – Under certain agreements all parties may agree to assist each other on a mutual aid, non-reimbursable basis.

6. Information and Coordination
   - Communication channels – Defines the protocols and methods to coordinate and exchange information.
   - Information exchange – Defines the types, amount and timing of information exchange.
   - Notifications – Sets the notification procedures for emergencies or for other significant events.
   - Coordination of work – Defines how and under what organizational structure the coordination of work will take place.

7. Liabilities, Claims and Compensations
   - Cross-wavier of claims/exemption from liability – Lists and defines how and when the cross-waivers and exemptions are in force for personnel that are being exchanged.
   - Exemptions to cross-wavier of claims – Lists and defines those areas or circumstances where the exemptions do not pertain to personnel that are being exchanged.
   - Damage to a third party – Outlines remediation methods and limitations for third party damage.
   - Medical assistance for injured personnel – Defines the protocols and procedures for assisting and possibly evacuating injured personnel.
   - Compensation in case of injury or death – Defines the timing, levels and limitations of compensation for injury or death. This may also be addressed above in the cross waivers and exemptions.
   - Privileges and immunities for the assisting personnel – Describes and defines the levels and limitations of privileges and immunities that the receiving country will provide to assisting country personnel.

8. Operating Plans / Operational Guidelines
    ▪ Provision for operating plans/operational guidelines – Operating plans/operational guidelines are a critical component of all cooperative agreements. They should be carefully crafted and reviewed by all parties to the agreement. The plans and guidelines outline and define specific operational areas to insure that the agreement can implemented in a timely and efficient manner. They include items such as points of contact, procedures for requesting resources, entry procedures, annual updates of costs, reimbursements, and cross waivers, and updated standards, qualifications or training requirements Also identifies how often and by whom the plans and guidelines will be reviewed, updated and the method for revalidating the contents of the plans and guidelines.

9. Border Crossings
    ▪ Sets protocols and procedures for simplifying of border crossing taking into account sovereignty issues, including the following:
        - Opening of alternative border-crossing points to facilitate the assistance
        - Customs provisions:
    ▪ Concerning personnel
    ▪ Concerning equipment and materials
    ▪ Concerning officer responsible for equipment
    ▪ Concerning aircraft
        Portions of this information will also be included in the operational plans and guidelines.

10. Link to Disaster Management Plan for the receiving country.
    ▪ Explains how the fire assistance plan sits within the wider disaster management plan for the receiving country, including legislation giving the necessary powers.

11. General Provisions
    ▪ Entry of force of the agreement - Defines when agreement is activated.
    ▪ Duration – Specifies how long the agreement will remain in force
    ▪ Withdrawal – Defines how countries or organizations can withdraw from the agreement.

- Termination – Defines under what circumstances the agreement will terminate.
- Interpretation – Provides understandings and interpretations for countries and organizations concerning under what circumstances and limitations each party is entering into the agreement.
- Settlement of disputes – Defines the method of dispute resolution.
- Amendments – Defines when and how amendments to the agreement may be submitted, reviewed, and acted upon.

12. Standard Operation Procedures
- These procedures describe in detail the methodology to be followed when the agreement is activated, especially in relation to command and control, fire suppression procedures to be followed, communications systems and safety procedures to be used.
- The SOPs should be tested and refined using tabletop exercises, dry field exercises and low scale operations before being deployed in a full scale emergency.

13. Other Provisions
- Provides the opportunity for any country, agency or organization signing this agreement to define other areas of cooperation that they want to include in the agreement such as:
  - Shared training activities, including materials
  - Study tours, technical exchanges, and joint exercises
  - Relationship of this agreement to other agreements
  - Standards for personnel
  - Safety equipment
  - Limitations on the type and use of telecommunications equipment
  - Method of recall of firefighting resources

14. Participating Countries/Agencies/Organizations Signature Page
- It is important that all potential participants review and confirm their authorities to sign such an agreement.

Types of Cooperation and Assistance

International cooperation and assistance occurs in a variety of ways. Some agreements are non-reimbursable while others call for reimbursement. Some assistance is offered on a technical non-reimbursable basis and other assistance is offered or solicited during periods of disaster. When countries develop international cooperative agreements the purpose and method of cooperation and assistance need to be clearly identified and understood between all parties. The following describes several types of cooperation and assistance that currently exist.

Mutual Assistance:
Mutual Assistance agreements often deal with fire management issues along shared borders. Assistance by one country to another is usually non-reimbursable with the understanding that both countries may benefit at different times from assistance along mutual borders

Cooperative Assistance:
These agreements are for assistance and cooperation throughout the countries or states that have signed the agreement, not just for the border areas. These agreements are usually set up on a reimbursable basis.

They may also include non-reimbursable exchanges of experts. These exchanges may include areas such as fire prevention and mitigation, prescribed fire, personnel exchanges, and broad based study tours of fire management programs.

Technical Exchanges:
Activities carried out under technical exchanges are similar to cooperative assistance agreements but are much more informal and exchanges are not always tied directly to an ongoing agreement. These are usually self-funded, non-reimbursable activities that occur on an as needed or as desired basis. They remain at technical and informational exchange level and do not include exchanges of resources to help with direct fire suppression activities.

Technical Assistance:
An offer of or a request for technical assistance may or may not be a part of a formal agreement. Technical assistance provides experts from one country to

another country in need of technical assistance, to improve and strengthen the receiving country's abilities and capacity to deal with wildland fire management issues. The goal of technical assistance should be to reduce the need for outside assistance in the future. This type of assistance is usually non-reimbursable and is paid for by the country offering the assistance.

Disaster Assistance:

When wildland fires involve trans-border issues from a humanitarian, ecological, medical, economic, or diplomatic standpoint, some countries will offer immediate disaster assistance to affected countries on a non-reimbursable basis. Disaster assistance is meant to assist the affected country during a critical time period and may or may not be based on existing cooperative agreements. Disaster assistance may be the genesis for future cooperative agreements or technical assistance programs.

Responsibilities of Sending Country and Receiving Countries

Countries sending or receiving assistance through the methods and agreements identified above need to understand that certain responsibilities are inherent in these relationships. The following paragraphs identify the responsibilities of all countries, agencies, or organizations involved. There are certainly more issues than those listed below that should be discussed prior to sending or receiving assistance but the information below attempts to identify some of the key elements of the responsibilities involved in these types of arrangements.

Sending Countries:

It is important to note that as countries enter into formal cooperation agreements with other countries, the success or failure of those agreements rests just as much on the personal conduct of the sending country's representatives as it does on the effectiveness of their fire management capabilities. It is critical to always send the country's most appropriate and qualified personnel, as the receiving country will quickly detect whether they are receiving the help they need or individuals who were selected on rank or seniority and not on skills and capabilities. This is especially critical with reimbursable agreements. Of particular importance is cultural sensitivity towards the people of the receiving country. Personnel being sent will be seen as ambassadors for their country and qualities appropriate to such a role should be included in the selection criteria.

Teams and individuals must also be made aware of local issues dealing with laws, customs, language, dress, food, etc. They must also be briefed on the command and control arrangements and their role and responsibilities within the fire management system of the receiving country.

Sending countries should prepare lists of resources, funding, materials and manpower that may be made available to receiving countries. It is essential that this information is kept accurate and current.

Both sending and receiving countries should maintain and exchange data on the nature, extent and frequency of fires so that the level of assistance sought and made available can be anticipated in any particular season.

Receiving Countries:
Just as sending countries have certain responsibilities, receiving countries must also accept the responsibilities involved in hosting personnel from other countries. Receiving countries must be prepared to brief sending country teams and representatives on the issues mentioned above as well as fire issues such as fuels, weather, topography, safety, management structure on the fires, fire fighting techniques and equipment, types and lengths of assignments, etc. Of particular importance is briefing on communications and legal issues within fire management as well as political and social sensitivities within the wider community. Receiving countries must also be prepared to provide logistical and operational support including welfare support as required.

Conclusion

The fire management issues identified and discussed at the 3rd International Wildland Fire Conference highlight the connections and common concerns of the global community about wildland fire. This Summit represents an extension of the work accomplished at the Conference and provides a mechanism to identify ways to continue that progress. This paper has identified issues and provided a template to encourage countries to cooperate in dealing with wildland fire.

A System Scheme for ICS Efficiency of Korea

한국의 ICS 효율화를 위한 시스템 정립

Kim Kwang-Il, Choi Yong-Sun

Abstract

A response and command system for a forest fire should be different according to conditions which defines topography of a forest, characteristics of fuels and weather and so on. Especially, a risk of forest fire spread and cost - loss of life and property have been great because it has not been done to establish a Decision Tool of small, medium and large forest fire and a standard of determination of Risk Ranking when the forest fire occurs.

In this study, it has been presented a scheme for the effective response and command system after establishing factors of Decision Tool and indexing Risk Ranking through researching and analyzing the response and command system of domestic and foreign. Additionally,

It has been established the Web-Publishing for setting up a general and simple system to access.

요 약

산불은 산림의 지형, 연료의 특성, 기상 등의 상황에 따라 대응 및 지휘체계가 달라져야 한다. 특히 산불 발생의 상황접수시의 소, 중, 대형 규모별의 판단기준과 위험등급의 선정기준이 정립 되지 않아 산불확대의 위험 및 인적/물적 비용의 손실이 크다. 본 연구에서는 국내외의 지휘 및 대응 체계를 조사 분석하여 판단기준(Decision Tool)의 요소를 정립하고 위험등급(Risk Ranking)을 지수화하여 보다 효율적인 대응 및 지휘체계(안)을 제시하였다. 그리고 보편적이고 누구나 접근하기 쉬운 체계를 확립하기 위하여 웹퍼블리싱(Web-Publishing)을 정립하였다.

A System Scheme for ICS Efficiency of Korea

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Abstract

A response and command system for a forest fire should be different according to conditions which defines topography of a forest, characteristics of fuels and weather and so on. Especially, a risk of forest fire spread and cost - loss of life and property have been great because it has not been done to establish a Decision Tool of small, medium and large forest fire and a standard of determination of Risk Ranking when the forest fire occurs.

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Introduction

한국의 산불 대응 단계는 지금까지 총 8단계로 구성되어 있으며 산불 현장 대응에 관한 매뉴얼은 2006년 처음 작성되어 사용하여 왔다. 이는 각 지자체의 현실과 실정에 맞도록 재편되어야 하지만 이를 재편하거나 수정, 보완 할 수 있는 체계가 이루어지지 못 하였다. 따라서 표준화되어 있지 못한 상태에서 대응기관별로 임의의 방법을 적용하고 있고 유관기관 및 관계기관의 체계적인 지휘체계 및 대응체계가 확립되지 않아 각각의 역할과 임무가 명확하게 확립되어 있지 못하다. 이로 인해 산불 대응 활동이 비효율적이며, 부적절한

대응으로 인명 및 재산 피해가 커지고 있는 실정이다. 그렇기 때문에 이러한 문제점을 보완하고 실질적인 대응 체계를 개발하기 위해 국외 사례 및 국내 산불 진화 실태를 조사하여 기존의 1단계 조직구성부터 8단계 야간산불로 구성된 대응 체계에서 1단계 조직과 관리부터 6단계 산불원인 조사까지 총 6단계로 나누어 산불 현장 대응 체계(안)을 제시하였다. 또한 국내외의 지휘 및 대응 체계를 조사 분석하여 판단기준(Decision Tool)의 요소를 정립하고 위험등급(Risk Matrix)을 지수화하여 보다 효율적인 대응 및 지휘체계(안)을 제시하였다. 그리고 보편적이고 누구나 접근하기 쉬운 체계를 확립하기 위하여 웹 퍼블리싱(Web-Publishing)을 정립하였다.

Methodology

1. 국내외 자료 조사
산불 진화 현장 대응 매뉴얼을 개발하기 위하여 미국의 NFPA Code, 일본 동경 소방청의 임야화재 소방활동기준, 호주의 SOP 사례 및 국내 산불 진화 절차 실태를 조사하여 비교 및 분석 검토하여 산불 대응 체계(안)을 도출하였다.
2. 설문조사
국내의 산불 현장 대응 매뉴얼의 개발을 위하여 국내 지자체 28개 기관의 산불 담당자를 대상으로 설문조사하여 분석하였다. 조사내용은 각 지자체의 산불대응조직, 인원, 장비 및 과거 산불 대응 사례를 통해 각 지자체의 산불 대응 체계를 조사하였다.
3. 비교·분석
국내외 자료의 비교·분석을 통해 한국의 실정에 맞는 체계적인 산불대응에 관한 사항을 도입하여 적용하였으며 국내 실태 조사를 통해 각 지자체의 산불 대응 체계에 대한 실정과 문제점을 도출하여 산불 현장 대응체계(안)에 적용하였다.

Results and Discussion

1. 현행 대응 단계와 개선(안)의 비교 분석
기존의 지휘체계는 1단계 조직구성, 2단계 상황접수, 3단계 산불확인, 4단계 현장출동중 5단계 현장도착, 6단계 산불 규모별 행동, 7단계 뒷불정리, 8단계 야간산불까지 총 8단계로 구성되어 있으며 산불의 유형을 소·중형(30ha 미만), 대형(30ha 이상)으로 나누어 분류하였다. 하지만 개선(안)에서는 산불 발생시

발생할 수 있는 위험에 대한 분석 및 각종 상황에 따라 대응 방법을 결정할 수 있는 판단기준(Decision Tool)과 현장 대응 인력, 유관기관의 지휘체계 및 임무가 포함되어 산불 대응에 효율적인 활용이 가능하며 평시 산불 발생에 대비한 위험을 분석하고 대응에 필요한 각종 요소를 준비하고 활용할 수 있도록 1단계 조직과 관리, 2단계 유형별 진화계획 수립, 3단계 상황파악 및 등급선정, 4단계 현장 진화 활동 5단계 상황종료, 6단계 산불원인 조사까지 총 6단계로 구성하였으며 산불의 유형을 소형(1ha 미만), 중형(1ha 이상 30ha 미만), 대형(30ha 이상), 초대형(대형산불의 24시간 이상 지속시)로 구분하였다.
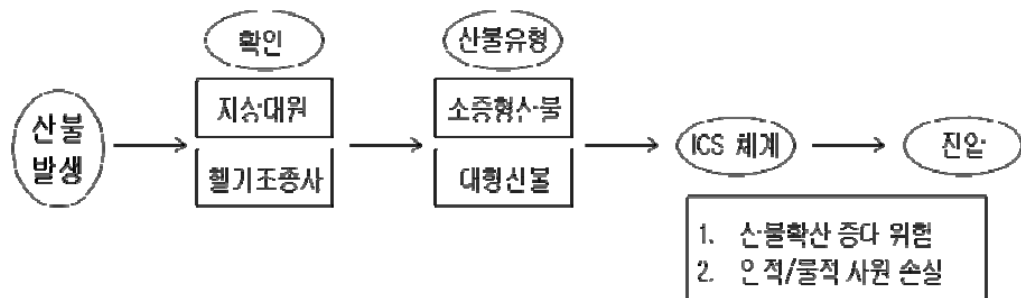
Table 1. Before & Now ICS System
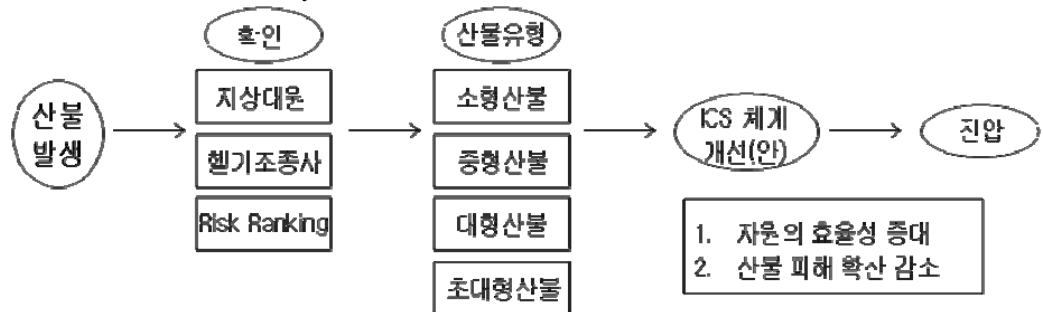
Table 2. ICS System Improvement Direction

2. 한국형 ICS 체계 개선(안)
1) 조직관리
  조직관리에서 규모가 소형산불인 경우 지상진화대의 대장은 산림계장이 맡고 5명으로 구성된 선착대 2개팀과 의용소방대1개팀으로 구성된다. 중형 산불인 경우 필요시 현장대책반을 구성한다. 현장대책반은 지상 진화대와 홍보대책반, 보급/재정 지원반으로 구성된다. (초)대형산불인 경우 현장대책본부가 구성되고 대형산불인 경우 시장·군수, 초대형산불인 경우 시·도지사가 현장대책본부장이 된다.

현장대책본부는 상황총괄반, 산불전문가. 지상진화대, 공중진화반, 홍보대책반, 보급/재정 지원반으로 구성된다.

```
            ┌─────────────┐
            │  지상진화대   │
            │   산림계장    │
            └──────┬──────┘
       ┌───────────┼───────────┐
┌──────────┐  ┌──────────┐  ┌──────────┐
│ 선착대 A 팀 │  │ 선착대 B 팀 │  │  의용소방대  │
│   5 명    │  │   5 명    │  │   5 명    │
└──────────┘  └──────────┘  └──────────┘
```

Table3. Small Forest Fire Organization System

```
            ┌─────────────┐
            │  현장대책반   │
            │  : 산림과장   │
            └──────┬──────┘
       ┌───────────┼───────────┐
┌──────────┐  ┌──────────┐  ┌──────────┐
│ 지상진화대  │  │  홍보대책반  │  │ 보급/재정지원반 │
│ : 산림계장  │  │          │  │          │
└──────────┘  └──────────┘  └──────────┘
```
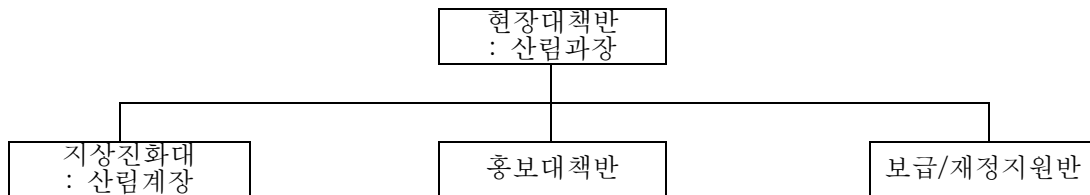
Table4. Medium Forest Fire Organization System

```
┌─────────────┐          ┌─────────────┐
│ 현장대책본부장 │──────────│  산불전문가   │
│  : 시도지사   │          └─────────────┘
└──────┬──────┘
┌─────────────┐          ┌─────────────┐
│  상황총괄반   │──────────│  전략수립담당  │
│  : 시장·군수  │          │  상황분석담당  │
└──────┬──────┘          │  자원관리담당  │
                         │  유관기관공조  │
                         └─────────────┘
   ┌────────────┬────────────┼────────────┐
┌────────┐ ┌────────┐ ┌──────────┐ ┌────────┐
│ 지상진화반 │ │ 공중진화반 │ │ 보급/재정지원반 │ │ 홍보대책반 │
└────────┘ └────────┘ └──────────┘ └────────┘
```
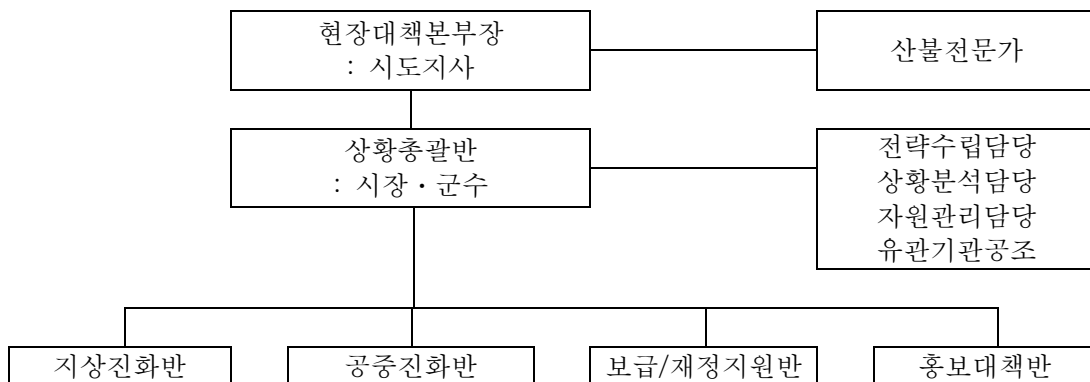
Table5. Large & Extra-Large Forest Fire Organization System

2) 유형별 진화계획 수립

유형별 진화계획은 다음과 같다.(Table6.)

소형산불	중형산불	대형산불	초대형산불	야간산불	뒷불감시
.조직구성	현장지휘본부 설치및조편성	조직구성	자원배정 및 조정	대책본부설치 및 운영	진화선구축
선착대출동	자원배정 및 조정	현장지휘본부 설치및조편성	진화장비 및 진화물품	진화계획 수립	잔불정리
	진화장비 및 지원물품	자원배정 및 조정	지상진화대의 진화계획	진화장비 및 지원물품	
	지상진화대의 진화계획	진화장비 및 진화물품	공중진화대의 진화계획		
		지상진화대의 진화계획			
		공중진화대의 진화계획			
		구조활동			
		주민대피계획			

Table6. Devise the Graduated Project of Suppression Construction

3) 현장 진화 활동

현장진화활동은 다음과 같다.(Table 7)

소형산불	중형산불	대형산불	야간산불	야간산불
지상진화 조직체계	지상진화 조직체계	지상진화 조직체계	철수 및 대기 기준요령	행동요령
진화대원의 배치	진화대원의 배치	진화대원의 배치	진화장비 및 진화물품	진화계획 수립
진화방법	진화방법	진화방법	지상진화대의 진화계획	진화장비 및 지원물품
	교대기준	교대기준	공중진화대의 진화계획	
	보급지원	현장상황설명		
		헬기추가지원 요청시고려사항		
		대국민홍보 및 보도자료 배포		
		보급지원		

Table7. Spot Suppression Acivity Construction

4) 상황파악 및 등급선정

- 신고 접수 절차

신고접수는 산불감시원, 지역주민, 군·소방서를 통해 시군상황실에 신고가 된다. 신고를 받은 통신담당자 또는 산불담당자는 지역산불관리 소장에게 보고를 하고 유선연락 및 무인카메라를 통해 산불을 확인한다. 또한 시간대별 조치사항을 기록하고 상황조치를 할 수 있도록 위치표시, 상황, 기상을 파악한다
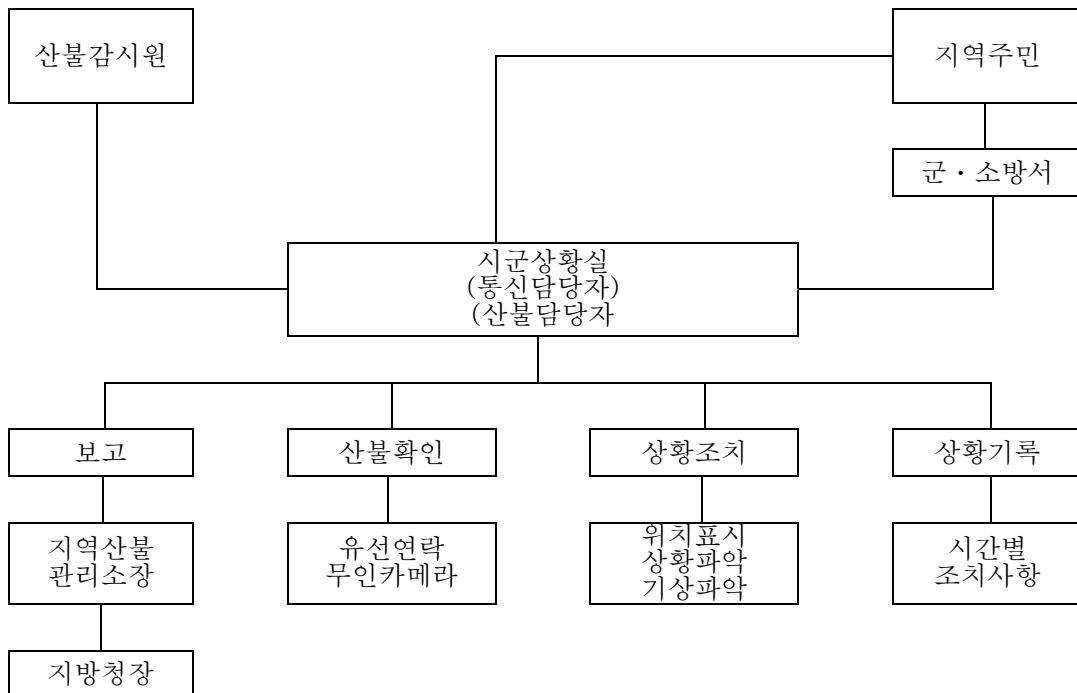
Table8. Report Construction

- 상황파악

상황실에서 선착대 대장에게 최단거리출동경로, 산불 발생 지역 정보, 진화대 및 진화 자원의 집결 가능 장소 등이 포함된 산불 진화 활동 기본도와 사전에 파악된 지역산불 위험성 분석 자료를 제공한다.

- 등급선정

등급선정은 기상, 수종, 지형, 과거 산불 이력의 요소를 통해 산불 위험 등급지수를 결정한다. 기상은 평균풍속과 최대풍속, 수종은 활엽수, 활엽수와 혼효림, 침엽수, 지형은 고도와 사면장, 산불이력은 과거 산불이 발생 횟수가 0회, 1회, 2회, 3회, 4회이상으로 구분한다. 그리고 각각의 요소에 가중치를 부여하고 이들 등급선정 4가지요소를 조합해 최종 산불위험등급지수를 결정한다. (Table 10, 11)
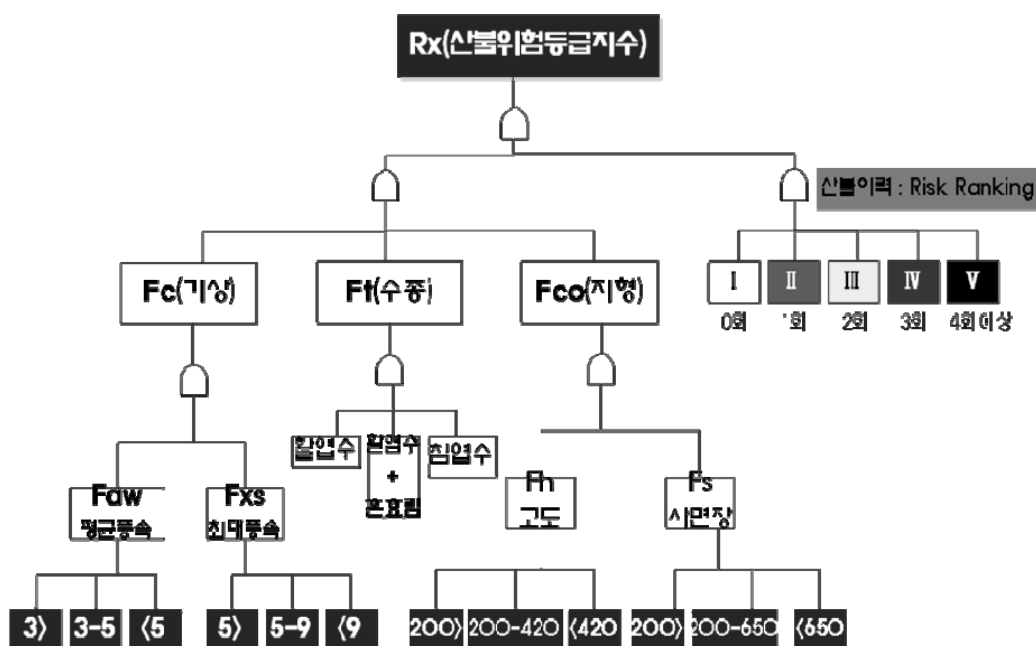
Table9. Risk Ranking Construction

Rx(산불위험등급지수)

$$Rx = \frac{(Fc + Ft + Fco)}{3} \times H_{i=1\sim5}$$

Fc = (Faw + Fxs)/2 : 기상
Fco = (Fh + Fs)/2 : 지형
Ft : 수종

Factor			산불이력(과거)		History 0	History 1	History 2	History 3	History 4 회이상
					1	2	3	4	5
기상	평균풍속 Faw	0 이상 ~ 3 미만		1	1	2	3	4	5
		0 이상 ~ 3 미만		2	2	4	6	8	10
		5 이상		3	3	6	9	12	15
	최대풍속 Fxs	0 이상 ~ 3 미만		1	1	2	3	4	5
		0 이상 ~ 3 미만		2	2	4	6	8	10
		9 이상		3	3	6	9	12	15
수종		활엽수		1	1	2	3	4	5
		활엽수 + 혼효림		2	2	4	6	8	10
		소나무림(침엽수)		3	3	6	9	12	15
고도		0 이상 ~ 3 미만		1	1	2	3	4	5
		0 이상 ~ 3 미만		2	2	4	6	8	10
		420 이상		3	3	6	9	12	15
사면장		0 이상 ~ 3 미만		1	1	2	3	4	5
		0 이상 ~ 3 미만		2	2	4	6	8	10
		650 이상		3	3	6	9	12	15

Table10. Risk Index

구 분		산불위험등급지수
산불유형	소형산불	4 미만
	중형산불	4 이상 ~ 8 미만
	대형산불	8 이상 ~ 12 미만
	초대형산불	12 이상

Table11. Risk Index

　5) 상황종료

상황종료 보고 체계는 진화조장에 의해 진화작업조를 점검하고 진화도구를 회수한다. 진화작업조와 진화도구 회수가 끝나면 진화조장은 진화팀장에게 보고하고 진화팀장은 현장지휘관에게 보고한다. 현장지휘본부의 철수와 함께 보급지원반과 홍보담당은 각각의 임무를 최종점검하고 현장지휘관에게 보고한다. 현장지휘관은 보급지원반, 홍보담당, 진화팀장에게 최종보고를 받은 후 지방청장에게 진화완료보고를 한다. (Table12.)
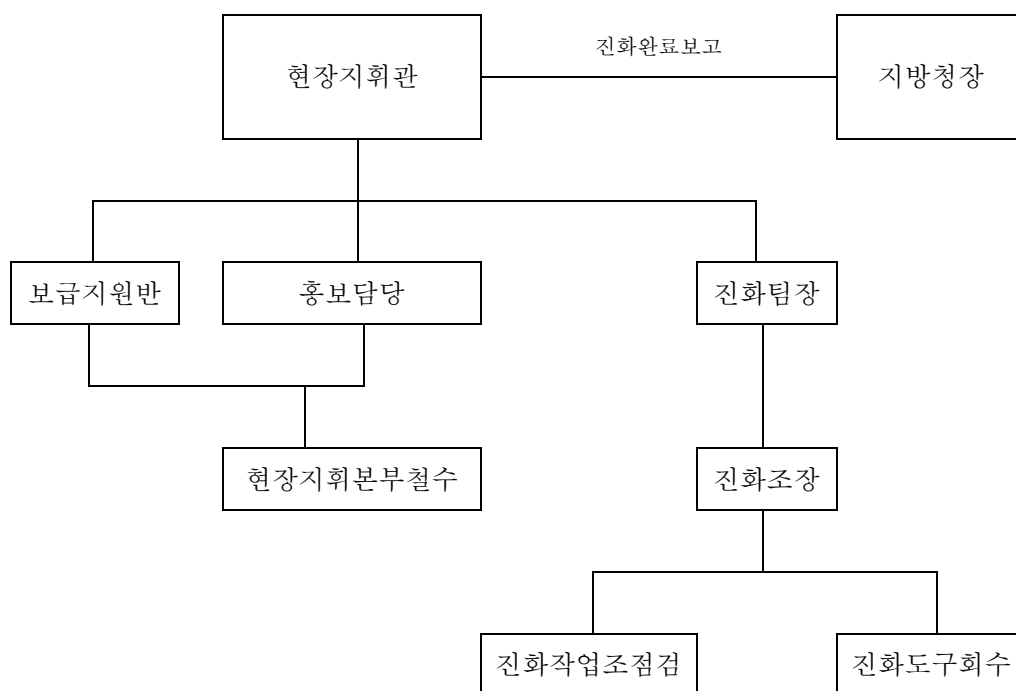
Table12. End Report Construction

　6) 산불원인 조사

　– 운영기준

산불 원인 조사 운영 기준은 산불 발생 후 진화되었을 때 즉시 실기 되어야 하며 현장에서 산불의 진행방향 지표를 활용하여 추적하여야 한다. 또한 현장에서 사용된 도구와 방법을 추정하여 유사한 산불을 효과적으로 예방함을 목적으로 한다.

- 적용범위

구 분	피해면적	진화지휘책임	진화지휘 부책임	산불원인조사
소형산불	1ha 미만	시·군산림계장		즉시현장조사
중형산불	1ha 이상	시·군산림계장		
대형산불	30ha 이상	시장·군수	시·군 산림계장	
초대형산불	대형산불의 24시간 이상 지속	시·도지사	시장·군수	항공 사진 등 초동 조사 후 현장 조사

Table13. The Limit of Application

3. 웹퍼블리싱

Business Process Management System

BPMS(Business Process Management System)는 조직 내 프로세스를 설계, 실행, 모니터링, 분석하면서, 또한 기존의 전산 시스템들을 그 프로세스에 융합할 수 있는 소프트웨어 시스템을 말한다. 이를 아래와 같이 크게 3가지 특성으로 정리 할 수 있다.

- ● 프로세스 생명주기 관리
  - 업무 절차(프로세스)의 시스템적 관리
  - 프로세스의 가시화
  - 프로세스 변경 및 생성의 유연성 제고
- ● 유연한 업무 통합
  - 사람과 시스템간에 엮어진 프로세스 중심의 통합
  - 기존 데이터와 기능의 공유에 이은 "프로세스의 공유" 실현 → 업무절차에 대한 조직 내 공통 언어 역할
- ● 지속적인 프로세스 개선
  - 프로세스와 조직원 역할의 지속적인 재설계 및 재 분배를 통한 지속적인 프로세스의 개선과 발견
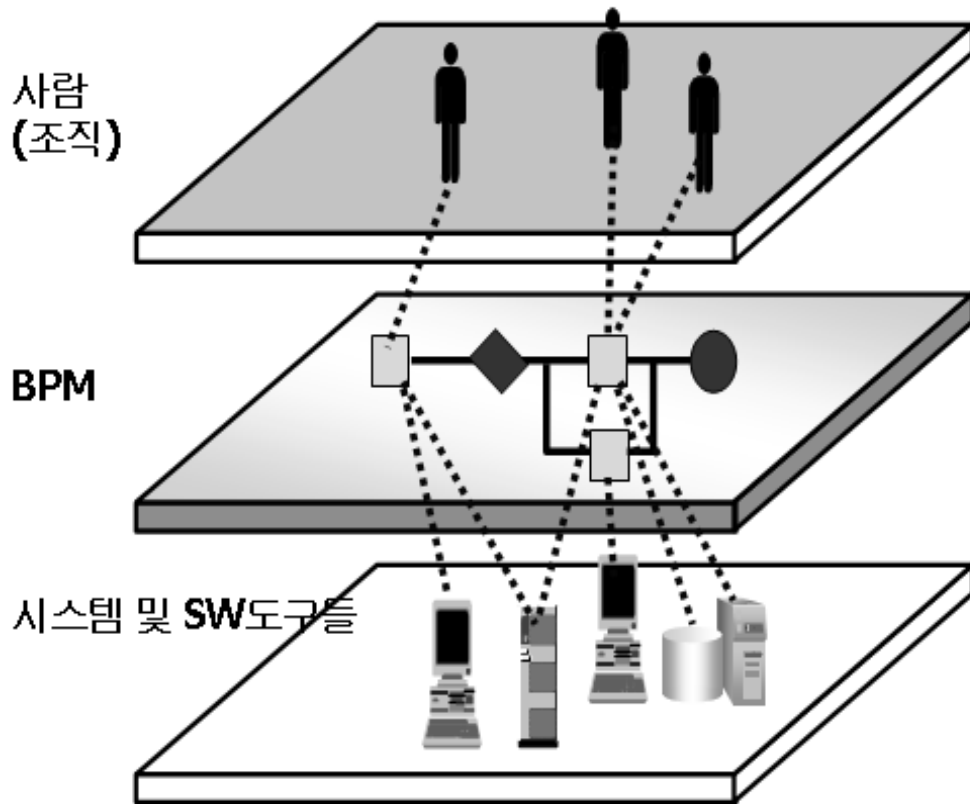
Figure1. Concept of BPMS

이러한 BPMS(Business Process Management System)은 다음과 같은 핵심 기능으로 구성되어 있다.

● 프로세스 전자화 : 프로세스 가시화 및 정의 도구

사람과 사람간, 어플리케이션과 어플리케이션 간 업무절차 및 통합 연계관계를 GUI 기반 모델링 도구를 통하여 "프로세스"라는 형태로 DB화 할 수 있도록 제공.

- 프로세스를 표준화하고 재사용을 가능하게 함.
- 한번 정의된 프로세스는 여러 사용자를 통해 실행, 모니터링, 평가 됨.
- 이러한 프로세스의 전자화/DB화는 향후 조직 내 프로세스 혁신의 기초가 됨.

● 프로세스 자동화 : 프로세스 실행 및 제어

전자화된 프로세스를 전산팀의 도움없이 직접 실행될 수 있도록 지원

하여 각 정의된 단계별로 업무를 분배, 통제하는 기능.

- 사용자가 업무를 찾아가는 것이 아니라 업무가 담당자를 찾아오게 됨.
- 프로세스 실행 중에 관여되는 여러 시스템들 간의 시너지 효과를 최상으로 끌어올려줌.

● 프로세스 모니터링 : 업무 진행 상태의 파악, 실시간 뷰, 누적 데이터 뷰.

모니터링 기능은 기존에 보이지 않던 현 업무 진행 경과를 플로우 차트, 간트 차트, 대시보드 등을 통해 확인하고 그에 따른 여러가지 위험 요소 등을 보여주어 즉각적 액션을 취할 수 있도록 표시해 주는 기능

- 정확하지도 않은 업무 경과 보고서를 기다리고 작성할 필요가 없다.
- 업무관리자로 하여금 보다 효율적인 업무 분배에 대한 계획을 가능토록 한다.
- 투명한 업무 통제를 통해 조직 내 정서적/정치적 원인으로 인한 업무 정체 현상을 극복할 수 있다.

● 프로세스 분석 : 조직원들의 성과 측정/분석

프로세스 운영에 핵심적인 이슈인 프로세스 병목 원인, 최적(휴먼) 리소스의 발견, 프로세스 실행 성과 및 고객 만족 등에 대한 분석 기능.

- 이러한 분석 결과를 토대로 하여 기존 설계된 프로세스 정의를 개선할 수 있는 포인트를 이끌어 낼 수 있고 이를 통한 BPM 라이프 사이클은 프로세스의 지속적인 개선을 도모할 수 있게 된다.
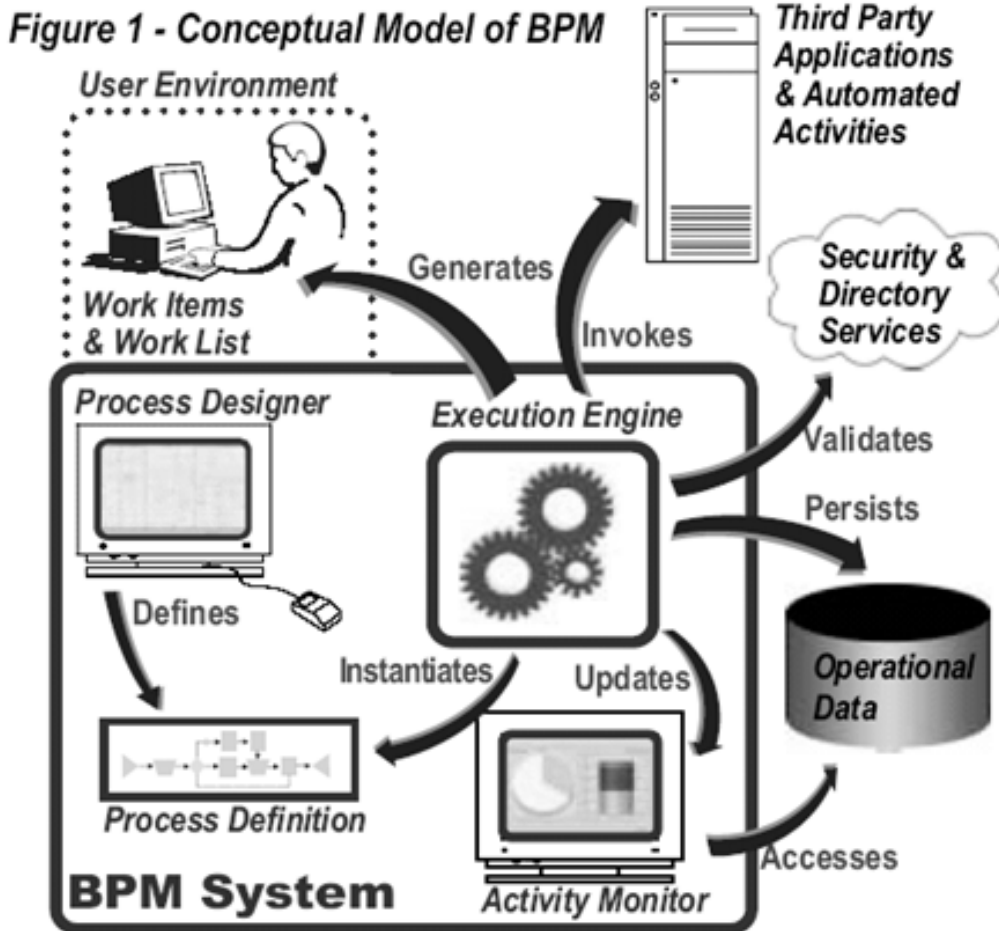
Figure 2. Core Feature of BPM
(Source : Delphi Group, BPM 2003 Market Milestone Report)

 이러한 BPM의 특성 및 기능을 산불진화대응체계에 적용하기 위해서는 산불진화대응체계 SOP를 바탕으로 프로세스의 도출이 반드시 선행되어야 하며, 각 담당자 별 업무의 정의가 반드시 필요하다.
 프로세스의 도출 및 담당자별 업무의 정의가 완료되면, 이를 바탕으로 각 각의 업무 프로세스를 웹 기반의 BPM 시스템으로 구현이 가능해 진다.
 이번 과제에서는 유관기관별 참여자가 다양하기 때문에 BPM을 기반으로 한 시스템의 구현 시 실시간 업무 처리 능력 향상 및 모니터링의 효과를 기대할 수 있다.

Update On The Implementation Of The ASEAN Agreement on Transboundary Haze Pollution
국경지역의 연무오염에 관한 아세안협정 이행 개정

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Regional Haze Action Plan (Dec 97)

Objectives
- to prevent land and forest fires through better management policies and enforcement
- to establish operational mechanisms to monitor land and forest fires
- to strengthen regional land and forest fire-fighting capability and other mitigating measures

ASEAN Agreement on Transboundary Haze Pollution
- Signed on 10 June 2002 in Kuala Lumpur by all ASEAN Member States
- Entered into force on 25 November 2003
- So far 8 countries have ratified the Agreement

ASEAN Agreement on Transboundary Haze Pollution

Objectives
Prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated, through concerted national efforts and international cooperation

Principles

- Ensure that activities within the jurisdiction do not cause damage to the environment and harm to human health
- Strengthen cooperation and coordination
- Take precautionary measures where there are threats of serious or irreversible damage
- Manage natural resources in a sustainable manner
- Involve all stakeholders

Institutional Arrangement

Meetings Heads of Government			
ASEAN Ministerial Meeting (AMM)/Meeting of Foreign Ministers	*COP to the ASEAN Agreement on Transboundary Haze Pollution*	*Sub-Regional MSC on Transboundary Haze Pollution*	*ASEAN Secretary General*
ASEAN Standing Committee (ASC)	*Committee*	*TWG (Southern)*	*ASEAN Secretariat Bureau for Resources Development*
	TWG Mekong		

- COP: Conference of the Parties
- TWG: Technical Working Group
- TWG Mekong: Technical Working Group of Mekong Sub-Region
- MSC: Sub-Regional Ministerial Steering Committee
- Conference of the Parties (COP) - reviews and evaluates implementation
- Committee under COP - oversee operation of ASEAN Centre; develop, implement and monitor operational work programme; advise COP re. management of ASEAN Haze Fund
- Secretariat - served by ASEAN Secretariat
- ASEAN Transboundary Haze Pollution Control Fund (ASEAN Haze Fund) – voluntary contributions from the Parties, open to contributions from other sources subject to approval by the Parties

ASEAN Coordinating Centre for Transboundary Haze Pollution Control (ASEAN Centre)

- Currently performed by ASEAN Secretariat and the ASMC since the entry into force in November 2003
- Will be handed over when the ASEAN Centre is physically established
- Detailed TOR for the management and operation of the ASEAN Centre with proposed organisational structure already developed

ASEAN Agreement on Transboundary Haze Pollution

Contains measures on:

- Monitoring and assessment
- Prevention
- Preparedness
- National and joint emergency response
- Procedures for deployment of people, materials and equipment across borders
- Technical cooperation & scientific research

Implementation of the Haze Agreement

Projects and Activities

<u>*Prevention*</u>

- Guidelines for implementation of zero burning policy
- Dialogues with plantation and timber companies
- Guidelines for controlled burning practices
- Community-based fire management programmes through pilot projects in fire-prone areas
- Demonstrations and workshops on ZB best practices
- Public and community awareness programmes
- Training and capacity building on investigation, prosecution and

enforcement against open burning
- ASEAN Peatland Management Initiative (APMI)
- ASEAN Peatland Management Strategy (APMS)(2006-2020) to guide actions to sustainably manage peatlands and reduce fires and associated haze
- Project on 'Capacity building to improve peatland management and reduce land and forest fires and associated transboundary haze pollution in the ASEAN region' – under ASEAN-Australia Development Cooperation Program
- IFAD/GEF Project on Rehabilitation and Sustainable Use of Peatland Forests in Southeast Asia – to commence in early 2009

Monitoring
- ASEAN Specialised Meteorological Centre(ASMC) based in Singapore - provision of hotspot and smoke haze maps, satellite imageries, monthly weather & haze outlook, haze modelling
- Comprehensive regional early warning system to be developed
- Workshop involving relevant experts and agencies to discuss on how to enhance the reporting of weather and haze outlook, incl. simulation/ modeling of haze transport and incorporating data on PM10 which will be a useful indicator to track the extent of haze – early 2009 in Singapore

Mitigation / Fire Suppression
- Fire Suppression Mobilisation Plans in fire-prone areas
- Online regional inventory of fire-fighting resources to facilitate sharing of resources during emergencies
- Standard Operating Procedures (SOP) for monitoring, assessment and joint emergency response
- Regional table-top and simulation exercises to strengthen coordination and response

ASEAN HAZE ACTION ONLINE
- daily-updated information on fire-and-haze and info on ASEAN cooperation on transboundary haze pollution
- consist of public information and

intranet services
- fire-and-haze situation reports
- hotspot and smoke haze maps from ASMC
- online inventory of fire-fighting resources
- online Regional and National Detailed Implementation Plans
- database of projects & documents

Public and Community Awareness

- Public/community awareness programmes in fire-prone areas, e.g. workshop in West Kalimantan Province to explore traditional values of Dayak and Melayu tribes in managing fires and haze in or surrounding their areas (March 2001). Follow-up actions include establishment of community groups at the village level to prevent and control land and forest fires, and public awareness programmes on the impact of haze on health.
- The World Conference and Exhibition on Land and Forest Fire Hazards, 10-12 June 2002, Kuala Lumpur – *signing of the Haze Agreement*
- Conference on Promoting Partnerships for the Implementation of the ASEAN Agreement on Transboundary Haze Pollution, 10-13 May 2006, Ha Noi involving ASEAN countries, Dialogue Partners of ASEAN, relevant regional and int'l organisations, NGOs, academia and research institutions, and international donor community

Panel of ASEAN Experts on Fire and Haze Assessment and Coordination

- Established by the ASEAN Senior Officials on the Environment in August 2005 to provide rapid independent assessment and recommendation for the mobilisation of resources during impending critical periods. TOR adopted by Ministers in September 2005.
- Currently consists of 29 nominated experts from ASEAN Member States with various technical expertise and background.
- Operational procedures developed for activation of the experts, deployment procedures, execution(or the conduct of the rapid assessment itself), demobilisation, and reporting procedures.
- The Panel has been deployed 3 times during dry season in 2006:
  - 1st deployment: Riau Province, Aug 06

- 2nd deployment: West Kalimantan Province, Sep 06
- 3rd deployment: South Sumatra Province, Oct 06

▪ A workshop was convened in April 2007 in Palembang, Indonesia to review the experiences from the three deployment missions in 2006 and refine the deployment and operational procedures for the Panel of ASEAN Experts

▪ Hands-on activities, such as refresher courses on conducting rapid assessment, field trips and table-top/simulation exercises to test the procedures for the Panel of Experts

Sub-Regional Groups

• Southern ASEAN region:
  Sub-Regional Ministerial Steering Committee (MSC) on Transboundary Haze Pollution

• Northern ASEAN region:
  Technical Working Group on Transboundary Haze Pollution in the Mekong Sub-Region

Sub-Regional Ministerial Steering Committee(MSC) on Transboundary Haze Pollution

• Established in November 2006

• Comprise Environment Ministers of
  Brunei Darussalam, Indonesia,
  Malaysia, Singapore and Thailand

• Currently chaired by Malaysia

• Assisted by a Technical Working Group (TWG)

• Has met 6 times between Nov 07 to Oct 08

Activities:

• Focus on Indonesia's Comprehensive Plan of Action (PoA) in Dealing with Transboundary Haze Pollution

6th MSC, 23 Oct 2008, Phuket, Thailand

• The Ministers appreciated Indonesia's efforts in effectively implementing its PoA and congratulated Indonesia for achieving its 50% hotspot

reduction target as of mid October for 2008, compared to 2006.
- It was noted that while there has been an increase of hotspot activities in the region, there was no significant corresponding increase in transboundary haze in the region. This is attributed to the concerted mitigation actions taken to suppress the fires and wetter than normal weather conditions.

Singapore-Indonesia collaboration on Muaro Jambi Regency include:
- capacity development for Jambi provincial government officials
- socialisation workshop for local community
- development of a fire danger rating system

Malaysia-Indonesia collaboration on Riau Province include:
- capacity building programmes on ZB techniques
- installation of air monitoring station
- peatland management activities

Technical Working Group on Transboundary Haze Pollution in the Mekong Sub-Region (TWG Mekong)
- Established in September 2007
- Members: Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam
- Chaired by Thailand

Activities:
- Selected key activities to be implemented within 1 year have been identified
- Sub-Regional Action Plan to be developed
- Workshop on sharing of experience on small-scale and shifting agriculture in relation to land and forest fire prevention – March 2008
- Thailand has offered mobile air quality monitoring units to be placed in Cambodia, Myanmar and Lao PDR during the dry season (Jan-Apr 2009).

Regional South Asia Wildfire Incident Management System : Need for Intervention

남아시아 지역의 산불 사건 관리 체계 : 개입의 필요성

Sharma, Sundar Prasad

Abstract

Wildfires, among natural disasters, have been emerging as the most common disaster since last decade, adversely impacting socio-economy and environment of the countries in the South Asian region. Particularly, the forests of Hindu Kush-Himalayas are more frequently vulnerable to wildfire due to increasing human intervention in the fragile mountain ecosystems. In addition fire fighting operations are extremely difficult due to steep mountain landscapes, scarce water sources, poor communication and a lack of infrastructure. Almost all fires are human-induced. The best way to manage a wildfire is strengthening local communities coping with wildfires and aiding them in addressing the consequences of climate change and wildfires and the effects on their livelihoods; emphasizing the improvement of community-based fire management approaches and institutional and technological capabilities at all levels; assisting countries in fire management planning, enhancing institutional and technological capabilities and developing synergies through coordinated and collective action both within the region and internationally; promoting education and awareness-raising programmes on wildfire prevention and incorporating wildfire incident management system at all levels.

Almost all countries have institutional arrangement to response disasters. However, specific Wildfire Incident Management Systems (WIMS) in the countries in the region are either not existing or in a premature stage. India has just started to professionalize emergency response management. It has been proposed to introduce the Incident Command System (ICS) in the country. This system provides for specialist incident command teams with an Incident Commander and officers trained in different aspects of incident management – logistics, operations, planning, safety, media management etc. The Lal Bahadur

Shastri National Academy of Administration (LBSNAA) Mussoorrie has been designated as the nodal training institution. It has already started to conduct programmes for the training of trainers, officers training in Basic and Intermediate ICS course and Planning Sections module. Notwithstanding the existing efforts, it is still felt that there is an acute shortage of resources, capability and institutionalization of WIMS in the countries in the region. Considering the trend of climate change, increasing risk from wildfires and human pressure on the ecosystems of South Asia, governments of the region should come forward to develop national and regional strategies for fire management incorporating all stakeholders concerned. Strategic approaches should be targeted to stabilize the livelihood of the local communities and conservation of the ecosystems.

요 약

많은 자연재해 중 산불은 지난 10년간 남아시아 지역 국가들의 사회경제와 환경에 부정적 영향을 미치는 가장 흔한 재해로 대두되었다. 특히 힌두쿠시-히말라야 산맥의 산림은 연약한 산지 생태계에서의 인간 간섭의 증가로 더욱 산불에 취약해졌다. 또한 소방활동은 가라픈 산지 경관, 부족한 수자원, 열악한 통신과 시설의 부족 때문에 극히 어려운 상황이다.

대부분의 화재는 인간에 의해 야기된다. 산불을 관리하기 위한 가장 좋은 방법들은 다음과 같다: 산불에 대응하는 지역사회를 강화하는 것과 그들이 기후 변화, 산불 그리고 그들의 생계에 주는 영향들이 미치는 결과를 해결하는 것을 돕는 것; 지역사회에 기초한 화재관리 접근방법의 향상과 모든 면에서 제도적이고 기술적인 능력 향상을 강조하는 것; 화재 관리 계획과 제도적이고 기술적인 능력 향상면에서 다른 나라들을 도우며 지역간, 국가간 협력적인 공동의 행동을 통해 시너지 효과를 일으키는 것; 산불예방에 대한 교육과 의식 향상을 위한 프로그램을 증진시키며 모든 면에서 산불 사건 관리 체계를 통합하는 것이다.

대부분의 국가들은 재해에 대응할 제도적인 준비가 되어 있다. 그러나 보다 구체적으로 명정된 산불 사건 관리 시스템(Wild Incident Management Systems-WIMS)은 남아시아 지역의 국가들에 아직 존재하지 않거나 혹은 초기단계에 있는 실정이다. 인도는 이제 막 비상사태 대응 관리체계를 전문화시키기 시작하였다. 인도에서는 사건 지휘 체계를 도입해야 한다는 제안이 되어 왔다. 이 시스템은 전문가들에게 병참, 군사행동, 안전, 언론관리 등의 다양한 사건 관리 측면에 훈련되어 있는 사건지휘자와 관리들로 구성된 전문적인 사

건 지휘팀을 제공한다. Mussoorrie 시에 있는 Lal Bahadur Shastri 공무원 교육원은 중추적인 훈련 기관으로 지정되었으며 이미 트레이너들의 훈련을 위한 프로그램과 관리들을 위한 초·중급 사건 지휘 체계 과정과 기획 영역 모듈을 개설하고 있다.

기왕의 노력에도 불구하고 아직은 자원, 능력 그리고 산불 사건 관리 체계의 제도화가 남아시아 지역 국가들에서 극심하게 부족한 상태라 생각된다. 남아시아에서의 기후 변화 추세, 증가하는 산불의 위험성 그리고 생태계에의 인간의 압력을 고려해 볼 때 이 지역의 정부들은 관련된 모든 투자자들을 포함하여 화재 관리를 위한 국가적, 지역적 전략을 개발하기 위해 앞장서야 한다. 전략적인 접근들은 지역사회의 생계를 안정시키는 것과 생태계의 보존을 목표로 삼아야 할 것이다.

Regional South Asia Wildfire Incident Management System : Need for Intervention

Sharma, Sundar Prasad

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proposed to introduce the Incident Command System (ICS) in the country. This system provides for specialist incident command teams with an Incident Commander and officers trained in different aspects of incident management – logistics, operations, planning, safety, media management etc. The Lal Bahadur Shastri National Academy of Administration (LBSNAA) Mussoorrie has been designated as the nodal training institution. It has already started to conduct programmes for the training of trainers, officers training in Basic and Intermediate ICS course and Planning Sections module. Notwithstanding the existing efforts, it is still felt that there is an acute shortage of resources, capability and institutionalization of WIMS in the countries in the region. Considering the trend of climate change, increasing risk from wildfires and human pressure on the ecosystems of South Asia, governments of the region should come forward to develop national and regional strategies for fire management incorporating all stakeholders concerned. Strategic approaches should be targeted to stabilize the livelihood of the local communities and conservation of the ecosystems.

1. INTRODUCTION

In 1989, the General Assembly of the United Nations proclaimed the decade 1990-2000 as the International Decade for Natural Disaster Reduction (IDNDR). At the World Conference on Natural Disaster Reduction in the city of Yokohama, Japan in 1994, deep concern was expressed for the continuing human suffering and disruption of development caused by natural disasters and a Yokohama Strategy and Plan of Action for a Safer World was developed. The conference was a definitive step in Disaster Mitigation and Preparedness Planning. It emphasized that natural hazards were beyond the control of human beings, however vulnerability towards disasters usually stems from the human interventions and activities. Hyogo Framework of Action and country's response is to prepare National Strategic Plan to realize the priority actions at national level as envisaged by the framework. UNISDR-Regional South Asia Wildland Fire Network (http://www.fire.uni-freiburg.de/GlobalNetworks/South_Asia) is promoting development of Wildfire Incident Management System (WIMS) in the countries in the region by providing platform to share information, expertise, training, knowledge network and bridging international/regional cooperation.

Almost all wildfires in the countries in the south Asia region are human-

induced. Wildfires, among natural disasters, have been emerging as the most common disaster since last decade, adversely impacting socio-economy and environment in the areas. Particularly, the forests of Hindu Kush-Himalayas are more frequently vulnerable to wildfire due to increasing human intervention in the fragile mountain ecosystems. In addition wildfire incident management are extremely difficult due to steep mountain landscapes, scarce water sources, poor communication and a lack of infrastructure and further aggravated by lack of national capability and resources.

The article assesses the status of disaster management system in general and Wildfire Incident Management System in particular to Bhutan, India and Nepal.

2. CASE STUDIES FROM BHUTAN, INDIA AND NEPAL

2.1 Bhutan

2.1.1   Disaster Management in Bhutan

Forest fire is one of the major hazards causing extensive damages to infrastructures, lives and properties every year. This is because of the rugged and fragile geophysical structures, vulnerable ecosystem and variable climatic conditions. The problem is further aggravated by socio-economic and changing demographic pattern.

The poor and least developed countries like Bhutan are the one which are most vulnerable because there are no proper response mechanisms and resources to cope with disasters of higher magnitude (NRBWCDR 2005).

Government has taken a sole responsibility to ensure that there are proper and adequate disaster management systems but the lack of financial and technical resources, awareness and capacity in the country's major constraints. However, Bhutan is committed to develop a national strategy for disaster management and commensurate capacity to deal with disasters (NRBWCDR 2005). Bhutan National Adaptation Programme of Action (NAPA) is the one step forward for such initiatives. NAPA formulate following two actions among nine prioritized projects:
  1. Develop Disaster Management Strategy
  2. Promote Community-based Forest Fire Management and Prevention

2.1.2 Institutional, Legal and Policy Framework for Disaster Management in Bhutan

In Bhutan there does not exist any law or any other legal framework to deal with different types of disaster (NRBWCDR 2005). There is no centralized disaster risk management mechanism but the government has already taken policy measures in dealing with disaster. The Ministry of Home and Cultural Affairs (MoHCA) is the focal agency to coordinate disaster management with other organizations. There are District Relief Committees established in some districts to respond disasters but they lack logistics and capacity for active and professional response to natural disaster (NRBWCDR 2005).

International organizations such as UNDP, WFP and UNICEF also have plans and programme to assist government in disaster management.

Department of Local Governance was recently established under the MoHCA as a focal agency, which major functions, among others, are to coordinate disaster management in all twenty districts and operate 'His majesty's Relief Fund'.

Over a last one year, through a highly consultative process various ministries and departments, a National Disaster management Framework (NDRMF) has been developed and endorsed by the government (NDRMF 2006).
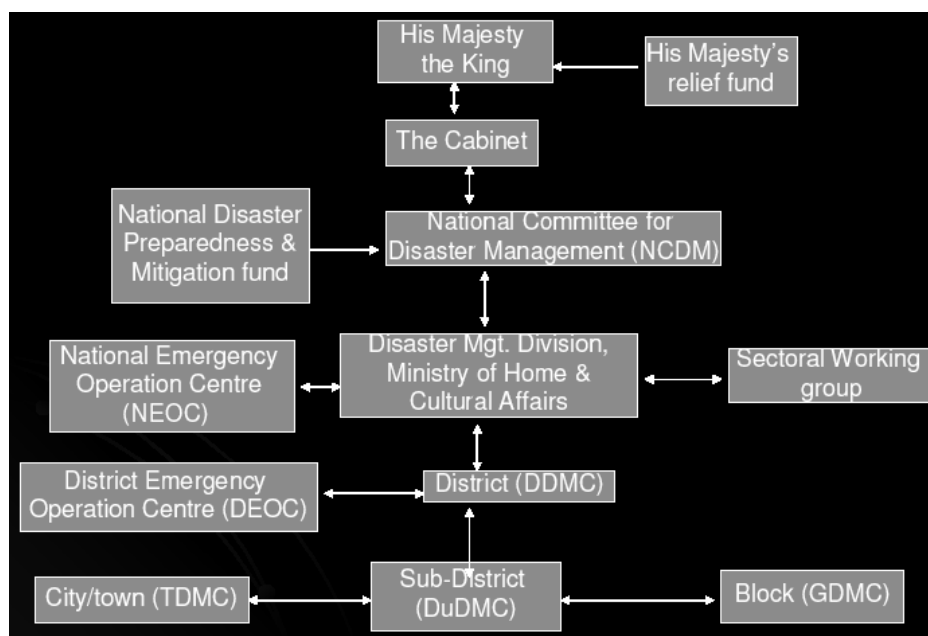
Figure 1: Organizational Set up of the Disaster Management of Bhutan (Source: Dema 2006)

India

Disaster Management in India

The basic responsibility for undertaking rescue, relief and rehabilitation measures in the event of natural disasters, as practiced, is that of the concerned State Governments. Role of the Central Government is supportive, in terms of supplementation of physical and financial resources and complementary measures in sectors like warning, transport and inter-state movement of food grains, etc. (DAC 2001).

India has just started to professionalize emergency response management. It has been proposed to introduce the Incident Command System (ICS) in the country. This system provides for specialist incident command teams with an Incident Commander and officers trained in different aspects of incident management – logistics, operations, planning, safety, media management etc. The Lal Bahadur Shastri National Academy of Administration (LBSNAA) Mussoorrie has been designated as the nodal training institution. It has already started to conduct programmes for the training of trainers, officers training in Basic and Intermediate ICS course and Planning Sections module (NDMD 2004).

Past experiences of showed that there is often delay in mobilizing and deploying resources at the site of the incident in the event of an emergency (NDM 2008, LBSNAA 2009). An ineffective and inefficient use of available resources was the major problem in responding disaster due to lack of developed planning process and logistic support. There is also a felt need to address the requirement of specialized disaster management functions at different level, whether it is the State, District, or local levels. Often the designated coordinating officers at these levels are not backed up with professional teams whose members are trained for performing specialized functions such as materials/ logistic management, management of search and rescue operations, management of personnel, communications etc.

These issues and managerial tasks ultimately devolve upon the coordinating officer who is required to take decisions on all aspects of an emergency like drawing up plans; logistic management; handling of media, transports etc. The officer concerned may get overwhelmed and available resources are not used optimally which rather create additional problems.

Professional management requires an approach, which recognizes importance

of such specialized roles and training of officers to perform these roles at the time of emergencies for the overall coordination, support for mobilizing different agencies, monitor the situation, coordinate the response, tackle logistics, dispatch materials and provide assistance in the event of a disaster (NDM 2008, LBSNAA 2009).

To address these issues, Ministry of Home Affairs in collaboration with the United States Agency for International Development (USAID) has developed a program for institutionalizing Incident Command System (ICS) in India. A proposed ICS (LBSNAA 2009) is given below:
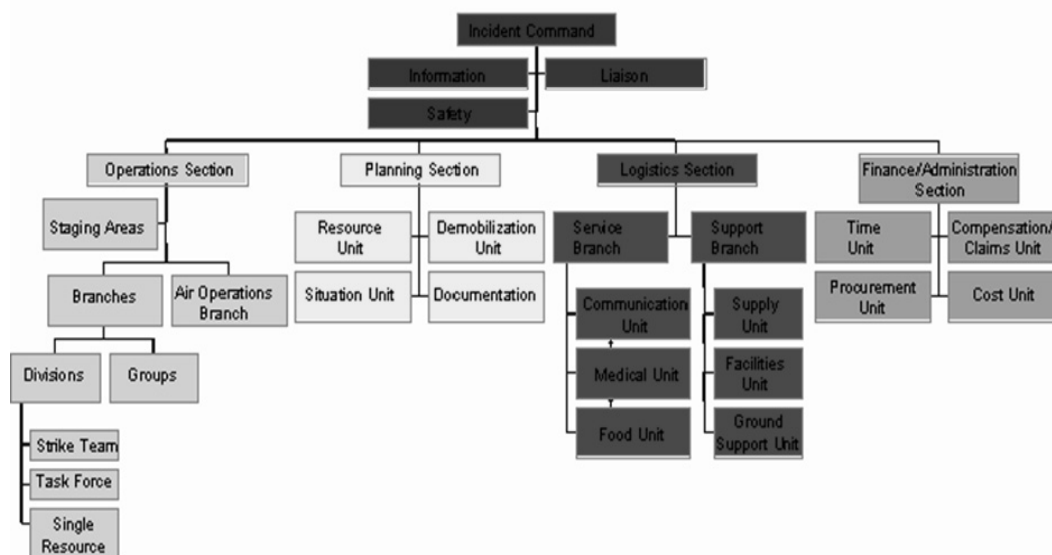
Figure 2: A Proposed Incident Management System in India (expansion or contraction of the organization is possible depending on complexity of incident) (Source: LBSNAA 2009).

Institutional, Legal and Policy Framework for Disaster Management in India

National Disaster Management Division (NDMD) under the Ministry of Home Affairs is the focal agency for disaster management in India. The Disaster Management Act 2005 is the main legal provision. Calamity Relief Fund (CRF) and National Calamity Contingency Fund (NCCF) are the financial windows.

The institutional and policy mechanisms for carrying out response, relief and rehabilitation have been well-established since Independence (NDMD 2004).

These mechanisms have proved to be robust and effective insofar as response, relief and rehabilitation are concerned.

Mitigation, preparedness and response are multi-disciplinary functions, involving a number of Ministries/Departments. Institutional mechanisms which would facilitate this inter-disciplinary approach are being put in place. Disaster Management Authorities have been created both at the National, State and District levels (MLJ 2005), with representatives from the relevant Ministries/Departments to bring about this coordinated and multi-disciplinary with experts covering a large number of branches. National Institute of Disaster Management and National Disaster Response Force have also been constituted in accordance with the Disaster Management Act 2005. When a disaster strikes, the concerned Authority coordinates disaster management activities. The National Disaster Management Authority will be responsible for, among others (NDMA 2009):

- Coordinating response to a disaster when it strikes
- Providing necessary support and assistance to State Governments by way of resource data, macro-management of emergency response, specialized emergency response teams, sharing of disaster related data base etc.
- Coordinating/mandating Government's policies for disaster reduction/mitigation
- Ensuring adequate preparedness at all levels
- Assisting the Provincial Government in coordinating post disaster relief and rehabilitation
- Coordinating resources of all National Government Department/agencies involved.

The technological advancement in space remote sensing (RS) and Geographical Information System (GIS) has been widely experimented in last three decades to obtain the desired information in India (NDMD 2004, Roy no date, APFD 2009). The RS and GIS data base is an effective tool for emergency responders to access information in terms of crucial parameters for the disaster affected areas (NDMD 2004).

Recognizing the crucial importance of Geographical Information System (GIS) as a decision support tool for disaster management, the Ministry of Home Affairs proposes to establish a GIS database, 'National Database for Disaster Management (NDDM)', which will assist in hazard zonation, risk assessment, preparedness and emergency response management (NDMD 2004).

An initiation has been taken by the Andhra Pradesh Forest Department With the aid of Ministry of Environment and Forests (MoEF), Government of India, to provide a decision support to disaster response, to analyze the effect of wildfires and to prepare a fire management plan using Geomatics (APFD 2009). Forest density, Forest Type, Road, Village, Slope, Aspect and Fire Risk Zonation maps were prepared. An example of Fire Risk Zonation Map is provided below:
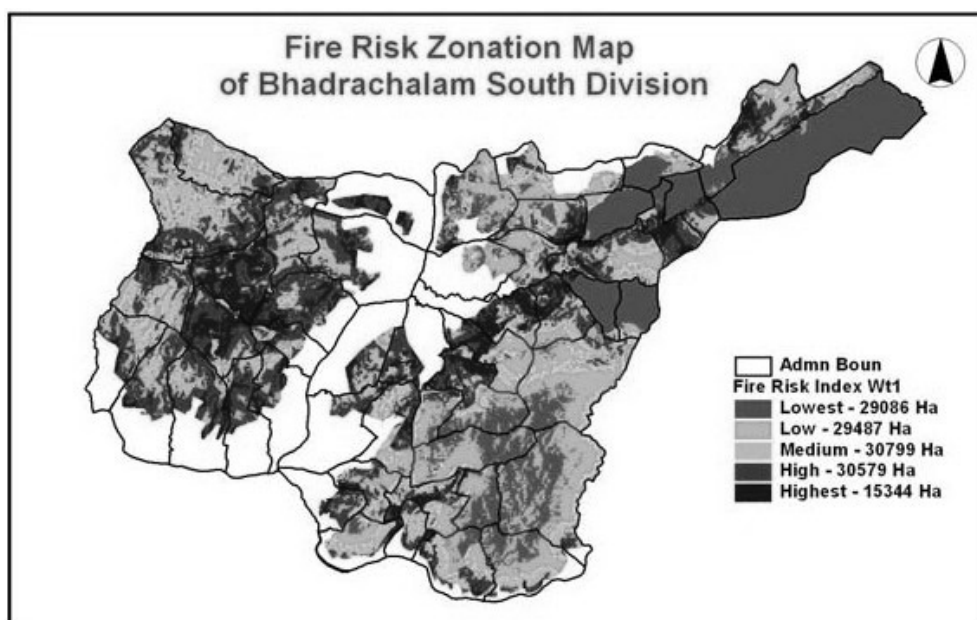
Figure 3: Fire Risk Zonation Map of Bhadrachalam South Division, Andhra Pradesh (Source: APFD 2009)

2.3 Nepal's response to Disaster Risk Reduction and Disaster Management: with particular emphasis on Wildfire Incident Management System (WIMS)

Nepal is one of the disaster prone countries in the world. Natural disasters are on the increase every day in Nepal owing to her specific geographical and geological formation as well as unmanaged settlements, increasing population, economic backwardness, lack of education, ignorance and climate change (NPC 2002). Fire is one of the common disasters that occurs more in the country during the dry period (NRCS 2009).

On the one hand, natural disasters like floods, landslide and wildfires are

creating the destruction of development infrastructures like road, electricity irrigation, settlements etc. resulting in the possibility of the wastage of investment. In addition to this, thousands of people have lost their lives and countless cattle have been destroyed, lots of agricultural land and crops have been damaged. In order to minimize the damages caused by natural disasters in a country, it is necessary to prepare a comprehensive plan beforehand. The main challenges to disaster are the absence of adequate coordination among agencies involved in it, the reactive and ad hock nature of disaster management efforts, the absence of a modern technology to give prior information, warning system, preparedness and response (NPC 2002). Lack of national capability, resources, coordination and cooperation among stakeholders are the main constraints for natural disaster management in Nepal (NPC 2002).

If a disaster occurs in remote villages, it becomes difficult to provide instant relief services from outside because of geographic complexity, lack of transportation and communication facilities as well as insufficient resources (NRCS 2008).

However, there is a national wide network in 75 districts to address the total disaster management in the country (HMGN 1982). There is also a provision of Central, Regional, District and Local level Natural Calamity Aid Funds to operate rescue, relief and rehabilitation activities in times of disasters (HMGN 1982).

To address the multi-hazards response, the following organizational structure (Figure 4) has been constituted under the Natural Calamity (Relief) Act 1982:
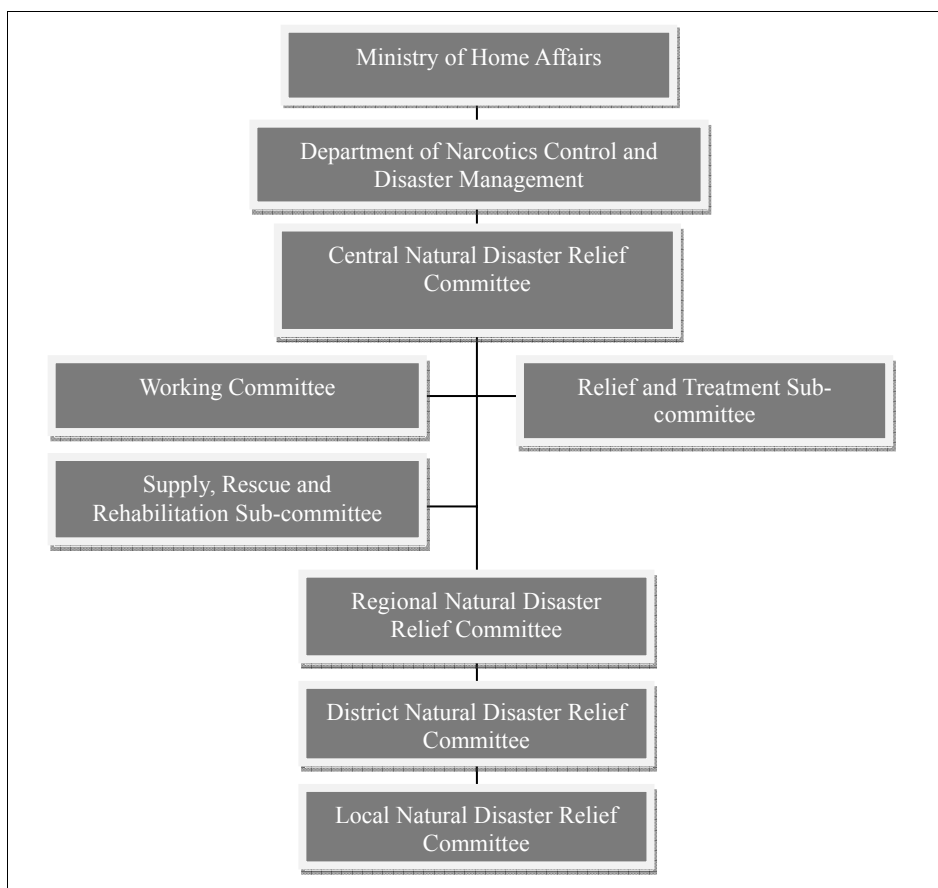
Figure 4: Organizational Structure for Disaster Management in Nepal

Ministry of Home Affairs (MoHA) is the National Focal Agency for Disaster Management. Department of Narcotics Control and Disaster Management under the MoHA look after disaster management activities and serve as a secretariat of Central Natural Disaster Relief Committee (CNDRC). Central Natural Disaster Relief Committee under the Chairpersonship of Home Minister and comprising of related ministries and security agencies along with voluntary organization like Red Cross. CNDRC is mainly responsible for policies and plans formulation. To support the functioning of the Central Committee, there are Working Committee, Relief and Treatment Sub-committee and Supply, Shelter and Rehabilitation Sub-committee. Regional Natural Disaster Relief Committee (RNDRC) under the Chairpersonship of Regional Administrator and comprising of related government agencies and security agencies along with voluntary organization like Red Cross

which is constituted only in big disaster. District Natural Disaster Relief Committee (DNDRC) is a functional institution chaired by the Chief District Officer (CDO) mainly responsible for coordinating the district level relief efforts including the provision of medical support and the distribution of food and other essential supplies. Local Natural Disaster Relief Committee (LNDRC) is also constituted only in a case of big disaster.

The act does not describe the duties and responsibilities of all disaster related agencies except the Ministry of Home Affairs. The act has a provision of four tired committees, viz., Central Natural Disaster Relief Committee (CNDRC), Regional Natural Disaster Relief Committee (RNDRC), District Natural Disaster Relief Committee (DNDRC) and Local Natural Disaster Relief Committee (LNDRC).

However, due to problems of cooperation, coordination and mutual understanding among various disaster management related agencies, sometimes disaster victims do not always receive immediate, efficient and effective rescue and relief services (Chhetri et al. 2001). As a focal agency, Ministry of Home Affairs (MoHA) is responsible for the overall disaster management in the country. But, the wildland fire is always been neglected in overall disaster management scenario. The Ministry of forests and Soil Conservation is the line ministry and the Department of Forests is implementing agency for wildland fire management in the country. Forest Act 1993 and Forest Rules 1995 are the main legal provision for wildland fire management in the country.

UN Nepal gives priority to the following six types of response: assessment, relief, leadership, coordination, communication and fund raising. UN Nepal's Disaster Management System is given in figure 5 below:

The only way to save the fragile Himalayan ecosystem from recurring forest fires and it's secondary consequences of soil erosion and landslide is to put in place viable disaster management action plans (SAARC 2009) with due consideration of Wildfire Incident Management System (WIMS). The risk of a major disaster with frightening humanitarian implications is so big that a high level of emergency preparedness and standing readiness must be maintained (UNDMT 2001).

With regard to wildfire disaster, it is recommended to constitute the Disaster Relief Fund (DRF) as funds earmarked for capacity building for wildfire disaster management to act as a buffer for handling local level and district level emergencies without support from central government.
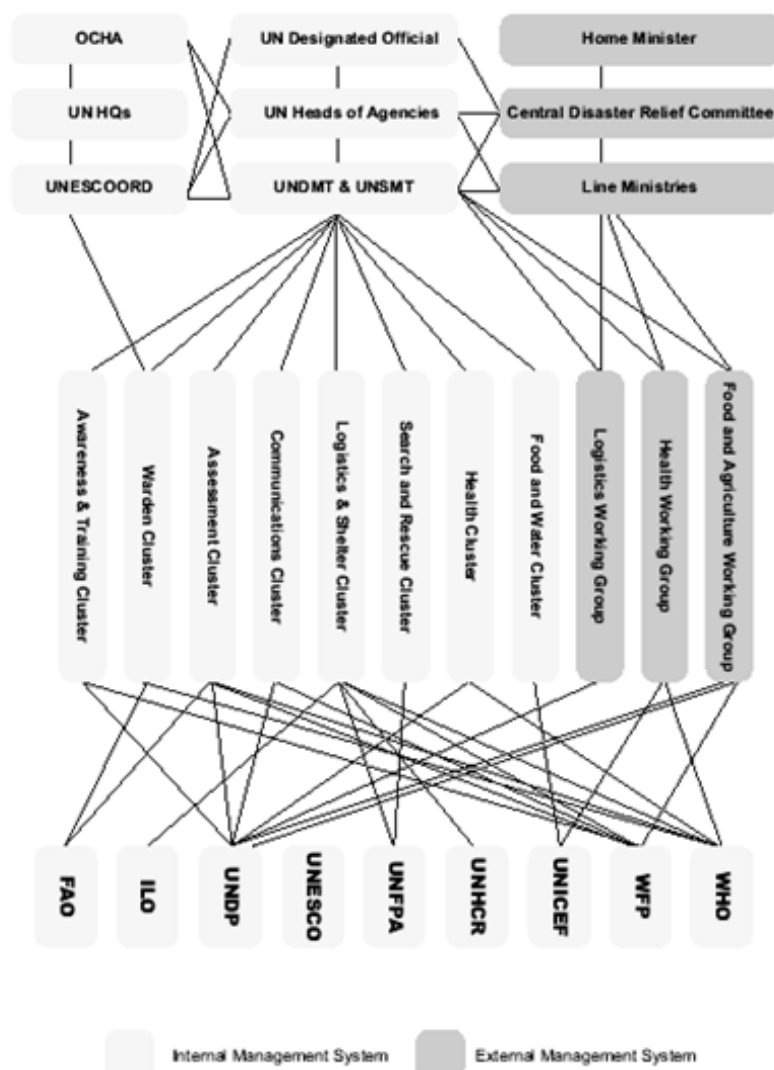
Figure 5: UN Nepal's Disaster Management System (Source: UNDMT 2001)

3. CONCLUSIONS

Almost all countries have institutional arrangement to response disasters. However, specific Wildfire Incident Management Systems (WIMS) in the countries in the region are either not existing or in a premature stage. The magnitude of a wildfire disaster is greatly influenced by the vulnerability and

coping capacity of humans and societies affected by it.

Despite the existing efforts, it is still felt that there is an acute shortage of resources, capability and institutionalization of WIMS in countries. Considering the trend of climate change, increasing risk from wildfires and human pressure on the ecosystems of region, governments should come forward to develop national and regional strategies for wildland fire management incorporating all stakeholders concerned. Though, wildfire disaster has significant relationship with poverty alleviation, natural resource management, and sustainable development, governments have given less importance in it. Therefore, strategic approaches should be targeted to stabilize the livelihood of the local communities and conservation of the ecosystems.

There is an urgent need to develop an efficient and effective Wildfire Incident Management System (WIMS) in times of disaster with close cooperation among local, national and international communities by developing an appropriate disaster management system incorporating indigenous management system for emergencies. Responsibility and lines of command should be clearly defined at all levels.

Furthermore, disaster management needs a dedicated political commitment at all levels of national and local government. A structure with clearly defined authority and appropriate funding mechanism to maintain an effective disaster plan is needed. Preparedness plans should be comprehensive in scale and operational, ideally through a nominated national body. In this regards, UN Nepal's Inter-Agency Disaster Response Preparedness Plan may provide the basis for developing Wildfire Incident Management System (WIMS) in the countries in the region. The overall objective of the WIMS should ensure human survival and well-being, particularly of the most vulnerable groups. Wildfire Incident Management System requires multi-disciplinary and pro-active approach. National and/or State and District governments, local communities, civil societies, NGOs and media have a key role for incident management which requires institutional, legal and policy support for prevention, mitigation and response.

Strengthening local communities coping with wildfires and supporting them in addressing the consequences of climate change and wildfires and the effects on their livelihoods could be the best way to managing wildfire incident emphasizing the improvement of community-based fire management approaches and institutional and technological capabilities at all levels. It is important to assist countries in fire management planning, enhancing institutional and technological

capabilities and developing synergies through coordinated and collective action both within the region and internationally and promoting education and awareness-raising programmes on wildfire prevention and incorporating wildfire incident management system at all levels.

As a very few but significant steps have already taken in the countries in the region towards vulnerability reduction, putting in place prevention and mitigation measures and preparedness for a rapid and professional response.is required A massive awareness raising campaign and capabilities building (communities, voluntary organizations and government functionaries at all levels) as well as institutionalization of the entire mechanism through policy and financial support has been started in some countries to move forward for sustainable development.

To build a safer and secure nation from disaster through sustained collective effort, synergy of national capacities and people's participation are vital. And, the instruments to tackle wildfire disaster should be good governance, use of modern technology such as remote sensing (RS) and geographic Information system (GIS), public health and medical care, capacity building, awareness and education, people's participation, insurance, and regional / international cooperation.

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Education for early suppresion of wildlandfire by utilization of IT in Korea(Case study)

산불 초기진화를 위한 IT 기반 산불진화 시스템 교육사례

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Abstracts

 This study has peformed to develope of education system into forest fire suppression. In Korea wildlandfire was occurred 485 by 10 year-mean. This is expected more occurrences by global warming and climate change. According to growth of tree or/and increase of biomass of trees had influenced to wildlandfire occurrence. Causes of fire were classified various and complicated by annual report of Forest Service. In case, when wildlandfire was occurred, it will be big fire. In order to prevent of fire we have developed the system of suppression by revised ICS. Especially we used IT for development of machines and build the suppression system. For the first step, we have to build the improved education system in order to manage IT system, and to create education subjects.

요 약

  우리나라의 산불은 10년간(1998~2007) 평균 발생빈도는 485건 발생하고 피해면적은 3,714ha 이다. 지구온난화에 따른 기후변화로 산불발생은 더욱 증가할 것으로 예상하고 있으며, 산불 피해면적도 증가하고 있다. 특히 기후 변화에 따라서 산불의 발생빈도 또한 증가 될 것으로 예상하고 있다. 우리나 라는 조림녹화 성공국으로서 산림내 바이오매스가 매년 증가하는데 이는 산불 의 발생과 산불확산에도 영향을 주고 있다. 특히 산불이 발생하게 되면 대형

산불로 이어질 가능성이 매우 높다. 따라서 산불의 초기 발견과 정확한 위치 확인은 산불진화에 매우 중요하며, 이는 산불의 피해를 줄일 수 있을 것으로 생각된다. 산불발생의 주요 요인이 복잡하고 다양하게 변화하고 있다. 따라서 과거의 산불교육은 교육과정과 과목에서 중복되어 있어 교육효과가 저하되는 경향이 있어 발전하는 IT를 접목한 진화시스템 및 장비개발에 따른 교육과정과 과목개선이 요구된다. 따라서 효과적인 산불현장을 대응하고 운영하기 위해서는 발전하는 산불진화 전략과 시스템에 맞추어 교육하는 것이 필요하며 IT를 기반으로 개발된 시스템을 효과적으로 운영할 수 있는 강의와 실습을 병행하여 빈번하게 발생할 수 있는 산불에 대한 피해를 최소화 할 수 있는 단계별 교육과목을 개발하여야 한다.

서론

산불은 산사태, 산림병해충과 더불어 산림재해에 속한다. 또한 산불재해는 봄철에 82%가, 가을철에 13%가 발생한다. 세계적으로도 계절은 달라도 기후, 즉 온도와 상대습도가 산불발생의 조건으로 작용한다. 우리나라는 연평균 산불발생빈도는 5년간 평균418건 발생하고 있으며 산불발생은 기후변화와 더불어 더 증가할 것으로 예상된다. 또한 우리나라는 녹화성공국으로서 산림의 비약적 증가는 산림내 연소물(바이오매스)의 증가로 산불이 발생하게 되면 대형산불로도 이어질 수 있기 때문에 산불의 초기 발견과 초기 진화는 매우 중요하다. 우리나라의 산불은 10년간 산불발생 변화를 분석하였을 때 3월 초순에서 시작하여 5월 중순에 산불발생이 줄어드는 것으로 나타났으며, 지역별로 보면 부산 경남지방에서 가장 먼저 시작되어 전남지방과 전북지방으로 확대되며, 다시 내륙지방인 충북과 충남지역으로 확대된다. 이후로 경기 이북과 강원영서지방으로 확대되어 강원 영동지방으로 확대되어 진행된다(원명수 2008, 이병두 2008). 산불이 진화되면 산불피해와 함께 산불원인도 함께 조사를 한다. 따라서 산불이 발생하는 시기와 지역을 구분하고 산불원인에 따라 산불방지를 위한 예방활동을 하는 것이 산불발생 빈도를 줄이고 피해를 줄일 수 있는 방법으로 생각된다. 또한 산불의 조기진화를 위해서는 산불발생위치를 정확히 파악하는 것이 중요하다. 따라서 산불감시원과 무인감시카메라를 이용하난 산불발생 위치 확인 시스템을 개발하는 것은 매우 의미가 있다. 산불이 발생하게 되면 산림청의 IICG에 따라 산불진화대원이 출동하여 산불을 진화한다. 그러나 산불은 바람의 방향과 풍속에 따라 변할 뿐만 아니라 화염 자체에 의해서 바람이 생성되어 확산된다. 따라서 산불을 진화할 때 이러한 산불의 특성

은 물론 지형적 특성과 임상적인 요인 주변 환경 등의 요인이 숙지되어 있지 않으면 자칫 인명피해가 발생할 수 있기 때문에 현장에 대한 정확한 정보를 상황실과 송수신하며 진화하는 것은 매우 중요하다. 그러므로 산불발생의 빈도와 산부로 인한 피해를 줄이고 또한 재발 방지를 위한 프로그램 개발이 필요하다.
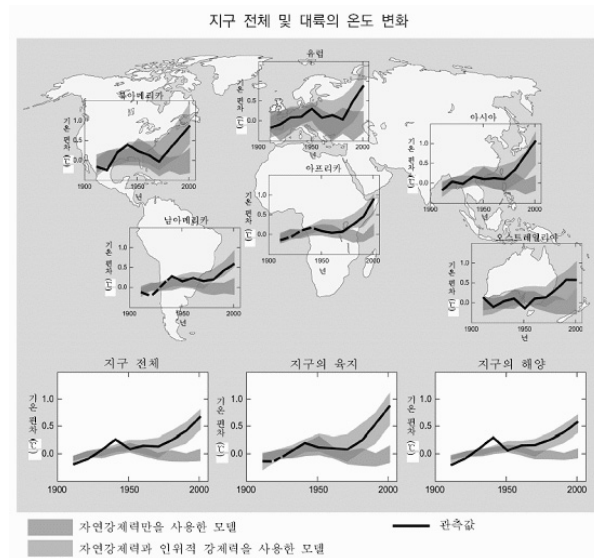
<그림 1> 대륙별 온도변화
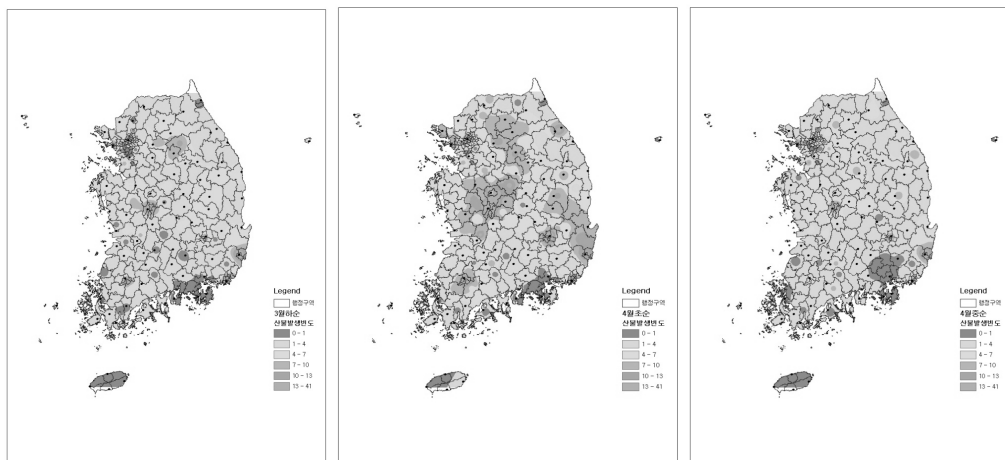
<그림 2> 순기별 산불발생 빈도
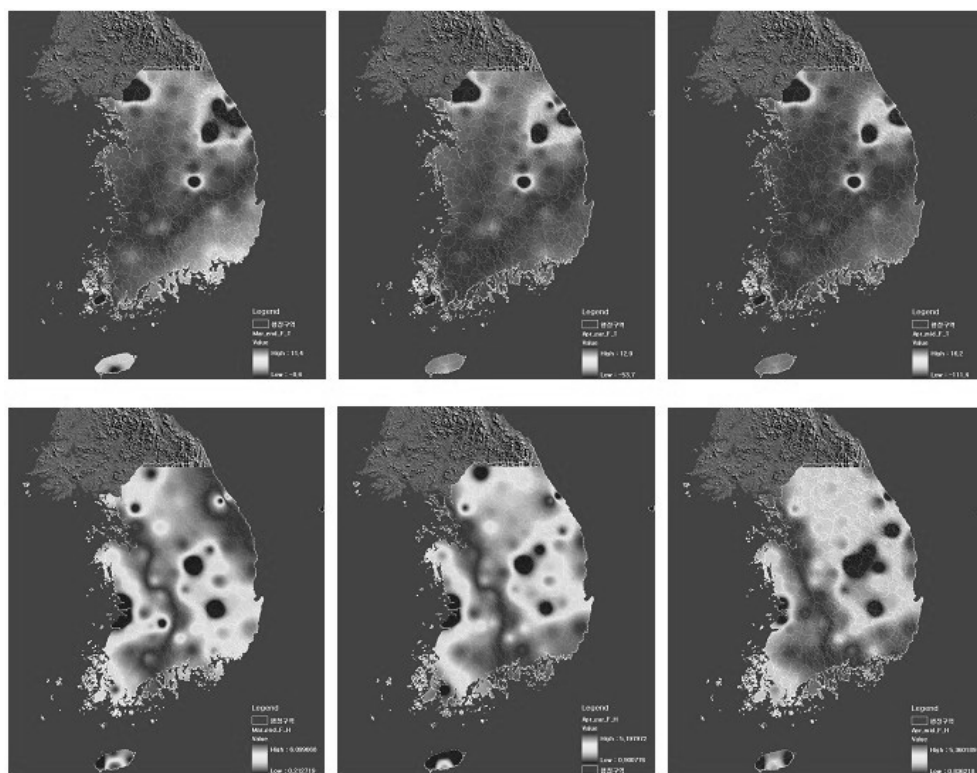
<그림 3> 온습도 변화에 의한 산불발생 위험

연구내용

기후변화에 따라서 산불이 과거에 비하여 많이 발생할 것으로 예상됨에 따라 산불의 조기 발견과 신고 시스템 그리고 진화장비개발과 진화를 효율적으로 운영하기 위한 조직과 체계의 정비는 매우 중요하다. 특히 가상의 상황을 설정하고 반복적인 교육과 훈련을 통해서 산불현장을 운영하여야 산불로부터의 피해를 줄일 수 있을 것으로 판단된다. 이와 함께 기존의 교육시스템은 기존의 산불방지 교육훈련 중심의 교육에서 기후변화에 따라 산불재해분야에 대응할 수 있고, 이미 개발되어 현장에 적용된 첨단 장비와 시스템을 교육하여야할 것이다. 또한 기계화된 진화 장비 분야가 비약적으로 발전하여 이에 대한 실습을 통한 현장화가 필요하고, ICS 개발에 따른 진화지휘체계에 따른 진화대 지휘와 장비운영술 및 타기관과 자원봉사자의 운영에 관한 활용과 자원봉사자의 임무 등에 대한 교육도 필요하다. 특히 IT를 기반으로 개발된 산불진화 및 감시 시스템이 구축되었으므로 이를 다룰 수 있는 전문가 양성이 필요하다.

1. 산불 위치 확인 시스템 개발

산불을 조기에 발견하고 정확한 위치를 파악하게 되면 진화대원은 산불진화를 초기에 진압하기 용이 할 것이다. 지금까지는 유선으로 산불발생위치를 랜드마크와 같은 개념의 지형지물 또는 신고자가 사용하여 왔던 관행적인 용어나 사투리 또는 그 지방의 단어를 사용하기 때문에 신고자와 신고접수간에 의사소통이 원활하지 않은 문제점이 나타났다. 그러므로 이러한 문제점을 해결하기 위해서는 서로가 동의하고 통일된 용어 사용이 필요할 것이다. 그러므로 국가 FGIS 국가사업에서 구축된 각종 DB 가운데 구축된 수치지형도를 활용하고 디지털 방위계를 활용한다면 복잡하고 시간이 오래 걸려서 통일된 용어를 사용하지도 않아도 정확한 위치를 확인 할 수 있을 것으로 판단된다. 따라서 산불감시원 또는 감시카메라를 이용한 시스템에 새로이 개발된 산불 위치 확인 시스템을 접목하여 현장에 적용하면 산불을 조기에 발견 할 수 있을 것으로 생각되며, 산불발생억제를 위한 산불예방 기법으로 적극적인 산불예방법 필요한 것으로 생각된다.

2. 산불 영상 전송 시스템

산불현장을 효과적으로 대응하고 지휘하기 위해서는 현장의 모습을 상황실에서 모니터하고 진화대원를 지휘하는 것이 필요하다. 지금까지는 무전기에 의하여 진화대원이 산불현장 상황을 알려주었으나 이는 전반적인 산불의 진행방향을 알기 어렵고 오히려 진화대원 주변에 대한 국소적인 정보로 산불현장 전체적인 상황을 오판할 가능성이 상존하고 있었다. 따라서 현장의 진화대원과 상황실에 산불의 전체적인 상황과 산불의 확산 경로를 실시간으로 전송하는 시스템을 개발함으로써 산불진화를 효과적으로 진화할 수 있을 것이다. 이 시스템은 지상과 헬기에서 산불현장을 전송할 수 있다.

3. Mobile GIS 시스템

산불진화대원의 안전성을 확보하고 진화대원의 장비와 급식 또는 구급약과 부상자를 후송할 수 있도록 정보를 공유 할 수 있는 시스템이다. 따라서 Mobile GIS 시스템은 진화대원의 안전한 진화 활동뿐만 아니라 진화에 필요한 부족장비, 구급약품, 부상자 후송위치 등 다양한 용도로 활용될 것이다. 특히, 산불현장의 정보를 영상과 함께 상황실에서 판단할 수 있는 의사결정 수단으로도 활용 될 것으로 판단된다.

4. 뒷불 감지 장치

최근 뒷불 재발화에 의한 산불피해사례가 보고되고 있다. 특히, 2005년 양양산불은 진화 후 뒷불정리 중에 재발화되어 발생한 대표적인 사례이다. 특히 대형산불의 경우는 뒷불을 감시해야 하는 범위가 워낙 넓어 짧은 시간에 뒷불을 발견하고 진화하는데 많은 시간과 노력이 소요된다. 따라서 IR 센서를 이용한 열감지 장치 개발은 뒷불 재발화에 의한 줄일 수 있을 것으로 판단된다.
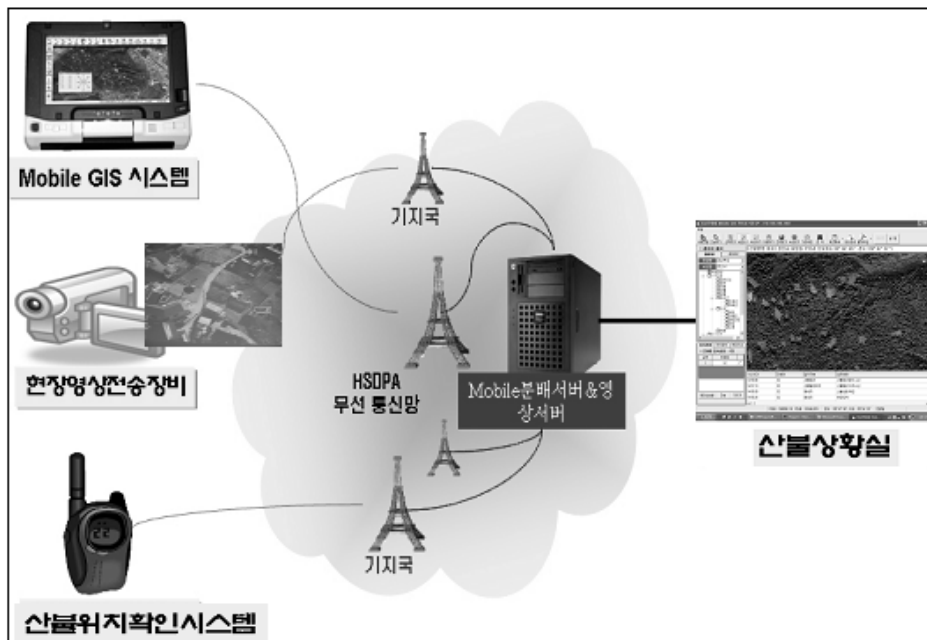
<그림 4> IT 기반 산불관리 시스템 개념도

연구결과 및 고찰

산불피해를 줄이고 효과적으로 산불을 진화하기 위해서는 잘 조직된 조직과 반복적인 훈련이 필요하다. 또한 단계별로 산불진화대원을 훈련시키는 교육단계와 과목개발은 산불재난을 효과적으로 대처할 수 있는 능력을 쌓게 하는 것이다. 특히 과거에는 산불훈련과목이 너무 많고 유사한 과목이 중복됨으로 교육효과가 저조하였고, 수강자의 흥미 유발을 위한 교과목 개발이 떨어짐으로써 새로운 진화기술 개발에 따른 교육과목 증설 및 개편이 필요한 것으로 생각된다. 이와 함께 신설되어야 하는 교육과정으로는 산불진화 후 피해액 조사

와 산불원인 조사 방법에 대하여 교육할 필요가 있다. 그러나 대부분의 교육과정은 집합교육방식에 주입식의 강의형식으로 구성된 제도를 실습과 자율의 교육방식을 채택하고 스스로 상황시나리오를 작성하고 가상현실에서 교육생 스스로 ICS체계를 터득하게 하는 자발 참여방식의 교육으로 진행되어야 할 것이다. 특히 IT의 발전으로 모든 분야에서 적용되고 있는 실정으로 산불분야에서도 IT접목은 대세이다. 따라서 산불연구 선진국에서 사용하고 있는 첨단 장비를 우리 실정에 맞도록 기능개선을 통한 종합관리시스템 개발과 개발된 프로그램의 효율적 활용을 위한 교육이 실시되어야 산불의 발생을 억제할 수 있고, 또한 산불 초기진화로 산불로부터의 피해를 저감할 수 있을 것이다.

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Session 2

Incident Command System in Fire Management, Thailand Report

태국의 산불 관리 사건 지휘 체계

Siri Akaakara

Abstract

Second only to deforestation, fire plays the most destructive role in the forest ecosystem in Thailand which results in not only drastic deterioration of the environment but also jeopardy to life, health and properties of people. All fires are caused by human activities such as gathering of forest non-timber products, agricultural debris burning, incendiary fire, hunting and carelessness. Statistically, about 23,920 ha of forests is affected by fire annually.

The Forest Fire Control Division under the National Park, Wildlife and Plant Conservation Department, Ministry of Natural Resources and Environment is the main agency dealing with forest fire nationwide. The activities includes fire prevention campaign, fire detection and monitoring, fuel management, fire volunteer training, fire suppression and research.

Regarding suppression, 120 forest fire stations nationwide maintained 5,000 full-time fire crew during fire season. The incident management system used to response to fire incident have long been developed over this long period of times to suit the situation, condition as well as tradition of the country. The existing system which endorsed by the government called "Fire suppression mobilization plan" There are 3 levels of plan depending on the level of fire severity. Single command is applied with clear line of command.

요 약

산림벌채는 이차적인 요인일 뿐이고, 화재는 태국 산림 생태계에 가장 큰 해를 끼치는 요인이며 이 것은 환경에 심각한 악화를 가져올 뿐만 아니라 사람들의 삶과 건강, 그리고 재산에 해를 끼친다. 모든 화재는 산림 내 비목재 산물을 모으거나, 농업 잔해를 태우는 것, 방화, 사냥과 부주의 등과 같은 인간 활동으로 인해 발생한다. 통계적으로 매년 약 23,920 ha의 산림이 불의 피해를 입는다. 국립공원청, 야생동물 및 식물 보전 자연자원, 환경부 산하의 산불방지과는 전국적으로 일어나는 산불을 처리하는 주요 기관이다. 화재 예방 캠페인, 화재 탐지와 감시, 연료 관리, 진화대원 훈련, 화재 진화와 연구 등의 활동을 한다.

진화와 관련하여 전국적으로 120개의 산불 관리소들은 산불 계절 동안 풀 타임으로 일하는 5,000명의 진화대원들을 유지한다. 화재 사고에 대처하는 데 사용되는 사건 관리 시스템은 나라의 관습만큼이나 상황과 상태에 적합하도록 아주 오랜 시간 동안 발전해왔다. 정부가 보증하는 현존 시스템은 "화재 진압 기동화 계획"이라 불린다. 이 시스템은 화재의 심각성에 따라 이를 세가지 레벨로 분류한다. 단일 지휘 체계가 명백한 지휘선을 따라 적용된다.

Incident Command System in Fire Management, Thailand Report

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Abstract

Second only to deforestation, fire plays the most destructive role in the forest ecosystem in Thailand which results in not only drastic deterioration of the environment but also jeopardy to life, health and properties of people. All fires are caused by human activities such as gathering of forest non-timber products, agricultural debris burning, incendiary fire, hunting and carelessness. Statistically, about 23,920 ha of forests is affected by fire annually.

The Forest Fire Control Division under the National Park, Wildlife and Plant Conservation Department, Ministry of Natural Resources and Environment is the main agency dealing with forest fire nationwide. The activities includes fire prevention campaign, fire detection and monitoring, fuel management, fire volunteer training, fire suppression and research.

Regarding suppression, 120 forest fire stations nationwide maintained 5,000 full-time fire crew during fire season. The incident management system used to response to fire incident have long been developed over this long period of times to suit the situation, condition as well as tradition of the country. The existing system which endorsed by the government called "Fire suppression mobilization plan" There are 3 levels of plan depending on the level of fire severity. Single command is applied with clear line of command.

1. Introduction

In recent years, our environment which once was taken for granted, has become a subject of great concern to society. Various natural forces have shaped the biotic community over time and will continue to do so. Fortunately, such changes caused by natural foactors are gradual and therefore within the ecosystems's capapbility of self-maintenance and self-regulation. However man-caused forces are a different story. Their effects on mother nature are serious and thus beyond the natural mecahnisam of environment to remedy itself.

For Thailand in particular, the environmental changes caused by man during the last two decades are obviously terrible. Second only to deforestation, fire plays the most destructive role in the forest ecosystem which results in drastic deterioration of the environment as a whole. However, these changes over time seem slow to human eyes. For example, over 20 years of environmental degradation, people gradually get used to the deterioration of nature and actually accept new conditions such as annual flood and drought.

Second only to deforestation, fire plays the most destructive role in the forest ecosystem in Thailand which results in not only drastic deterioration of the environment but also jeopardy to life, health and properties of people. All fires are caused by human activities such as gathering of forest non-timber products, agricultural debris burning, incendiary fire, hunting and carelessness. Statistically, about 23,920 ha of forests is affected by fire annually.

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2. Organization

The main legitimate organization undertaking forest fire control activities is currently the Forest Fire Control Division under the National Park, Wildlife and Plant Conservation Department.

Forest fire suppression is carried out by the Forest Fire Control stations. There are 120 stations nationwide. Due to budget limitation, only 4.68 million hectares or equivalent to 38 % of total forest lands are placed under intensive fire suppression programme. The suppression activities include :

- Training of fire crew as well as fire volunteer brigades
- Fuel management (fire break, control burning etc.)
- Fire detection and report
- Pre-suppression
- Fire suppression

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                    │   National Park,     │
                    │ Wildlife and Plant   │
                    │   Conservation       │
                    │    Department        │
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    │ Forest Fire Control│          │  16 Regional     │
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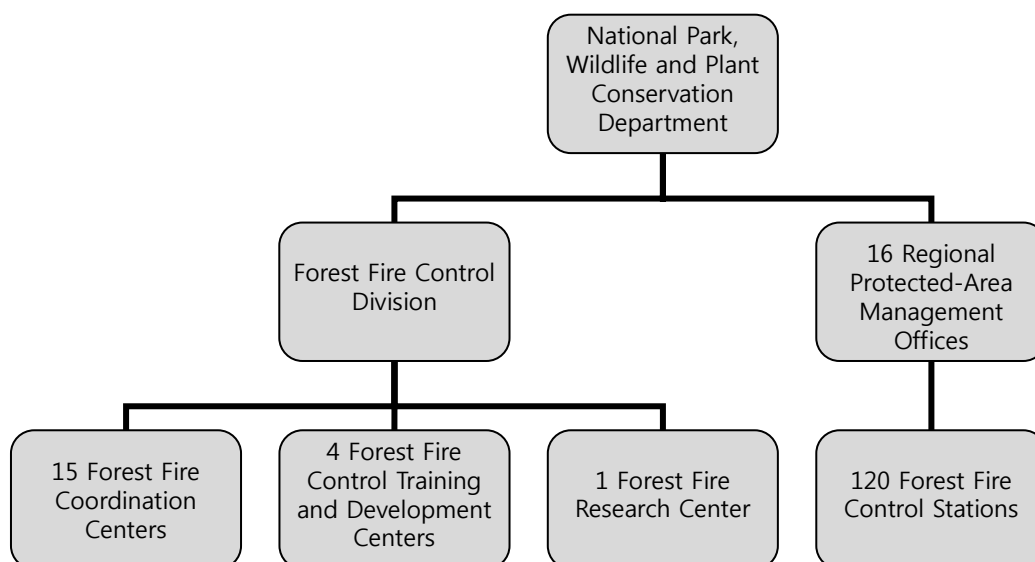
3. Incident Command System

The Incident Command System (ICS) is a standardized, on-scene, all-hazard incident management concept in the United States. It is a management protocol

originally designed for emergency management agencies and later federalized. ICS is based upon a flexible, scalable response organization providing a common framework within which people can work together effectively. These people may be drawn from multiple agencies that do not routinely work together, and ICS is designed to give standard response and operation procedures to reduce the problems and potential for miscommunication on such incidents. ICS has been summarized as a "first-on-scene" structure, where the first responder of a scene has charge of the scene until the incident has been declared resolved, a superior-ranking responder arrives on scene and seizes command, or the Incident Commander appoints another individual Incident Commander.

Thailand in particular have almost 3 decades of experience in fighting forest fire. The system used to response to fire incident have long been developed over this long period of times to suit the situation, condition as well as tradition of the country. The existing system which endorsed by the government called " Fire suppression mobilization plan" There are 3 levels of plan depending on the level of fire severity.

Fire Suppression Mobilization Plan, Plan level 1 (Controlled Situation)
Activated when fire just take place and detected instantly or fire just detected, area burnt not yet exceed 20 ha.
Fire Suppression Mobilization Plan, Plan level 2 (Severe Situation)
Activated when fire just detected but area burnt already exceed 20 ha. or
when suppression operation under Plan level 1 failed to contain fire within 3 days.
Fire Suppression Mobilization Plan, Plan level 3 (Crisis Situation)
Activated when Suppression operation under Plan level 2 failed to contain fire within 15 days. When this Plan level 3 is activated, the incident commander is empowered to mobilize all manpower and resources within the country to combat fire.

Fire Suppression Mobilization Plan, Plan level 1 (Controlled Situation)

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Situation

1. Fire just take place and detected instantly   or
2. Fire just detected, area burnt not yet exceed   20   ha.
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Command Post
Chief of Fire Control Station

Ground Unit

1. Fire Suppression Teams of Fire Control Station

Pump and Machinery Unit

1. Fire engine, Slip-on Tank, Water pump of Fire Station

Air Support

1. Helicopter, Fixed wing plane of Fire Station (if any)

Suppression
⇓

Forest Fire

Fire controlled with in 3 days

Fire still Uncontrolled
⇑

Plan level 2
(Severe Situation)

Fire Suppression Mobilization Plan, Plan level 2 (Severe Situation)

Situation

1. Fire just detected but area burnt already exceed 20 ha. *Or*
2. Suppression operation under Plan level 1 failed to contain fire within 3 days

Command Post
Governor of province in question

Planning Sector Chief of Fire Station	**Operation Sector** Chief of Fire Station 2	**Logistics Sector** Chief of Fire Station 3

- Planning
- Coordinate and Evaluate

    - Provide Logistics
    - First Aids and Rescue

Ground Unit

1. Fire Suppression Teams of Fire Control Station.
2.- Forest agencies within province
- State agencies within province
- Fire volunteer brigades in province

Pump and Machinery Unit

1. Fire engine, Slip-on Tank, Water tank of Fire Station
2.-Water tank, Tractor form Forest Agencies within Province
-Fie engine, Water tank, Tractor form all state agencies Within province

Air Support

1.Helicopter, Fixed wing plane of Fire Station(if any)
2.Helicopter, Fixed wing plane Form nearby Fire Station

Suppression
⟹

Forest Fire

Fire controlled with in 15 days	**Fire still uncontrolled**

⟸

Plan leve 3
Crisis Situation

Fire Suppression Mobilization Plan, Plan level 3 (Crisis Situation)

Situation
1.Suppression operation under Plan level 2 failed to contain fire within 15 days

Command Post
Director General of National Park, Wildlife and Plant Conservation Department

Planning Sector	**Operation Sector**	**Logistics Sector**
Director : Fire Control Division	Director : Regional Forest Office	Director: Logistic Division

- Planning
-Coordinate and Evaluate

- Provide Logistics
- First Aids and Rescue

Ground Unit	**Pump and Machinery Unit**	**Air Support**
1. Fire Suppression Teams of Fire Control Station 2 .- Forest agencies within province - State agencies within province - Fire volunteer brigade in province 3. - *Fire Station from other province* *- Forest agencies form other provinces* *-State agencies form other Provinces* *-Fire Suppression Special Task Force(Fire Tiger Unit)*	1. Fire engine, Slip-on Tank, Water tank of Fire Station 2. -Water tank,Tractor, from forest agencies within province - Fire engine,Water tank, Tractor from all state agencies within province *3 .-Water tank,Tractor from Fores agencies from other provinces* *-Fire engine,Water tank, Tractor from state Agencies from other provinces*	1. Helicopter, Fixed wing plane of Fire Station (if any) 2. Helicopter, Fixed wing Plane from nearby Fire Station *3.-Helicopter, Fixed wing plane from Agriculture Aviation* *- Helicopter, Fixed wing plane from other state agencies*

Suppression
⇓

Forest Fire

Fire under control

Use of Incident Command System
in Central Asia and Russia

중앙아시아에서의 사건 지휘 체계의 사용

Leonid Kondrashov

Abstract

Each Central Asian country has its own fire fighting system directed to suppress all fires. The existing systems of fire fighting resemble each other since all of them have basically been founded and formatted in the USSR. However, current Russian fire management is now again under restructuring after adopting Forest code (in force since 01.01.2007). As a result, fire forest protection is now a responsibility of the regions, Avialesookhrana has been disintegrated and some airbases were established in several Russian regions. It is clear already that these changes had some negative consequences for the whole fire management system in Russia though the creation of 3 new fire coordinating centers in Vladimir, Krasnoyarsk and Khabarovsk could ease the resources and forces maneuvering regionally and maybe in border regions of Russia putting into agenda the introduction of international aspects of ICS. But Central Asia continues to face questions about forestry practices, funding levels, and the federal role in wildland fire protection on the background of the current world crisis. That simply means the decrease of constant attention to the ecological questions though in emergency situations there are no alternatives but suppresses fires and prevents big losses including the assistance of international community which is provided in the frames of ICS.

요 약

중앙아시아 동부의 국가들은 각자 모든 화재상황을 진압하도록 지시하는 고유한 소방 시스템을 갖추고 있다. 현존하는 소방 시스템들은 모두 구소련(USSR)에서 근본적으로 만들어지고 체계를 갖추었기 때문에 서로 비슷하다. 그러나 현재 러시아의 화재 관리는 산림코드를 채택한 이래로(2007년 1월 1일부터 실시됨) 지금 다시 재구성 중에 있따. 이 결과로서 산림을 화재로부터 보호하는 행위는 지역 책임이 되었다. Avialesookhrana는 붕괴되었고 러시아 여러 지역들에는 몇몇의 공군 기지가 설립되었다. 이러한 변화들이 러시아의 전체 화재 관리 시스템에 있어서 상당히 부정적인 결과를 낳았따는 것은 이미 명백하다. 비록 Vladimir, Krasnoyarsk 그리고 Khabarovsk에 창설된 3개의 새로운 화재 협조 센터가 사건지휘체계(ICS)의 국제적 측면의 도입을 의제로 선정하면서 자원 부족 문제, 그리고 지역내에서와 러시아 국경 지역에서의 병력문제를 해결할 수 있었음에도 말이다. 하지만 중앙아시아는 현재 세계가 처한 위기 속에서 임업 실행, 기금 수준 그리고 산불 보호에 관한 연방정부의 역할에 대한 문제들을 계속해서 겪고 있다. 이것은 비상사태임에도 불구하고 생태계 문제에 대한 지속적인 관심이 저하되고 있음을 의미한다. 따라서 사건지휘체계(ICS)의 체제 안에서 제공될 국제사회의 조력을 포함하여 화재를 억제하고 큰 손실을 막는 것 외에는 다른 대안이 없다고 볼 수 있다.

Use of Incident Command System in Central Asia and Russia

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Abstract

Each Central Asian country has its own fire fighting system directed to suppress all fires. The existing systems of fire fighting resemble each other since all of them have basically been founded and formatted in the USSR. However, current Russian fire management is now again under restructuring after adopting Forest code (in force since 01.01.2007). As a result, fire forest protection is now a responsibility of the regions, Avialesookhrana has been disintegrated and some airbases were established in several Russian regions. It is clear already that these changes had some negative consequences for the whole fire management system in Russia though the creation of 3 new fire coordinating centers in Vladimir, Krasnoyarsk and Khabarovsk could ease the resources and forces maneuvering regionally and maybe in border regions of Russia putting into agenda the introduction of international aspects of ICS. But Central Asia continues to face questions about forestry practices, funding levels, and the federal role in wi ldland fire protection on the background of the current world crisis. That si mply means the decrease of constant attention to the ecological questions t hough in emergency situations there are no alternatives but suppresses fires and prevents big losses including the assistance of international community which is provided in the frames of ICS.

1. INTRODUCTION

Central Asia, here defined as Kazakhstan, Uzbekistan, Tajikistan, Kyrgyzstan, part of Russia, Turkmenistan, China and Mongolia, is a much diversified region in many aspects including forestry resources availability, fire situation, fire management potential and technical fleet, political approach to solve urgent questions. Last decades showed the intensification of fire incidents, growth of fire damage, increase of fire fighting costs, efforts to elaborate new approaches to fire management. In most of the countries, especially in former Soviet Republics, the influence of previous approaches to the wildland fire questions is very strong. However in some cases with the assistance of international fire community the attempts to introduce new methods and forms of sustainable forest development and fire management are registered.

The model of ICS and new effective and useful experience of Global Fire Monitoring Center (GFMC) and other international organizations is studied actively in Central Asia on national and regional levels. ICS, being a standardized on-scene emergency management concept specifically designed to allow its user(s) toadopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries, needs to make advances in organization of the whole fire fighting systems.

Russia, for many years being a leader in fire fighting in this region, in many cases provides a model for others for command, control and co-ordination of a fire incident response. The main elements of fire protection in Russia being a foundation for measures for preventing, detecting and suppression of forest fires are air protection service, forest fire subdivisions, personnel and technical means of local various land forest fire organizations, mixed air and land activities and satellite monitoring.

2. Authorized Organizations in Russia

In accord with Russian legislation the functions of organizations involved in fire management are divided in the following way:

1. Ministry of Emergency organizes the state fire supervision and organization of fire extinguishing on the objects and in communities including the right of ways along federal automobile roads and railways and also transmission and communication lines, main oil and gas pipelines adjacent forests; provides for methodological guidance and control of preparation and implementation of actions to eliminate the consequences of possible urgent situations activated by forest and peat fires; provides for registration, activities coordination, check of practical suitability of Ministry forces and resources of constant preparedness to pursue actions to eliminate the consequences of possible emergency situations activated by forest and peat fires; provides for the population informing on undertaken actions to eliminate the consequences of possible emergency situations, activated by forest and peat fires and measures on fire safety in fire danger season.

2. Ministry of Internal Affairs provides for the prohibition of population to visit forests and entry of transport into forests and implementation of determined types of works in case of emergency on the period of high fire danger in the forests; provides for legal regime and law and order in the zones of emergency situations elimination activated by the natural fires; provides for administrative suppression of law breaking in the frames of Ministry authority including on the right of ways along federal automobile roads and railways and also transmission and communication lines, main oil and gas pipelines adjacent forests;

3. Ministry of Defense organizes and conducts in the armed forces and on right of ways areas actions to prevent and eliminate emergency situationsconnected to forest and peat fires; organizes fire-preventive protection of the armed forces' objects against emergency situations, as well as foresees the provision of special machinery, military troops in case of emergency situations activated by forest and peat fires.

4. Prosecutor General's Office of Russian Federation organizes supervisionon pursuing the laws on environment protection, atmosphere, reserves, rational land use, subsoils, forests, waters, wildlife, and also the legislation on sanitary wealth of the population, radiation safety and protection against natural and anthropogenic emergency situations; it supervises the legality of environment protection documents issued by federal ministries and other organizations; it

supervises   the legality and completeness of measures taken by controlling and law enforcement organs in detection and suppression of ecological law breakings.

5. Rosselkhoznadzor in accord with the governmental regulation dated 11.06.2008 N 445 controls and supervises sphere of forest relations including control and supervision of local authorities; state fire supervision in forestsж curb of forest use in accord with federal laws; implementation of activities on forest protection; state of forest fire-prevention organization (roads, fire lines, landing facilities, etc.); development and maintaining of forest fire prevention and suppression systems and assets; accumulation of fuels and oils stocks during high fire danger period; fire danger monitoring in forests, availability of fire suppression plans; implementation of other measures of fire safety in forests.

6. Rosleskhoz approves the norms of fire suppression systems and assetswhich citizens and legal entities must have; approves the normative expenditures for forestry and forest fire suppression per hectare of forest land; organizes forest protection with land and air methods in the frames of its competence; implements a set of actions to protect forests and suppress fires; arranges the prohibition of forest visits by population and transport and also conduction of some works on determined sites of the forest fund.

7. Roshydromet organizes development of detailed weather forecasts fro fire danger period; it conducts constant monitoring of environment state in Russia.

8. Public Corporation Russian Railways provides for if necessary transportation of forces and assets operating in actions on preventing and elimination of emergency situations activated by wildland fires; provides for fire safety of railway vehicles anв fire protection of railway objects and nearby territories against the emergency situations activated by wildland fires.

9. State power organs of Russian Federation subjects organize the development and implementation of wildland fire preventing plans, fire arrangement of forest fund and other forests; provide for the preparedness of organizations involved in forest protection and forest users for fire danger season; approve annually before the fire danger season operational plans of wildland fire fighting; establish the order to involve population, commercial and non-commercial organizations' workers and also fire prevention machinery, transport and other means of these organizations to wildland fire suppression;create reserve of fuel and other material resources fro fire danger season; organize fire suppression in the forest fund on the territory of Russia's subject; assist organizations responsible for forest protection and forest users in construction and repairing of fire roads, airfields and

landings, in providingfuels for firefighters; organize the conduction of fir-prevention propaganda, media response to fire situation and rules of fire safety; use powers in administrative control and supervision for pursuing fire requirements including on the right of ways along federal automobile roads and railways and also transmission and communication lines, main oil and gas pipelines adjacent forests;provide for coordination of all works on fire fighting on the territory of subject of Russian Federation and if necessary create special commissions.

3. Forest Fire Situation in Russia

By the 1990s the Soviet Union had amassed the largest firefighting system in the world. However, when the Soviet political system collapsed in 1991, budgets for fire control were greatly reduced. With these political and economic changes in Russia, the past gains in fire suppression became difficult to sustain as the area receiving fire protection, the frequency of reconnaissance flights, and the numbers of fire fighters that could be hired and deployed were all substantially decreased.

Since the early 1990s the resources available for fire detection, monitoring and suppression as well as for fire prevention decreased substantially in comparison with the 1970s. At that time over 8 000 smokejumpers and rappellers were employed in the Aerial Fire Protection Service Avialesookhrana. On average they were able to suppress about 70% of fires on initial attack.   During this peak period, about 600 aircraft were rented from aviation enterprises. As a consequence of the reduction in available aircraft, permissible flight hours and personnel (in 2005 the number of smokejumpers and helirappellers was reduced by 50% from the 1970s levels), fire detection is often delayed substantially. Consequently the average size of fires at detection and initial attack has constantly increased over the past decade resulting in an increase of the number of large fires (Figure 8). Official records indicate that aerial patrols detect 42% of Russian fires, with 7% being detected by ground resources, while satellite monitoring accounts for the detection of 51% of fires nationally.

Annually there are about 30 thousand of fire incidents in the forests of Russia. In 2007 due to favorable weather and climatic conditions in some regions

the fire danger season was lower on some burning parameters comparing with past long-term levels. Russia had 16.8 thousand forest fires which covered 1040.8 thousand hectares including 708.4 thousand hectares of forest lands. This is lower than in 2006 by 1.9 and 2.4 times correspondingly. 24 regions of Russia accounted for 67% of fire incidents and 95% of burned area in Russia. Khabarovsk Krai and Chita Oblast accounted for 15% of fire incidents and 56% of burned area.

Main causes of high burning were abnormal weather conditions (high temperatures, insufficient or lack of precipitation, strong winds up to 20 m/sec) and careless fire use. In 2007 28 airbases were organized in some regions to protect forests. For the first time, airbases were organized in Murmansk, Vologda, Kirov, Kostroma Regions, Mari El Republic and Jewish Autonomous Region.

Figure 1. Example of unsuccessful agricultural burning. Khabarovsk Krai, 2006

Airbases are fulfilling the following types of works:
1. Aviation patrolling of forest resources in order to detect wildland fires. 2. Suppression of forest fires. 3. Delivery of personnel and machinery to fire spots by aircrafts. 4. Development and introduction of technical means and technologies of fire detection and suppression with the use of aviation. 5. Participation in preventing activities related to wildland fires and implementation the primary air

rescue works.

According to Rosleskhoz, the start of fire season in 2008 was complex since many regions did not take into account the forecast and did not provide for the preparation for fire danger period which led to the negative consequences – comparing with 2007 the wildland fire number increased significantly.   In 2008 there were 25 thousand of forest fires which burned about 2 million hectares. As a result, the forest area destroyed by crown fires reached 48 thousand hectares comparing with 23 thousand hectares in 2007.

The cause of 98% of fires is uncontrolled agricultural burnings, fire passage from stripes along settlements and railways and automobile roads as well as lack of fire-prevention actions.
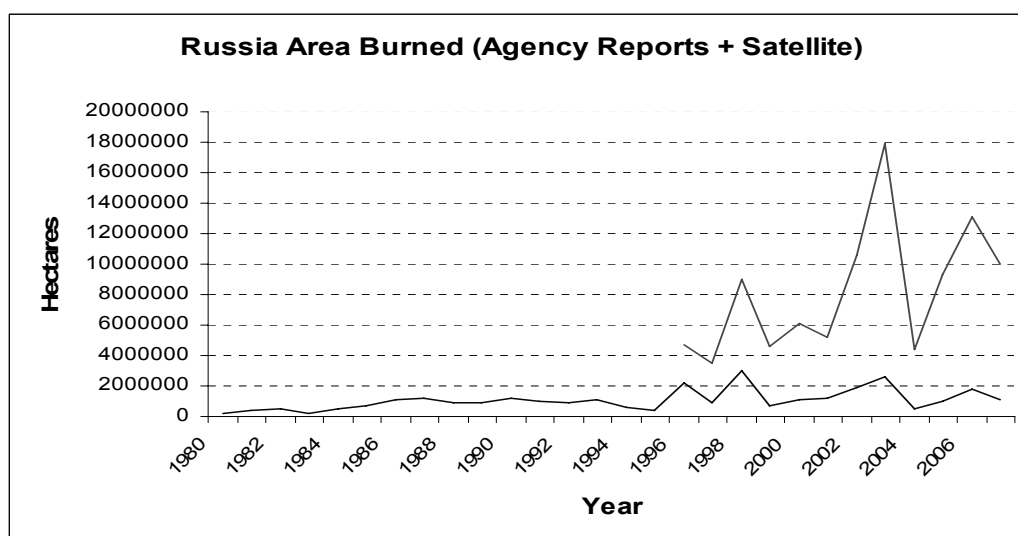
Figure 2. Russian area burned statistics from agency official statistics (1980-2007) and satellite measurements (1996-2007). Source: Goldammer et al. 2008.

The management transformation as usual in Russia requires much money and resources, and leads to the loss of the effectiveness and time in implementing forest fire protection duties, creating unresolved issues between federal and local authorities. According to Rosleskhoz, in 2007 regional agencies were only 40% prepared for the beginning of the fire season, and a lack of resources to control spring agricultural burning resulted in a significant number of large spring wildfires. Reduced fire management capacity in Russia often combines with other

factors to produce extreme fire years. This was the case in 2003 when an extended drought, inappropriate forest management (illegal logging and extensive clearcuts), and economically motivated arson combined with a greatly reduced fire management capacity to create an extreme fire situation in which close to 18 million hectares burned.[Stocks et al. 2008].

In the long run Rosleskhoz offered the ministries and other organizations involved in fire management to elaborate measures to improve the fire situation. For example, Ministry of Justice, Ministry of Agriculture and Ministry of Emergency of Russia have to prepare proposals to change civil legislation foreseeing the obligation of land owners or users to reimburse the damage caused by forest fire including the expenditures for its suppression and elimination of its consequences in full independently from their fault. New proposals must be included in the federal Programme Fire Safety in Russian Federation till 2012 to introduce new modern forest fire machines and equipment of land fire facilities and air bases. There are plans to organize new forest fire centers in Krasnoyarsk, Vladimir and Khabarovsk to improve the maneuvering of forces and resources between the regions. For 2009 there are plans to renew the voluntary groups and their training in many settlements of Russia, etc.

The Central Asian region for the last two decades is experiencing an increase in occurrence, area burnt and environmental impacts caused by wildland fires. In most Central Asian countries the damages from wildland fires and the costs of suppression, as well as their influence on human health and wellbeing, are increasing. The scale of wildland fire sometimes has transboundary effects and demands international and cooperative efforts for the solution.

Reasons for the escalation of destructive wildfires are, among other, result of the rapidly changing socio-economic conditions, declining public budgets for fire management, and side effects of illegal logging; Projected trends of climate change impacts on vegetation cover and fire regimes, as well as observed demographic and socio-economic trends suggest that wildland fire may continue to play a major role in the destruction of vegetation cover in Central and Northeast Asia, resulting, among other, in accelerating steppization, permafrost thawing and desiccation of peatlands / wetlands. There is no international operational mechanism in the region allowing rapid response to large-scale, catastrophic fires. There is a lack of a comprehensive understanding among fire specialists, policy makers and the general public of the nature and the role of fire in natural ecosystem processes, and in the concepts of fire management.

In most of Central Asia countries, the fire situation is quite complex and curtailment led to lowering of functions of state agencies involved in fire suppression. This reduced availability of modern equipment and flight hours to detect and monitor fires timely and to respond efficiently by aerial and ground means. The amount of firefighters employed also decreased sharply over the last years.

Taking into account the scale of wildland fire problem, its transboundary character in many cases, it is very important to arrange international cooperation in the field of fire management. Global Wildland Fire Network (GWFN) headed by Global Fire Monitoring Center (GFMC) and its subdivision Regional Central Asia Wildland Fire Network coordinated by Pacific Forest Forum (PFF) are actively working promoting international cooperation, capacity building, training in the field of fire management in Central Asia.

Wildland fires, dust and sandstorm by which China, Mongolia and Russia exchange with each other cause huge problems to the economies of these countries. These problems are regularly discussed in the process of bilateral governmental negotiations, research conferences and symposia. For example, the bilateral cooperation between Mongolia and Republic of Korea relating these issues has intensified since 1990. South Korea renders assistance to Mongolia in reducing effects of desertification, implementing the Mongolian program "Nogoon kherem" (Green wall), in monitoring the sources of sandstorm disaster and determining the environmental pollution. Mongolia has concluded agreements with Russia and China on protecting water at the border lines and protected areas, and was cooperating with the neighbors to modernize the information system on forest fires and natural disaster. However, in fire transboundary issues there is a need in signing Protocol which could determine all the procedures of international assistance including information exchange, procedure of crossing the border by fire fighting forces, etc. during fire emergency.

Mongolia has signed all the major environmental treaties though sometimes it has limited resources for their effective practical implementation. For example, under RAMSAR in Dornod Aimag Mongolia has a trans-boundary protected area with Russia and China. With China, Russia and North Korea, Mongolia is committed to joint protection of the Tumen River Basin because the Kherlen and Khalkh Gol rivers in the east of the country feed the Amur River which ultimately flows into the Pacific. Regional co-operation is also promoted with Russia and Kazakhstan on the protection of the Altai-Sayan eco-region in Western Mongolia.

The Trans-boundary Water Conservation Inter-government Agreement between Mongolia and Russia on regional water resources had a successful study phase, but due to lack of funding little else was accomplished.

A similar agreement with the Russian forestry agency to cooperate on issues such as infestations of Siberian and Gypsy Moth and wild fires does not apparently work well. Russia provides satellite based data and information but action is limited by lack of funds. Another area of intended co-operation is the programme 'Prevention and Control of Dust and Sandstorms in North-East Asia' funded by ADB. It is aimed at action to mitigate "red" dust storms whose origins are in China and Mongolia. These are seminatural in origin but have 'downstream' impacts in local nuisance experienced as far as South Korea and even Japan. Mongolia has cooperated since 1998 with UNEP and the Acid Monitoring Network in East Asia and has participated with Russia and China in Tripartite Environmental Ministerial Meetings.

On a national and regional scale, both China and Mongolia share the same environmental concerns as evidenced by the number of cooperative agreements signed by these countries since the 1990s. National level:

(i) A Cooperation Agreement on the Natural Environment Protection on May 1990 between China and Mongolia. The major thrusts of the agreement are: (a) developing bilateral cooperation in soil erosion; anti-desertification efforts; grassland protection; and establishment of common natural reserves and hunting ban zones along the borders and coordinating surveys and experimental works; (b) joint study and implement techniques on control of sand storm and soil erosion; (c) joint study and implement conservation, research, breeding and rational

utilization of Mongolia Gazelle and other wildlife animals and vegetables along China/Mongolia

border; and (d) under the support of the UN and its professional organizations, encourage Non-Government Organizations (NGOs) to cooperate on natural environment conservation.

(ii) The Memorandum of Environmental Protection Cooperation between the then National Environmental Protection (NEPA) of China and the Ministry of Natural and Environment (MONE) of Mongolia on September 1990. The main provisions of the memorandum are to: (a) establish protected areas for wildlife animals, especially for Mongolian Gazelle along the border; (b) conduct survey and research on prevention and control of pollution as well as water resources use of the border rivers and lakes, especially for Halkh River and KeLuLun River; and

(c) exchange experiences on nature conservation and management.

(iii)Agreement between China, Mongolia and the Russian Federation on the Establishment, Management and Protection of Trans-boundary Nature Reserves on March 1994. The purpose of the agreement was the establishment of joint nature reserve and, hence, to protect the biological diversity, as well as joint scientific research and monitoring along the borders. The area of the joint nature reserve covers the Daurski nature reserve in Chita Region in Russia, the Dalai Lake nature reserve in China's Inner Mongolia and the Daurski nature reserve in Dornod Province of Mongolia.

(iv) The Establishment of the Third Committee of Trade and Economy Cooperation (CTEC) with the signing of its Terms of Reference in Huhhot (China) on December, 2000. The aim was to coordinate the development of bilateral relationships between the China's Inner Mongolia government and the Mongolian Ministry of Industry and Trade. The committee's activities included environmental conservation and protection measures.

(v) In 1992, PRC and Mongolia are signatories to the Biodiversity Treaty. This has the potential to facilitate bilateral cooperation.

Thus, several national and international organizations united their efforts to hold the First International Central Asian Wildland Fire Conference "Wildland Fires in Natural Ecosystems of the Central Asian Region: Ecology and Management Implications", Round Table on Fire Management and First Central Asian Forest Fire Experiment in Tunkhel Soum, Selenge Aimag (2008) addressing the most pressing issues of the fire situation and the status of fire science and fire management in Central Asia.

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Wildfire Incident Management System in Mongolia

몽골의 산불 사건 관리 체계

Colonel GANBAATAR, Jamiyansuren

Abstract

Mongolia, with vast territory, extreme continental climate and traditional nomadic culture, and livestock husbandry – dominant agricultural sector developed for hundreds of years, experiences mostly forest fire, drought, dzud, flood and animal infectious diseases.

In accordance with the international standard, National Emergency Management Agency of Mongolia (NEMA), responsible for disaster prevention, rescue, response and recovery, was established in 2004 by the decision of the Government of Mongolia, merging the State Board for Civil Defence, Fire Fighting Department and State Reserve Agency that previously and separately carried out disaster related activities. Today NEMA executes honorably and professionally its duties entrusted by the State and the People of Mongolia.

Since no disaster is confined to the territory of one state, becoming regional and global issues and being the priority of Governments and international organizations, we focus on extending foreign relations and cooperation, collaborating with regional and international organizations in the field of disaster prevention and response, preparing qualified professional staff in developed countries, improving knowledge and professional skills of rescuers and fire fighters, renovating techniques and equipments, stocking and restocking state disaster reserve items.

Implementing disaster protection not only with the effort of the Government and the organization in charge for emergency management, but also with collaborative involvement and partnership of the general population, governmental and nongovernmental organizations, private sectors and international organizations is to strengthen disaster resilience of Mongolia.

요 약

광대한 영토, 극심한 대륙성 기후, 전통적인 유목문화 그리고 수백년 동안 발달되어 온 주요 농업분야인 가축사육으로 알려진 몽골은 대부분 산불, 가뭄, dzud, 홍수 그리고 가축전염병을 겪고 있다. 국제적 기준에 따라서 2004년 몽골 정부는 이전에는 개별적으로 재난 관련 활동을 실행하던 State Board for Civil Defense, 소방국과 주 보전 기구를 합병하여 재해 예방, 구조, 대응 그리고 복구를 책임질 몽골국가비상사태관리기구(NEMA)를 설립하였다. 비상사태관리원은 화재와 다른 재해에 대응하는 인도주의적이고 신성한 임무를 수행하며 환경친화적 개발과 국민의 안전을 대표하다.

NEMA의 임무는 위험성과 취약성을 완화시키고 재해관리를 강화하며 지역사회의 개입에 기초한 재해보호대책을 철저하게 실행함으로써 국가안전보장을 지원하는 것이다. 몽골국가비상사태관리청은 그들의 임무를 구조, 화재전문 운송차량, 산불과 초원지역의 불을 진화할 기술과 장비 인력을 운송할 운반장치를 이용하여 수행한다.

NEMA의 주요 역할 중 하나는 산불을 예방하고 억제하는 것이다. 초원과 산림에서의 화재증가와 관련하여 산림산업부 산하에 초원과 산불을 진화할 책임을 질 "공중 감시 및 산불진화대"가 435번째 결의안에 따라, 1968년 몽골인민공화국, 행정평의회에 의해 설립되었다.

1980년에는 천만 헥타르 이상의 산림지역을 조사할 항공관제 시스템이 산불에 취약한 Arkhangai, Bulgan, Khuvsgul, Dornodm, Khentii, Selenge aimags에 만들어졌으며 좁은 면적에서의 화재 혹은 초기 단계의 화재를 발견하여 진화에 효과적이었고 중요한 역할을 하였다. 주비상사태위원회, Aimag와 수도의 주지사들은 예방활동 강화, 화재 방어태세 향상 그리고 자연, 특정 연도의 기후 상태, 봄과 가을의 건조지수, 산불의 위험성 등을 고려한 진화장치와 기술을 준비하는 공식적인 임무와 명령을 발행하고 국민, 자산 그리고 산림재원을 보호할 다각도의 조치를 취한다.

그러나 법률상의 초원환경과 산림 소방활동 강화, 화재 예방과 전국적인 관리 향사을 위해 정부가 취한 정책 조치에도 불구하고 화재의 수는 줄어들지 않았으며 재산, 자연 그리고 생태계의 피해는 수천억의 MNT에 달하여 소방활동을 개혁할 필요성을 시사한다.

Wildfire Incident Management System in Mongolia

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Abstract

Mongolia, with vast territory, extreme continental climate and traditional nomadic culture, and livestock husbandry – dominant agricultural sector developed for hundreds of years, experiences mostly forest fire, drought, dzud, flood and animal infectious diseases.

In accordance with the international standard, National Emergency Management Agency of Mongolia (NEMA), responsible for disaster prevention, rescue, response and recovery, was established in 2004 by the decision of the Government of Mongolia, merging the State Board for Civil Defence, Fire Fighting Department and State Reserve Agency that previously and separately carried out disaster related activities. Today NEMA executes honorably and professionally its duties entrusted by the State and the People of Mongolia.

Since no disaster is confined to the territory of one state, becoming regional and global issues and being the priority of Governments and international organizations, we focus on extending foreign relations and cooperation, collaborating with regional and international organizations in the field of disaster prevention and response, preparing qualified professional staff in developed countries, improving knowledge and professional skills of rescuers and fire fighters, renovating techniques and equipments, stocking and restocking state disaster reserve items.

Implementing disaster protection not only with the effort of the Government and the organization in charge for emergency management, but also with collaborative involvement and partnership of the general population, governmental and nongovernmental organizations, private sectors and

international organizations is to strengthen disaster resilience of Mongolia.

INTRODUCTION

The Emergency Management Servicemen assume humanitarian and sacred duties confronting fire, and other disasters, and standing for sustainable development of the country and safety of the people.

The Emergency Management Service was established on the 7th January 2004, merging **the State Board for Civil Defence,** responsible for protecting population, providing stable activities of the national economy, organizing rescue and recovery in nuclear and other strike affected area, radioactive poisoned and flood hazardous area, **the Fire Fighting Department**, responsible for extinguishing and preventing fire, implementing state fire monitoring and inspecting and **the State Reserve Agency,** responsible for stocking state disaster reserve items in accordance with an approved list, quantity and quality and keeping them ready for emergency use.

LEGAL ENVIRONMENT

Law on Disaster Protection:

1. to regulate matters relating to the principles and full powers of disaster protection organizations and agencies, their organization and activities, as well as the rights and duties of the State, local authorities, enterprises, entities and individuals with relation to disaster protection.
2. to communicate activities between the State and Local Governments, enterprises, entities and the state services in the framework of coordinating disaster prevention, rescue, response and recovery.

Law on Fire Safety:

1. to regulate matters relating to providing fire safety, setting the legal basis of organization, responsible for fire safety monitoring, as well as the rights and duties of the local authorities, enterprises, entities and individuals on providing fire safety.
2. to organize and direct nationwide fire fighting and fire prevention.

Law on Forest and Steppe Fire Protection:

1. to regulate matters relating to forest and steppe fire prevention, fighting, extinguishing and liquidating their consequence.
2. to arrange nationwide implementation of legal acts on Forest and Steppe Fire Protection.

VISION

The vision of the NEMA is to support in providing national safety through risk and vulnerability reduction, strengthening disaster management and implementing intensively disaster protection measures based on community involvement.

MISSION

The Mission of the NEMA is to strengthen legal environment of disaster protection, provide strategic policy guidelines, assess disaster risk and vulnerability, prevent from potential disaster, reduce hazards, provide disaster preparedness, carry out immediately search and rescue, response and recovery of infrastructure, improve disaster protection capacity, implement the state reserve integrated policy, provide intersectoral coordination and to cooperate with States and international organizations in the field of disaster management.

FUNCTIONS

- develop disaster protection legal environment, integrated planning and policy system;
- provide preparedness and readiness of Emergency Management Service, and strengthen disaster protection capacity and technical supply;
- establish additional rescue and fire fighting units considering current necessity, and provide techniques and equipments;
  improve the professional staffs' training system for the Emergency Management Organization and local units;
- introduce advances of science and technology and findings of research work to disaster prevention, rescue, response and recovery;
- create conditions to apply external factors in strengthening and developing the Emergency Management Service through establishing relations and cooperation with States, global and regional organizations in the field of disaster management;

Fire Department of NEMA shall have the following rights:

- To provide the implementation of provisions of the Fire Safety Law and Forest and Steppe Fire Protection Law
- To provide provincial and capital city fire fighting divisions with professional administration and organization in their fire fight and prevention.
- To organize and guide the country's fire fighting and preventing work.
- To research and eliminate fire sources and causes.
- To exercise the state fire monitoring / object and forest fire.

Provincial and capital city fire fighting divisions shall have the following rights and responsibilities within their territorial units:

- To provide public awareness work for fire prevention.
- To extinguish object, forest and field fires
- To conduct registration of fire cases
- To organize air monitoring for forest fire prevention.
- To Monitor the implementation of legislations of fire safety

CAPACITY OF EMERGENCY MANAGEMENT SERVICE

Human resource capacity

- Officers and administrative officers – 22.3 %,
- Professional rescuers and fire fighters with sergeant rank – 77.7 %.

Techniques and equipments capacity

The Emergency Management Service of Mongolia carries out its duties with rescue and fire specialized vehicles, and transporters for carrying people, technique and equipments to extinguish forest and steppe fire.

31.8 % of fire specialized vehicles, 14.5 % of rescue specialized vehicles and transporters for carrying people, technique and equipments to extinguish forest and steppe fire have been used for over 20 years; 9,6 % of emergency vehicles exploited for over 10 years.

Types of hazardous phenomena and industrial accidents occurred in Mongolia *(the last 3 years)*

- forest and steppe fire – 5.9 %
- fire - 86.9 %
- human highly infectious and infectious diseases – 0.6 %
- animal highly infectious diseases – 0.09 %
- animal infectious diseases – 0.09 %
- natural and climatic hazardous phenomena – 2 %
- accidents related to explosives and chemical substances – 0.61 %
- river and lake accidents – 2.3 %,
- industrial and traffic accidents – 0.24 %.

Average annual occurrence of hazardous phenomena was 2817, in which 195 people lost their lives, 206 were injured, 16.8 thousands of animals perished, 3764675.1 hectares of forest and steppe was burned, and the total damage estimated as 72.8 billion MNT. Totally 23517 people and 5130 vehicles were mobilized for liquidating the consequences of hazardous phenomena from the Emergency Management Service, Armed Force, Police and local communities.

ORGANIZATIONAL STRUCTURE

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                    GOVERNMENT OF MONGOLIA
                      (DEPUTY PREMIER)

    STATE DISASTER         NATIONAL            STATE EMERGENCY
    MANAGEMENT             EMERGENCY            COMMISSION
    SERVICES              MANAGEMENT

    DISASTER                                    EMERGENCY
    MANAGEMENT                                  COMMISSION OF
    SERVICES OF                                 CAPITAL CITY AND
    CAPITAL CITY                                AIMAGS
    AND AIMAGS

  STATE      EMERGENCY        EMERGENCY        DISASTER      SEARCH AND
  RESERVE    MANAGEMENT       MANAGEMENT       RESEARCH      RESCUE
  BRANCHES   DEPARTMENTS AND  DEPARTMENT OF    INSTITUTE     UNIT
             DIVISIONS    OF  CAPITAL CITY

        FIRE      RESCUE       EMERGENCY
        FIGHTING  SUBUNIT      MANAGEMENT
        UNITS     S            DIVISIONS OF
                               DISTRICTS

             EMERGENCY              RESCUE      AND
             TEAM-105               FIRE
                                    FIGHTING
                                    SUBUNITS
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POLICY ISSUES ON STEPPE AND FOREST FIREFIGHTING

Mongolian people have ancient tradition and culture on steppe and forest fire prevention. From the time of Chinggis Khan's Empire legal documents provided with the provisions to protect forest and pasture land from fire. For instance, the Law "Ikh Zasag" included spring and autumn seasonal steppe and forest fire prevention measures, when the Law "Khalkh juram", 1709 had provisions to protect pasture land from fire and to punish strictly guilty to fire person.

The first step of nature and environment protection and their rational use was done by announcing Bogd Khan Uul near to Ikh Khuree, Capital City, Mongolia as a National Park in the middle of XYI century.

The base of the professional fire fighting organization was set up in the beginning of the Peoples Government, 1922, through designating watch-post

commander under khoshuu governor in Khan Khentii to protect forest from fire. For this period, forest and pasture land protection from fire fitted into traditional culture or livelihood behavior that relied on nature and getting its fruits and was important for fire prevention.

Since the middle of XX century, Mongolia started to experience urban style of life and were established branches of industry used wood and began to prepare hay and fodder for livestock husbandry. All these initiatives in green area have created some negative consequences.

In connection with increases of fire at steppe and forest territories, "Air-Watch and Firefighting Service" was established under Ministry of Forest Industry with the responsibility to extinguish steppe and forest fire by the 435th resolution, 1968, Ministerial Council, the Peoples Republic of Mongolia. As a result of regular attention of the Government on forming legal environment of steppe and forest firefighting, preventing from fires and strengthening human and technical capacity, organizational structure was developed under General Department of Police, Ministry of Social Security by the 112th resolution of Ministerial Council, 1973, in the framework of State Board for Civil Defence by the 112th resolution of the Government of Mongolia, 1990 and under Ministry of Justice and Internal Affairs after adopting the Law on Fire Safety, 1999 and since 2004 it has begun to work under present structure.

In 1980s, air-control system for surveying more than 10 millions of hectares forest area created in Arkhangai, Bulgan, Khuvsgul, Dornod, Khentii, Selenge aimags prone to forest fire and discovered fires at small area or in earlier stage that were effective and important for extinguishing. For that period state policy on steppe and forest firefighting has executed in accordance with Government resolutions and Minister orders.

The Law on Protection Steppe and Forest from Fire was adopted by the Parliament of Mongolia, 28 May, 1996. Regarding to this Law, the procedure on estimating steppe and forest fire damage, the procedures on mobilizing human and technical resources and fire warning and other documents like the list of required firefighting techniques and equipment were developed and adopted by the Government of Mongolia and have been pursued in daily activities.

State Emergency Commission, Aimag and Capital City Governors issue official tasks and orders on intensifying prevention activities, improving fire preparedness and preparing fire extinguishing machines and techniques considering nature and climate condition of specific year, dryness level of spring and autumn and risk to

fire and take a complex measures to protect people, property and forest fund. All these measures give their effects.

Since 1990s, as a result of global warming, technological development, population growth and human careless activities damage to nature and ecology caused by disasters, especially by steppe and forest fire exceeds monetary measurement. The Government of Mongolia developed National Forest Program in connection with Development Program of decade to protect nature of Global Sustainable Development Program for 21 century, Rio de Janeiro, 1992 and provided it with provisions on steppe and forest firefighting and annually reviewed its results and implementation. Government Action Plan has reflected strengthening disaster prevention and preparedness capacity.

Nevertheless policy measures taken by Government on strengthening legal environment of steppe and forest firefighting, preventing from fire and improving nationwide management, the number of fires has not been reduced and damage to property, nature and ecology estimated in hundreds of billions MNT and highlights needs to reform firefighting.

Priority issues on strengthening steppe and forest firefighting

1. Improving the implementation of the responsibilities of aimag, capital city, soum, bag governors, entities and enterprises, and citizen identified by the Law on Protection Steppe and Forest from Fire, Mongolia and implementing control mechanism and responsibility system.
2. Strengthening legal environment and determining scope of burned area properly taking into account fire situation assessment difficulties caused by distribution of tasks like extinguishing fires executes by emergency management service, identifying reason and guilty person by police and determining damage scope by governor's working group, preventing by ministry of nature and environment.
3. Studying a possibility to cooperate with Global Fire Monitoring Center considering backwardness of nationwide determining steppe and forest fire scope and assessing direct and ecological damage of fires.
4. Studying a possibility to receive information and satellite images on fires at the territory of Mongolia from satellite data network of Siberian Center for Emercom, Russian Federation and to cooperate with

international organizations on data processing using GIS system taking into account increases of fire scope and damage which depends on discovering steppe and forest fire at small area or in earlier stage (late receiving fire images from NOAA, Information and Computer Center, National Agency for Meteorology, Hydrology and Environmental Monitoring due to clouds).

5. Studying a possibility to implement a project to renew techniques and equipment with the support of international organizations and foreign countries considering that NEMA firefighters extinguish steppe and forest fires by manual equipments like water spray, blowing apparatus and their difficulties to get unreachable for human and techniques places.

6. Setting up traditional horseman-watch service at emergency management units with steppe and forest firefighting and preventing purpose.

ACKNOWLEDGMENT

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Session 3

Construction Plan of Ground Forest Fire Fighter Conduct Manual on Use of Incident Command System in Korea

산불진화 행동매뉴얼 구축 방안

Si-Young Lee

Abstract

The manual was proposed for individual role, according to the stages of forest fire suppression at forest fire occurrence site, for forest fire crew who has a responsibility of national forest office. The scopes of this manual are ① apply to initial attack before arriving helicopter, ② apply to ground fire fighting support with air attack, ③ apply to mop-up after withdraw air attack, ④ apply to night suppression when air attack is impossible. This manual is arranged for incident commander or ground fire fighter duties from the 1st stage of acceptance of forest fire to the 10th stage of withdraw of helicopter. This was developed for the purpose of every awareness of the crews and therefore of fire reduction of damage of lives, properties and forest through systematic and rapid response to forest fire.

요 약

산불현장에서 산불진화 단계에 따라 조치하여야 할 국유림관리소의 개인별 임무.역할 수행내용에 대한 행동매뉴얼 구축방안을 제시하였다. 본 매뉴얼의 적용범위는 ① 헬기 도착 전에 초기산불 진화에 활용, ② 헬기 투입 후 지상진화지원 활동에 활용, ③ 헬기 철수 후 뒷불진화에 활용, ④ 헬기진화 불가능한 야간진화에 활용에 두었다. 또한, 본 매뉴얼은 주로 현장진화 지휘자 또는 담당자의 임무를 산불대응 단계에 따라 제1단계인 산불접수단계에서 10단계 철수단계에 이르기까지 총 10단계로 구별하여 정리하였으며, 진화대원들이 평상시 이를 숙지하여 진화대원의 안전은 물론이고 체계적이고 신속한 현장대응을 통해 산불로부터 인명, 재산피해 및 산림피해를 감소시키는데 기여하고자 개발하였다.

Construction Plan of Ground Forest Fire Fighter Conduct Manual on Use of Incident Command System in Korea

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Abstract

The manual was proposed for individual role, according to the stages of forest fire suppression at forest fire occurrence site, for forest fire crew who has a responsibility of national forest office. The scopes of this manual are ① apply to initial attack before arriving helicopter, ② apply to ground fire fighting support with air attack, ③ apply to mop-up after withdraw air attack, ④ apply to night suppression when air attack is impossible. This manual is arranged for incident commander or ground fire fighter duties from the 1st stage of acceptance of forest fire to the 10th stage of withdraw of helicopter. This was developed for the purpose of every awareness of the crews and therefore of fire reduction of damage of lives, properties and forest through systematic and rapid response to forest fire.

1. 서 론

우리나라의 산불은 캐나다나 미국과 같이 번갯불에 의한 자연발화는 거의 없고 대부분이 사람들의 사소한 부주의에 의하여 발생하지만, 산불발생 빈도는 월별, 시간대별, 요일별로 다르게 분포하고, 지역별로도 다발시기와 피해규

모가 다르게 나타나고 있다. 따라서 산불발생위험도를 사전에 판단하기 위해서는 기상, 임상 및 지형요인과 같은 자연적인 조건 이외에도 지역별·시기별 산불발생 통계분석을 통하여 실질적인 산불발생 실태를 구명하여 체계적이고 효율적인 산불예방체계를 구축할 필요가 있고), 산불이 발생했을 경우에는 보다 체계적이고 효율적으로 대응할 수 있는 산불현장통합지휘체계와 개인별 산불진화 행동매뉴얼의 구축이 필요하다.

2005년 4월 4일 밤 11시 50분에 강원도 양양군 양양읍 화일리 야산에서 발생한 산불은 천년고찰인 낙산사와 많은 재산피해를 주었다. 이 당시 산불현장에는 군, 관, 민 등의 진화인력과 장비가 많이 모여도 대규모 동원된 산물 진화자원의 효율적인 배분과 지휘가 미흡하였고, 효율적으로 진화지휘를 할 수 있는 산불전문 지휘관도 거의 없었다. 대형 산불에 대한 전문인력, 장비가 열세였고, 도로가 협소하여 진화차량의 진입도 곤란하였으며, 도로면적에 비해 과잉 진화자원의 투입으로 교통체증마저 야기 시켰다. 화마는 이러한 혼란을 틈타 재 발화를 일으키며 낙산사를 전소시켰다. 따라서 우리나라도 이러한 비효율적인 진화를 보완하기 위한 미국의 ICS(산불현장 통합지휘체계, Incident Command System)와 같은 체계적인 진화시스템 구축이 필요하다.

1970년대에 시작된 미국의 ICS 시스템은 1970년 9월에 남부 캘리포니아에서 13일 동안 발생한 수많은 화재로 약61만ha 이상의 피해면적과 16명 이상의 사상자 피해 그리고 700채의 집과 구조물의 소실을 입은 후 시작되었다. 이 당시 미국은 가장 우수한 장비와 잘 훈련된 기관들을 가지고도 화재대응에 있어 공동작업상에 많은 어려움을 겪었고, 비효율적이고도 소모적인 혈세의 집행이 이루어졌다. 그로 인해 모든 대응기관과 기구 간의 보다 더 효율적이고 효과적인 협조를 위한 하나의 통합된 재난통합관리체계의 절대적 필요성이 대두되어 이 시스템을 개발하였다.[7]

우리나라도 2005년 강원도 양양산불을 계기로 미국의 ICS를 Bench-Marking하여 우리나라 실정에 알맞은 산불현장통합지휘체계(IICG, Integrated Incident Command Guidelines)를 개발한 바 있으며, IICG의 주요 구성 대용을 보면 ① 산불규모별 진화지휘 책임자의 규정 ② 산불단계별 대응 요령 ③산불확산 단계별 조치사항 ④현장지휘책임자의 역할 및 지휘권 인계 ⑤ 진화대의 조적식(組積 式: Modular Organization) 편성 운영 ⑥유관기관 진화자원의 운영 관리 ⑦산불진화 완료의 판단 기준 ⑧유관기관의 임무 및 역할 등으로 정리되고 있다. 그러나 산림청 에서 개발한 IICG의 적용범위는 대형 산불현장에서 적용 가능한 대응매뉴얼 로 작성되어 있어, 실제 소규모의 산불현장에 적용이 쉽지 않은 것이 현실이 었다. 또한, 산불 확산단계별로 개개인의 임무와 설명이 규정되어 있으나 주

로 나열식 위주의 설명으로 사용자로 하여금 자신의 임무를 명확히 알 수 없고 또한 손쉽게 찾아볼 수 없는 단점이 있었다.

따라서, 본 논문의 목적은 산림청 국유림관리소 산불담당자를 중심으로 담당자의 각각의 임무를 산불접수단계에서 진화 후 철수단계까지 단계별 구성단위로 세분화 및 도식화하는 한편, 산불담당자의 일련의 행동을 산불신고 접수단계에서부터 초동진화, 진화완료까지 개인별로 명정함으로써 보다 체계적이고 책임감 있는 산불현장 지상진화를 수행하게 하는데 있다.

2. 산불 지상진화 행동매뉴얼의 적용범위 및 적응요령

본 매뉴얼은 산불재난 위기관리 업무를 수행하는 산림청 국유림관리의 산불대비 및 대응 활동에 적용하며, 산불현장에서 산불진화 단계에 따라 조치하여야 할 국유림관리소의 개인별 임무.역할 수행에 적용하고자 개발하였다. 또한, 현재 산불진화에 가장 핵심적인 역할을 수행하고 있는 진화헬기와 연계하여 ① 헬기 도착 전에 초기산불 진화에 활용, ② 헬기 투입 후 지상진화지원 활동에 활용, ③ 헬기 철수 후 뒷불진화에 활용, ④ 헬기진화 불가능한 야간진화에 활용하게 하고자 개발하였다.

본 매뉴얼은 Fig. 1과 같이 산불규모별 진화가능시간에 따라 산불현장 진화 지휘 책임자 및 담당자 등이 조치하여야 할 사항을 규정한 것으로써 산불이 급속히 확산되는 경우 등에는 상황단계 구분에 불구하고 일을 융통성 있게 적용하게 한다. 또한, 본 매뉴얼은 주로 현장진화 지휘자 또는 담당자 중심으로 평상시 이를 숙지하여 산불발생시 향후 조치하여야할 사항을 예측하고 신속하게 대응 할 수 있도록 하고자 한다.
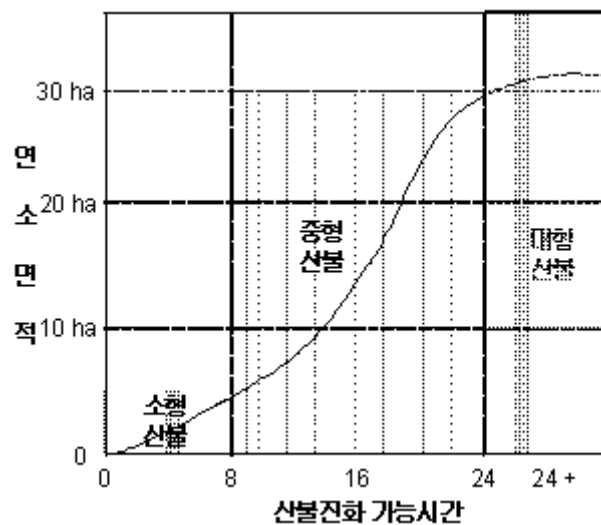
Fig. 1. Extinguishable time according to the forest fire size

3. 단계별 산불 지상진화 매뉴얼 구성

　본 매뉴얼의 산불에 대한 대응단계는 산불신고 접수후 산불담당자에게 신속히 인계하는 1단계로 부터 산불진화 완료후 철수단계인 10단계 현장철수에 이르기까지 일련의 상황을 구별하여 아래의 Fig. 2에 정리하였다. 그 외 단계는 산불 상황 조치별로 출연하는 담당자를 중심으로 임무를 간략하고 체계적으로 분류 및 정리하였다.

　즉, 1단계에서는 신고접수단계 및 본부상황실의 역할이다. 산불신고 접수자는 산불발생지에 대하여 최대한 상세한 자료를 신고자로부터 획득해야만 하며, 이러한 자료는 산불 초동진화에 매우 중요한 자료가 된다.

　또한, 본부상황실 산불담당자와 통신담당자는 산불신고접수자로부터 산불신고상황을 인계받아 신속히 상부에 보고, 산불여부 확인, 산불발생지에 대한 상황 조치 그리고 시간대별 상황을 기록하는 임무를 담당하며 다음 단계인 초동진화 단계에 대비하여야 한다.

Fig. 2. Overview of forest fire attack process

2단계에서는 초동진화대 출동단계로 본부상황실부터 산불상황을 보고 받은 현장지휘관은 우선 지방청장이나 산림청에 산불상황을 보고한 뒤 진화팀장을 주축으로 신속히 초동진화대를 출동 시켜야 한다. 부득이 산불전문진화대가 없을 경우에는 우선 산불발생인근 전문예방진화대에게 연락을 취하여 신속히 산불현장에 투입하여야만 초동 진화에 성공률을 높일 수 있다.

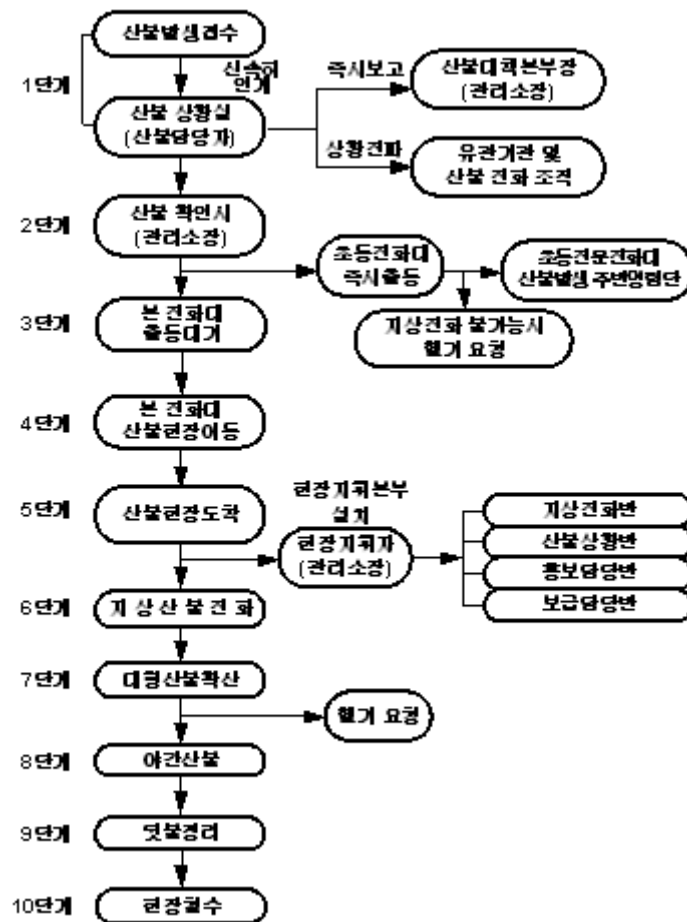진화팀장은 현장도착 직후 현장상황을 파악하고 인력지상진화 여부를 판단하여 인력지상진화가 불가능할 경우 국유림관리소 본부상황실에 헬기 요청을 하여야 하며, 헬기요청시 지형도나 GPS를 이용하여 정확한 현장위치를 보고하여야 한다. 또한, 이 단계에서는 현장지휘관인 관리소장은 본부진화대의 출동

준비를 명해야 하며, 본부상황실은 이 명령에 따라 진화대를 소집하고 현장의 지휘본부 설치를 준비하여야 한다.

3단계에서는 본진 진화대의 출동 대기단계로 현장지휘관은 신속히 현장지휘본부를 구성토록 지시하고 산불현장으로의 출동준비를 하며, 동시에 본부상황실에서는 각종 유관기관에 산불상황을 전파하여 만약의 산불확산에 대비하여야 한다. 현장지휘본부는 지상진화를 담당하는 지상진화반, 산불진화 전략 및 전체상황을 총괄하는 산불상황반, 산불상황을 홍보할 홍보담당반, 각종 진화에 필요한 물품을 담당할 보급담당반으로 편성 한다.

4단계는 본진 진화대의 현장 이동시의 단계로 현장지휘관은 이동시에도 현장의 초동진화대와의 통신을 통해 산불상황을 보고받아 상부에 현황을 보고하여야 하며 또한, 이동 중에 산불진화계획을 구상 하여야 하며, 진화대원의 현장집결지를 선정 현장접근로를 통보하도록 하고, 본진의 현장진입에 앞서 현장의 질서유지를 위한 담당자를 편성 현장의 질서유지를 하여야 한다.

5단계는 본진 진화대의 현장도착시 흐름도이다. 우선 현장지휘관인 관리소장은 산불현장 도착시 상부에 현장의 상황을 파악하여 보고하여야 한다. 그리고 신속히 지상진화대를 산불 현장에 투입하여야 한다. 현장지휘 본부의 설치 위치는 산불상황을 조망할 수 있는 곳으로 통신이 유지되고 최대한 산불현장과 가까운 접근이 용이한 곳으로 위치를 선정하여야 한다.

6단계에서 지상진화 단계로 현장에 지휘본부가 설치되면, 현장지휘관은 지휘본부내의 산불상황반, 지상진화반, 홍보반, 보급반의 담당자와 대책회의를 소집하여 산불진화계획 수립, 홍보대책수립, 보급계획수립을 지시하고 산불진화에 총력을 기울여야 한다. 또한, 현장에 투입된 진화조장들과의 지속적인 통신을 통해 산불상황을 보고 받고 산불진화전략 수립, 인원 투입계획, 헬기 요청 등을 판단하고 산불진화지휘를 하여야 한다. 지금까지 기술한 내용은 소·형 산불단계에서 적용할 수 있는 절차이다.

7단계에서는 대형산불(24시간이상 경과하고 30ha이상 연소) 확산시의 임무전환 단계로 대형산불로 확산시 중소형 산불지휘자는 시도지사에게 지휘권을 신속히 인계하고 이때 지방청장은 상황총괄반장이나 부지휘자로서 대형산불단계의 임무를 수행하게 되며, 중소형 단계에서 현장지휘자의 역할을 수행하던 관리소장은 지상진화반장이 되어 지상진화를 담당하게 된다. 그 외 중소형단계의 현장지휘본부에 편성되어 있던 홍보담당자는 홍보대책반에 보급담당자는 보급지원반에 소속되어 산불진화 임무를 지속적으로 수행하게 된다. 대형산불 확산시에 가장 중요한 문제는 중소형 산불 지휘관이 지휘권을 인계할 때 현재의 산불상황에 대하여 정확하게 시.도지사에게 브리핑 하여 향후 산불 진화에 전략을 세울 수 있도록 하여야 한다.

8단계는 야간산불 진화단계이다. 즉, 야간산불 현장지휘자인 관리소장은 산불현장 상황을 고려하여 현장지휘본부를 이동설치 하여야 하며, 신속히 야간산불 진화계획을 세워야 한다. 야간 산불진화계획 수립시 우선 고려할 사항을 야간에도 지속적으로 진화를 계속할 것인가 아니면 익일 진화 할 것인가를 판단해야 하며, 익일진화를 결정할 경우 감시조를 배치한 뒤 익일진화를 위해 진화대원을 철수 시켜 휴식을 조치하여야 한다. 이러한 상황들은 산불현장에 투입되어 있는 진화조장과의 통신을 통해 결정을 해야 한다. 또한, 보급담당자는 야간 진화에 대비하여 안전장비를 추가지급 및 식사계획을 철저히 세워 야간진화에 임해야 한다.

9단계는 뒷불정리 단계로 현장지휘자인 관리소장은 진화대장으로부터 산불진화 완료 보고를 받은 뒤 상급기관인 지방청과 산림청에 우선 진화완료 상황을 보고한 뒤 진화대장으로 하여금 재불 발화에 대비하여 진화선을 구축하고 뒷불진화조, 뒷불감시조, 뒷불순찰조를 편성함과 동시에 운영토록 하여야 하며, 진화대장은 산불피해상황을 조사하여야 한다. 한편, 진화조원들은 재불 발견시 신속히 보고하고 뒷불진화를 수행함으로써 재불 발화 방지에 만전을 기해야 한다. 또한, 관리소장을 헬기를 통해 산불지역을 순찰하여 진화가 완료되었는가를 확인하여야 한다.

10단계 철수 단계로 산불진화가 완료되었다고 판단되면 보급지원반과 홍보담당반은 현장지휘본부를 해체하고 진화대장은 진화장비의 회수 및 피해상황을 조사하여야 하며, 진화조장들은 진화작업조의 안전 체크 및 진화도구를 회수하고 현장정리를 한 뒤 복귀하여야 한다.

4. 결론 및 제안

본 논문은 기존의 산림청 및 지자체에서 개발한 IICG 등 『산불재난』위기대응 실무매뉴얼의 적용범위가 대형 산불현장에서 적용 가능한 대응매뉴얼로 작성되어 있어, 실제 소규모의 산불현장에 적용이 쉽지 않은 것이 현실이었다. 또한, 산불 확산단계별로 개개인의 임무와 설명이 규정되어 있으나 주로 나열식 위주의 설명으로 사용자로 하여금 자신의 임무를 명확히 알 수 없고 또한 손쉽게 찾아볼 수 없는 단점이 있었다.

따라서, 이러한 문제점을 해결하고자 산불담당자의 각각의 임무를 산불접수단계에서 진화 후 철수단계까지 단계별 구성단위로 세분화 및 도식화하는 한편, 산불담당자의 일련의 행동을 개인별로 명정함으로써 진화대원의 안전은

물론이고 체계적이고 신속한 현장 대응을 통해 산불로부터 인명과 재산피해를 감소시키고자 한다.

　본 산불지상진화 행동매뉴얼은 국유림을 관리하는 국유림관리소의 개인별 임무.역할수행에 적용하고자 개발하였으므로, 일부 사유림의 산불진화체계와는 조직과 담당업무, 진화방법에서 다소 차이점이 있을 수 있으므로 향후 사유림 관점에서의 지상진화 행동매뉴얼 대한 재구축이 필요한 것으로 판단된다.

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Incident Command System in Fire Management, Indonesia Report

인도네시아의 산불 관리 사건 지휘 체계

Bambang Hero Saharjo

Abstract

Until the year 2006 forest and land fires performance in Indonesia was quite significance as it caused negative impacts as it was occurred during the years before. This situation is quite different during the year 2007 and 2008 where forest and land fires occurred less than usually as it could be seen through hotspot detected which decreased around 70 % according to Forestry Department official report, while according to ASMC Singapore only 50 %.

During January to December 2007 it had been found that most of hotspot detected in Indonesia totally about 10,280 (64.07 %) rooted from the community; 2,644 hotspots (16.48 %) in estate crops; 1,691 hotspots (10.54 %) in the forest concession and 1,430 hotspot (8.91 %) in the forest plantation area.

Based on the government authority, the central government has responsibility to protect fire in the forest conservation area, this is the reason why 30 (thirty) fire brigade called Manggala Agni in the fire front area of 8 provinces supported by equipment and crews exist especially in the dry season. Meanwhile for the local people (community) they have they own brigade as it call "Masyarakat Peduli Api" (The Community Care Fire) which consist of the peoples in the village who care on fire. Indonesian government regulation stated that if the fire exist in the district the responsibility belong to Head of District (Bupati), when smoke move to the neighboring district then responsibility belong to Governor, and when smoke move to the neighboring country then responsibility belong to Ministry of Forestry which should provide equipments, crews, techniques, getting international cooperation, while dealing with environmental situation, ad vocation, responsibility belong to Ministry Environment. If the forest and land fires situation worsen then National Disaster Management Agency led for suppression activities.

요 약

   2006년까지 인도네시아의 산불과 들불 발생은 이전에 발생했던 산불이 그랬던 것처럼 부정적인 영향을 야기시키기 때문에 매우 중요한 사안이었다. 그러나 평소보다 산불과 들불이 적게 일어난 2007년과 2008년에는 상황이 사뭇 다르다. 이 같은 상황은 임업부 보고서에서 감지된 산불 위험지역이 약 70% 감소했다고 밝힌 것에서 알 수 있다. 반면 싱가포르 기상정보포털에서는 50%만이 감소했다고 밝혔다.

   2007년 1월에서 12월 사이에 인도네시아에서 감지된 산불 위험지역은 10,208(64.07%) 개소가 지역사회에서, 2,644(16.48%) 개소가 작물재배지에서, 1,691(10.54%) 개소가 산림 양해지역에서 그리고 1,430(8.91%) 개소가 식재림에서 야기되었다.

   정부 당국에 따르면, 중앙정부는 산림보호 구역에서 산불을 예방해야 할 책임이 있다. 8개 주(province)의 화재 전방구역에 있는 Manggala Agni라고 불리우는 30개의 화재여단이 장비와 인력을 지원 받고 건기 동안에 존재하는 것도 이러한 이유 때문이다. 한편 현지인 사회들을 위하여 화재를 보호하려는 마을 사람들로 이루어진 "Masyarakat Peduli Api"(지역사회 화재 보호)이라 불리는 자체 여단을 보유하고 있다. 인도네시아 정부 법규는 화재가 행정구역(Bupati)에서 발생할 경우 책임은 구청장에게 있으며, 연기가 인근 구역으로 옮겨갈 경우 책임은 주지사에 있고, 연기가 이웃나라로 넘어갈 경우 책임은 국제적 협력을 얻어내는 동시에 장비, 인력, 기술을 제공해야만 하는 임업부에 있다고 명시하고 있다. 반면 환경 관련 사태나 이송절차 문제는 환경부에게 책임이 있다. 산불이나 들불 상황이 악화될 경우 국가재난관리기구가 진화 활동을 이끌게 된다.

Incident Command System in Fire Management, Indonesia Report

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Abstract

Until the year 2006 forest and land fires performance in Indonesia was quite significance as it caused negative impacts as it was occurred during the years before. This situation is quite different during the year 2007 and 2008 where forest and land fires occurred less than usually as it could be seen through hotspot detected which decreased around 70 % according to Forestry Department official report, while according to ASMC Singapore only 50 %.

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INTRODUCTION

Scientific evidence show that forest fire in Indonesia is not new because it had been found that repeated fire had been occurred between 15510 BC and 1650 AD, especially in lowland tropical rain forest in East Kalimantan. Big forest fire for the first time occurred in East Kalimantan in the year 1982/1983 where 3.6 million ha of forest and land burnt, then very year fire blow up with different size and impact. The biggest fire at the 20th century in Indonesia occurred in the year 1997/1998 where 10 million ha of forest and land burnt which caused cost damaged of US$ 10 Billion and environmental impact faced to about 20 million peoples and most of the fires blow up in Sumatra and Kalimantan Island. It was very surprised that most of the fire rooted from arson during dry seasons and it had been investigated that it was come from land preparation of using fire for oil palm and forestry plantation done by companies and local peoples.It has been scientifically demonstrated beyond reasonable doubt that fire has been part of the natural ecosystem in Indonesia for many thousands of years, and burning coal seams have been part of the landscape in that time.

The vulnerability of Indonesian forest is also linked to more fundamental issues of forest management and the role of communities and local governments. There is very little attention given to the existence of local communities living close to the forests, including those that are vulnerable to fire (UNCHS, 1999). Burning for land preparation is banned by law for companies, but since it is cheap and quick, and companies need to achieve planting targets, it is still widely practiced. Although burning increases the amount of nutrients in the soil, which temporarily enhances growth performance, it also has negative effects. It has been found that the smoke of fire rooted from land preparation using fire mostly (60-80%) from an oil palm and industrial forest plantation illegally where rest of it to be believed made by shifting cultivation which unfortunately usually blaming for the smokes occurred. Zero burning policy had been used as a promising solution for reducing smoke which has an implication to reduce greenhouse gasses; unfortunately it was not work because the smoke increased due to high increasing

of land conversion activity done for oil palm and industrial forest plantation.

Smoke and "haze" from forest fires produce some of the most visible costs to society. People suffer respiratory problems, which puts pressure on meager medical facilities in many tropical countries. Estimates suggest that between 20 million and 70 million people were adversely affected by smoke from the Indonesian fires and at least 40,000 people were hospitalized both in Indonesia and neighboring countries (Asian Development Bank, 1999 and Glover and Jessup, 1999). Smoke reduces visibility, provoking transportation accidents and airport shutdowns. This often leads to transboundary smoke pollution, which provokes international indignation (ADB, 1999). It had been found also the flooding area emerges in several districts and regions mostly believed have directly due to the fire done before.

CAUSES OF FOREST FIRES

Land Conversion

It is a common misconception that most land conversion in the ASEAN region involves the clearing of pristine forest (Qadri, 2001). While this may be true in the case of peat swamp forestland, much land conversion in the region simply continues the process of human intervention that began with timber extraction from virgin forestland. According to a recent report, of the total area of about 4.8 million ha consumed by fire during 1994, 88 percent comprised logged-over forests, some of which were under cultivation by traditional dry land agricultural techniques. By contrast, shifting cultivation areas accounted for only 5.3 percent, transmigration farmland 4.5 percent, areas occupied by previously-established plantations only 0.8 percent, and natural protected forests a scant 0.2 percent. The corresponding figures for 1997 (which exclude information for calendar year 1998) tell a similar story. Of the total land area consumed by large-scale fires during that year, logged-over production forest accounted for 62 percent. The reminder comprised the following: national parks, 20.6 percent; protection forests, 8.4 percent; nature reserve, 6.5 percent; and recreation parks, 0.6 percent (MOE/UNDP, 1998).

Observation made during the fires and haze of 1997-1998 and previous

cases have indicated that the intensity of the fire in logged areas was directly related to the intensity of logging. Even severe fires did not completely destroy moderately logged stands where, after fire, a few trees with green foliage could still be observed, although spaced and scattered. In heavily logged forest areas, which remaining trees were widely spaced, shrubs had formed a thick ground cover, providing an efficient biomass source for the fires after the extensive drought. Here, the fuel consumption was more complete (BAPPENAS, 1999).The main factors causing increased combustibility are wasteful logging and forest clearance for agricultural crops, estate crops, and forest plantations leading to build up of dry materials. The changing composition of vegetation due to mono-cropping, draining of peat swamps, and mining practices that expose coal deposits also contribute to altering the fuel characteristic (Qadri, 2001). The land clearance and preparation activities influence the volume and condition of the fuel load, serve as the ignition source, and often cause the spread of fire. These activities, in the effect, take advantage of drought conditions created by weather disturbances such as ENSO.

Drought Condition

Indonesia's climate is shaped by the annual cycle of east and west monsoons, which affect rainfall and winds across the archipelago (Qadri, 2001). The major islands and smaller island groups are dominated by a humid tropical climate and rain forest vegetation, although the Lesser Sunda Islands, eastern Java, and small parts of other islands have mild to pronounced rainfall seasons. There are two weather phenomenon considered to be crucial to the spread of forest fires and haze (Qadri, 2001). The first is recurrent ENSO conditions, bringing extraordinarily dry weather to the region (and in the process, creating conditions ideals for disposing of biomass residue by open burning). Prolonged drought in Indonesia occurs at least once every 10 years. Data on rainfall in Bali, Java, Kalimantan, Sulawesi, and Sumatra, since the early 1900s show that prolonged drought occurred 17 times during the century, of which 11 corresponded with an *El Nino.* When the dry season in Indonesia occurs at the same time as an *El Nino ,*the result is a prolonged drought, which extends from June to November and can continue until May of the following year. The second weather factor is that in geographic areas that lie close to the equator, there is relatively little wind. This means that in the ASEAN areas where land conversion is in progress, the

weather forces that mix (and dilute) the particulate matter from land conversion fires with unpolluted air are weak (Qadri, 2001).

In Indonesia, a prolonged drought as a consequence of an *El Nino* has occurred fire times over the last 20 years. This had varying effects in different parts of the country, depending on the strength of the El Nino and the monsoon winds sweeping past Indonesia. Compared with the previous El Nino years, the once in 1997 had the highest impact on drought and fires in Indonesia. Forest and land fires in 1997 occurred in nearly all provinces.

SOURCES OF FIRES

Illegal Shifting Cultivators

Usually when fire broke up in many provinces in Indonesia, many people's blames shifting cultivator as source of it, because they used fire for land preparation for agricultural purposes. It was proved by jailing three of them in East Kalimantan in 1997 and also in Riau in 1999 and another's six person in the year 2005. Of course shifting cultivators used a fire for they land preparation, because it was cheap, and easy to do, and it was done for thousands years ago (Goldammer, 1993) without any environmental problems like it happens now. Shifting agriculture systems in their early practice and extends use largely determined by low human population pressure on the forest resources. They provided a sustainable base of subsistence for indigenous forest inhabitants, and their patch impacts had little effects on overall forest ecosystem stability (Nye and Greenland, 1960). By burning they will got a free mineral from ash that rich of organic-carbon, phosphorus, magnesium, potassium, and sodium. The nutritional value increase temporarily after burning, however, because when rainy comes, it will be leached and decline (Garren, 1943; Jordan, 1985 and Saharjo, 1995).The origin of the 1982-83 fire has not been definitely identified, but swidden agriculture has been considered as one of the most plausible sources (Wirawan 1993). Swidden, slash-and-burn or shifting agriculture has been traditionally practiced by rural people in Borneo, as in many other parts of the tropics. With the intention of planting crops at the onset of the rainy season in November and December, they usually start clearing and then burning their fields during the second half of the dry or less rainy period, usually in September and

October, while in Sumatra on August to September. The timing of their slash-and-burn practice is well established and is primarily based on the annual variation of the Monsoon.By the way one of the reasons why shifting cultivators activity become environmental problem is because of illegal shifting cultivator did it (Saharjo and Husaeni, 1998). They are not the real shifting cultivators but they are a new comer from other cities or region who never did shifting cultivation and without any experienced. For the real shifting cultivator they are know how to burn and prevent fire jump to other place, for instance using fire breaks and they know also when fire should be put down and stop. This knowledge is not a simple and easy thing to be done quickly by the new comer. Some time they never think about this, then, burn it directly and we can imagine what would happen, burned are become larger and spread everywhere. Some time it takes several days, with black smoke in the sky.

Forest and Oil palm plantation

It was proved that the sources of fires in 1997 forest fires were mostly from land preparation using fire for forest plantation and estate crops. It was shown that 65 % (Anonymous 1998) until 80 % (WWF 1998) of the forest area burned in East Kalimantan was done in the forest concessions and estate crops. This was also supported by the Ministry of Forestry statement which announced the list of 176 companies that suspected burn they land for forestry and estate crops planting. By the way, none of those companies being subject for punishment by the government due to not enough evidence. In the year 1999 it has been known that more than 40 companies in Riau province doing the same things like in 1997/1998 but no punishment. After the year 2000 then forest plantation and oil palm (un or intentionally) and the community with business perspective become the most significant activities produce smoke within the country. Fortunately in the year 2001 an oil palm company finally had been punished, and until the year 2005 at least around 25 companies being investigated for court.The use of fire is officially forbidden although every company uses it, because this is the only viable and economic method of reducing the huge biomass. The underlying cause is, hence, the policy that plans to convert 500,000 ha of forest into plantations every year (Schindler, 1998). The government (CIFOR, 1998) has licensed and stimulated many companies to develop new industrial plantations of rubber, oil palm and pulpwood, as well as transmigration sites. These activities require the clearing of

hundreds of thousands of hectares of land, and fires are their cheapest option. The traditional method of claiming forested land as in many parts of the world has been to burn and then plant. It seems likely that migrants, particularly in areas near cites, as well as large government-sponsored agricultural or forestry development programs, are clearing forest to establish land claims.

Logging

Logging activities have greatly increased both fire risk and hazards (Mackie, 1984). Access roads opened up the forests to both immigrant and local people for making field (Wirawan, 1993). By opening up the forest canopy, logging activities have greatly stimulated the growth and accumulation of plant biomass near the ground. Additional dead biomass is also provided by deformed logs and branches left behind by loggers. The failure of the rainy season to arrive on time, as was the case in late 1982, prolonged dry season, dried this plant biomass and then helped the fires started by shifting cultivators in September or October to spread wildly unchecked for several months until heavy rain fall in May 1983. As a result, 70 % of the burned forest in East Kalimantan, occurred in the logged-over forest areas (Wirawan, 1993).When logging companies enter into a new area, they automatically bring with them the fire problem. They are opening up the forests and making them more susceptible to forest fires through road, logging waste, bulldozing through the stands and opening up the canopy and finally bringing in people as the source of fire (Schindler, 1998).Fire risk is increased dramatically by the conversion of material forests to rubber and oil palm plantations, and by the logging of natural forests, which opens the canopy and dries out the ground cover. Plantations are drier and trees are move evenly spaced than natural tropical moist forests, thus increasing the opportunities for fire to spread. Evidence also suggests that fires burned mostly easily in secondary forests that had already been disturbed through (frequently illegal) timber operations. Selective logging destroys much of the most undergrowth and the closed canopy that reduces the likelihood and impact of forest fires in natural forests (Dudley, 1998). Fire was used to exploit the natural rain forest especially in Kalimantan by the name of salvage logging. It was realized when fire come to their area and they do not have ability to fight it, resulted in the cleaning of the natural forest from shrubs and grass create a condition which easily entered. Unfortunately the do not cut down the trees burned but also fresh tress which is the main target.

RECENTLY FIRE SITUATION

Based on data made by Department of Forestry (2007), it had been known that until 2006 the increasing of hotspot was very significant as it can be seen that from 8 (eight) fire risk provinces in Indonesia only North Sumatra which produce less hotspot (-6.50%), meanwhile other provinces produce more hotspot that varies from 56.54 % until 1,738.75 % (Table 1). The total forest and land burned during 2006 predicted about 6 million ha.

Table 1. Number of detected hotspot in the period 2005-2006 monitored by Department of Forestry

No.	Province	Number of hotspot detected		
		2005	2006	%
1	North Sumatra	3,380	3,581	-6.50
2	Riau	22,630	35,426	56.54
3	Jambi	1,208	6,948	475.17
4	South Sumatra	1,182	21,734	1,738.75
5	West Kalimantan	3,022	29,266	864.43
6	Central Kalimantan	3,147	40,897	1,199.56
7	South Kalimantan	758	6,469	753.43
8	South Sulawesi	133	1,201	803.01

Fire incident in the year 2006 seems anti climax of fire occurred following 1997/1998 fires which burnt more than 10 million ha of forest and land. To fight forest and land fire during 2006 incident, two BE-200 from Russian help us for suppression activities in Sumatra and Kalimantan and it takes around 100 days, beside that helicopters and other heavy equipment provided by Manggala Agni fire brigade which separated in 30 station at fire risk provinces (under controlled by Department of Forestry) and companies (oil palm and forestry plantation) also involved. Suppression activities during 2006 fire incident led by Coordinator Ministry for Welfare because the fire effects worsen and out of control and transboundary haze pollution occurred. This command system was also based on the standard procedure regarding the fire out of control and trandsboundary haze pollution occurred then the suppression activities take over by National Disaster Management Agency. Department of forestry take responsibility for suppression equipment, human resource, technique and connecting with international community on fire, while Ministry for Environment takes responsibility for advocating and environmental evaluation.

Number of hotspot during 2006-2007 according to the data taken by

Department of Forestry (KNLH, 2008) shown that hotspot detected decreased significantly compared to hotspot detected in 2007 at average of 71.39 % (Table 2), while according to the data made by ASMC Singapore the decreasing of hotspot detected was only 49.76 % (Table 3).

Table 2. Number of   hotspot detected during 2006 – 2007 taken by Department of Forestry (KNLH, 2008)

No.	Province	Number of hotspot detected		
		2006	2007	%
1	North Sumatra	3,581	936	-73.86
2	Riau	11,526	4,169	-63.83
3	Jambi	6,948	3,120	-55.09
4	South Sumatra	21,734	5,182	-76.16
5	West Kalimantan	29,266	7,561	-74.16
6	Central Kalimantan	40,897	4,800	-88.26
7	South Kalimantan	6,469	928	-85.65
8	South Sulawesi	1,201	551	-54.21
	Average			-71.39

Table   3. Number of   hotspot detected during 2006 – 2007 taken by ASMC Singapore (KNLH, 2008)

No.	Province	Number of hotspot detected		
		2006	2007	%
A	Sumatra Island			
1	Bangka Belitung	953	477	-49.95
2	Bengkulu	233	118	-49.36
3	Nanggroe Aceh Darussalam	336	172	-48.81
4	Jambi	2,617	1,310	-49.94
5	Riau Island	67	34	-49.25
6	Lampung	947	474	-49.95
7	Riau	4,654	2,361	-49.27
8	West Sumatra	361	181	-49.86
9	South Sumatra	5,057	2,532	-49.93
10	North Sumatra	1,015	512	-49.56
	Total Sumatra	16,240	8,171	**-49.69**
B	Kalimantan			
1	West Kalimantan	6,197	3,103	-49.93
2	South Kalimantan	1,079	540	-49.95
3	Central Kalimantan	5,580	2,801	-49.80
4	East Kalimantan	2,842	1,430	-49.68
	Total Kalimantan	15,698	7,874	**-49.76**
	Total A+B	31,938	16,045	

Most of hotspot detected in the period of January-December 2007 (Table 4) totally about 10,280 or about 64.07 % was in the community (KNLH, 2008), followed by hotspot detected in the estate crops was 2,644 (16.48%) in the estate crop, in the forest concession was 1,691 (10.54 %) and in the forest plantation was 1,430 (8.91 %).

Table 4. Number of hotspot detected during January-December 2007 according to land use (KNLH, 2008)

No.	Province	Forest concession	Forest plantation	Estate crop	Community	Total
A	**Sumatra Island**					
1	Bangka Belitung	0	0	0	477	477
2	Bengkulu	2	0	13	103	118
3	Nanggroe Aceh Darussalam	7	15	23	127	172
4	Jambi	72	172	119	947	1,310
5	Riau Island	0	0	2	32	34
6	Lampung	0	99	35	340	474
7	Riau	323	422	698	918	2,361
8	West Sumatra	8	1	32	140	181
9	South Sumatra	12	172	136	2,212	2,512
10	North Sumatra	6	23	34	439	512
	Total Sumatra	440	904	1,092	5,735	8,171
B	Kalimantan					
1	West Kalimantan	350	271	675	1,807	3,103
2	South Kalimantan	74	51	36	379	540
3	Central Kalimantan	598	91	430	1,682	2,801
4	East Kalimantan	229	113	411	677	1,430
	Total Kalimantan	1,251	526	1,552	4,545	7,874
	Total A+B	1,691	1,430	2,644	10,280	16,045
	%	10.54	8.91	16.48	64.07	100

Hotspot detected in peat land during January-December 2007 totally about 3,127 both in Sumatra (2,036) and Kalimantan (912) or about 20.05 % compared to the all hotspot detected, 16,045 (KNLH, 2008) . Hotspot detected in mineral soil totally about 12,828 both in Sumatra (5,866) and Kalimantan (6,962) or about 79.95 % compared to the all hotspot detected (Table 5).

Table 5. Number of hotspot detected in peatland during January-December 2007 (KNLH, 2008)

No	Province	Peat land	Mineral soil	Number	%
A	**Sumatra Island**				
1	Bangka Belitung	31	446	477	5.84
2	Bengkulu	3	115	118	1.44
3	Nanggroe Aceh Darussalam	44	128	172	2.11
4	Jambi	109	1,201	1,310	16.03
5	Riau Island	6	28	34	0.42
6	Lampung	73	401	474	5.80
7	Riau	1,242	1,119	2,361	28.89
8	West Sumatra	41	140	181	2.22
9	South Sumatra	580	1,952	2,532	30.99
10	North Sumatra	176	336	512	6.27
	Total Sumatra	**2,036**	**5,866**	**8,171**	
B	Kalimantan				
1	West Kalimantan	420	2,683	3,103	39.41
2	South Kalimantan	75	465	540	6.86
3	Central Kalimantan	293	2,008	2,801	35.57
4	East Kalimantan	124	1,306	1,430	18.16
	Total Kalimantan	**912**	**6,962**	**7,874**	
	Total A+B	**3,127**	**12,828**	**16,045**	
	%	**20.05**	**79.95**	**100**	

EFFORTS TO REDUCE THE FIRES

It was found that Indonesian forest fire management lacked useful data rooted through forest fire research, making effective action against forest fires very weak. There was also a weakness in the interest of the people who working in the forest plantations and agricultural activities such as rubber and oil palm plantations that use fire in land preparation without any clear guidelines. There is no alternative solution for shifting cultivators who have been using fire for land clearing for thousand of years. There is also a loss of control from the government side which causes rules and laws become absurd. This situation has remained for a long time, even there were a large forest fires in 1982/1983 which destroyed 3.6

million ha. Unfortunately forest fires have occurred every year from small to large scales as happened in 1994, destroying 5.4 million ha of forest and land. Shifting cultivation and El-Nino would be blamed for those fires, without any clear solution on how to solve the problem. To solve this problem through law enforcement, education and technique then Indonesian government fight the fires.

Law

Through law enforcement, land and forest fires tried to be reduced. Beside Indonesian Law No.23 regarding Environmental Management announced in the year 1997, Law No.41 about Forestry that announced in the year 1999 there was also another Government regulation   and Law that produced until the year 2005. It was such Government Regulation No. 4 regarding Destruction and Pollution Management Related with Land and Forest Fires that announced in the year 2001, Indonesian Law No.18 regarding Estate Crops and Government Regulation No.45 regarding Forest Protection that both announced in the year 2004. The results of those regulation give a significant results when for the first time an oil palm Estate Manager found guilty of using fire for the land preparation that proved by fire expert witness which then send him to the jail and finalty for US$ 1.1 Million. Following this case now at least 50 cases not only from oil palm but also from forest concession and forestry plantation being processes to go to the court.

Technical

Through those regulations also now the companies and ministry of forestry fight the fires based on their own responsibility using simple and high technology with the main purpose to protect their asset from fire invasion rooted from un or intentionally. In July 2002 the forest fire control brigade named 'Manggala Agni' was established under Ministry of Forestry. This Manggala Agni is an institution facilitated with personnel, equipment and budget to perform the function and tasks of prevention, suppression and post-suppression of forest fire. The fire brigade is attached to the MoF with a single command line under the Director General of Forest Protection and Nature Conservation down to its Technical Executing Unit at Natural Resource Management Unit. Until today 30 fire brigades had been established at eight fire prone provinces including North Sumatra, Riau, Jambi, South Sumatra, South Kalimantan, West Kalimantan, Central Kalimantan and South Sulawesi. This fire brigade is supplied with forest fire equipment including hand tools, water pumps, mechanical tools, communication and transportation

facilities, logistic and medical.

Education

Fighting fires are not only through law enforcement and equipment but also through human education. Most of the fires in Indonesia rooted from human intervention with certain purpose some time not. For the local people nowadays Community Development (CD) program become very important on how to facilitate the community for not using fire through productive activity. The program directly focused on how to reduce fuel load that usually burned but getting benefit from it without burning.Another important aspect also regarding the role of human in preventing fire is through training. The training could be given to the company staff, local peoples and to the decision makers with different purpose and responsibility.

CONCLUSION

Most of the hotspot detected during January-December 2007 trend to decreased significantly (71.39 %) and it was located in the area belongs to the community that was about 64.07 % which means that the sources of the fire significantly different compared to the forest and fire incidents before. This situation means that the community base fire management should be put in the first priority and without any clear command during fire incident will increase the hotspot as it occurred before.

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Forest Fire Suppressions in China

중국의 산불 진화

Shu Lifu   Wang Mingyu   Tian Xiaorui   Zhao Fengjun

Abstract

The natural environment of China is very complex. Plantation and secondary forest account for greater proportion of the total forest in China, and forest fire is severe. Since 1987, Chinese government have strongly enhanced the prevention, fighting, and management of forest fires. In order to strengthen the leadership of forest fire fighting, Forest Fire Headquarters were set up successively in total 30 provinces, autonomous regions, and municipalities. The main measures to manage forest fires fighting are to raise public awareness through publicity and educational activities, manage forest fires by legislation, firefighting team development, and mobilize the power of society to prevent forest fires, reinforce the infrastructure construction and key fire danger zones management. China utilizes many means to prevent, monitor, and fight forest fires. In the long time for future, how to manage the forest fires effectively, decrease the load of fuel in the forest, and avoid large forest fires occurrences are still the challenges we face in forest fire fighting.

Key Words: China; Forest fires; Fire suppression

요 약

중국의 자연환경은 매우 복잡하다. 인공림과 이차림이 중국의 전체 산림 중 상당히 큰 비율을 차지하고 있으며, 산불 피해가 심각하다. 1987년 이래로, 중국정부는 산불의 예방, 진화 및 관리를 강력하게 강화해왔다. 산불 진화 활동의 지도력을 강화시키기 위해 산불 본부를 총 30개의 주와 자치구, 그리고 시들에 성공적으로 배치하였다. 산불 진화 활동을 관리하는 주요 대책들에는 산불에 대한 대중의 인식을 홍보와 교육활동을 통해 확립시키는 것과, 법률 제정을 통해 산불을 관리하는 것, 진화팀의 발전, 그리고 산불을 예방하기 위해 지역 사회의 힘을 동원하는 것, 사회 기반 시설을 강화하는 것, 그리고 주요 산불위험구역을 관리하는 것 등이 있다.

중국은 산불의 예방, 감시, 진화를 위해 많은 방법들을 동원하고 있다. 장기적으로는 어떻게 산불을 효과적으로 관리하고 산림 내 연료량을 감소시키며 대화재의 발생을 억제할 것인가 등이 산불 진화에 있어서 우리가 당면한 과제이다.

Forest Fire Suppressions in China

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Abstract

The natural environment of China is very complex. Plantation and secondary forest account for greater proportion of the total forest in China, and forest fire is severe. Since 1987, Chinese government have strongly enhanced the prevention, fighting, and management of forest fires. In order to strengthen the leadership of forest fire fighting, Forest Fire Headquarters were set up successively in total 30 provinces, autonomous regions, and municipalities. The main measures to manage forest fires fighting are to raise public awareness through publicity and educational activities, manage forest fires by legislation, firefighting team development, and mobilize the power of society to prevent forest fires, reinforce the infrastructure construction and key fire danger zones management. China utilizes many means to prevent, monitor, and fight forest fires. In the long time for future, how to manage the forest fires effectively, decrease the load of fuel in the forest, and avoid large forest fires occurrences are still the challenges we face in forest fire fighting.

Key Words: China; Forest fires; Fire suppression

Introduction

The government of China always pays much attention to the reproduction and protection of forest. The forest coverage has increased from 8.6% to 16.55% in the late 50 years. By the fifth statistics of forest resources during 1994-1998, that the forest area is 158,900,000 ha, the stocking 12,490,000,000 m^3, the forest coverage 16.55%, and the latent stocking 11,267,000,000 m^3. The forest area per person is only 0.12 ha, and the stocking per person 9.63 m^3, which is far lower than the average level of the world. The forest resources cannot meet the needs of

society development. The China government takes the forestation as the centre task for ecology construction. The reinforcement of forest resources protection, especially the fire prevention, is the most important component of environmental construction.

The "Daxing'anling conflagration" in 1987 is the turning point of the fire prevent in China. With summarizing the experiences and studies on the forest fires occurrence, the China government has enhanced the fire management and techniques on the whole. As a result, the integrated ability of fire control increased and fire damage decreased sharply.

1 Forest fire management in China

The prevention and fighting of forest fires is a sociality work. With the guideline of "Prevention mainly and fighting actively", our purposes is to decease fire occurrence and damage to the lowest level.

1.1 Organization of fire prevention in China
Headquarters of fire prevention and branches have been established at different administration level. There are 3085 fire prevention headquarters and 3257 branches, and 16945 staff. During fire season, the administration personnel keep on duty day and night and make the forest fire information informed timely.

1.2 Propaganda and education
Increase the fire prevention consciousness in society. By setting post, slogan, broadcast, TV, publication and internet and other activities to disseminate fire prevention knowledge, strength the management of fire source and persons to enter into forest.

1.3 Establish forest fire prevention laws and regulations
According to "Forest Law" and "Forest Fire Prevention Act", all the provinces constitute "Forest Fire Prevention Act Implementation Measures", and establish the fire management system with fire sources management, persons management who to enter into the forest and education as the work center.

1.4 Establish forest fire-fighting team

There are 22 aerial fire prevention satiations and 7 forest fire prevention police armies in northeast and southwest forest region. We established about 10,000 semi-specialized fire prevention teams in some counties with abundant forest, and there are about 294,000 persons take parts in the teams.

1.5 Prevent forest fire by social power together

In fighting large forest fires, many government sectors involve in the work, such as transportation, weather, police and other agencies. Supports from these sectors play an important role in control the conflagrations.

1.6 Infrastructure Establishment

The establishment of fundamental facilities is the material base of fire prevention and fighting. The government provide expert subsidy for the fundamental facilities establishment. For example in 1998, the total money that the government provided added up to 1 billion Yuan. The different level governments provide complimentary money to buy all kinds all fire fighting equipments. To fight large area forest fires, we established 3 fire fighting material storage centers in Beijing, Northeast and Southwest, and the local governments have also established about 4200 material storage centers.

1.7 Synthetic management of key fire danger regions

According to the distribution principle and characteristics of forest fires, the government enhanced the establishment of fundamental facilities and management of forest fires in northeast, Inner Mongolia and southwest region since 1996.

2 Measures and techniques of forest fire prevention in China

The level of technique and management of forest fires increases with the recognition of forest fires damage. Some techniques, such as fire rate prediction, fire monitoring and large area fire fighting, are put in the prevention, fighting and management of forest fire.

2.1 Regionalization of fire danger regions

Classify different forest fire danger rating according to the combustion of tree, human density, mean precipitation, air temperature, wind speed, roads network density etc. Classify all the counties into 3 rate danger regions by the administration boundary. There are 2130 regions that are included in 3 fire danger rate regions in China. By the classification of the fire danger regions, we can guide the fire prevention and management effectively.

2.2 Forest fire danger rating forecast system

To determine the fire weather danger rating by five factors provided by local weather stations, these five weather factors are air temperature, relative humidity, precipitation, wind, biological characters. The fire weather danger rating is classified into five classes:

Ⅰ: No danger, the fuel can not be ignited.

Ⅱ: Low level danger, the fuel is difficult to be ignited.

Ⅲ: middle level danger, the fuel is not easy to be ignited.

Ⅳ: High level danger, the fuel is easy to be ignited.

Ⅴ: Extreme level danger, the fuel is very easy to be ignited.

The local forest fire headquarters manage and prevent forest fires according to the fire danger rating. Local forest fire headquarters cooperate with the local weather stations, and forecast the fire danger rating.

2.3 Forest fire monitoring

2.3.1 Ground patrol

Patrol in the forest to prevent the occurrence of forest fires according to different fire danger rating and time by men. Inspect the passerby and vehicles to

know whether their behaviors accord with the fire prevention. Mange the fire sources to prevent fire occurrence.

2.3.2 Watchtower monitoring

By the distribution of forest and the topography, build watchtowers to monitoring the occurrence of forest fires, identify the location of the fires and transmit the fire information to the forest fires directing headquarters. There are about 10000 watchtowers in the whole country and cover above 85% of all the forest area.

2.3.3 Television monitoring

In some important area, we use the television monitoring technique to monitor forest fires and it has the advantages of large area cover, good quality image, sequence, saving etc. This means has been used in many important areas.

2.3.4 Aerial monitoring

2.3.5 Remote sensing monitoring

Use the red and near infrared bands to detect the hot spot information from ground surface, and monitor the fire occurrence and fire spread by interpret the image from meteorological satellites. By this way, we can cover large area region, get the information quickly, receive sequence information and can detect the dynamic change of forest fires. We have constructed 3 satellite monitoring centers in Beijing, Kunming and Wulumuqi, compose the satellite monitoring network and the effect is very well.

2.3.6 Lightning monitoring

In Daxing'anling Mountain, monitor the location and intensity of lightning to complement the monitoring of the occurrence of lighting fires by lightning detecting and location equipments. We built one AF station and 4 DF stations in Inner Mongolia and Daing'anling Mountain.

2.4 Forest fire resisting techniques

Firebreak is one effective means of resisting fire spread and decreasing damage. With our research achievements, we have built large quantity of fuelbreaks in south China, which play an actively role in fire prevention.

2.4.1 Building fuelbreak

Fuelbreak can resist the fire spread, can be the control line of fire fighting, and also can be the simple bypass of passing material and fire fighting crews. There have been 490,000 km firebreaks in China by now. The mean measures to build fire lines including of bulldozer, weeding herb with herbicide or manpower, and prescribed burning.

2.4.2 Building shaded fuelbreaks

To build shaded fuelbreaks with the plantation establishment or rebuild from the closed forest. The property of fire prevention trees includes fast growing, strong germinating, and high moisture content and fire resistance. Due to the property of shaded fuelbreak, the fire is not easy to spread in the forest.

2.5 Forest fire fighting

To extinguish forest fires needs experienced director and fighter team, effective fire fighting tools and equipment, and good fundamental facilities and logistics guarantee. The mean measure and means of forest fires fighting as follows:

2.5.1 Fighting fires with simple tools

Use fire fighting bat, shovel and other hand tools to fight low intensity surface fires.

2.5.2 Fighting fires with Air Jet Extinguisher

Block the fuel and decrease the temperature with Air Jet Extinguisher, it can

effectively put out the initial fire and moderate surface fire. There are 92,000 Air Jet Extinguisher.

2.5.3 Fighting fires with water

Water is the most effective extinguishing agent, Tank trucks, fire pumps and other equipments using water can effectively fight surface fires, ground fires, low intensity crown fires and mop up fire scars.

2.5.4 Fighting fires with extinguishing bombs

Using extinguishing bombs to control fire front, can fight the fire with other means.

2.5.5 Fighting fires with back fire

In fire fighting, especially when the fire is very intense, the fire fighters can not approach the fire. Under this conditions, fighting fires with fires is usually be used. Choose the roads, rivers as the control line, and ignite the backfire in proper place so as to form fire prevention line.

2.5.6 Fighting fires by helicopter landing and rappeling

Use the helicopters to carry the fire fighters and tools, or use the rappeling to slip down to the ground. Every year, we hire about 50 helicopters in northeast, Inner Mongolia and southwest to fight fires.

2.5.7 Fighting fires with plane

Use plane to carry chemical extinguishing agent or water to fight the fire directly. There are 5 chemical extinguishing agent bases in key forest region. Usually use M-8, M-171 and AS-350 helicopter to fight fire line, and use AS-350 helicopter to fight initial lightning fires or mop up fire scars.

2.5.8 Fighting fires with artificial rainfall

Under the condition of cumulonimbus, artificial rainfall can be used in fire

fighting. This means is widely used in northeast and southwest.

3 Prospect of forest fire management and fighting in China

3.1 Fire management in China is very severe.

With the increasing plantation, forest area expand, especially the area of young forest and half-mature forest increase quickly, the task of forest protection and fire prevention become more heavy. Prescribed burning has not been widely used in large area, this leads to the accumulation fire fuel, and the potential fire danger rating becomes very high.

With the reforming of forest region, many persons enter into the forest for tour and other economical activities, potential fire sources become more than ever, and the fire sources management becomes more difficult.

3.2 Due to the anomaly of global climate, drought, high temperature, big wind become more frequent than ever, the fire danger rating is very high.

3.3 Fire fighting equipments are relative old and fire fighting technique is low, the means of forest fire prevention and fighting can not adapt to the needs of forest fire management, especially lack of the ability and means of controlling large area forest fires.

3.4 The fire management in China should meet the needs of our country, abiding by the guideline of "prevention mainly and fighting actively".

It is necessary to transmit the experienced fire fighting to scientific fire fighting, develop technologies and increase the investment in fire prevention. We will strength the construction of fundamental facilities and fire fighting equipments, increase the education level of fire fighters, advance the fire research technique application, and increase the management level and the synthetic ability of fire fighting. We will do our best to decrease the fire damage and improve the environment.

4 Conclusion

The average forest cover per person of China is very low. Plantation and secondary forest account for greater proportion of the total forest in China, and forest fire is severe. In order to strengthen the leadership of forest fire management, Forest Fire Headquarters were set up successively in total 30 provinces, autonomous regions, and municipalities. The main measures to manage forest fires are to raise public awareness through publicity and educational activities, manage forest fires by legislation, firefighting team development, and mobilize the power of society to prevent forest fires, reinforce the infrastructure construction and key fire danger zones management. China utilizes many means to prevent, monitor, and fight forest fires. In the future, decrease the load of fuel in the forest, and avoid large forest fires occurrences are still the challenges.

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