Forest Fire Management under Autonomy in Rep. of Korea

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I. Development of Rep. of Korea
1. Social, Economic & Political Change

- **1940s**: Independence (1945)
  Establishment of Rep. of Korea (1948)
- **1950s**: Korean War & stabilization after War
- **1960s**: Poorest countries in world
  (GNP per capita: $82 (1961))
  Start of industrialization (1962, 1st Econ. Dpt. Plan)
- **1970s**: Acceleration of economy & social development
- **1980s**: Development of democracy
- **1990s**: Development of decentralization
  (Autonomy in 1995, GNP per capital: $10,000 (1995))
- **2000s**: Development of equal development
  11th in world economy (GDP, trade, export & import)
  GNP per capita: $16,500 (2005)
Change of Land Use and Population

- **Urbanization**: the fastest increase
  - Korea: 57% (80) → 81% (05)  24%↑
  - USA: 74% (80) → 81% (05)  7%↑

- **Old aging**: the fastest speed in world
  - Older than 65 yrs in 2000: 7.2%
    - 2019: 14.4% (Expect 19yrs)
  - The fastest record in world: 24 yrs in Japan

- **Birth rate**: the lowest rate in world
  - Korea: 4.53 (70) → 2.03 (83) → 1.08 (05)
  - The lowest record in world: 1.18 (97) in Italy

⇒ The shortage of Labor (1,000): 200 (05) → 630 (15) → 1,520 (20)
2. Change of Forest Policy

- 4 times Forest Long Term Plan

* 1st Plan: 1973-1978, Period of Reforestation (’73, 11.3 m³/ha)
  Restoring 770,000 ha of denuded forest &
  Reforestring over 2.16 million ha

* 2nd Plan: 1979-1987, Period of Reforestation (’79, 17.9 m³/ha)
  Formation of 80 commercial forest zones &
  Reforestation of 325,000 ha

* 3rd Plan: 1988-1997, Period of SFM (’88, 33.3 m³/ha)
  Focus to forest & tree
  Harmonizing the economy and environment issues

* 4th Plan: 1998-2007, Period of Decentralization (’98, 56.5 m³/ha)
  Focus to people & villages
  Change from government led program to diverse social, local
  and international need
• Basic Statistics on Forest & Forestry (2003)

- Forest Land: 6.4 million ha
  (65% of total land)
  70% is private forest (2.3 mil. owner)
  Average Volume: 79 m³/ha (2005)

- Outline of mountain villages (2003)
  - Area: 4.5 million ha
    (45.9% of total land)
  - Household: 690 thousand
    (4.7% of total)
  - Population: 1.87 million people
    (3.9% of total)
    reduce 254,000 (12%) for 10 yrs.
  - Population density: 41/km²
    (8.5% of the average 482/km²)
  - Income: 18.3 million Won
    (56.3% of average)
Large Scaled Forest Fire

N.K.
- 2004. 4. 18
- MODIS

Goseong F.F.
- Period: 1996. 4. 23 ~ 25
  (54 hrs)
- Area: 3,762 ha
- Amount: 23 billion Won
- Max. wind speed: 27m/sec

Cheongyang F.F.
- Period: 2002. 4. 14 ~ 15
  (18 hrs)
- Area: 3,095 ha
- Amount: 6 billion Won
- Max. wind speed: 15.1m/sec

Samchuk F.F.
- Period: 2000. 4. 7 ~ 15
  (191 hrs)
- Area: 17,097 ha
- Amount: 36 billion Won
- Max. wind speed: 23.7m/sec
## Large Scale Forest Fires

<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Location</th>
<th>Area (ha)</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>April 23</td>
<td>Goseong, Gangwon-do</td>
<td>3,762</td>
<td>Shooting range</td>
</tr>
<tr>
<td>2000</td>
<td>April 7</td>
<td>Samchuk, Gangwon-do</td>
<td>23,794</td>
<td>Simultaneous outbreak in 13 places</td>
</tr>
<tr>
<td>2002</td>
<td>April 14</td>
<td>Cheongyang, Chungcheongnam-do</td>
<td>3,095</td>
<td>Visitor to graves</td>
</tr>
<tr>
<td>2005</td>
<td>April 4</td>
<td>Yangyang, Gangwon-do</td>
<td>973</td>
<td>Visitor to mountain</td>
</tr>
</tbody>
</table>
2. Policy of Forest Fire Management by Period
1. Forest Fire Status and Trend

<table>
<thead>
<tr>
<th></th>
<th>5-year average</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fires</td>
<td>586</td>
<td>729</td>
<td>785</td>
<td>599</td>
<td>271</td>
<td>544</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>6,621</td>
<td>25,953</td>
<td>963</td>
<td>4,467</td>
<td>133</td>
<td>1,588</td>
</tr>
<tr>
<td>Area Burned per case (ha)</td>
<td>11.3</td>
<td>35.6</td>
<td>1.2</td>
<td>7.5</td>
<td>0.5</td>
<td>2.9</td>
</tr>
</tbody>
</table>

25 Years Average (’80-2004) : 337 fires, 2,100ha
Continuous Dry Day in Spring in East Coast Area by Föhn

Geographic Reason
Homogeneous species by Pinus
<table>
<thead>
<tr>
<th>Air mass</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siberia</td>
<td>Winter season, cold and dry</td>
</tr>
<tr>
<td>Sea of Okhotsk</td>
<td>Rainy season, cold and humid</td>
</tr>
<tr>
<td>Yangtze</td>
<td>Spring, fall, warm and dry</td>
</tr>
<tr>
<td>North Pacific</td>
<td>Summer, humid with high temperature</td>
</tr>
<tr>
<td>Equator</td>
<td>Typhoon with high temperature</td>
</tr>
</tbody>
</table>

Climate

- Siberia (cP)
- Sea of Okhotsk (mP)
- Yangtze (cP)
- North Pacific (mT)
- Equator (mE)
Seasonal Fire Distribution

- Winter (Dec~Feb): 22%
- Spring (Mar~May): 68%
- Fall (Sep~Nov): 6%
- Summer (Jun~Aug): 4%
Causes of Forest Fire

- Visitors to mountains: 42%
- Burning ricefield/farm: 18%
- Visitors to graves: 7%
- Children playing with fire: 3%
- Cigarette littering: 10%
- Trash burning: 8%
- Others: 12%

Total: 100%
2. Forest Fire Policy

* 1950’s: Enact of Forest Protection Temporary Act in 1951 during Korean War
* 1960’s: Duty of forest fire management moved to Forest Administration (FA) established in 1967
* 1970’s and 1980’s: FA moved from Min. of Agri. & Forestry to Min. of Home Affairs for Reforestation & Protection in 1973. Chief of regional government has the management responsibility for forest fire according to area of forest fire.
* 1990’s: Under autonomy in 1995, advanced forest fire management system introduced to central and local government.
3. Current Issues for Forest Fire

* Downsizing of forest structure in regional government
  - Reduction of 25% of forest officers in Kangwon Province.
    (from 400 to 292 officers in last 10 years),
  - Merge of forest structure with the others after autonomy
    (7 local governments have forest division, and 11 governments
    merged with the others in Kangwon Province)

* Poor financial status of local government
  - the average financial index of local government : 0.34
  - the average of mountain village : less than 0.20(96.3%)
  - Insufficient infrastructure like forest road and equipment for forest
    fire management

* Increase of forest fire risk by natural and social factors
  - Dry season increase(1998: 45 days, 2000: 96 days, 2002: 136 days)
  - Increase of no. of forest hikers by 5 working day
3. Goal and Plan of Forest Fire Management under Autonomy
1. Goal of Forest Fire Management

1. Preparation of Forest Fire
2. Prevention of Forest Fire by Strengthening PR and Reducing the risk of forest fire
3. Suppression of Forest Fire
   - Establishment of Early Detection System
   - Quick Control by aircraft and crew
   - Construction of systematic and scientific integrated system forecasting of risk + wireless communication network + GPS + Statistical system
   - Development of the forest fire complex control system using Integrated Incident Command Guideline (IICG)
2. Forest Fire Preparation(1)

1. Set fire prone season: Spring(Feb. 1 - May 15)
   Fall(Nov. 1 – Dec. 15)
2. Forest Fire Preparation(2)

2. Web-based Forest Fire Warning System
   - Analyzes forest status, topography, weather condition using GIS technology
2. Forest Fire Preparation (3)

3. Establish Forest Fire Control HQ & Ctr.

Central Forest Fire Control HQ (KFS)

Regional Forest Fire Control Ctr. (Province)

Regional Forest Fire Control Ctr. (City, County)

Fire Control Commander
Small-scale: Directors of Forest Divisions
Medium-scale: Mayors, County heads
Large-scale: Governors

Forest Fire Fighters
Backup Forest Fire Fighters

Forest Aviation Office (8 stations)
Smoke Jumpers
Aerial Suppression

Local Fire Stations
Aerial Assistance
Fire engine Assistance

24/41
2. Forest Fire Preparation(4)

4. Coordination with relevant agencies

- Establish inter-cooperation through Fire Prevention Associations, etc.
- Task of each agency
  - **Fire Service**: Protect residential properties and other facilities
  - **Police**: Provide police helicopters and traffic control
  - **Army**: Adjust battle practices and provide manpower
  - **Government Information Agency, Korea National Parks Authority**
3. Forest Fire Prevention(1)

1. Public awareness through mass media
   - TV, radio, newspaper, magazine, etc.
3. Forest Fire Prevention (2)

2. Mountain access restriction and hike trail closure

Forest Act and Ordinance from Ministry of Agriculture

<table>
<thead>
<tr>
<th>Warning level and Action Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caution Warning (Orange)</strong></td>
</tr>
<tr>
<td>• Station more than 1/6 of local forest office and Park Authority employees in fire prone zones</td>
</tr>
<tr>
<td>• Restrict access to 30% of forest area and close 50% of hike trails (9,896 km)</td>
</tr>
<tr>
<td><strong>Danger Warning (Red)</strong></td>
</tr>
<tr>
<td>• Station more than 1/4 of local forest office and Park Authority employees in fire prone zones</td>
</tr>
<tr>
<td>• Restrict access to 50% of forest area and close 80% of hike trails</td>
</tr>
</tbody>
</table>
### 3. Forest Fire Prevention(3)

3. Restriction of cooking and carrying flammable

<table>
<thead>
<tr>
<th>Activity</th>
<th>Penalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arson</td>
<td>7 years imprisonment 10 years or less (own property)</td>
</tr>
<tr>
<td>Accidental Fire</td>
<td>3 years or less or Fine of 15 million won ($15,000)</td>
</tr>
<tr>
<td>Setting fire in the vicinity Littering</td>
<td>Fine of 1 million won ($1,000)</td>
</tr>
<tr>
<td>Cigarette littering</td>
<td>Fine of 300,000 won ($300)</td>
</tr>
<tr>
<td>Cooking with fire</td>
<td>Fine of 200,000 won ($200)</td>
</tr>
<tr>
<td>Possession of flammable device Trespassing</td>
<td></td>
</tr>
</tbody>
</table>
4. Forest Fire Suppression(1)

1. Establishment of early detection system
   • Monitoring system: 165 sites (‘05) → 191 sites (‘06)
   • Patrolling Persons: 22,000 (‘05) → 26,000 (‘06) crews
Watching by people
2. Quick Control by aircraft and crew

8 Aviation Stations

<table>
<thead>
<tr>
<th>Type</th>
<th>Total</th>
<th>Local gov’t</th>
<th>Nat’l F. Mng’t O.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>730,077</td>
<td>716,037</td>
<td>14,040</td>
<td></td>
</tr>
<tr>
<td>Aircraft</td>
<td>42</td>
<td>-</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Fire Engine</td>
<td>716</td>
<td>698</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Auto pump</td>
<td>1,117</td>
<td>1,115</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Comm.</td>
<td>27,150</td>
<td>25,283</td>
<td>1,867</td>
<td></td>
</tr>
<tr>
<td>Tools, etc.</td>
<td>700,992</td>
<td>688,941</td>
<td>12,051</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>322,229</td>
<td>305,407</td>
<td>16,822</td>
<td></td>
</tr>
<tr>
<td>Smoker Jumper</td>
<td>46</td>
<td>-</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>First Attack Fire Fighter</td>
<td>21,934</td>
<td>20,677</td>
<td>1,257</td>
<td></td>
</tr>
<tr>
<td>Backup F.F</td>
<td>300,249</td>
<td>284,730</td>
<td>15,519</td>
<td></td>
</tr>
</tbody>
</table>
ANSAT helicopter
Crew: 11 persons, Capacity: 1.3 Ton, Speed: 210 km/h
4. Forest Fire Suppression (3)

3. Construction of Scientific Integrated System

- Risk Forecasting
- Wireless Communication System
  * Wireless transmission facility: 72 stations nationwide (by 2005)
  * prioritized in remote places & areas with poor reception
- GPS System for fire management
  - Central and branch control system
  - Equip GPS in 26 heavy helicopters
- Statistical System
Construction of Scientific Integrated System(1)

- Stage 1: Fire Control Diagram using topographical map
  - Dimensions: Height-90cm, Width-160, 3 sides
  - Scale: 1:25,000, 1/50,000

1. Fire Status
   - Date/time:
   - Location:
   - Damage
   - Mobilization

2. Current conditions & outlook

3. Suppression goals and tactics

4. Suppression Plans

Fire Condition & Control Plan
<Current Date and time>

Side1

Side2

Side3

34/41
Stage 2: Fire Control Program using FGIS
4. Forest Fire Suppression (4)

4. Development of Forest Fire Control System using IICG

Aug. 1986: Legislated Korea Forest Service Order
   Designated fire control commander, and coordination agency
   according to fire intensity

Jan. 2001: Provided legal foundation
   Established Wildfire Control Command Guidelines

Dec. 2004: Prescribed forest fire as a Calamity & Command guidelines
   for unified commanding authorization
   Provided standard manual for action against forest fire risk
   Established forest fire suppression guidelines

Nov. 2005: Established the Integrated Incident Command System (IICG)
   Provided manual under NSC (National Security Council)/Office of the President
Incident commander to Forest Fire Scale in IICG

<table>
<thead>
<tr>
<th>Type</th>
<th>Damaged Area</th>
<th>Chief Commander</th>
<th>Deputy Commander</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Less than 30ha</td>
<td>Mayor/ County Chief</td>
<td>-</td>
</tr>
<tr>
<td>Medium</td>
<td>More than 50% damage from national forests</td>
<td>Mayor/ County Chief</td>
<td>Station chiefs</td>
</tr>
<tr>
<td>Large</td>
<td>More than 30ha</td>
<td>Mayor/ Governors</td>
<td>Regional chiefs</td>
</tr>
<tr>
<td>Scale</td>
<td>More than 50% damage from national forests</td>
<td></td>
<td>Mayor/county head</td>
</tr>
<tr>
<td></td>
<td>More than 50% damage from private forests</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Conclusion
1. Social and Economical Development under Central Government helps to introduce the Autonomy and Decentralization in Korea, and also helps to reforest the denuded forest and to establish the basis of SFM in Korea.

2. The risk of forest fire has complexly increased by the climate and geographic condition, and decrease of residents in and near forest.

3. Downsizing of forest management organization, the poor financial status and the lack of resposibility of Regional Government under Autonomy are one of main reasons for increase of forest fire.
4. To manage the forest fire, the modernization for Preparation, Prevention and Suppression using high technology has introduced to Government.

5. Especially the Integrated Incident Command Guideline for Forest Fire will be effective to cooperation between the Central and Local Government under Decentralization.

6. Without the financial and economic support, the cooperation between Central and Local Government can’t be successfully implemented under Autonomy and Decentralization.
THANK YOU!